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FIRST WORD

But What Do We Really Think?

One of our jobs at *Aviation Consumer*—really the most important one—is to review products and make recommendations for our readers. In a nutshell, that's why we exist. The process to arrive at these recommendations is straightforward, if not always simple. We gather facts, examine and try the products, then make our recommendations based on disclosed fact.

With some products, the facts part is not so simple and the poster child for problem products is engine oils. There are two reasons for this. One is that readers

want take-it-to-the-bank recommendations supported by unassailable testing and the other is that this testing isn't feasible. So every time we publish an article like April's report on oil additives and supplements, we get a trickle of letters like Jerry Johnson's (at right) asking what we *really* think.

Consistent with disclosed fact, we *always* tell you what we really think. With oils, the fact part is more difficult because all the manufacturers do expensive laboratory testing to prove lubricity, anti-wear and anti-corrosion characteristics of their oils. We've done similar testing. But lab tests don't duplicate how oils behave in the real world and proving the correlation would require thousands of hours of testing in real engines of many kinds, in many climates and many types of flight operations. No one is doing that. If anyone is doing it, they haven't published anything convincing, so the selection of oils becomes a best-we-can-do process. Consider the testing, apply what you know about oil and field reports and make your choice.

Based on this, when I'm asked what I recommend or would use myself, I usually reply that any modern multi-grade oil is my universal choice. I like multi-grades because they're technologically advanced, do a good job of staying in grade and obviate the need for seasonal oil changes, which many of us don't have time to fool with. Furthermore, I have personally tested the oft-repeated claim that single-grade oils "cling" better and thus protect more effectively against corrosion. I find the claim to be hogwash, frankly, and the oil companies say privately that they continue to produce single grades merely to satisfy customer preference. For those who care, single grades such as Aeroshell 100W are about a buck cheaper than the 15W50 multi-grade. If cheap really matters to you more than anything else, single-grade oils fit that design brief.

So when I'm asked for my recommendation and based on my personal preference, it's Phillip XC, a 20W50 multi-grade to which I add Camguard, bringing the effective price to about 75 cents more per quart than either Aeroshell 15W50 or Exxon's Elite, both excellent oils in their own right. I'd be happy with either of them, frankly.

My reasoning for the XC? For aircraft engines, which eat a lot of lead and have more blowby than auto engines, I prefer a mineral basestock, which has better solvent characteristics than the semi-synthetic basestocks used in the Shell and Exxon products. Second, Camguard gives a sliver of improved corrosion protection over the other products, although the difference isn't dramatic. Last, it has a seal conditioner to reduce oil weepage, which dried out our leaky TSIO-360 on the first oil change.

But if your experience suggests you can get the same performance from, say, a straight-grade oil with no additive package, I don't have convincing data to talk you out of it. And I wouldn't even try. —Paul Bertorelli



Which Oil?

Since Shell's W100 Plus is probably the most logical alternative to the additives that you and Mike Busch praise from the same script in the additives review in your April



issue, it would have been interesting to hear your observations, research and/or opinions as to its relative value. Busch says nearly equal but don't use both, without clear definition of why. I have been running W100 Plus in an 1100-hour engine with recent new cylinders. Not flying it often enough. I purchased Camguard since you both think it is great. Not cheap.

And the W100 Plus I purchased awhile back isn't either. I don't know if I should add the Camguard, mix it, or see if someone at the airport is interested.

Jerry Johnson
Via e-mail

Shell's W100 is a single-weight oil with an anti-wear additive package similar to the company's top-selling multi-grade 15W50. Choosing it depends on whether you like and believe in single-grade oils or multi-grade oils. We prefer the multi-grades, frankly. We think they do as good a job as the single-grades and give some advantage in not having to be changed seasonally.

Our first choice is Phillips XC, which is an inexpensive multi-grade. When dosed with Camguard, it costs a little more than Aeroshell 15W50 and Exxon Elite. See the detailed reasoning on the opposite page for more.

Seeing Clearly

Bob Glass' article on progressive lenses in the April 2011 issue was informative and interesting, but there are several important points worth mentioning. I am neither an ophthalmologist nor an optometrist, but as a pilot for 42 years, an aviation medical examiner for 30 years, a former Air

Force flight surgeon, and the owner of a pair of 64-year-old eyes, I've given the matter some study.

Large numbers of older pilots love and rely on their progressive lenses, but there are also many for whom traditional, lined bi- or tri-focals are easier, more comfortable and clearer. It is also important to make clear that an older pilot whose uncorrected distant vision remains good, may well get by with a pair of \$5 non-prescription reading glasses from the drugstore or www.4readers.com.

The biggest advantage of progressive lenses over traditional bi- or tri-focals is cosmetic; they don't have the obvious demarcation lines that make you look old. True, they do provide a smooth and infinitely variable transition between distant and near vision. The downside is a much smaller sharp focus "sweet spot" at any distance than lined bi- or tri-focals, requiring more frequent and more precise head movements to focus. Referring to Dr. Glass' sidebar on page 18, the clear-focus near- and intermediate-vision segments of lined tri-focals are wider than the widest part of the blue, near-vision segment of progressives, and there is no "at-least-some-distortion" red/orange segment—that area simply provides clear distant vision. Even experienced progressive wearers continuously bob their heads as they look around the cockpit; bi- or tri-focal wearers just look at what they want to see.

Finally, Dr. Glass briefly mentions interference between polarized lenses and some digital displays, but this needs to be emphasized further. Polarized lenses are wonderful for reducing glare and for driving, but many LCD displays will appear completely blank through polarized sunglasses unless you turn your head 90 degrees. As he said, be sure to try them in the actual cockpits you intend to fly before buying them.

Stephen D. Leonard, M.D.
Atlanta, Georgia

Sporty's Kudos

A little over a year ago, I wrote a letter to you about my experience with

a Telex ANR-1D and what I felt was poor manufacturer support. I had an affection for the clunky, comfortable, quiet headset, but when the ANR electronics went belly up for the second time, I was stuck with a fancy-looking paperweight. Subsequent articles and letters to the editor expanded on the phenomenon of GPS, headset and other electronic obsolescence culminating in one from an economist that concluded, "Get over it, electronics are consumables, the stuff wears out faster now."

I've certainly gone through my share of portable GPSs and cell-phones, and I have lots of dead or damaged electronic things lying around my house that I'm just too reluctant to part with.

One of these was a Sony Air-8 scanner that I got from Sporty's about 12 years ago. Although it looks hopelessly anachronistic—big, clunky, BNC antenna—it still works and sounds great. It's the kind of radio you listen to in your car at the end of a runway or Car Talk on Saturday mornings on the deck, usually with a cup of coffee. Somehow, an iPhone just doesn't seem equivalent.

At some time in the past, the "execute" button fell off and probably got vacuumed up. Since it is no longer manufactured, I doubted Sony would support it. I had almost resigned my-

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Prop Replacements: Growing Competition

With MT-Propeller coming on strong with dozens of new STCs, Hartzell and McCauley are responding. But composite multi-blades aren't a slam dunk yet.

by Paul Bertorelli

Coded into the DNA of every aircraft owner is a grim acceptance that engine overhauls are a fact of life. But prop overhauls and replacements tend to be last-minute, kicking-and-screaming add-ons and with costs up and flight hours down, there are probably more standard—if not dangerous—props in

the field than ever. At least a couple of prop shops we've talked to report that the overhaul business is down, suggesting owners are stretching prop TBOs more than they used to. That's bad. But the good news is that the competition in the new prop market is hotter than ever and getting even hotter, thanks to MT-Propeller's aggressive push into both the OEM and STC replacement markets. This has

Hartzell is still betting on metal props, top photo, but they're investing in composites, too. With the development of a composite prop for the Skycatcher, left, McCauley thinks composites are the future.



CHECKLIST

-  There are more replacement props than ever, thanks to an active STC market.
-  Price competition can be fierce, but not on all models of aircraft.
-  Composite props look like real comers, but McCauley isn't ready to cover the board yet.
-  Composite life-cycle numbers are good, but they're still more expensive than metal.

forced the established manufacturers, Hartzell and McCauley, to respond in kind, although those two companies don't agree on where the market will move in terms of materials choices.

But at least McCauley believes that long-term—at least five to 10 years—the cost of composite props will become competitive with metal props and ultimately result in lower direct operating costs for owners because composite props can be easily renewed through more overhaul cycles.

NO MAGIC BULLET

But the overriding reality is that the old guys working with slide rules during the 1940s largely nailed down a good understanding of prop efficiency. Since then, the industry has made what can best be described as incremental gains in prop efficiency due to more sophisticated profiles and, more important, computer-aided manufacturing.

"The aero guys can work magic if they have something to play with, but if it's a good design to begin with, it's hard to improve that. You're talking about playing with the margins," says Hartzell's Mike Disbrow. Even with sophisticated CAD-CAM and computer modeling, a prop is still just a way to move air to make thrust.

But what about the fancy scimitar profiles we're seeing in airplanes like the Cirrus SR22 and as replacement props? Mostly cosmetic, says McCauley's Peter Wilkinson. And that applies to three-blade replacements

for two-blade applications as well.

"People like to put three-blade propellers on an airplane that would be better with a two-blade because they like the way it looks on the ramp," says Wilkinson, but none of the manufacturers make significant claims in cruise performance for a three-blade over a two-blade. They're happy to just keep the performance comparable.

But that's not to say three-blade or multi-blade props don't deliver some advantages over two-blade versions. Climb performance can be better with a three-blade, although it isn't always, and takeoff runs can be shortened. In some applications, the prop blades are shorter, improving ground clearance for back-country operations. M-T Propeller's David Noad told us that if the aircraft has the available power, a three-, four- or even five-blade prop can reduce takeoff roll by as much as 15 percent, and it has the data to prove it. When M-T started making its composite-clad props for the aerobatic market, few thought these designs would ever find application in high horsepower aircraft, especially turboprops. But M-T did and has moved aggressively to develop props for such high-performance aircraft as the Socata TBM series, the Jetstream 41 and even the P-51 Mustang, the real one, not scale amateur-built versions. It's generally accepted that multi-blade—three or more—props are best suited for aircraft with the horsepower to absorb that rotational energy, otherwise you're just adding more drag for no particular benefit.

TWO VS. THREE

Ten years ago, there seemed to be a movement afoot for owners to convert two-blade applications to three blades. Part of this was due to favorable pricing Hartzell was offering, part was due to a more robust market and the rest was because owners succumbed to emotion. Three-blade props just look sexier and if they don't cost much more than three-blades, why not?

But is the bloom off that rose? Hartzell's Disbrow says although it sold a lot of three-blade props, most owners replacing a two-blade props probably stuck with two-blade props.

"Some applications went up to three blades, most stayed two to

Critics of MT-Propeller's composite-clad wood design said it could never adapt to high horsepower engines. They were wrong. MT's five-blade design, left, is making inroads in the Socata TBM market, right. The company is churning out STCs for other models.



APPLICATION	NEW TWO-BLADE METAL	NEW THREE-BLADE METAL	COMPOSITE OPTION
BEECH BONANZA IO-470	HARTZELL: \$7350	HARTZELL: \$10,500	NA
	MCCAULEY: \$7800	MCCAULEY: \$10,500	NA
	NA	NA	NA
BEECH BONANZA IO-520	HARTZELL: N/A	HARTZELL: \$10,500	NA
	MCCAULEY: N/A	MCCAULEY: \$10,500	NA
	NA	NA	MT-PROP: \$13,100
CESSNA 210 IO-520	NA	HARTZELL: \$10,500	NA
	NA	MCCAULEY: \$7740	NA
	NA	MT-PROP: N/A	MT-PROP: \$13,100
CESSNA 182 O-470	HARTZELL: \$6900	HARTZELL: \$9900	NA
	MCCAULEY: \$7207	MCCAULEY: \$9963	NA
	NA	NA	MT-PROP: \$13,100
MOONEY M20J IO-360	HARTZELL: \$8500	HARTZELL: \$9950	NA
	MCCAULEY: \$8150 ¹	NA	NA
	NA	NA	MT-PROP: \$11,740
CESSNA CARDINAL IO-360	NA	HARTZELL: \$9950	NA
	MCCAULEY: \$8550	MCCAULEY: \$11,059	NA
	NA	NA	NA
PIPER SARATOGA IO-540	NA	HARTZELL: \$8700	NA
	NA	MCCAULEY: \$11,700	NA
	NA	NA	MT-PROP: \$13,110
CIRRUS SR22 IO-550	NA	HARTZELL: \$14,000**	HARTZELL: \$25,000
	NA	MCCAULEY: N/A	NA
	NA		MT-PROP: \$14,070 ²
BEECH BARON 58 IO-520	NA	HARTZELL: \$25,500	NA
	NA	NA	NA
	NA	NA	MT-PROP: \$18,860
PIPER TWIN COMANCHE IO-320	HARTZELL: \$23,900 ³	NA	NA
	NA	NA	NA
	NA	NA	MT-PROP: IN PROCESS

CHART NOTES: As the chart above shows, there's competition among manufacturers for most but hardly all models of aircraft. All three manufacturers are adding STCs, so model coverage is slowly increasing. The best deals are almost always through STCs, since these are usually kits that include spinners and other accessories. When buying a prop that was original equipment, such as the McCauley two-blade for the Mooney¹, price includes the prop only. Spinner and backplate aren't provided. Some of M-T's offerings² are four-blade models. Hartzell props for twins are quoted as as pairs.³

PROP PROGRESS? THANK DRONES

In about 2006, when it was obvious that Thielert was getting real traction with the Centurion diesel in the Diamond DA42, an interesting whisper campaign started. The gasoline doubters sniffed, "Well, you know they can't keep a metal prop on that thing."

That was certainly true then and it probably remains true now, to which most people in the diesel and prop industry say: So what? On the other hand, Hartzell's Mike Disbrow says never say never. "It really depends more on the engine than the prop, to be honest," he says. Diesel engines are famous for pounding the hell out of the hub and blades with powerful torque pulses that resonate throughout the engine. Thielert tried to—and did—isolate the prop somewhat from this punishment with a gearbox and clutch arrangement, but the Thielert engines still swung composite props.

Composites are simply better at absorbing the torsional inputs and they don't tend to resonate the way metal does. We've been led to believe that tip fatigue was why diesels chewed up props. The larger problem is really blade retention in the hub and grease being driven out as a result. Further, torque causes the composite to disbond from the metal shank holding the prop in place, which could lead to failure.

With its two- and three-blade composite designs, M-T has dominated the emerging diesel field. But McCauley's Wilkinson sees an opportunity because he claims field experience hasn't been good with M-T props. He believes McCauley's blade retention mechanism will prove superior.

"We've been testing that retention mechanism and the certification requirement is 2.5 times the CF load. We got to five times and we broke our test machine. We built a new test machine, we shook it for two million cycles and we couldn't break it. So we're pretty certain it's going to hold together," he says of McCauley's prop design.

Interestingly, what's driving prop design at this level is the UAV market, which seems to be pushing the fixed-wing business at every level. (See page 15.) Wilkinson told us at McCauley, prop R&D for drone projects outstrips other applications by 10 to one.

The military flies some drones 300 to 400 hours a month, meaning a prop is trash in five or six months, if that. Wilkinson says some drone operators are desperate to have longer-lasting, more durable props and McCauley is on it full time.

One technical issue is weight versus structure, and this is nothing new. Prop designers have been fighting it for years. He said one manufacturer lightened a prop too much and



had hub failure. The hub was beefed up, but then the bolts failed.

"One of the things is that if you stiffen up the prop too much, you drive the vibration signal back down the crankshaft through the drivetrain of the engine, and you start seeing failures in mag drives or accessories," says Wilkinson.

Diesels don't have mags, but they do have pumps, alternators, fuel lines and wiring that's happy to shake itself to pieces. The prop designer's job is to hit the Goldilocks zone on weight, without sacrificing the engine itself.

With all that military project money going into prop design, one wonders if the benefits will trickle down to GA diesels. Wilkinson believes they undoubtedly will.

two," says Disbrow. "It very much depends on the applications. Generally, the two-blade to three-blade conversions are mostly about improved takeoff and climb performance and a different kind of noise signature. Most people seem to say they sound better because you get a frequency shift when you go from two to three blades. In some cases, there are ground clearance additions, but not all," he adds.

At M-T, Dave Noad offers almost the same advice for an owner confronting an overhaulable two-blade prop and considering a three-blade replacement. "Of course, we're happy to sell you a new three blade, but in terms of cost, you're probably better off having the overhaul done on your two blade. Generally speaking, an overhaul is usually slightly under the cost of a new propeller."

Then again, it depends on what the overhaul will require. If the hub is serviceable and only requires minor reworking, and the blades are reusable, a typical two-blade overhaul will cost between \$2000 and \$3000. But it goes up from there.

"A hub and one blade is definitely a new prop. But one blade by itself, no, that's not necessarily a new prop. Neither is the hub alone," says Art Michaud, at Aircraft Propeller Works in Auburndale, Florida, an overhauler.

As noted on the chart, new two-blade props are in the \$7000 to \$9000 range, variable by model and brand. So if the overhaul is going to cost \$5000, is it better to jump up and buy a new one or stick with what you've got. "It's hard to make blanket statements," says Disbrow. "You have to ask specific questions about specific applications." And one of those questions has to do with speed.

Some owners complain that their airplanes with two-blade props aren't as fast as they once were, sometimes even after an engine and prop overhaul. One reason for this is that as they wear, metal props lose their original profiles and with that goes some efficiency. In highly worn props, this can be noticeable.

And that leads to the advantages of composites.

A SEA CHANGE?

M-T started out with composite designs—composite cladding over Beech and Spruce cores—and hasn't looked back. Having watched M-T make market gains, both McCauley and Hartzell have aggressively pursued composites, too. But they part company on what this means. McCauley thinks aluminum props are on the way out, to be displaced by composites, while Hartzell thinks aluminum and composite will co-exist for the foreseeable future.

As McCauley sees it, metal manufacturing costs and more attractive direct operating costs will drive its conversion to composites.

"From my perspective, it's going to composite. And I say that because today, there's a single source supplier for aluminum forgings and that's Alcoa. We are such a small part of Alcoa's demand—and they know that—that they can just keep jacking up the price of forgings year after year. There's nothing we can do about it," says Peter Wilkinson.

McCauley has recently invested heavily in composite design and manufacture, producing a novel fixed-pitch composite for the Cessna Skycatcher. Wilkinson says that project won't directly yield marketable products, but it builds a foundation for McCauley that will.

While Hartzell's Disbrow believes composites will be more expensive than metal props for the foreseeable future and will thus apply mostly to high-horsepower or high-utilization aircraft, Wilkinson believes McCauley can make them cost neutral.

While we're loathe to use the phrase "game changing," cost-neutral composite props would be attractive because their life cycle costs are much lower.

"Just to give you an example, on a Cessna 208, you will typically get two overhauls on a metal propeller. You grind it down on the first overhaul, you grind it on the second, but it probably won't make the third overhaul," says Wilkinson. "After that, you have to put a new blade set in. With a composite, you'll typically get 30,000 to 40,000 hours, so the life cycle cost should be significantly less," he adds.

There's also a performance kick, since composites are generally lighter than equivalent metal props, and they don't suffer in-service loss of efficiency because the blades don't need to be reshaped. The metal leading edges can simply be replaced and any dings or damage repaired with epoxy or other materials in the field, without requiring special tools or equipment.

Says M-T's Noad, "The beauty of composite propellers is that you can do a field repair very quickly and very easily. Clean it, put a small patch in there with good quality epoxy, sand it, paint it and you're good to go. You haven't lost any of the profile of the blade. It's no problem at all for any A&P to do."

At Hartzell, the market view is a little less broad based. Disbrow thinks that composites will make inroads in those applications where weight matters or where long-term operating costs are decisive. That doesn't necessarily describe the owner of a Bonanza or a Cardinal.

RECOMMENDATIONS

The prop market has shifted substantially since we last examined it. Five years ago, M-T was a boutique maker servicing the experimental and LSA markets. Now, as Hartzell and McCauley are painfully noticing, it's a player worth paying attention to.

As our chart on page 5 shows, prices and applications have become intensely competitive in the prop market. Between the three manufacturers, just about every conceivable application is covered and although there are significant areas of overlap, not every application is overlapped by all three.

When considering an overhaul against a new prop, we think you need to construct a spreadsheet and consider the cost of the overhaul against new. It's up to you to decide what cost Delta is worth new vs. the overhaul. Our view is that if the difference is within \$2000, a new prop is a good value, especially if you're going to keep the airplane for awhile.

Two blade versus three? That's easy. If speed is paramount, the two-blade prop will almost always be a better choice. But if ramp appeal and better takeoff and climb performance are



Like Hartzell, McCauley offers three- and four-blade options with a scimitar option. The profile is more style than performance substance.

goals, three-blade props are worth a look. For some applications, the manufacturers have two-to-three-blade comparative data, and that's worth asking for.

Composite versus metal is more difficult. As Hartzell points out, its composite props are considerably more expensive than metal and recommended only for applications for which the economies make sense. McCauley plans to be competitive in this field, but it isn't yet, so that leaves M-T.

We think the same reasoning applies as that which Hartzell uses. M-T has a respectable catalog, but it's not as large as either McCauley's or Hartzell's. But the company is adding at least five STCs a year—that's a pretty good clip. But the M-T props are generally more expensive than equivalent metal, so unless your core prop is totally trashed, an overhaul may be more economical. The long-term operating costs of an M-T prop may pencil out on paper, but that doesn't mean it will work that way in the field.

We recommend building these numbers into your spreadsheet, including the direct cost per hour based on the manufacturer's recommended TBO. Most props are now six years on the calendar and between 1800 and 2400 hours. But get those numbers before buying and plug them into your comparison.

Upgrading to a GTN: What Makes Sense?

Garmin's new GPS navigators complicate a shaky retrofit market. The logic for upgrading depends more on where you're starting than what you're buying.

by Larry Anglisano

As the fanfare fades, we still think Garmin hit a homerun with the GTN 750 and 650 navigators. As we reported in the March issue of *Aviation Consumer*, these state-of-the-art navigators offer huge amounts of capability, if at a higher cost than their GNS-series predecessors.

But as far as we can determine, these units aren't exactly flying off the shelves. A thriving economy or a factory trade-up program would probably change that picture, but neither is true today.

Here's a look at some hurdles and

tough economics that tag along with Garmin's new star of the avionics world and how you might justify buying in ... or not.

SUCKER PRICES

The list pricing for the flagship GTN 750 and smaller 650 appear nearly unchanged from that of their GNS 430 and 530 predecessors (which are still offered, for now). Don't be fooled. It's the installed pricing that really matters, and these new units will cost more to install than the older units because of a changed dealer pricing structure.

How much higher? We'll respect dealer-privileged cost confidentiality, but the net difference between a GNS 430W and a new GTN 650 is nearly two grand (higher yet for the GTN 750). When we queried Garmin on this pricing structure early on, they admitted that shops will need to adjust their price quote structure, and they were right. Trade value of removed 430s and 530s complicates the economics even more.

We've spotted several shops advertise flat-rate, entry-level pricing. How about a flagship GTN 750 installation starting at \$17,395? Seldom will the installation send you flying away paying the "starting at" price. Maybe it's a \$600 cooling fan installation or \$2000 extra in labor to make the equipment fit in the stack. There are just too many variables that come into play once the aircraft is opened up for the installation. Beware of low-balled install quotes on these, or any, avionics retrofits.

SHOULD YOU BUY?

We can see how pilots would want these units after a short demo. The flagship GTN 750 is years ahead of the GNS 530 in flight planning, screen quality and feature set. While GTN 650 is scaled down, there's still little comparison to the old GNS boxes.

For lower-end aircraft that don't have a capable GPS navigator—and there are still quite a few of these—the GTN 650 is reasonable choice. With Garmin's GI106A nav indicator, a basic installation might start at around \$13,000. The bigger screen GTN 750 would push \$18,000, and introduce space problems that might only be fixed with a bigger check. For lesser aircraft, that's a questionable number for a single box.

We know of many capable aircraft with equipment dropping off the support curve. The Garmin/Apollo MX20 MFD was a great box, playing



Removing one of the KY197 coms and one of the KN53 navs frees up 2.7 inches of vertical space in this Archer panel. Install the 2.6-inch-high GTN650 with a GI106A CDI and an avionics cooling fan for around \$15,000. It's a high-payoff upgrade for this aircraft class.



charts, radar, weather and terrain. It's the focal point in many panels, but it's essentially unrepairable after a display or power supply failure. The same holds true for Apollo GX-series navigators. They're boat anchors once they fail. A big-screen GTN 750 offers comm, WAAS GPS and MFD (except for displaying ship radar) as an all-in-one replacement for such a stack. Call the GTN 750 an MFD-killer and we won't argue with you. This somewhat justifies its price.

For aircraft already decked out with one or more of the old GNS navigators (as long as they're WAAS units), it's tough to justify the expense of a new teardown installation. We're finding that unless the shop offers a trade-in deal on the existing gear, many owners are walking out the door lusting for a GTN, but sticking with what they've got.

There are exceptions. The savvy owner of an already well-equipped Centurion admits that his current GNS 530W does nearly everything he needs for his wide mission profile. He also has an Avidyne EX500 MFD piped with XM, charts and radar. The way he sees it, the GTN 750 is the logical step-up for his panel and should remain fresh for at least as long as the GNS 530 has for this airplane—10-plus years.

The stack in this Seneca won't accommodate a GTN 750 unless you remove either the audio panel or transponder. A GTN 750 and remote GTX 33 transponder would be about \$23,000 installed. Moving the GNS 530W to the right stack would mean moving the autopilot and losing the DME. Or it could sell for about \$6000.



Putting a GTN 650 in this radio stack is about as easy as it gets. Remove the GNS 430W and rewire for a GTN 650. With a modest trade-in on the under-warranty GNS 430W, you might fly away for as little as \$6000.

Of course, he's hoping his GNS 530W will fetch at least five grand to help offset the cost. Used GNS pricing is still in flux. It may settle around \$3500-4000 for a 430W and

\$6000 for a 530W. On the other hand, retaining an existing 430 or 530 as a secondary system isn't a bad choice if you aren't willing to take a hit on a recent investment.



WHAT'S MISSING ON THIS PANEL?

When it comes to wiring the new GTN units share little in common with the GNS boxes and there's no direct slide-in. The wiring isn't more complex, it's just different. The real issue is panel real estate.

The smaller GTN 650 is about the size of the GNS 430, so the swap only requires mounting and wiring changes. It's not as simple with the big GTN 750.

The GTN 750 measures a colossal six inches tall. (The old GNS 530 stands just over 4.5 inches.) Only so much shuffling of boxes will fix this, so you might need to resort to remote boxes.

Garmin's GMA35 remote audio panel and GTX32 or 33 remote transponder are controlled from the GTN 750. Garmin smartly designed the chassis of the GTN750 with a pseudo avionics shelf—or at least a convenient surface area to mount the GMA35 audio box. The remote transponder will need to go elsewhere in the airframe. The integrated audio is cool. Just be ready to pay \$4000 for it.



The new and old boxes won't talk to each other the way two GNS navigators can. Also, GTN systems won't play the backdoor-engineered WSI AV200-series weather that works on GNS systems. You'll need a \$6000 GDL69.

THE TRAILING EDGE

Based on our surveys, the floodgates for used GNS boxes are half open, and demand remains high. These units are still offered from Garmin, and it's a mistake to call them obsolete. Long-term support even after they're discontinued is a sure thing.

We suspect as time goes on and more GTN units are installed, the value on used GNS units will eventually drop. For now, however, you'll still pay top dollar. Just remember that not all units are created equally.

A unit back from the Garmin factory after a \$1000 flat-rate service event is as good as overhauled and offers an advantage to the buyer and seller. It also had a warranty. If you score a used unit on eBay or Controller and carry it to your shop to have installed, there's a good chance they'll require it goes back to the factory for that \$1000 blessing before they install it.

We think unloading a non-WAAS GNS unit on the used market and investing in the GTN 650 makes better sense than the \$3000-plus investment in upgrading the old box. Expect about \$2000 for a non-WAAS GNS 430. At that price, if WAAS isn't important to you, the same unit could be an excellent entry-level buy as long as it's had factory service fairly recently.

Units that are still under warranty and have relatively fresh factory tags will bring top dollar. One shop quoted us nearly \$7000 for a used GNS 430W and \$8000 for a 530W with factory overhauls. Don't expect that much for your units, but it probably pays to shop them around.

CONCLUSION

Fears of \$7 avgas, a gouging increase in service and maintenance costs, and a seemingly daily decrease in aircraft values temper the enthusiasm for an expensive avionics upgrade. This is hurting GTN sales, in our view, but it's also making the install environment more competitive, if not cut-throat.

If you have a basic aircraft that's been waiting for the big avionics upgrade, we think the GTN 650 is a smart move that will have lasting value. It's already become the new standard. Buying a new GNS 430W would be a step backwards and only save you about \$2000. How about dual GTN 650s? We think a single GTN 750 instead offers more capability, including charts, remote audio control and a more powerful user interface. Plan on an installed price closing in on \$20,000. And that's not including the remote audio or transponder, which you may need to make it all fit. That's a huge number for a single box, but remember it's really two boxes in one: full-up GPS/VHF nav/com and an MFD.

For others who've recently taken it on the chin with a \$15,000 avionics upgrade of the older boxes, it's exhausting just thinking about doing it again. One owner commented: "The headaches associated with my project just two years ago has me reluctant to rip it all apart again just to get touchscreen and advanced flight planning features. Plus, my GNS 530W and GMX 200 do what I need it to do for my mission."

If you're happy with your existing GNS-series suite, we say leave it alone unless your shop makes you a sweet deal on the used gear that would be coming out. But stay away from GTN 750 demos if you do. That same owner who vowed to keep his stack got his paws on a GTN 750 up at a dealer. His equipment is now on eBay, and he sheepishly says he'll deal with the install hassle when the day comes.



- + Electric instruments are demonstrably more reliable than pneumatic instruments and pumps.
- + Ongoing maintenance costs might not be lower, but they will be more predictable.
- Conversion is far more expensive than keeping pneumatics as backup.

Going Vacuumless: Say G'bye to the Pump

Aircraft originally certified with vacuum systems are now legally flying as all-electric aircraft. A little research will show if you can, too.

by Jeff Van West and Larry Anglisano

From the moment light singles started shipping with no pneumatic (vacuum or pressure) instruments, it's been the dream of many an owner to yank out the maintenance-hungry vacuum pumps and replace the pneumatic instruments with electric ones. Doing away with pneumatics makes even more sense after

a glass panel upgrade where the only item left is usually a vacuum-driven attitude indicator doing duty as a backup.

A dry-vane vacuum pump with over 500 hours in service is of questionable reliability. Many pneumatic instruments last over 1000 hours, but that's the exception rather than the rule. There are also the filters to check and replace. Meanwhile, the mean time between failures (MTBF) of electric gyros with spinning components is many thousands of hours. For MTBF

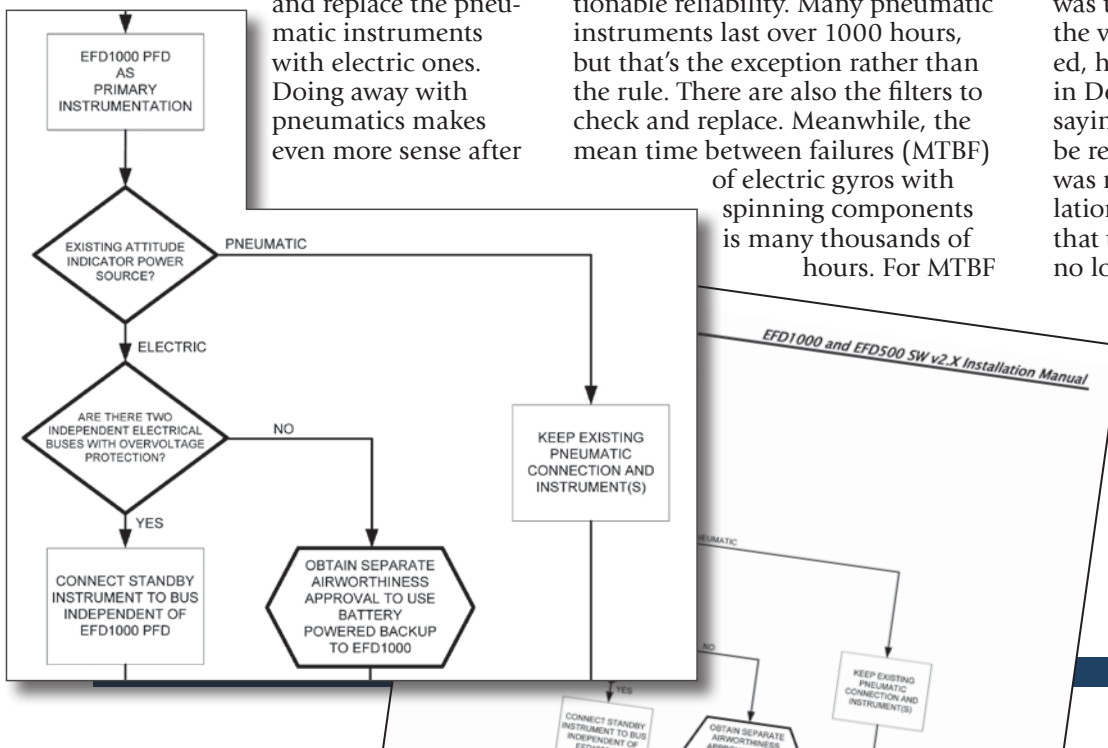
for digital "gyros" you'll have to add another zero. Or two.

There's nothing ignoble about keeping a pneumatic attitude indicator and pump after a glass panel upgrade. It's the cheaper option short-term and is probably cheaper even over the long haul. But when upgrading to digital primaries, it's worth looking at going all-electric.

BOOKWORK

The first question is whether you can legally ditch the pneumatics. This is a multi-step process that starts with the aircraft's type certificate data sheet (TCDS). These can be downloaded from the FAA (<http://snipurl.com/27u3bq>).

If the TCDS specifically lists the pneumatic system or instruments, you have to keep them. Our search of several popular GA aircraft showed this was rare. One exception was the Mooney M20 series, where the vacuum pump is specifically listed, however, the TCDS was revised in December 2010 to include a note saying that the vacuum system can be removed if the attitude indicator was replaced with an STC'd installation of a non-vacuum system and that the remaining vacuum system is no longer connected to any opera-



Aspen Avionics' install manual flow chart says to keep the existing pneumatic instruments if they exist. But this isn't actually required. If you do substitute electric ones, you follow the flow charts as if they were original.



tional system. Peter Lyons, VP of product management and co-founder of Aspen Avionics, points to this as proof that, "The FAA has clearly recognized that vacuum pumps are going away and doesn't want to have barriers standing in the way."

Another catch might be in the common TCDS phrase, "The airplane must be operated according to the appropriate AFM." Many newer aircraft have a "kinds of operations" list in section two of the AFM (the Aircraft Flight Manual, a.k.a., the POH). A mid-70s Bonanza won't have this but if you wanted to remove the vacuum-powered attitude indicator from a G1000 Cessna 182 you'd be out of luck. It specifically says the vacuum instrument is required for IFR.

Now here's a stumper: You get a great deal on an early Cirrus SR20 with its Rube Goldberg vacuum system and want to upgrade the whole thing to glass panel and electric backups. The kinds-of-operation list doesn't require a vacuum system or instruments, but it requires a vacuum gauge. Can a gauge that always reads zero satisfy this AFM requirement? We have no idea.

RC Allen offers a digital attitude instrument and emergency backup power. That's the backup for the vacuum-free Mooney above. In fact, the only spinning gyro in the airplane is the turn coordinator used by the S-Tec autopilot.

Other catches might be in a minimum equipment list or if you need the pumps for pneumatic de-ice boots.

Finally, you must ensure the STC for the glass-panel installation doesn't require the original pneumatic instruments to be retained. Complying with FAR 23.1311 (a), the Aspen Evolution install requires standby attitude indicator with a separate power source (among other things), but it doesn't need to be original equipment. The Aspen install manual goes further to note "Removal of the pneumatic system is not authorized by this STC." That doesn't mean it's forbidden. It means you'll need a separate approval—probably a Form 337—to complete the process.

EQUIVALENT SAFETY

When it comes to how much redundancy your new, all-electric setup will be, you have some flexibility. Step one is the STC. The Aspen install needs

a second attitude indicator with a separate power source, as noted before, and that source must supply the system for at least 30 minutes. Keeping the vacuum-powered attitude indicator certainly qualifies.

FAR 23.1353 (h) says that any storage battery must supply 30 minutes of juice, so that's probably where their number comes from. A Bonanza we know that recently went all electric used the popular Mid-Continent Lifesaver with battery backup to meet this requirement. The \$4867 unit claims 60 minutes of run time. (Tip: Get the \$77 remote mounting kit so the battery can be put somewhere for easy access and replacement rather than mounted on the instrument back.) RC Allen and Castlebury also have qualifying electric gyros.

The Lifesaver has no STC for its installation, but it's a fully-TSO'd part, which makes it simpler to say it qualifies as "functionally similar equipment" under AC 20-41A. Because the instrument is probably installed in a different location than the old attitude indicator it's replacing, you'll probably need to submit a Form 337 or get a field approval. This is



TWO ALTERNATORS IS THE WAY TO GO IF ALL-ELECTRIC

Question number two on the installers' checklist for the Aspen EFIS is, "Does the aircraft have sufficient electrical capacity to supply all required equipment given the current draw in Table 7.1?" For a two-screen Aspen setup, that's five amps for a 28-volt system or over 10 amps at 14 volts. Add the required backup attitude indicator, that new big-screen GPS and the digital engine monitor, and your original charging system may simply roll over and call it a night.

A supplemental alternator could be all you need to beef up the available power pool while also giving you the backup you need in case of main alternator failure.

B & C Specialty offers a 20-amp system that drives off the accessory pad vacated by the vacuum pump. The alternator will supplement the primary buss any time the buss voltage dips below a set threshold (one volt low for 14-volt systems, two volts low for 28-volt systems). A standby alternator light illuminates so you know it's feeding the electrical system.

If the primary alternator has completely failed and the draw on the secondary exceeds 20 amps, the annunciator will flash and you have five minutes to shed the extra load.

B & C has STCs for the Bonanza, some Piper models and the Cessna 210. Virginia Aviation has an STC for Cessna 206s and 182s. The B & C system has been used by Cirrus and is factory equipment on Bonanzas, Pipers, Mooneys and Kodiacs.

Bill Bainbridge of B & C told us, "The FAA has done many field approvals for non-STCs. It seem like the FAA's been pretty receptive to field approvals because we have PMA'd parts." The B & C systems are \$2635 with the standard installation kit. The Cessna 206 and 182 version from Virginia Aviation is \$3750. The warranty is one year, but Bainbridge told us they'll treat each issue on a case-by-case basis.

An option in the works is GAMI's Suplinator. This is also a standby unit that runs from an accessory pad. The

Suplinator is self-exciting (it can create a charge even with zero battery voltage), has its own control module and can put out 40 amps in a 14-volt system or 36 amps under 28 volts. It weighs 6.5 pounds. The \$5000 kit includes a panel instrument showing the health and relative output of both the standby and primary alternators.

The initial STC is expected late this year for the Bonanza and will be extended to most engines with a similar accessory drive.

BEEFING UP THE PRIMARY

There are several options for lighter weight and more powerful alternators that have come on the market in the past several years.

Plane Power has 60- to 70-amp choices for both belt-driven and gear-driven systems. Most weigh under 10 pounds.

They also have generator-to-alternator conversions that would be an excellent move if you're starting with a really old mount and turning it into a cutting-edge machine. The list of approved aircraft is extensive, and the company can assist with an aircraft that isn't listed, offering copies of field approvals already granted for more uncommon aircraft. The alternators are available from several vendors and range in price depending on the application. Expect to pay between \$400 and \$550. The warranty is two years.

National AirParts caters to higher current needs and premium reliability. They have PMA approval for direct replacement on a wide range of singles and twins for alternators from 70 to 200 amps. Many are small case designs. They weigh in at 11.2 pounds through 120 amps. National also offers kits for generator conversion for some models.

Al Petrone, president of National AirParts, makes a point that these are heavy-duty systems with stainless steel connections and dynamic



balancing. He

also states that

they can put out near full power even at idle RPM. Some users with seriously high power needs believe him. You'll find National alternators on several Predator military UAVs and running all the camera and transmitter equipment on the MetLife blimp. "We recently got one back from a flight school that was still working but needed a rebuild. I couldn't believe it; it had 3000 hours on it," said Petrone.

National AirParts alternators aren't cheap. Expect to pay \$1100 for the 70-amp variety to \$4000 for a 200-amp monster. They come with a two-year, 600-hour warranty. If you're building a really power-hungry system, such as something with hot props, or want the lowest odds for alternator failure, these alternators might be a good fit for you.

Kelly Aerospace's extensive 50- to 70-amp alternator line was recently acquired by Hartzel. Both new alternators and overhauled units are available. New unit prices run from \$750-\$1300 with a two-year, 1000-hour warranty. Most overhauled are in the \$450-\$600 range with a six-month warranty.



technically the installing shop's call as to whether it's a major alteration or not. So far, our sources say the forms aren't getting kicked back by Oke City, and the airplanes are returning to service vacuum free.

You have to read the fine print. Having a second Aspen display does not qualify as a backup attitude indicator, even though it has internal battery backup. Aspen is working on design changes to remove that restriction. The Garmin G500 installation specifies that any non-electric attitude indicator is acceptable for backup, but the only acceptable electric attitude backup is the Mid Continent 4300-2 or -4. That means you couldn't install a \$15,000 L-3 Trilogy system that provides backup attitude, airspeed, altitude and (optionally)

heading even if you want to. As an aside, the new Cessna Corvalis TTX uses the Trilogy, and is probably the first certified GA aircraft with no spinning-mass gyros at all, primary or backup.

An attitude indicator with electric backup sounds great, but you've got to think through the potential scenarios. The Lifesaver can run up to 60 minutes after total electrical failure, but a vacuum gyro can spin until you run out of gas. If total electrical failure means you also lost all navigation, then you must find VFR to let down and land. Attitude for 60 minutes might not be enough.

We think an all-electric aircraft must also have some backup navigator. This could be as simple as a portable GPS or even an iPad with good GPS—just enough to get you down to an airport in an emergency. The Aspen Evolution does have 30-minute backup power of its own (we've heard reports of it lasting twice that, however) and an emergency GPS. But that's only 30 minutes.

While it wouldn't be required, the open accessory drive vacated by the vacuum pump would be a great place for a standby alternator. This gives serious peace of mind in an all-electric aircraft that we could continue to the destination without losing the digital displays after an alternator failure. Even on a dark VFR night, you may wish you had more than even 60 minutes of attitude display. There are also pure battery backup systems, but practically speaking, we'd lean toward the second alternator, with a slight preference to the self-exciting type that don't require any outside battery power to work.

More robust would be upgrading to a full dual-alternator, dual-battery, dual-buss system. This complicates the install process and may mean more 337s or field approvals. A standby system with its own STC simplifies the process.

Because every one of these installs is different in the details, you'll want to search for any single-point failures your reworking puts into the new layout. You'll also want to know cold the emergency process for the new instruments. For example, both the Lifesaver and the Aspen Evolution require you to push a reversionary button within 30 and 20 seconds of main power loss, respectively,

to keep them running on backup power. The Aspen flight manual supplement also says that IFR flight when the backup battery is not fully charged is prohibited.

RUNNING SOME NUMBERS

Going electric won't save you money. Moving your old instruments and replumbing the vacuum lines isn't free, but even worst case it shouldn't be more than \$500 in labor. The standby attitude indicator with battery would be 10 times that in parts alone. That'd buy a lot of pneumatic system repair.

While you're free from the procession of filter, pump and (probably) instrument replacements, the standby battery must be replaced periodically. Mid Continent told us their standby battery is expected to last three years and replacement is \$400. However, once the switch to all-electric is made, maintenance downtime is probably limited to 15 minutes every three years to replace those batteries. No vacuum system can make that claim, even for just replacing the filters.

A logical question is whether there's value in taking out pneumatic instruments and replacing them directly with an electric attitude indicator and electric HSI as primary instruments without doing a glass-panel install. If the only pneumatic instrument on the aircraft was the AI and the maintenance was costing you money and downtime, it might be worth the \$5000 install and periodic battery maintenance. To replace both an AI and DG, we don't think the numbers work. The electric AI and electric mechanical HSI (such as a Bendix-King KCS55A) would be around \$9000. That's equal to an Aspen Evolution Pilot install and within \$5000 of the far more capable Evolution Pro.

The allure of familiarity may be the biggest hurdle in going all-electric. The Bonanza owner making the final design decision for his new panel realized he'd lose the old vacuum-powered DG he'd planned to put on the copilot side.

"Do I really want to do that?" he asked. The technician replied, "What are you keeping it for?"

The owner didn't have a good answer. Now the airplane is vacuum free.

CONTACTS

B & C Specialty Products
316-283-8000
www.bandc.biz

Castlebury
512-251-5322
www.ciamfg.com

General Aviation Modifications, Inc.
888-359-4264
www.gami.com

Hartzell Engine Technologies
(formerly Kelly Aerospace)
334-386-5400
www.hartzellenginetechnology.com

Mid Continent Instruments
800-821-1212
www.lifesavergyro.com

National AirParts
800-713-1111
www.nationalairparts.com

Plane Power
877-934-5700
www.plane-power.com

RC Allen
316-265-6868
www.kellymfg.com

Virginia Aviation
434-237-8434
www.standbyalternator.com

Eastman's CH750: Super STOL LSA

Eastman is plying the private owner market, but it sees as much potential as a sensor platform for law enforcement agencies

by Paul Bertorelli



If the world of manufacturing offered such a thing, it would have to issue a special award to the light sport aircraft industry for sheer, blind tenacity in the face of hopeless market conditions. Dozens of companies persist in peddling so-so designs with no chance of achieving enough volume to survive, much less prosper. The smarter companies are figuring this out and are

re-jiggering their business plans into hybrids whose sales

rely not just on flightschools and owner operators, but other business lines entirely.

An intriguing example of this is tiny Eastman Aviation, headquartered at Georgia's Heart of Georgia Airport, south of Atlanta. The company is plying the usual sales leads among private owners and flightschools, but it's also doing something unique: It's pitching its products to law enforcement and government agencies as a cheap replacement for expensive helicopters and it's even exploring

ways to convert them into unmanned aerial vehicles, a white-hot market segment with few inexpensive options. Diamond has done the same with its DA42 MPP twin, converting the airplane into a multi-sensor surveillance platform that can be manned or unmanned. There's little doubt that demand exists for such products. Eastman's challenge will be to break

into a field dominated by products many small agencies can't afford.

TWISTS AND TURNS

When, in 2004, we first visited the spacious hangar where Eastman now lives, it was home to another company: Aircraft Manufacturing and Development, a company that was building the CH2000 Alarus, a light, two-place trainer meant to compete with the likes of the Diamond DA20. Although that model achieved moderate success, the trainer market is thin and fickle and AMD failed to sustain. After an ownership change, the company

CHECKLIST



STOL performance is impressive, with docile handling.



Fat wings and inverted horizontal stab make helicopter-like hovering possible.



Not the best-looking LSA of the litter. Form definitely follows function.

morphed into a second AMD—Aircraft Manufacturing and Design, and moved into the LSA market, tooling up to build the CH601 LSA, a design that originated with the prolific Chris Heinz of Zenith Aircraft. Zenith was also responsible for the Alarus design and the original AMD manufactured it under a subsidiary arrangement with Zenith.

While ramping up in the LSA market, the second iteration of AMD was bought by George Bryce, Jr., a Florida-based aircraft dealer and investor, who reformed it into Eastman Aviation. The company's product line now consists of two aircraft, the low-wing CH650 and the high-wing, STOL-capable CH750. These two aircraft were also designed by Zenith and all the parts and pieces are provided by two



to-fly SLSA CH650 and 750. Eastman is set up a little like a mini-Boeing, buying airframe subassemblies from Zenith and obtaining engines, avionics and other hardware to merge into the ready-to-fly whole. The subassemblies—wings, fuselages and controls—arrive complete. Eastman assembles the aircraft, paints

them and installs avionics and systems.

Between the AMD and Eastman iteration of this manufacturing effort, about 60 of the low-wing versions have been delivered another four of the high-wing 750 have been built. Both of these airplanes owe their genesis to Zenith kit designs. The 650 started life as the CH601, which was both a kit and later an LSA. With the addition of a larger bubble canopy and other minor changes, it became the CH650.

Likewise, a variant of the CH750 appears in the Zenith product line as the STOL CH750 and like the kit version, the LSA version has been constantly improved since its progenitor appeared as the STOL CH 701 some 20 years ago.

DIFFERENT STROKES

Zenith is somewhat unique in the kit world for producing so many designs aimed at different market interests and so it is with the CH650 and 750. Eastman's

Frank Woodward told us the 650 is pitched as a go-places cruiser for owners who want a practical, sport flyer with respectable speed. As far as Eastman is concerned, it can be equipped to be flown under IFR.

The CH750, on the other hand, is the LSA equivalent of a utility aircraft and herein, Eastman sees an opportunity. With the ready-for-business looks that only a mother could love, the airplane shines at short field and STOL performance and it can fly nearly slow enough to compete with a helicopter. Woodward, who has a background in unmanned systems, is working on

fitting it with lightweight airborne camera systems, searchlights and hailing speakers, among other ideas that law enforcement agencies would want for an aerial platform.

Eastman has been making the rounds of law enforcement and agency trade shows trying to pitch the idea of an LSA as a stand-in for an expensive, dedicated helicopter or perhaps as a supplement.

Our response to this would be "good luck," were it not for the fact that virtually every jurisdiction with an air unit—fixed or rotary wing—is cash strapped and facing budget cuts. Some of these have simply gotten out of the air unit business entirely. Eastman believes that for at least some of these agencies, an LSA will be an attractive option and the company is getting some nibbles. Although the ASTM consensus standard doesn't allow LSAs to be used in for-hire operations, it does allow government agencies to deploy them in the utility role. Further, in such public use, the aircraft's gross weight can be increased to 1440 pounds, 120 pounds higher than the civil LSA limit. Eastman's Woodward believes that's more than enough additional payload to accommodate modest sensor packages.

For owner-flown use, the CH750 would be a good choice for owners interested in backcountry or utility flying or who just want something different—really different.

Base price of the CH750 is a rather frugal \$99,900, but typically equipped with a comm radio, transponder and Dynon glass (100, 120 and/or 180), typical invoices are competitive with everything else: about \$125,000 to start, but as much as \$180,000 with everything you can stuff into the airplane. That can include a BRS parachute system (\$8000 and a 40-pound payload hit) and AmSafe airbag seatbelts.

Although the Rotax line seems to dominate the LSA segment, both CHs are equipped with the Continental O-200 swinging fixed-pitch, two-blade propellers from Sensenich. Woodward told us this choice does cost a significant difference in payload, given that the Rotax is a much lighter engine. But he also said they are pitching to a market that prefers a conventional aircraft engine and Eastman is dedicated to the idea that these LSAs will be built in North America, at least



Full-span flaperons, top, and inverted profile horizontal stabilizer help with control at high angles of attack. Both CH650 and CH750 use Continental's 100-HP O-200.

Zenith sister companies, the Canada-based Zenair and Zenith Aircraft of Mexico, Missouri, both of which are actively involved in the kit industry and offer both of these models as kit aircraft.

But only Eastman makes the ready-

as much as possible. Even with the heavier engine, the CH750 has typical LSA empty weights of between 830 and 850 pounds for a typical useful load of 460 to 480 pounds.

It carries 24 gallons of fuel (22 gallons useful), so with tanks full, there's payload for one FAA 170-pounder and another light person, but no baggage. (If you wonder why people fly LSAs a little over gross, that's why.)

FLYING IT

These two airplanes are so dissimilar that comparing them is pointless, so we won't. We'll look at the CH750 in this article and the CH650 in another report. If there's one word to describe the CH750, it's pragmatic. Pretty it ain't. It has a fat wing with a large, full-span fixed leading edge slot that kicks in at high angles of attack, keeping the airflow attached and allowing the airplane to fly controllably at slow airspeeds. Another curious aspect of this design is a reverse camber horizontal stabilizer, which also contributes to slow speed controllability at high AOA.

The cabin ergos are, well, different. The gear legs and struts are positioned far enough aft of door centerline to make ingress and egress easier than it looks. Just plant your butt in the seat and swing your legs in. There's no stick to get in the way because...for dual controls, the CH750 has a single, center-mounted stick a Y-contraption on top to give both pilots something to grip.

At first glance, it doesn't look like it will work right, but it does. It's just as natural as a dedicated center stick and the Y provides a nice notch to rest your arm on during taxi.

How does it perform? Impressively. With an 8-knot, gusty breeze right down the runway, the CH750 levitated into climb in what we would estimate was under 200 feet. By the end of Eastman's 6000-foot runway, the airplane was at nearly 1000 feet and still climbing at 600 FPM. As you can see in the photos, the CH750 has a bunch of glass, so visibility is unrestricted in all directions, even forward. And that's good, because the climb deck angle is quite high.

The airplane's glareshield ducks sharply downward, terminating at nearly knee level for the pilots. One odd effect of this is that the right-seater's throttle control is squarely in front of the seat, not offset to the left or right. On further rumination, we realized that's the only place to put it, otherwise the rightseater would have to awkwardly reach across the cabin to get at the throttle.

Roll and pitch forces are pleasantly light, but not to the point of twitchiness. However, that can't be said of the rudder forces, which are quite stiff. Both of these airplanes are equipped with a steerable nosewheel—something you don't see in many LSAs—and the bungee mechanism that provides this appears to impart some stiffness to the circuitry. It takes a grunt to move the rudders and there's very little feedback.

Slow speed handling is superb and stalls are nothing but a docile parachute mode. We couldn't provoke a break with anything short of abusive control input. Because the airplane has full-span flaperons, it has good roll control throughout the speed range. In slow flight, habit dictates using the rudder for roll control, but the flaperons are also an option.

Speed? Well, not much. At 3000 feet, we noted 80 knots true at about 65 percent power at 6.5 GPH. With 22 gallons usable, that makes the CH750 a three-hour airplane, with a little reserve. The seats are comfortable enough, so you could stay in for longer if the spirit moved.

Landings are a showoff's delight. On a large runway, you can not only



The CH750 has a single center stick with a Y-head to provide access to both seats, top. Eastman is exploring lightweight sensors and cameras for law enforcement, lower photo.

make the first turnoff, in a maximum effort arrival, you can touchdown inside the threshold and stop short enough to turn in where a departure is doing his runup. This will elicit some comment on the frequency, to be sure.

CONCLUSION

Eastman's shtick with the CH750 is twofold: max performance STOL for any owner who wants that performance and a strong tilt toward the UAV and law enforcement platform market. In our view, if they get traction with either, that's a good thing. It's always in any would-be owner's interest to have more rather than fewer airplanes in the field. For more information, contact Eastman Aircraft at www.eastmanair.com or 478-374-2759.

AC TV



For a video demonstration of CH650 and CH750, log on to www.avweb.com and select the video index. Scroll down to the Eastman Aircraft videos.



-  Wireless Bluetooth for telephones and music.
-  Perfected cabin music control and muting.
-  Control logic might overwhelm the button-challenged.

Bluetooth Audio Panel PM8000BT Does It All

PS Engineering takes the overachieving PM8000 audio panel even further with Bluetooth connectivity for music and phones. It goes vertical, too.

by Larry Anglisano

PS Engineering is compulsive when it comes to perfecting and adding new features to otherwise well-engineered aviation audio products. The result is a product line that remains cutting edge and a step above the competition. The newest talent of the line is the PM8000BT.

The six-seat-capable PM8000-series audio system earned top-dog status in our audio panel review

(*Aviation Consumer*, August 2009), and that status has held up under long-term testing. We didn't think it could get any better until company founder Marc Scheuer took it to the next level with the logical addition of Bluetooth connectivity—an industry first.

BLUETOOTH DONE RIGHT

We've used Bluetooth audio connections in the cockpit with mediocre results, so we approached our 8000BT flight trials with generous amounts of skepticism. Turns out we were wrong. The 8000BT easily synched to our quirky Motorola Droid X phone where we stashed some of our favorite MP3 tunes.

And for sophisticated music on the fly, you won't find a panel more

complete than the 8000BT. Just like the original PM8000 introduced a few years ago, the 8000BT retains the backward compatible and slide-in capability for Garmin GMA340 replacement without an audio rewire job. The 8000BT will also play with existing plain-vanilla PM8000 installations without the need for rework. As we go to press, Garmin brings to market the new GMA350, which we'll look at in the near future.

We applaud PS Engineering's smart thinking when it comes to this direct-replacement mentality because audio installations are big work, and tearing apart the radio stack and interior to replace an otherwise modern audio panel is a crummy way to spend upgrade money.

Our test aircraft had a GMA340 which we swapped out a few times to sample the differences between it and the 8000BT. The PM8000BT wins hands down in entertainment audio quality and clarity (and we think the GMA340 has fine audio to begin with).

The raw audio level of the music input piped into the 8000BT offers higher output than the GMA 340. We had the volume cranked all the way up on the Droid, and on a wired MP3 player, and could barely hear the tunes from the GMA340. The 8000BT had plenty of gain. There is an official field service modification that can be made to the GMA340 that increases this entertainment audio gain, but it also increases the presence of unwanted background noise. Noise filters for that seem to give hit-and-miss results.

As a side note, it's not uncommon to hear injected electrical system noise in the entertainment circuit of any panel, and increased volume could exaggerate this unwanted noise. We've seen some owners painstakingly chase alternator and

CONTACTS

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865-988-9800

ignition noise with poor results. While the 8000-series is perhaps the best cabin audio you can install in your noisy piston cabin, it won't be perfect.



NEW TRICKS, MOUNTING

Panel space in most aircraft is getting tighter, and the audio console is getting in the way. Garmin's solution is the remote-mount GMA35. But PS Engineering has an alternative. The V version of the 8000 can be mounted vertically, perhaps next to the radio stack, perhaps somewhere else where there's room. We applaud this outside-the-box thinking. PS clearly has a handle on the challenges techs face every day.

Some other enhancements include four selectable muting functions: music mute on, where both cabin chatter and radio activity mutes the music; music mute off, for uninterrupted music flow regardless of radio or intercom activity; radio mute, where only the aircraft radio mutes the music; and intercom mute, where only activity inside the cabin mutes the music. These modes are smartly annunciated through the headphones as they are activated.

If you don't want to fumble in a side pocket to change the volume on your stowed music device, PS Engineering added a music volume control that's accessed by pressing and holding the speaker button. Since some telephones won't provide a side-tone (the sound of your own voice in the headphones as you speak) the panel can create an artificial sidetone. To answer a ringing call, you can answer from the telephone or from the panel itself—by pressing the TEL button, of course.

The 8000BT can connect wirelessly with up to eight devices. Only one can be a telephone, but we can't see why you would want to connect more than a single phone in such a small cabin anyway. The phone connection is controlled by intercom mode. It's a party line in a normal group intercom. Crew isolate puts the phone up front, and pilot isolate gives the left seat a private call. Radio calls won't mute the phone, but you're not supposed to be making calls in flight anyway, right?

We found the pairing of our phone to be seamless. It dropped the connection once, but we had a low battery we assume was the culprit.

Because the 8000BT is always discoverable, connecting is a straightforward matter of searching for and selecting the 8000BT from your devices menu. The connection streams music into the Music 1 input, which can be programmed to stream throughout the entire cabin.

Music control functionality is dependent on the device that's paired. The panel commanded our Droid X for skipping forward, back, pausing and playing the music. Some other units like the LG nV and iPhone might not have all of these functions.

A cool trick is the unit's ability to pair up with some notebook computers that have a compatible Bluetooth AV source. You simply add the 8000BT just as you would a remote speaker device. Another potential is to use a remote pairing device as a bridge to take music from computer's output jack and connect to the audio panel.

If there's a fault with the new \$2095 PM8000BT, it's that many pilots won't learn all of the features this panel brings on board.

WORTHY TECH

Many pilots dis the idea of flying with music in the headsets—until they make the leap and then can't live

In addition to the Bluetooth, the PS8000BT has a faceplate jack to connect dinosaur cell phones or music devices that don't have wireless capability. A vertical version (below) opens new mounting options for crowded panels.

without it. As one Cirrus owner put it, "XM-delivered smooth jazz at just the right volume is part of every mission. Angel Flight passengers are more relaxed and, for me, it takes the edge off when things get interesting."

Whether pilots will be more attracted to the freshly improved Garmin GMA350 remains to be seen. On the other hand, PS Engineering has certainly earned brand loyalty with products that focus on quality and bang for the buck value. Investing in their latest PM8000BT is smart money, in our view.





Replacement Plastic: Aftermarket Saves Big

For aircraft interiors made after the late '60s, availability and price is best in the aftermarket. For rarer birds, salvage or repair may be the only option.

by Jeff Van West

Like bargain wine and crotchet magazine editors, plastic gets touchy with age. Sunlight is the biggest enemy, but even tucked in a climate controller hanger, the compounds that give plastic its flexibility outgas, leaving the remaining material prone to cracking or shattering from a stress it would have sloughed off 10 years prior.

Everything aviation costs roughly an order of magnitude higher than an analogous non-aviation part, and plastic interior pieces are no different. The small redeeming point with interior plastic is that parts for the majority of GA aircraft can still be had, and that you can save a bit by doing the installation yourself, if you're so inclined.

OEM AND OTHERWISE

Bobby Cook, Parts Manager for Cessna Aircraft Parts told us, "We don't sell a ton of plastic. We used to

sell more, but these days everyone is tightening up their dollar." It's logical that non-essential items like a crack in the left seatback would be one of the first things to get hacked from the aircraft repair budget. Cook

"Forty dollars for a vent cover? What are they smoking?"

admitted, however, that this drop in sales may also be from more business going to suppliers of non-OEM parts, looking for a better price.

The price delta between OEM and non-OEM sources is huge—commonly over 50 percent. Parts resellers like Cessna Aircraft Parts buy from the OEMs. The advantage is the parts are usually a perfect fit and are at least as good as the original.

Many pieces may fit fine out of the box, but it's common to have a bit to trim off to match your exact aircraft. Because exact screw-hole position varies from aircraft to aircraft, these are often left for you to drill out.

We say at least because any newly manufactured part must meet the current structure and burn standards. Plastic technology has improved in the past 30 years. That said, formulations for UV protection and fire retardancy are somewhat at cross purposes, so the new part may not outlast the original if it's an antique.

All plastic parts have to be cleaned up after casting and Cook says some aftermarket parts fall short here. "Some [buyers] have come back to us and bought the original plastic because you have to cut the [aftermarket] plastic."

OEM parts are usually made in large batches, so delivery time can be days for stuff that's in stock or months for items waiting for the next production run. The latter seems the exception rather than the rule. Cessna parts are widely available. Mac Little of Piper Parts Plus told us that Piper and Cirrus are also good about turnaround time on interior parts.

What are the tough items to find? "Old doors," says Cook. These panels take regular abuse from kicks and bangs during normal use and can be specific in some detail to as few as 70 serial numbers. When ordering a part where there is a lot of variability, you'll want not only the part number but also the year and serial number of your aircraft.

One source for tough-to-find parts is Preferred Airparts. They buy surplus OEM inventory, as well as part out used aircraft. The ordering paradigm is a bit different from Preferred in that they don't publish prices. Instead, you request a quote for the parts you want. "We usually give 40 percent off the list price," says Dale Miller, Marketing Manager for Preferred.

Preferred maintains a large inventory extending back to piston singles built in the '40s and up through

Common parts can usually be had in days, but if a run of parts has to be made waits of eight to 12 weeks are not unusual.

modern turboprops and jets. The stock is primary Cessna, with some Piper and others. "We have what we have," says Miller. "But we might have something you're looking for tomorrow or in a year." Miller sees common requests for window trim and headliners for twins and, of course, those door panels. Having access to used inventory doesn't help much, as those door panels tend to be cracked already.

THE AFTERMARKET STUFF

The least expensive route is aftermarket, and the 800-pound gorilla in that arena is Vantage Plane Plastics. This price spread follows a predictable variance across many makes and models. For example, the rear seatback for a Cessna 172M lists for \$470, can be had from OEM resellers for \$376, is available as surplus OEM (from Preferred Airparts) for \$268 and can be bought from Plane Plastics or its resellers for \$164.82.

These aftermarket parts are still usually a PMA'd direct replacement with all the documentation. Plane Plastics has over 3500 PMAs for parts and continues to add them.

They also have non-PMA'd parts they can sell, but with some restrictions. The aircraft must have been type certificated before 1981 and you must send Plane Plastics the original part so they have it in house. They can then send you a replacement as a custom-made part. Non-PMA'd

parts for non-structural applications were common before the mid '90s. Then fallout from some events in the jet engine market led to a serious tightening of the regulations on this practice.

Plane Plastics has an online catalog that's easy to browse and covers a wide range of aircraft, including less prevalent makes such as Grumman, Mooney and Commander. They also have many helicopter interior parts. The company is branching out into exterior plastic parts, although none are PMA'd yet.

Plane Plastics' installation manager, J.D. Casteel, told us the company is more than happy

Both Vantage Plane Plastics and Texas Aeroplastics sell repair kits. This may be your only option with more obscure parts.



Vantage Plane Plastics simply incorporated a clickable version of their printed catalog into their website for easier ordering. It's a good source for part numbers, too.

to look into building a part they don't have in stock if there's been enough demand. But there has to be real demand. The tooling cost to start with a customer-supplied part and create the forms for replication is about \$10,000.

Plane Plastics is the biggest shop making new plastic interior parts, but they aren't the only one. Bob Atkins is the owner of both a Piper Cherokee and Plane Parts, which specializes in Piper interior plastic. Their catalog isn't extensive, but it hits the most commonly requested pieces from PA-28, -32, -34 and -44s.

Atkins' background is in classic cars and he was appalled by the OEM cost of some parts when he went to order them. "Forty dollars for a vent cover? A part that's sitting on the floor where someone will



YES, YOU CAN DO YOUR OWN INTERIOR REPAIRS

Per FAR 43.3, an owner or operator of an aircraft with a pilot certificate may perform preventative maintenance so long as the aircraft isn't operated under Part 135, 129 or 121. (Sport pilots may only work on light sport aircraft.) What constitutes preventative maintenance is spelled out in Part 43 Appendix A (c), and interiors fall under section (9) "... or cockpit interior when removal or disassembly of any primary structure or operating system is not required."

You will have to make a logbook entry to return the aircraft to service saying exactly what work was done, but you don't need to be an A & P to do that and you don't need an A & P to sign it off.

Pertinent to this discussion is whether you can make your own parts and install them when they are simply interior pieces. Broad-brush, you can. But there are details on burn resistance and structural equivalence you must meet. Best to check with an A & P if you want to make sure that change is technically legit.



step on it? What are they smoking?" Atkins says one of his mandates is selling parts at a reasonable cost.

Plane Parts tries to get the part as close to the original as possible, but is willing to improve it in small ways if they don't interfere with fit and function. "Many of the original parts were not that well made," says Atkins. Thickness and finish were often uneven. Piper's original overhead consoles screwed in through a thin plastic edge that readily cracked. The Plane Parts version is just a bit thicker.

Color choice is limited for almost all plastic parts sources. There just

While there was a time when non-PMA—and cheaper—interior parts were common, it's a rarity today.

isn't enough demand to justify that lovely maroon Vero Beach designers felt went swimmingly with the orange velour seats. Atkins says people wanting colored parts should look at applying vinyl dyes to white or almond parts. The dye soaks in, which lasts longer than paint and doesn't dull the plastic finish.

CAN'T FIND EVERYTHING

If you can't find the plastic part you need, you might be able to repair what you've got. Casteel of Plane Plastics told us a surprise seller has been their new plastic repair kit. This is the same formula they use in-house to build parts assembled from multiple plastic pieces.

The \$12.49 kit is available in white, beige or black, but it arrives missing one key ingredient:

methyl ethyl ketone (MEK). There's a hazmat issue associated with shipping MEK, so you'll have to get some of that on your own. A quart from Aircraft Spruce is \$11.65.

Fixing a crack is only delaying the inevitable, however, because the old plastic is likely to crack again.

Sometimes there's just no good remedy for getting old.

CONTACTS

Aero Resources
281-438-6511
www.aeroresourcesinc.com

Cessna Aircraft Parts
800-441-1485
www.cessnaaircraftparts.com

Piper Parts Plus
866-897-2787
www.piperpartsplus.com

Plane Parts Company
310-318-1902
www.planeparts.com

Preferred Airparts
800-433-0814
www.preferredairparts.com

Texas Aeroplastics
817-491-4735
www.buyplaneparts.com

Vantage Plane Plastics
866-307-5263
www.planeplastics.com



Dynon DX15: Compact, Capable

But also compromised as a back-up comm because of its Li-Ion-only battery pack. Performance is comparable to Icom's A24 and Sporty's SP-400.

by Paul Bertorelli

It's more or less a given that carrying a handheld VHF transceiver in the airplane is a good idea, for ground frequency monitoring, pre-start clearance getting and as a back-up comm. The market hardly lacks for choice and now it has one more to pick from.

At Sun 'n Fun, Dynon Avionics announced the DX15 VHF air band transceiver to compete with Icom, Vertex and Sporty's at a price point of \$156 that we think is competitive with other radios.

The DX15 itself is a compact and credible product, in our view. It's the smallest, lightest VHF portable we've tried, but that size comes with compromise. It doesn't have some of the higher end features that the Sporty's SP-400 or Icom products do, such as built-in VOR or localizer/CDI capability. On the other hand, who cares? Most of us use portable radios as comm radios and depend on portable GPS for backup nav, so

no dings from us against the DX15 for lack of ancillary features. You get what you pay for.





Another limitation of the DX15's compact size is its battery pack. The only option is a dedicated lithium ion battery pack, the rechargeable chemistry of choice these days. While Li-Ion chemistry delivers good power with a graceful discharge rate, it's also slower to charge than other types of batteries and has self-discharge at an unknown rate. For this reason, Dynon recommends that for storage, the battery be removed and stored separately. This complicates its use as a back-up comm a bit—just more parts and pieces to keep track of. Also, the battery needs to be in a plastic bag or a container that other-

continued on page 32

The DX15 is among the most compact of the VHF portables we've tried, measuring a mere 4 inches high by 2.25 inches wide and 1.43 inches deep. Like all such products, it will accept an external antenna, but you need an optional BNC converter to adapt the SMA threaded antenna fitting, top photo. Keyboard, lower photo, is compact, so if you're fat of finger, let your nails grow long. The keyboard lock is a must to avoid unintentionally tuning. Orange key automatically tunes 121.5 MHz.



CHECKLIST

-  Small size is a plus. It's easy to store in a flight-bag or map pocket.
-  No-nonsense featureset makes it a snap to operate right out of the box.
-  At about \$156 retail, the DX15 is a good value against competition.
-  We would prefer an alkaline battery pack option.



Socata TB-20 Trinidad



It may not be the fastest airplane to sport a six-cylinder Lycoming, but on pure style points, it has no equal.

When the so-called Caribbean line from Aerospatiale first appeared at the Paris Air Show in 1977, the U.S. general aviation industry was booming, building mainly tried-and-true, if staid, designs like the Cessna 172 and the Piper Cherokee line.

Against that backdrop, the new TB-20 was a splash of cold water.

It's not that the airplane was terribly innovative—it wasn't, sporting the same Lycoming engines we had all been flying behind for years. But it had something no Skyhawk ever did: a sleek and stylish European panache. Ultimately, this didn't help much with sales, but the thing sure was—and is—good looking, what one aviation writer famously described as a Cherokee done over by Club Med.

The Trinidad is the top of the line of a small family (five) of single-en-

gine aircraft developed and built by Socata in Tarbes, France, from which the TB derives. Socata is the general aviation division of the government-owned aerospace conglomerate, Aerospatiale. Although the TBs are out of production, Socata is still go-

ing great guns with its turbo-prop TBM line, now up to the 850 model.

The Caribbean line of aircraft includes the TB-9 Tampico and -10 Tobago, fixed-gear singles of 160 and 180 HP and the 250-HP, retractable-gear TB-20 Trinidad and -21-TC turbocharged Trinidad. In this regard, the French have largely duplicated the American marketing strategy of a model for every price and usage strata. No surprise there.

The models share a common fuselage, wing and empennage, which has obvious advantages in production economies, something U.S. airframers

haven't always done. In practice, this means that a batch of fuselages and flying surfaces can be built and kept on the shelf until orders need to be filled. It also means that for the Caribbean series, no distinction is drawn between the airframes: The two variants co-exist within the same run of serial numbers.

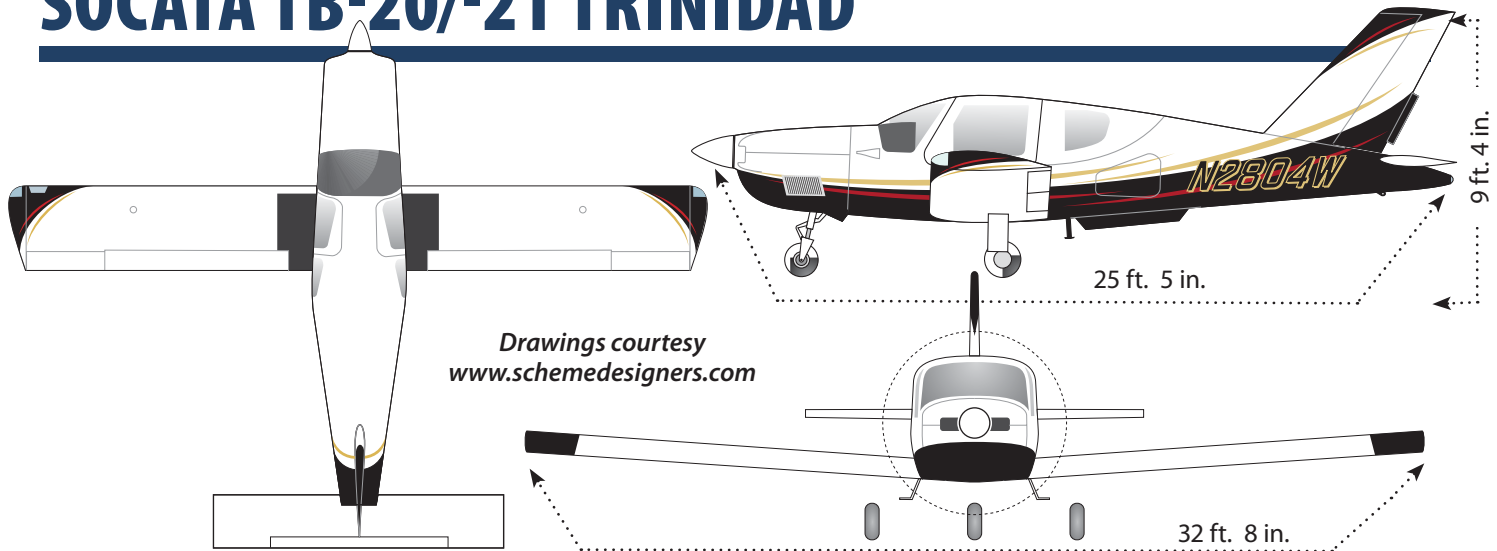
To date, the total worldwide TB-20/21 population tops out at about 830 airframes worldwide, with the plurality based in France. There are about 270 on the U.S. registry, according to the TB Users Group.

After its promo appearance at the Paris Air Show in 1977, the TB-20 was awarded French type certification in December 1981. The first Trinidad arrived in the U.S. during the summer of 1983, with FAA approval the following year. The turbo'd TB-21 got FAA certification in March of 1986.

Acceptance of these models can best be described as mixed. The French had been in the U.S. before with the Rallye, of which 3500 were made worldwide, and had not done

The Trinidad had something no Skyhawk ever did: a sleek and stylish European panache.

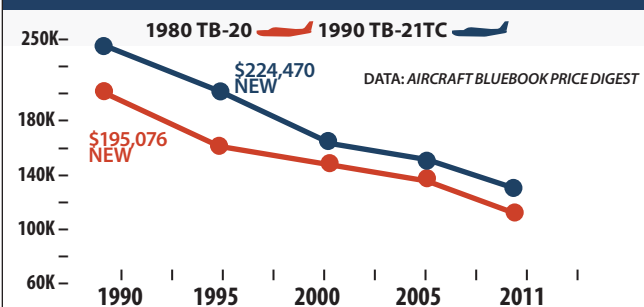
SOCATA TB-20/-21 TRINIDAD



SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1984-1988 TB-20 TRINIDAD	LYC. 250-HP IO-540-C4D5D	2000	\$35,000	86	1280 LBS	160 KTS	±\$90,000
1986-1988 TB-21 TC TRINIDAD	LYC. 250-HP IO-540-AB1AD	2000	\$50,000	86	1230 LBS	180 KTS	±\$110,000
1989-1992 TB-20 TRINIDAD	LYC. 250-HP IO-540-C4D5D	2000	\$35,000	86	1280 LBS	160 KTS	±\$110,000
1989-1992 TB-21 TC TRINIDAD	LYC. 250-HP IO-540-AB1AD	2000	\$50,000	86	1230 LBS	180 KTS	±\$120,000
1993-1997 TB-20 TRINIDAD	LYC. 250-HP IO-540-C4D5D	2000	\$35,000	86	1280 LBS	160 KTS	±\$140,000
1993-1997 TB-21 TC TRINIDAD	LYC. 250-HP IO-540-AB1AD	2000	\$50,000	86	1230 LBS	180 KTS	±\$150,000
1998-2002 TB-20 TRINIDAD	LYC. 250-HP IO-540-C4D5	2000	\$35,000	86	1280 LBS	160 KTS	±\$175,000
1998-2002 TB-21 TC TRINIDAD	LYC. 250-HP IO-540-AB1AD	2000	\$50,000	86	1230 LBS	180 KTS	±\$185,000
2003-2005 TB-20 TRINIDAD	LYC. 250-HP IO-540-C4D5	2000	\$35,000	86	1280 LBS	160 KTS	±\$225,000
2003-2005 TB-21 TC TRINIDAD	LYC. 250-HP IO-540-AB1AD	2000	\$50,000	86	1230 LBS	180 KTS	±\$260,000

RESALE VALUES



SELECT RECENT ADS

- AD 07-02-04 WING SPAR LOWER BOOM/ FAIRING ATTACH SCREW
- AD 03-04-03 AILERON CONTROL GIMBAL
- AD 02-20-04 EXHAUST SYSTEM MOD
- AD 01-23-04 RUDDER HINGE FITTING
- AD 98-18-13 MAIN LANDING GEAR BEARING

SELECT MODEL COMPARISONS

PAYLOAD/FULL FUEL

TB-20 TRINIDAD	500	600	700	800
TB-21TC TRINIDAD	500	600	700	800
BEECH F33 BONANZA	500	600	700	800
CESSNA 182RG	500	600	700	800
PIPER PA-28 ARROW	500	600	700	800

CRUISE SPEEDS

TB-20 TRINIDAD	140	150	160	170
TB-21TC TRINIDAD	140	150	160	170
BEECH F33 BONANZA	140	150	160	170
CESSNA 182RG	140	150	160	170
PIPER PA-28 ARROW	140	150	160	170

PRICE COMPARISONS

1990 TB-20	(\$110,000)
1990 TB-21 TC	(\$125,000)
1990 F33	(\$170,000)
1982 CESSNA 182RG	(\$115,000)
1990 PIPER ARROW	(\$105,000)
	\$50K \$100K \$180K



Socata got the lines just right on the TB20—it's pleasing to look at from any angle, top. Gullwing doors are a mixed blessing. They're great for ingress/egress, but owners say they're a nuisance in gusty weather on the ground. Cockpit visibility is good, but forward windshield post and door frame obstruct. (Top photo: Marshall Ferguson.)

well with it in a market that still supported volume sales. After a couple of failed efforts to introduce the TB line, Socata established its own operation just outside of Dallas, Texas. Aerospatiale General Aviation (AGA) shared facilities with Aerospatiale Helicopter Corp. in Grand Prairie. This facility was phased out in favor of a single distributor in Florida and as of this writing, Socata Aircraft USA is headquartered in Pembroke Pines, Florida, as a wholly-owned subsidiary of EADS Socata. It still supports all models.

TB-20 models built between 1977 and 2000 are so-called "Generation

One" aircraft and most of those already in the field are of this vintage. In early 2000, Socata introduced the "Generation Two" or GT line, with upgrades to the original aircraft design. The GTs have essentially the same airframe, controls and powerplant as the originals, but

they have a modified carbon-fiber-based cockpit roof which increases headroom and cabin volume, thus addressing complaints from taller pilots. Other minor changes have been introduced. In 1990, starting with serial number 950, maximum landing weight was increased to 3086 pounds. Unfortunately, structural modifications were made to the landing gear attach points and they are not retrofitable to earlier models.

At the same time, the electrical system was changed from 14 to 28 volts. A change to a higher-speed starter motor followed. To its credit, the detail and systems changes Aerospatiale/Socata has made to the design are almost completely the result of customer experience. Also to its credit, according to reader feedback, the company has been responsive to customer requests for assistance, although one former owner who contacted us complained of weak parts support.

CONSTRUCTION

The relatively simple, monocoque fuselage has a comparatively low parts count compared to like aircraft.

According to the company, it takes about 600 man hours to construct a Trinidad, which is excellent in context. This is lower than, for instance, the hours required to build a Mooney or Bonanza airframe. Most of the cabin is fabricated from reinforced glass fiber which sits on top of the load-bearing structure, the fuselage tub.

Flight controls are actuated by push rods rather than the more typical cables, which gives a positive—albeit a bit heavy—control feel similar to Mooney models. Since much of the wing trailing edge is occupied by the flaps, the ailerons are short span. It's a simple, yet sleek design.

A prominent distinction is the vertical stabilizer, which is located forward of the horizontal, all-flying tail or stabilator. Both control surfaces have trim tabs. Pitch trim is via an anti-servo tab.

The rudder trim tab is an additional surface appended to the rudder that looks like an afterthought. The main landing gear is a trailing link design that favors pilots who occasionally botch landings; it soaks up the bumps well.

For power, the TB-20 uses the Lycoming IO-540-C4D5D version rated at a conservative 250 HP. The turbocharged TB-21TC combines the AB1AD version of the same powerplant, also rated at 250 HP, with a variable wastegate-controller Garrett AiResearch turbocharger. Recommended TBO for both is 2000 hours, which is a plus. But that doesn't mean TB-20 owners have an easy time of it. As with any large engine, overhaul costs are relatively high. In a phenomenon unique in recent experience, there's actually good news about the cost of operating the turbocharged engine.

When we covered the Trinidad some years ago, our sources quoted an average overhaul cost for the turbocharged engine of a whopping \$30,000. During the early 2000s, thanks to competition in the cylinder markets, overhaul costs actually dropped for awhile. But according to *Aircraft Bluebook Digest*, the turbo version now overhauls for about \$50,000, compared to \$35,000 for the normally aspirated model.

CABIN COMFORT, LOADING

Another feature that distinguishes the TB series is the top-hinged, gullwing

cabin doors. These make access to any seat quite simple, with a minimum of fumbling and clambering. The cockpit/cabin is modern looking and is well organized.

It's 50 inches wide, the most expansive in its class. In fact, it's one inch wider than the Piper PA-32 family of cabin-class singles. The Trinidad can accommodate up to five people, with three on the rear bench seat when optional center lap belts are installed. There are individual bucket seats up front. The airplane is quite comfortable for four, although tall individuals have noted tight headroom, particularly in the rear. The newer GT models address this. The seats include an adjustable lumbar support.

To go with its notable spaciousness and comfort, the Trinidad can carry a comparatively hefty payload. It's almost a full-tanks and full-seats airplane, which is unusual for singles and light twins. It also has a generous CG range to permit loading flexibility.

At an average equipped weight of 1990 pounds, payload with full fuel (86.2 gallons usable/517.2 pounds) is 589 pounds. That works out to 3 1/2 170-pounders.

To put things in perspective, its full-fuel payload exceeds that of any other four-place single and even beats the A36 and B36TC Bonanzas. Among singles, only the Cessna 210 surpasses the TB-20's payload capability, but with less comfort, at least with regard to seat design and ingress/egress.

Visibility from all seats is first rate. The windshield and side windows wrap up into the roof line and the windshield extends down alongside the panel, meaning that the pilot can actually see down and forward a bit. That's unusual in low-wing airplanes and is a nice benefit.

Further, the seating position is high and the window sills are low, rather like modern fighter aircraft. Ergonomically, the cockpit is well organized. The panel is a modular arrangement with the right-side gauges mounted at an angle to face the pilot squarely. The center console has a trim wheel cleverly placed directly under the pilot's hand when it's on the throttle; trim adjustments during final approach are easy.

Models built before 1987 have the fuel selector mounted to the left of and just below the pilot's yoke, an arrangement that was the subject of



Although it looks a tad dated now, the TB20's panel was a state-of-the-art wonder in the late 1970s, when it first appeared. Power is provided by the Lycoming IO-540 series, a reliable if not economical choice. (Top photo: Jerome Zbinden.)

an AD. The three panel modules can be released quickly and tilted back for maintenance access to the instruments and avionics, making for easier repairs. Additional access panels are provided in the glareshield. The interior is well thought out, in our view, providing a lot of pockets and crannies for manuals, charts and odd pieces of gear. The biggest drawback is the relatively small, odd-shaped baggage door. It's hinged at the bottom and when fully opened, it projects quite a ways.

Care must be taken when loading the baggage bay. Access to the baggage bay for bulkier items than can fit through the door can be gained from inside the cabin. The rear seat back can be folded down or removed, which opens up a spacious area behind the two forward seats.

HANDLING, PERFORMANCE

There's nothing peculiar about operating the TB-20. From pre- to post-flight, the airplane is quite conven-



tional; anyone stepping up from a Piper or Cessna will have no trouble with it.

There are some quirks: Inspection of the engine compartment is difficult because a number of fasteners must be unscrewed. Then, the one-piece cowl has to be put in a safe place while the inspection is performed so that a gust doesn't send it sailing down the ramp.

Many owners probably won't bother frequently enough to catch the odd deteriorating hose, loose connection

ACCIDENT SCAN : NO REAL PATTERNS

Low population airplanes such as the TB-20/21 represent a conundrum when it comes to judging the accident record. There are too few of them and too few accidents to make for a meaningful analysis.

We examined a 20-year period from 1990 to 2010 and found only about 20 U.S. accidents in which there was enough information to determine probable cause. There were a handful of accidents elsewhere in the world, including several in Europe.

We didn't find any smoking guns to speak of, but one accident did speak to concerns some owners have expressed about inadvertent door openings. It occurred in September 2008 when two relatively inexperienced pilots in a university flight program took off from

Dubuque Regional Airport on a local flight. Shortly after takeoff, the right cabin door opened for unknown reasons. But the pilot in the right seat was able to hold it closed.

However, during a go around from an attempted landing at a nearby non-towered field, the right seater lost control of the door and the left seater the airplane itself. It rolled and crashed between two motel cottages off the end of the runway. The right seat occupant was killed, although the commercially rated pilot survived. The investigation revealed that Socata had done no flight testing with a door removed or open.

Although this was the only such incident we found of an inflight door opening, we think it's something that owners need to watch.

or nesting bird before such oversights become a problem. (Mooneys suffer a similar shortcoming.) The cockpit layout is generally good, but it takes some getting used to. For example, the instruments have vertical temperature and pressure gauges, not analog dials.

Getting airborne is nothing unusual. Normal takeoffs call for 10 degrees of flap. The standard flap control is an electric switch that permits settings anywhere from up to full-down (40 degrees) to any increment in between. It must be monitored during operation to get the right setting.

Many Trinidads are fitted with the optional pre-select switch, which offers flaps retracted, 10 and 40 degrees. In maximum performance takeoffs, and climbing at best angle, the forward view is filled with cowling. You'll need to S-turn a little to get a full view of what's ahead. Rate of climb at Vy of 95 KIAS is 1250 FPM. Critical speeds are Vne, 187 KIAS; Va (maneuvering) 129 KIAS; Vlo (gear operating) 129 KIAS; and Vfe (max flap extended) 103 KIAS.

The airplane is not blisteringly fast for having such a large engine nor is it as slick in the descent as even some older Mooneys. Nonetheless, descent takes some planning, due to relatively low Vlo and Vfe. One option is to lower the gear at the top of descent

and use the wheels as speed brakes.

The Trinidad's control response is good, with the highest noticeable effort in roll. The ailerons aren't large and under airload, the push rods may pick up some operating friction. This won't be objectionable to anyone stepping into a Trinidad from a Cessna but a Bonanza pilot will notice.

Pitch and yaw control effort is lower. So it's more an issue of balance, or control harmony, than hard work. The good tradeoff is that the airplane, thanks also in part to its comparatively high wing loading, handles turbulence well. It also displays good manners in the clouds, with no tendency toward pitch twitchiness or wing fall off.

Slow flight handling is good, too. While the stall speeds are marginally higher than with other singles, the stall is mild. The typical result is more of a high rate of sink rather than a pronounced break. The flight controls are fully functional right through the stall. Intentionally cross-controlling near the stall or even in it produces sink rather than a snap.

Pitch change with initial flap extension is minimal. It's more pronounced when full flaps are selected, particularly at the higher end of the allowable speed range. Saving full flaps until the landing is assured means adjust-

ing trim or accepting high pitch forces down to the flare, at which point the up trim has to be put back in.

Full flaps generate a lot of drag, which means either accepting a steeper approach (good for obstacle clearance) or a partial-power approach. Low-speed technique is rewarded with satisfyingly short landing performance. In this respect, the TB-20 shows a bit of the Rallye heritage. Landings, except for the most highly botched and abusive, can be done repeatedly with grace. Lightly loaded, with just the pilot, it takes more attention, because CG is forward. But its manners (and willingness to forgive) are good.

It's axiomatic in airplanes that you never get something for nothing. In the Trinidad, this translates to modest cruise performance, thanks partly to that wide cabin. According to factory figures, 75 percent power at 8000 feet nets a true airspeed of 159 knots. Endurance with 45-minute reserve is 5.65 hours.

At the same altitude, 65 percent generates 149 knots and a bladder-busting 6.4 hours endurance. The turbocharged version doesn't perform quite as well at lower altitudes, which is typical of most turbo models.

The crossover point comes at about 12,000 feet. At its maximum operating altitude of 25,000 feet, 75 percent power generates a true airspeed of 187 knots and endurance of 4.5 hours; 65 percent power produces 169 knots and 6.2 hours. In the real world, say owners, the airplanes are a bit slower than the POH values.

MAINTENANCE, ADS

Owners report no characteristic maintenance bugaboos and we get mixed opinions on parts support. Parts are generally expensive, however. One of our least favorite features in any airplane is gullwing doors. They're a bad idea because they can trap occupants after a rollover accident.

Most of the changes made to the TBs are reflected in service bulletins and airworthiness directives. About a dozen ADS had been issued on the TB-20 and -21 by early 2003. Most of these are blanket ADS affecting many different aircraft: paper induction air filters, Bendix ignition switches, Bendix magneto impulse couplings, Hartzell propellers and Airborne vacuum pumps. Several blanket ADS



If the fixed-gear Tobago looks just like the retractable Trinidad, it should. The two share virtually identical fuselages, wings, tailfeathers and other major components.

cover various aspects of Lycoming engines (91-14-22, calling for inspection of the crank and associated parts for corrosion following a prop strike or at overhaul).

An AD issued in 1990 requires a one-time inspection of oil coolers on all TB series airplanes for cracks and what the text merely calls "distortions." If anything is amiss, the oil cooler must be replaced. The AD on the fuel system mentioned earlier was issued to deal with a few instances of fuel starvation.

In the original design, fuel lines run from the tanks forward and up to the panel-mounted fuel selector. Two conditions could occur: Fuel could drain to the low point, causing the fuel pump to cavitate. The original Dukes fuel boost pump is lubricated by fuel. Dry lines resulted in its failure. Or, vapor lock could occur, blocking normal fuel flow. The fix for the original system is to replace the boost pump with a wet-or-dry Weldon pump and to install a check valve in the line to preclude draining.

In 1987 and later models, the fuel selector has been relocated to the center console. Also, it has been modified so that it's not necessary to pass through "off" when changing tanks.

Three ADs have been issued on the horizontal tail; two of them require repetitive inspections. One requires replacement of the elevator trim tab control attachment. The second

requires repetitive (every 100 hours) inspection of the stabilator actuator rod end assembly and attach fittings. Another repetitive AD affects the ailerons. The skin and balance weight attach rivets must be inspected every 100 hours. Substantial cracking requires aileron replacement.

OWNER COMMENTS

I really love my 2000 Trinidad TB21 GT. I flew hundreds of hours in a Piper Arrow, but was ready for an upgrade. Having looked at lots of options, I was ready to sign for the purchase of a new Piper when a local aircraft broker said, "just take one test flight in a Trinidad before you buy that Piper." And that's all it took. The design, comfort, speed, range and solid flight characteristics sold me within the first 10 minutes.

My kids call it our flying sports car and we easily and comfortably fit our family of four (and all our baggage) on three- to four-hour flights. I am over 6 feet tall and find the cabin has good headroom and plenty of elbow room. I often fly it with three or four passengers. Kids use the optional fifth seat.

The quality of construction is excellent and despite much talk about limited availability of parts, I have found it to be actually better and faster than dealing with Piper. The visibility is very good and the handling is exceptional. I typically cruise at 8000

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Bob Gilchrist, above, with UK-based G-OMAO.

to 12,000 feet and plan for 160 to 165 knots, burning 16 GPH.

My annuals run around \$2500 to \$3000 per year and I understand that mechanics find it an easy airplane to work on. I do the recommended 25-hour oil changes and also complete lubrication of the control surfaces every two years. The Trinidad is an exceptional aircraft that has few equals.

Gregory Maxwell Applegarth
Kentfield, California

I've owned a Trinidad TB21 serial number 638 since July 1991—just short of 20 years. I have over 2500 hours in this baby with landings at 265 different airports in the U.S., Canada and Mexico. Most of this flying is with my partner, Carolyn, although we have done quite a bit of four-person flying, as far as Maryland to Mazatlan.

This is a terrific travelling airplane—extremely comfortable seats, fantastic visibility, stable IFR platform and wing loading that allows easy flight in turbulence. Huge rudder control allows big crosswind control. Landing in Chihuahua with 20 knots gusting to 35 with an 80-degree crosswind is the only time I got from tower, “nice landing.”

What does Carolyn like? She said number one was the way it stalls. It doesn't drop a wing, the nose drops, wing picks up lift, it rises, nose drops in a little rocking motion. She likes the wide cabin, the great seats, the

built in oxygen and the beauty of the airplane. It still gets quite a bit of notice and comment with the original paint.

What do I like? Mainly the strength of construction. The dealer had a sample of the wing spar. I got caught in a thunderstorm once. The airplane did fine (some hail damage), I didn't do so well. See my book *Flying Lessons 2005*, available

from Amazon.

My experience of performance: Flight plan 160 knots, which is 70 to 75 percent power, 16 to 16.5 GPH. On west to east flights, we commonly fly 800 to 1000 miles in the low teens with ample reserve.

Cost? I went back through my records. Insurance (Avemco) started at \$2100/year and the latest is \$2585. Annuals: \$3350, \$1790, \$2645, \$3705, \$2680, \$7810 (two fuel pumps), \$7355 (new windshield), \$7810 (required 25-year replacement of oxygen bottle, replace turbo).

At 2000 hours, a firewall-forward overhaul cost \$50,000. The Mattituck overhaul was very satisfying—the engine is smoother than ever. At this year's annual, I replaced the turbocharger due to a small oil leak.

One of the reasons I have had such a satisfying experience with the IO-540 Lycoming is the ability to watch shock cooling between climb and cruise. With this airplane, that can be dramatic. I also added an electric AI. I'm thoroughly satisfied with my steam gauges and these add-ons.

Socata support has been excellent. Never any problem securing parts, but they are expensive. Owners who are able to make comparisons say they are not out of line. An example of support: In Texas on the way to Mexico and with the landing gear slow in retracting.

My Socata man on the phone had the local A&P crawl under and told him what to adjust. I asked Philippe if I should go to Mexico. He said, “Sure, John, go, I'll come get you if you need!” The worldwide Socata club maintains an active website,

providing answers and suggestions to everything one would care to know.

John A. Snyder
Via e-mail

I'm an *Aviation Consumer* subscriber. I also own a share in a Trinidad, G-OMAO, based at Shoreham, on the South Coast in the UK.

I think it best to point you to the definitive source of pretty much all there is to know about operating a TB20. This is a website created by Peter Holy, who has been operating a TB20 since he bought it in 2002. See: www.peter2000.co.uk/aviation/tb20-experience.

This website is so comprehensive and so valued by other TB20 operators, that when I stumbled across it, I contacted Peter and offered him free hosting. We have since become friends.

Bob Gilchrist
Via e-mail

The TB20 is one fabulous airplane. I have a 2001 GT model, with ultimate 20th century (pre-glass panel) avionics, including GNS530W, GNS430W, GDL-69 XM Weather, WX-500 Stormscope (which play on the Garmins) and Ryan TAS-600 traffic. I have a Bendix/King autopilot with flight director. Several TB20 and 21 drivers that I know have made the leap to Garmin 500 or Aspen panels. The install is straightforward and the result looks very nice.

The TB cockpit feels like being in a sports car. It is comfortable for long trips. I flew last summer from Durango to Baltimore with two fuel stops. The trip took 11 hours but was not particularly tiring. It was certainly more relaxing than driving for 11 hours! I love the two doors, especially with passengers who are not expert in getting into low-wing singles. However, the gullwing doors can easily fly up if they're not latched securely. This can be a big distraction on a takeoff roll, or, as once happened to me, when turning from crosswind to downwind.

The plane is stable as a rock, flies really well at low speed, and climbs at over 1000 FPM up to 8000 feet. Above that point, she slows down, but I've taken her several times to above 16,000 feet in the summer over Colo-

rado, where she's still climbing at 200 FPM. (I do wish I had turbocharging, though. Sadly, I don't think there's an aftermarket turbo.) On long trips, I fly at 65 percent power, which translates to 14 GPH and 150 knots at 7000 feet. At this burn, I can go five hours and have one hour in reserve.

I bought my airplane used in 2005, with 450 hours. The crankshaft was replaced (free of charge) by Lycoming at 500 hours, following a blanket AD. At 1400 hours, I am still on the original engine. I replaced the vacuum pump as a precaution when I purchased the airplane (at 450 hours) and then at 1100 hours. I've had no other significant repairs. I keep the ailerons, elevator and rudder lubricated, and replace at every annual the Sachs rods for the front gear.

There is a superb user's group (www.socata.org) which is a wonderful technical and social resource for TB20 drivers. I've met many friends through this group and through the annual fly-ins that the group organizes. The airplane at max weight is slightly over 3000 pounds, about 500 pounds lighter than a Corvalis or Bonanza. This makes a big difference when you're pulling the airplane out of a hangar.

The visibility is terrific, but all that glass raises the interior heat level in the summer. Having a pilot's side door that can be kept cracked open greatly helps, but I'd really appreciate an air conditioner. I got one estimate for an aftermarket Keith AC, but I wasn't ready to pay \$35,000. I use an Arctic Air cooler, which takes the edge off, but is not the same thing.

I have 1800 hours, of which more than 1000 are in my TB20. I fly between 150 and 200 hours a year, with many local flights and some longer cross-countries. On the longer trips, I'm either alone or with one passenger. Next summer, I'm flying from Baltimore to Salt Lake. The airplane is well suited to my mix of short and long trips. Naturally, I'd like something faster, but feel very fortunate to own a TB20.

My recent annuals have cost about \$3000. Most of the parts I've needed are made in the U.S. Once, I needed a fairly specialized part from France. My mechanic had it within a week.

My TB20 looks sexy and is sufficiently exotic that I often get compliments. Once, I was rolling off the

active at Concord, North Carolina (the home of NASCAR). Someone on the freq (either the tower or a bizjet pilot) said, "very nice paint job." Was I pleased!

Millard Alexander
Via e-mail

I have owned a 1993 TB20 Trinidad since 2007 and fly between 50 and 70 hours per year. Fuel burn is between 11 and 12 GPH in cruise at 145 knots true and 65 percent, which is pretty much according to the flight manual.

My annual inspections have averaged \$3600, but this typically included some preventive maintenance/parts, such as gear relays, vacuum pump, nosegear extension struts, door seals and upgrades, such as installation of PulseLite and reupholstering/padding of the front seats.

My airplane had been very well taken care of by the previous owners, hence has not required any remedial/catch-up maintenance. Even though the aircraft is no longer produced by Daher-Socata in France, parts availability is generally good through Socata North America in Pembroke Pines, Florida, or through my local dealer, Muncie Aviation. Insurance has been around \$2200 per year, based on \$1 million smooth and \$150,000 hull value.

The airplane is a joy to fly and is very comfortable on long trips, although headroom is very limited for tall people. Thanks to the trailing link landing gear, landings can be made very smoothly. It gets admiring comments at most airports where I land.

The gullwing doors could use stronger hydraulic struts to keep them open when there is any wind; watch out in any strong/gusty wind! Baggage compartment accessibility is limited due to the triangular-shaped access door, so I tried several of my empty hard-shell suitcases to determine which ones will fit through the opening and how to stack them.

Trinidads have an excellent user group that provides a lot of very useful information, including service and parts manuals online. Any current or prospective owner should use these resources.

Rolf H. Scholz
Via e-mail

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Dynon DX15

(continued from page 23)

wise protects its exposed terminals against shorting. (A piece of tape would work with this pack.)

Like other handhelds, the DX15 can be used with an external antenna through 50-ohm coax, but there's a twist: The antenna jack is a threaded SMA-type, so you need an SMA-to-BNC adapter. No big deal, but that's another bit to carry along and one that's just begging to be dropped behind the rudder pedals.

Performance wise, the DX15 is comparable to Sporty's SP-400 and the Icom products. We tried it in our LSA Cub, with both an external antenna and the standard rubber duck. Audio quality and RF punch seemed to be about the same as the Sporty's and Icom products. All have 1.5 watt nominal transmit power, but our impression was that the SP-400 did a little better than the DX15 when both were used with just the rubber duck antenna from inside the airplane. From the ground, the two sounded about the same when the Cub's external antenna was used.

According to the specifications, both the SP-400 and DX15 have -6dB receiver sensitivity, but we thought the SP-400 clearly outperformed the DX15 in receiving distant, weak signals. On the ground, seven miles from a neighboring airport, breaking the squelch on the SP-400 brought in a readable, if noisy ASOS broadcast while on the DX15, we could make out faint modulation, but nothing readable.

The DX15 has good basic features such as band scanning, multiple stor-

age of frequently used frequencies, good backlighting and—something unique—a dedicated key to tune 121.5 MHz.

So given its credible performance, how does the DX15 stack up against its competition value wise? Very well, in our view. When it rolled out the product at Sun 'n Fun, Dynon rather uniquely offered buyers the opportunity to bid on it auction-style, with the first 100 bidders being awarded the radios for the lowest bid among the 100. (It made only 100 radios initially, but will keep the product in its line, we're told.)

Dynon said comparable radios sell for about \$250, but the auction price settled at a realistic \$156. In our view, given the competition, that's just about right and it's interesting that the market pegged it. The Icom IC-A14, for instance, sells for as low as \$199 to \$215 and has VOR and comm capability, plus an alkaline battery pack option that we think is a must for back-up duty. On the other hand, the Icom isn't as compact as the DX15. So if small size and simplified operation are drivers, the DX15 is a worthy choice. Otherwise it's a credible if not exceptional portable radio.

Letters

(continued from page 3)

self to buying one on eBay to cannibalize. On a hunch, I Googled "Sony Air-8 repairs" and saw a sentence that said, "They might still have parts to that at Sporty's, check with them."

An e-mail to Sporty's customer support confirmed, yes, they did have the

FEEDBACK WANTED

BEECH 55 BARON



For the September 2011 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Beech 55 Baron, one of the most popular light twins. We want to know what it's like to own these twins, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the Baron by July 1, 2011, to:

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button, that would be \$5 plus shipping. The button is back in place, the thing works, I'm happy.

Now, this is not a fancy GPS or ANR headset. And it may break again and will finally have to be laid to rest. Pilots are funny creatures, though, especially as we get older. There are some things that defy logic and Econ 101. When we can extend the life of an out-of-date but lovable old piece of equipment, it seems to cause some kind of chemical reaction in our brains. Call it loyalty. And I can imagine a grey-haired old man back in the parts department at Sporty's who understands this more so than the Telex marketing department.

Peter Ver Lee
Via-mail