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The consumer resource for pilots and aircraft owners

The Aviation Consumer®

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The Aviation Consumer

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A REALITY CHECK AT TIEDOWN ROW NUMBER FIVE

Showing my friend Cindy around the local airfield one cold winter evening reinforced the reasons for the tanking pilot population. For one thing, the sport can always use more local-level mentorship, which has to start with an enthusiastic, up-close-and-personal tour of the airport environment. I don't do enough of this, so I seized the moment.

My friend (who has flight training on the bucket list) has lived within a few miles of the airfield for a lot of years, yet never made it onto the field to see just what this little-airplane flying thing is all about. I put on my ambassador's hat and offered a tour, careful not to understate the risks, but saved the cost of aircraft ownership thing for later, which might have set her up for a big letdown. Still, there was no doubt in my mind this gal could be a good pilot and future aircraft owner.

To someone who's truly interested (or even remotely intrigued), a first-time casual stroll down a flight line of airplanes with coffee in hand is a fascinating experience. Cindy was hooked. As a mentor, there were plenty of aviation tales and techy explanations for me to tell. A vintage V-tail Bonanza left in the tall weeds wasn't flattering, but worth an unglossy explanation of how the model killed the Big Bopper, while also pointing out the tail-stiffening mod to keep it from killing doctors. I could see the intrigue and could also read the questions in my friend's eyes. "How much does a vintage Bonanza cost" which got me thinking about the real cost of ownership. There were three convenient examples.

For the aspiring pilot who also loves collecting pieces of history, *Aircraft Bluebook* says a 1959 Beech Model 35 should retail for around $43,000, but significantly more if nicely restored, which many are. This one wasn't. Still, ownership won't be cheap. According to owner feedback we received when we last looked at the N-series Bonanza in our Used Aircraft Guide, routine costs for a relatively trouble-free airplane average between $16,000 and $20,000 per year. That includes insurance, fuel, routine maintenance, storage and supplies. If the engine tanks, I explained, a 250-HP Continental IO-470-C has an average overhaul cost around $30,000. I was asked to repeat that number.

For something perceivably more affordable, there was the little yellow J3 Cub a few spots over, and Cindy wanted to know why its landing gear is different than the Bonanza's. After explaining that real pilots fly tailwheels—and why the best sometimes end up in the weeds on landing—I nearly closed the deal by explaining how you can fly the fabric Cub with the doors open. To own that kind of fun, a decent J-3 might sell for around $28,000, and considerably more for one that has been carefully restored. Cub owners report typical all-in yearly costs of around $7000, when nothing goes wrong. Remember that these aircraft must be hangared, so that's included in that cost. A 65-HP Continental A-65-8 engine on a Cub has a typical overhaul cost of around $12,000. The one potential gotcha on a Cub is the fabric covering, which could ultimately cost as much as the airplane. For this reason, a Champ is worth considering, less some romance.

The last stop on the tour was perhaps the best option for entry-level flying—a venerable Cessna 150. A mid-1970s model A150 Aerobat like Brian Anderson's airplane, shown in the main photo, might sell for around $25,000, according to *Aircraft Bluebook*. As Anderson reported, the 150 Aerobat makes for good, inexpensive upset training, plus it's just plain fun to fly. Owners say typical annual inspections are around $2000, but can be as high as $5000 when stuff needs replacing. Insurance might run $800, and a 100-HP Continental O-200A is around $20,000, when its time has come, hopefully beyond the 1800-hour TBO.

If none of those options are affordable for a wanna-be airplane owner, the FBO's manager told us there will be a Cessna 150 (with a new engine) available for rent, priced at $90 per hour. For an aspiring pilot on a budget, that's not chump change, but it's not a bad deal, either. Who knows what the right price for basic flying really is, if there is one. Heck, I remember asking this question 35 years ago when I forked over $35 per hour for a Cessna 150. —*Larry Anglisano*

WHERE ARE THE BENDIXKING PRODUCTS?

I've read *Aviation Consumer's* reporting of BendixKing products over the past few years, and with interest the KI300 electronic attitude indicator. The mechanical KI256 flight director gyro in my Baron is costing me a fortune every time it needs overhaul, but I need to keep it to drive the KFC225 autopilot.

BendixKing has long promised this electronic replacement but it never seems to make it to market. Do you have an update on this and some of the other products you've covered?

Stan Weisman
via email

We've been wondering the same thing. We saw the latest version of BendixKing's electronic EFIS at AirVenture last summer, which it was calling the AeroFlight. Unlike the KI300 BendixKing was showing previously, the AeroFlight has speed and altitude tapes and looked to have an improved display.

But there are more BendixKing products, including the AeroCruze autopilot and the AeroVue Touch retrofit flight display, that we're waiting for. We reached out to BendixKing with an update and per its request submitted a list of questions pertaining to product and certification status. At press time, we were told by a BendixKing spokesperson that its communication team is spread thin and finding the right spokespeople to answer our product questions was posing a challenge. It said it would reach out to Aviation Consumer when it can offer product updates.

CO DETECTOR FIELD REPORT

I thought your readers would like a report on my use of the CO Experts carbon monoxide detector you recommended in the October 2016 issue of *Aviation Consumer.*

After using it for a few years in our single-engine turboprop, its ability to alarm at low levels is really attractive. We saw an alarm once in our airplane during a delay on a taxiway with a tailwind. The alarm went off at 7 PPM and cleared when I turned the airplane so we weren't directly downwind. Luckily it's never alarmed in the air, but my accidental test gives me confidence so I bought one for each of our adult kids to use when they travel.

I really enjoy and respect the great job you guys do at *Aviation Consumer.* I've been flying for 54 years, have been a long-term subscriber and find your magazine the best source for plane and product information.

Bob Mittelstaedt
via email

NEGLECTED AIRCRAFT

I read Larry Anglisano's First Word commentary about abandoned aircraft in the January 2019 *Aviation Consumer,* where he describes a J-model Mooney rotting away in its parking spot.

I first saw this several years ago when searching for a Cessna 150. I was flabbergasted. The number of once-nice aircraft melting into their concrete/asphalt tiedowns was sad. At least in Arizona, some were still in nice shape with respect to corrosion. But not all. One aspect Larry didn't mention is that some owners think their aircraft are worth a fortune even after sitting for 12 years with a fist-size hole in the side window, while the owner boasts of its vintage King Silver Crown radios.

However, neglected airplanes are worse than neglected boats. Some owners, rather than sell their prized airplane, continue to pay pricey monthly tiedown fees just to watch the poor airplane disintegrate. It's like some sort of deranged science project. By the time the owners realize what they've done, the aircraft might not be worth parts value.

Tim Boese
via email

INSURANCE PRICES

I read with interest the insurance market update article in the February 2019 *Aviation Consumer.* Although a bit off point, I thought you might be interested in an experience I just had.

Plagued by incessant offers of a free hat, I relented to Avemco and let them bid on my insurance. I'd asked them for a bid years ago, and their premium was absurdly high compared to the competition. I fly a piston-twin Cessna 340, have about 400 hours in type, remain active with over 100 hours a year, get regular recurrent training and have an ATP with just under 8000 total time. I've never had a claim.

My current policy term is about half gone and I expect an increase this year. Nonetheless, my current policy was $3706 while Avemco's bid for the same coverage approaches twice as much, at $7021. The company had no real explanation.

Frank Bowlin
Santa Fe, New Mexico

On The Cover: Editor at Large Paul Bertorelli pointed his cameras downrange on a dark night at the airfield to see which modern landing light outshines the others. The results are in the field report starting on page 4.

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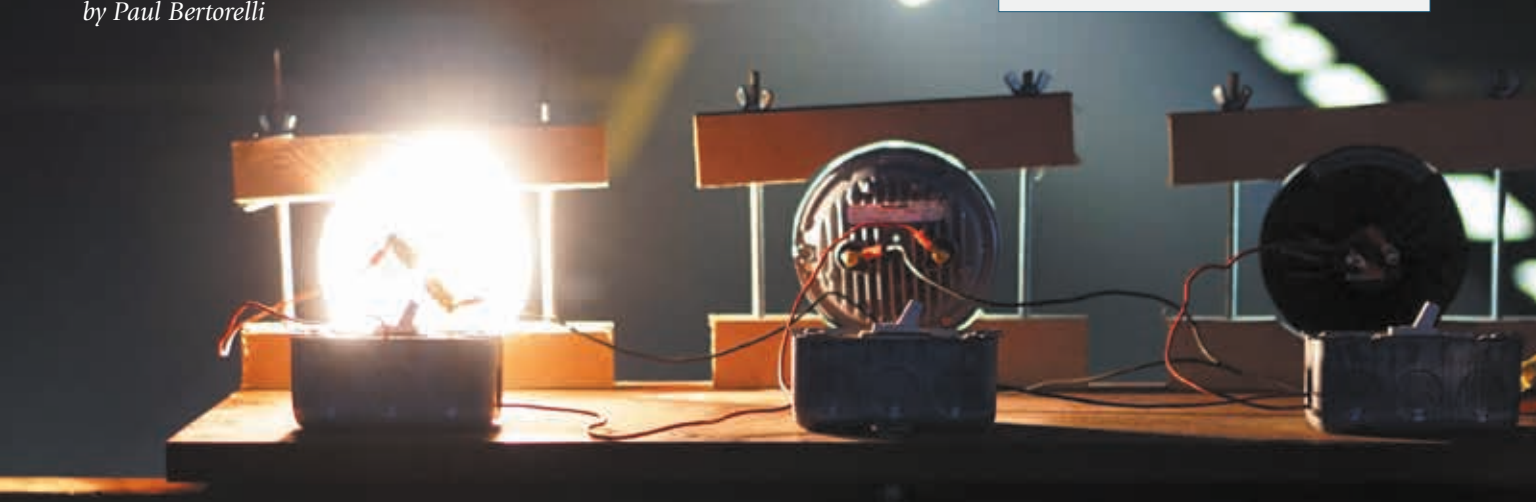
LED Landing Lights: Worth the Investment

Although they're not any cheaper than the last time we tested them, improved performance and safety benefits make them a good value.

by Paul Bertorelli

CHECKLIST

- ✚ Lamps perform uniformly well and crush incandescent performance.
- ✚ You can find a lamp as a drop-in replacement for virtually all popular aircraft.
- ~ If you don't fly much at night, or at all, a $300 landing light may not appeal.



Two questions about LED landing lights: Are they brighter than ever and, if so, is it worth upgrading if you bought one five years ago? Two answers: Yes and no.

LED technology continues to advance incrementally and the lamps we examined are both measurably and visibly brighter. But what they are not is cheaper. If you're slumming around with an old GE 4509—the industry standard landing light—the cheapest LED replacement will cost six to 15 times as much.

But, hands down, it will be brighter and is likely to last essentially forever. In this report, we tested some of the lamps we examined four years ago and one newcomer to the market. Two product lines—Teledyne's Alpha Beam and Aveo's line of premium lamps—weren't available at the time of our trials, the latter because the company is in the midst of yet another upgrade cycle.

CONSTANT IMPROVEMENT

In virtually any market segment requiring lighting, LEDs have achieved significant if not dominant market penetration. The automotive lighting market alone is worth $20 billion and although incandescent lamps still retain a commanding lead for household use, the LED market continues to grow.

This economy of scale has put upward pressure on volume, downward pressure on pricing and competitive pressure to improve LED efficiency and longevity. In new aircraft, LED landing lights are all but standard, as are LED position

Most LEDs use a multi-cell lens, one for each LED, such as the AeroLEDs Sunspot, right. The Illumivation PAR 46, left, has a unique parabolic reflector and only four LEDs.

and strobe lights. The aftermarket remains a mixed bag. A survey of any ramp will find a smattering of LEDs, but a bunch of old GE 4509s. That the retrofit market is small is indicated by the small number of players—about six. As we went to press in February, that dropped by one when Whelen announced that it acquired LoPresti Aviation's entire line, including the recently formed Illumivation for LED products. The new combined entity is called Whelen Aerospace Technologies. Most of these companies have some tilt toward large commercial and military applications because, well, that's where the profit is.

Small volume and evolving technology make the LED landing light biz challenging, according to Nate Calvin, of AeroLEDs, one of the best-known manufacturers. All of the companies tell us that they face a constantly changing landscape of new or at least improving LED technology and sometimes that's easy to incorporate into new products, sometimes not.

Calvin said the LED improvement cycle from manufacturers can be as little as a year. "You might start the year with parts that are 160 lumens per watt. By the end of the year, it's not uncommon to see 168 or 175," Calvin says.

At Whelen Engineering, Jeff Argersinger says the product cycle isn't necessarily predictable. "We're constantly in a redesign flux. LED improvement is only one factor and LED intensity is not the only consideration," he says. "The ability to focus the LED is very important. Current draw versus intensity is very important, as the assembly is somewhat thermally constrained. Cost, delivery, reliability, testing are all factors in the decision process," he adds.

HOW BRIGHT?

Obviously, brightness is an important consideration, but it's not the most important one. As LEDs get ever brighter, smaller and more efficient, lenses and housings have to be redesigned to shape or collimate the light into something usable for aircraft applications. And here an important disclaimer: Raw candelas, lumens or candlepower doesn't really mean much, as we found in our brightness trials.

"You maybe think that 100,000 candela is good and 500,000 would be awesome. How about 3.5 million? Well, that's a laser pointer. How about lumens? An incandescent bulb is 1500 lumens, a nice big number. But try to land behind it," says Calvin.

Whelan and AeroLEDs say the magic sauce is how the beam is focused and shaped. Legacy lamps—the GE 4509—tend to be narrowly focused so they have good throw, but offer little peripheral illumination for taxiing. And that's why you missed the taxiway sign or turn at night. LED manufacturers can address this by designing lenses that trade throw distance for a wider beam.

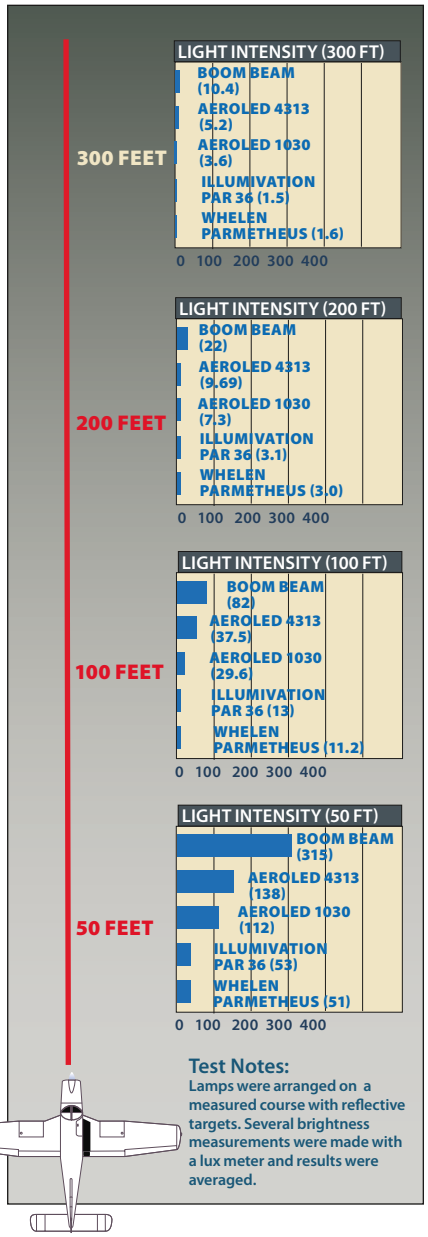
"There's no standard for what it has to be. Legacy bulbs are about a five-degree angle. So if you take the peak candela and move out of that until it's 10 percent, it's about five degrees, 10 degrees total. We're about double that—10 degrees or 20 degrees total. We do that purposefully to widen up that field of view. Our view as pilots is that you're sacrificing the width of the beam for that center profile," Calvin says.

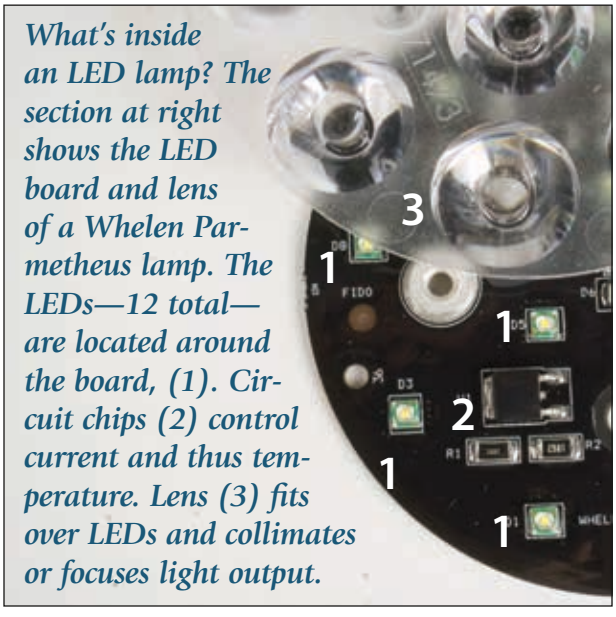
Does this suggest that there's really no longer any meaningful distinction between taxi and landing light bulbs? That's exactly what it means.

"In 10 years of talking to pilots, I've had them say, 'well, I need a landing light and a taxi light.' And I say before you do that, buy two landing lights and if you feel it's not wide enough, I'll exchange it for free," Calvin says. He's had zero takers.

MAKING THEM LAST

There's a reason 4509 bulbs cost as little as $12. They have a filament, a reflector, a housing and some terminals. But LEDs have many dozens of parts because the LEDs themselves are mounted on a board





What's inside an LED lamp? The section at right shows the LED board and lens of a Whelen Parmetheus lamp. The LEDs—12 total—are located around the board, (1). Circuit chips (2) control current and thus temperature. Lens (3) fits over LEDs and collimates or focuses light output.

PRODUCT	AMPS	PRICE	APPLICATIONS
TELEDYNE ALPHABEAM	3.75	$325	Approved PAR 36 drop-in replacement for common lamps. Newest version not available for testing. (www.aircraftspruce.com)
AEROLEDS 36 LX 1030-L-A	3.75	$349	PAR 36 drop-in replacement. Top pick for value versus performance. (www.aeroleds.com)
AEROLEDS 4313	6.7	$650	Higher output PAR 36 replacement lamp. Tested noticeably brighter.
AVEO HERCULES PART 36 DROP-IN	4.2 to 10.5	$845	Not available for testing for this report. Lamp uses up to 30 LEDs and has variable output for combination landing and taxi. (www.aveoengineering.com)
ILLUMIVATION LAZR PAR36	1.8	$699	New entry to the LED market. PAR 36 and 46 models offered for most GA aircraft. (www. flywat.com)
WHELEN PARMETHEUS PLUS	1.2	$227	Approved PAR 36 lamps for landing and taxi applications. (www. flywat.com)

This list doesn't include all lamp options available in any type, but gives an overview of price and application comparisons. Check with vendor for specific prices on the model aircraft you're interested in. Some manufacturers offer combination landing/taxi/wigwag features.

that's also populated with chips to regulate temperature and, by extension, light output. "The biggest enemy is the junction temperature. If you're running that too hot, it's going to kill it," says Whelan's Argersinger. "Every manufacturer has a different type of design. There may be the mindset to say, let's just drive these things as hard as we can to get the most light out of it, knowing that they're going to be mounted on the nosegear of a King Air, so there's going to be cooling involved," he adds.

But an LED selling point is longevity. Whelan, for instance, specifies 10,000-hour lamp light backed by a five-year warranty. Keeping the LEDs alive is a tradeoff between driving them hard enough for good brightness, but well short of frying the junction. Manufacturers do this is varying ways.

Whelan, for instance, uses circuits that provide constant current to avoid overtemping. AeroLEDs actually has a thermistor on its LED boards. "It has resistance that's a function of temperature and it's saying hey, I'm at this temperature, then I'm going to be at this output," Calvin says. LED manufacturers also build durability into their products by wiring the LEDs in isolated series. "In some, if one fails, it will take only one out. In most of the lights, we do it in groups in two. If we have eight LEDs, and one dies, it takes only another one with it. You'd have to lose half the light to see any performance difference," Calvin says.

One thing we noticed during testing is that LED lamps don't get nearly as hot as the GE 4509 and we have some burned fingertips to prove it. But that's not to say the LED junction isn't getting warm.

"It wasn't that long ago, they couldn't even make a white LED that stayed white. They turned pink as they heated up. Now they're very color stable. And a lot of them are getting smaller, so you're getting the same light output and you can populate the lamp with more to get more light. But more heat, too, and you're limited by the geometry of the lamp housing," says Whelen's Argersinger.

OUT ON THE RANGE

Our goal in this round of testing was to determine if the latest generation of LEDs are measurably brighter than the previous versions and whether this makes any difference in what matters: how well the lamp illuminates what's ahead.

Our testing range consists of four reflective markers set at 50-, 100- and 200-foot intervals. We took an additional brightness measurement at 300 feet but couldn't place a marker because of an active taxiway. Brightness was measured with an ExTech lux meter at each reflector station. We fished the sensor around to find the brightest point in the beam and averaged the results.

A word here about lux as a unit. A lux is light energy in which area is taken into account, usually a square meter. One lux is equal to one lumen per square meter. Lux can be converted to lumens or candela, but for our comparative purposes, lux is sufficient since all the measurements were made consistently.

We would call our findings mixed. In the two apples-to-apples comparisons, we saw what we expected to see for the AeroLEDs lamps. The $349 Sunspot 1030-L-A—claimed 65,000 candela—was indeed slightly brighter than the last time we tried it, throughout the range of measurements. Last time, we measured 100.7 lux at 50 feet, while the new lamp measured 112.

The more expensive Sunspot 1030-4313—150,000 candela for $650—was, as expected, brighter than the cheaper lamp. It showed 138 lux at 50 feet.

Drop-in means drop-in. Even though LEDs have more complex innards, their depth allows fitting into the same bracket, right. PAR 36 refers to diameter in 1/8-inch increments, thus 4.5 inches.

The surprise was the $227 Whelen Parmetheus Plus, the latest version. The previous model measured a respectable 65 lux at 50 feet, but this time it scored only 51, despite being a newer generation. We asked Whelan for another sample, which yielded the same results. At about 66,000 candela, Whelan says the latest lamp is 40 percent brighter than the previous model.

When we contacted the company about our test results, they said there are two possibilities. One is that the sample provided was shy on output, but more likely, the lux meter we were using couldn't find the high-intensity center of the beam. We intend to repeat the testing with more averaged measurements for a follow-up.

In the meantime, without the old lamp for direct comparison, we can't say if it appears brighter. A customer on the Aircraft Spruce site did compare them side-by-side and thought the newer model was "a bit brighter." Side-by-side with the AeroLEDs 1030-L-A, the former appears a little brighter, but perhaps not so much that a half-dozen people looking at it would draw the same conclusion. This squares with AeroLEDs' Nick Calvin's explanation that it takes nearly a 40 or 50 percent drop-off in light intensity to notice a definite change.

We also looked at two lamps—a PAR 36 and a PAR 46—from a new company called Illumivation. It's a subsidiary of LoPresti Aviation which, heretofore, has specialized in HID aircraft lighting.

Illumivation's PAR 36 ($699) measured less bright than the Sunspots from AeroLEDs, but on the ramp, we noticed that it had a wider beam so it would make a slightly better combined taxi/landing light than the Sunspots. Even with the wider beam, its throw was impressive.

As we've reported before, standard incandescent landing lamps tend toward narrow, hot beams whose yellowish color flattens contrast, making it more difficult to see centerlines and, especially, taxiway centerlines faded by age and weathering. LEDs, on the other hand, tend toward cooler blue or even white. This improves contrast and makes all objects and colors more visible at night when taxiing or landing. As is plainly obvious in the accompanying video, the LED/incandescent side-by-side comparison is simply no contest. Even the measured least-bright LED, the Whelan Parmetheus Plus, crushes the GE bulb with higher perceived brightness and better contrast.

RECOMMENDATIONS

As aviation gadgets go, LEDs are only expensive when compared to old-school incandescents. Yes, $600 or more for a landing light is a lot of money, but, in our view, there's value in the performance of seeing better for landing and taxiing and improved conspicuity by turning the light on and leaving it on. There's every indication that LEDs are essentially lifetime bulbs and will always be available when you need them some dark and stormy night.

When we last reviewed LEDs four years ago, we recommended the AeroLEDs Sunspot as the top pick and we're repeating that advice. At $349, the 1030-L-A is a high value combination of price and performance. For a budget choice, you won't go wrong with the Whelan Parmetheus Plus at $227. It's not as bright as the Sunspot or the Illumivation, but it gets the job done.

If you bought an LED five years ago, the newer technology is definitely brighter, but not so much better that it would be worth replacing an older lamp, in our view. We also second Nate Calvin's recommendation to install two landing lights rather than one landing and one taxi in aircraft that accommodate two lamps.

Also worth considering are the LED models that include flashing wig-wag functions. Always-on lamps greatly enhance daytime conspicuity and wig-wags help further.

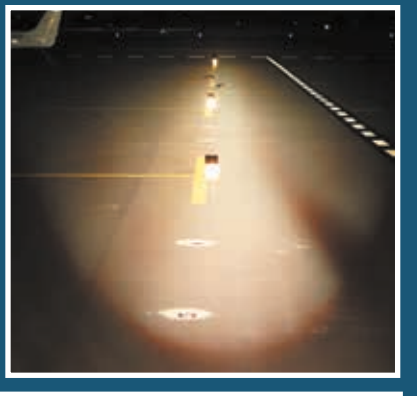
YouTube **See a video of the LED comparison at http://tinyurl.com/j95ht2a.**

IS HID OVER?

Not exactly, but as LED performance has improved and even with midrange lamps selling for $600 or so, it's a hard sell for light aircraft. "Many operators, especially with older assets, find that the HIDs do come at a higher cost, both to install and to purchase. We found we were missing some opportunities compared to AeroLED and Whelan and some of the other brands," says Jayde Machado of LoPresti Aviation.

LoPresti pioneered HID for aircraft with its Boom Beam product. But to compete with the LED onslaught, it formed a subsidiary called Illumivation about two years ago. The company markets a premium line of LEDs for aircraft of all sizes.

But the Boom Beam is still available for light airplanes, albeit pricey at between $2000 and $2500 for a single or twin. Installation is not overwhelming, but has to accommodate wiring and a ballast, which LEDs don't need. But the performance is no contest. HIDs blast a bright, focused beam practically the length of the runway. That would be a plus for serious outback flying at night, but otherwise, an LED will do for less money.



Vortex Generators: Got STOL? Think Twice

VGs are tiny vortices that keep airflow over the wing laminar at lower speeds, reducing stall speed and Vmc. The $2500 investment may be worth it.

CHECKLIST

- VGs reduce stall speed and usually improve low-speed and stall handling.
- On twins, VGs reduce Vmc and may allow an increased gross weight.
- VGs further reduce stall speed on airplanes with STOL kits, but not much.

by Rick Durden

We'll write the conclusion first: In our opinion vortex generators (VGs) are so effective in reducing stall speed in virtually all stock general aviation singles, and Vmc in twins, that we think installing them significantly increases the level of safety. While we have never ranked add-on safety devices for airplanes other than to say shoulder harnesses are number one, we think VGs could arguably be number two.

When things go south and you have to park an airplane in an unintended location, touching down at a lower stall speed means less energy to dissipate in the crash. Energy is a squared function, so reducing impact speed, even a little, pays big dividends. In a twin, reducing Vmc means reducing the risk of an uncontrolled roll following engine failure. A crash right side up means a far higher chance of survival than smacking the ground inverted.

COMPROMISE

Wing design of virtually all production (and most homebuilt/experimental) airplanes is the result of a massive series of compromises. They are almost never optimized for any one thing, such as stall speed. Engineers, test pilots, designers, marketing types, accountants, production teams, quality control folks—you name it—fight tooth and nail over what becomes the final design of the primary lifting device of the finished product that gets shoved out the factory door. A high-speed wing may fall out of the sky below 100 knots; a low-speed wing with complex flaps and movable slats may be so heavy there's no useful load and a lousy cruise speed; the wing the engineers think is perfect may cost a king's ransom to build. The issues are fought over until someone in charge steps in and freezes the design.

That's where VGs come in—at a tiny weight cost, they reduce stall speed and Vmc and increase slow-speed control effectiveness with little or no cruise speed penalty.

The earliest use of VGs that we've been able to find was in Pratt & Whitney's wind tunnel in the 1930s. They have been installed on transports and military aircraft for over 50 years—with Boeing and Learjet being some of the early adopters as they sought to keep the airflow firmly attached over the ailerons throughout the performance envelope. A few general aviation manufacturers have taken advantage of their benefits and included them as a part of new production aircraft.

We've found that realistic expectations for stall speed reduction are 4 to 8 knots. For Vmc, it's 5-12 knots—which means it is eliminat-

Removing the template after VG installation on a wing.

HOW VORTEX GENERATORS WORK

STOL kits weigh tens of pounds and reduce an airplane's stall speed through some combination of devices that reshape the wing to keep the airflow over it attached at low speeds.

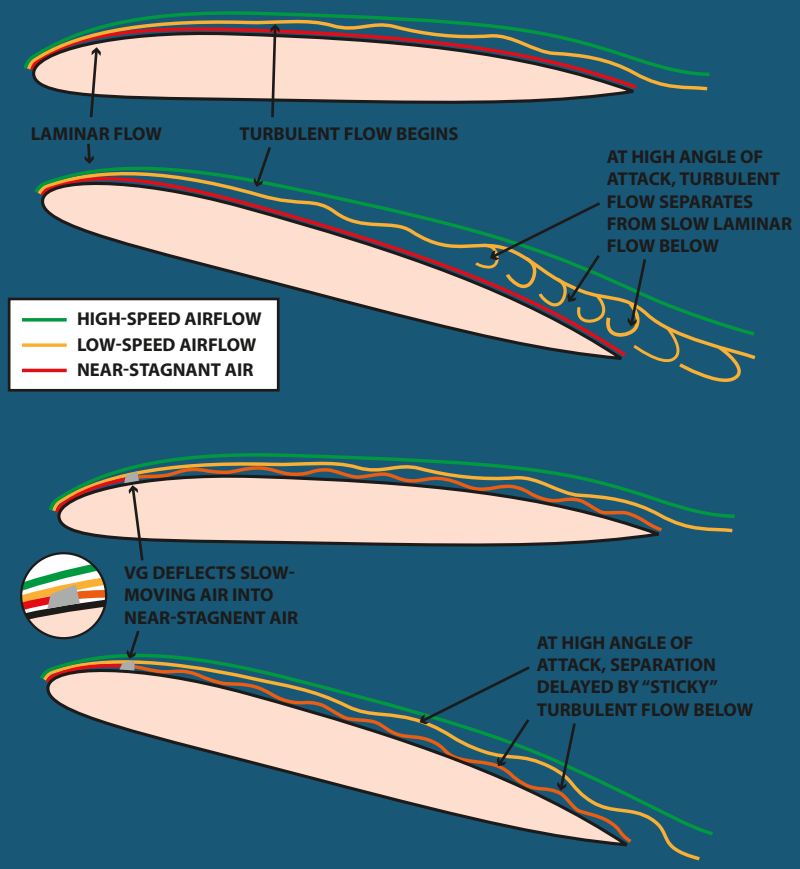
Pilots have sworn by STOL kits for years because they work. However, beyond the price of purchase and installation they exact twin additional costs in reduced useful load because of their weight and some reduction in cruise speed because the wing becomes more optimized for slow-speed operations.

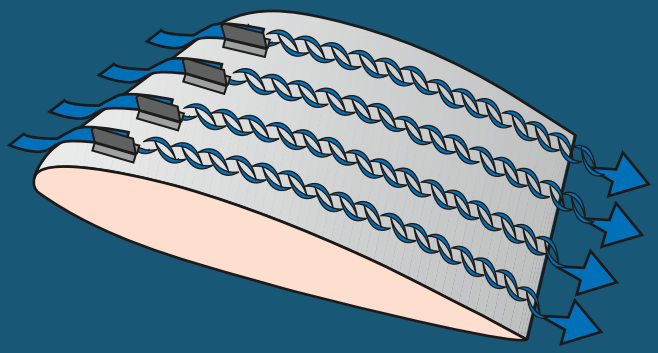
In recent years STOL kits have increasingly been viewed as the meat axe approach to reducing stall speed and improving low-speed handling as the benefits of vortex generators (VGs) have become understood and accepted in general aviation. When the weight of a VG kit is on the order of only a pound, installation takes a day or less and cruise speed may not be affected, what's not to like? But how do you reduce the stalling speed of a wing without physically reshaping it with leading edge cuffs, slats, slots and/or trailing edge flaps?

Thinking back to aerodynamics 101 you'll recall that when an airplane is whistling through the sky, the air molecules immediately adjacent to the top of the wing are moving along with the wing because of the effects of friction. To put it another way, they aren't moving when compared to the air molecules a fraction of an inch higher, which are moving with the air through which the wing is flying.

The transition between those two sets of air molecules is referred to as the boundary layer. Where the boundary layer is thin and the air is flowing smoothly over the wing, the airflow is said to be laminar—as depicted by the top drawing. That's also the lowest drag condition for the wing.

As the angle between the chord line of the wing and the oncoming air—angle of attack—increases, the laminar flow begins to separate from the wing (second drawing from the top). Eventually the flow has separated over enough of the wing that it will no longer fly—it stalls.





In addition, the control surfaces—ailerons, rudder and elevators—that are in the area where the airflow has separated progressively lose effectiveness.

VGs are placed in a spanwise line 2 to 15 percent aft of the leading edge of the wing. Each VG creates a whirling cylinder of air aft of it, in the boundary layer. (Third drawing from the top and bottom drawing.) It's not unlike a wingtip vortex.

The rotating cylinder of air acts to prevent laminar flow separation from the wing until the wing reaches a higher angle of attack than without VGs. (Fourth drawing from the top.) By keeping the airflow attached to the wing to a higher angle of attack, the wing stalls at a lower airspeed.

In addition to reducing the stall speed of the wing, keeping the airflow attached at higher angle of attacks keeps it attached to the control surfaces—making them effective at lower airspeeds. That improves low-speed handling overall. Attached to the vertical stabilizer, VGs make the rudder more effective at lower speeds, which helps it overcome the turning tendency when an engine is out in a twin, reducing Vmc.

ADD VORTEX GENERATORS TO A STOL KIT?

We've been following vortex generators at *Aviation Consumer* as they evolved from being viewed as a novelty item through a general recognition that they are effective in reducing stall speeds and increasing the level of safety of our airplanes. A question we've recently been getting from readers is whether it's worth the price of admission to install both a STOL kit and VGs for those mere mortals who want the benefit of stall speed reduction for the flying they do but aren't going to be entering Alaska-style short takeoff and landing competitions.

Plus, STOL and VG kits advertise stall speed reductions of 5 to 12 knots. Are the results cumulative?

The answer we got from our research was clearly no. Nevertheless, if you've got an airplane with a STOL kit installed, is it worth adding VGs?

To find out, we installed Micro AeroDynamics VGs on a 1966 Cessna 182J that had been modified with a Bush STOL kit—a cuffed wing leading edge and stall fences.

The VG kit was installed by Darryl Johnson and Phil Heisey at Northern Air on the Boundary County, Idaho, airport. Their comments confirmed the experience we'd had helping out with VG installations in the past—easy and straightforward. An after install photo is above.

We made before and after flights to gauge the effects of the VG installation. The flights were made at the same weight and same density altitudes with the center of gravity near the forward limit. The airspeed indicator on the 182J is marked in MPH. The results are in the table below.

With just the STOL kit, power-off stalls required nearly full aft travel of the yoke before a gentle, straight-ahead break. The power-on stall was accompanied by a moderate roll to the left.

With VGs installed, the power-off stall characteristics did not change noticeably. The power-on behavior changed for the better—there was no rolling tendency at the break.

The published normal approach speed for the stock 182J is 70-80 MPH IAS; 69 MPH is published for a short-field landing at gross weight. With the STOL kit alone, it was comfortable to hold the minimum book approach speed of 70 MPH IAS on short final with full flaps. There was sufficient energy to flare, power off, and touch down in a nose-high attitude with the stall warning sounding.

Best glide speed for the airplane is 80 MPH IAS with or without a STOL kit and/or VGs. As speed is reduced below best glide, the drag curves ramp up dramatically. Below 70 MPH, with full flaps, the airplane comes out of the sky like a dropped sewer cover and power is necessary to break the descent in the flare.

With the STOL kit we could fly final at 10 MPH below book short-field speed, although substantial power was required to control the sink rate and it was not possible to break the descent without using power to flare. Large control inputs were required to keep the airplane on speed and on centerline in a gusting crosswind.

With VGs added to the STOL kit, the slowest we felt comfortable approaching, power off, remained 70 MPH. Approaching at 59 MPH IAS still required substantial power to control the descent rate and break the descent to accomplish the flare. Handling a gusty crosswind still required significant control input; however, we had the impression that the control response was slightly crisper due to the effect of the VGs on the elevator and rudder.

The Micro AeroDynamics VG kit price for the 182J is $1450. Installation required 12 hours and cost $1,037. That included the time to paint the VGs.

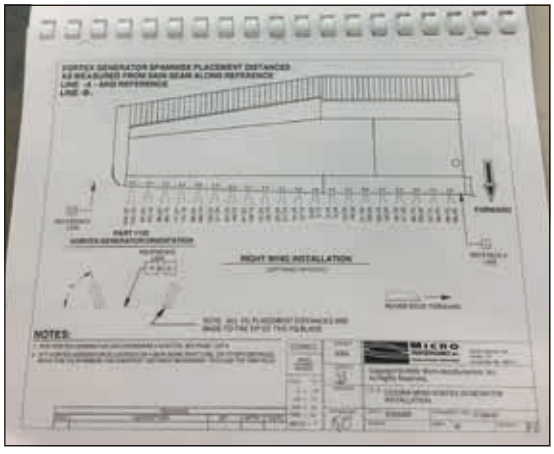
In our opinion, for $2500 installed, adding VGs to a stock 182J is a no-brainer. We'd choose VGs over a STOL kit because VGs do the same thing as STOL kit—and improve pitch and yaw control, which the STOL kit does not affect—and VGs weigh a lot less.

If the airplane has a STOL kit installed, we think the decision to install VGs depends on the type of flying you want to do. Unless your goal is absolutely getting the most low-speed performance out of the airplane possible, we don't think that the cost is worth the relatively small stall speed and handling improvement.

STALL SPEEDS, IAS—CESSNA 182J

STOL KIT ONLY—POWER OFF	STOL KIT ONLY—POWER ON	STOL KIT AND VGs—POWER OFF	STOL KIT AND VGs—FULL POWER
Flaps up—55 MPH Flaps down—43 MPH	Flaps up—38 MPH	Flaps up—53 MPH Full flaps—39 MPH	Flaps up—38 MPH

Phil Heisey and Darryl Johnson installing VGs on the underside of the horizontal stabilizer, forward of the elevator. The green template for installing the VGs on the vertical stabilizer, forward of the rudder, is in place (top). Micro AeroDynamics installation instructions are detailed and include engineering drawings (bottom).



ed for some twins as it goes below stall speed.

Some years ago we ran an owner survey regarding VGs: 98 percent of those who responded said that they improved stall speed and slow-flight handling; 2 percent said they weren't sure. No one said there was not an improvement. On a scale of 1-10, the average owner response was 9.8. Ninety-six percent said they would buy them again. Since the survey was published, we've noted that owners who had installed VGs and sold their airplanes tended to install VGs on new airplanes they purchased.

QUESTIONS

There are perennial questions about potential negative effects of VGs—notably for operation in icing conditions, whether they snag wing covers, how they affect washing the airplane and whether they adversely affect cruise speed.

When it comes to icing, VGs are far enough aft that they are not affected unless there is severe runback in freezing rain. If you're in icing that bad, the VGs are the least of your worries.

Some owners said VGs snag wing covers, others said they don't—we don't have enough information to make a recommendation. We've washed airplanes with VGs—they are a pain in the whatsis.

As for affecting cruise speed—of the owners who responded to our survey, 72 percent said no effect; 8 percent said there was a cruise speed loss and 20 percent said that they were not sure.

Anni Brogan, president of Micro AeroDynamics (www.microaero.com), the big dog in the VG world, said that because the VGs only stick up through 80 percent of the boundary layer and the vortexes generated help keep the airflow over the wing laminar, they do not normally see any loss of cruise speed.

As part of adding VGs to a Cessna 182J that already had a STOL kit (see sidebar at left), we did before and after cruise speed comparisons at 65, 75 and 80 percent power. We observed a TAS loss of 1 MPH at 65 and 75 percent power (which we think is within measurement error). Going to 80 percent, well above what we think most pilots use, we saw a TAS loss of 5 MPH. Our conclusion—for normal ops, you might see a very small cruise speed loss.

VMC AND GROSS WEIGHT

For most twins, the Vmc reduction usually combines with aircraft certification FARs to allow a gross weight increase—something we consider to be a big deal. Nick Dean of BLR Aerospace (www.blraerospace.com) told us that for the Piper Navajo Chieftain, the kit costs north of $4000, but it allows a gross weight increase of 368 pounds. He said that all Chieftains in Alaska have the mod installed. Being able to carry one more passenger and backcountry baggage means the kit pays for itself fast.

Our survey of the market indicated to us that between Micro AeroDynamics and BLR, there is an STC for VGs for virtually every legacy production piston single and twin

continued on page 32

IFR Training Hoods: ViBAN, Overcasters Top

Choose for personal comfort and compatibility with eyeglasses. Our market scan proved there's plenty of variability in fit, form and comfort.

by Frank Bowlin

The FAA calls them view-limiting devices, or VLDs, but we call them hoods. The concept is simple: In visual conditions simulate instrument conditions by restricting the pilot's view to only the instrument panel and nothing outside. Who among us, however, hasn't had "the hood" on and still snuck a peak outside? So, no matter how much it restricts your vision to the sides, you can always turn your head just that little bit and get a fleeting glimpse of the visual world beyond the instrument panel.

But, if you want to simulate instrument conditions in the actual airplane, other than impractically blocking the windows themselves, the best option is something you wear that restricts your view. Although simple in concept, the perfect hood remains elusive. Nonetheless, any of the products reviewed here are effective at their primary purpose of restricting your view to (mostly) just the instrument panel.

OUR EVALUATION

We evaluated each of these view-limiting devices for their practicality, quality of construction, expected durability and sufficient comfort to wear for some time. Our author/standard test dummy is a pilot who wears conventional headphones while flying and also wears prescription glasses and sunglasses.

CHECKLIST

- Hoods are cheap enough to experiment with until you find one that suits you best.
- Eyeglasses pose a challenge, but some hoods can accommodate them.
- But the unobstructed viewing angle of the hood may not match the area of needed RX correction.

We believe donning the view-limiting device shouldn't be too challenging, and it must be possible to get it off or out of the way quickly when the instructor proclaims, "Runway in sight. Land visually." Plus, fumbling to remove it close to the ground is dangerously distracting and lacks the realism of a sudden switch from instruments to visual reference.

This presents a possible limitation of the devices that are secured with an elastic strap. While it might be possible to put the strap over a headset you're wearing, we don't recommend that due to the possibility of the strap getting caught on the headset band. So, to put on the device you must remove your headset. Quick removal, therefore, is not possible. However, most of the devices that do use a strap can be slid higher onto your head, opening up the view. This requires a slight practiced maneuver that is quickly mastered. Nonetheless, consider the limitations presented by a strap when considering one of these devices.

Of course, the band only presents a challenge for conventional, over-the-top headsets; in-the-ear headsets and those with no headband work fine with the band. Initially we thought we were looking for one view-limiting device that best suited every user. The reality is that these are more user-specific, like not accommodating eyeglasses or presenting the strap challenges. Choose carefully. With these parameters in mind, we set out to see what the market offered.

We looked at nearly every one we could find. In a broad view, these

come in two general types: hoods and glasses. We'll look at glasses first and hoods second.

MJ BLOCKALLS

To envision Blockalls, think of wrap-around sunglasses, but made of clear plastic. Apply an opaque coating that blocks vision above and to the sides, leaving some of the clear lens to let you see the panel.

Blockalls are unique in that they have different models for different purposes. Since the vision is tightly restricted, they've actually slightly offset the unobstructed view so that, for example, the PIC can see directly in front, can't see to the left, but can see a bit farther to the right for a better view of the radios. That's the PIC model.

Seat-specific Blockalls also come in a CFII/SIC model with the offset to the left, allowing the wearer to see a bit farther to the left for use in the right seat. While of dubious use to a CFII, an SIC, however, might find this design useful. There's a third design specifically for helicopter pilots.

Blockalls come in different colors. The color application is always opaque, usually over a clear lens. Blockalls are well made and quite comfortable. The straight ear bows allow for easy on and off, even under a conventional headset.

Most Blockalls are $28.95. They're not compatible with eyeglasses of any type. The simplicity of design, comfortable use with a very soft bridge and effectiveness make Blockalls our top choice for pilots who need not wear other glasses—which is rare. They come with a storage bag.

There are many similar view-limiting devices that are simple glasses, usually with some degree of wraparound, but without the offset, of course.

We only tested Blockalls, but perhaps one notable example of these others is a product from IFRglasses.com and many retailers. Their products have ratcheting temples to allow some adjustability of the obstructed view.

IFRglasses.com offers this as Cloud-Eeze for $16.95 and a similar model they call Old Foggies is offered with bifocal correction built in for $29.95-$34.95 depending on color and coating. While Cloud-Eeze appears to be a viable product, we wonder what one is supposed to do when removing Old Foggies.

Yes, the BestHood, top, is bulky if not dorky, but it blocks all side vision. That's the hybrid ViBAN, middle, and the Overcasters, bottom.

FOGGLES

Foggles have more or less become the industry standard, and for the good reason that they do it all, albeit imperfectly. They can be worn with or without most glasses, are quick to don and remove, work well beneath a headset and aren't terribly expensive at around $18 to $20.

Foggles were the first of what has become a popular design of glasses and overglasses. The original Foggles are actually modified safety goggles. They're made of clear or colored plastic with frosting over all but the view straight ahead. They're designed to fit over many types of glasses. The curved, but not hooked, temples allow quick on and off.

But, Foggles have some drawbacks. While sufficient for our purposes, they're not the best made. In fact, the underlying safety glasses are intended to be somewhat disposable, so sometimes not a lot of care is taken to smooth out the actual rough edges, and durability is sometimes lacking. (One flight instructor we know uses a pair of Foggles with tape across the bridge to keep them together, bringing back memories of high-school nerds.)

In addition, the plastic is soft, so the lens is easily scratched. Last, many users complain that the frost-

ing, which is not opaque, causes a lot of glare and fatigue when flying in direct sunlight. Foggles come with a storage pouch, are available in clear/frost and yellow/frost, but we prefer the clear with sunglasses as needed.

SPORTY'S, JEPPESEN

Given the shortcomings of Foggles, similar products have evolved. We particularly like the IFR Training Glasses ($17.95 from Sporty's), which refine the concept of overglasses. They work well without underlying glasses and even over most eyeglasses or sunglasses. The temples ratchet up, down and at the hinge for some adjustability of the obstructed area, and the temples are even length adjustable for a good fit.

Like Foggles, though, the view obstruction is from frosting that might cause some glare problems in certain light. Nonetheless, we think the IFR Training Glasses are an improvement over Foggles at a slightly lower price, offering nicely improved comfort.

Jeppesen says its JeppShades are similar to Foggles, but we found them conceptually similar to the ASA Overcasters (covered in the subhead below) except that JeppShades are self-contained. While they flip up for a quick, unobstructed view, they include a frame so you don't need other glasses. The frame will work over some glasses, but perhaps not overly large frames. It has a Velcro-adjustable strap rather than standard temples. The strap is comfortable but makes them a bit more difficult to put on and take off. Because of the flip feature, though, they need not be removed for an unobstructed view.

JeppShades use an opaque white plastic, not black like the Overcasters. JeppShades are $30.96 from Jeppesen. They seem durable, but, like the Overcasters, there's a small rivet that could be a weak spot after extended use. JeppShades are just bulky enough that a little care is necessary in storage in the supplied storage pouch.

ASA OVERCASTERS

Remember clip-on sunglasses? If you wear prescription glasses, you can get shaded plastic lenses that are on a one- or two-function clip. You use one function to clip the lenses to your prescription glasses right at the bridge. This attachment is unobtrusive and works well to hold the shaded lenses in front of your prescription glasses.

An optional second function of that clip is to allow the shaded lenses to be flipped up out of the way to effectively and instantly revert to your prescription lenses without removing the sunglasses—a bit dorky, perhaps, but quick, easy and effective.

Overcasters work the same, but instead of a shaded plastic lens, opaque black plastic occludes your vision above and to the sides. In use, since you're not actually removing the Overcasters, it's simple and quick to flip them up for normal vision or back down for the "hood."

Attaching the Overcasters to prescription glasses or sunglasses will certainly require removing your glasses the first few times at least. However, once you put them on your glasses, perhaps during preflight, you can flip them up or down in an instant and won't have to remove them from your glasses until the end of the flight.

The clip is solid and tight. The pivot, however, is attached to the black plastic with two small rivets on each side of the bridge of your glasses. These appear solid, but we suspect the rivets could be a weak point that could cause cracking of the plastic over years of flipping them up and down. But, we saw no evidence of this during our testing.

At only $19.95, we think Overcasters are the best choice for pilots who always wear glasses of some type (prescription or sunglasses) when flying. Note, though, that Overcasters *require* existing glasses, so pilots with good vision will need another solution at night and when not wearing sunglasses.

Overcasters are as comfortable as the glasses to which you clip them. The sides make them bulky enough that some care should be exercised during storage.

We like that the ASA Overcasters are offset to provide a better view of the instrument panel to the right (radios) than to the left. Worth noting is the Blockalls offer this as a model-specific feature, so be sure to ask for it when you order.

THE BEST HOOD

One of the proclaimed top choices in previous *Aviation Consumer* hood reviews, we think The Best Hood remains a good choice. It's similar to a model called the Jiffyhood, which

VIEW LIMITING DEVICES COMPARED

MODEL	PRICE	TYPE	EYEGLASSES COMPATIBLE?	DURABILITY	COMFORT	EASY ON?	EASY OFF?	CONTACT
BLOCKALLS	$28.95	GLASSES	NO	GOOD	GOOD	YES	YES	www.blockalls.com
FOGGLES	$19.00	GLASSES	YES	FAIR	FAIR	YES	YES	Various mail order
IFR TRAINING GLASSES	$17.95	GLASSES	SOME	GOOD	GOOD	YES	YES	www.sportys.com
JEPPSHADES	$30.96	GLASSES	MOST	GOOD	GOOD	NO	PIVOT	www.jeppesen.com
OVERCASTERS	$19.95	GLASSES	REQUIRED	FAIR (RIVETS)	GOOD	YES	PIVOT	www.asa2fly.com
THE BEST HOOD	$10.00	HOOD	YES	POOR	FAIR	NO	REPOSITION	www.thebesthood.com
FRANCIS IFR HOOD	$34.95	HOOD	MOST	FAIR	GOOD	NO	REPOSITION	Various mail order
JIFFYHOOD	$12.95	HOOD	YES	FAIR	GOOD	NO	REPOSITION	www.asa2fly.com
VIBAN	$39.95	HYBRID	PERHAPS	GOOD	GOOD	YES	YES	www.viban.com

DILEMMA: HOODS AND EYEGLASSES

Sure, pilots who wear prescription glasses must select a view-limiting device that will accommodate them. The Jiffyhood in the main image is one of several. However, it's commonly assumed that pilots who don't wear glasses don't need a glasses-compatible view-limiting device. In the real world, that's unrealistic.

Face it, most pilots wear sunglasses when flying. So, while many view-limiting devices block enough outside light that you don't need sunglasses under the hood, as soon as you take off the hood, you might well want your sunglasses on.

With some of the tested devices being extremely quick to remove—like the top-choice Blockalls—once you do remove them, if it's bright out you'll want to put on sunglasses almost immediately. This can probably also be done quickly and easily, but is another and potentially distracting step that you should carefully consider when close to the ground as your eyeballs transition to the view outside.

We're only raising this as a concern, but we're not going to make a specific recommendation here. If you don't wear prescription glasses, you should at least consider what you'll do if removing a view-limiting device that can't be worn over sunglasses. This might be fine for you, or you might choose a solution that permits you to always wear your sunglasses with the view-limiting device.

Like many of you past "that age," we wear progressive (multi-focal) RX glasses. This identified an interesting problem we didn't anticipate.

Many of the products we reviewed here are overglasses—like Foggles—that fit over your glasses and provide a small unobstructed area through which to view the instruments and little else. With some, however, we found that the unobstructed viewing area of the device didn't match the area of needed correction of the eyeglasses. In fact, sometimes the desired viewing area of the glasses was in the obstructed area of the overglasses, creating a situation where we couldn't clearly see the instrument panel.

In some cases, the fit of the hood could be adjusted to minimize or overcome this problem; in other cases it couldn't. Since the potential for this problem is user-specific, depending on your prescription, lens style, face geometry, etc., we've not identified where we had this problem. In other words, we might have had this problem, but you might not.

Nonetheless, you should be aware of this possibility if you wear multi-focal glasses, and see if you can try before you buy. Or simply avoid the overglass-type of view-limiting device altogether and stick with the actual hoods.

is similar to the The Best Hood.

If you already understand what the Jiffyhood (we cover it on page 16) is and how it works, The Best Hood is similar, except cheaper and simpler.

But don't mistake The Best Hood for a high-quality, durable accessory. It's made of cardboard that's about the same weight as a file folder. That's creased and folded to provide a large but constrained viewing area. It's reasonably comfortable against your forehead and secured with a rather meager elastic strap that is simply stapled to the cardboard.

Nonetheless, it works, and works well to provide a kind of large tunnel through which you view the instrument panel and little else. Since it sits high on your head, glasses aren't a problem.

With a standard headset, putting on The Best Hood could be a little effort, but like most of the other hoods that use a strap, when you need it out of the way, you can just slide it up on your head for a nearly unobstructed view. After your flight, it folds flat and you can store it virtually anywhere.

As the manufacturer suggests, we like The Best Hood more than we thought on first glance. And, for $10 delivered from the manufacturer (TheBestHood.com) you can't go wrong. Given that it's made of cardboard, though, we expect it'll get soiled and possibly crumpled after a few uses.

THE HOODY, SUPER HOOD

The Hoody is relatively new to the market and offers an intriguing new design that uses a ball cap (not supplied) as the foundation.

The product is essentially just a piece of opaque plastic that attaches to the bill of the ball cap and offers extended view obstruction forward and to the side. It looks like it could be easy to remove by just sliding it off of the cap's bill, but attachment could be more difficult. Since it starts as a folded piece of flat plastic, storage should be simple.

We repeatedly attempted to contact the manufacturer by phone and email to request an evaluation sample, but our efforts yielded no response at all. Thus, we were unable to test The Hoody and cannot recommend it.

We found, but did not test, another product called The Super Hood, which is similar to The Hoody. The Super Hood ($21.75 from Aircraft Spruce) is a two-piece affair starting with a simple plastic sun visor like you might wear to the beach.

Then, a much larger visor with sides clips on the sun visor and provides a large view straight ahead; that's restricted above and to the sides.

While we believe this could be effective, we felt the two-piece arrangement and possible discomfort from the plastic visor (although it appears you could substitute a ball cap) to be suboptimal when compared with the Jiffyhood, ViBAN

The VLD group shot at the top proves there isn't a one-size-fits-all choice. Like eyeglasses, it's partly about personal fit and preference. Those are the IFR Training Glasses from Sporty's in the lower image.

and even The Best Hood. It reinforces how different these models fit.

FRANCIS IFR HOOD, ASA JIFFYHOOD

The Francis IFR Hood is another offering that's been around for a long time. It's extremely effective—perhaps better than most—at blocking views outside while providing a good view of the instrument panel. The $34.95 (from Sporty's) product is well made of opaque black plastic and is reasonably comfortable, although if you have a large head you might find it's too tight even at the loosest. It accommodates most glasses.

This hood uses an elastic strap around the head to secure it in place. We were able to slide it up on our head for a view for landing. The Francis Hood is bulky so some thought should go into storing it.

The Jiffyhood is a longtime staple. It's simply a curved piece of plastic with elastic straps around the head so the plastic protrudes out and down from your forehead much like an extended, curved visor on a ball cap. Since the Jiffyhood doesn't touch your face, it is fully compatible with glasses. Unfortunately, the Jiffyhood is bulky and we found it difficult to store.

The visor is effective at blocking outside views and can be adjusted to provide a larger view of the instrument panel than most of the others. The elastic band has three snaps, making it length-adjustable for acceptable comfort.

The band seems to be of high quality, but exposure to sun gradually degrades any elastic. We've seen older Jiffyhoods where the elastic band was shriveled and had lost its elasticity, but we assume that took years. Take good care of your Jiffyhood (and any device using an elastic band) and the elastic should last a long time.

The first time we tried a Jiffyhood, we fumbled with the strap for some time. Once accustomed to it, however, it works well and the Jiffyhood can be slid up higher on your head for a quick transition to visual conditions. MSRP from ASA for the Jiffyhood is $12.95, making it a bargain.

VIBAN HYBRID

The ViBAN is a bit of a hybrid between glasses and hood. It fits like glasses, but obscures your vision more like a hood. The marketing information for ViBAN led us to look forward to evaluating them. The reality, however, fell shorter. The product is conceptually quite similar to the Jiffyhood, but the hood is smaller and closer to your head and is worn like glasses rather than using an elastic strap.

First, for pilots who do not wear glasses while flying, ViBANs work quite well. It's light and comfortable and provides a larger view much like the Jiffyhood. Although the temples have a hook at the end to go behind your ear, ViBANs should still be easy and quick to don and remove, so long as you don't use the included lanyard.

The ViBAN is also available in a model for pilots who wear glasses. That product is identical except that the nose bridge of the non-glasses model is supplied but not affixed in the model for use with glasses. Thus, the ViBANs must rest on the glasses (not the nose) and the amount of vision occlusion is dependent on the size of the underlying glasses and can't be further adjusted. Plus, putting the ViBAN over glasses pushed them further from the wearer's ears such that the temple was too short.

The manufacturer recommends using the lanyard to hold the ViBAN in place, and that was necessary for use with glasses. Without the lanyard there was insufficient view occlusion and a very loose fit that occasionally just fell off.

ViBANs seem durable and comfortable. At $39.95 they're at the higher priced end, and would work well for a pilot not using eyeglasses. The design is bulky, but the product comes with a semi-rigid case.

OUR CHOICES

Again, any of these products will do the job, and there's enough variability in fit, form and function that our choices might not necessarily be yours.

Of the glasses types, by a large margin we preferred the ASA Overcasters for those who already wear glasses. If you don't wear glasses, we liked the Blockalls, but we'd prefer a model where you don't look through even a clear lens.

Of the hood designs, if you don't wear glasses the ViBAN would be our top choice. If you do wear glasses, or prefer a pure hood design, we'd recommend the Jiffyhood or, for infrequent use, we prefer The Best Hood.

Contributor Fran Bowlin is the Editor of sister publication IFR Magazine.

Garmin GTR200B: Comm, Bluetooth ICS

Garmin's new VHF comm radio all but eliminates the audio control panel with a built-in intercom, Bluetooth, 3D Audio and a smart feature set.

by Larry Anglisano

CHECKLIST

- A modern VHF comm with 10 watts of output and a deep wireless interface for cockpit entertainment.
- The $1395 price tag is fair, given the standard features.
- We'd like to see at least an option for a four-place intercom. It's limited to two.

In an avionics retrofit world dominated by all-in-one integration, the lowly VHF comm radio generally stands alone. But Garmin, with its new GTR200B VHF comm, blends advanced stereo intercom functions—including Bluetooth connectivity—in one chassis. It can also interface with Garmin's G3X Touch integrated avionics suite over a CAN (controller area network) bus.

If there's a downside to the GTR200B radio it might be that it lacks a TSO, which could keep it off-limits for certified aircraft. Here's a look at its functions and feature set.

FORM AND FUNCTION

The $1395 GTR200B (the B is for Bluetooth) picks up where the first-gen $1199 GTR200 (still available) left off and sports the same chassis and overall footprint. Weighing just shy of two pounds, the radio measures 1.35 inches high by 6.25 inches wide and 9.39 inches deep with the interface connectors in place. That chassis is fairly deep and can pose a challenge for some panels, but it's slim enough to save space on the face of the panel.

The radio's LCD display has a 200 by 33 pixel count, which is relatively unimpressive compared to the dazzling color glass displays we've grown accustomed to. Still, even with a small 2.95 by .48 inch viewing area and a generous 45-degree side viewing angle, we doubt most users will complain. Think in terms of utility.

The GTR200B's bezel knobs and buttons have a rugged feel and are unchanged from the GTR200. On the bottom left corner of the bezel is a rotary power knob that serves double-duty as a volume and squelch knob. Yes, the radio has automatic squelch but pushing the knob in puts the circuit in manual squelch mode for added sensitivity.

Speaking of sensitivity, it's worth mentioning that the radio has a 10-watt transmitter, which should be more than sufficient for transmitting as far as you need it to, provided the antenna system is healthy. Don't overlook it if replacing an older comm radio, or even when installing it from scratch.

The GTR200B is what we call a smartcomm, with a user interface driven extensively by software. That's good for a high level of customizing. To get to it, there's a Menu key for setting user frequencies, entertainment control, telephone interface and a variety of other functions from the menu at the ride side of the display.

The menus are navigated by two softkeys, some of which can be user-defined in the initial setup mode. The menu structure seems shallow enough to not cause extra workload when ham-fisted. But that doesn't mean the radio doesn't have a deep user interface. Remember, this is an intercom and VHF radio in one.

BUT LIMITED TO TWO

Since nearly every light sport model has two seats, the non-TSO'd GTR200B logically has a two-place intercom. But we wish it supported four stations for more kit-built aircraft.

But where the system lacks in expandability, it excels with standard features. From the softkey menu, you have access to an impressive wireless entertainment interface that's driven by a Bluetooth smartphone or tablet. The way it ought to be, accessing your tunes on the fly is fast and straightforward. Hit the MED (for media) key for access to the connected smartphone's Bluetooth media controls. Logically, this is how entertainment audio is piped into the intercom.

And yes, we know there is the ar-

The GTR200B packs a hefty punch in a slim chassis, and has a deep and customizable user interface.

G3X TOUCH AND GTR200 COMBO

Garmin's G3X Touch integrated avionics suite for experimentals and LSAs already has built-in VHF comms, with onscreen tuning. Garmin also offers standalone audio control panels for doing a lot of what the intercom in the GTR200B radio does. So why would you toss a GTR200B into the interface through the G3X Touch's CAN bus (if it has a GDU37X or GDU46X), or interface the radio with one of Garmin's portable GPSs?

One reason is that the G3X Touch (and later-model Garmin portables, including the aera660) can, using GPS position, send area-specific frequencies to the comm so you don't have to look up the frequencies.

While Garmin's G3X and current G3X Touch suites have built-in VHF comm capability, some basic systems (particularly single-screen versions in more basic aircraft) only have one radio. Adding the GTR200B to this interface adds another, while offering a dedicated control head as backup to the G3X and G3X Touch displays. Of course, adding a second comm radio to the suite means you'll have to buy an audio panel to switch between the two radios during transmit, and to separate the receiver audio. Moreover, nearly every modern audio panel has a built-in intercom—some with similar features as the GTR200B's.

Perhaps the interface that makes the most sense is a GTR200B and a compatible Garmin GPS navigator mounted in a panel dock. It's almost all you need for VFR.

gument that music can be a distraction when the workload gets high, and we say selecting the right music might take the edge off for both pilot and passenger. Still, you can turn it off altogether with a dedicated music on/off softkey. That same softkey, when pressed and held, also configures whether the comm radio mutes the intercom entertainment audio.

Further, if you want the other seat on the intercom to have tunes, while you concentrate on the flying, the pilot's position can be isolated from the entertainment, and also from the intercom.

To start and stop the Bluetooth tunes from flowing, there's a dedicated Play/Pause control. Press and hold it and you'll have access to the smartphone or tablet's media controls and library. You'll see the artist name, track title, the music volume level and other media playlist data. The Equalizer menu customizes the audio response for rock, classical and pop genres—useful with high-end headsets.

There's also a full-duplex telephone function, with display of the incoming telephone number. You can answer from the radio, but you have to go into the menu and turn the large rotary knob to highlight Answer, then press the small knob to select it. Do the same to hang up.

Softkeys are also used for more important tasks than dialing in the tunes. The EMR (emergency) softkey quickly tunes up 121.500 MHz, so you don't have to crank it in with the knob. There's also a configurable user list for quickly calling up your most-used frequencies.

And so you know precisely what is tuned, the station identifier and type is shown on the screen below the frequency. You can quickly monitor the frequency that's tuned in standby by pressing the MON key on the upper right area of the bezel, verified with a "M" tag above the STB label. If you've flown with the ability to monitor the standby frequency in a single comm radio, you appreciate the utility.

We like the stuck microphone utility for times when the wiring in a control stick (or pilot holding it) goes flaky and keys the transmitter uncommanded. The GTR200B alerts you of a stuck mic—and which position it is—with a "Pilot or Copilot PTT Key Stuck" onscreen message.

3D AUDIO

As with some Garmin audio panels, the GTR radio has 3D audio. By using different responses in each ear, 3D audio processing creates the illusion that each audio source is coming from a unique location or seat position. You'll need stereo headsets for the separation to work. During normal operation and with 3D Audio enabled, the listener hears the active frequency at the 12 o'clock position. If the standby is selected for monitoring, the listener hears the active at 11 o'clock and the standby at the 1 o'clock position. Intercom positions are processed to sound like their relative seat location. By default, the GTR 200/200B assumes the pilot sits in the left seat. Pilot seat location can be changed in the configuration mode. We like that you can turn this off in the menu.

PROGRESS

In our view, the GTR200B represents clear progress in VHF radio tech. Combining an intercom and VHF radio in a single unit just makes sense, while simplifying the mechanical installation.

As for installation, without a TSO, STC (or an FAA field approval) the GTR200B is realistically only a player in LSAs and experimentals. For those applications, we think the radio is a solid value.

TSO Certifications: Here To Stay, For Now

Straightforward and costly, product certification via FAA TSO remains an international standard. But broad STC approvals are lowering costs.

by Larry Anglisano

Digging deeply into the installation data for Garmin's new GTR200B comm radio got us thinking about the requirement of TSO certification. With autopilots and primary EFIS systems being approved without a TSO, but instead via AML-STC (approved model list supplemental type certificate), are the days of TSO approval coming to an end? Garmin—a company that cranks out a lot of them in short order—says no. You don't have to dive far into the regulations to see why.

The GTR200B, like most Garmin avionics aimed at the LSA and experimental market, doesn't have a TSO and it doesn't have an STC, pretty much killing it for Part 23 certified aircraft. And yes, a retrofit comm radio requires some form of certification. The TSO process remains the most common way to get there. It's a vigorous and expensive approval process that can drag along.

As an example, TKM Avionics in Scottsdale, Arizona, is long-delayed releasing its MX155 next-gen digital replacement radio as it keeps feeding R&D cash to the TSO process. The TKM name is no stranger to the industry; the original company built certified VHF radios as early as the 1980s.

We asked Garmin for a lesson in product certification as it relates to the TSO, and it led us to a slew of regulatory jargon that's worth sharing. Garmin's Bill Stone pointed out some pretty specific wording in the regulations, reiterating that as a replacement or modification article (no matter how basic its functions are) the product's design does need to be FAA approved. Additionally, the manufacturer of the article has to be a holder of an FAA production approval. The TSOA (technical standard order authorization) is still the most accepted means for doing so.

IT'S ALL IN THE REGS

For starters, 14 CFR 21.8, which covers the approval of articles, states that if an article is required to be approved under this chapter, it may be approved with a PMA (parts manufacturing approval), under a TSO, in conjunction with type certificate procedures for a product or in any other manner approved by the FAA.

The FAA's 14 CFR 21.9 deals with replacement and modification articles and has pretty specific language even when it comes to production. It says, in part, that if a person knows, or should know, that a replacement or modification article is likely to be installed on a type-certificated aircraft (maybe it's a Piper Arrow, as one of many plain-vanilla examples), the person may not produce that article unless it is produced under a type certificate or under an FAA production approval.

Garmin pointed out that the rules in CFR 21.9 pretty much answer our question of why the non-TSO'd GTR200B radio is off-limits to Part 23 certified aircraft. To comply with this regulation, Garmin has to state that the product is not suitable for installation in a type-certified aircraft. It's not just about U.S. regulations, either.

The TSO is an internationally recognized approval basis, so it allows for export and installation of the product in aircraft under the jurisdiction of civil aviation authorities other than the FAA. And the regs aren't all about aircraft.

Since a VHF comm radio contains a transmitter, there needs to be a method for what's called Spectrum Agency approval. In the United States, that's the FCC.

Garmin said that a TSO provides a pedigree for bilateral acceptance of the FAA/FCC Spectrum approval in most countries around the world. Lacking a TSO, a manufacturer would have to submit for Spectrum approval for a VHF transmitter in every country it intended to sell the product, in addition to every country where the product may get used.

A MIX OF TSO AND STC APPROVALS

A few years ago Dynon Avionics and EAA (Experimental Aircraft Association) started the industry-changing trend of sidestepping the TSO process in favor of a broad AML-STC with the D10A primary EFIS. Since then, we've seen several major products (including EFIS and autopilots from Garmin, Aspen and TruTrak) approved for certification in type-certified aircraft despite not having a TSO. While we think that trend will continue, don't expect the TSO to go away any time soon.

Airframe Vibration: Look Beyond the Prop

It's disconcerting, fatiguing and causes premature component wear, but there are ways to tame abnormal airframe vibration.

Staff report

The chide in the helicopter world is that excessive vibration is the unsolvable path to early destruction. Truth is, piston airplanes are a close second, and yes, the sit-up-straight paranoia-inducing vibration you feel in the floorboards while over large bodies of water is real.

Getting an airplane to fly smoothly enough to keep passengers satisfied and components healthy goes beyond a well-tuned engine and balanced props, although that's often the starting point.

In the end, troubleshooting and fixing abnormal airframe vibration is a tedious multi-step process best left to the pros, but here are some basic things to consider before bringing the aircraft to the shop.

IS THAT NORMAL?

Face it, some airframes inherently have more perceived vibration, simply by nature of their parts. Hang a fat wide-chord or even a long two-blade paddle prop on some airplanes and you'll likely feel a distinct rumble in the climb.

But aero engineers also rightfully place vibration in two categories: normal and abnormal. Jets aren't immune to either. No matter the engine, it has to sit on healthy engine mounts and be mated with a compatible prop, something the OEMs usually get right when mating propellers and engines for the aircraft's final type certificate.

If you're changing the original engine/propeller combination (say from a standard two-blade to a three-blade model), understand that you might be happy with the increased performance, but not with the induced vibration. We know of a particular Piper Cherokee Six 300 that from a vibration standpoint wanted no part of an STC'd three-blade prop upgrade, and its owners ultimately took it off when the shop just couldn't make it smooth.

The Insight GEM G3 series engine monitor shown center has an integral spectrum analyzer utility to help troubleshoot vibes.

As you would expect, years of wear and tear, plus neglected maintenance, is a recipe for abnormal vibration. There are good reasons to minimize vibration, and it's not just about comfort. Avionics, while built to sustain reasonable amounts of airframe vibration, do fail prematurely in vibey airframes, especially spinning gyroscopes.

On a side note, the popular vintage King KG102A remote heading gyro that's part of the KCS55A HSI system sits on a mount housing equipped with four shock mounts, which proves how critical vibration is to this component (an overhaul nears $2000). The health of the shock mounts can tell a story of how much vibration is present in the airframe, and how long a freshly overhauled gyro might really last.

ENGINE ISOLATORS

Although we're primarily concerned with airframe vibration for this article, it's worth a few words on engine mounts, or engine isolators, as they're more appropriately called. We covered them in detail in the January 2015 *Aviation Consumer*. These elastomer donut-like components that live between the airframe and the engine serve the important purpose of dampening the rigid airframe from the hammering vibration of the engine and propeller. Engine vibes can certainly do damage, including cracking major structural components, loosening rivets, fatiguing metal and damaging instruments, to name a few issues. Steve Gruenberg, a professional vibration analyst, told us to "Think of airframe vibration as multiple impacts—as in taking a hammer to the structure."

Unfortunately, engine isolators are often overlooked when they beg to be replaced, even during engine swaps or when the engine is overhauled—which is perhaps the most opportune time to replace them.

Most engine mounting systems use four isolators, although some aircraft use six. The Continental engine mounting system supports the engine from below—think of a person holding a beach ball. Lycoming engines are cantilevered out from the firewall, so the top isolators are loaded in tension, the bottom in compression.

While some isolators can last beyond engine TBO, nearly every tech we spoke with said it's more realistic to think of them as good for 10 to 12 years. They should be inspected for condition regularly.

They are all made of a compound based on natural rubber, which means that they will eventually solidify and deteriorate. Plus heat, oil and avgas are the enemies.

As the isolators wear out, the engine will sag on the mounts and vibration will get worse. As the engine sags it can and will come into contact with the cowling and items within. Worst case is the engine ring gear cuts into the lower cowling and starts chafing wires and fuel lines. Ugly.

Replacing a set of isolators takes anywhere from three to 12 hours. It involves loosening mounting bolts and hoisting the engine a few inches away from the mount, and then loosening or moving cables and lines as needed. Once there is adequate clearance, the bolts can be withdrawn and the replacement isolators installed. But you have to do it right, otherwise you can create vibration like we once witnessed on a Cessna P210.

After throwing a lot of money at troubleshooting by looking for a shuddering problem in the wrong places, the mechanics found the problem was a shanked-out isolator bolt. Closer inspection found that the left front isolator was tight in the attachment threads, but not against the structural leg. That play in the mount pack created a heavy, dull vibration felt mostly in a climb configuration as the engine rocked around.

Last, hard and sagging shock mounts will do little if any good at isolating the engine from the airframe. Instead, they'll transmit the vibration from one hard point to another.

CONTROL FLUTTER AND OTHER CULPRITS

Let's get back into the airframe for other sources of vibration. The vibration created by worn control surface hinge points and out-of-balance control surfaces can be subtle in its impact but increasingly destructive in nature. Balancing controls whenever repair or painting of a surface is accomplished is not only prudent, it's a requirement that doesn't always happen.

Even a slight imbalance of a control can cause a high-frequency oscillation that is dampened by the control cables but can still be felt in the control wheel. Manufacturers are stringent when it comes to trim tab free play. The main concern is for control surface flutter, which can lead to hinge-point failure and loss of control, but the rattling going on with several loose tabs can be unnerving. While difficult to feel, a slight increase in control wheel or rudder pedal "buzz" can be found by increasing the aircraft speed toward Vne.

Don't wait to make the necessary repairs. Vibration caused by loose trim tabs is not only annoying, it's downright dangerous. The real fix is replacing all associated hinge points, rod ends, bushings and bolts, as needed.

Still, control flutter and engine/prop issues aren't always the cause of vibration. Aircraft sometimes develop vibration issues associated with rig or a broken fairing, a bent or cracked landing gear door or even a cracked wingtip. Just forcing air out of the way in an effort to stay aloft also creates some vibratory noise. We recently learned that even gliders have some degree of vibration, particularly at certain speeds.

It's even more frustrating when the engine is running smoothly and there are no airframe vibes on the ground, but it all changes for the worse when airborne, where many

Since engine isolators are partially made of rubber, they might have limited service life, which leads to vibration. Those are the twin isolators on a Cirrus SR22 (it uses six) in the top image, and a lower isolator on a Beech Duke, middle photo. It's worth the effort to properly rig vibey gear doors and cowl flaps, bottom.

Aircraft vibration takes a toll on remote avionics that are along for the ride. The Garmin LRUs and Skywatch traffic processor in the Mooney's avionics bay, top photo, are perhaps more tolerant of long-term vibration than the Century NSD360A mechanical gyro, bottom.

factors come into play.

Impact air against the airplane, flexing of the fuselage and pressure-box buildup within the cowling can reposition inspection covers, baffling, cowl flaps and doors. Anything and everything attached to the airplane can cause some form of vibration or be caused to vibrate in response to tension-release input.

PROPELLER BALANCING

Probably the first thing that comes to mind when considering a vibration problem is the thing that has the most potential to vibrate: the prop. All propeller manufacturers establish balance criteria for their props. Across the board, regardless of make and model, the propeller is considered in balance when it can rest evenly on a knife edge beam without dropping a blade in either direction.

Typical tolerances for static balance are plus or minus one weight. The gram equivalent will vary depending on the propeller, and the weight slugs can vary in size, but getting it on the money is the goal.

Aside from outright balance, propellers are checked for blade track and blade angle (including relative to each other). All props will have slightly different specifications. Your prop shop should be consulted for the particulars on your aircraft. In addition, most propellers can be positioned on the crankshaft in one of two ways.

Typically, the number-one blade on the prop is placed at the top center mark on the crankshaft flange. Three-blade propellers are often installed with the number-one blade up or down, depending on balance requirements and the aesthetics of having both props positioned the same way on shutdown.

One distinct causal issue is where the prop blades are slightly out of specification with respect to each other. The prop needs careful spec checks when there are thorny vibration issues.

As was the case with our previously mentioned Cherokee Six example, ironically, switching an old airframe from a two- to three-blade prop can sometimes lead to endless vibration issues that can only be resolved by returning to the original two-blade prop. Again, use the original type certificate data sheet as reference for selecting an upgraded propeller. While you're at it, ask others with like-model aircraft who have made the switch if they encountered vibration after the upgrade. It's common sense, but don't install a propeller that's not approved for your particular model aircraft. We've witnessed it and the poor results that followed.

Regardless of the make and model, current wisdom dictates the use of a dynamic propeller-balancing machine in order to trace and hopefully eliminate prop vibration. It may be the very thing needed for the airplane that rattles through the air, but it should be the last thing accomplished in the vibration troubleshooting process, which also includes a detailed propeller specification check.

Worth mentioning is it does no good to dynamically balance the propeller if you have a partially plugged injector or if your exhaust stack is hitting the bottom cowling. In these circumstances, prop balancing may only help mask a potentially serious issue.

WHAT'S THAT RATTLING SOUND?

Airframe vibration can be very difficult to pin down because the smallest of vibration sources can be amplified by the "drum effect" of wing and tail cone recesses. Of particular concern are cowl flaps, gear doors, wing and tail fairings and cabin doors and windows.

Ever notice that speed increases make rattles and vibration worse? Generally speaking, an increase in aircraft speed will bring about an increase in the pitch and frequency of the vibration, although it does not always happen like that. Sometimes, deck angle will impact an ill-fitting nosegear door in the climb, causing a rumble as air loads buffet the nosegear wheel well, as was the case with a particular Piper Saratoga we used to fly.

Piper main gear doors are particularly problematic because of the poor fit caused by warping of the fiberglass door material. Adjusting the rod end to pull the door closer only aggravates the problem by cinching up the one side while the other sags with the strain.

Cowl flaps are a common vibration source because of the wear oc-

curring in the hinge-pin area. When the flap is pushed open, the air load holds the door in one position, regardless of the amount of hinge-pin wear. But when the cowl flap door is closed, the control cable pulls upward on the rear of the door, allowing the forward hinge and hinge pin to float. This play then allows the hinge pin and cowl flap to vibrate, causing even more pin wear.

Externally mounted components can wreak havoc on your smooth-running engine as well. Baffling that rubs inside the cowling, exhaust stacks that hit the lower cowl openings, crossover intake pipes that interfere with nosebowl structures and loose accessory mountings will produce a variety of noises and shudders. Even fluttering antennas add to overall vibration. We've seen antenna flutter severe enough to rip the thick skin of a Bonanza.

Good installers reference the procedures outlined in the antenna installation guide, along with guidance written in the FAA's AC 43.13-2B. We've seen plenty of installations done without the proper skin doublers or reinforcement. Need a skin repair? Get ready to write a fat check.

You wouldn't think so, but alternators and generators contribute to high-frequency vibration when the internal rotors and bearings come out of balance.

IT'S GETTING OLD

It's often a tough life for aircraft and things just don't stay factory-tight forever. If you've done major avionics upgrades there's a good chance the interior (including trim pieces, vents, headliner and panel molding) was removed. This often means cabin rattles bad enough to trigger vibration and noise.

Yes, it's possible and legal to hang a four-blade prop on a Cirrus. But avoid unapproved and untested prop/engine combinations.

And remember that dark, stormy night on the ramp when the passenger flung the door open to the wind? It might mean the door is out of rigging, if not damaged.

Sure, cabin doors and windows are notorious for causing wind noise and water leakage, but the burble created by a poor fit between the door and the frame can cause a "drumming" against the fuselage and vibration in the thin windows aft of the door.

Occasionally, no amount of rigging will get the door to sit flush in its frame. Years of flexing, combined with the warping that occurs every time the wind grabs the partially open door, will make cabin doors and windows difficult to fit.

Pay close attention to the instrument panel for vibration. Many so-called floating panels attach to the structure with shock mounts to dampen the vibration on the instruments—especially spinning gyros.

WRAP IT UP

Like new cars, new airplanes are generally vibration-free and keeping them tight means keeping up with maintenance. That means spending money on rigging, prop balancing, engine mounts and even an interior upgrade. New interior hardware, carpeting and modern seating can work wonders at taming the cabin dwelling, as can sound-deadening material.

We recall a service kit once offered by Cessna that included 1/4-inch thick, sticky-back foam sheets on flat sheet metal surfaces between formers and bulkheads. Made of dense foam covered by a layer of thin foil sheeting, the sound-deadening material was cut to fit and glued down on forward and aft bulkheads, belly pans and on fuselage skins.

This material worked well to keep the aluminum skins from vibrating in response to air loads and exhaust burble. Far as we can tell, these kits are no longer available, but there are plenty of aftermarket sound-deadening kits and mods to try. We'll look at them and interior upgrades in an upcoming market scan.

TIPS FOR TAMING VIBRATION

- ✔ Carefully chose an approved prop/engine combo.
- ✔ Regularly inspect and replace worn engine isolators.
- ✔ Keep gear doors, cowl flaps and control surfaces rigged.
- ✔ Repair broken and severely cracked fairings. They vibrate.
- ✔ Consult a trusted shop for balancing the propeller(s).
- ✔ Replace worn instrument panel shock mounts.
- ✔ Regularly inspect antennas and surrounding skin for flutter.
- ✔ Consider interior and sound-deadening upgrades.

Beech Baron 55:

The baby Baron delivers an impressive balance of speed, crisp handling and timeless good looks. Get ready to feed it fuel and maintenance.

All the way down to the basic Musketeer, Beech just took pains to get its airplanes' flying manners a cut above everything else, and that applies in spades to the Baron series. Fly most any Beechcraft model and you will likely come away impressed with its sturdy feel, solid build and, especially, its satisfying handling. Even so, every aircraft company has to make compromises. In the 55 Baron, for instance, what many find to be pleasant handling characteristics can prove to be a handful in poor weather, or when the air turns green with turbulence. We shouldn't have to reiterate that nothing comes for free, particularly in a higher-end Beech.

Maintenance shops will smile when you roll up in a Baron so, yes, this airplane is far from cheap to own or operate. The bright side is a perennially soft market for piston twins means a Baron may not be ruinously expensive to acquire, although since we looked at the market last, used market prices are clearly on the rise. There are still some used-market bargains for Model 55s—also known as the "baby Baron." Older Baron models are often priced lower than older Bonanza models, but as we've witnessed firsthand, engine and vintage autopilot repairs could eat the savings in the long run.

The Baron is not a 1000-mile airplane, but it will chew up 600 miles without breaking a sweat.

Still, among light piston twins, the Model 55 is a solid buy, as well as good investment for those who already own one if you can accept the costs to play. It seems Baron prices have declined just slightly less than other light twins. But even in the current improving market, there's enough softness left for the canny buyer to negotiate a deal on most twins, including a Baron.

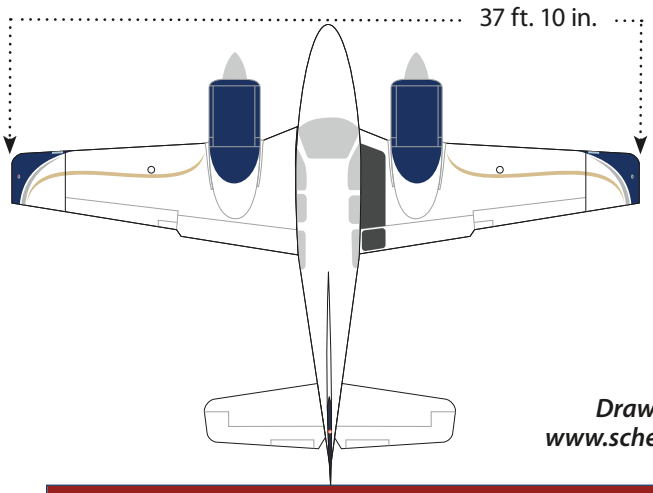
MODEL HISTORY

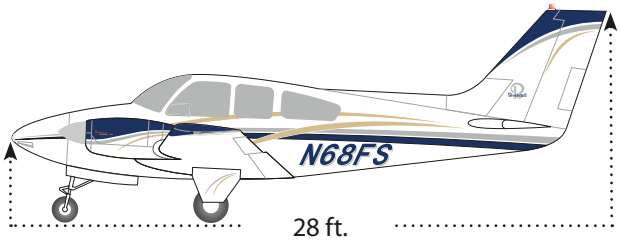
Although Beech (now Textron) isn't quite the master of the parts-bin model evolution that Piper is, the Baron has nonetheless been through some changes.

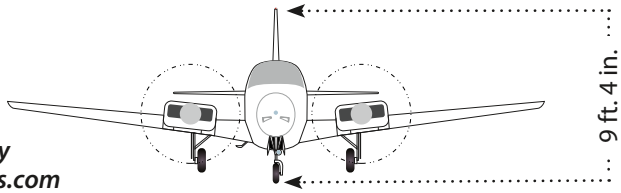
Like the Bonanza, it came in two sizes, long- and short-cabin (Models 58 and 55). There are several sub-types: The 58 could be had for a time with turbocharged engines and, if desired, pressurization. There aren't many P-Barons flying around and today,

That's Saul Bresalier's Colemill-converted 1974 B55 in the lead photo. With 300-HP Continental IO-550E engines, single-engine sea level climb is an impressive 560 FPM.

BEECH BARON 55





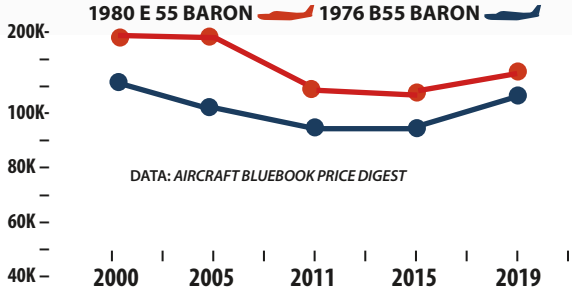


Drawings courtesy
www.schemedesigners.com

SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1961 BARON 55	CONT. 260-HP IO-470-L	1500	$30,000	112/142	1920 LBS	191 KTS	±$48,000
1962-63 A 55 BARON	CONT. 260-HP IO-470-L	1500	$30,000	112/142	1920 LBS	191 KTS	±$50,500
1964-66 B 55 BARON	CONT. 260-HP IO-470-L	1500	$30,000	100/146	1864 LBS	196 KTS	±$58,000
1966-67 C 55 BARON	CONT. 285-HP IO-520/C/CB	1700	$30,000	112/142	2225 LBS	200 KTS	±$77,000
1967-71 B 55 BARON	CONT. 260-HP IO-470-L	1500	$30,000	100/146	1864 LBS	196 KTS	±$68,000
1968-69 D 55 BARON	CONT. 285-HP IO-520/C/CB	1700	$30,000	112/142	2225 LBS	200 KTS	±$82,000
1970-73 E 55 BARON	CONT. 285-HP IO-520/C/CB	1700	$30,000	100/166	2009 LBS	195 KTS	±$93,000
1972-75 B 55 BARON	CONT. 260-HP IO-470-L	1500	$30,000	100/146	1864 LBS	196 KTS	±$89,000
1975-78 E 55 BARON	CONT. 285-HP IO-520/C/CB	1700	$30,000	100/166	2009 LBS	196 KTS	±$125,000
1976-79 B 55 BARON	CONT. 260-HP IO-470-L	1500	$30,000	100/146	1864 LBS	196 KTS	±$120,000
1979-81 E 55 BARON	CONT. 285-HP IO-520/C/CB	1500	$30,000	100/166	2009 LBS	195 KTS	±$150,000
1980-82 B 55 BARON	CONT. 260-HP IO-470-L	1500	$30,000	100/146	1864 LBS	196 KTS	±$140,000

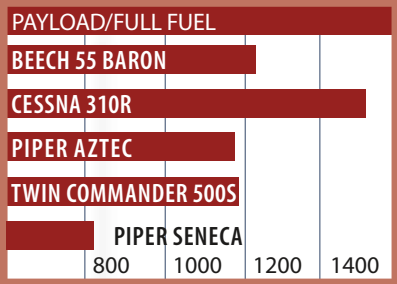
RESALE VALUES

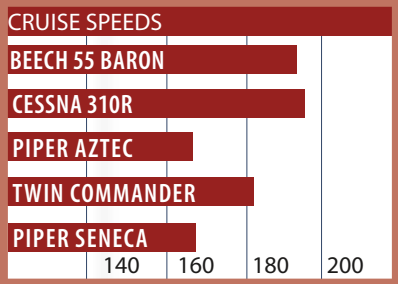


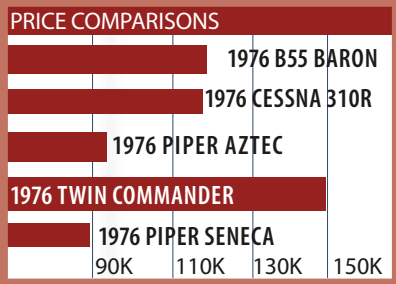
SELECT RECENT ADs

AD 09-25-01	SHOULDER HARNESS FASTENERS
AD 08-13-17	CIRCUIT BREAKER REPLACEMENT
AD 07-08-08	UPLOCK ROLLER MOD/REPLACEMENT
AD 08-18-02	ELEVATOR SKIN REPLACEMENT
AD 90-08-14	WING SPAR INSPECTION/REPAIR

SELECT MODEL COMPARISONS







You'll pay a premium for Barons that have modern major avionics upgrades. The B55 at the top has a three-screen Aspen suite, a JPI digital engine monitor and a stack of the latest Garmin gear. That's a King KCS55A HSI and KI256 flight director in the panel at the bottom.

only the long-body 58 remains in production. Plan on an eye-popping invoice well north of $1.3 million, complete with a Garmin G1000 glass cockpit and no shortage of luxurious appointments in its cabin. But there are more palatable options if you haven't budgeted that kind of dough for a Beechcraft twin.

The Model 55 was Beech's first Baron. It came out in 1961 as a replacement for the Model 95 Travel Air, which was a bit long in the tooth, to meet competition from Cessna's 310 and Piper's Aztec.

Like the Travel Air, the 55 comprised a Bonanza fuselage fitted with a conventional tail, not the V-tail. In place of the Travel Air's somewhat anemic 180-HP Lycomings, the original Baron had 260-HP Continental IO-470L engines.

After building 190 Barons that first year, Beech came out with the A55, which has a 10-inch-longer fuselage and could be ordered with a second fold-down rear seat, bringing potential seating capacity to six (more on that later). A total of 309 A55s were built in 1962 and 1963. The airplane's nose was then extended seven inches for more baggage and avionics equipment, and gross weight was bumped from 4880 to 5000 pounds. The airplane was redesignated B55.

This version remained in production the longest, until 1983, when all 55s were dropped from the line, along with the 58TC and V-tail Bonanza. Browsing the for-sale ads, expect to see more B55s than any other model because there are simply more of them. Beech built 1954 of the "long nose" B55s from 1964 through 1982, not including about 70 T-42A versions for the U.S. Army. Among a number of minor refinements during this time was an increase in gross weight to 5100 pounds, starting with S/N TC-955 in mid-1965. Earlier B55s were eligible for the higher gross through a Beech STC kit. The big-engine version arrived two years after the B55. The C55 Baron appeared in 1966 with a 12-inch-longer fuselage and 285-HP Continental IO-520C engines. The "little Baron with the big engines" also was certified with a gross weight of 5300 pounds. The airplane was redesignated the D55 in 1968 and the E55 in 1970. It, too, was dropped from production in 1983, after 1201 were built: 451 Cs, 316 Ds and 434 Es.

Big-engine 55 Barons are easily identified by the air scoops atop the cowlings. The difference in length is less obvious, but it shows up when it comes time to load the airplane: The nose baggage compartment is larger, as is the cabin. Other differences included the level of standard equipment and the availability of a 166-gallon fuel system on the big-engine version.

ERGONOMICS

Designing an airplane is one compromise after another. You have to put switches and controls somewhere and Beech decided to put the flap switch on the left and the gear on the right. There's nothing at all wrong with that arrangement. But as it happened, everybody else in the industry decided to do just the opposite. The result was (and is) predictable: A new Baron pilot reaches for the flap switch on rollout and retracts the gear instead.

The record shows a long string of gear goofs over the years and although some insist that the switch location has nothing to do with this, other models don't seem to suffer the same kind of incidents. The picture is further confused by the fact that in response to customer pressure and its long history of gear retraction accidents, Beech changed the controls around in later years so they matched the rest of the industry. (This only showed up in later versions of the 58 Baron. The 55 was out of production by the time the change was made.) The "backward" switches aren't really a bad design, it's just that a pilot has to remain aware of them. Many Baron pilots make a particular point of touching nothing until they're clear

of the runway and stopped, so that they can devote their full attention to the controls. And it's not just the gear and flap switches.

Beech's throttle quadrant is different, too. Instead of the more usual throttle-prop-mixture, Beech put the throttles in the middle. But the power levers are taller, so they don't demand the kind of care you need with the gear switch. While there have been some fuel mismanagement accidents, the Baron's system is simpler than some others. Early models can draw fuel into the engines from the main tanks—37 usable gallons, each side—or the auxiliaries, each with 31 gallons. The fuel system was simplified in 1974 with interconnected tanks and three-position (on, off, crossfeed) selectors. Also that year, extra aux tanks became available for the E55 model, boosting max fuel capacity to 166 gallons.

CABIN, LOADING

Beech cabins are notably plush and comfortable, and the 55s—even the early ones—are par for the luxury course. The tapered fuselage, however, can cramp normal-sized adults banished to the rear seats, although it does provide a couple of big windows to ease their exile. Since the rear seats can be gained only by clambering over the middle seats or through the baggage hatch, they're of little use. Many pilots get rid of them, using the space for baggage. The front seat of a 55 Baron has to qualify as one of the world's greatest places to be, with comfort enhanced by a retractable center armrest, adjustable rudder pedals, lots of headroom and good visibility over the nose and out the side windows. Beech was less successful at the finer points of panel design. The massive tube-like structure carrying the yokes obscures instruments on the lower portion of the panel and hides circuit breakers and switches. Also, the seats have limited forward and aft travel.

As twins go, the 55 Baron has decent if not exceptional payload. A typically equipped 260-HP Baron can carry about 1800 pounds of people, bags and fuel; a 285-HP model, about 1950 pounds. There is no zero-fuel-weight restriction, but care is needed to avoid busting the aft CG when the rear seats or aft baggage compartment is used, a typical Beech weak spot. Balancing the load is facilitated by a nose compartment that can hold up to 300 pounds (270 pounds in early models with gross weights below 5100 pounds). With the fifth and sixth seats removed, 400 pounds can be loaded into this space. Many Barons also have an extended aft baggage compartment approved for up to 120 pounds.

The left seat of a 55-series Baron isn't a bad place to be, especially with an interior upgrade. The passenger cabin, however, isn't exactly cavernous.

True airspeed of a small-engined Baron cruising at 75 percent power is about 190 knots on 27 gallons of fuel per hour. That's faster than the naturally aspirated Aztec and Cessna 310, but a good bit off the Aerostar's pace.

The big-engined Baron is about 5 knots faster and 5 GPH thirstier than its stablemate. Takeoff and landing performance is average. A B55, for instance, can take off or land over a 50-foot obstacle within 2160 feet. The E55 needs only about 2050 feet to clear the obstacle on takeoff but a bit more than 2200 feet to get back over it on landing. Short-field technique can cut these figures roughly in half, but it's hairy, involving liftoff below Vmc, for example.

Two-engine climb rates of 1630 to 1700 FPM for the small-engined Barons, and 1670 to 1680 FPM for the more powerful models, outpace the Aztec by a wide margin but lag behind the Aerostar and 310. The B55's single-engine climb rate is a paltry 318 FPM—again, better only than the Aztec.

At 388 FPM, the E55's single-engine performance is about par with the 310 and Aerostar. None of these are exceptional single-engine performers, so the wise pilot will keep them as light as possible. Range, of course, depends on fuel and that varies a bit in the 55 Barons. Depending on year and model, standard tankage was 100 to 112 gallons but optional tanks of 142 or 166 gallons were also available. The

BARON MISHAPS: FUEL, LANDING GEAR

The baby Baron has a reputation as one of general aviation's best personal hot rods with excellent performance but with demands that its pilot know what's what. After reviewing the 100 most recent 55-series accidents, we think the reputation is accurate. Based on what we saw we strongly recommend that Baron pilots take recurrent training—annually, at least—to be able to get maximum performance out of this good airplane and to keep from wrecking one, as the marque is not particularly tolerant of mishandling.

We were surprised to see 15 landing gear accidents; that's high for any retract. Only two involved a mechanical problem. Ten pilots simply forgot to put the gear down, while three lowered their airplanes abruptly when the Firestones were on the runway. With the variation in gear and flap switches on Barons, we recommend not touching either one while the airplane is rolling.

One pilot did not get a nosegear down indication and elected to make a low pass by the local FBO to get an opinion from those on the ground. At the end of the low pass he pitched up, rolled sharply and crashed.

Seeing 15 fuel-related accidents was troubling—we think that's high. The tip-tank Cessna twins have a fuel system that is considered by many to be complex and challenging to operate in comparison to the Baron's, yet in our experience, those average eight accidents per 100. While the majority of the accidents were due to fuel exhaustion (or not selecting a tank with fuel in it), nearly half involved pilots who either positioned the fuel selectors between tanks or tried to take off or maneuver with the aux tanks selected.

In the "other" category, there were three wing explosions on engine start due to fuel leaks, something we don't recall seeing on other airplane types.

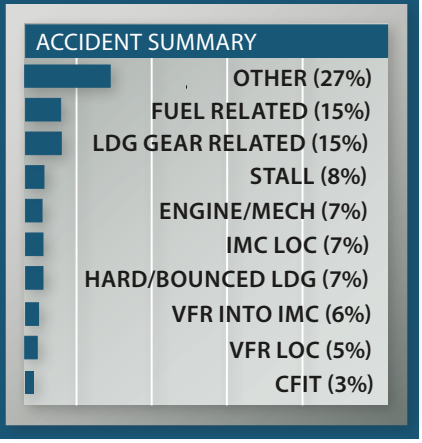
We give kudos to the pilot who found himself diverting due to weather and made the decision to make a precautionary landing when fuel got low. The airplane was damaged but no one was hurt.

There were eight accidents that occurred after the pilot stalled the airplane—almost all developed into spins from which the pilot did not recover.

One pilot was observed to taxi out rapidly and launch without a runup. The airplane pitched up sharply on rotation, stalled and crashed. Investigators found that the pilot had installed a homegrown control lock and not removed it. It didn't help that the airplane was loaded over gross and aft of the rear CG limit.

There were only seven engine stoppages due to maintenance issues. Beech aircraft have never had a reputation for being inexpensive to operate, so it appears that most Baron owners have been willing to shell out the bucks to keep their airplanes in shape.

An open cabin door is not a major problem on a Baron, but we think it is reason to abort a takeoff. One pilot continued, climbed to safe maneuvering altitude and intended to pull the power back to start his landing approach. Used to flying different model twins, he confused the power levers and feathered both props. With no accumulators, he was unable to effect a restart in the altitude available.



56TC Baron could be fitted with as much as a whopping 204 gallons of gas. With 112 gallons aboard, the 55 has acceptable but not exceptional endurance and range.

Figure on 26 gallons an hour at 185 knots in the mid altitudes and three- and four-hour legs are easily doable. Without larger tanks, four-plus hours chews into the reserves. The Baron is not a 1000-mile airplane, but it'll knock off 600 miles without breaking a sweat.

The 55 Baron is proof that a light twin doesn't have to handle like a truck. Responsive and well-harmonized, the airplane's controls are one of its biggest selling points. As one owner put it, "Once you've flown an E55, everything else feels like a tin can." As mentioned earlier, however, hand-flying may be delightful in nice weather, but when it gets bumpy, an autopilot comes in handy. There are trim controls for elevator, rudder and ailerons. Early models have relatively low gear- and flap-extension speeds (143 and 113 knots, respectively). Gear speed was raised to 152 knots, beginning with airplanes built in 1969. The B55 came with approval to lower flaps 15 degrees at 153 knots, and full-flap speed was raised to 122 knots, beginning with TC-955 in 1965.

MAINTENANCE, MODS

Owners of all Beech models consistently complain about one thing: The high cost of Beech parts, especially control surfaces in need of replacement due to hangar rash or corrosion. Fortunately, the 55s aren't considered maintenance hogs and owners say replacement parts aren't needed often.

Much maintenance relates to the engines. The O-470s are among the most robust and reliable engines in the Continental line and although the O-520s are nearly as good, they might suffer premature cylinder wear. Some owners complained of low compression on Continental cylinders after 500 or fewer hours.

Owners say annuals range from $2000 (we don't think that happens often) to as much as $6000 (realistic), but we think the wise owner will budget at least $10,000 a year to cover both the annual and ongoing maintenance. As an hourly maintenance cost, one owner told

The "baby" Baron gets high marks for crisp handling. Ross Detwiler sent this air-to-air shot of his B55 over Banton Lake in Connecticut.

us a good guideline is to double the fuel cost. With avgas running about $4.50 a gallon, that works out to about $230 per flight hour. Fly 150 hours a year and you'll spend about $35,000 to include engine reserves.

The IO-470L is considered a bulletproof engine, although a few owners, as well as several Service Difficulty Reports, mentioned occasional cylinder problems. The IO-520's reputation is not so good; operators have been beset by cracking crankcases. Continental's switch to so-called "heavy" cases in the late 1970s helped somewhat, but case cracks and broken camshafts have appeared frequently in the SDRs.

Among the notable Airworthiness Directives are: 87-18-06 Rev. 1, requiring replacement of recline actuator handles on copilot and center passenger seats to prevent inadvertent unlocking; 84-26-02, replacement of paper air filters; and 84-09-01, requiring various inspections and modifications to ensure that the emergency window will open. Prospective buyers should also ensure that 91-15-20 (repair or reinforce cracked engine mounts) has been complied with.

There are three ADs on the props: 97-18-2 (repetitive inspection, A55 and B55 Hartzell props); 95-24-5, (repetitive inspection, E55 McCauley props); and 91-15-4, on the A55. AD 89-5-2 deals with cracking elevator components, with possible replacement of the elevator. Owners of Beech 55, 56TC, 58 and 95 Barons should look for cracks in the wing forward spar carry-through. The cracking, according to Airworthiness Directive 90-8-14, could lead to "loss of the airplane." Beech first apprised owners through a mandatory service bulletin. The bulletin—No. 2269—was originally issued in August of 1989. In March 1990, Beech revised the bulletin that increased allowable crack lengths as described in the service bulletin will not compromise the integrity of the forward spar carry-through structure."

The AD specifies that the carry-through must be inspected at 1500 hours total airframe time and repeated every 500 hours if no cracks are found. To get at the carry-through, the mechanic must remove the front seats and the carry-through cover on the floor. From there, it's a standard crack inspection. The carry-through and webs are cleaned, then checked using visible dye-penetrant. If no cracks are visible, he can button it up and come back in 500 hours.

If cracks are visible, it's time to get out the rulers. The cracks must be measured and, depending on where they are and how long they are, repaired. Beech sells a kit to do any required repair work. The other area of concern is the spar web face, in the area of the huck fasteners. Here, cracks are limited to one inch length. Only one crack is allowed per side, and Beech specifies that it can't be stop drilled. Instead, the mechanic must look at it again in 200 hours to see if the crack has grown. If it has grown, or if it was more than an inch long to begin with, another Beech kit is needed for the proper repair. The repair must be made within the next 25 hours, or immediately if it is between two fasteners and extends more than a half inch beyond the fasteners.

Beech figures one tech should be able to complete the inspection in four hours, provided the airplane is already apart for an annual or similar inspection. Like EPA mileage estimates, your labor charge may vary. If cracks are found, there's the added cost of stop drilling, plus the price of the kits if the cracks need repair. The kits cost several hundred dollars each. Installation time depends on the shop's sheet metal proficiency. The average shop should be able to install one kit in about 55 to 60 hours.

Many mods are (or once were) available for the Baron, including the usual engine upgrades from Beryl D'Shannon and the defunct Colemill, which was taken over by Tennessee-based Mike Jones Aircraft (www.mikejonesaircraft.com).

The STC'd Colemill President II conversion replaces the existing engines with 300-HP Continental IO-550E engines and new Hartzell three-blade propellers. The mod also comes with new accessories, including starters, alternators, magnetos, engine mounts, hoses and vacuum pumps.

Performance wise, these engines can be run all day at full power and lean of peak EGT. The advertised climb performance at sea level is 1900 FPM (owners tell us they see often see better), while cruise is 200 knots. But the real impressive performance boost is during an engine-out situation, where a Colemill Baron 55 can climb at 560 FPM and the service ceiling is raised to 14,400 feet. Saul Bresalier, who converted his B55 in the 1990s, verified these claims and made some good points for real-world performance perks.

"I think the bigger engines make it a much safer twin. It eats much less runway during takeoff, and lightly loaded I've seen turbine-category climb performance without using much more gas than I did with old IO-470 engines," he told us.

Bresalier said it took him nearly 100 hours before he really felt

Pay particular attention to the performance of a Baron's autopilot during a prebuy demo flight. A good performer when working, the Century IV in the subpanel shown at the top generates long repair invoices. Two engines, two props for a Baron is roughly $80,000. Don't forget engine mounts, bottom, for taming engine vibes.

comfortable having the extra power, plus his insurance company required additional training. He transitioned to his Baron after significant flight time in a Piper Saratoga.

The current price list for the President II mod with factory remanufactured engines is $157,900. For an additional $11,000, you can have factory new engines. Mike Jones Aircraft also offers STC-approved winglets for $19,900, or $34,900 in combination with long-range fuel tanks. These prices include installation.

The current *Aircraft Bluebook* put the average retail value of a 1975 B55 at $98,000, but we spotted a couple of Colemill-converted models of the same year (with modern avionics) priced close to $200,000 even with higher times on the engines.

General Aviation Modifications makes GAMIjectors for the Baron line. One mod in particular deserves mention, since it gives such a dramatic improvement in performance: vortex generators. VGs are available from a couple of different manufacturers. We tested VGs in this issue of *Aviation Consumer.* Bottom line: On the Baron, they work as advertised. Kits are available from Beryl D'Shannon and Micro AeroDynamics of Anacortes, Washington.

Baron owners don't have an association of their own, but the Wichita-based American Bonanza Society well supports the Baron along with the Bonanza. The ABS publishes an informative newsletter and conducts service and proficiency clinics at about a dozen locations each year. We highly recommend the organization.

Contact them at American Bonanza Society, 3595 N. Webb Road, Suite 200, Wichita, Kansas 67277, phone 316-945-1700 or www.bonanza.org.

OWNER FEEDBACK

I'm a co-owner of a 1968 D55 that's been in my family since 1971. The C55, D55 and early E55s are light in weight and heavy on power with their 285-HP Continental IO-520s. In general, these airplanes can get out of any field they can get into. And the landing gear is stout enough to handle flying in and out of our farm's grass airstrip for 47 years with minimal required maintenance. These days, many of these airplanes can be had for less than $100,000. You can't get much better bang for the buck than a fun-to-fly, 190-knot, six-seat twin that can comfortably use 3000-foot strips of any surface (at sea level).

Load-carrying ability is a major benefit of these airplanes. Don't be surprised to see 2000-pound useful loads in early models. It is one of the few fill-the-seats-and-tanks airplanes flying. As the E55s continued in production toward the end in 1982, they were progres-

sively optioned with more stuff and useful load suffered somewhat. CG, however, must be minded and can be maintained by filling the generous nose baggage compartment with luggage or ballast. Early models (prior to 1972 or so) use large, extended-chord flaps (also found on the Beech Duke) to provide a lot of extra lift and lower stall speeds to 67 knots (dirty, power off). If power is kept on, the wing will fly to amazingly slow speeds. The early C/D/E55s have the load-carrying ability of a Piper Aztec with the luxury of 20 knots more speed. They also have amazing short/soft-field takeoff abilities that were later abolished when Beechcraft removed the POH data that utilized flaps for takeoff. Prior to then, the published takeoff ground roll at max takeoff weight was 596 feet! The 50-foot obstacle distance is a similarly astonishing 968 feet. To achieve this feat, the airplane has to be off the runway and flying well below Vmc—it doesn't take much imagination to figure out what happens if an engine fails in that situation. Without flaps these numbers are basically doubled. In a pinch, of course, the performance is still there.

There are many less-obvious differences in the 520-powered Barons compared to the 470-powered 95-55 through B55 models. The C/D/E55s are more akin to a 58 than a B55. The long nose is shared with the 58 and holds substantially more cargo than a B55. The maximum structural cruising speed (top of the green arc) of the C/D/E55 models is the same as the Model 58, allowing for more buffer against the yellow arc in turbulent air. The tailspan is the same as a 58 and is substantially larger than the B55, so plan carefully when looking at T-hangars.

The engine mounts are the dynafocal type rather than cradle type used by the IO-470-powered Barons. One caution: Many owners and mechanics think all Model 55s are the same, which can cause lots of problems when ordering replacement parts. Check airframe serial number compatibility carefully.

One downfall of the C/D/early E55s is fuel capacity, which is 136 gallons usable. Model year 1975 and later E55s had optional 166-gallon tanks. We long for an affordable STC to graft the wet wingtip of later Model 58s onto our airplane. In addition, fuel management of the older airplanes with four separate tanks is a potential trap. It's possible to burn out of one set of tanks while the gauges are actually measuring the other set.

We upgraded the motors to the 300-HP IO-550s in 2004 using the Beryl D'Shannon STC and have further boosted our D55's performance and economy. If you want to go 200 KTAS it'll cost you 32 GPH. We typically run it LOP getting about 190 KTAS on 28 GPH on longer trips, just like the old 520s did. For short trips, we often run it about 170 KTAS on 18 GPH total, set LOP. Barons like to be flown high and all of this data is for altitudes from 8000 to 10,000 feet.

With the 550s, you can have your cake and eat it too with a 200-knot six-seater that can be run almost as efficiently as a Piper Twin Comanche.

Peter Bedell
Gaithersburg, Maryland

We purchased our 1978 Baron 55 for $110,000 and now base it at Waterbury Oxford Airport in Connecticut. My partner and I both wanted to move up to a twin. I definitely recommend a good partner as the way to purchase a twin because this can make ownership somewhat affordable. My co-owner is a retired corporate and Air Force Reserves pilot, while I own a Beech V35S Bonanza.

There are reasons decent 55-series Barons sell in the very low $100,000s. Although the time on our engines was low (800 since a major overhaul and 170 since prop overhaul) the plane had just not been flown enough. Year-to-year maintenance had been kept up and we had few problems with the pre-buy. We took it to Reese Aviation in New York for paint, which was a $26,000 investment. Then Executive Aircraft Interiors at Waterbury Oxford redid the interior for $21,000. An avionics retrofit by VIP Avionics in Hartford, Connecticut, included a new Avidyne IFD 540 navigator, an Avidyne ADS-B transponder and Avidyne MLB-100 weather system,

The Aviation Consumer

Vortex Generators

(continued from page 11)

as well as numerous experimentals. Trying to identify each would take more space than we have—and by the time you'd read it, the list would be out of date. D'Shannon Aviation (www.d-shannon-aviation.com), Cub Crafters (www.cubcrafters.com) and RAM Aircraft (www.ramaircraft.com) expand the number of VG STCs available.

We saw prices as low as $695 for two-place singles. For a four-place bird, plan on about $1500 and up. Prices for twins approach $5000.

We have assisted in the installation of VGs on piston singles and twins. Each time we've been impressed with the quality of the kit, the clear explanations and the ease of installation—do some measuring, lay out the templates and then scuff up the paint and glue the VGs into place where shown by the template. We have never had an installation take more than a day.

CONCLUSION

Our experience with VGs on stock airplanes has been positive from purchase through installation and use. We like the handling improvements and think they improve the level of safety.

While we do not think that the marginal improvement VGs provide for a piston single with a STOL kit installed (see sidebar on page 10) justifies the cost of adding them, we do recommend them for stock singles and twins.

Used Baron 55

(continued from page 31)

We also had a JPI EDM760 twin-engine monitor installed. The total cost of the avionics retrofit was about $30,000. This included a used electric 3-inch standby attitude indicator and some repair work on the S-TEC 55X autopilot.

The first annual inspection at Master Aviation in Danbury, Connecticut, was an eye opener at $47,000. We had to address broken exhaust stacks, replace the brakes, replace two cylinders, fix the electric propeller anti-ice system, repair the fuel gauges, replace the engine mounts and had both props overhauled for $17,000.

One of us flies the Baron mostly around New England in two-hour hops, while the other routinely flies it to Texas and Florida. We save $100 per hour for engine overhauls and we each leave the tanks full for the next guy. Three oil changes per year adds about $7 to the operating costs. Fuel burn is in the 22- to 23-GPH range when operating LOP. After all that, our total operating cost is about $217 per hour.

In reality we should be, at this point, charging ourselves more like $150 per hour for engine overhauls, but we figure we'll face the difference when that day comes.

For fixed costs, there's the $750 per-year tax for the privilege to keep the airplane in Connecticut, $1100 per year for electronic charts, $2200 per year for insurance, $6600 per year for the hangar, plus we expect this year's annual inspection to be around $12,000, even after getting caught up on maintenance issues.

I think these are beautiful airplanes to fly, as light on the aileron control as a Bonanza or even some jets. Elevator control is heavier than single-engine airplanes, but the plane trims well.

We highly recommend a two-owner (perhaps three) partnership, especially when you can have as much fun at it as we do.

Ross Detwiler
via email

FEEDBACK WANTED

PIPER WARRIOR

It's time again to take a fresh look at the Piper Warrior market in an upcoming Used Aircraft Guide in *Aviation Consumer*. We want to know what it's like to own these singles, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your Warrior to appear in the magazine, send us any photographs (**full-size, high-resolution please**) you'd like to share to the email below. We welcome information on mods, operating expenses or any other comments that can be helpful for buyers considering one. Send correspondence by April 10, 2019, to:

Aviation Consumer
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