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The Aviation Consumer®

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The Aviation Consumer

EDITOR
Larry Anglisano

SENIOR EDITOR
Rick Durden

EDITORIAL DIRECTOR
Timothy Cole

EDITOR AT LARGE
Paul Bertorelli

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

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

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DOES FBO PRICE GOUGING NEED FAA INTERVENTION?

Call them ramp fees, facility charges or handling fees. When you pull up to many FBOs there's a good chance you'll be billed a flat-rate charge just for taking space on the ramp. In general, the larger the aircraft, the more you'll pay. Most facilities that collect facility fees will waive them if you oblige by buying a specific amount of fuel, which of course always works out to be more than the fee. No matter what, my mentality is that I never expect anything for free and that's especially true when aviating. If I'm using the FBO's Wi-Fi, drinking its coffee, refreshing my breath with its mouthwash and using its line staff to reposition the airplane so I can get good photos, I have no problem paying a reasonable charge. Like at hotels, I've been gouged and treated fairly by the best and the worst. Some FBOs just get it and they're worth mentioning.

When we flew the Cirrus Vision Jet last fall, we set up shop for a couple of hours on the ramp at Pentastar Aviation in Pontiac, Michigan (PTK), for some filming. Wandering inside to find a snack machine, I was thrilled to find no shortage of quality munchie food on the counters for the taking. There was a lot of it—like stuff your cargos with as much as you can fit. Even better, the restrooms were clean and overly lux. Noticing my cookie-eating grin, my colleague Paul Bertorelli had to remind me that we were on the better side of the tracks, where fresh lemonade, pastries and granite urinals come at a price.

Pentastar says for it to "provide maximum value" (which means stocking its counters for guys like me who mooch its food), it charges a $30 handling fee for single-engine airplanes, which is waived if you buy 25 gallons of $4.95 per gallon full-service 100LL. Light jets are billed $150 unless they take on 100 gallons of Jet-A. Given the above-average level of service and quality of its facility, plus fuel prices that fall well within the average for the region, it's tough to complain about Pentastar's handling fees, which would be bolder yet when you climb out of a $1.5 million ride. But there's a larger issue brewing and it's totally valid: What if you don't want ramp services, free food or even tiedown ropes? Should you have to pay flat-rate handling fees to an FBO on a public, federally funded airport when all you want to do is park and get to the other side of the fence? I think there need to be better options and I'm not alone.

According to both AOPA and the FAA, they've heard from an increasing number of pilots who are being charged for FBO services they don't ask for or receive. There have also been complaints of price gouging at certain airports with no competing FBOs, which has prompted AOPA's initiative attempting to ensure reasonable and transparent pricing at FBOs on public airports. Even the FAA has stepped in, publishing its own Q&A guidance for pilots, FBOs and airport sponsors that addresses how federally funded airports should facilitate competition and transparency, while promoting reasonable pricing and access. The link to the December 2017 six-page document is at tinyurl.com/ycxq2kwr. Like most FAA guidance, be prepared to read through it a few times.

Some FBO managers I talked with are losing their minds over the mere existence of an FAA document on the matter that, according to the agency, "is not an attempt to impose new regulations or policies on airports." But in the document, the FAA essentially says it can review FBO/airport sponsor (that's the tenant/landlord) leases and follow up on complaints of price gouging, while reinforcing that it has a statutory mandate to ensure that airport sponsors comply with federal obligations. To me, that's a setup for more FAA intervention. Stay tuned.

To get a sense of how widespread the problem of FBO price gouging is, we'll launch an FBO satisfaction survey and report on it in a future issue of *Aviation Consumer*. In the meantime, drop us a line and describe your best and worst FBO experiences. We'll include them in the reporting. —*Larry Anglisano*

CESSNA 414 FLYING CLUB

I read the Cessna 414 report in the February 2018 *Aviation Consumer* Used Aircraft Guide section with interest. My aircraft partner and I have owned three airplanes, including our current 1977 Cessna 414, through our nonprofit S Corporation. It is set up as a flying club, allowing for as many as five members, although we've never had more than three. There are three primary elements that affect our shared ownership arrangement.

First, we divide responsibilities. My partner Richard takes care of coordinating maintenance and avionics work and I take care of managing the finances for the club. We try to keep the Cessna 414 maintained as well as we can during the year, addressing squawks as they occur. We find that keeps our expense for the annual inspection fairly low, but at the cost of more regular repairs during the year. Also, we upgrade our cockpit technology from time to time, which generally means an extra contribution to the reserve pool. Richard regularly updates our Garmin systems and other avionics.

Each member contributes a fixed monthly payment to include a share of the hangar costs ($550 a month), annual insurance premiums ($4700), an estimate for the annual inspections and other maintenance ($12,500) and annual avionics update expenses ($1500). We each pay for our own fuel and oil as we go and we contribute $100 an hour for engine repairs and overhauls.

We are both aware that when it comes time to rebuild or replace the engines, we will be making a one-time assessment for that purpose. Our monthly contribution for engine reserves gets used up regularly for maintenance expenses not covered by other contributions, or for a piece of technology we've decided to upgrade to. The ADS-B requirement and Garmin GDL we installed did the trick this past year. All in, we estimate our hourly cost for the aircraft based on 150 hours of annual use is between $500 and $550 per hour.

We use a shared Google calendar to schedule the aircraft and we've been fortunate that our schedules rarely conflict and when they do, we work it out. That usually involves the other partner driving to a nearby destination or renting a single-engine aircraft for a longer trip. The Google calendar works well for our needs and I can't recall an argument about who gets to use the aircraft. We have talked about adding a third owner. I believe we eventually will add a member in order to lower individual fixed costs and to prepare for one or another of us aging out. Both of these are good reasons to consider adding another pilot, but there will be a utility cost. That is, a third pilot will complicate scheduling and potentially affect the present culture of our arrangement. We will be careful to find a member/pilot with the right fit—not an easy task.

The key to making this work is solid communication. We talk about repairs, the service we receive from our mechanic and FBOs—you name it, we've talked about it. We have monthly business meetings and fly together for fun and training. Richard and I both use the aircraft for family, fun and business but we still go through periods when we just can't fly enough. During these periods I typically will work with my flight instructor to train and stay current. We arrange for our annual recurrent training to be done together. During inactive periods Richard and I swap our time as safety pilots once or twice a month. On occasion, we'll even act as each other's second-in-command on long trips when there is a quick turnaround.

Our 414 meets nearly 80 percent of our mission needs and we marvel at what a terrific airplane it is. We've considered a Cessna 421, but in our opinion the added gross weight, speed, service ceiling and range don't justify the expense. We've also considered a used turboprop, but the dollar numbers don't make sense to us. For now we are pleased as punch with our 414 and ownership arrangement.

Stewart S. Koesten
via email

SKYBEACON ADS-B

I found the article on budget-based ADS-B (February 2018 *Aviation Consumer*) extremely resourceful. These articles are why I'm a lifetime subscriber. What wasn't clear, however, is when uAvionix will earn FAA certification so I can install the system in my humble little Piper Cherokee. Is this system a dream or will it ever be a reality?

Also, I thought I read in one of your articles you were going to review aircraft wash and wax products. Did I miss it?

Stan Woodruff
Greenville, South Carolina

We asked uAvionix for an update on certification and were told that spring 2018 is still the target time frame.

You didn't miss our wash and wax product coverage—the lengthy evaluation is in progress. In the interim, if there's a particular product our readers like, we want to hear about them.

CONTACT US

Editorial Office
860-614-1987 (EDITORIAL ONLY)
Email: consumereditor@hotmail.com

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

Online Customer Service:
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FIELD REPORT

Engine Shop Survey: High Satisfaction

Shops that consistently earn high marks for field overhauls know how to communicate, stay on budget and deal with warranty issues.

by Larry Anglisano

There's nothing quite like fetching your bird from the shop after a high-quality engine overhaul. Done right, it should perform like it did when the aircraft came off the factory floor. In the world of aircraft ownership, that's a beautiful thing. But done wrong, you could be in for the time-consuming hassles of dealing with warranty work—or worse should the engine fail, despite it running great before handing it over to an overhaul shop. After all, engine overhauls are supposed to increase your confidence, not kill it or you in the process.

To find out how shops are doing when it comes to field overhauls, we ran an engine shop survey on sister publication AVweb, where nearly 400 respondents answered a variety of questions about their experience.

The good news: 60 percent said their experience with their overhaul shop was terrific and 24 percent said it was good. But there's room for improvement. Customers and shops can learn a lot from sour experiences.

A BIT ABOUT THE RESULTS

As with all surveys we run, we'll start with some caveats. We recognize that the sampling can be skewed because it might attract buyers who are disgruntled with a shop and can't wait to tell the world about it, but we're still interested to hear about the circumstances that sent the relationship off the rails. Similarly, the survey is an opportunity for happy customers to tell their story of bliss. That's equally useful. In the end, what we're really interested in is trends, and the survey does a good job of doing just that.

Additionally, some of the respondents reported having their engines overhauled several years ago (but roughly 50 percent had overhauls done within the last five years). In many ways that's quite useful because we get to hear how the engine is holding up over time (especially with owners flying fewer hours per year) and how well the shop has supported the work.

Moreover, we asked respondents to rate the shop's customer service performance (from awful to terrific) on a five-point scale. As an example, the owner of a turbocharged Arrow who so far has flown off the overhaul for 400 hours told us the cam in his TSIO-360 showed signs of wear after 250 hours. The shop—Graham Aircraft Engines—did the right thing and made it whole, but he was disappointed that it took six months to complete the overhaul and another six months for the cam replacement. As with any large project, the survey results made it clear that downtime plays a significant part in customer satisfaction.

As you can see in the stats on page 5, not surprisingly the majority of respondents have Lycoming and Continental engines—split almost equally. While we're most interested in the experiences with field overhauls (they ruled in the survey at 77 percent), 14 went with factory-remanufactured ones, 5 percent went with factory-overhauled engines and only 4 percent went with factory-new engines.

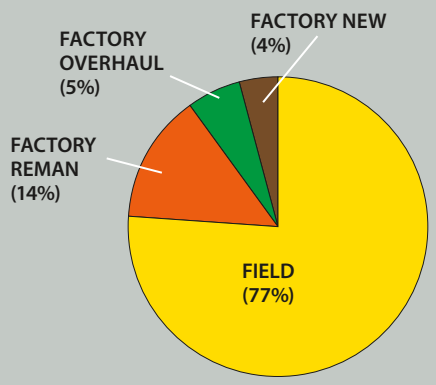
While we'll concentrate on field overhauls for this report, it's worth a brief lesson on factory engines. A factory reman isn't an overhaul because you end up with a zero-time engine built by the manufacturer to new standards (the crankshaft and crankcase can be reused), plus it can carry a new maintenance log without noting any previous history. We found that the average price delta between a high-quality field overhaul and a factory reman is on the order of 30 percent, and slightly less with a so-called boutique engine from Ram and Victor, to name two.

Lycoming offers new, zero-time rebuilt and factory-overhauled options, while Continental has new and reman options. If you want to retain your original crankcase and crankshaft, a factory exchange isn't for you.

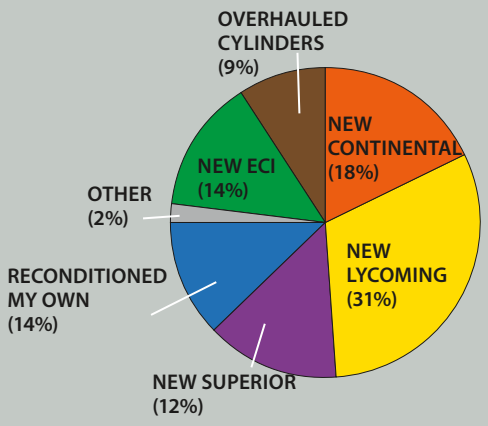
WARRANTY MATTERS

We asked what kind of warranty the shop offered at the time of the overhaul and the answers were all over the board. Surprisingly, many didn't know

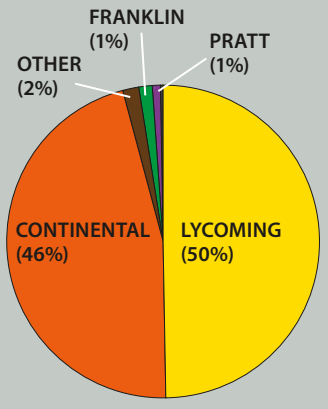
SOURCE OF OVERHAUL



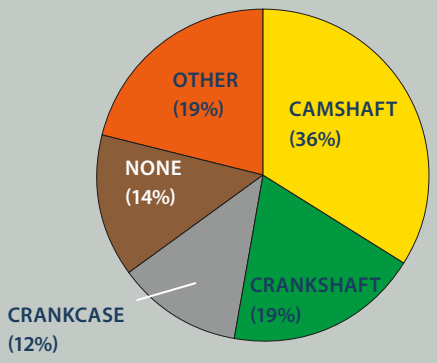
CYLINDERS USED



ENGINE MAKE



OTHER MAJOR PARTS



what the warranty was. In our view, this is one of the first questions you'll want to ask before committing to any major work. For a field overhaul, one year and 200 hours is typical (some shops covered the engine for 500 hours) and that's generous, in our view.

During the period since the overhaul, 74 percent said they didn't have any warranty claims. And whether customers had any warranty claims or not, 84 percent said the overhaul/engine performed just as they expected it would. We think that's a decent trend. For some who had to use warranty coverage, there were some standouts for terrific customer service.

"The overhauled Continental had valve problems at roughly 700 hours and four cylinders lost compression, so Powermaster in Tulsa, Oklahoma, did a top overhaul under warranty. A-plus-plus for Bill Cunningham at Powermaster for the support and for reworking the cylinders," said Bob DeFilippo of the work on his IO-550. Powermaster reeled in plenty of favorable comments, including "They put high standards above making a profit."

Since internal corrosion is a huge concern when it comes to engine longevity, we asked respondents if they encountered any and a whopping 91 percent said no. That was surprising, but refreshing. Are we treating our engines better while they sit for longer periods of time? We took it one step further and asked about preheating.

In the survey, 48 percent said they don't preheat the engine at all, 40 percent said they turn on an engine preheater within a day or so of going flying and 12 percent leave the engine heat on all the time in cold temperatures. As far as we could tell, there was no smoking gun when it came to instances of corrosion, and some are unlucky despite best attempts at keeping it at bay.

Harry Moore told us the IO-360-A1A in his Mooney engine developed corrosion despite leaving the preheater on all the time in cold temperatures (he lives in a northern state). Triad Aviation in Burlington, North Carolina, used factory-new Lycoming cylinders during the overhaul and also replaced the camshaft. Still, Moore couldn't be happier with the shop—a positive trend we noted for this shop in the survey.

Speaking of replacing major components, 36 percent of the overhauls included camshaft replacement, 19 percent included the crankshaft and 12 percent included the crankcase.

One respondent was unimpressed when he learned the shop overhauled the Lycoming engine in his Skyhawk, but in the process swapped his 2500-hour serviceable case with one that had upward of 9000 hours on it. He was offered no price discount or a good explanation, and told us he thinks the shop's action decreased the value of his engine by half. He was pleased with the quality of the engine overhaul, but not so much with the quality of the installation and the deceptive switching of the case.

Lesson learned? Ask how many hours the replacement case will have,

The Lycoming TIO-540A-AE2A, left, used on the Piper PA46-350P Mirage has an average overhauled price of $75,000 and a 2000-hour TBO.

if it will be replaced.

Worth mentioning is that overhaul shops generally quote pricing based on a repairable or serviceable core. Crankcases and crankshafts do wear out, which means you could be in for some money when the engine hits the overhaul stand.

As we reported last spring, there's some good news because Lycoming has drastically reduced the prices on new crankcases by as much as 60 percent. Of course, we wouldn't exactly suggest shotgunning the case when it's fully serviceable.

Instead, discuss its condition with the shop and make a decision while the engine is torn down.

What defines "serviceable" in the world of crankcases? Universally, it means the case meets the specs written in the official overhaul manual. Losing sleep over a cracked case? Believe it or not, you might not be out of luck. Continental Motors has a service bulletin that prescribes continued use with minor cracks, but only if the cracks are repaired or if the case is replaced, of course. For good reading, hit the FAA's AC 33-6. It describes the repair process used for both cylinders and crankcases.

When it comes to cylinders used during the overhaul, Lycoming dominated, followed by Continental. Some bought Continental's NiC3 nickel silicon carbide-coated cylinder, bottom.

WHAT GOES WRONG?

When asking respondents if their overhaul hasn't performed as expected, cylinder troubles were high on the list of problems. As we found in other surveys, factory-new Lycoming cylinders were the most commonly used and generally yielded favorable comments. In a separate cylinder survey we ran a couple of years ago, Lycoming cylinders scored nearly 90 percent in customer satisfaction. We'll refresh it with another survey and follow up.

But not surprisingly, cylinders in general cause fits for owners even after an otherwise high-quality engine overhaul. As one owner put it, "In hindsight, I should have gone with ECI-like coated cylinders because I simply don't fly the airplane as much as I should. The Plane-Jane Continental cylinders barely made it to 400 hours".

He's referring to the nickel+carbide corrosion treatment process that ECI used before the company was bought by Continental Motors. Since then, Continental released its own NiC3 cylinders at a price premium (and extended warranty), which are nickel silicon carbide-coated (creating a hardened barrier inside the cylinder wall) and are available for all of the cylinders Continental produces.

This includes cylinders for a wide range of Continental engines, on the PMA cylinder line for Lycoming engines and also the Titan line of experimental and ASTM-certified engines, which Continental also acquired from ECI.

But cylinder woes aside, we also heard some horror stories of engine installations gone wrong, reiterating the importance of working with a shop you can communicate with. This includes the one that's doing the installation work.

"Penn Yan Aero Services in New York was great and had the engine overhauled within three months, but the shop doing the install was horrific," said a reader about the IO-540 overhaul process on his Comanche. According to him, the shop took nearly two years to complete the work and the engine was out of warranty before it was even hung on the airplane. He eventually got another mechanic to inspect the installation and got a ferry permit to fly the airplane out.

Luckily there weren't many instances of owner/shop relationships that went that far off the rails. If you're unfamiliar with the shop doing the installation work, ask for references and get a quote in writing. Consider your physical location to the shop and whether or not it's practical to visit it during the work.

As for price quotes, we know from experience that some overhauls won't include the cost of hoses and other accessory replacement. In the survey, 33 percent of the overhauls didn't include them in the original price quote. Only 14 percent of the respondents didn't replace the hoses at all, but most didn't specify the age of the existing ones. In our view, if you're going to invest the time and money in a quality overall, it pays to address the hoses while the engine is off.

The same goes for engine mounts. Bottom line, good shops offer professional guidance. Ask them about the condition of these accessories and get a total price for the job (parts and labor) with and without replacing them.

STABLE COSTS, BUT LOOK OUT FOR PARTS PENALTIES

On the data page in each *Aviation Consumer* Used Aircraft Guide, we print the average engine overhaul cost, including installation, as published by *Aircraft Bluebook*. In our survey, owners reported real-world costs that are in line with the guide. One respondent reported paying $104,000 total to overhaul both of the Lycoming TIO-541-EIC4 engines on a Beech B60

"ON BUDGET AND IT RUNS GREAT"

SHOP	LOCATION	OVERALL SATISFACTION	WARRANTY RATING	CONTACT
ZEPHYR AIRCRAFT ENGINES	Zephyrhills, FL	4.8	5.0	www.zephyrengines.com 800-204-0735
PENN YAN AERO	Penn Yan, NY	4.1	3.8	www.pennyanaero.com 800-727-7230
RAM AIRCRAFT	Waco, TX	4.2	5.0	www.ramaircraft.com 254-752-8231
WESTERN SKYWAYS	Montrose, CO	3.8	3.2	www.westernskyways.com 800-575-9929
TRIAD AVIATION	Burlington, NC	4.2	4.0	www.hhtriad.com 336-227-1467

There were a handful of shops that earned consistent comments like that. Not surprisingly, they also scored high marks for warranty performance and customer service. The ones that came up the most often in our survey are in the chart to the right. But there are other small, specialty shops that also deserve recognition, including Don's Dream Machines in Griffin, Georgia, and Powermaster Aircraft Engines in Tulsa, Oklahoma.

Everyone understands you can't keep every customer happy every time, and even high-ranked shops got dinged in the survey. As with avionics retrofits, it's unrealistic to expect every job to be problem-free and they aren't. But the shops that end up on top are the ones that know how to keep relationships on the rails. Not surprisingly, we've seen these names in other surveys. Expectations are high for delivering an on-budget, reliable and fully supported overhaul. That's not too much to ask, given the high-dollar investment for a real overhaul. But shops also rely on the customer to operate the engine properly and as important, to pay the bill. The profit margin, factoring warranty support and liability, isn't high. Shops tell us improper preheating, improper leaning and infrequent operation are almost a sure way to early failures and a warranty hit. But they do like the customers who use engine monitors and trend engine data. That's a plus for the customer, too, to help support a warranty claim.

To gauge the quality of overhaul, warranty performance, customer service response and overall performance, respondents rated shops on a five-point scale—awful, not good, acceptable, good and terrific (five points is terrific). As we've found in previous service surveys, shops that consistently get the highest marks are the ones that don't make a habit of surprising customers with cost overruns, deliver the work to the agreed-upon schedule (and if they slip, explain why) and, most important, respond to questions and status inquiries in a reasonable amount of time.

The same rules apply to the shop that's doing the engine removal and reinstallation work. Sometimes it's done in-house at the overhauler or at the customer's preferred maintenance shop and some owners do it themselves to save money. Wherever its done, don't underestimate the effort to swap and properly set up an engine; turbos are more involved. Trust that the installing shop will properly coordinate with the overhauler (we've heard stories of everyday flyers turned hangar queens because the shop didn't coordinate with the overhauler). You'll pay for the shop's effort, plus the cost of freight if the engine has to get shipped.

If you're focused on one of many capable but less popular shops that didn't make the chart above, drop us a line and we'll tell you if and how other owners rated the performance.

Duke. Both engines got factory-new Lycoming cylinders and the work was done by Epps Aviation in Atlanta, Georgia, a shop known for its high-quality work.

We checked that against *Aircraft Bluebook*, which says an average overhaul is $55,000 per engine. Each TIO-541 in a 1978 B60 Duke has a 1600-hour TBO.

Reader Dan Brennan offered useful dollars-and-cents feedback after Corona Aircraft Engines in Corona, California, overhauled the Continental IO-550B in his A36 Bonanza in 2017. His invoice totaled $33,262.74, which included new Superior cylinders. Procraft Aviation, also in Corona, did the installation. *Aircraft Bluebook* says the average price is $30,000. Brennan gave perfect scores and said he wouldn't go anywhere else.

If you think a Cessna 150 is your ticket to affordable flying, it might at least be palatable should you have to overhaul its Continental O-200A. We got a report from one owner who paid $18,000 for his, which included factory-new cylinders and also the replacement of the crankshaft.

We were pleased to see that in general, field overhaul prices have remained constant over the past five years thanks to a competitive market. Still, work to accessories that aren't part of the overhaul can quickly add to the bottom line, and shops tell us the prices of components are steadily on the rise.

Last, beware of and understand the price penalty for rejected parts (in writing) before the engine gets pulled from the aircraft. You might have little negotiating power once the engine is torn down for the overhaul.

Used SE Turboprops: Engines Drive Value

They're powerful, they're reliable and suddenly they're everywhere. Operating costs are near those of piston twins but an engine problem can cost a fortune.

by Rick Durden

The engine is the size of a large picnic basket, easily puts out more power than the biggest horizontally opposed piston pounder, has a TBO nearly twice as long, is more reliable and weighs less—so what's not to like about turboprop engines?

Over the last 60-plus years, the answer has proven to be that there's a great deal to like. In fact, once turboprops expanded from their original applications on multi-engine airplanes to larger singles, their high power density and evidence of reliability has caused them to either make heavy inroads into the associated piston-engine aircraft market or dominate it.

Want examples? Certainly—the Cessna 208 Caravan series wrested control of the small-package cargo world away from the Beech 18 as owners found the operating cost was cheaper and the airplanes didn't have to be surrounded by mechanics after every flight. The reliability history caused the FAA to allow single-engine turboprops to carry passengers in IMC under Part 135, something it had never allowed for piston power.

The owner-flown, single-engine turboprop world has exploded, seemingly as no one was looking. In this article we're going to look at the burgeoning used aircraft market, run through a brief review of the more popular machines available and then look at some of the factors, including costs, a pilot considering stepping into the used single-engine turboprop world should keep in mind. The big one, of course, is engine condition.

As we researched this article, we were struck by the fact that the operational costs for the smaller singles, while not inconsiderable, were on the order of those for a piston twin. In addition, our experience flying some of the airplanes and talking at length with those who know them intimately also caused us to pass along a caveat repeated so often for turbine step-up pilots that it became mantra: You are going from an engine that you can hurt by improper operation in flight to one that takes care of itself in flight but that you can destroy when starting it.

Whistling along at 320 knots, the TBM 850 is nearly as fast as a number of light jets.

A LITTLE HISTORY

By the early 1980s, conversion shops as well as Beech, Cessna and Piper were considering hanging turboprops on the front of the airframes of top-of-the-line piston singles and the first of the conversions appeared on the market, notably of the Beech Bonanza.

While the general aviation collapse of the mid-1980s slowed the development of single-engine turboprops—it didn't stop. Cessna shelved its proof of concept turboprop P210 but discovered, to its surprise, that there was a market for owner-flown Caravans with family-friendly interiors. In 1988 Socata made the first flight of its TBM 700, a six-seat turboprop descendant of what was to be the pressurized Mooney 301 (the result of a joint venture between Socata and Mooney—the "M" in TBM stands for Mooney). The TBM 700 begat a hugely successful line of turboprop singles with near-jet speeds.

Pilatus, which had been building the "it's even uglier than a Grumman" STOL turboprop single, PC-6 Turbo-Porter since 1961, began delivering its larger, more attractive, 280-knot PC-12 in 1994. By the year 2000, Piper had modified the Malibu and was delivering its turboprop offspring, the Meridian. We'll go into more detail on production turboprop singles below.

CONVERSIONS

Yanking the piston engine from the nose of a high-performance single and hanging a lighter, more powerful turboprop in its place sounds rela-

Originally designed as a freighter, Cessna's Caravan series has evolved into a multi-role aircraft with versions available on floats, above, and with luxury interiors, below.

tively simple. After all, the turboprop has all of its moving parts going in the same direction, so vibration is reduced and it's more powerful, so performance is enhanced.

Unfortunately, power is destabilizing, so there are going to be stability and control issues. In addition, the airframe may have to be modified to absorb the extra power—and maintain flutter margins.

In addition, turbine engines have higher fuel specifics than piston—and the jet fuel they consume in greater quantities weighs more than avgas—0.7 pounds per gallon more. The light weight of the turbine is offset by the need to carry more, heavier fuel to achieve reasonable range. That's a major challenge in the relatively small airframes of piston singles designed for piston fuel consumption specifics.

Persistence paid off—there are a number of single-engine turboprop conversions on the used market. We'll note that not all of the companies that did the conversions are still in business. We recommend extreme caution going into the purchase of an orphan machine. We've heard a few horror stories of airplanes grounded for extended periods because the manufacturer was out of business and specialized spare parts, including gauges, were not only hard to find but carried eye-watering prices.

We also recommend looking closely at performance and useful load numbers of the turboprop conversions. For some it's necessary to carry full fuel to get any kind of range—and fly high—but with full fuel the useful load may be too low for your needs.

THE MARKET

We discussed the single-engine turboprop market with Joe Casey, a Jacksonville, Texas-based aircraft broker specializing in turboprops (www.flycasey.com). He said that over the last several months he's seen "an upward tick in an already good market." He said he averaged two single-engine turboprop sales per month in 2017 and "2018 is starting out even better."

Casey, and others, told us that the demand for PT6-powered, pressurized single-engine turboprops is strong. In wide-ranging discussions with brokers and salespeople with manufacturers and conversion shops, we came away of the opinion that prices are softer when it comes to the unpressurized turboprops.

We heard frustration expressed over the combination of the need to fly high to get good performance, which necessitated the use of oxygen, and the problem with getting oxygen refills.

We were told that more than half of the single-engine turboprop mods go overseas, largely because of the difficulty in finding avgas. Especially in more remote areas, the conversions of workhorse airplanes such as the Cessna 206 and 207 are popular and they are routinely operated below 10,000 feet.

The JetProp conversion of the Piper Malibu elicited praise for its performance and quality of its pressurization (well over 300 conversions have been completed and we regularly see ones listed for sale). By the same token, we heard criticism of the turboprop conversions of the Cessna P210 because of shortcomings in its pressurization system and lower maximum pressure differential. We were aware of two companies that had been carrying out that modification; neither is doing so any longer.

WHAT'S OUT THERE

Before going into cost and step-up considerations, the following is a thumbnail sketch, in no particular order, of the more popular single-engine turboprops we see on the used market.

PropJet. Developed by Rocket Engineering of Spokane, Washington (www.rocketengineering.com), the PropJet DL (economy) and DLX (performance) modifications of the Piper Malibu use the 550-HP PT6A-21 (DL) and 560-HP PT6A-35 engines. Both have a TBO of 3600 hours with the hot section inspection requirement dropped if trend monitoring is used. A four-blade, reversing, full-feathering prop is standard.

The 5.3-PSI pressurization system gives a 9500-foot cabin at the FL270 maximum operating altitude. Usable

The common factor among most turboprop singles, the one that gives them their performance, including the Piper Meridian, top, is Pratt & Whitney's PT6A engine, inset. The various dash numbers share a history of reliability and long TBOs, but overhauls are pricey—figure on $350,000 for a -67B in a Pilatus PC-12, bottom.

fuel is 151.6 gallons. With full fuel, figure on being able to carry 350 to 400 pounds in the cabin.

Cruise for the DL at FL250 is published at 231 knots while burning just over 28 GPH. VFR range is on the order of 1000 miles. Plan on the DLX being 20 knots faster while using an additional 5 GPH, with slightly shorter range.

We consider the JetProp to be the entry-level airplane for those considering stepping up to a single-engine turboprop. Our research indicated that a used JetProp in decent condition with reasonably modern avionics can be bought for $750,000—which is also the number most often quoted to us as the starting figure for those who want to enter the pressurized single-engine turboprop world.

Rocket Engineering has also turned out some PT6A conversions of the Beechcraft Bonanza and Duke. The numbers involved are small enough that we felt them to be beyond the scope of this article.

Piper Meridian. Evolving steadily since its appearance, eventually morphing into the Piper (www.piper.com) M500 and M600, the Meridian has proved to be one of the most popular single-engine turboprops. High cruise is 260 knots at FL300 with a fuel burn of 39 GPH. As with other airplanes in its class, you have to go high and stay there to get any kind of range. If everything is right, it has a 1000-mile VFR range with reserves.

Loaded with full fuel, plan on being able to put just under 500 pounds in the cabin. The 5.5-PSI pressurization system gives a 10,200-foot cabin at FL300. As with the Malibu, the cockpit is cramped and can be uncomfortable for anyone over six feet tall.

We like the fact that the Meridian does not require an inertial separator to protect the engine from damage when flying in icing conditions. The engine does not need the intake ram effect others do to make power, so Piper could use non-icing NACA ducts on the nose, thus protecting an owner-pilot from making a very expensive mistake.

Soloy Cessna 206. Having been making turbine conversions for nearly 50 years, starting with helicopters, Soloy Aviation Solutions' (www.soloy.com) most common airplane mod has been dropping a 417-HP Rolls-Royce B17F turboprop into a Cessna 206. TBO is 3500 hours. The Mark II version of the mod has been in production since 2008. Soloy's business development manager, Kurt Robertson, told us that the mod now sells for $765,000 (although that can vary slightly based on the price Rolls-Royce charges for the engine) and takes 8 to 12 weeks to be completed at the shop you select.

Max cruise is published at 186 knots at 25 GPH at FL180. Pulling the power back to max range produces 146 knots at 17.5 GPH. Usable fuel is 87 gallons; with all of it in the tanks, just under 900 pounds may be carried in the cabin.

We've seen prices all over the waterfront for used Soloy 206s, largely dependent on time on the engine

SELECT SINGLE-ENGINE TURBOPROP *AIRCRAFT BLUEBOOK* PRICE COMPARISONS			
AIRCRAFT	MODEL YEAR	AVERAGE RETAIL PRICE	ENGINE TYPE, TBO AND OVERHAUL COST
PIPER PA-46TP MERIDIAN	2001 2005 2015	$625,000 $850,000 $1,800,000	PT6A-42A, 3000 HOURS, $150,000
PILATUS PC-12	1995 2000 2015	$1,600,000 $2,100,000 $4,400,000	PT6A-67B, 3500 HOURS, $350,000
SOCATA TBM SERIES	1991 TBM 700 2001 TBM 700B 2015 TBM 900	$800,000 $1,200,000 $3,100,000	PT6A-64 (THROUGH 2006), SUBSEQUENTLY PT6A-66D, BOTH 3000-HR TBO AND $400,000 OVERHAUL COST
CESSNA 208B GRAND CARAVAN	1991 2001 2015	$675,000 $950,000 $2,200,000	PT6A-114A, 3600 HOURS, $250,000

and airframe and installed avionics. We think the range for a decent one is between $500,000 and $600,000.

Soloy also offers a Rolls-Royce B17F conversion for the Beechcraft A36 Bonanza. Soloy's Robertson told us that the price for the kit, with engine, ranges between $850,000 and $900,000. We think the performance advertised for the mod by Soloy is representative of what can be expected of the PT6A mods in the field: cruise speed of 200 knots at FL200, VFR range about 1000 miles and useful load with full fuel of about 600 pounds.

There are enough turboprop mods of the Bonanza that we cannot make an educated estimate of a price range but we repeat our caution about buying one that was made by an organization that is no longer in business.

Quest Kodiak. With over 200 in service since production began in 2007, Quest Aircraft's Kodiak (www.questaircraft.com) has proven popular throughout the world as a high-powered mini-Caravan. With a 750-HP (700 continuous) PT6A-34 up front, the Kodiak has a max cruise of 174 knots at 12,000 feet while burning 48 GPH, giving a VFR range of just over 1000 miles. Pulled back to max range power at the same altitude, cruise speed drops to 135 knots but fuel burn comes down significantly, to 33 GPH, and range jumps up over 100 miles, to 1130 NM. Engine TBO is a whopping 4000 hours.

A Kodiak will carry 320 gallons of fuel and has a useful load of just under 1400 pounds with full tanks. There are a number of interior options and the airplane can be mounted on floats without any mods.

Bluebook prices for Kodiaks range from $1.2 million for the first production year to over $2 million for recent models. Floats add another $400,000 to the value.

Cessna Grand Caravan. For the prospective owner with a Meridian budget, but the need to haul a lot of people and/or stuff, the 208B Grand Caravan from Cessna (www.txtav.com) may be the right choice. It was designed as a workhorse, so a 160-knot max cruise (with cargo pod, as most are so equipped) is the result. For that speed and a burn of 50 GPH, plan on an altitude in the low teens and, possibly, oxygen for you and your guests. If you can't go high, plan on a fuel burn of 60 GPH. If you want to go a long way, pass out the masks as the 2240 pounds of fuel will give you 1000-NM VFR range at FL200 (max operating is FL250). Interior furnishing weight varies widely; nevertheless, you can probably take eight friends along with you when you top off the tanks.

Depending on the model year and equipment, prices for a decent Grand Caravan can be as low as $675,000 and range north of $2 million.

Socata TBM. Beginning with the model 700, Socata (www.tbm.aero) has been building personal hot rods since 1988. The most recent 850-HP TBM 930 will smoke along at 328 knots at FL260 with VFR range over 1200 NM. The TBM 850 is nearly as fast—we saw 315 knots at a fuel burn of 60 GPH during our review. Depending on the model, figure on four people in the cabin with full fuel.

The six-place cabin is truly large enough to carry the pilot plus five comfortably with reduced fuel; the seat rails are continuous through the length of the cabin, creating a wide selection of seat locations. The larger airframe allows for baggage behind the seats as well as in a compartment outside the pressure vessel. Max pressure differential is 6.2 PSI, giving a 9300-foot cabin at the maximum operating altitude of FL310.

Brokers we spoke with said that the Socata got the airplane right with the C model of the 700 in 2003 and did not recommend buying an earlier version. We saw prices for the earliest 700C of $1.3 million—from there TBMs ranged up to over $3.1 million for a two-year old TBM 900.

Pilatus. Adding a million and change to the budget for the Grand Caravan shopper means stepping up to pressurization and 100 more knots for cruise on about the same fuel burn. The Pilatus (www.pilatus-aircraft.com) PC-12 with its BMW-styled interior and cargo door that is, perhaps intentionally, an inch taller and wider than that of the Grand Caravan, has a max cruise speed just a bit faster than the Meridian.

With a fuel burn of 50 GPH, best altitude is FL240. The 2704 pounds of usable fuel gives the airplane a stunning 1500-NM NBAA IFR range with a pilot plus five aboard. If one desires, it can stay aloft some eight hours at max economy power settings. Max differential for the pressurization system is 5.75 PSI, giving a 10,000-foot cabin at FL300, the maximum

The JetProp, top, is a turboprop conversion of the Piper Malibu. The Soloy turboprop conversion of the Cessna 206, middle, and the Silver Eagle conversion of the Cessna P210, bottom, use a Rolls-Royce engine.

certificated altitude for the airplane. Prices range from $1.6 million for the earliest PC-12s to over $4.4 million for a 2015 model.

OPERATIONAL COSTS

During our research for this article we were struck by the number of comments that we got from operators stating that their operational costs for the Meridian and JetProp were about the same as for a pressurized, piston twin—although those estimates ranged from $300 to $600 per hour for everything, including set-aside for engine overhaul.

The consistent comment was that the turbine engine was much more reliable than a piston engine so operating costs were predictable. "When you want to go, you can go," was a phrase we heard more than once. We also heard owners say that turbine performance meant that they could safely plan and take trips in weather they would not wrestle in a piston twin.

Of course the elephant in the room is the price of an engine overhaul. Without detailed knowledge in of the various dash numbers and service bulletin status, a prospective buyer faces a mass of unknowns when making an initial buying decision as well as where to send the engine for overhaul. While the chart on the previous page gives estimated overhaul costs, a component problem can drive the cost up radically.

We recommend that if you are considering buying a single-engine turboprop that you retain a broker who's a specialist in the model. We do not recommend the piston-engine approach of buying an airplane with a runout engine and overhauling it. Our research into turboprop overhauls revealed that the value of an airplane with a zero-time engine and a 500-hour engine is about the same.

We also recommend retaining an expert service to manage the overhaul of your engine when the time comes. A $5000 fee is a small fraction of the cost of the overhaul.

For an in-depth analysis of overhauls of the PT6A, see the October 2015 issue of *Aviation Consumer.*

THE STEP UP

While it's true that turbine-powered aircraft are easier to fly than piston-powered, they are more demanding to flight plan for fuel burn and weather. That, plus the value of the aircraft itself, means that to get insurance, the new pilot is going to have to go through organized training (and recurrent training) for the type of airplane involved.

Depending on the type of single-engine turboprop, we saw training available on every level from individual instructors offering courses approved by insurance companies through the flight training big dogs, Simcom and FlightSafety.

A type rating is not required for any of the single-engine turboprops. One TBM owner told us that he bought his TBM because he could afford to be away from work for four days of training per year but not for the two weeks that would be required to get a type rating and maintain it if he had bought the light jet he'd considered.

We saw training prices starting in the $4000 range for a four-day classroom and in-airplane course (including 15 hours of flight time) and going up from there. We think that a pilot with something over 1000 hours of flying time and experience in high-performance piston aircraft can complete a course in a four-day time frame if she knows the avionics. We also think that the pilot should be prepared to pay for a mentor pilot to fly with him for some time to satisfy insurance requirements.

CONCLUSION

We think the price of admission to the single-engine turboprop world starts at $750,000. That buys dispatch reliability and performance not available in the piston world.

No matter what, we think any purchase should be approached with care and with assistance of an expert in the type of engine involved as it's the biggest variable in the value of the airplane. The good news is that there are more single-engine turboprops to choose from than any time in history, so finding a good one should just be a matter of a diligent search.

Avionics Cooling Fans: Worth The Cost

Heat will always be the enemy behind the panel, which makes avionics blowers a wise investment. Sandia and Lone Star models get the job done.

by Larry Anglisano

CHECKLIST

- Avionics fans are easy to install while the panel is open for other work.
- When installed properly, they create enough airflow to save high-dollar equipment from frying.
- Sandia's models with motor fault detection only work with 28 volts.

If you've ever scrutinized an invoice or a proposal for an avionics upgrade, you might have spotted a line item that mentions an avionics cooling fan. While it's an option that could add $500 to as much as $1000 to the project, it's a sign that the shop is thinking about long-term reliability. We've seen too many high-dollar avionics installs completed without protecting the avionics from heat damage, which is easily handled with an avionics cooling fan.

While the market has fewer choices than it once did, all fans aren't created equal. Some have single outputs for cooling one radio, while others can cool an entire stack while also providing warnings of impending motor failure. Here's a fresh look at the current offerings for retrofit.

RADIO COOLING 101

In the bad old days, aircraft manufacturers had the creative idea of cooling the radios using outside air. While it might seem like a logical way to do it (after all, there's often plenty of colder air at altitude), the execution was partly flawed.

If you've ever spotted what look like vents in the wing's leading edge, you were looking at the ram air induction point for an old-school (and hopefully removed) avionics cooling pack. This is nothing more than an air box that is bolted to the side of the radio stack and connects with the outside vent with scat tubing. When the airplane is moving, ram air gets pumped into the box and is dissipated through small holes in the air box.

Part of the trouble with this ancient design is the moisture that can get pumped into the radio stack when flying through rain. The system also collects bugs. And no, the design does no good when sitting idle—where heat builds up rapidly on hot days.

Cooling fans, however, draw air from inside the cabin and their outflow pushes the hot stagnant air from the radio's chassis out the front of the radio stack. The fan is connected to an air fitting on the rear of the radio's mounting rack for direct input. For some radios that don't have cooling ports, installers often get creative and direct the air hose toward the rear of the radio.

The idea is to eliminate as much of the chimney effect as possible. This is where heat rises from the bottom of the stack (often from the hot-running transponder) and rises up into the rest of the radios.

We've measured temperatures beyond the TSO certification limits in some tightly packed radio stacks in the heat of the summer while ground running. Big color displays don't help matters.

Luckily, even older avionics like Garmin's GNS530/430 have built-in fans, but their primary purpose is to cool the display and not move heat away from the radio's chassis. Add a properly installed external fan and you're doing all you can do to protect

The $510 Sandia Safe 328 fan pictured lower left has circuitry that warns of low fan speed. The $169 Lone Star Cyclone 21, lower right, has a high-impact phenolic housing and a laser-balanced impeller.

SELECT COOLING FANS COMPARED			
MODEL	PRICE	PORTS	SIZE (INCHES)
GARMIN			
GFC314/328* (*28 volts)	$299	3	5.1 x 2.1 x 2.1
LONE STAR			
CYCLONE 100	$129	1	1 x 2 x 2
CYCLONE 21	$169	3	3 x 3 x 1
CYCLONE 600	$349	6	4.5 x 3 x 6.25
SANDIA			
SAFE 128	$220	1	2.3 x 2.8 x 1.4
ACF 314	$275	3	5.1 x 5.1 x 2.1
ACF 328	$225	3	5.1 x 5.1 x 2.1
ACF 528	$295	5	6.8 x 5.1 x 2.1
SAFE 328	$510	3	5.5 x 4.7 x 1.2
SAFE 528	$590	5	5.1 x 6.7 x 2.1

the equipment. Here's a look at specific brands your shop will use.

LONE STAR AVIATION

Based in Mansfield, Texas, Lone Star (www.lonestaraviation.com) makes a tiny single-port fan with a brushless motor. It's good for tight spaces and for cooling a single radio, but it's not approved for certified aircraft.

The Cyclone 21, which has three ports, does have FAA-PMA approval and sells for under $200. We like its rugged housing, compact design and flexible mounting options. For serious cooling, the $349 Cyclone 600 has six ports and can directly replace the long discontinued King KA-series fans. There's also the $389 optional Fan Failure Warning System (FFW) for the Cyclone 21 that can drive external LEDs if the fan's motor drops to 50 percent.

That's the fan built into a Garmin GNS430 chassis. While its purpose is to cool the radio's display, we've seen display failures in some installs that don't have external cooling fans and in ones where the fan or ducting has failed.

SANDIA, GARMIN

Based in Albuquerque, New Mexico, Sandia Aerospace (www.sandia.aero.com) supplies a line of cooling fans for retrofit and to OEMs including Garmin. The Safe models, which are available with one, three and five outflow ports, use brushless blower motors and the company's proprietary RunQuiet technology.

The Safe series fans have fault detection output that provides an operational warning if the motor begins to fail. When the fan motor is operating normally, the circuit outputs a low impedance signal, but if the RPM of the motor drops below a preset threshold (usually below 65 percent of nominal airflow), the output goes to high impedance and some connected avionics—including Garmin's G1000—will flag a warning message that the cooling system has failed. Unfortunately, most retrofit avionics don't have the capability to monitor this smart output, although we've heard of some shops getting creative and wiring the outputs to an annunciator lamp. Plus, these fans are only available for 28-volt electrical systems. The Safe 328/528 multi-port fans supply up to 20 CFM of cooling air.

Garmin sells the three-port GFC314/328 (14 and 28 volts) series fans for $299, which are really the ACF-series fans made by Sandia. The Sandia ACF fans move 25 cubic feet of air per minute and use quiet brushless motors that are rated for 78,000 hours of continuous operation.

WHO NEEDS ONE?

According to shops we spoke with, not everyone and it depends on the equipment that's installed. Dave Fetherston at NexAir Avionics in Massachusetts told us his shop almost always recommends a fan if the panel has older Narco and King radios, even when they're used for backing up a modern navigator like an Avidyne IFD or Garmin GTN. But Fetherston attests that a pair of Garmin GTN navigators provide good cooling on their own, thanks to large internal fans.

Garmin's Jim Alpiser offered advice we couldn't argue with, given the eye-popping cost of new equipment. "Generally speaking, avionics cooling fans are a good idea even when they aren't required (by the STC install manual) as a pragmatic way to further protect your investment," he said. Incidentally, the current Garmin GTN-series install manuals don't specifically call for a dedicated fan.

Avidyne's technical support lead, TJ Sutton, pointed out that the IFD540/440 units have integral cooling fans and also cooling vents around the bezel. "While our install manual does not require external cooling per se, it is always a good idea to have adequate cooling around the radio stack," he told us. We agree, and in our view a cooling fan is a way to ensure that happens.

Which one you choose will depend on which model your shop prefers to install, based on space and even what it has on hand, but don't assume it will install one—ask. We have no problem recommending Sandia or Lone Star—we've installed both with good results. More important is to make sure the system is inspected regularly, and proactively replace the ducting. Even the best blower is worthless if its air can't get to the radios you're trying to protect.

Waco on Floats: Don't Call It Practical

For the owner who wants everything, the YMF-5F biplane on floats is an attention getter and a hoot to fly on and off the water.

by Paul Bertorelli

The phrase "irresistible urge" is as good as any to describe why some airplanes get fitted with floats. A Super Cub and a 185, sure. But a DC-3 and a Cherokee 140? And now a giant Waco biplane in the form of the company's just-introduced YMF-5F floatplane, with the "F" signifying floats.

Can this thing be described as anything other than an esoteric, expensive lark? Well, no. But then you could say the same about a $300,000 light sport with a glass panel. In the rarified slice of the airplane market where the toys live, "want" has always been more important than "need."

The 5F exists for the simple reason that Waco CEO Peter Bowers got his float rating a couple of years ago and decided it would be really fun to put a Waco on floats. And it is, as long as you don't get your pants snagged on practicality. In its Battle Creek, Michigan, shops, Waco builds a modernized version of the YMF-series biplanes that first appeared during the 1930s. The company has been in and out of existence, but in 1986, it came back into being and has revised the airframe to modern standards while retaining the basic biplane idea.

The float model is based on the YMF-5D and the model I flew was actually reclaimed from a wrecked 5D.

CHECKLIST

- Craftsmanship and finish on the YMF-5F are uniformly superb.
- Despite its size, the airplane is docile and easy to handle.
- Don't even think it's a practical substitute for a utility floatplane.

The airplane retains the same 300-HP Jacobs R-7555A2 radial swinging either a fixed-pitch wooden prop or a constant-speed wood/composite model, both provided by MT. The engines are sorta new, but not really. They're built up from original data plates with new manufacture parts. Technically, they're overhauls built with new PMA parts.

The airframe itself is constructed just as Wacos always have been: welded chromoly tubing covered in fabric, but with metal panels at select points where wear or puncture resistance is needed. The airframe innards are protected by modern corrosion proofing. The Aerocet 3400 floats are a complete package customized for the Waco. That includes the floats themselves, amphibious main and castering wheels and retractable water rudders. Wheel retraction is handled by an electrohydraulic system that sucks the wheels into cavities in the floats.

A series of confirming lights show the position of both the castering and the main wheels. The mains have oleo shocks so even though they're a couple of yards away from the pilot's head and a challenge to touch on the runway delicately, they soak up

From the dock, it's quite a climb into the Waco's cockpit, top photo. Aerocet 3400 floats, right, are a good match.

View from the rear hole, top, is restricted by cowling, wires and struts. Gear control is front and center on the panel, lower photo.

the bumps nicely. The system has an audible gear nanny. It doesn't know if it's over land or water, but it will audibly pester you until you confirm with a button choice that you know what you're about to land on.

Water rudder retraction is handled via a spring-loaded cable next to the pilot's left knee. The rudder is retracted for landing and during the takeoff roll.

EQUIPAGE

A begoggled pilot of the 1930s would see the cockpit of the modern Waco as alien technology. There was no resistance to the urge to equip with glass because that's what people want. The basic panel has the Garmin G5, a GTX 345 transponder for ADS-B In and Out and a digital navcomm and engine monitor. The 5F's land-dwelling cousin can be IFR certified, but not the float model. It's day and night VFR only.

The floats are equipped with cavernous compartments for storing things like anchors, paddles, lines and all the various nautical paraphernalia floatplanes must have. There's also a pump to de-water the bilges for although they're made of impervious fiberglass, water finds its way in. Shipping water is not to be taken lightly because it adds weight and if there's an undetected puncture, the airplane can very well founder at the dock.

Speaking of docks, how do you do that with an airplane that's both a high and a low wing? It's a piece of cake with a Cub or 185, whose wings will clear about any dock or float. Waco thought of that by building some nice handles into the lower wingtips, but you're not going to dock this thing into a wharf with four-foot pilings. Only low-profile floats and quays, please.

THIS THING IS BIG

Because of its size, the land-based YMF-5D is daunting. It ain't no Cub-type taildragger. Because of the floats, the 5F is even more so. It's a long, high climb into the cockpit and once there, the view is of struts and flying wires and very little else. Surprisingly, the 5F is both docile and delightfully easy to handle. Peter Bowers described it as a giant shopping cart during taxi and that's about right. In fact, I've used shopping carts that don't handle as well.

While you can't see immediately under the airplane, you can see well enough to avoid any obstacles and the airplane tracks more precisely than any taildragger and perhaps better than many tri-gear airplanes. The rear cockpit is spacious to the point of almost being too wide.

With feet on the rudders, you feel fairly spread out. The cockpit is superbly detailed, especially the throttle quadrant, a faithful duplication of the 1930s version, but updated. The power pack for the landing gear is immediately under the panel, between the pilot's legs. It's backed up by a hand pump to lower the gear manually. Trim is handled by a 1930s-style automobile window crank. The front hole is even larger than the rear and will easily accommodate two people side by side if they aren't too wide. There's a small hinged door to make ingress and egress less awkward.

For its size, the 5F is fair to middling on payload. On a gross weight of 3218 pounds, the useful load is 718 pounds. With 46 gallons of gas aboard, that's 442 pounds for people and stuff, so in practical terms, this is a two-place airplane if you want to fly very far.

But would you? Maybe for seasonal movements for fishing in the summer lake district, but at 100 MPH typical cruise, you won't be getting there very fast. Behind the rear cockpit is a big baggage compartment with a lock, so with the weight in the sweet spot, you could certainly travel in the airplane. By the way, to accommodate the floats—400 pounds total—Waco bumped up the gross over the land version.

While it's popular to transition some floatplanes from floats back to wheels, that's a little involved with the 5F. Bowers says it takes about a day and half. The only reason I can think to do that is for hangar accommodation. The airplane is just too high on floats to get into a standard T-hangar and I doubt you'd want to let an airplane this expensive live long term soaking in a lake or baking in the sun tied down on a ramp. I suspect if it stays on floats, the 5F would find a home in a group hangar.

FLIGHT IMPRESSIONS

If the YMF-5F's stated purpose is flying for fun, it nails the design brief, especially if you define fun as attracting a lot of attention on the ramp. A bright red airplane 12 feet tall is hard to miss. While Peter Bowers gave me some general target airspeeds, the Waco can be flown entirely on the wing. It telegraphs when it's ready to fly on the takeoff and when it's about to quit in the air.

With the floats, the stall is mushy but not as abrupt as I expected. Those wings produce a lot of lift. But in a full-up glide, the airplane is a brick and in an engine-out event, it's going to land not too far from where the power gives out. It does have adverse yaw, as most 1930s designs do, but it doesn't require much rud-

der in normal turns at cruise speeds. Control forces are lower than I would have expected for an airplane of this size and trim stability is surprisingly good.

I noticed this when we were enroute to a lake about 10 miles from the departure at Tampa's Peter O. Knight. Trimmed for level flight, the airplane hardly deviates in pitch or roll, obviating the need for an autopilot on a long cross country. It behaves exactly the same way on approach. Trimmed for 75 MPH, it flies on rails to the trimmed airspeed.

With 300 HP, the 5F doesn't leap off the water, but it's no slouch. I timed a couple of runs at 15 seconds and noted that the cockpits are high enough not to feel so much as a drop of spray.

I was nervous about landing because with all those struts and wires, the visual cues are minimal, plus the height above the floats makes judging any flare a challenge. It has to be done by feel. That turns out to be relatively easy by using the glassy water technique of pitching the nose up slightly—the cues are good for that—setting the power and just letting the airplane settle on the water. A little back pressure keeps the float tips from digging in, but the Aerocets have sufficient buoyancy to discourage that anyway.

You can use a version of the same technique on a paved runway with good results. With four wheeled contact points, there's little risk of a ground loop. Even the taildragger version of the Waco, which I flew a few years ago, is relatively docile as tailwheel airplanes go.

CONCLUSION

Yes, a biplane on floats is as wildly impractical as it is fun. At a $595,000 base price, the YMF-5F is a niche airplane within a niche and not likely to sell more than a handful a year. It would be the second airplane for someone with the wherewithal to afford…whatever.

But if attracting attention on the ramp or the river is your thing, the Waco will get more eyeball time than anything I can imagine short of a Martin Mars. And at least you'll be able to afford the fuel bill.

YouTube See a video review of the Waco at http://tinyurl.com/j95ht2a

Used IFR GPS Systems: Garmin GNS Still Tops

But you'll pay top dollar for a good one. Consider the cost of installation kits, antennas and pricey factory service while striking a deal.

by Larry Anglisano

We've been around enough avionics installations to know that most every project can snowball once the aircraft hits the hangar floor. That's especially true as more owners finally commit to ADS-B installations. If the aircraft hasn't seen an avionics installation in ages, low-budget buyers might noodle the idea of buying used GPS navigators. But what may seem like a smoking-good deal on used equipment websites could be a setup for a serious case of buyer's remorse.

In this article we'll take a fresh look at the used IFR GPS navigator market, how you might choose the right one and ones to steer clear of at any cost.

WHY WAAS?

VFR pilots might know little about WAAS GPS capability, except that it's a mysterious requirement in an ADS-B installation. When shopping the used market, it's often difficult to differentiate WAAS units from plain-vanilla ones, even though both can be approved for flying GPS approaches.

If your intention is to equip the aircraft for IFR, FAR 91.205 is a good place to start to understand what it needs to be bare-bones legal. IFR GPS isn't a requirement, but we think most IFR missions will be seriously lacking without one. If your plans include instrument training, a WAAS navigator will be your ticket to the modern world of flying precision GPS approaches. One without WAAS, but that's eligible for

Don't even think of buying a used Garmin GNS navigator without having it bench tested. The GNS530W in the main photo has a $1500 flat-rate factory repair cost.

We found some salvaged Garmin GTN750 navigators, top, on the used market, some with factory warranty remaining. You'll pay top dollar for those. When shopping any navigator, it should include an unweathered antenna, middle. You'll have to supply your own CDI or HSI, bottom.

IFR certification, will allow you to legally file and fly IFR flight plans using the GPS navigator as your primary source of navigation. What you won't be able to do is fly a GPS glideslope.

We won't go deep into procedures here, but in the approach environment non-WAAS navigators are the equivalent to flying a localizer-only approach (an LDA is one). There's lateral guidance, but no vertical guidance, which means you fly the published step-down procedures without glideslope cues from the navigator.

The benefit of all-in-one navigators is they update three systems in one box—comm, nav and GPS. But this also means you could be paying for sizable amounts of antenna work. If the aircraft only has one radio, you'll need a second comm antenna (that's if you want to keep the existing radio as a backup), and rework the navigation antenna system with splitters to accommodate a second nav radio with glideslope.

And, simple panels might not even have an audio switching panel that you'll now need to install to support dual radios. See what we mean by snowballing installations? Now the budget is really getting tight. Let's take a look at the used market for specific models.

GARMIN HUNTING

Searching the used market for the right Garmin navigator will take some knowledge. To start, you need to recognize not all have WAAS—especially earlier models, which hit the market somewhere around 1998. Which used GPS navigators don't have WAAS? Anything older than a Garmin GNS530W/430W. And that W suffix in the nomenclature is your important guide when searching the used market. Beware of misrepresented units; a straight GNS530 or GNS430 isn't a WAAS model. You'll also find the GNS400/500 series. These don't have integrated VHF radios. The GNS420/520 have a built-in comm, but no nav receiver.

Upgrading any of these units to WAAS is possible. It's a factory modification that has a current flat-rate price of $4395, which includes a new navigation datacard and a new WAAS antenna. It also includes any repairs that are required to bring the unit to TSO specs. Non-WAAS antennas and datacards won't work with an upgraded unit. While the wiring is the same across the board, WAAS installations require low-loss twin-shielded coaxial antenna cable to help preserve signal integrity.

All vintages of the GNS430 and larger (5-inch screen) GNS530 have proven reliability, although there are some usual wear-and-tear issues and some potential failures to look out for. These include display problems, navigation receiver board problems and even cosmetic imperfections like faded display lenses and worn bezel button nomenclature. Beware of older 28-volt GNS430s. We've heard of board failures in some that couldn't be repaired, and all will require a voltage converter for use in a 14-volt electrical system. This will add to the cost and complexity of the installation and introduce a component that could be a source of failure down the road.

The discontinued Garmin GNS480 and Garmin-AT CNX80 are WAAS units, are generally desirable and can be used as a mandate-compliant GPS position source in an ADS-B Out installation. But, they were produced in far fewer numbers than the GNS series, which makes

Avidyne upgrades like the IFD550 and IFD440 shown in the Cirrus panel in the upper right are populating the used market with Garmin GNS430 navigators, middle. WAAS, voltage compatibility and software level are major considerations when shopping. Some used navigators won't be pretty. That's a trashed GNS430 display lens, bottom.

them tougher and fairly expensive to source. We couldn't find many for sale during our research. The couple we did locate had asking prices in the $7000 range, and factory flat-rate repair pricing—even if nothing needs repairing—is $1100.

Your used navigator shopping experience could be easier at established avionics shops and retailers, instead of eBay and online classifieds like Barnstormers, although there are plenty of legit sellers on these sites, and some scammers, too. The purchase should be easier if the seller is a Garmin dealer, since they can easily source any missing installation accessories if they're still available.

AVIDYNE PRIMES THE PUMP

One reason we're seeing a healthy supply of used Garmin GNS430 and 530 navigators on the used market is the growing popularity of Avidyne's IFD-series navigators. These were strategically designed as slide-in replacements for the GNS series, sidestepping a complicated teardown installation. Avidyne has been aggressive with its marketing strategy. As we go to press, it has a generous trade-in program for removed Garmin navigators when buying a new IFD550/540/440 navigator. Trade allowances (handled through the Avidyne dealer) hint at the impressive resale value of a Garmin GNS.

For example, for credit against the purchase of the flagship IFD550 (which has a list price of $21,999), a removed GNS530W is worth $8500, and $7500 against an IFD540 (priced at $15,999). As the pricing chart on page 20 shows, the GNS530W might sell for $9000 on the used market. Legacy (non-WAAS) GNS530s trade values from Avidyne are worth $4500 and $3500.

For trade against the smaller Avidyne IFD440 (priced at $11,999), Avidyne is offering $5000 for a GNS430W and $2000 for a non-WAAS GNS430. Avidyne is offering as much as $4250 for a GNS480 against an IFD550 and as little as $2250 against an IFD440.

Worth mentioning is that slide-and-fly Avidyne navigators don't come with antennas, since they'll use the existing ones on the aircraft. This could mean an extra $400, on average, for you or the installing shop to source one. And even if the used navigator does come with an antenna, it might be weathered and faded—probably not what you would want to bolt on to a new paint job. Given the complexity of some antenna installations, especially on pressurized airframes, we suggest springing for a new one.

There's also the install kits, to include mounting tray, backplate and main connectors. Again, they'll be used in an IFD slide-in install. The bad news is that Garmin doesn't supply the kits for the GNS units any longer. The good news is that Avidyne earned PMA approval so that its IFD installation kits (the ones used in a new IFD installation) can be used with the old Garmin navigators. Some shops told us even in a slide-in IFD install, they'll remove the existing Garmin rack so it re-

SELECT USED GPS PRICING EXAMPLES			
MODEL	TYPICAL PRICE	FACTORY REPAIR PRICE	COMMENTS
GARMIN			
GNS530	$6000	$1400	Factory upgradable to WAAS
GNS430	$4000	$1100	Factory upgradable to WAAS
GNS530W	$9000	$1500	Install kits no longer available
GNS430W	$7000	$1200	Install kits no longer available
GTN750	$12,000+	$1144	Price a factory-new one with a warranty
GNS480/CNX80	$6000	$1200	ADS-B compatible GPS source
AVIDYNE			
IFD440	$10,500	$1200	Verify software and wireless capability
BENDIXKING			
KLN94	$2500	time/materials	Non-precision approaches only
KLN90B	$1000	$3228	KLN90A model enroute IFR only

mains with the unit.

We were curious if Avidyne had stockpiles of used Garmin navigators lying around but Avidyne's Tom Harper told us that in nearly every case, the installing Avidyne dealer keeps the unit and resells it on its own. Shops we talked with admitted having no problem reselling them. "There is definitely a second-tier market for used Garmin GNS navigators," Tom Harper told us. Shops also admit the promotion has been quite good for driving more customers to the shop for Avidyne upgrades because Garmin doesn't offer any trade allowance for its GTN navigators.

VINTAGE NAVIGATORS

These include King KLN90 and newer BendixKing KLN89 and KLN94 units. The KLN90A was one of the first IFR navigators and is for IFR enroute use, while the KLN90B adds non-precision approach capability. We wouldn't exactly call them boat anchors, but flat-rate factory repair pricing (or exchange) could make one uneconomical to keep in service.

If you have one that fails, replacement is still cheaper than a new install, but it's crazy expensive. BendixKing's Roger Dykeman told us the BendixKing factory offers quick-turn exchanges (dependent on the part number) and repairs for $3228, with a one-year warranty.

The newer KLN94 (this is the model with color display and non-precision approach capability) is repaired on a time-and-materials basis (no exchanges) because the display is obsolete. For that reason, we would avoid one for new installations.

Other units to avoid include the Apollo GX-series navigators. That's because a display failure makes them unrepairable since the vendor is gone. Garmin's early-generation IFR navigators are the GPS155 and comm-equipped GNC300, which are far out of production. According to Garmin, repair services are no longer available.

You'll have no problem finding cheap vintage BendixKing navigators. That's a pile of old KLN90 units. Flat rate repair price: $3228.

Frankly, given the accessories that will be required for a legal IFR installation (nav indicator and annunciator panel), we can't see buying them anyway. They'll never be WAAS compatible, they have stark moving map displays and they have an antiquated feature set. Reliability is good, though.

ACCESSORIES, PAPERWORK

Where you source the used navigator is almost as important as the one you choose. That's because you'll want traceability and at the least, proof that the unit works to specs. The only way to really get that guarantee is with a bench test and a sign-off that it's airworthy, known as an FAA 8130-3.

Don't always put a lot of faith in a unit advertised as being "yellow tagged." This is marketing speak left over from the days when shops differentiated the status of equipment by the color of the identification tags they attached to the chassis. Yellow meant it was serviceable, green was repairable and red meant the unit was for parts salvage only.

The 8130-3 is the form the technician or repair station representative completes and signs after a part has been tested, inspected (and perhaps repaired) and found to conform with manufacturer specifications. The 8130-3 usually goes in the aircraft logbook or flight manual supplement.

We've found that some shops won't issue a signed 8130-3 on modern GPS navigators because they don't have the capabilities to fully test the unit the way the manufacturer can. This includes verifying that the GPS receiver is within specs, among other items. Moreover, resellers know that sending the unit back to the factory for a flat-rate repair will eat up all of its profit. That's fine, as long as they'll guarantee that the unit is fully functional. Reputable companies will.

Wentworth Aircraft in Minnesota is one and often has a healthy inventory of used avionics. While it's a long-established and respected salvage dealer, it isn't an FAA repair station and can't sign off on an 8130-3 form. Wentworth's Kevin Helvey told us the company generally warranties its used avionics for 30 days but for an extra fee can have the equipment bench tested at a third-party shop. The going bench labor rate ranges from $110 to $150, not including parts needed for repairs.

WHAT WILL IT REALLY COST TO INSTALL?

Since there are more variables when installing used equipment, the first step before even shopping the used market is to bring the airplane to an avionics shop you trust for evaluation. This might lessen the possibility of major cost overruns once the project hits the hangar floor. For one thing, that big-screen GPS you want might not fit in the radio stack without major rework. There's also the possibility that the unit isn't compatible with existing nav indicators. HSI systems might make the interface easier since modern ones are generally compatible with a wide variety of navigators. But that doesn't mean you won't have to buy more accessories to comply with the guidelines prescribed in the STC installation manual.

For example, since IFR GPS has mode annunciation (these are the navigator prompts and warning message outputs required for IFR), the installation manual might require that the GPS is installed within the pilot's field of view so you can see them. If it's not, many models—including the Garmin WAAS GNS navigators—require the installation of a dedicated annunciator panel. In older Beech Bonanza and Baron models with displaced radio stacks, you can pretty much count on it. This

work can easily add $1000 to the job, including the hardware.

Since IFR GPS systems have to be interfaced with the Mode C altitude encoder for baro input, you might find yourself spending some money on a new altitude encoder. Some navigators like the Garmin GNS480/CNX80 require serial altitude input, a more precise altitude format that older gray code digitizers won't have. Moreover, if the installation also includes ADS-B equipment, you might need a new encoder anyway. We covered altitude encoders in the July 2017 *Aviation Consumer*.

As one common scenario, consider a used Garmin GNS430W that you bought for $7000. If you don't have a compatible nav indicator, a GI106A generally sells for roughly $1500. It's recommended to interface the GPS with an avionics cooling fan, which might cost an additional $600. With labor, shop parts (wire, connectors) and paperwork (GPS installations require a flight manual supplement and in some cases, an FAA field approval) the total installed price could easily come in just shy of $12,000. While that's still cheaper than a new Garmin GTN650 or Avidyne IFD440, the narrow price spread might be worth it for a two-year factory warranty and newer technology.

For aircraft that haven't had avionics work done in a while, the GPS installation is a good time to remove abandoned antennas, old wiring and install an avionics master switch and new circuit breakers.

CONCLUSION

We're generally cautious about recommending high-priced discontinued avionics because there's always the concern about future support. When it comes to Garmin's GNS530W/430W navigators the future is uncertain, but Garmin has given no indication that it won't support these units going forward. Given the impressive number of units that remain in service, we see why. Plus, Garmin gave these units a new lease on life when it included them in its Flight Stream wireless interface. When connected, there's a tablet-based victor airway/flight planning function that improves the feature set tenfold, in our view. For aircraft sporting vintage analog navcomm radios and no IFR GPS capability, we think a WAAS GNS navigator upgrade offers as much bang for the buck now as it did when these boxes hit the market in the late 1990s.

But, you're buying old technology and in particular, a unit with dated graphics and processing power that's tapped out. This should be an incentive to strike the best deal you can. This means finding one that's been serviced by Garmin fairly recently, looks clean and has current operating software. Last, always get a price quote for a new navigator for comparison.

In an upcoming article, we'll look at ways you might train to become proficient flying with older navigators—a continuing dilemma for those new to even aging technology.

USED GPS CHECKLIST

- ✔ Save money by installing the GPS while the panel is open.
- ✔ Decide if you'll want WAAS capability.
- ✔ Be sure the system comes with an installation kit.
- ✔ If it comes with an antenna, is it severely weathered?
- ✔ If possible, research the service history. Recent factory work is best.
- ✔ Shops might require an FAA 8130-3 to sign off the installation.
- ✔ Always get a price quote for a new system as a comparison.
- ✔ Factor pricey flat-rate repairs in the purchase price.

Reliefband 2.0: Same Tech, Restyled

For motion sickness, we still favor the Reliefband wearable device. The latest 2.0 model has fitness tracker-like styling and a higher price.

by Larry Anglisano

When we evaluated motion-sickness aids in the July 2017 issue of *Aviation Consumer*, we favored the Reliefband 1.5 wearable therapeutic neuromodulation device over other remedies. Most important is the device is easy to use and doesn't cause side effects, other than potentially minor skin irritation around the area of the electrode. But we thought the Reliefband, which is worn like a wristwatch, had a dated design and a clinical look and feel.

That's why we were anxious to try Reliefband's redesigned model, simply called Reliefband 2.0. Here's a field report.

NOT A FITNESS TRACKER

But it looks like one and according to Reliefband, that's intentional. For nervous passengers dealing with motion sickness, using a device that better fits a high-tech lifestyle might be better for the psyche, plus it's stylish enough for wearing in any setting. Passengers who helped with our latest trial seem to prefer the new styling, comfort and a better fit, although one evaluator dinged it for being too large and pinching her petite wrist when putting it on.

Retaining Reliefband's patented Neurowave technology, the model 2.0 has a J-shaped, latex-free sports watch-like rubber band that's ultra-modern compared to the older model 1.5, which has a thin fabric band. The old device is worn on the underside of the wrist, but the model 2.0's sensor has hypoallergenic 316L surgical steel contacts built into the underside of the J-shaped smartband.

Note the image at the top of the page with the red arrow pointing to the sensor, which sits in the location of the median nerve at the P6 location on the underside of the wrist. Like the older device, the transmitted signals sooth nausea/vomiting by normalizing the messages within the central nervous system that travel from the brain to the stomach. According to Reliefband, the new sensor design not only increases wear comfort, but it also ensures a more efficient transmission of current to the median nerve.

The model 2.0 has a utilitarian feature set, a sunlight-readable LED display and two function keys. There's a battery charge status indicator in the lower right of the display, a 10-setting intensity indicator in the center of the display and a therapy indicator at the top, which verifies the device is transmitting. The bottom bezel key is for power and the top one adjusts the intensity of the sensor's output.

Battery life is good—approximately 17 hours when operating at the mid-intensity level. The device has a three-pin magnetic connector (yes, another oddball USB charging cable to add to your collection) and provides six hours of use after only a 15-minute charge. We found that convenient since we kept forgetting to charge it before going flying. The older model uses two CR2025 lithium batteries.

In our use, we found the device wouldn't provide adequate therapy without coating the skin with conductivity gel—something we generally didn't need to use with the previous model. Still, we think the 10-intensity therapy setting yields better results than the five-intensity older model.

The Reliefband 2.0 is priced at $174.99—a sizable increase from the older model 1.5, which is street priced at around $95 and still offered.

Contact www.reliefband.com, 877-735-2263.

The Reliefband 2.0, left and top images, has a simple feature set, modern styling and a sunlight-readable display.

Kannad Ameri-Fit ELT: Ameri-King Drop In

If you have an Ameri-King AK-450/451 ELT, forget about future support. Kannad's latest Ameri-Fit version of its Integra 406 ELT is designed for an easy replacement.

by Larry Anglisano

If you own one of the roughly 14,500 Ameri-King ELTs hit by an FAA AD (AD 2017-16-01) because the now-defunct company falsified that the system was FAA approved, ELT manufacturer McMurdo now has a relatively easy replacement option with its Kannad Ameri-Fit system.

The Ameri-Fit is based on the company's Integra AF 406 MHz ELT, but has a universal mounting bracket, the RC103 remote control panel and an adapter cable and coupler that are specifically designed for installations that already have an Ameri-King ELT.

The GPS-equipped Integra ELT is a follow-on product to the Kannad Compact, a beacon that's a standout for its small footprint, but it doesn't have built-in GPS. In addition to its GPS, the Ameri-Fit has internal backup 406 MHz ELT and GPS antennas. In the retrofit, most FAA-approved external ELT antennas can likely be used. The Kannad Ameri-Fit is an AF type, or fixed beacon.

The Ameri-King AK-451 (which was a replacement beacon for the 121.5 MHz AK-450) was originally marketed as both an AF (automatic fixed) and AP (automatic portable) beacon since it can be removed from a Velcro strap and connected with a portable antenna.

The beacon is also equipped with a 121.5 MHz homing transmitter. When activated, the ELT transmits continuously over the 406 MHz frequency for over 24 hours and for 48 hours on the 121.5 MHz frequency. The Kannad has a six-year battery that currently costs around $500 to replace.

The McMurdo Kannad Ameri-Fit 406 MHz ELT, shown in the center of the page, is really the GPS-equipped Kannad Integra ELT. A special retrofit kit makes it mostly compatible with Ameri-King ELTs.

In comparison, Ameri-King advertised that the AK-451—which had a five-year battery—could transmit for 78 hours and we once sourced a replacement battery for under $200.

INSTALLING IT

The Kannad Ameri-Fit should be an easy retrofit for the AK-451 (and other ELTs) because the universal mounting bracket can accommodate a variety of mounting hole patterns. When it's installed in the bracket, the footprint measures 6.89 by 3.90 by 3.40 inches and total system weight including the battery is just shy of two pounds.

Since 406 MHz ELT systems require the installation of a panel-mounted remote control switch, the Kannad Ameri-Fit comes standard with the model RC103 remote controller. This switch was originally designed for ACK and Ameri-King retrofits. The beacon is supplied with an adapter cable and an RJ11 coupler for connecting the RC103 remote control with the beacon.

The remote control has a three-position switch (On, Armed, Reset/Test), plus a red visual/status indicator. You can't turn the beacon off from the remote control, but there's a switch on the beacon itself for doing so.

The company offers an optional external buzzer that can be installed on the outside of the aircraft to give an audible indication that the system is activated.

The Ameri-Fit installation kit for existing Ameri-King ELT systems has a street price of around $189, and the beacon is street priced at around $850. It can be sourced from a variety of online aircraft parts suppliers, including Aircraft Spruce (www.aircraftspruce.com) and most avionics shops.

ABOUT THAT AD

The FAA's AD against the Ameri-King AK-450/451 ELT systems was effective Oct. 24, 2017 and was prompted by multiple reports of ELT failure, in addition to Ameri-King's noncompliance with quality standards and manufacturing processes. Additionally, the FAA issued an emergency cease-and-desist order to Ameri-King (and terminated its TSOA and PMA certifications) when it determined the company misrepresented a variety of its products as being FAA approved.

You don't have to remove an existing Ameri-King ELT to maintain an airworthy status. That's optional. The AD says the beacon has to be inspected yearly to verify compliant operation. This could cost roughly $200. With Ameri-King out of business, most repairs will be unlikely. Ameri-King ELTs are installed as OEM equipment on most GA aircraft and many have been field retrofitted.

Kannad is branded by the French company McMurdo Group, with U.S. headquarters in Washington, D.C. Contact www.mcmurdogroup.com.

Piper Saratoga:

The PA-32R-series retracs offer a healthy amount of load hauling and passenger comfort. Strong resale values for good ones reflect a high market demand.

Shop the six-seat, retractable piston-single market and you'll find three basic choices: Beech's Model 36 Bonanza, Cessna's Model 210 Centurion and Piper's PA-32R series, which is the Lance and Saratoga. At first blush, the Bonanza arguably handles better than the other two while perhaps squeezing out a knot or two over the Centurion. The 210, on the other hand, generally has better short-field performance than the Bonanza and offers an improved hand-flown IFR platform.

Piper's Lance/Saratoga series, however, can carry more than the other two, albeit more slowly, and usually is thought of as the most stable of the three when flying IFR. That's a plus for newly branded instrument pilots upgrading from trainers.

The PA-32R line (these are all retracs, and what we'll focus on in this review) is tough to sift through because Piper kept it in long production, beginning somewhere around 1976 and ending in real numbers around 2008, where the current Aircraft Bluebook tags the PA-32R-301T as a $405,000 airplane. When equipped with a low-time Lycoming TIO-540, air conditioning, icing protection and oxygen, it might easily sell for over $500,000 in the current market. The current Aircraft Bluebook says an early Lance retails for around $85,000, but sales pros tell us that won't buy you much. More realistic is $120,000 for a cherry one.

The Saratoga is a logical step-up plane for newer pilots who load the cabin with passengers and stuff.

The Bonanza, 210 and Saratoga are growth versions of earlier, smaller airframes. All three are available in turbocharged models, either from the factory or in the aftermarket. In some cases, you have fixed-gear versions or derivatives as alternatives.

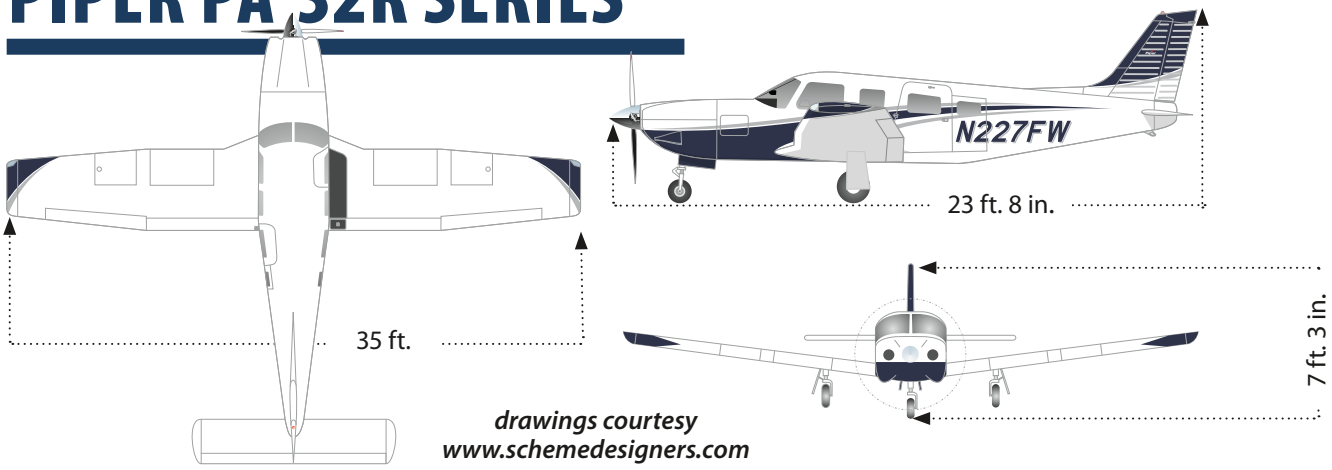
If trying to describe their differences by referring to the automotive world, the A36 Bonanza might be thought of as a BMW station wagon; the 210 as a Ford Explorer and the PA-32R as a Chevy Suburban. All three make fine platforms when there are two or three people and a few bags. But when there are a lot of bags and people, the Suburban is one that gets the job done with ease. So it is with Piper's Lance/Saratoga. You just might have to stop for fuel a bit more often.

HISTORY

In the early 1970s Piper suffered a major setback when a flood destroyed much of its Lock Haven, Pennsylvania, plant. Among the casualties was the tooling for the popular, but labor-intensive, Comanche, which had an option for small third-row seats.

The turbo Saratoga in the lead photo was totally refurbished by Aircraft Sales Inc. ASI's Pristine Airplane mod strips the airplane to the skin and builds it back up to modern standards.

PIPER PA-32R SERIES

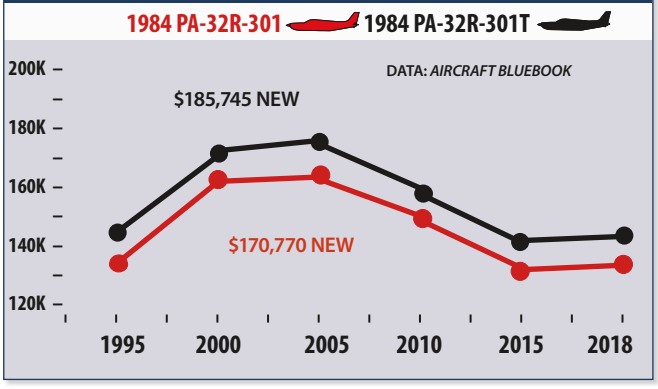


drawings courtesy
www.schemedesigners.com

PIPER PA-32R LANCE/SARATOGA SELECT MODEL HISTORY (NOT REFURBISHED)

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1976-78 PA-32R-300 LANCE	LYCOMING IO-540-K1G5D	2000	$40,000	94	1632 LBS	156 KTS	±$85,000
1978-79 PA-32RT-300 LANCE II	LYCOMING IO-540-K1G5D	2000	$40,000	94	1632 LBS	156 KTS	±$100,000
1978-79 PA-32RT-300T TURBO LANCE II	LYCOMING TIO-540-S1AD	1800	$50,000	94	1529 LBS	175 KTS	±$105,500
1980-92 PA-32R-301 SARATOGA SP	LYCOMING IO-540-K1G5D	2000	$40,000	102	1660 LBS	158 KTS	±$140,000
1980-92 PA-32R-301T TURBO SP	LYCOMING TIO-540-S1AD	1800	$50,000	102	1597 LBS	177 KTS	±$153,000
1994-2007 PA-32R-301 SARATOGA II HP	LYCOMING IO-540-K1G5D	2000	$40,000	102	1189 LBS	166 KTS	±$240,000
1998-2007 PA-32R-301T SARATOGA II TC	LYCOMING TIO-540-AH1A	2000	$60,000	102	1136 LBS	177 KTS	±$300,000
2008 PA-32R-301T SARATOGA II HP	LYCOMING TIO-540-AH1A	2000	$40,000	102	1189 LBS	166 KTS	±$365,000
2008 PA-32R-301T SARATOGA II TC	LYCOMING TIO-540-AH1A	2000	$60,000	102	1136 LBS	177 KTS	±$405,000

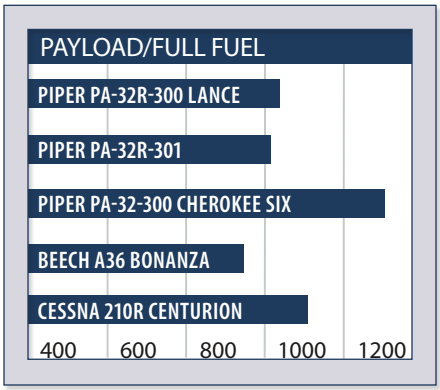
PIPER PA-32R-301 RESALE VALUE

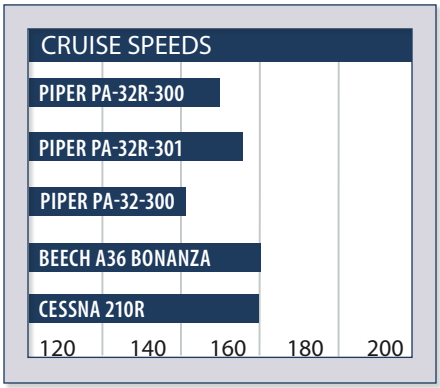


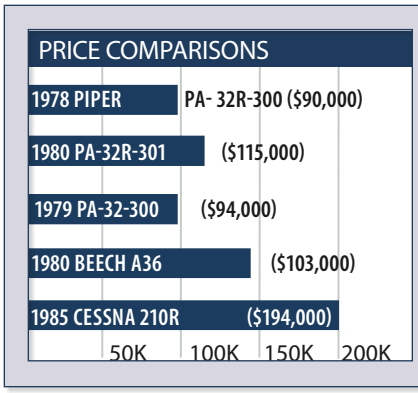
SELECT RECENT ADs

AD 10-15-10	INSPECT AND REPLACE CONTROL-WHEEL SHAFTS
AD 09-05-05	MODIFY AVIDYNE PRIMARY FLIGHT DISPLAYS
AD 06-03-08	REPLACE STC AERO ADVANTAGE VACUUM PUMPS
AD 95-26-13	RECURRING INSPECTION OF OIL COOLER HOSES
AD 78-23-01	INSPECT FUEL DRAIN LEVER DOORS EVERY 100 HOURS OR REPLACE

SELECT LATE-MODEL COMPARISONS







There's plenty of panel to work with in a Saratoga. Air-Mods in New Jersey installed a new one in Paul Weintraub's 1982 model shown at the top. That's the modified panel of a 1983 PA-32R-301T at the bottom.

The company decided to abandon the Comanche in favor of a new retractable derived from the fixed-gear PA-32 Cherokee Six. The company was already having success with the Seneca, a light twin derived from the same airframe, so it made sense to build on a familiar design. Not much needed to be done to the Cherokee Six: The PA-32 was already available with the 300-HP Lycoming IO-540, so essentially the only change was to fit a retractable landing gear. That meant a new engine mount and changes to the wing. Piper also modified the wing spar in the process, allowing a 200-pound boost in gross weight, to 3600. The new airplane was dubbed the PA-32R Lance and introduced to the public in 1976.

The powerplant was the 300-HP Lycoming IO-540 K1G5D with a 2000-hour TBO in the normally aspirated airplanes and the TIO-540-S1AD with a TBO of 1800 hours in the later turbocharged models. (The first 140 Lances built had K1A5D engines, the only difference being in fuel pump design.) The D means that the engine has the infamous Bendix dual magneto system. The fuel system originally held 94 gallons in four tanks, later upped to 102 gallons.

The PA-32R borrows heavily from its siblings. The main landing gear is much like the Seneca—logical, since the basic airframe is the same—and the nosegear resembles the Seneca and also the Arrow. The PA-32R also came with Piper's automatic extension system for the landing gear. The fuel system is similar to the Seneca's.

The Lance remained essentially unchanged for two years. In the late 1970s, though, someone at Piper decided that T-tails were a good idea. We believe it unlikely that the responsible parties were aerospace engineers or experienced pilots, based on the aerodynamic qualities of the Piper T-tail singles in general. The Lance wasn't the only T-tailed Piper. This also was when the PA-38 Tomahawk was rolled out and the T-tailed Arrow IV debuted.

Piper combined the T-tail's introduction to the PA-32 airframe with a turbocharged variant. These two aircraft, the Lance II (PA-32RT-300) and Turbo Lance II (-300T), were not very well received. Though Piper ballyhooed the supposed advantages of the T-tail (smaller size and weight, reduced pitch changes with trim and flap application), the truth was that when the stabilator was moved up out of the propwash, the airplane's handling suffered. In particular, takeoff runs increased significantly since it took a good deal of speed for the stabilator to become effective, and when it did, the result was a pronounced pitch-up. Some complained of lack of rudder authority. The T-tailed Lances were also sensitive to trim settings. The T-tail was also a pain to preflight, especially in winter, when a ladder is required to remove snow from the stabilator.

When pilots found out about these traits, sales plummeted. In 1980, two years after the T-tail's introduction, Piper saw the light and reverted to the original tail design.

At the same time, the company applied the same wing upgrade that had already appeared in the PA-28 series. The constant-chord "Hershey Bar" wing was replaced with a semi-tapered planform. Piper also "simplified" the designation of the entire PA-32 series, renaming them Saratoga SP. The fixed-gear versions were simply called Saratogas. As before, there were turbo versions available, designated by a T at the end of the model number. The fixed-gear

Pulling the top cowling on a stock Saratoga offers generous access to the six-cylinder Lycoming, top. The big rear cabin door scores points with passengers. The 1985 model at the bottom kicks up the lux with club seating.

option was dropped in 1993, only to reappear briefly as the Piper 6X from 2004-2007. The retractable version saw various iterations under the Saratoga name until 2008.

Used values of the T-tail models have historically been lower than those of the conventional-tailed airplanes, which makes the T-tail a relative bargain in a six-place airplane. Owners of T-tails seem to like them. It should be noted that although T-tail owners without exception stand behind their airplanes and claim the poor reputation is undeserved, the airplane nevertheless has documented performance differences from the otherwise identical straight-tail version (more on this later).

TURBO DIFFERENCES

The turbocharged engines have AiResearch turbos with wastegates mechanically linked to the throttle controls. The pilot has to adjust the throttle to maintain manifold pressure during climb, and it is possible to overboost the engine if too much throttle is applied. (The MP gauge is inconveniently located in front of the pilot's right knee, but there is an overboost warning light on the panel's eyebrow.)

The Turbo Lance II has an unusual updraft engine-cooling system that takes air in through a low-mounted "fish-mouth" oval scoop, forces it up over the cylinders, then back down and out through cowl flaps. Owners say the system is ineffective and requires the use of extra fuel and step-climbs to avoid engine meltdown. The Turbo Saratoga SP has a more effective cooling system replacing cowl flaps with louvers mounted on top and on the bottom of the cowling. A popular mod is to add an intercooler.

CLUB INTERIOR

Most find the interior of the PA-32R quite comfortable. The cabin is over 10 feet long and 3.5 feet high. Shoulder room for the front and center seats is 4 feet and 3.5 feet for the back row. Most 32Rs have club seating and there's a big side door for the passengers, who need not clamber over a wing to enter the airplane. It's remarkably quiet, due in no small part to the presence of a nose baggage compartment located between the cabin and engine. The rear seats are easily removed for cargo, and some owners just leave the rear ones at home most of the time. Because of the wide cabin, there's plenty of room on the panel for any gadget one might want. Other than that, it's pure Piper single.

The fuel selector is a bit different from the familiar PA-28 sidewall-mounted pointer, being sensibly located on the center pedestal. One thing we don't like is the sump-draining procedure. Not a simple matter of sticking a fuel tester in a quick drain, the procedure requires the pilot to first put a bucket under a nozzle in the belly, then get back in and hold down a lever located under the right center-row seat while simultaneously switching tanks.

This gymnastic routine continues for a minimum of 18 seconds due to the length of the fuel lines, after which the pilot gets to go back outside, look in the bucket and try to figure out which tank the water came from.

PA-32R ACCIDENTS: ENGINE FAILURES

From the first time we flew the Piper Lance, we liked its docile handling as well as its manners on takeoff and landing, although we weren't crazy about its lack of speed. The taper-wing Saratoga fixed that nagging problem nicely.

Our review of the 100 most recent accidents involving those airplanes confirmed our affection for the overall design of the machines as the accidents reflected an extraordinarily low rate of runway loss of control (RLOC) events, three, and fuel-related engine stoppages, four. For a system that requires the pilot to select among two tanks, only four fuel-related accidents place it at a rate nearly as good as what we see in the simplest fuel system: one that gives the pilot only the choice of off and on.

While PA-32R pilots had little trouble keeping the airplanes on the runway after landing, seven of them did manage to hit the runway so hard on touchdown that they damaged the airplane. We note that even though the Lance and Saratoga SP/HP are tolerant of some sloppiness in speed control on final, they will develop an impressive sink rate if power and speed are not coordinated.

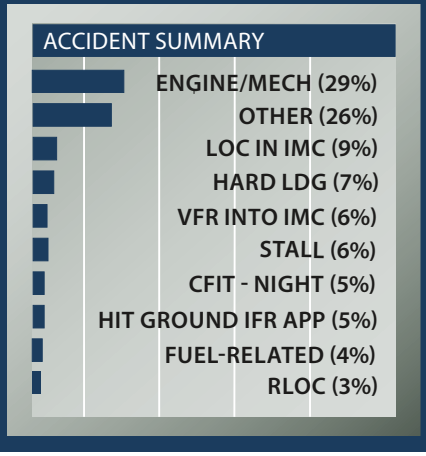
We raised our eyebrows at finding eight inflight breakup events. While six-place singles will accelerate rapidly in a diving spiral and generally have the highest inflight breakup rates in general aviation, eight seemed high to us. All but two were in IMC, mostly in or near thunderstorms (one pilot had reported a vacuum pump failure). A few involved pilots who were ostensibly trying to remain VFR. Of the non-weather breakups, one came when a pilot descending at high speed hit the wake turbulence of a Boeing 737 and the other when a pilot apparently decided to perform aerobatics.

The largest number of PA-32R prangs came after a partial or total loss of engine power, often for reasons that could not be determined after the fact. Nevertheless, at least half of the engine stoppages were traced directly to maintenance that should have been performed and wasn't or was done wrong. A fuel line that had been repaired rather than replaced—as called for in maintenance instructions—failed a second time, leading to an engine fire. A worn exhaust clamp on a turbocharged bird was the culprit in another engine fire.

The human-generated problems on the maintenance side of the flight equation were, sadly, matched by human-generated problems on the pilot side. Attempts to take off over gross and downwind on grass runways led to aircraft hitting obstructions about where the POH performance charts predicted they would—especially if pilots left the gear down. Five pilots attempted to remain VFR at night in questionable weather or in mountainous terrain on moonless nights and flew into terrain.

Five others shot instrument approaches to below minimums and hit the ground either while still in the clouds or attempting to circle to land beneath them.

Finally, we had little sympathy for the pilots who ignored a zero oil pressure indication because the engine was running smoothly. When it started making clanking noises, they turned for the nearest airport. The engine seized well before they got there.



Later PA-32s have some good crashworthiness features, including seats with S-shaped frames designed to progressively crush on impact, plus a thickly padded glareshield.

LOAD CARRYING

Typical of single-engine airplanes, the Lances and Saratoga SPs force the pilot to choose between filling the cabin and filling the tanks. Still, an airplane this size is quite practical when it comes to hauling, because carrying four with baggage and full fuel is possible. The turbo models are a bit more limited. With six FAA-standard people aboard, a PA-32R can carry enough fuel to fly 2.5 to 3.5 hours. The CG range is quite wide, but with only two people aboard, care must be taken to avoid exceeding the forward limit. There are two baggage compartments, both with a 100-pound capacity: the nose bay and a large one aft of the rear. One way to improve the T-tail's squirrelly handling reputation is to put 50 pounds in the aft baggage compartment to bring the CG aft into the center of the range.

PERFORMANCE ANXIETY

While 150 knots isn't all that bad, when compared to other big retractables the PA-32Rs are rather slow. Almost any A36 Bonanza or Cessna 210 will walk away from the 32R, being about 10 knots faster.

At 75 percent power, a Lance cruises at 158 knots while burning 18 GPH. The Saratoga SP isn't faster, but improvements in induction air cooling allow their engines to be leaned to peak EGT, saving a couple of gallons an hour. The turbocharged airplanes can cruise at 177 knots while burning nearly 20 GPH up high, but at lower altitudes they're only a couple of knots faster on the same fuel.

Because of its T-tail, the Lance II has a significantly longer ground roll than the conventional-tail models. The book indicates a 1650-foot ground roll under standard conditions, and notes the roll will be one-quarter longer if the airplane is loaded toward its forward CG limit. Ground rolls for the Lance and SP are posted as 1380 and 1200 feet, respectively. Initial rate of climb is just over 1000 FPM.

MAINTENANCE

Several Turbo Lance II owners com-

Michael Hawbaker stepped up to his 1985 Saratoga SP, top, from a Piper Dakota and says the transition was easy.

plained about their hot-running engines. (One said his mill once toasted the forward baggage compartment sufficiently to melt plastic diaper bags that had been stowed there.) However, as noted below, there are modifications designed to eliminate the heat problem.

Among recurring ADs are: 77-12-06, which requires the shanks of Hartzell propellers to be inspected and cold-rolled every 2000 hours or five years (90-2-23 also calls for a one-time inspection and possible replacement of the hub, and 94-17-13 requires recurrent inspection of hub grease fittings); 78-23-01, which requires the fuel drain lever doors in naturally aspirated Lances to be checked every 100 hours until they're replaced; 93-5-22, which addresses the fuel injector lines on the TIO-540-S1AD engine; and 95-26-13, which requires recurrent inspection of oil cooler hoses.

A rash of engine fires in turbocharged Lances and Saratogas prompted an Airworthiness Directive requiring portions of their exhaust systems to be periodically inspected and eventually replaced. The AD targets the fittings on a 90-degree elbow between exhaust ports and turbocharger in the Lycoming TIO-540-S1AD engine powering the big Piper singles.

In 1988, the NTSB issued a warning about the fittings when it concluded its investigation of a Turbo Lance that crashed during an attempted emergency landing in Lincoln, Nebraska. The safety board found the elbow fitting in the Lance had separated, allowing hot exhaust gases to flow into the engine compartment and start a fire. The board noted the gasket and flange on the fitting had been misaligned during maintenance on the exhaust system about a month before the accident occurred.

The FAA responded with an AD (89-12-4) requiring periodic inspections of the exhaust elbows and fittings, and replacement with modified components developed by Lycoming. The FAA estimated that compliance would cost $858 per engine.

However, later evidence of a string of exhaust system-related accidents and incidents involving both the Turbo Lance II and the Turbo Saratoga SP prompted the NTSB to call for a more stringent AD. Four such crashes occurred in 1990 alone. The safety board, noting that some of the crashed aircraft had received new parts called for by the AD, declared the AD was not an effective solution and called for a revision mandating repetitive inspections whether or not new parts are installed. The revised AD, AD 91-21-01, requires new exhaust parts that would beat the cracking problem.

Landing gear problems are prominent in Service Difficulty Reports, accounting for about a quarter of the total. Chief among them were broken nosegear actuators and cracked or broken nosegear trunnions. Other frequently cited problems included cracked engine mounts, exhaust system leaks and separations, broken magnetos and loose stabilator attachments.

MODS, REFURBISHMENT

Several companies have developed means to alleviate the heat problems plaguing the Turbo Lance II; if

Reader Al Lipper reports a 1407-pound useful load capability for his 1984 Saratoga SP shown above. He reversed the club seating to forward facing.

this is the model you're interested in, check to see if one of these kits has been installed in a candidate airplane. TurboPlus still offers intercoolers for the turbocharged Lance and Saratoga (www.turboplus.com).

Aerodynamic cleanup kits (e.g., gap seals and fairings) are available from a number of companies, including Knots 2U (www.knots2u.com) and Laminar Flow Systems (www.laminarflowsystems.com). LoPresti (www.loprestiaviation.com) offers gap seals, too, along with a redesigned cowling, which the company says improves engine cooling and reduces drag. It certainly has good looks.

Precise Flight (www.preciseflight.com) offers speedbrakes, a standby vacuum system and a pulse-light anti-collision system. Upgraded propeller systems are available from both Hartzell (www.hartzellprop.com) and McCauley (www.mccauley.txtav.com) for most PA-32R models.

While not exactly a mod, Aircraft Sales Inc. in Smithville, Ohio, offers the Pristine Airplane refurbishment program for a variety of aircraft, but specializes in Saratoga, Lance and Cherokee Six models. The company is extremely selective when sourcing the airplane to be refurbished, which includes new paint, interior, avionics and an extensive teardown process. Most aircraft include a field-overhauled engine as part of the refurbishment process.

When we visited the company a couple of years ago at its facility on the Wayne County Airport, we saw a hangar packed with a variety of Saratogas and Cherokee Six models in various stages of refurbishment. Indeed ASI tears the airframe down deeper than even the most thorough annual inspection. Customers we spoke with admit paying a hefty premium for a Pristine Airplane refurbished model, but ended up with an aircraft that was like new. The company is currently listing a refurbished 1976 Lance for $199,900.

"The demand for Piper PA-32 models in general (including fixed-gear airplanes) is at the highest I've seen in my career," ASI principal Matt Kozub told us during our research. According to Kozub, one reason for the demand is the PA-32's utility. "Cabin size and useful load are two things that fit with the modern trend of today's society," he said.

Kozub reinforced a point that maintenance shops and owners seem to agree on: Piper products remain some of the least expensive to maintain. Parts are readily available and almost any mechanic can work on them. Contact www.pristineairplanes.com, 330-495-6569.

As for type organizations, several thousand owners of PA-28 and -32 series airplanes belong to the Cherokee Pilots Association (866-697-4737 or www.piperowner.org), which according to the website united with the Piper Owner Society. The group has an active forum and publishes the monthly *Pipers Magazine*, which focuses on maintenance, avionics and operational information.

OWNER COMMENTS

We are three partners owning N886JH, a 1982 retractable Saratoga. I am a CFII and had flown the aircraft as an instructor at Hortman Aviation as long ago as 2001, and had flown her to Florida, Ohio and Maine on personal flights. In 2015 several of my former students and I began looking for a Lance or Saratoga to purchase. After several other choices, N886JH—which had been on leaseback to Hortman—arrived at Air-Mods in Robbinsville, New Jersey, where I had been instructing. After a prebuy and discussion with Dave Mathieson at Air-Mods and a thorough review of the logs, we decided to make an offer.

The aircraft was in need of a new interior and the panel was in poor condition, but the engine was below mid-time, the prop was new and the airplane was straight and had flown regularly since new. The paint was mostly original and presentable, but would need to be redone soon. We got a good deal on the plane and started in the fall of 2015 on a plan of significant restoration.

Air-Mods completely removed the interior and panel, and a new interior was installed (including new insulation), plus a new instrument panel was constructed. Mostly all new avionics—including new circuit breakers and master switch—were installed. We had the yokes leather wrapped and subsequently installed a door steward on the front cabin door.

We upgraded the avionics to a Garmin GTN750 and a GNS430W, and since our timing was before the introduction of Garmin's GTX345, we have a GTX330ES transponder and a GDL88 for ADS-B compliance. We upgraded to a Bendix-King HSI, kept the Century 41 autopilot, moved the DG to the right side of the panel and installed an L3 EFIS as a backup. An

EDM700 engine monitor, a digital tachometer and rebuilding of the original turn coordinator and AI completed the panel work. We moved all switches to the center of the panel, replacing the original ones with lighted switches. We installed LED exterior and panel lighting.

After the work, we ended up with a useful load of 1334 pounds. On the exterior we installed wingroot fairings, new wingtips and stabilator tips. The wingroot fairings do not appear to increase the cruise speed, but do make better mid-speeds possible at lower manifold pressure settings and seem to reduce wind noise some.

This Saratoga cruises between 155 to 160 knots, consistently burns 15 GPH in cruise and burns a quart of oil roughly every seven hours. Following the POH starting procedures, the engine starts in less than one turn of the prop when cold and in about eight seconds when warm. We keep her in a hangar and use the Reiff engine preheater and Switchbox to preheat before winter flights. We are using Shell multigrade in the winter and 100 in the summer.

With one CFII with many retractable hours in type and two relatively low-time pilots as owners, we pay about $2400 annually for insurance with the hull set at market value. We have no deferred maintenance and the last annual was under $4000 and we anticipate that the forthcoming annual will be about half that. We have a paint job scheduled for March of 2018.

Although the Saratoga with full fuel and two aboard without baggage is close to the forward limit of the CG envelope, we have no problem making smooth landings if a stable approach and gradual reduction of power to idle just before touchdown is followed. Fly the approach at 90 knots, reduce to 80 knots over the fence and 75 knots over the end of the runway and you will be rewarded with a good landing. The Saratoga handles crosswinds very well, is a stable instrument platform and the Century 41 autopilot does wondrous approaches as long as you intercept the final approach course a minimum of two miles outside the FAF. Of course, you still must manually reduce power and drop the gear, but the Century 41 is reliable and accurate. We use either heading mode or Nav mode and when aligned on the final course, hit APR and it intercepts and captures the glideslope and flies a perfect ILS or LPV.

Paul Weintraub is all smiles after the acceptance flight of his 1981 Saratoga following sizable renovations.

In summary, the Saratoga isn't quite as fast as a Bonanza, but with a wider and more comfortable cabin and a wider weight and balance envelope (and with good fuel endurance) we think she is the ideal traveling machine for our missions.

Paul Weintraub
Bristol, Pennsylvania

After owning my first airplane, a 1980 Piper Dakota, for six years and 600 hours, I decided to step up to the retractable six-seat 1985 Piper Saratoga SP that I've owned now for two years. I bought the SP to transport my family of four on cross-county trips mainly throughout the Midwest, typically covering 200 to 400 nautical miles.

The transition from the Dakota to the Saratoga was an easy one. The forward baggage area extends the nose of the Saratoga and provides a different view than a PA-28, but the noticeable drop of engine noise in the cabin was welcomed by the family members who camp out in the back and typically now do not use or need their headsets. We all love the extra room the Saratoga provides. The extra width a PA-32 provides is as enjoyable for me when I fly with

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USED SARATOGA

(continued from page 31)

other pilots or instructors as the length of the club seating is for the passengers. The back seats remove in seconds to provide a lot of space for cargo. The 102 gallons of usable fuel and nearly 1300 pounds of useful load provide a lot of options.

Cruise speed is less impressive; 75 percent power yields about 152 knots and consumes about 16 GPH. I typically fly at 65 percent power when I'm alone and consume around 13.8 GPH. At 55 percent power practicing approaches, it burns about 11.8 GPH.

Insurance for its $190,000 hull value and as an 850-hour pilot with 160 hours as PIC in this Saratoga costs me $3200 per year through AOPA insurance. The plane was refurbished inside and out by AirMart Inc. prior to my purchase, so besides a persistent coolant gas leak in the air conditioning system, maintenance items have been limited. Still, there always seems to be a number of small items that add to a typical $4000 annual.

I have been happy with my purchase and choice of the Saratoga for my Midwest travel. It provides an honest and stable IFR platform that transports both pilot and passengers in comfort.

Mike Hawbaker
via email

I've owned a Saratoga SP for about 18 months now and absolutely love it. Mine is a fully refurbished 1984 model (the Pristine Airplane mod done by Aircraft Sales Inc. in Ohio) and so far it seems the company did an excellent job on it.

Later Saratogas had more standard equipment, including turbocharger, built-in oxygen, air conditioning and a de-icing system, but this reduced their useful load by 300 pounds or so. My normally aspirated model has a huge useful load—1407 pounds—which is enough to carry six adults and fuel for three hours, plus reserves.

The cabin is very roomy and comfortable. My wife and I have four kids and there's plenty of room for everyone. A big rear cabin door lets you load just about anything in.

Most Saratogas have the club seating option, which is great for business and adults, but I've found that my kids all want to face forward. I had the club seating reversed to the forward-facing seating configuration and have been very happy with this. The back seats are easy to remove for cargo.

The Saratoga is fast enough for most travel, cruising at around 150 to 160 knots on 14 to 18 GPH. Climb performance at sea level with one person on board is 1500 to 1600 FPM. Turbo models go faster at higher altitudes, but have roughly 100 pounds less useful load and a more expensive engine overhaul.

My airplane is equipped with newer avionics including an Aspen PFD1000 EFIS, Garmin GNS530, JPI EDM730 engine monitor, GTX345 ADS-B transponder (with Bluetooth traffic and weather data on my iPad), a panel-mounted Garmin aera796 GPS and a Bendix-King KAP150 autopilot with GPSS steering from the Aspen PFD.

The Saratoga is not much more complex mechanically than a PA-28R Arrow—just bigger with lots more power. I've only been through one annual inspection so far, and that cost around $6000.

I've found that it flies similar to an Arrow or even an Archer, but it has a lot more inertia. It's not heavy on the controls, but you're controlling a larger mass with more inertia that's going faster. It's harder to fly a really tight traffic pattern like you can in slower aircraft, but it's very stable with no surprising flight characteristics.

Last, the Saratoga looks sharp on the ramp. I often get compliments on it.

Al Lipper
via email

FEEDBACK WANTED

CESSNA 206

It's time for a fresh look at the used Cessna 206 Stationair market in an upcoming Used Aircraft Guide in *Aviation Consumer*. We want to know what it's like to own these load-hauling singles, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your Stationair 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 a Cessna 206. Send correspondence by April 1, 2018, to:

Aviation Consumer
Email at:
ConsumerEditor@hotmail.com