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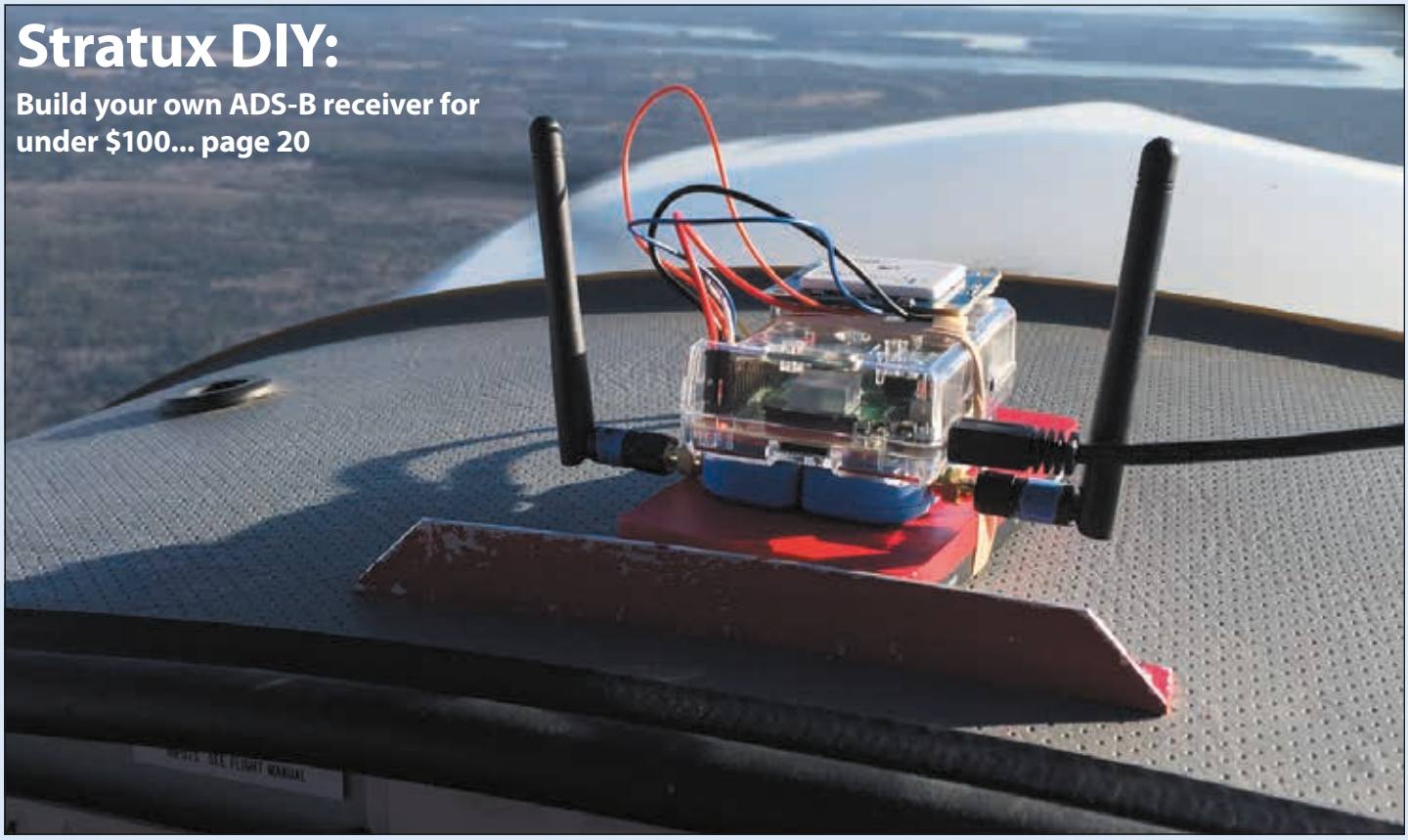

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The Aviation Consumer

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A REGULATORY STEP FORWARD, AND THEN BACK

The FAA turned a lot of heads with its official policy statement, PS-ACE-23-08, authorizing the installation of electronic attitude instruments for one-and-only primary use. Using rare language that's sympathetic to owners burdened by the high cost of iron gyro upkeep, the agency offers leniency for shops to sign off the installation as a minor alteration, which also includes yanking out the vacuum system even if it's required per the aircraft type certificate. According to the policy, no field approvals, no additional STCs, no backup gyro or time-consuming paperwork is required. Progress at last, or so it seemed.

We covered the eligible electronic attitude instruments and the installation guidance in the December 2015 issue of *Aviation Consumer,* where we recognized the value of Sandia's SAI-340 and the advanced feature set of L-3's ESI-500 Genesis, pictured right. Like many buyers, I think it's logical to consider either one of these instruments as a backup to primary glass. This could include a Garmin G500, Aspen Evolution or Avidyne Entegra.

If the Feds say these things are good enough for primary VFR and IFR, sign me up for one as a backup. This gee whiz backup strategy is precisely what reader Matt Evans had in mind, but his shop couldn't sign off the Sandia as a legal backup to a Garmin G500 PFD in his Cessna P210 without lobbying field approval. When our December report hit the mailboxes, I heard from several other owners describing similar regulatory roadblocks. Huh? This was supposed to be easy.

I did some regulatory digging and indeed found the gotcha. One problem: Sandia's SAI-340 (and L-3's Genesis) isn't on Garmin's approved list of standby attitude instruments, an equipage requirement governed by Garmin's G500/600 STC. Since the current revision of its AML STC installation manual doesn't recognize these latest generation electronic models, installing them would deviate from the STC. Naturally, buyers want to know when and what Garmin is doing to include these off-brand instruments in its STC. In an official statement, Garmin said it's evaluating other approved standby instruments, but adding them to its recognized list requires an STC amendment—something it does with major software releases; roughly once per year. Until then, try for a field approval. The same goes for backing up Garmin's G1000 integrated avionics, also governed by the aircraft type certificate. This is a larger regulatory snag, requiring amendment to the original type design.

It isn't any easier for Aspen PFD owners. Its STC manual says that the standby electric attitude indicator must not rely on pitot and static air input for its operation (the Sandia and L-3 instruments utilize pitot and static air). That's logical, since an iced pitot tube can take both systems down. Even adding an independent pitot and static source isn't good enough for Aspen's STC because a single-point failure of the aircraft alternator or battery will kill the pitot heat. Given these precise technical requirements, Aspen said there is no need for it to update its current documentation to accommodate the new backup instruments. I say good luck getting a field approval.

Both Sandia and L-3 told me some shops have been successful winning field approvals for electronic backups to Garmin's G500/600, but said it's ultimately in everyone's best interest to expedite an STC amendment. L-3's Steve Rutherford says there is an unprecedented number of buyers wanting the ESI-500 as a backup, a buying trend confirmed by several shops I spoke with. Over at Sandia, a frustrated Barry LeBlanc described the FAA as being overwhelmed by contradicting regulations, while shops stumble over the new policy's verbiage.

Until all this finger-pointing is sorted out, the money the FAA was trying to save owners on hardware will be paid to a convoluted field approval process. That's a major step backward in progress.—*Larry Anglisano*

WIRELESS LIGHTSPEED

It takes two to Tango (two batteries, that is). After reading your January 2106 report on the Lightspeed Tango wireless headset, it seems Lightspeed desperately needs a new charging system.

The problem is that the $35 external charger accessory for the Tango headset only charges one battery at a time. However, you need both batteries—the one in the headset and the one in the panel interface—charged for the headset to function fully. Even if you have the ability to charge the headset in the plane at home, when traveling, you will have to either take the headset out of the plane and lug it to your lodging or charge each battery individually in the external charger. Or, you can spend another $35 and get an additional charger, though that is one more thing to carry around, find a plug for and leave behind.

Art Friedman
Santa Paula, California

The supplied USB wall charger has dual outputs for charging the remote module and headset. You need to plug in two USB cables, of course (one for the module and the other for the headset), but at least both components can charge from a single wall outlet.

AIRCRAFT APPRAISALS

I would like to add a footnote to the worthy Aircraft Appraisal article in the January 2016 issue of *Aviation Consumer.* One should be very careful of the aircraft appraiser when having a unique aircraft appraised such as warbird, antique and homebuilt aircraft. Unless the appraiser has documented experience in these specialty aircraft, steer away quickly, no matter if they are NAAA appraisers, or not. An inexperienced appraiser might take you down the wrong path.

I had one such appraiser say there was something wrong with my warbird (a Lockheed T-33) because refurbished replacement parts were installed. The cost of the replacement parts were subtracted from the baseline value estimate of the aircraft. This decreased the aircraft appraisal substantially below what the average market numbers indicated. This is very poor reasoning. In the warbird world, installing new old-stock parts is common and a desired improvement to the aircraft, something this appraiser did not recognize.

As the article correctly states, labor costs for parts or equipment installation are not appropriate to include in aircraft valuation. However, damage history does not necessarily decrease the valuation of the unique warbird, antique or homebuilt. The quality and depth of the repair may likely maintain or in some cases increase the value of these aircraft.

An appraiser experienced with these unique aircraft can identify and substantiate their valuations. Do very good homework prior to engaging any appraiser—it will be your best investment.

Vlado Lenoch
Burr Ridge, Illinois

I agree with the gist of your recent aircraft appraisal article, but take issue with the conclusion that labor has no market value. As a decades-long *Aviation Consumer* subscriber, I hesitate to argue with the editor's experience, but feel I must stand up for the enduring value of quality installations.

As editor Larry Anglisano's many avionics upgrade articles over the years have stressed, installing new avionics using the old wiring can be a costly mistake, but this article's logic pushes the opposite. Does anyone believe the only resale difference is the cost of wire? Asserting that the value of a plane's avionics is the sum of its boxes is like saying a meticulously done custom interior is worth no more than an owner-installed prefabricated one, or that a run-of-the-mill field overhaul is the resale equivalent of a Victor Black. This isn't so. The whole is more than the sum of its parts. It's fair to tell owners (depending on the state of the market) that they may not get back everything put into their airplanes, but equally important to tell buyers that database-driven appraisals reflect a least-common denominator.

Buyers seeking quality are advised to join type clubs and to enlist the help of brokers with type-specific expertise to help find it.

Ken Towl
via email

There is a difference between "reporting" and "setting" value, and the difference in those strategies is normally overlooked by the typical layperson. The professional appraiser is not attempting to penalize owners who paid a premium price for avionics upgrades, but are simply "reporting" the market response to that effort.

NAAA appraisers are responsible for supporting whatever opinion of value they develop. As part of the appraisal process, any final opinion of value should be compared against the marketplace overall to validate their conclusions or highlight any differences.

CORRECTION

In the January 2016 issue, we erroneously quoted the base price for the Maule M-7-235C as $250,000. That is the base price for the 180-HP model, the M-7-180B. The base price for the M-7-235C is $294,900. The price of the airplane we flew, with installed options, was $320,000.

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406 MHz ELT Retrofits: GPS Ups Effort, Cost

We favor the Artex 1000 for its build quality and the Kannad Integra for wise power management. To trim costs, upgrade while the aircraft is disassembled.

by Larry Anglisano

CHECKLIST

- There are good reasons to upgrade to 406 MHz beacon technology.
- Antenna work and external GPS interface drive up cost considerably.
- If you don't time the install while the interior is removed, labor costs could double.

The 406 MHz ELT market never quite achieved liftoff, probably because the FAA hasn't mandated these beacons, even though it still requires an installed ELT of some kind. A lively market of capable, inexpensive personal locaters (PLBs) further muddies the buying decision. But there are good arguments for an installed 406 MHz beacon, not the least of which is that after a crash, you might not be in any condition to activate a PLB.

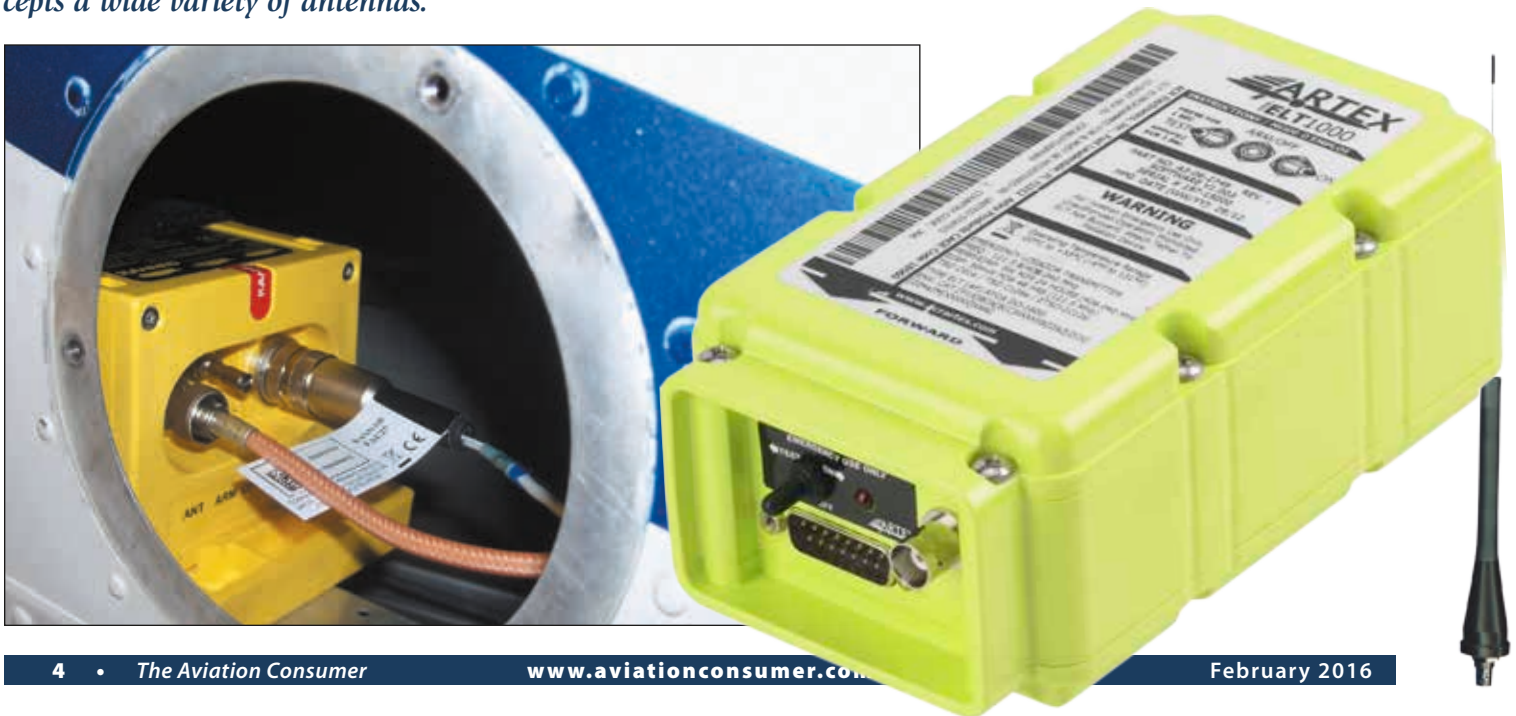
In this report, we'll examine GPS-enabled third-gen 406 MHz ELTs that substantially improve your odds of being located after a crash. Shops tell us installed costs may hover around $3000, but you can knock the sting off that number by having the work done when the airplane's pulled apart at annual.

WHY UPGRADE?

The FAA's ELT requirements for U.S. registered aircraft haven't changed in years, but new-production beacons are governed by TSO C-126A. In the regs, FAR 91.207 says an approved automatic emergency locator beacon must be attached to the aircraft, which means personal locator beacons (PLBs) can not be substituted. But this doesn't mean you can't fly with older beacons transmitting on 121.5 MHz—there's no rule that says 406 MHz beacons have to be used. But as nearly everyone should know, rescue organization Cospas Sarsat doesn't monitor the 121.5 MHz frequency. Additionally, these older systems generally can't interface with onboard GPS for even tighter position reporting, a tough sell which makes us wonder why all new beacons don't have integral GPS receivers, and at a lower cost. More on that in a minute.

While ELT upgrades may offer little gee-whiz appeal on the outside, more reliable electronics on the inside could make the major retrofit worth it. Controlled 24-hour battery endurance, programmable tail-number/pilot information encryption, better location accuracy (as tight as one mile), plus the ability to activate

That's a Kannad 406AF Compact tucked behind an access hole in the fuselage, lower left. The 406AF is one of the smallest 406 beacons on the market and is field programmable. The Artex ELT1000, lower right, is known to work with all of Garmin's GPS navigators and accepts a wide variety of antennas.



the beacon from a panel-mounted switch, are a few benefits.

In general, 406 MHz beacons transmit a 5-watt signal burst every 50 seconds, while streaming data in an encrypted short-message format. Compared to the average 15-mile accuracy of a 121.5 MHz beacon, a 406 MHz beacon ping might be contained to a three-mile area. One user who inadvertently activated his new GPS-equipped beacon during maintenance said Sarsat rescue phoned him within 10 minutes and pinpointed the beacon's position within 100 yards of his hangar.

As for selecting a retrofit system, that might depend on what type is currently installed in the aircraft, the installer's preference and whether or not you want GPS interface—external or internal. The choice might also depend on the design of the ELT antenna. Faster airframes could require antennas with higher speed ratings. In pressurized aircraft, this could require additional approvals and lots of installation effort.

Your shop should evaluate the old ELT wiring and accessories. Existing 121.5 MHz beacons may or may not have a control head for manual activation and self-test, a TSO requirement for new 406 MHz beacons. It must be located on the instrument panel, accessible by both front seat crew members. The physical installation of the beacon is basically the same as it ever was, but requires that the attachment point is solid enough to withstand a 100G load. If not, a reinforcement mounting plate might have to be fabricated.

GPS-EQUIPPED, OR NOT?

A GPS interface could maximize search and rescue efforts, since the beacon transmits GPS coordinates, along with its programmed address data. But, don't be confused by marketing claims of "built-in GPS navigational interface" because this doesn't necessarily mean the beacon is equipped with its own GPS receiver. Instead, it means that GPS data can be connected to the beacon from a panel navigator over a serial databus. This can be a time-consuming chore that you'll pay for, since it will require the shop to access and run new wiring from the panel GPS into the beacon.

Some beacons will work with portable GPS receivers by inputting NMEA and Garmin's Aviation Out data stream, but it's up to the installer to determine airworthiness.

Speaking of airworthy, since the beacon is mounted in the tail section, it could require sizable interior disassembly to route the harness. This is good reason to include an ELT installation during annual inspection or other avionics projects.

The latest flagship ELT systems are equipped with internal GPS receivers, including the recently certified ELT406GPS from Tyler, Texas-based Emerging Lifesaving Technology. With a list price of $1600, the GPS receiver is contained inside the beacon, while a low-profile blade antenna houses both the GPS and 406 MHz antenna. The system is powered by three owner-replaceable D-cell lithium ion batteries, which are molded in a single pack and cost roughly $200.

While most other 406 MHz beacons also include a 121.5 MHz transmitter, the ELT406GPS does not. Company principle Johnnie Johnson told us the FCC banned 121.5 MHz receivers while the ELT406GPS was undergoing certification, but "the FCC and FAA have since worked out their differences and agreed to allow 121.5 MHz back in any new systems being certified," he told us. Johnson admitted that the company can inexpensively equip the beacon with a 121.5 MHz receiver, but the recertification effort would make it cost prohibitive.

On a side note, although 121.5 MHz distress pings aren't satellite-

The Emerging Lifesaving Technologies ELT406GPS, top photo, has an internal GPS. That's the control head, middle photo, and the combination GPS/ELT blade antenna, bottom.

SHOPS: ELT/GPS A TOUGH SELL

While the handful of avionics shops we talked with said new ELTs aren't flying off the shelves, sales aren't exactly stagnant, either. Unanimously, shops report having to suggest ELT upgrades during other avionics work. For the most part, buyers aren't making a special effort to install these things, unless an existing 121.5 MHz beacon has failed. Interfacing them with a panel GPS (or beacons with internal GPS) isn't exactly high on the priority list, either. That might have something to do with the already improved accuracy of 406 MHz technology. Kirk Fryer at Sarasota Avionics in Venice, Florida, said his customers generally pass on the additional labor to interface a beacon with GPS. John DenDecker at Carpenter Avionics in Smyrna, Tennessee, reports similar trends.

"Many buyers view ELT upgrades as an insurance policy, and people don't like buying insurance," he said.

DenDecker prefers the Artex products for build quality and overall reliability. As for GPS interface, he favors built-in receivers. "Aside from reduced wiring, if the panel GPS goes down, so will position data to the ELT," he said.

monitored, control towers and air crews might be listening in.

Canadian-based Pointer Avionics (not to be confused with Arizona-based Pointer Electronics) sells the Skyhunter 406, which has an internal GPS receiver and is compatible with a variety of antenna options, including an all-in-one GPS/ELT whip. While the Skyhunter has an internal GPS antenna worthy for fiberglass and fabric applications, metal and carbon fiber airframes will require an external antenna. The Skyhunter sells for $1150 with a whip antenna and prewired remote control switch, and $1500 with a high-speed blade.

The $450 ACK E04/R system, pictured below, comes with everything you'll need to upgrade from the extinct model E-01 121.5 MHz system.

PLUG-AND-PLAY

ACK Avionics, ACR Artex and Pointer Electronics offer systems to upgrade same-brand 121.5 MHz models to new 406 systems. This is where you'll need the advice of your shop, which should know which system will be the easiest to upgrade, which type of antenna is required and just how much rewiring will have to be accomplished, based on current configuration. Most of the shops we spoke with generally run new wiring from the beacon to the remote panel switch, so a same-brand drop-in model might not save a whole lot in labor.

The ACK E-04 system is intended for fresh installations, while the E-04R is designed to drop into an existing ACK E-01 installation—a popular 121.5 MHz beacon.

The E-04 and new E-04C Commercial model (for jets and transport aircraft) accept Arinc 429, Garmin Aviation, BendixKing Aviation and NMEA 0183 data outputs for position feed, while the control head fits Artex and Kannad remote control switch panel cutouts, and can use the Ameri-King remote control. The standard system comes with a whip antenna with a 250-knot speed rating. The five-year battery is $153.

The $920 Pointer Electronics model 8000 is designed to replace the company's 121.5 MHz model 3000 and includes a five-year battery pack, remote switch with guard, plus a short whip antenna and cabling. If you have an older Pointer 3000 (the system is still in production), the company honors a lifetime parts and labor warranty and charges a $45 handling fee. The only stipulation is the system has to have an approved Pointer battery installed.

One model that shops we spoke with prefer perhaps more than any other is the $620 Artex ELT-1000. It's reverse-compatible with the older ME406 and can work with some legacy remote control switches. The ELT-1000 doesn't have internal GPS, but it is compatible with a variety of external GPS data labels. Worth mentioning is the ELT-1000 is Garmin's preferred system—with one installed in every aircraft in its fleet—a testament to Artex's GPS compatibility. We like that the ELT-1000 is compatible with a variety of antennas. That isn't the case with the budget-minded $550 ELT-345, which comes in only one kit form (with a whip antenna) and is limited to aircraft with speeds under 225 knots. The ELT-345 shares much of the same feature set as the 1000, including external GPS compatibility.

On the topic of Artex, 406test.com is ACR Electronics' web-based ELT self-testing and beacon management service. For a one-time fee of $60—which includes one ELT test—and $30 per test after the beacon is registered, you can perform a satellite diagnostic test on the beacon using its internal test circuit. Simply log in to your account and enter the aircraft information. Once the self-test is initiated, you'll receive notification through the smartphone app and if it passes, you can print an FAA-compliant certification for the aircraft records. The service even has fleet management, providing reminders when certifications are due.

KANNAD

When we last covered 406 ELTs nearly five years ago, we favored the

French-made McMurdo Kannad AF Compact for its small size, which measures 6.6 by 3.9 by 3.4 inches and weighs 1.8 pounds. Shops we spoke with during our research also favored the Kannad not only for its small footprint, but also for its field programmability.

Also worth mentioning is the Compact's single six-year battery (priced at $500), which powers both the beacon and the remote control switch. This means the system remains independent of the aircraft electrical bus.

The follow-up product to the Compact is the $1200 AF Integra model, which has all of the same features, but with a built-in GPS receiver. Like the Compact, the Integra is compatible and approved with an external whip, rod or blade antenna. The beacon also houses a GPS antenna, eliminating the need for an external one. The Integra can be removed from the aircraft and will still transmit position.

We like that the Integra is compatible with several remote control switches, which might be matched to the existing ELT wiring configuration, or available panel space. This including the RC100, which connects to the beacon with a supplied three-wire interface cable (all of the switches are available with optional programming dongle for programming the beacon inside of the aircraft). The RC102 switch assembly interfaces with the beacon via a two-wire interface and the RC200 (standard with every system) is compatible with both three or four-wire harnesses, perhaps the most common wiring interface.

The Ameri-King AK-451 (which can replace the 121.5 MHz AK-450) is 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. So if you auger, survive and need to hike away from the crash, you can take the beacon with you.

The AK-451 has a transmit battery life of 78 hours. The battery has a five-year replacement interval and there's internal self-test monitoring. It comes standard with a whip antenna rated for 300 knots and there are optional blade and rod antennas for use on jets, turboprops and rotorcraft.

SELECT 406 MHZ ELT SYSTEMS COMPARED

MODEL	STREET PRICE	GPS INTERFACE	BATTERY COST	COMMENTS
ACK E-04/R	$450	SERIAL DATA	$155	Easy upgrade from earlier E-01 series.
AMERI-KING AK-451	$570	SERIAL DATA	$134	78-hour battery endurance, portable antenna for handheld use
ARTEX 1000	$620	SERIAL DATA	$180	Various antenna options, liberal data label input
ARTEX 345	$550	SERIAL DATA	$180	Limited to whip-style antenna
EMERGING LIFE-SAVING 406ELTGPS	$1095	INTERNAL	$212	Internal GPS saves wiring.
KANNAD COMPACT	$950	NONE	$500	Field programmable, small size
KANNAD INTEGRA	$1200	INTERNAL	$200	Internal GPS antenna for fiberglass and fabric applications.
POINTER 8000	$920	NONE	$135	Direct replacement for 3000 series
SKYHUNTER 406	$1150	INTERNAL	$175	Integral USB port for Internet-based programming, internal GPS antenna

TOP PICKS

As we mentioned, how you might choose depends on what is already installed. We favor the Artex ELT-1000 because of its fair price and antenna options. If you don't need a high-speed antenna, save the $70 and go with the Artex ELT-345.

For integrated GPS, we think the Kannad Integra is a good value at $1200. We like the internal antenna for a simplified installation and for use in fiberglass and fabric airframes, plus its smart battery management.

In a follow-up article, we'll look at portable locator beacons, a backup alternative when retaining a functioning 121.5 model.

At $1150, the Skyhunter, right, has integral GPS and antenna, plus a USB port for Internet programming.

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www.pointerinc.com

Pointer Avionics
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Oil Analysis Providers: It's About Service

We sent oil samples to five analytical labs. Blackstone and AvLab gave same-day results and they're our top picks.

by Rick Durden

We consider engine oil analysis to be a valuable early warning system for certain types of engine problems. It allows an aircraft owner and maintenance technician to catch those problems before they become safety of flight items.

Because we feel it's valuable, we wanted to know more about the labs that perform it. Do they give results consistent with each other? What is the turnaround time for a sample? Can they explain the results of a sample in a way that makes sense to an aircraft owner? Is there information on their website about the process and results clearly?

To answer those questions, we'll give you a thumbnail sketch of oil analysis, then look at five of the most well-known labs—with what they offer and what they charge—and give our recommendations. We overnighted oil samples from two airplanes to five popular labs—receiving notification of the time of delivery—to monitor response time (you may need a fast response if you're doing a prebuy on an airplane and need to see if there's a deal-killer in the oil). We did not alert the labs that the samples were en route.

We'll tell you up front that we put Blackstone in first place and AvLab second for their rapid response time, quality of their reports, knowledge of aircraft engines and information presented on their websites. We do not recommend any of the others.

The samples were from a Cessna T210L with 609 hours since major and a Piper Warrior with 2600 hours since new.

Where it all starts. A technician about to drain the engine oil—a plastic container for the sample is at the ready.

THE BASICS

All engines wear during normal operation—eventually they wear out. As they wear, they shed microscopic metal particles, too small to be caught in the oil filter—less than five microns in diameter. (A micron is one-millionth of a meter.) The quantity and type of particles produced as the engine is operating normally varies between engines, although there are commonalities between engine models.

Since wear is normal, analyzing the engine oil at every oil change provides a history of the type and quantity of metal particles shed by an engine, which means any significant change in the pattern is obvious and provides a warning that something is going wrong.

The value of oil analysis is trend monitoring. That means three things:

First, deciding to send in an oil sample for analysis only after you find pieces of metal with part numbers on them in the oil filter may not be of any value because the engine's degeneration may be so bad that there aren't any particles being shed small enough to make it past the filter and be analyzed.

Second, it's using the system backward—without trend monitoring, it's impossible to tell what led to the

A lab tech testing for oil viscosity—a test that can help determine if the oil has been overheated or contaminated.

current condition and whether it's a symptom of the problem or a result.

Finally, because the value of the system is trend monitoring and the values obtained from one lab may vary from another, it's a good idea to stick with one lab.

Even though oil analysis is trend monitoring, we also recommend it on pre-buy examinations because it may turn up something that requires further evaluation or warns you to walk away from the airplane—that's why we think a lab should be able to give you a result fast.

To have your oil analyzed the first step is to get a kit from one of the labs. Most sell the kits through the big aviation product suppliers, although one, Blackstone, sends out the kits for free and only charges your credit card after the analysis is complete (we like that a lot). The kits consist of a container, a form to be filled out and media for holding and shipping the sample.

Once you have the kit and are ready to take a sample, follow the procedure outlined in the kit. Fill out the form, providing the information requested such as engine model, time since overhaul, time since the last oil change and type of oil. Then ship the sample.

A container of a few ounces of oil is not hazmat. We noted that only Blackstone provides detailed information about this on its website. We think a lab's website should have clear instructions on shipping—and dealing with a shipping rep that doesn't know the rules.

Once the lab has received and analyzed your sample, it will provide you with a report, usually via email.

THE TESTS

We think a good lab should run four tests on your engine oil, spectral, insolubles, viscosity and flashpoint.

In its very basic form, oil analysis consists of spectral analysis—running a sample of your engine oil through a spectrometer. It determines the levels of various elements (metals) in parts per million, as well as additives, in the oil. Most of the labs only did a spectral analysis. We found that the results of the spectral analysis to be within a few parts per million between the labs—within what we felt to be normal measuring variation.

The insolubles test measures the amount of abrasive solids in the oil—they are formed by oil oxidation and blow-by past the piston rings. It's a basic sediment and water test performed in a centrifuge, and it is an indicator as to how well the oil filter is doing. All oil has solids in it; the question is whether the amount is appropriate and whether the oil has oxidized.

The viscosity test measures the grade (thickness) of the oil. You tell the lab on the form you filled out what type of oil was used—the test determines whether the viscosity falls outside the range for that oil. If it does, it's a heads-up that the oil has either been overheated or contaminated, usually with fuel.

Flash point is a test that measures the volatility of the oil—the temperature at which the vapors ignite. It should flash at a given temperature for a specific grade of oil. If it flashes at or above that temperature, the oil is not contaminated. If it flashes below, it's contaminated; an indicator of a problem. The most common contamination is fuel due to a system issue or from normal priming.

THE LABS

We obtained **AvLab's** (www.avlab.com) Metal Check oil analysis kit through Aircraft Spruce. The price is $14.95 or $18.95 for the pre-paid "FedEx-Smart Post" shipping-paid version that can be dropped off at either the Post Office or Fed Ex and

ONE TOOL IN THE ENGINE-LIFE KIT

We recommend that every aircraft owner have his or her engine oil analyzed at every oil change. That doesn't mean oil analysis is the be-all and end-all of methods to maximize engine life and catch problems before they become serious. As far as we're concerned, it's one of the five main tools in the kit used by the aircraft owner and his or her maintenance technician to assure a long, happy life for the engine.

As pointed out in the body of the article, oil analysis is both a trend-monitoring device for long-term health of the engine as well as an alert mechanism that can sound the alarm should something serious be developing over the course of the last few dozen hours of flight.

Nevertheless, while we think it's important, it's not enough by itself. As Scott Utz, principal and head of maintenance of Arapahoe Aero at Denver's Centennial Airport, told us, the engine health tool kit consists of oil analysis, compression check results, borescope examinations, engine analyzer data and the maintenance technician's personal knowledge of the engine accumulated over time.

Relying on just one method of inquiring into engine health has cost owners a lot of money over the years. For example, to this day, mechanics are recommending—and owners are acquiescing—to yanking and replacing a cylinder when a compression check doesn't meet the technician's standard. That's despite the fact that it's been more than 10 years since Continental issued SB03-3 that requires that the results of a compression test be corroborated by other, noninvasive, methods including a borescope exam, review of oil consumption, appearance and color of the oil and crankcase pressurization.

By the same token, one oil analysis report that shows a high level of wear is virtually never the reason to ground the airplane and send the engine off for overhaul.

The report should be evaluated in conjunction with, at least, changes in quantities and type of metal found during the inspection of the oil filter that was done during the oil change, how things look through the borescope, trend indications in the engine analyzer data, previous oil analysis results, color of the oil and crankcase pressurization. Almost invariably, the right thing to do is fly the airplane for five to 10 hours while monitoring engine operating parameters and take another oil sample.

Until we have Star Trek tricorders that can tell us the exact condition of our engines through a few-second scan, evaluating engine health in the short and long run is a matter of good detective work, which means not limiting ourselves to just one source of evidence.

tracked to the Kenner, Louisiana, laboratory. AvLab sent us an email with its report the day it received our samples—faster than the advertised 24-48 hour turnaround it advertises. The report included levels of 12 elements with comparisons to the lab's experience with average wear levels for the type of engine. Based on the results, the lab techs make comments and recommendations.

AvLab's analysis only includes spectral analysis, not insolubles, flash point or viscosity, but it does include lead quantity in the spectral analysis, one indicator of blow-by. The report is color-coded to warn both of high absolute wear values as well as major changes from previous tests. Previous reports are attached with the current one. The website contains good information on the source of wear metals and has a moderate level of information on the oil analysis process but is not easy to navigate.

Based in Fort Wayne, Indiana, **Blackstone Laboratories** (www.blackstone-labs.com) sends out sample kits at no charge. You don't pay until it emails you its report. Price for a standard analysis is $28 and it includes the four tests we feel are appropriate. The report is among the most complete and includes not only past results for fast trend monitoring, but also what it calls universal averages and unit/location averages for each metal. In addition, the easily navigated website provides information as to where each wear element/metal potentially came from in your engine, something we feel is valuable. It also provides videos on such things as taking a sample and understanding the report.

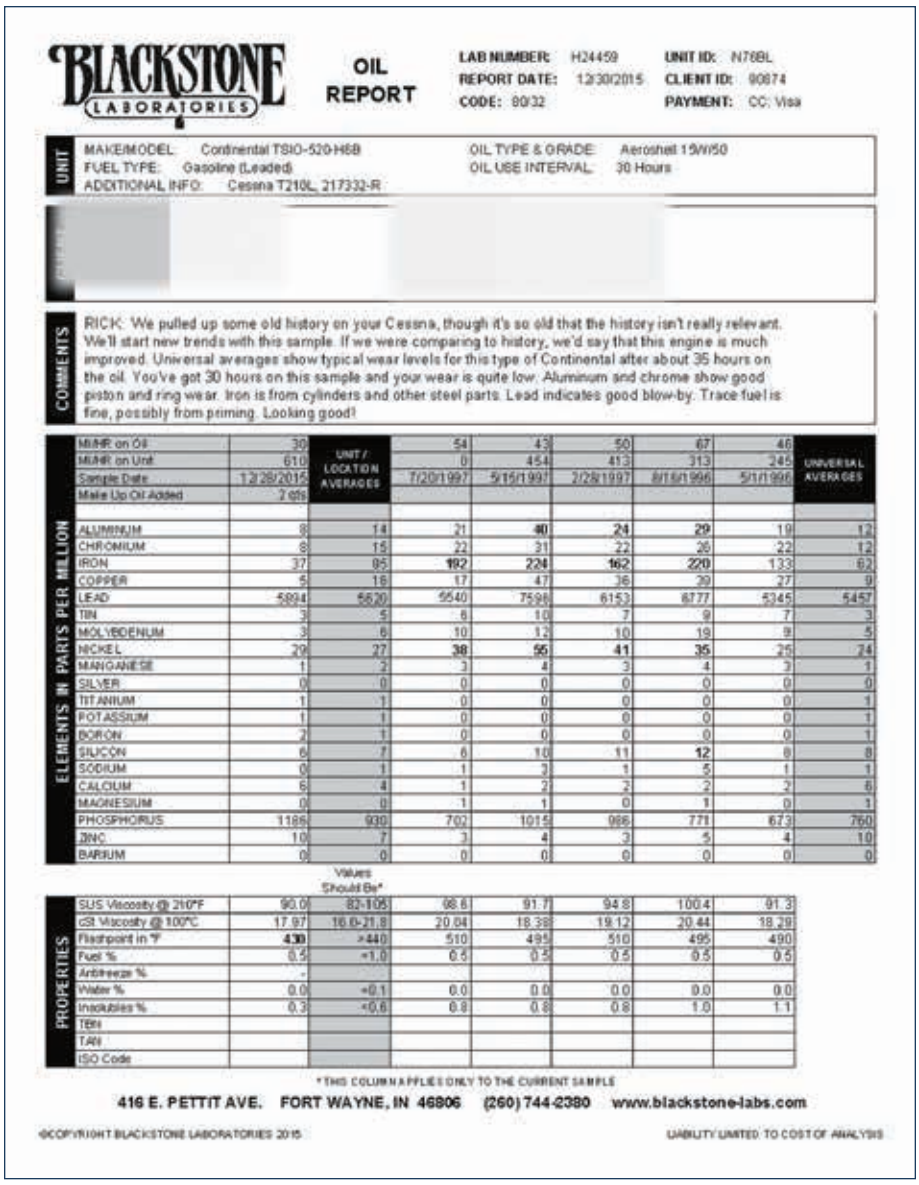
Above the hard data on Blackstone's report there is a comment section in which the techs give their evaluation on the results. As with the comments section on AvLab's report, coming from folks that have looked at a multitude of analysis results on a particular type of engine, we consider those comments to be of great value. In our experience they include potential sources for wear metal, evaluation of piston and ring wear considering the time on the engine, blow by and why there may be some fuel contamination (often normal from priming).

Blackstone says it will do its best to analyze and report on an oil sample it receives of a morning via overnight delivery. It did so with what we sent.

Oil Analyzers, Inc. (www.oaitesting.com) has several labs and encourages users to send its $24.60 ($34 postage paid) kit to the nearest. It advertises 24-hour turnaround on samples, although it sent us a notice it had received our samples the morning that UPS advised us they had been delivered, we had not received reports by the end of the next business day.

The company provides parts-per-million element information as do the other labs, however, it breaks those metals down into categories of wear, contamination, multi-source and additive—something we thought was useful. The presence of 24 metals are reported as well as a breakdown by micron size of the particles. Oil Analyzers also reports on oil viscosity and oxidation. The company appears to target customers more in the motor vehicle and industrial equipment sector than it does in aviation—and the reports do not provide comments on engine wear. Due to a lack of orientation toward aircraft engines and failure to provide a report within two business days of receipt of a sample,

A Blackstone Oil Report for a Cessna T210L showing the wear metals found in the oil, averages expected for the type of engine and comments on the sample.



BLACKSTONE LABORATORIES

OIL REPORT

LAB NUMBER: H24459 UNIT ID: N76BL
REPORT DATE: 12/30/2015 CLIENT ID: 90874
CODE: 80/32 PAYMENT: CC: Visa

UNIT
MAKE/MODEL: Continental TSIO-520-H6B
FUEL TYPE: Gasoline (Leaded)
ADDITIONAL INFO: Cessna T210L, 217332-R
OIL TYPE & GRADE: Aeroshell 15W50
OIL USE INTERVAL: 30 Hours

COMMENTS
RICK: We pulled up some old history on your Cessna, though it's so old that the history isn't really relevant. We'll start new trends with this sample. If we were comparing to history, we'd say that this engine is much improved. Universal averages show typical wear levels for this type of Continental after about 35 hours on the oil. You've got 30 hours on this sample and your wear is quite low. Aluminum and chrome show good piston and ring wear. Iron is from cylinders and other steel parts. Lead indicates good blow-by. Trace fuel is fine, possibly from priming. Looking good!

ELEMENTS IN PARTS PER MILLION

Miles on Oil	30	UNIT / LOCATION AVERAGES	54	43	50	67	46	UNIVERSAL AVERAGES
Miles on Unit	610		0	454	413	313	245	
Sample Date	12/28/2015		7/20/1997	5/16/1997	2/28/1997	8/16/1996	5/1/1996	
Make Up Oil Added	2 qts							
ALUMINUM	8	14	21	40	24	29	19	12
CHROMIUM	8	15	22	31	22	26	22	12
IRON	37	85	192	224	162	220	133	62
COPPER	5	16	17	47	36	39	27	9
LEAD	5894	5620	5540	7596	6153	8777	5345	5457
TIN	3	5	6	10	7	9	7	3
MOLYBDENUM	3	6	10	12	10	19	9	5
NICKEL	29	27	38	55	41	35	25	24
MANGANESE	1	2	3	4	3	4	3	1
SILVER	0	0	0	0	0	0	0	0
TITANIUM	1	1	0	0	0	0	0	1
POTASSIUM	1	1	0	0	0	0	0	1
BORON	2	1	0	0	0	0	0	1
SILICON	6	7	6	10	11	12	8	8
SODIUM	0	1	1	3	1	5	1	1
CALCIUM	6	4	1	2	2	2	2	6
MAGNESIUM	0	0	1	1	0	1	0	1
PHOSPHORUS	1186	930	702	1015	986	771	673	760
ZINC	10	7	3	4	3	5	4	10
BARIUM	0	0	0	0	0	0	0	0

PROPERTIES

		Values Should Be*					
SUS Viscosity @ 210°F	90.0	82-105	88.6	91.7	94.8	100.4	91.3
cSt Viscosity @ 100°C	17.97	16.0-21.8	20.04	18.38	19.12	20.44	18.29
Flashpoint in °F	430	>440	510	495	510	495	490
Fuel %	0.5	<1.0	0.5	0.5	0.5	0.5	0.5
Antifreeze %	-						
Water %	0.0	<0.1	0.0	0.0	0.0	0.0	0.0
Insolubles %	0.3	<0.6	0.8	0.8	0.8	1.0	1.1
TBN							
TAN							
ISO Code							

*THIS COLUMN APPLIES ONLY TO THE CURRENT SAMPLE

416 E. PETTIT AVE. FORT WAYNE, IN 46806 (260) 744-2380 www.blackstone-labs.com

LIABILITY LIMITED TO COST OF ANALYSIS

we cannot recommend the company.

Lab One (www.laboneinc.com) began its life 30 years ago as an aviation oil analysis laboratory and expanded into other services. Based just outside of Phoenix, Arizona, it provides a 20-element oil analysis plus an oil viscosity report. Price for the kit, through Aircraft Spruce, is $12.95. We overnighted two kits with samples in one envelope and received confirmation from UPS the next morning that the package had been delivered. By the middle of the third business day, we had heard nothing from Lab One.

Adding to our dissatisfaction with the silence, we found that despite the company's avowed aviation background, there was virtually no information on oil analysis in general or as it applies to aircraft engines on its website. The example reports provided were for diesel engines and engine coolant. While the price for Lab One's service is attractive, we were not satisfied with the response time or the information we could receive on the website and cannot recommend Lab One.

We received the reports from **Aviation Oil Analysis** (through ALS Laboratory Group's Tribology Division) (www.alsglobal.com) the morning of the third business day after it had received the samples. According to the advertising, "Upon receipt at the laboratory in Phoenix, AZ, the oil sample is analyzed and a full report is forwarded within 24 hours."

The reports provided are rudimentary, sampling only seven elements. There is a basic color-coding regarding the overall condition. Past results are shown along with a graphic presentation that we liked. The diagnosis/recommendation provided for each case was terse: "All values appear normal."

We obtained the kits for $12.95 each through Aircraft Spruce. As with the other kits, a form is included to provide information on the engine and oil. There was no form in one of the kits—and they serve as proof of purchase for the lab. Nevertheless, using the form we got, we provided the requested information on a sheet of paper and enclosed the Aircraft Spruce shipping label showing we had bought the kit—we're pleased to report that it worked.

The website provides no information whatsoever about its aviation oil analysis. Overall, the company's slow response, very basic report and absence of information on its website, led to the conclusion that we cannot recommend it.

CONCLUSION

Comparing oil analysis results indicated to us that the differences between spectral analysis results for the same oil sample—where parts per million are being measured—were so small that they can be chalked up to noise in the data and small differences within the same oil sample.

That led us to the conclusion that for aircraft engine oil analysis, what matters is the level of service provided and the ability of the level of aircraft engine expertise offered. Therefore, we recommend only two of the providers. We rank Blackstone first and AvLab a close second because of the quality of their reports, their response time and the fact that they know the general level of wear expected for engine types and thus make informed comments and recommendations based on the data and their experience. Blackstone got the nod because it does more involved testing, doesn't charge for the service until it's completed and has a more informative website.

COCKPIT ACCESSORIES

Aftermarket Visors: Rosen is Still Tops

But Vantage Plane Plastics has competitive products for Cessnas and RAM's portable visor can accommodate any airframe, including taildraggers with tubes.

by Paul Bertorelli

The lowly aircraft sun visor isn't really a safety accessory until you have to land on runway 27 an hour before sunset on a summer evening. The accident record is peppered with pilots who lost control because they lost sight of the runway at a critical moment due to sun glare. Into this narrow breach of need several companies have stepped up, offering improved visors and shades.

And they aren't entirely about safety, but also comfort. Squinting into a low sun or being broiled through a canopy or windshield for several hours gives a bright new dimension to the definition of misery. Fortunately, a range of products are designed to address this annoyance and the market is somewhat more competitive than it was the last time we visited this topic.

Rosen's newest product is the Monorail mount system, left. In addition to visors, it can also support tablet mounts.

Visors and shades sort themselves into two categories: Permanently installed replacements for OEM equipment and portable or temporarily installed visors to cut the glare on demand. These span the price range from under $5 to several thousand for top-of-the-line installed visors for turbine aircraft. We'll examine some of the popular options in this report.

INSTALLED VISORS

Installed visors in legacy aircraft run the gamut from not that bad to barely adequate versions of automotive-type visors. Older training aircraft are notorious for minimal if not missing visors. The two companies plying the replacement OEM market are the well-known Rosen Sunvisor Systems and, more recently, Vantage Plane Plastics with two lines of visors for Cessna and Beechcraft aircraft, with more approvals pending.

Rosen is a constant fixture at the major shows and has been in the visor market since 1985. Although it started in aviation, the company expanded with visors for the military, transportation and heavy equipment markets. By most standards, Rosen visors are considered top of the line with prices commensurate with the premium market the company plies. Rosen has more aftermarket approvals than any other visor manufacturer.

With its first visors, Rosen took visor design several notches beyond even the best OEM offerings of the day. Rather than an upholstered flap, Rosen introduced optically balanced acrylic visors supported on nicely machined articulated mounts customized for each

We wouldn't call Rosen lenses delicate, but as the broken one shows, care is required in adjusting them.

Vantage Plane Plastics has a full line of visors for most Cessna models, right. These fit the existing OEM mounts. RAM's visor, lower photos, attaches with a suction cup.

aircraft. Although the visors fit in the original mounts, they offer better glare protection for being larger, with enough transparency to see through without giving up the desired protection. Rosen visors are more adjustable than most OEM visors, albeit with one caution: They can be delicate and require care in repositioning lest the plastic break. (See photo opposite page.)

With Rosen quality comes a moderately high price tag that varies with both the aircraft and the mounting style. (Some visors are center mounts; some are side mounts, automotive style.) Aircraft Spruce lists a pair of center-mount Rosens for a Cessna 172 at $343, while a Cherokee center mount set costs $419. No surprise that more capable aircraft also require more expensive visors. A set for a Malibu retails for $1590.

Rosen covers most models and even has universal mounts for amateur-built aircraft. The visors use the original mount point and generally don't require modification to the aircraft, although some may require minor mods. The prices include the necessary STC to replace the OEM visor, if the aircraft was so equipped.

Rosen visor systems can be adjusted to place the lens between the pilot's eyes and the sun, just above the glareshield. In addition to pivoting in two axes, they can also be adjusted along the length of the mounting arm using a small thumbscrew. Once adjusted, they stay put.

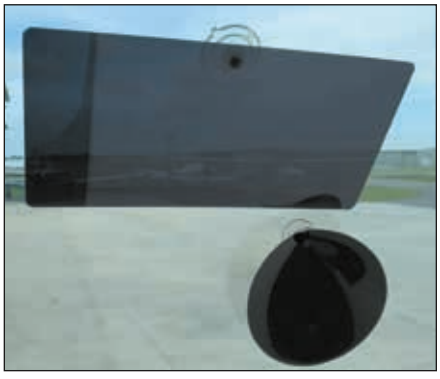
Rosen has recently introduced a new mounting system it calls a Monorail. The mount is a curved metal rod shaped to the contour of the cabin ceiling above the windshield. The visors are suspended from the rod and can be moved laterally along the rod's length for adjustment or pivoted up out the way against the ceiling when not needed.

Rosen originally developed the Monorail for turboprops and light jets, but it's beginning to migrate the system into smaller aircraft. In keeping with demand for cockpit accessories, the Monorail can also mount a moveable bracket for a tablet, as shown in the photo on the opposite page. As with Rosen's other products, the anchor point of the Monorail is the original mounts for the OEM visors. We don't have Monorail prices for smaller aircraft yet, but for jet aircraft, the system retails in the $1500 to $2200 range. More prices and applications are expected during 2016.

VANTAGE

Competing with the top-of-the-line offerings from Rosen in the installed visor market are two product lines from Vantage Plane Plastics, a company well-established in the PMA replacement plastic field. While Vantage also sells the Rosen line, they offer ARFC visors for Cessnas and Ayers visors for Beechcraft and experimental aircraft. Like the

The Ayers visor, left, is similar in design to Rosen models but fits only Beechcraft aircraft. The Dim-It and Sun Spot, lower photo, are suitable for on-the-fly glare blocking.



Rosens, ARFC visors use the original mounting points and have a dark lens that pivots down from a single axis mounting point. Vantage has a long list of Cessna approvals for its visors,

most priced at $192.79, although some sell for $225.50. Specs on the installation documentation describe the lenses as cast acrylic Lucite.

The ARFC products we examined are robustly made, but not, in our view, quite up to Rosen quality. (But then they cost half as much.) The sample we were sent had a stiff metal bracket riveted to the lens and the lens itself was dark and optically true.

A step up is the Ayers visor system from Vantage. We would say this product is in the Rosen style, with a dark lens attached to a concentric rod arrangement that allows lateral adjustment across the width of the cockpit.

The attach point is a base that screws into existing mounts. At $399.95, the Ayers products are priced to compete with Rosen, but only Beechcraft airplanes are approved. Also, we noted that the edges of the lens were sharp and could have used some dressing with Scotch-Brite.

STICK-ONS

For owners not ready to invest in Rosens or not disposed toward mounted visors, there are plenty of inexpensive stick-on choices.

One of the most effective, in our view, is the RAM Universal Sun Visor. RAM makes ball-and-socket mounts—RAM means Round-A-Mount—and in its prodigious line is a standard suction cup that sticks like glue to smooth surfaces. To this, RAM attached a dark tinted lens via an articulated socket arm. The suction cup can be mounted on a side window or a windshield, as long as the surface isn't too curved.

Rosen's Crew Sun Shade, left, collapses and stows in a small zipper pouch.

We tried this product in a Bonanza and found that the bottom edge of the lens could be adjusted to the top of the glareshield, shielding the eyes entirely from direct glare. It's a bit awkward to adjust and is probably best suited for occasional use, but at about $70 complete, depending on vendor, it's well made and a good value against more expensive permanently installed visors.

For aircraft with interior exposed tubing, RAM has a clamp mount called the Claw that can be used in lieu of the suction cup. For storing the lens when not in use, we think a felt bag would be a good idea.

We found several other stick-ons suitable for occasional use, ranging from the Dim-It and Sun Spot moveable visor, the Adjustavisor and the Slap On Sun Visor. The principle is the same for all of these products, even if the execution varies. The Dim-It and Spot have suction cups and are simply placed to block the glare. The Dim-It is rectangular and larger than the Spot. Depending on source, it varies in price from $7.95 to $11.95. The Spot retails for $13.95 from Aircraft Spruce and Spruce also has a circular Dim-It version called the Mini Dim-It shade for $6.95.

The Slap-On Sun Visor is merely a smoked sheet of heavy plastic that applies to a canopy, window or windshield where needed. It retails for between $4.95 and $7.95, depending on size. Two recommendations here: If that style appeals, buy several because they're cheap and once wrinkled, they're pretty much useless. Keep a sturdy mailing envelope with a cardboard sheet inside to store them and protect against damage.

One unique product that's more of a shade than a visor is Rosen's Crew Sun Shade. For $15.60 from Aircraft Spruce, the sun shade, as the name implies, is a collapsible translucent shade with a pair of suction cups to mount it on a windshield, rear window or canopy. It cuts glare substantially and also appears to reduce cabin temperature. The shade

continued on page 23

Buying Utility STOL: Ignore the Ad Hype

Our top pick is the four-place King Katmai for its overall utility and short-field performance.

Staff Report

Whether for work or a heck of a lot of fun, if you're in the market for a STOL/utility airplane—one that will let you commune with nature in the most rugged of backcountry airstrips as well as cruise at a reasonable speed and carry a little something—what's out there and how do you choose among them?

We looked at what's available in the production Part 23 (CAR3) world for airplanes that are purposefully built for short takeoffs and landings, yet also have respectable cruise speeds—a tough combination, as serious STOL usually means snail-like cruise—to see how they stack up. We did not include LSAs in the mix for a number of reasons, including useful load and trying to keep the sample size reasonable. We did, due to the exploding refurb market, include one machine that is the result of a modification of a production airplane because of its cruise speed and backcountry/STOL capabilities.

The group that made the cut are, in no particular order: Maules (tailwheel and nosewheel), Aviat Husky series, American Champion Scout series and the Peterson 260/King Katmai series.

New, most of the airplanes fall into a $250,000 to $350,000 price range, depending on engine selection and options. As refurbs, the Peterson 260/King Katmai mods fall into the low end of the range, depending on the cost and condition of the Cessna 182 that is to be modified and whether the full mod is carried out.

All of the airplanes meet the old DoD/NATO definition of STOL—able to land or take off within 1500 feet over an obstacle on a standard day, at sea level. Beyond that, which one is best?

Our conclusion is that while the Scout has slightly better handling than the Husky and the King Katmai than the Maules, the question boils down to the needs and wants of the prospective buyer.

All are extraordinarily capable—if the pilot is willing to take a thorough checkout from a knowledgeable instructor. While often bought as second or third airplane by wealthy pilots, they are not toys and require serious respect. Each has particular features/quirks that must be learned in to obtain the performance of which they are capable—or they can eat your lunch.

As the prices are in the same ballpark, the needs of the buyer for useful load, seats and space become a consideration. Do you want a two-seater that you'll use for fun or hauling a bit of stuff to your cabin, or do you want to take some friends along with you? All of the airplanes do pretty well when it comes to the fuel versus payload trade off (although watch it on older models).

The Aviat Husky is capable of impressive short-field performance, although not as stunning as Aviat marketing claims. We think its AFM procedures should be followed for takeoff and landing.

SAFETY

In any discussion of utility STOL airplanes, it's absolutely necessary to talk about the elephant in the room—safety. The combination of operating very near stall speed, in and out of backcountry airstrips or no airstrip at all, means the risk of things going south starts going up fast. When a tailwheel is added to the mix, the accident rate skyrockets.

Marketing of these airplanes is targeted at pilots who want to be able to land anywhere. That's appropriate—but off-airport operations have a very high "Oh $#&@!" factor due to any number of things waiting to bite a pilot who lands where the deer and antelope play.

The advertising for these is classic macho—pure 1960s Marlboro Man, tough-guy-in-the-backwoods schtick. Hmm, nearly all of the Marlboro Man models died from using their product. Backcountry flying is incredibly enjoyable, but it requires a high degree of skill and judement. Buying the airplane from the ad doesn't make you a backcountry pilot any more than ski clothes make you a giant slalom competitor.

We strongly urge anyone considering a utility/STOL airplane to look beyond the advertisements and any performance numbers in them.

We constantly hear that nosewheel airplanes aren't macho and one shouldn't take them into backcountry airstrips because they can't handle the rough terrain. We haven't seen any data that supports the notion that a purpose-built nosewheel STOL airplane can't go anywhere a tailwheel airplane can. We've looked at accident reports for years and

BACKCOUNTRY AIRPLANES: ATTRIBUTES

There are a lot of airplanes that are alleged to be good for backcountry operations by pilots who want to seriously recreate. In doing research for this article, we spent an extended period speaking with the proprietors of Backcountry Aviation in Nampa, Idaho, Kasey Lindsay and Bob Hannah and with Jeff Welch, who gives type-specific utility/STOL training, primarily in the Husky, in Alpena, Michigan. All are highly experienced backcountry pilots.

We asked them for their thoughts on the attributes of a good STOL/backcountry machine. We combined their comments, along with reviews in this magazine of rugged utility airplanes, to come up with our list of as to what makes a good backcountry airplane.

Landing gear strength and stability. It has to absorb punishment from solid touchdowns as well as ever-present rocks, brush and holes. The brake lines should be protected as there's a good chance a gear leg is going to strike something that could break an exposed brake line.

The gear geometry should make ground handling as easy as possible and minimize the risk of noseovers in tailwheel airplanes. The most common cause of accidents in backcountry flying is loss of control on landing—gear design matters.

In addition, the gear geometry of a tailwheel airplane should allow a competent pilot to apply the brakes while the tail is off the ground to allow good visibility over the nose and maximize deceleration. Nevertheless, we strongly advise this be done with extreme caution as the rate of flipover accidents is high.

Suitable stability in pitch to allow precise speed control on final.

Flaps should provide high drag and rapid deceleration so the airplane doesn't float if the pilot isn't perfect with airspeed control.

Easy access to the flap control.

Good visibility over the nose during all phases of landing and takeoff. Hitting obstructions short of, on the runway and just after liftoff are common cause of backcountry accidents. An airplane that has the nose block forward visibility is at risk of hitting something. The nosewheel King Katmai is proving popular partially because of its good visibility over the nose. No nasty behavior in a slip—and the ability to slip steeply, hold the slip into the flare and straighten out at the last moment.

A design that allows installation of oversize tires.

Power. Lots of it. When things go wrong, the ability to climb steeply and rapidly may mean everything. As Kasey Lindsay put it, the airplane has to be able to "climb like a rocket and come out of the sky like a piano."

Good prop clearance.

High wing for brush clearance.

Good overall visibility. When maneuvering for a runway in a canyon, a skylight means you can see what you need to see in a steep turn. Having lots of window area, with few bars and posts that can get in the way is important—especially when looking down and aft, something you do surprisingly often.

Excellent control response in gusty crosswinds and the ability to pin the airplane after landing so a gust doesn't put it back into the air.

Easy-to-use, fast-acting trim system.

The ability to go around at the last possible moment, without a lot of trim change when going to full power in landing configuration—you don't want to have to be stiff-arming the stick or yoke while you're trying to get maximum performance out of the airplane.

A good mix between STOL ability and cruise speed. Sacrificing everything for STOL means a slow airplane in cruise. The ideal backcountry airplane will handle an 800-foot strip safely and get there and back home without having to time the trip with a calendar or worry about running out of fuel.

have yet to see a report of a nosewheel breaking off due to terrain on a backwoods airstrip. While nosewheel pilots may generally self-select away from those strips, backwoods airstrips are regularly used by Cessna 182s, 205s, 206s, 207s and 208s as well as Cherokee 6s. If there were a problem with fragile nosewheels, the data would show it.

The real problem with nosewheels on unpaved airstrips is prop clearance, as noted in the sidebar to the left. Tailwheels aren't perfect when it comes to dealing with rough terrain. We've broken one off, and know of others who have.

RUNWAY LOSS OF CONTROL

The biggest part of the safety elephant for utility STOL airplanes is the rate at which pilots lose control of the tailwheel machines on landing (and, sadly, takeoff). On the opposite page we reproduced the accident summaries from our most recent Used Aircraft Guides for tailwheel Maules and the Aviat Husky series. At least 60 percent of the reported accidents in those airplanes were landing-related.

We did an informal review of Scout-series accidents and found that its landing accident rate is comparable. By comparison, nosewheel landing-related accident rates tend to be one-third to one-half that of tailwheel airplanes.

We recommend that any prospective buyer of a tailwheel, utility STOL airplane go in with eyes wide open to the significant increase in landing accident risk, get a thorough checkout and understand viscerally that touchdown on a backcountry landing must be made with minimal energy—meaning either three-point or with the tailwheel only inches above the ground if there is concern about damaging it.

We also recommend following any manufacturer's guidelines—such as Aviat's call for tailwheel-first landings with full flaps in crosswinds—and respecting the maximum demonstrated crosswind speed.

STOLEST OF THE STOL

It's really the burning question in this world—which one will get in and out the shortest? The answer is, just about any of them with a big engine. On any given day nearly

American Champion Scout Denali on a backcountry airstrip, top. Accident summaries from our most recent Used Aircraft Guide for the Aviat Husky, middle, and all tailwheel Maules, bottom, show landing-related accident rates of at least 60 percent. A review of data for the Scout showed it to be consistent.

any of these airplanes can win a short takeoff and landing competition. YouTube is rife with videos of them getting in and out in only a few airplane lengths. If any of the big-engine versions of these airplanes is stripped of every possible bit of weight, flown by a skinny pilot who knows what she or he is doing and carries minimal fuel, they have takeoff and landing runs akin to a gyrocopter.

For the real world, at gross weight, at sea level, based on AFM numbers and our flight reviews, other than the King Katmai, the airplanes are almost so close from the standpoint of takeoff and landing performance that slight differences in pilot technique can cancel out the differences between the machines.

American Champion publishes a 417-foot takeoff roll on pavement for the 180-HP Scout; Aviat's AFM for the 180-HP Husky shows 580 feet (the Husky AFM says no max performance takeoffs in crosswinds) and Peterson says 270 feet for the 300-HP King Katmai.

Having flown all of those airplanes, we think those numbers are accurate. The King Katmai is so short because its 31-knot stall speed is about 10 knots slower than anyone else.

Maule does not publish takeoff and landing distances. We disagree with that decision. Nevertheless, a number of recent takeoffs and landings in a 235-HP Maule M-7-235C and experience in other models indicate to us that the Maule-series performance is consistent with the Husky and Scout.

With corrections for temperature and runway elevation, we would be comfortable regularly operating any of the airplanes from unpaved strips of less than 1,000 feet (no obstructions) on a standard day, at sea level—after a thorough checkout.

PERFORMANCE/HANDLING

The procedure for a max performance takeoff varies among the aircraft.

The King Katmai uses 20 degrees of flap for takeoff and lifts off at 35 knots due to influence of the canard. It requires pitching down after liftoff to a nearly level attitude with a climb speed of 45 knots. The ailerons are effective even at 35 knots, although we would be cautious about a 35-knot liftoff in a gusting crosswind until we knew the airplane well. We observed very good roll control at 45 knots.

The Maule M-7-235C uses 24 degrees of flap on takeoff, but no liftoff speed is published. We have lifted off from three-point attitude with good control authority in all axes. The Scout calls for just 14 degrees of flap and liftoff at 50 MPH, so the tail has to be lifted to keep the airplane on the ground to the published liftoff speed. It has good aileron authority down to stall speed.

The Husky manual calls for full flaps on a max-performance takeoff. It then presents a quandary—it says to hold the tailwheel on the ground, but liftoff at 53 MPH, which is impossible. The tail has to be raised to keep the airplane on the ground to 53 MPH.

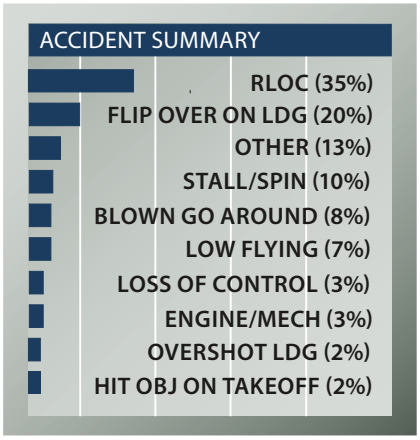
If the tail is kept on the ground, the rate of acceleration is reduced, but a 180-HP Husky will lift off as low as 40 MPH in three-point attitude. That's at or below the power-on stall speed—it flies because it's in ground effect.

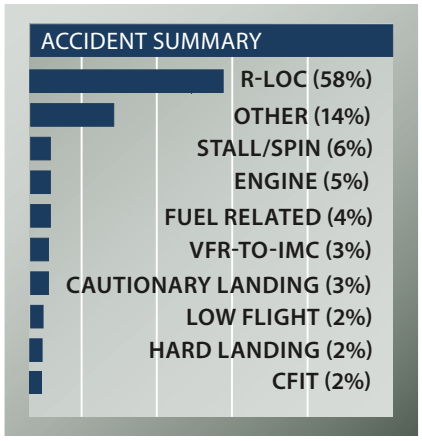
In a series of flights we conducted with Jeff Welch, a high-time Husky instructor who provides type-specific checkouts, we observed that there is about a 100-foot reduction in takeoff roll when the airplane lifts off three-point versus holding it on the ground to the recommended 53 MPH.

At altitude, Welch had us fly the airplane just above stall speed, with full flaps and full power and observe the aileron effectiveness when moving the stick stop to stop for roll command.

Of the airplanes we flew for this review, we observed the Husky to have the slowest roll rate and least effective ailerons at speeds close to the stall with full flaps. It was also the most difficult to coordinate when rolling, slightly edging out the Scout.

Welch explained that in 2005 the span of the Husky's flaps was increased, which reduced the span of the ailerons. The ailerons were re-





200-FOOT TAKEOFF ROLL? NONSENSE

A number of readers contacted us, attaching copies of the ad depicted below showing a Tundra tire-equipped Husky perched in the high country. The readers either asked if the numbers were true or claimed they were what comes out of the south end of a northbound bovine.

We found that unless the airplane is stripped to minimum weight and flown by an expert, the 200-foot takeoff distance number is a figment of someone's imagination, especially when operating off of an unpaved surface at higher elevations. The AFM for the Husky provides a chart to calculate takeoff distances for the airplane at gross weight in calm wind conditions. For a 2200-pound gross weight A-1B, at sea level on a standard day, the ground roll portion of the takeoff distance for a normal takeoff—flaps up—is 775 feet. For a maximum performance takeoff—30 degrees of flaps—the ground roll drops to 580 feet on a dry, paved surface.

Going to a high elevation airport, we looked at a 5000-foot elevation on a standard day; the ground roll for a maximum performance takeoff is 800 feet. In our opinion, those numbers are impressive. They are consistent with the American Champion Scout, a direct competitor and similarly impressive performer.

Aviat Aircraft's Steve Anderson said the Husky's AFM is written with performance figures for the average pilot with standard pilot technique, and the figures have a built-in safety margin for reliability. In preparation of this article, we did numerous takeoffs in a loaded Husky and our experience was consistent with the AFM data. We have no reason to dispute the Husky AFM data.

Still, why Aviat advertised a 200-foot takeoff distance for the Husky, despite its own data, baffles us. In the 1960s, the intense competition between Beech, Piper and Cessna meant each manufacturer fought to have the highest cruise speed numbers in their handbooks. One manufacturer put inflated numbers in its manuals for several years. The result was a widespread belief that all manufacturers lied about performance numbers. Despite the manual numbers being accurate—or even conservative—from the 1970s on, there are still lingering suspicion about them.

We are aware of the internal fights that go on within aircraft manufacturers as marketing wants to inflate performance to sell airplanes and engineering fights to publish accurate information. We don't want to see inaccurate performance claims by one general aviation manufacturer again taint all of them.

We don't like advertising that inflates performance. We note that when we contacted Aviat asking about this advertisement, we did not get a response, however, we also haven't seen it in any print publication since then. If Aviat has pulled the ad, we applaud the decision.

Maule M-7-235C, above right, offers essentially the same runway performance as the Husky and Scout, but with four or five seats. King Katmai, below right, is a Cessna 182 with a canard and modified wing and a stall speed of 31 knots—and demonstrates that tailwheels are not mandatory in the backcountry.

designed with a longer chord, but he observed a reduction in roll rate in what he referred to as the new wing airplanes. We contacted Aviat and asked about the roll rates of the two wings, but did not get an answer.

Welch expressed concern about uncommanded roll of the airplane following a full-flap takeoff in three-point attitude in a crosswind (a procedure contrary to the Husky AFM). Lifting off at or below the power-on stall speed makes the airplane vulnerable to one wing stalling. Application of aileron to counteract the roll may not be productive due to the high adverse aileron yaw rate, which can aggravate the rolling tendency.

Welch referenced six shortly after takeoff accidents which he believes were due to uncommanded roll. He teaches his students to follow the Husky AFM by making all crosswind takeoffs with the flaps up and to keep the airplane on the ground to 53 MPH when making a full-flap, max-performance takeoff.

FEATURES/QUIRKS

The Husky, Scout and Maule all have very high adverse aileron yaw when maneuvering at low speed. The Maule line has an interconnect between the ailerons and rudders (simplified explanation) that assists with coordinating the controls.

All require dedicated effort by the pilot to learn how to keep the airplane coordinated and to do so in low-speed operations, especially in turbulence on a short field takeoff or landing.

The Husky and Scout—except the Denali—have flat (no airfoil) horizontal stabilizers. The effect is to increase the airplane's tendency to roll off abruptly in a cross-control stall. A cross-control stall in those airplanes can mean a loss of several hundred feet even if the recovery is done precisely right.

The Husky's trim system requires a new pilot to spend a little time getting used to its operation and how to recover from an out-of-trim event such as a go-around.

The fuel systems require education—on many Maules a transfer pump is used to get fuel from the aux tanks into the mains. On most Scouts two wing tanks are interconnected, which means using care when filling the tanks to assure they are actually full.

Cabin comfort varies, even though all offer high-end interiors. The Husky is more difficult to board than the Scout and has slightly less room once inside. Maules and the Petersons have much more room to carry people and things, although the 182 conversion is roomier for occupants

It still boils down to landing—and that a new pilot become comfortable with the very low approach speeds required for the backcountry. That requires training so that low-speed flying and rudder coordination become second nature. It means understanding that it's never appropriate to tack on extra speed on approach or touching down at the speed of heat if making a wheel landing.

CONCLUSION

We treasure the time we have flying utility/STOL airplanes off unimproved airstrips. For sheer fun, nothing beats a Husky with the door open. We think that open door trumps the Scout's better handling when it comes to sales.

Nevertheless, in the two-place, utility/STOL market, we lean toward the Scout for its low-speed handling, ease of entry, easier trim use and cabin comfort.

While the two-seaters win the fun battle, for the price per seat, overall utility and short-field performance, we favor the Maule and Peterson/Katmai lines. Between the two, we like the amazing STOL ability and roomy cabin of the King Katmai.

Exposed parts for you to see. The wired board on top is the GPS/AHRS. The clear case is the Raspberry Pi. Beneath that are two blue SDRs. Power is from USB, or the red battery brick.

Stratux ADS-B: DIY and Save Big

You can have ADS-B weather and traffic on your iPad for as little as $61. Some assembly is required.

by Jeff Van West

Get pilots talking about ADS-B and they start griping about money. Forget the soon-to-be required ADS-B out systems; just getting free ADS-B weather and traffic costs between $500 and $1100. If you want it to work with ForeFlight Mobile, the most popular aviation app by far, you are limited to only one brand of receiver—Appareo's Stratus.

Portable ADS-B In isn't that complicated. It requires a 978 MHz receiver for weather and some traffic, a simple computer that converts those signals to a common protocol and transmits the results via Wi-Fi. You can pump up system performance with a second 1090 MHz traffic receiver, GPS position and AHRS.

So if you had the right shopping list, the software to put on the computer and a little technical savvy, you should be able make your own. And that's exactly what the Stratux is.

We built one and discovered: Yes, you can build a working portable ADS-B receiver with parts ordered off Amazon. No, it's not "just as good as an Appareo Stratus 2S." And, yes, it will work with ForeFlight—at least for now.

WE CAN DO THIS

Chris Young is a programmer and pilot who loved the idea of ADS-B on his iPad, but didn't feel the value justified the price. He'd heard other efforts to use a software-defined radio (SDR) to receive ADS-B didn't work, but decided to try anyway. SDRs look like USB flash keys with an antenna and can receive a range of frequencies. They cost about $30.

Chris plugged one into a Raspberry Pi, which is a project computer about the size of a deck of cards. In a couple of days, he had ADS-B weather on his iPad, so he published the results to see if anyone could benefit. So many pilots expressed interest that Young created a sub-reddit that's now the home of Stratux (https://www.reddit.com/r/stratux).

Users now have Stratux homebuilds flying in every configuration and regularly try out new equipment. They also support each other, recommend hardware choices and discuss additions to the software.

Several have created 3D printed cases to stuff all the parts into so a Stratux is as convenient as a commercial unit. For a more utilitarian appearance, others just stick with rubber bands and duct tape.

NUTS, BOLTS AND SOLDER

The Reddit discussion includes instructions and a shopping list for building your Stratux. That list is already outdated, so read up before you buy. It also depends on how much work you're planning on.

For example, if you just want to plug it all together and go, the $60 Raspberry Pi B+ Kit with a case and Wi-Fi included plus the newer Nano-SDRs ($40 each) are compact and easy. You also might want compact antennas ($10 for both) instead of the stock ones and their long cables.

But if you're planning on building everything into a custom box, you could look at the new Pi Zero for a computer for only $5 and the $30 SDRs that you'll remove from their stock cases anyway. The Pi Zero is new and we don't know of a Stratux using it yet, but Chris Young says it should work fine.

The RY835AI GPS listed is a bare chip. We stuck it to the top of the Pi with double-sided tape, but you'll want it inside some plastic case if you have concerns about damage. Connecting the GPS via USB is

CHECKLIST

- ADS-B weather and traffic reception should be good enough for most users.
- GPS, baro altitude and magnetometer available; AHRS in development.
- The Stratux works with multiple tablet apps, but ForeFlight support is unofficial.

easy, but currently doesn't support the AHRS. You'll have to solder on jumper cables for that. You can wire all RY835AI connections (shown in the photo on page 20). If so, we recommend 20AWG jumpers for power, as the common 24AWG Pi jumpers barely flow enough juice. There's some indication the RY835AI locks quicker and more reliably via USB, but we couldn't show that definitively.

The Pi uses a USB power cable, which you can plug into a cigarette lighter converter or use a USB battery pack. Current flow from the battery packs can be an issue if you use two SDRs. Avoiding a USB hub helps. So does using a battery pack with two USB ports and a power cable that draws from two USB sources to the single power input on the Pi.

Getting Stratux onto the Pi requires downloading the image and putting it onto the mini-SD card the Pi uses as a "hard drive." The Stratux software is self-launching and the Pi creates a Wi-Fi network called Stratux. Connect your iPad and you're done. The aviation apps do the rest on their own. There's also a web page you can access with your iPad to monitor the Stratux software directly. If you want to tweak the system and can type some Linux commands, there's no stopping what you can do.

One oddity is the only shutdown is via the web interface (and only in the beta code as of this writing). You can just pull the power, but that has the potential to corrupt the SD card (many users report no issues).

The UPS system we found incorporates a shutdown button if you can do a little programing, and Reddit users have created custom systems. There's also a way to protect the SD card to make it read-only if you know how to remote into the Pi and type a set of commands.

ENOUGH BANG FOR LESS BUCK?

How well does it work? The answer is a big, "That depends." The essential features are weather and traffic. Stratux's SDRs and stock antennas simply aren't as good as a dedicated system, and head-to-head with a Stratus 2, that's exactly what we saw. The Stratux acquires ground stations at least as fast, or faster, and shows as many ground stations, or more.

The biggest issue we see with Stratux is ADS-B reception. Antenna placement is critical. Losing sight of towers for a bit is less critical with METARs (top screen grab) than with radar or traffic. Users have created and shared 3D-printed cases, like the one by Ryan Dewsbury, bottom (Reddit username: Helno).

That's only a real issue if the Stratux shows zero towers, so this could be a deal-breaker if you're in an area with poor ADS-B coverage or you fly something highly shielded, like many jets. It's a non-issue if most of your flying happens in areas of good coverage. In addition, both systems report towers before they acquire actual METARs or NEXRAD frames. So long as both had towers, it was a toss-up which system showed fresh data first. Note that the newer Stratus 1S and 2S are supposedly more sensitive, so the difference could be more pronounced.

On the flip side, the Stratux lets you mount an antenna remotely if you want (something shops have been doing with other portable receivers), and several users have designed custom antennas. Antenna placement appears to be the biggest variable. Overall, Stratus wins on ADS-B reception with the units side-by-side—no matter what.

The Stratux was a bit better about receiving 1090 direct traffic. This is more important if you don't have ADS-B Out on your aircraft. However, the Stratux showed some traffic up to 500 feet lower than the Stratus, or even the installed active TAS system. That's presumably a bug that will be squashed, but it's indicative of issues you may encounter with software that's still in development.

The Stratus GPS locks faster that the GPS we used on our Stratux. The Stratux occasionally dropped GPS position for few minutes on one test flight. This code is still in development, so another point to Stratus, but that will likely be a wash soon.

The RY835AI chip we used in the Stratux also includes an AHRS, barometric sensor and magnetometer. However, it requires soldering at least two wires RY835AI to get that data. The AHRS data is strictly developmental and lacks filtering

BAD ELF'S ADS-B KICKSTARTER

Brett Hackleman, co-founder and CTO of Bad Elf, has been thinking low-cost ADS-B for years. When he first explored it four years ago, it would have been a $900 product. You could say the market has weighed in that $900 is an acceptable cost, but Hackleman disagrees.

"When you look at the numbers, less than 10 percent of pilots are flying with portable ADS-B. Some have ADS-B permanently installed, but that's still a low number. It really frustrates me. I won't fly without it anymore," Hackleman said.

Every year Hackleman checked out the changing hardware landscape, and finally saw a combination of parts he thought could work. He's quick to point out these aren't the parts used in a homebrew Stratux—which he has built and tried.

"I love the [Stratux] project. But the radio isn't sensitive enough. It won't work in a jet," he said. He also felt the power consumption was too high. Bad Elf was looking at commercial and military interest, in addition to GA.

In 2015, Bad Elf constructed a proof-of-concept unit and tested it in a variety of aircraft and locations. It worked well. Then they took the unconventional route of a Kickstarter campaign to bring the device to market. Essentially, Kickstarter meant the company could presell units and use the capital to ramp up production.

The numbers are good: $299 for 978 MHz only, and $499 to add an AHRS. Dual-band ADS-B is a $100 upgrade. Hackleman heard from pilots in Europe and Australia (where there is no 978 MHz weather) that they wanted a 1090 traffic and AHRS version, so Bad Elf added that as a $449 option.

Hackleman believes compatibility with many apps is critical, but admits the Bad Elf device won't work with ForeFlight—yet. He's fully aware how Stratux gets around this, but it's not an option for a commercial vendor.

Pilots aren't the normal Kickstarter demographic, either, and these two factors probably contribute most to the unpromising status of the project on Kickstarter. Hackleman says if the Kickstarter campaign fails (which may have happened by the time you read this) it will reassess the project from scratch.

"I have no doubt it deserves to live and would do well," he said. "I want to see this come to market, and we'll see what's the best path for this to happen."

and damping required for a smooth, steady display. Heads-up view in ForeFlight and WingX works in the Stratux, so you can use the synthetic vision, but it's rough. Clear point to Stratus, for now.

Battery life depends on what battery you choose, but we found it pretty easy to top Stratus' claim of eight hours with the bigger battery. Young says the code is getting smarter about power use. A Stratus lets you run on ship's power via USB and automatically switch over to batteries without interruption. We found a tiny backup power supply (UPS) for the Raspberry Pi, however, so a Stratux can do this, too. We'll call power a tie.

When it comes to app compatibility, Stratux wins hands down. It works with ForeFlight, WingX, FlyQ and many others. Like ForeFlight or not, they own the lion's share of the market. None of the commercial alternatives to a Stratus work with ForeFlight because the company won't allow it; they own an interest in Stratus. Stratux bypasses this problem by using a GDL90 protocol ForeFlight does accept. ForeFlight thinks the Stratux is an installed FreeFlight ADS-B system.

ForeFlight could fight back and create a secret hardware handshake so the ForeFlight app knows this ADS-B isn't coming from the FreeFlight system, rendering Stratux unusable, but hacking hackers is usually a losing battle. Our guess is ForeFlight will neither acknowledge nor deny the Stratux community. The number of subscribers they gain probably outweighs the loss of Stratus sales by an order of magnitude.

Stratux code is constantly being improved at the request of users. Young tells us that big on his improvement list are solid AHRS code, an open protocol for weather data, better power conservation, and even more app compatibility.

Software improvements are a double-edged blade. Sometimes you like them; sometimes you're spewing language unfit for polite society. Overall, we like the idea of updatable and flexible code, especially where users have real input on development. Point to Stratux.

FINAL TALLY

Like virtually every DIY project, if your sole motivation is cost, you should probably pony up for the off-the-shelf solution and be done with it. But if you like the idea of saving some bucks while tinkering, the Stratux could be for you.

Given some of the Stratux's limitations and that it's a community-powered project, we think the best deal is a simple, single-band Stratux. It's a small investment and yields a great return.

The minimum Stratux would be a Pi Zero for $5, one SDR for $25, a Wi-Fi dongle for $10, a USB power supply and cable for $21. Download the Stratux image and tape the whole thing together.

That'll get you just ADS-B weather and traffic on 978 (no GPS, AHRS or direct 1090 traffic) for $61, plus an hour of setup.

Even if you go all out and get the better Raspberry Pi B kit ($60), two Nano SDRs (two at $40), custom antennas ($10), GPS/AHRS ($40), a UPS power system for the Pi ($45), jumpers for wiring ($5) and a nice case ($30), that's still only $220 in parts for an open source ADS-B in system with all the perks.

Compared to $549 for the cheaper Status 1S and $899 for the deluxe 2S model, $61-$220, plus some sweat equity sounds pretty good. Just know it's not quite as polished an end result. Not yet, anyway. Give the Stratux community time and anything is possible.

Sun Visors

(continued from page 14)

If cheap is your thing, the Slap On Visor, top, is $5 at Sporty's.

collapses and folds into a small zippered pouch—with effort. But it's the neatest stowing of all the visors or shades. We suspect rear seat passengers would get the most use out of it.

RECOMMENDATIONS

For as sure as we are that everyone wants a set of Rosen visors, we're just as sure that not everyone can afford them. But they're top-of-the-line equipment and recommended without reservation. If you own a Cessna, lucky you. Vantage's replacement visor is a high-value alternative to the Rosens. True, it's not as well made, but it costs a lot less, too.

As for the stick-on shades, two stand out: The RAM Universal Sun Visor and Rosen's collapsible sun shade. Both are well-made stand ins for expensive permanently mounted visors and will do the job of cutting dangerous or annoying glare. That's not to dismiss the other stick-ons by any means. Any of them will do in a pinch.

CONTACTS...

Aircraft Spruce and Specialty
877-477-7823
www.aircraftspruce.com

Sporty's Pilot Shop
800-776-7897
www.sportys.com

Vantage Plane Plastics
877-307-5263
www.planeplastics.com

SAFETY SYSTEMS

AltAlert Cabin Sensor: Portable, Simple

It's pricey, but for backup cabin pressure altitude sensing and alerting, the mountable/wearable AltAlert device makes sense.

by Larry Anglisano

Early detection is the key to cabin pressurization failures and that's precisely the purpose of the $399 Aviation Technology AltAlert personal cabin pressure sensor.

The six-ounce AltAlert measures 3.0 by 1.75 by 0.75 inches and can be mounted on a flat surface, clipped to a sun visor or worn on clothing. Powered by a 3-volt lithium CR2032 coin battery, the device utilizes an internal algorithmic software program to sense cabin pressure and rate of climb by way of a temperature corrected pressure sensor.

I like that it's stone simple to use. Simply load the battery (which activates the sensor) and the unit enters sleep mode while at ground level, but begins to sample pressure and its battery voltage every 15 seconds during climb, and once in level flight at altitudes above sea level. There isn't even a power switch. Instead, the device functions continuously until the battery is spent, which is roughly 18 months unless an alert is triggered.

The alerting is via aural chirps and visual cues, with an internal 100-dBA Piezo alarm, plus a flashing LED, which is built into the test/mute button on the face. Above 10,000 feet, the LED flashes red every 15 seconds, accompanied by a courtesy chirp. As the pressure altitude climbs, the flashing increases in interval and the chirp is constant. A low battery is indicated by a yellow annunciator.

I tried the device (clipped to a kneeboard) in the pressurized cabin of a Pilatus and it never indicated false alarms. At 12,500 feet in a non-pressurized Cessna Centurion, it flashed every second and sounded three chirps, activating a 30-minute timer and subsequent sustained alert because I didn't descend.

Contact www.aviationtechnology-inc.com and 858-735-7943.

The AltAlert has a clip for attaching to the shirt, pictured below, but that makes it difficult to see the LED indications.

Piper Archer/ Cherokee180:

Piper's PA28-180/181 can slightly outpace and outclimb a Cessna 172, while still offering decent payload. The market has plenty to choose from.

In the heady days of the 1960s and 1970s, personal airplane manufacturers were heavily invested in marketing their products the same way Detroit had been selling cars: Get new owners hooked on an entry-level model, offer several step-up models and make annual but incremental improvements. Just as Detroit's Big Three had dealer networks, Beech, Cessna and Piper had them also, offering everything from primary flight training to maintenance, rental and charter.

Rarely would a new pilot trained in, say, a Cessna 150 look at another manufacturer's product as a step-up airplane, because a larger, faster version of what he or she was already flying was readily available. Brand loyalty was important to general aviation's Big Three back then, just as it was to Detroit.

But times changed, models were eliminated and some brands went out of production entirely, at least for a time. Despite economic upheavals, the microcomputer revolution and the advent of modern composite airplanes, the realities of aerodynamics, along with design, certification and manufacturing costs mean some models first conceived in the 1950s are still popular today. But that's true only because those older designs perform well enough that potential new entrants know they'd encounter stiff headwinds trying to bring a new model to market.

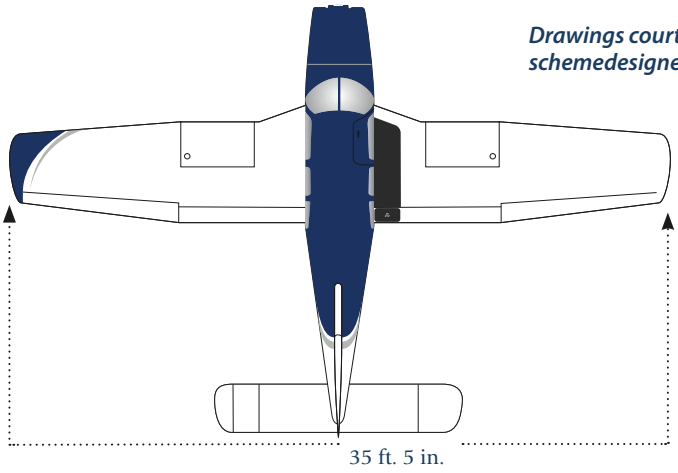
> ***For many, the Cherokee 180/Archer is as close as mere mortals can get to the perfect airplane.***

For proof, look no farther than the market for new, four-seat, fixed-gear piston singles of less than 200 HP, which has long been dominated by Cessna and its 172. Along the way, Piper carved a deep niche with its Warrior and Archer. No viable competition has emerged, despite both designs having originated during Eisenhower's years in the White House. And until the mid-1990s, the 172 wasn't available fresh from the factory with a fixed-pitch propeller and more than 160 HP, while Piper offered the Cherokee 180, a model besting the basic Skyhawk in almost every category and which remains available today as the Archer III.

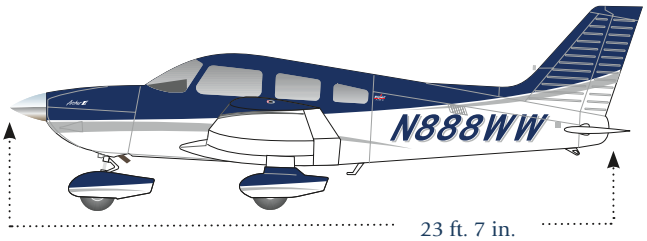
The original PA-28-180 was powered by a Lycoming O-360, which has proven to be a durable powerplant well suited to the airplane's weight and performance. Before becoming the Archer in the mid-1970s—and before gaining a tapered wing and becoming the Archer II—it already was among the most popular Cherokees.

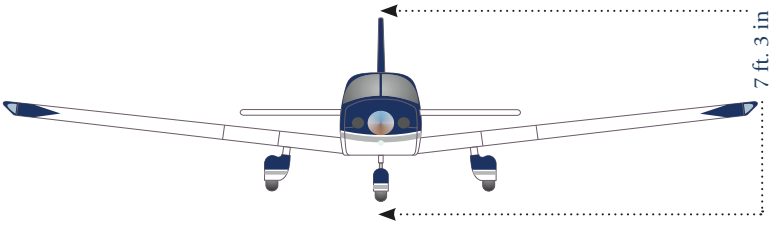
Brodie Otway's 1966 Cherokee 180 in the lead photo is just rugged enough to get in and out of unimproved backmountain strips in British Columbia.

PIPER PA28-180/181 ARCHER



Drawings courtesy schemedesigners.com

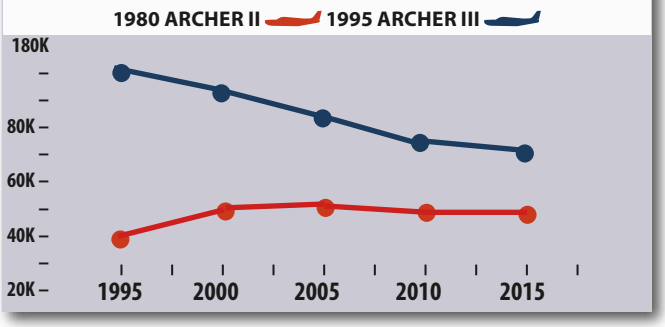




PIPER CHEROKEE 180/ARCHER SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1963-64 PA-28-180B	LYC. 180-HP O360-A3A	2000	$21,000	50	1170 LBS	124 KTS	±$28,500
1965-67 PA-28-180C	LYC. 180-HP O360-A3A	2000	$21,000	50	1170 LBS	124 KTS	±$31,000
1968-69 PA-28-180D	LYC. 180-HP O360-A3A	2000	$21,000	50	1090 LBS	124 KTS	±$35,000
1970 PA-28-180E	LYC. 180-HP O360-A3A	2000	$21,000	50	1090 LBS	124 KTS	$38,000
1971-72 PA-28-180F	LYC. 180-HP O360-A3A	2000	$21,000	50	1090 LBS	124 KTS	±$42,000
1973 PA-28-180 CHALLENGER	LYC. 180-HP O360-A4A	2000	$21,000	50	1055 LBS	123 KTS	$44,000
1974-75 PA-28-180 ARCHER	LYC. 180-HP O360-A4A	2000	$21,000	50	1055 LBS	123 KTS	±$45,000
1976-1994 PA-28-181 ARCHER II	LYC. 180-HP O360-A4M	2000	$21,000	48	1134 LBS	125 KTS	±$67,000
1995-2000 PA-28-181 ARCHER III	LYC. 180-HP O360-A4M	2000	$21,000	48	1134 LBS	125 KTS	$95,000
2001-2005 PA-28-181 ARCHER III	LYC. 180-HP O360-A4M	2000	$21,000	48	870 LBS	125 KTS	$130,000
2006-2010 PA-28-181 ARCHER III	LYC. 180-HP O360-A4M	2000	$21,000	48	870 LBS	125 KTS	$195,000
2011-2014 PA-28-181 ARCHER LX	LYC. 180-HP O360-A4M	2000	$20,000	48	870 LBS	125 KTS	$310,000

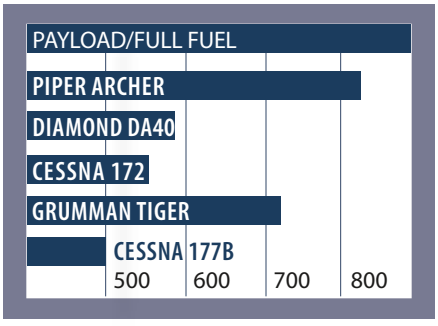
ARCHER RESALE VALUES

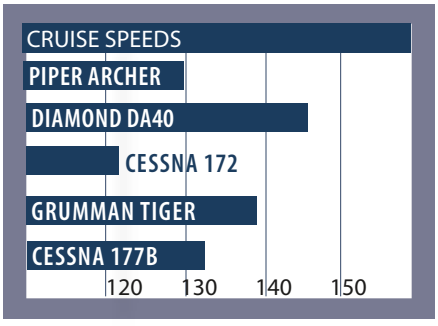


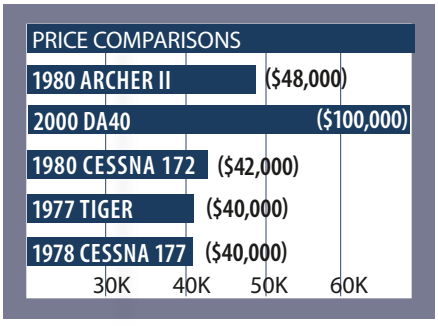
SELECT RECENT ADs

AD 04-14-12	CONTROL WHEEL HARDWARE
AD 99-05-09	INDUCTION AIR FILTER
AD 96-10-03	FLAP HANDLE ATTACH BOLT
AD 95-26-13	OIL COOLER HOSES
AD-86-17-01	AMMETER REPLACEMENT

SELECT MODEL COMPARISONS







The newest Archer LX has Garmin's G1000 avionics and Sandel backup EFIS, top photo. Avidyne Entegra glass, middle, was standard in the Archer III between 2004 and 2009. Cherokee 180s like the vintage 1967, bottom, might have a wide variety of retrofit avionics.

For many, the Cherokee 180/Archer is about as close as mere mortals can get to the perfect airplane. It has simple systems, a stone-reliable engine, sufficient room that four adults won't commit immoral acts and economics good enough to serve as a basic trainer. For cross-country work, it has enough speed to make most headwinds only a slight nuisance and long-enough legs to be a decent though entry-level instrument platform. All of which means a good Archer will command a healthy price on the used market and, depending on year, generally will cost a bit more than an equivalent Cessna 172.

Of course, the 172 isn't the Archer's only competitor: Cessna's own fixed-gear Cardinal, the Grumman/American General Tiger and the Beech Sundowner abound on the used market, often available for fewer dollars. But the Archer's mix of good numbers, good looks and ongoing production—which usually translates into excellent parts availability—means its popularity likely will continue. Prospective owners know that and usually are prepared to pay the premium required.

MODEL HISTORY

The PA-28-180/181 series, of course, can trace its roots back to the basic Cherokee 140 and point to close relatives like the Arrow, Cherokee Six/Lance/Saratoga and even the Seminole twin. All owe their existence to the first Cherokee airframe originally designed by the late John Thorp, best known for the crank-winged Thorp T-18 homebuilt, among his many other designs. He reportedly considered the PA-28 among his favorites and, if viewing an original copy in plan form, one can easily see the resemblance between the first Cherokee and the Thorp T-18.

And this Piper's lineage highlights something Piper has always done well, perhaps better than everyone else: Build a good basic model and evolve it into improved follow-on products without greatly increasing manufacturing costs. First rolled out in 1963, the original Cherokee 180 has been upgraded considerably, but is fundamentally still the same airframe, with some 10,000 flying.

The first Cherokee 180 had the constant-chord Hershey-bar wing (span 30 feet)—so-named because of its resemblance to the candy bar—and a Lycoming O-360-A3A engine. That early engine had a TBO of only 1200 hours, mainly due to a weak valve-train design, including 7/16-inch exhaust valves, which was far from Lycoming's best effort. Later, those engines were switched to ½-inch valves, which increased the TBO in part by eliminating chronic issues with excessive wear and heat-induced damage. The smaller valves long ago should have been flushed entirely from the market by overhaul or remanufacture, but prudent buyers will check anyway if looking at an older engine.

The newer engines all carry Lycoming's more-or-less standard 2000-hour TBO, and the overall engine has a well-earned reputation as one of the company's—if not the industry's—more bulletproof designs. In fact, the engine's reputation is one of the reasons for the Archer's ongoing popularity. Throughout its history, the PA-28-180/181 has used essentially the same Lycoming O-360—still 180 HP—with only minor variant changes, although many wish for fuel injection.

After five years of production and few airframe changes, the instrument panel was modernized and a third, trapezoidal window was added to each fuselage side in 1968. This resulted in the airplane's current ramp presence while admitting more light into the cabin. A longer wing came along in 1973—still with a constant chord, though—accompanied by a bigger stabilator and a five-inch fuselage stretch. The extra inches made a noticeable difference on cabin space.

At the same time, a modest,

50-pound boost in gross weight (to 2450 pounds) improved the airplane's payload by half a person while a larger door, more-crashworthy seats and additional panel improvements rounded out the cosmetic improvements.

For 1973, the Cherokee 180 became the Challenger, but that wasn't a Native American name, so Piper quickly changed it again—to Archer, beginning with the 1974 model year—continuing its ongoing theme. (Neither of those strictly are Native American names either, but despite the illogic, Piper's are perhaps easier to follow than Mooney's.)

It wasn't until 1976 that the new tapered wing—still the standard configuration today—was introduced to the 180-HP airframe, resulting in the type-designation change to PA-28-181, which also continues with the current model. This change was so significant the model received yet another name: Archer II. Subsequent-manufacture PA-28-181s are known as Archer IIIs, while the latest Archer is the LX.

The basic tapered wing first was installed on the then-new 1974-era Warrior and, after a few tweaks involving the aileron control system, was added to the company's other PA-28 models and, eventually, to the PA-32. The new wing's inner panels were still constant-chord, while the outer panels were both lengthened and tapered. Wing-mounted fuel tanks remained in the same location, although total unusable fuel increased to two gallons.

The Archer II got a powerplant change as well, to the -A4M version of the 180-HP Lycoming O-360. That same engine is installed in new Archers today. These changes, of course, brought escalating prices. An original, 1974 PA-28-180 Archer with average equipment brought in $23,495 to Piper's coffers while a typically equipped 1980 Archer II sold for $47,610.

There was no 1991 Archer, as Piper became ensnared in the light-aircraft industry's overall economic troubles but by 1995, a reinvigorated and rebranded company—New Piper—rolled out the Archer III. It sold for $181,700, again with average equipment installed. We'll always remember plucking one of the first Archer IIIs from the Vero Beach factory ramp during a ferry mission, while marveling at its modern appointments, compared to the early ones we grew up with.

By then, the New Piper Archer III got an upgraded cowl, an all-metal instrument panel, factory-installed Garmin GNS430/530 navigators, new paint schemes, air conditioning, better seats and an improved exhaust system. A 2010 model retailed for $299,500, and came standard with an Avidyne Entegra glass panel, an S-TEC 55X autopilot, air conditioning and two Garmin 430W navigators.

That's a 1973 Challenger, top, wearing nice paint work. With cowling off, there's easy access to an Archer's powerplant. For some, it's not so easy climbing in and out of the cabin, bottom.

Priced in the low $300,000 range, the current Archer LX has Garmin's G1000 integrated avionics (standard are two 10-inch displays), electronic engine indication system, a backup EFIS system, plus an ultra-modern paint scheme. It still has Lycoming's O-360-A4M engine mated to a Sensenich two-blade propeller.

Speaking of engines, in 2014 Piper unveiled the Archer DX at the Aero show in Friedrichshafen, Germany. It has Continental's 1200-hour TBO and FADEC-controlled CD-155 diesel. We covered it in the June 2014 issue of *Aviation Consumer.*

MARKET SCAN

Any would-be owner wanting to upgrade from a basic trainer—or even looking for an affordable entry-level airplane to use as a trainer, then as a platform with which to perform the weekend getaway—always should at least consider an Archer. It's a bit faster than a Cessna 172, it climbs better and it carries a smidge more, all without gulping fuel the way a 182 does. Main-

The Archer DX pictured above has Continental's CD-155 diesel engine and a $400,000 price tag.

tenance costs are on the low side of reasonable. On the flip side—at least when compared to the Skyhawk—there's only one door and passengers may not like clambering up on the wing to gain entry.

Despite the tapered wing's better looks and—as many pilots confirm—its improved roll response, the market hasn't always treated the Archer II well. In fact, there's not much difference in performance between the Hershey-bar-winged versions and the tapered wing. The original Archer wing's span of 32 feet increases to 35 feet, five inches on the Archer II after it's tapered, while the service ceiling decreases and takeoff ground roll increases. Distance to clear a 50-foot obstacle is markedly reduced by tapering the wing, however, as is stall speed.

Those numbers—and perhaps the ability to use a smaller hangar—probably explains why early Archers—the 1974 and 1975 models—today sell in the $45,000 range, according to 2015 trends, while their slightly younger brethren fetch less, on average. The deficit isn't overcome until the 1980 model but—all things being equal—prices start escalating from there. By comparison, a 1980 Cessna 172 retails for about $42,000 while a Grumman/GA Tiger of about the same vintage sells for around $50,000. You can't touch a newer Archer III for under $80,000, in general.

Given the wide range of model years and histories of used Archers, it should be expected they will vary widely in installed equipment. Unlike Cessna—which only installed its house-brand ARC avionics in new piston singles until selling the unit in 1983—Piper put into its Cherokees either King or Narco products for quite some time. A recent scan of *Trade-A-Plane* revealed quite a few earlier models still equipped with orphaned avionics, plus a mix of old and new.

LOADING/ PERFORMANCE

For 180-HP airplanes, Archers haul respectable loads. Empty weights vary by year and example, of course, but one owner told us his PA-28-180's empty weight was 1452 pounds on a gross weight of 2400 pounds. With full tanks, that allows 650 pounds of people and stuff, or three husky people and a bit of baggage. Not bad.

Later Archers allow a 2550-pound gross but empty weights are often higher, so payloads are lower. A 2010 Archer III with standard equipment, weighs in at a hefty 1688 pounds empty with a ramp weight of 2558 pounds, for a useful load of 870 pounds. Older Archers might beat that by 75 pounds or more. With four people in the airplane and, say, 50 pounds of baggage, a typical example has room for 35 to 40 gallons of gas, or about three hours' endurance with 45-minute reserves. Again, not bad for a modest airplane. If the passengers are light, full fuel and full seats may be possible.

Performance-wise, the Archer is respectable, but no one will mistake its numbers for a Bonanza's, or even an Arrow's. How fast you go on 180 HP depends on the year of manufacture and the equipment. Specifically, the semi-tapered wing on the 1976 and later Archers yielded benefits at both ends of the airspeed spectrum. The stall dropped by four knots and cruise speed went up by about the same amount. The large wheel pants available in 1978 add another four knots or so to cruise speed.

Even so, a late-model Archer with wheel pants will cruise at only about 120 knots, although some owners insist they see 125 to 130 knots. (We suspect erroneous airspeed indicators or tachometers.) The airplane gives up 10 knots to a Tiger but pulls ahead of a Cessna 172. Climb rate, while better than a 172, isn't stellar. According to the POH, the airplane will climb out from sea level at about 740 FPM but, by the time it reaches 6000 feet MSL, upward mobility has trended off to around 450 FPM. As noted earlier, original Archers with the Hershey-bar wings eke out slightly better rate-of-climb numbers than later models with tapered wings.

The nosewheels are steerable on the ground, and the rudder pedals come with conventional toe brakes. Parking or emergency braking is controlled by a meaty handle and locking mechanism just to the left of the center console and easily manipulated with the pilot's right hand.

Unless the airplane is air-conditioned, summertime cooling of the occupants can be a problem on the ground and at low altitude. Fresh-air ventilation is via wing-root inlets with outlets above the floorboards, supplemented by fan-driven overhead vents getting fresh air from an inlet at the top of the vertical stabilizer. Neither works well on the ground, requiring an open-door policy until right before takeoff. The good news is the Archer's heating system usually works well.

Piper long ago abandoned its overhead pitch trim control—pilots never could remember which way to turn it to get what they wanted—and put a conventional wheel on the center console, between the seats. Below the instrument panel, in a center pedestal, is a rudder trim knob, though it's not always necessary.

Early airplanes came with a double stack of avionics, with less-critical boxes mounted in a second column to the right of center. Again, many of these airplanes have since seen an avionics shop for upgrades, but many others haven't. Reaching to the far side of the panel isn't a chore, but it's surely an inconvenience and something you should consider when inspecting a potential purchase. Recent upgrades may have eliminated boxes from the right stack, but unless the entire panel was redone, cosmetics may suffer.

Wing flaps are controlled with a Johnson-bar handle between the seats, including detents. It's an easy system to deploy smoothly, while also affording the ability to immediately retract or extend flaps, depending on your needs, without having to wait for an electric motor. And, of course, they're

fully available even in the event of an electrical failure. Deploying flaps does result in an upward pitching moment, but it's relatively easy to counteract with forward pressure on the yoke. Most crosswinds are easy to handle, thanks to the low wing and wide gear.

Early airplanes mounted the circuit breakers to the far right of the instrument panel, about as far from the pilot as possible. Same with the heat/defrost controls. On the upside, frequently needed switches—master, fuel pump, beacons and the like—are mounted just above the engine controls. Systems gauges are just below the flight instruments, with an idiot-light annunciator panel above them. The tachometer is mounted in front of the pilot's right knee, which often makes for unnecessary head motion during takeoff.

COMFORT, HANDLING

Occupants should have no trouble remaining comfortable during a three-hour leg, although pre-1973 back seats—before the five-inch fuselage stretch—are somewhat tight. Pipers have decent but not exceptional front seats with an S-shaped frame designed to absorb energy in a crash. The height adjustment uses a gas-assisted spring and when this wears out, the seat automatically falls to its lowest setting, giving a short pilot a good view of the glareshield, but little else.

The seat stuffing tends to compress with use, causing sags, and the plastic back trays on the seats aren't at all durable and fall apart with use. The aftermarket is your friend, as relatively inexpensive solutions exist for both well-known issues. There's an adequate baggage compartment behind the rear seats that's accessible in flight, but can't be opened from the inside.

Cabin appointments can range from the original avocado green or bright orange upholstery and subpanels dating from the 1970s to more tasteful and less jarring designs, including what seems to be the new industry standard: light gray fabric or leather. Later models came with all-metal instrument panels—the Royalite plastic overlays were finally banned.

The Piper Cherokee didn't get to be an industry-standard airplane by having handling quirks; it simply has none. Its flight controls are relatively well balanced, with roughly equivalent pressures required in all three axes. The Archers are safe, stable and predictable and easy to land, even on short runways. In slow flight, the airplane has no bad habits, nor does it build speed in unusual attitudes.

MAINTENANCE

Archers don't have much AD baggage. It was the target of a controversial AD in 1987 calling for an expensive inspection of the wing spar for cracks. This procedure required de-mating the wings and cost some $1200 at the time. In typical FAA overreaction, it was an emergency measure brought about by the crash of a 7000-hour Archer used for pipeline patrol. That AD was rescinded when the expected rash of cracked spars failed to materialize.

However, in reviewing recent service difficulty reports, we noted that mechanics are finding evidence of corrosion in the spars, at least one of which required replacement. This corrosion is often discovered when leaking fuel tanks are removed for repair. Make sure a pre-buy includes an inspection and check the wing-attach fittings, too.

Check the baggage door for a leaking seal; the tell-tale sign is wet or waterstained carpet on the baggage floor. By now, early Archers should have been through at least one interior refurbishment, so pulling up the floorboards in that area to inspect for corrosion is a good idea.

While you're back there, take a few extra moments to inspect the battery box just aft of the baggage compartment. Piper placed it there, presumably to help with loading. But in a misguided effort to save weight, the company at one time equipped its airplanes with aluminum battery cables, which proved susceptible to corrosion. Given the lengthy cable run from the battery box to the engine compartment, many owners have encountered starting issues. Aftermarket kits and a Piper service bulletin are available to help replace the aluminum cables with copper, which isn't as prone to corrosion and high resistance.

Another problem is leaky fuel tanks, particularly on older airplanes. An airworthiness directive (AD 79-22-02) addresses peeling tank sealant, with which owners long ago should have complied. It's not much of a problem any more, certainly nothing like the hassle of owning a Mooney. The vents are also a source of maintenance trouble. One SDR found they

ACCIDENT HISTORY: NO SMOKING GUN

When we looked at the 100 most recent accidents for the Archer/Cherokee 180 series—50 for each model—we saw some crunch causes we expected and a few we didn't.

First, in an airplane often used as a trainer, we expected to see a significant number of landing-related accidents. We did. Thirty percent of the airplanes came to grief due to either runway loss of control (RLOC), hard landing, runway overshoot or a botched go around. We didn't expect to see that of the 15 RLOC accidents; only two were in Cherokee 180s, the rest were Archers. As the airplanes have essentially the same landing gear, we are puzzled as to how the only major difference between the machines—the wing—could have anything to do with the proclivity of Archer pilots versus Cherokee 180 pilots to lose control on rollout.

We are fans of the 180-HP Lycoming engines that power the 180/Archer line, so we didn't expect to see 15 percent of the accidents due to a problem with the engine. A closer look at each event caused us a sigh of relief. One accident was due to the prop flinging half a blade after a long-progressing fatigue crack let go. Lack of maintenance was the culprit. Poor or no maintenance was the cause of the majority of engine stoppages—an oil filter wasn't tightened in one case; in several either the engine overhaul was done improperly or a new cylinder wasn't installed correctly. Reading some of those reports reminded us of the need to be cautious on the first flight after maintenance.

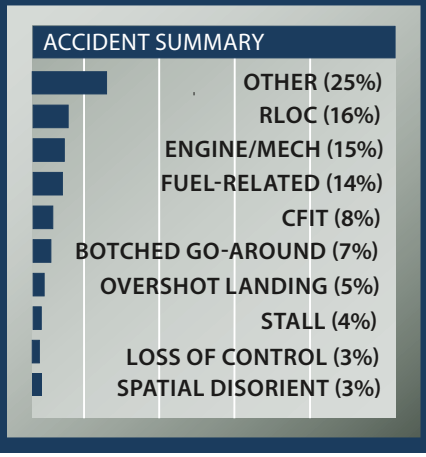
Twelve pilots ran their airplanes completely out of fuel, a few times after amazingly optimistic flight planning. Two pilots were flying low enough that when they ran a tank dry, there wasn't enough time to switch tanks and let fuel in the good tank replace the air in the fuel lines before ground contact. The fuel selector on one airplane had deteriorated so badly—an AD on it had been ignored—that the pilot couldn't find a detent and positioned it to cut off fuel flow to the engine.

That there were eight CFIT crashes got our attention. Four were at night, the pilots flew into the ground in areas of few lights. One instructor and student decided to fly below the rim of a canyon, upstream, despite having carefully plotted their route prior to the flight and noting ground elevations. Eventually they couldn't hit rising terrain. Trying to scud run claimed two pilots. Each had ignored an IMC forecast. One hit trees while trying to make a 180.

There may be something deceptive about the wings on Archers. In five cases, pilots hit other airplanes, a pole or a hangar while taxiing.

Density altitude brought two Archers to grief. Even though they were loaded below gross weight, they could not climb after takeoff and were facing rising terrain. In one case the DA was over 10,000 feet. The pilot said he didn't think he leaned the mixture correctly.

We were impressed with the determination of one pilot. He aborted a series of takeoffs because he didn't think the engine was making power. On the fourth try he got off the ground before deciding the power wasn't right and aborted. You can see the conclusion coming—he tore up the airplane when he ran into obstructions off the end of the runway.



had been installed incorrectly.

Otherwise, maintenance hotspots have to do with typical Lycoming issues, such as cracked cylinders, corroded cams and problems with Bendix and Slick magnetos. Also, on older airframes, the stabilator bushings may need work. Have them checked during pre-buy. Another area to look at, according to the SDR database, is cracking in the skins of the forward wing walk. One SDR submitter reported six high-time airframes with this damage.

MODS, TYPE CLUBS

Various aerodynamic mods are available from LoPresti Aviation (www.speedmods.com, 772-562-4757) and Met-Co-Aire (www.metcoaire.com, 800-814-2697). LoPresti has flap gap seals, wheel pants and flap hinge fairings. Met-Co-Aire offers replacement wingtips, tailcones and dorsal fins. LoPresti also offers its BoomBeam landing-light enhancement.

Knots 2 U (www.knots2u.net, 262-763-5100) also sells a range of Cherokee mods, including gap seals, wingtips and wheelpants. The company also offers upgraded strobe lights, engine air filters and aftermarket control wheels, among other products.

Laminar Flow Systems (www.laminarflowsystems.com, 386-253-8833) offers a wide range of gap seals, wheel fairings and other aerodynamic clean-up kits for the Cherokee. For fiberglass parts to replace broken or cracked plastic exterior fairings, of which the Cherokee has many, try Globe Fiberglass (www.globefiberglass.com, 262-763-5100).

There are two type clubs serving the Piper Archer models. The Piper Owner Society (POS, www.piperowner.org) consolidated its efforts with the Cherokee Pilots Association (CPA) several years back. The Piper Owners Society serves all Piper products and is a good source of tech and operating information. Meanwhile, the Piper Flyer Association (PFA, www.piperflyer.org) offers services similar to POS's. There's also www.piperforum.com, with plenty of good discussion about these aircraft.

OWNER COMMENTS

I bought my first airplane, a 1966 Cherokee 180, in May 2014 almost as an impulse purchase when I saw a really good deal on Barnstormers.com. That was one impulse buy that

I haven't regretted for one second. In the year and a half I have owned the Cherokee, I have visited 37 airports in seven states and two provinces. It has been a vehicle for exploration and travel that never would have been possible while I was renting.

With a four-cylinder Lycoming and fixed-pitch propeller riding on fixed landing gear and with manual flaps, the Cherokee's systems are stone simple and so far I haven't encountered any mechanical issues worth mentioning.

Insurance was easy and not overly expensive. I had about 160 hours (mostly in Cessnas) when I bought the airplane. The insurance company required a basic checkout from a flight instructor, then I was free to go on my own. My first year's insurance was about $1200 (Canadian) for $45,000 hull value and $1 million liability. All of the quotes I received were in that range, but some required up to 10 hours of dual before they would insure me. It pays to shop on more than just price.

The Hershey-bar wing has certain advantages and disadvantages. It feels solid in the air—much less kite-like than the Cessnas I was flying before—and it rides turbulence very nicely. In rough air it feels like a much larger airplane than it is. On the downside, it can be a bit of a groundlover when heavily loaded at high density altitude days, so I am planning on adding vortex generators.

At high altitude it doesn't climb as quickly as I would expect given the power and weight. Hershey-bar Cherokees are known for their prodigious descent rate and the 180 is no exception. I actually like this quality as it makes doing a tight circuit with an approach at nearly any speed you like very easy. It's easy to slip off any excess airspeed on final (being able to slip with full flaps is a nice change coming from flying 172s). Float is non-existent with the Cherokee. Keep in mind that if a Hershey-bar airplane floats at all you are coming in way too fast. When I observe others landing Cherokees, there seems to be a tendency to fly the approach too fast (probably out of fear of the sink rate). Fly a nice approach speed and the Cherokee will reward you with a precise, short landing every time. My exit on the runway I usually land on is 1800 feet from the threshold, and light braking is all that's required to make the turn. Arrivals can be firm if the flare isn't timed right and holding a touch of power right to touchdown can do a lot to smooth things out. A touch of power (sometimes a blast of power if sink rate on final is high) can really help with stabilator authority, which is sorely lacking at low speeds on these early birds.

One of the Cherokee 180's strongest suits is useful load. My airplane has a full fuel payload of 800 pounds. There aren't many four-cylinder, four-place singles that can haul weight like a Cherokee 180. Unless you are hauling lead ingots you will cube out before you gross out. Front seat space is comfortable, and two grown men can sit side by side without touching shoulders.

The rear seat is comfortable also, but rear legroom is non-existent (something corrected in the longer wing airplanes). Though the airplane will readily haul the weight of four adults, at least two of them had better be short-legged because the cabin just isn't long enough to accommodate two sets of long legs one in front of the other.

The baggage area is adequate, but not generous. Packing in small soft bags works much better than large suitcases. With the single cabin door on the wrong side, loading isn't easy. Less able people can have real trouble getting in and out of the airplane. I've flown it nearly 200 hours now and still haven't figured out how to get in and out gracefully. I think that in the event of a forced landing, the single door could seriously impede egress if the person in the right seat is injured or has mobility issues.

No one will ever call the Cherokee 180 a speedster, but I get where I need to go in good time. Firewalled at sea-level density altitude, my airplane will do 127 knots. Most four-cylinder Lycomings will run lean of peak without any trouble and the O-360 is no exception. I typically cruise at 2450 RPM and 117 knots, burning 9.3 GPH.

I typically flight plan at 110 knots, and on a 3000-NM trip I averaged a block-to-block speed of 112.5 knots. Pulled back to sightseeing/long-range speed (2100 RPM) I true around 100 knots burning 6.2 GPH. The large fuel tanks on this machine

The Aviation Consumer

Used Archer/181

(continued from page 31)

give very good endurance and range. I recently tested the endurance of my airplane and climbed to 10,000 feet and flew a triangle pattern (to negate the effects of wind) at 2100 RPM. I landed 6.1 hours later with one hour and 20 minutes fuel remaining in the tanks, having covered 630 NM. This was probably the most boring flight of my life, but it proves that these Cherokees have legs.

A winterization plate is a good idea if you fly in a cold climate, as my airplane's oil doesn't get hot enough to burn off the nasty bits if it's much below freezing.

I've developed an interest in backcountry flying and the Cherokee 180 works OK for this, provided you keep it light and respect its (and your) limitations. The nosegear on the Cherokee is quite robust, attaching to the engine mount rather than the firewall.

It's far from a bush machine, but it's gotten me into and out of several abandoned strips and great fishing spots.

Overall the Cherokee 180 is an economical, comfortable, versatile machine that I think would satisfy the (realistic) needs of most pilots well. It will haul a pile of weight, is easy and forgiving to fly, has adequate cruise speed for all but the longest trips and has simple, reliable, and easy-to-maintain systems that won't break the bank. They offer excellent value and performance for the money.

The nearest competition in terms of payload and speed is a 180-HP Cessna 172. Check out the price delta between the two types—it's staggering. The Cherokee is an excellent first airplane, but it has sufficient performance that it could be your last airplane, too. I'm very happy with my machine and I would buy it again in a heartbeat.

Brodie Otwas
Prince George, BC Canada

Fighter jocks have to start someplace. The one in the photo at the left started in the cockpit of a Cherokee 180.

I am in a 1974 Piper Archer partnership and from my experience, the Archer strikes a wonderful balance of performance, payload and efficiency. The Archer is no Mooney or Bonanza, but frankly, unless you are regularly flying 500-mile trips, you won't notice much difference. I just keep thinking that with a faster airplane, I would get to fly less!

The stabilator makes the plane easy to fly in the pitch axis, making it a good instrument trainer. Our plane has a useful load of about 940 pounds and is nicely equipped with modern avionics, including Garmin GNS430. I'm surprised at how efficient the airplane is to fly. I often return from local flights having burned 6 to 7 gallons of fuel per hour. If you would have told me that this was likely in anything but a Cessna 152, I would not have believed it. Of course, I lean aggressively (including on the ground), which also keeps the plugs clean and the magnetos smooth.

This plane is perfect for just poking holes in the sky in an inexpensive way.

Hish Abouelleil
via email

FEEDBACK WANTED

SOCATA TBM700

For the May 2016 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Socata TBM700. We want to know what it's like to own these turboprop singles, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs (full-size, **high-resolution**) you'd like to share to the email below. We welcome information on mods, support organizations or any other comments. Send correspondence on the TBM700 by March 1, 2016, to:

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