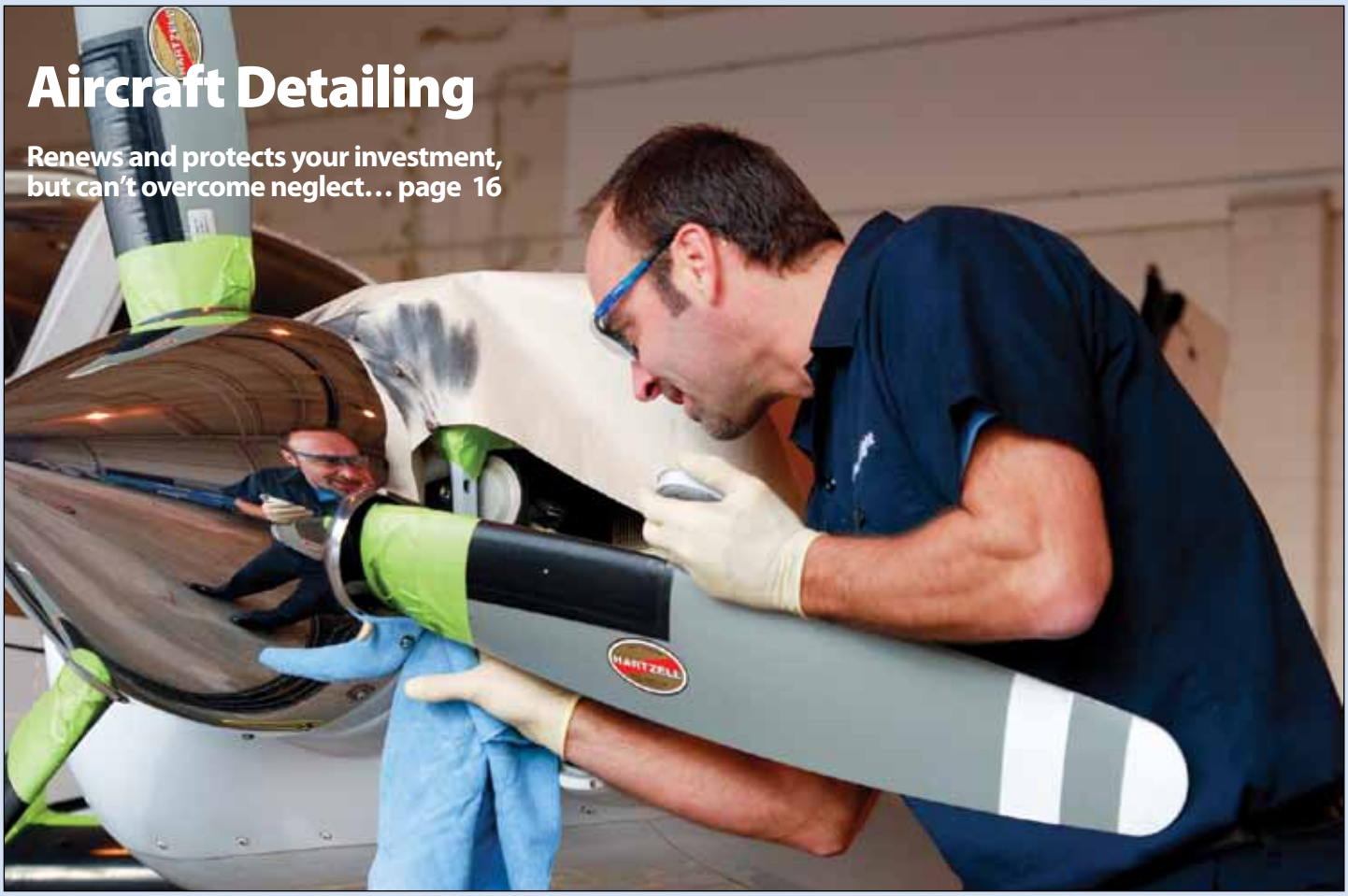
April 2013
Volume XLIII
Number 4

The consumer resource for pilots and aircraft owners

The Aviation Consumer®



Aircraft Detailing

Renews and protects your investment, but can't overcome neglect… page 16

Eclipse 550 … page 4

GPS for iPad … page 19

Piper Aztec … page 24

The Aviation Consumer

EDITOR
Rick Durden

MANAGING EDITOR
Larry Anglisano

EDITORIAL DIRECTOR
Paul Bertorelli

CONTRIBUTING EDITOR
Jonathan Doolittle

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

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

Back Issues, Used Aircraft Guides
203-857-3100

REPRINTS: *Aviation Consumer* can provide you or your organization with reprints. Minimum order is 1000 copies. Contact Jennifer Jimolka, 203-857-3144

AVIATION CONSUMER (ISSN #0147-9911) is published monthly by Belvoir Aviation Group LLC, an affiliate of Belvoir Media Group, 800 Connecticut Avenue, Norwalk, CT 06854-1631. Robert Englander, Chairman and CEO; Timothy H. Cole, Executive Vice President, Editorial Director; Philip L. Penny, Chief Operating Officer; Greg King, Executive Vice President, Marketing Director; Ron Goldberg, Chief Financial Officer; Tom Canfield, Vice President, Circulation.

Periodicals postage paid at Norwalk, CT, and at additional mailing offices. Revenue Canada GST Account #128044658. Subscriptions: $84 annually; single copies, $10.00. Bulk rate subscriptions for organizations are available.

Postmaster: Send address corrections to AVIATION CONSUMER, P.O. Box 8535, Big Sandy, TX 75755-8535. In Canada, P.O. Box 39 Norwich, ON NOJ1PO, Canada. Publishing Agreement Number #40016479

OXYFLY Revisited

Last month I reviewed the new OXYFLY Light—an oxygen concentrator from Durr Technik. It can provide oxygen for up to six people up to 18,000 feet. Based on examination by two A&P mechanics of the unit that was provided for an in-flight review, I was unwilling to put it in an airplane. I wrote a review that gave my opinion that the concept was good but the execution wasn't right. It was in keeping with the purpose of this magazine—to give an honest evaluation of products and let the chips fall where they may.

Another purpose of this magazine is to encourage product improvement. If we give a bad review to a product and the manufacturer subsequently makes it better, we'll review it again. If it is better, we'll say so, loud and clear. If not, we'll say that as well.

It's also important to recognize that a bad review may be the result of a bias, a one-off problem with a particular unit or just a bad day all around. Because of that, I followed the practice of this magazine and sent the Durr Technik representative an outline of the shortcomings I was going to report and asked if his company wanted to comment or rebut my opinions.

Durr Technik did reply, thoughtfully and in detail. As a result, this column is going to be a little longer than usual this month so that I can put in as much of the Durr Technik response itself as space will allow—it was too long to run in our Letters section and still run other reader letters.

I'm also reiterating my support for the oxygen concentrator concept because it provides oxygen so long as the device is getting electricity and I've had problems getting oxygen bottles refilled. I think it's also important to have an effectively unlimited supply of oxygen because of what I learned when researching the pulse oximeter article last month—pilots are at risk of cognitive impairment at much lower altitudes than previously believed. That may explain some of the oddball decisions pilots have made before stuffing airplanes into the ground. If a pilot isn't concerned about the quantity of oxygen on board and the cost of replacing it, he or she will be more likely to use it at lower altitudes, increasing the level of safety.

Durr Tecknik's response referenced the unit that was provided for our review and said it "is an early, working prototype that we use for trade show/bench demonstrations and occasional test flights. As such, its wiring harnesses and cable arrangements are not up to the standards of the production unit. We sent this example for two reasons; one is because this is what we had on such short notice, and second because we understood that you wanted to test the performance and the user experience with the unit, both of which are identical to the production model."

"As we clarified it during our earlier conversations, the OXYFLY models are offered as mobile devices and not FAA certified. We'd like you to know that both versions were designed to follow FAA regulations, while the OXYFLY Light was to be offered as a permanently installed aircraft accessory. Our engineering [department] has been continuously making adjustments and revisions to the specifications in order to prepare the product for the RTCA DO-160G test procedures. Those changes, however, do not affect the performance and functionality, but are geared towards compliancy."

I was critical of the failure to use aircraft quality wiring. Durr Technik said, "Accepted. Indeed, this is one of the areas in which we have had to make im-

continued on page 32

Pulse Oximeters

I enjoyed the article on pulse oximeters (March 2013). You can also buy them at Walgreens or Walmart for $30 to $40. I have an Oxywatch C20, which I bought a few years ago at Walgreens for around $40. It is within one percent of what is used at my medical clinic.

You mentioned that the units tested were within "two percentage points" of the medical unit. This can be misleading as one can control the level on the pulse oximeter by altering one's breathing. Most people breathe shallowly. So with the pulse oximeter on a finger reading say 94 percent, one can take very deep breaths and in a minute or two temporarily raise the blood-oxygen levels up to four or five percent.

So, when Dr. Blue recommends using supplemental oxygen when at five percentage points below home, the way the person is breathing matters. A person who is at 98 percent at home and is breathing deeply in flight and reading 93 percent may actually be at 88 percent, a 10 percent reduction in saturation level.

Bob Worthington, Ph.D.
Via email

Cessna 120-140

You continually overstate cruising speeds on old airplanes. No 85 HP Cessna 120 or 140 will ever cruise at 100 knots. It will do 95 to 100 MPH if it is rigged properly. The fastest of the post-war two-placers was the 85 HP Taylorcraft BC-12, which cruises about 100 to 110 MPH.

The high rate of nose overs is because of geometry and weight distribution in the design, since other side-by-side planes of the time don't have this problem.

The ballooning you discussed is caused by the overly active spring main landing gear. That gear gives back about twice as much as it gets and is to be respected. It is the reason that wheel landings are not to be encouraged for low-time pilots. It is also extremely noisy on the ground because of the gear, much more so than any other of its era.

Gus Causbie
Via email

Social Networking

I would like to add my whole-hearted support to the March article on social networking. The biggest problem I faced as a recreational pilot was "Nowhere to go, with nothing to do."

Without flying clubs or social groups such as the local group that calls itself the Sunday Morning Breakfast Club, what does the new pilot do once the checkride is completed? Plop down $200, fly around the city for an hour and come home?

Much as I love flying, even I can think of better ways to spend $200. If you add a flying club to bring in both affordability and camaraderie, you're getting a morning or afternoon of purpose to flying. To me, it's like the difference between lifting weights by yourself in your basement versus joining a health club with programs, social events and other cool stuff to get you out of your cave.

Henry Fiorentini
Via email

We agree with the social networking article in the March issue and believe that it is a key element to both enjoying and revitalizing general aviation. We are not alone. The recent proliferation of social media geared towards pilots shows that others think so as well.

Of course, "organized social networking" can move beyond the realm of social media and informal networks, it can involve aircraft access. The recent push by AOPA to increase the number and vitality of flying clubs is one example. The popularity of shared ownership options is another. For example, the Aviation Access Project promotes both the lower cost of shared ownership and the development of a community of aviators at its Flight Center locations.

Market research and common sense showed us that aviators love the sense of community in aviation as much as they love the machines themselves. Communities have the potential to grow. Growing the community of pilots and aviation enthusiasts can only be a good thing for an ailing industry.

Len Assante
Aviation Access Project

CORRECTION

In the GTN Owner Survey article in the March 2013 issue, on page 15, we inserted the wrong pie chart under the question "How many repairs have you had on the system?" The correct data are:

0 repairs - 83 percent
1 or 2 repairs - 13 percent
3 or more repairs - 3 percent
Other - 3 percent

CONTACT US

Editorial Office
616-901-6516
E-mail: consumereditor@hotmail.com

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

Online Customer Service:
www.aviationconsumer.com/cs

Back Issues,
Used Aircraft Guides:
203-857-3100
E-mail: customer_service@belvoir.com

For weekly aviation news updates, see www.avweb.com

Eclipse 550: A Jet for a Niche

The 550 is what the original Eclipse was supposed to be. Priced right, it may find takers among buyers looking for speed and economy.

by Paul Bertorelli

The Eclipse 500 lives at two ends of the same spectrum. At one terminus, it's the oversold, overpromised underperformer that traditional jet operators love to hate. At the other, it's a nifty little high-tech jewel that a small cadre of owners rave about. Somewhere in the vast gulf between, the new Eclipse Aerospace hopes to mine some jet sales.

As we go to press this month, Eclipse is touring the U.S., offering demo flights in the Total Eclipse, the factory refurb version of the original airplane and a virtual stand-in for what will be a new-production model, the Eclipse 550.

On paper, the 550—whose components will be manufactured in Poland with cooperation from Sikorsky Aircraft—appears to be what the original Eclipse never quite was: A highly refined, sophisticated, all-weather small jet capable of flying up to four people about 1000 miles. For now, Eclipse has this tiny niche to itself and it touts a modest business plan to sustain about 40 to 60 sales per year.

We recently flew the Total Eclipse, reviewed its numbers and spoke with Eclipse CEO Mason Holland about the company's prospects.

CHECKLIST

- The new company has refined the design and will produce completed airplanes.
- At $2.7 million, the price isn't cheap, but it's refreshingly realistic.
- Even if demand is there, the challenge may be production funding.

FROM THE ASHES

Eclipse Aerospace is the new iteration of the original Eclipse Aviation, which managed, despite more than a billion dollars of invested capital, to end its days in bankruptcy in 2008. The Eclipse had been lavishly promoted as not just the next big thing, but so-called disruptive technology so revolutionary that it would reset the very nature of air travel. With an introductory price under $1 million, Eclipse, at one point, claimed to have some 2500 orders booked.

With nine-figure capital investment from private sources, including tech luminaries such as Bill Gates, Eclipse embarked upon an ambitious development and certification program that soon fell behind even its basic goals. The airplane's sophisticated avionics were troubled and late, vendors were fired, performance fell short and deliveries were slipped.

As the company's fortunes unraveled, it became so desperate to deliver airplanes to customers that they rolled out the factory door with Garmin portable GPS units in place of the promised sophisticated FMS, no anti-icing systems and compromised brakes and tires.

Nonetheless, Eclipse managed to build 260 aircraft before escalating costs crushed the company in 2008. The assets were liquidated and acquired by what has become the new company, Eclipse Aerospace, for $20 million in cash, plus promissory notes; mere pennies on the original investment dollars.

These assets, including a number of unfinished aircraft and all of the original tooling and production equipment, form the basis of what will be new production.

RESURRECTION

Although Holland says Eclipse Aviation never quite managed to match production rates with unit quality, nor did it ever produce a finished aircraft that met the promised specs, it left one positive legacy: The basic airplane is a sound design, with reliable, economical engines and good, if not exceptional, performance for a

specific mission profile. On the plus side, Eclipse Aerospace won't have to do much expensive certification work, although it will face the challenge of finding capital to re-start what will be a modest production line.

Thanks to the fact that former Sikorsky President Jeff Pino owns an Eclipse 500, Sikorsky bought an equity share in Eclipse Aerospace, capital that provided pump-starter money to resurrect Eclipse production. Pino left Sikorsky last spring and both companies subsequently agreed that Sikorsky wouldn't invest additional money in Eclipse.

However, the two have also agreed that Eclipse will use Sikorsky's Poland-based PZL Mielac manufacturing base to build 550 components, including fuselages, tails and wings. Sikorsky acquired PZL in 2007 to build its international products, including overseas sales of the S-70 Blackhawk export helicopter.

Production of the new 550 started in Poland last summer, but only the empennages. Eventually, within 18 to 24 months, Eclipse plans to move at least one of its friction-stir welding gantries to PZL for production of fuselages. In the meantime, Holland told us, the fuselages will be manufactured in the company's original facility at the Albuquerque, New Mexico, airport. All of the final assembly will be done in Albuquerque.

Eclipse concedes that the challenge ahead is not so much to ramp up, but to retool a company designed to produce hundreds of airplanes a year to one that will build but dozens.

"The challenge is ramping down something that was so massive, to bring the production down to meet the demand—or the lack of demand—in the GA market. It's been pretty anemic across the board, not just any one model," Holland says.

He says there are pros and cons to the smaller volume. On the plus side, a lower production rate means that assemblers can devote more time to quality, something the original company struggled with. On the other hand, lower volume and hand work means higher unit cost, thus the Eclipse 550 will sell for about $2.7 million, some three times its initial come-on price. Holland says the first production 550 will deliver in July of 2013.

Latest version of Eclipse's Avio system, top and left, will have a dedicated backup EFIS system. Cabin has staggered seating, right, to ease getting into the seats. But the aisle between the front seats, lower, is a tight fit.

THE NEW ECLIPSE

The 550 will be, according to Holland, the version of the airplane the original Eclipse might have eventually delivered had the company survived. But the production and ongoing develop-

The 550 will add anti-lock brakes to its new tire type, left. Engines, lower, have improved combustion liners to eliminate carbon build up.

ment was so chaotic that it never got to completing the avionics nor one other vital feature: approved anti-icing.

The Total Eclipse program—which will ultimately convert as many as 50 airplanes—retrofits the original aircraft with features the 550 will have, although the two aren't carbon copies. Total Eclipses have flight into known icing, improved tires, the completed Avio avionics suite and other minor upgrades.

Although these airplanes can be upgraded with the 550's improvements, the new production airplanes will have the next generation of Avio avionics with higher-resolution screens, a new, discrete glass backup EFIS system, anti-lock brakes, new paint schemes and other cosmetic features. The basic underlying airplane won't change much, which is to say original Eclipses represented a substantial leap in avionics and aircraft and systems integration and that's still the case. Virtually everything in the airplane is integrated into and controlled by the Avio avionics suite, right down to dozens of circuit breakers that are controlled electronically, not electromechanically. The airplane has a sophisticated internal data network to advise the pilot of faults and even transmit this data to the mother company for maintenance analysis.

Size wise, the 550's dimensions are diminutive for a jet, but medium size for a cabin-class twin. Think Cessna 340 and you're in the ballpark.

Wingspan for the 550 is 37.9 feet on a fuselage length of 33.5 feet. It might not fit into small T-hangars, but it also doesn't require a large box hangar, either. The tail is 11 feet high. Max cabin width is 56 inches by about 50 inches high. While not capacious, it's high enough to allow passengers into the back seats without undue strain.

The front seats are another matter. The cabin narrows toward the front, so calling the space between the front seats an aisle is generous. Getting in requires a degree of contortion that tall or heavy people might not find amusing. Mercifully, someone realized this and placed a beefy handle above the glareshield. It's needed.

Originally, the Eclipse was touted as a six-place airplane; realistically, it's five, with the rear seats staggered longitudinally so that only the far aft one is difficult to get into. Those seats have adequate, but not generous leg room. The seat behind the pilot's is the most comfortable.

Maximum ramp weight for the Eclipse is 6034 pounds, so again, at 5975 pounds, the Cessna 340 comparison is apt. Eclipse claims empty weights of about 3634 pounds for a typical useful load of 2400 pounds.

That sounds like a lot and is—it's about 600 pounds more than the aforementioned 340. However, what aerodynamics giveth, thermodynamics taketh away. Topped off with 251 gallons of Jet A, the 550 is hauling 1698 pounds of fuel for a payload of 700 pounds. That means four people with briefcases and toothbrushes or three people with all the bags they want. Full fuel promises 1125 still-air miles at normal cruise with NBAA IFR reserves or 1300 miles with plain-vanilla FAR IFR reserves.

Practically, we think 1000 to 1100 miles is a realistic number for the Eclipse, but substantially less when westbound in the winter.

AUTO EVERYTHING

Fortunately, crunching the weight and payload numbers doesn't require a calculator or even an app, although Eclipse has one of those. Eclipse demo pilot Preston McClay, who flies EA500s in charter for North American Jet, showed us how the W&B calcs work on the Avio system.

The airplane is equipped with a custom loading map with each seat depicted. The pilot simply scrolls in the weights of each passenger and the baggage—the airplane already knows how much fuel it has—and total weight and CG are presented graphically instantaneously. Try as we might, we couldn't push the CG out of either the forward or aft limits, or even near them. McClay says he's never encountered an out-of-CG loading problem, although gross weight is a sensitivity.

That every flight begins with diddling with the Avio is telling because the entire flight will consist of diddling with the Avio. Although it's neither too fast nor too complex for a mere mortal to fly, the Eclipse is clearly designed to be flown as an automated airplane. Even starting it is automatic. Just flip the start knobs to on/start and watch the turns and temperatures come up. We would say listen, but the cabin is so quiet—even in flight—that aural cues are deceiving. The Pratt & Whitney 610F FADECs even oversee a hot start, stopping the sequence if necessary.

The engines are near the centerline, so differential thrust for taxi turns is minimally effective. But steering with the nosewheel is positive and precise and there's just enough residual idle thrust to require an occasional tap on the brakes.

Acceleration for takeoff is what

you'd expect, if you expect a brisk gather up and not quite being slammed back into your seat. At rotation—about 87 knots at mid-weight—it takes a firm tug to lift the airplane off the runway. What's not expected is relatively heavy control forces, especially in roll. The Eclipse may look like a sports car, but it doesn't steer like one. The angle and position of the sidestick controller means that left turns require more perceived effort than right turns, because the arm's musculature favors contraction, not extension. From the right seat, it's the reverse.

What this means is that in flight, the Eclipse is exceptionally stable in roll. Left alone, it won't depart much, even if disturbed by turbulence. It's less so in pitch. It's not squirrelly, but in normal cruise at altitude, it's not pleasant to hand fly because the tiniest pitch inputs will translate to 100-foot or more altitude excursions. Better to let the autopilot fly it and manage the airplane through Avio.

Although we didn't dig deeply into the Avio system, it's obviously a fully integrated, capable FMS with a enormous center MFD and two PFDs. In the current airplanes, a backup ADI appears in the upper left corner of the MFD, but the 550 will have a dedicated glass backup EFIS. (See photo inset, page 5.)

Power setting in the 550 is as simple as a pair of P&W FADECs can make it. Just advance the throttles to the desired speed and/or climb rate or pull them back, as necessary. In cruise, the FADECs calculate max continuous thrust and display this as a carat.

After takeoff, the Eclipse accelerates quickly and if you're not careful, it will bust 250 knots when you're leveling for a step climb. We noted 2500 FPM-plus on initial climb and maintained 1200 FPM into the teens. McClay told us the 500's sweet spot is in the mid-30s, truing 360 knots in high cruise on 440 pounds total fuel flow. In long-range cruise, the speed drops to 310 knots on 357 pounds.

The airplane was originally certified to 41,000 feet, but was subsequently restricted to lower altitudes because of carbon build-up in the engine combustion liners. Pratt engineered a fix and all but a few of the airplanes have been upgraded.

On a previous Eclipse 500 flight, we tried some engine outs and found them to be non-events, although from high-altitude cruise, the airplane will have to drift down to a lower altitude. Following an engine failure, the FADECs automatically increase thrust by 10 percent on the operating engine, unless it's already producing full thrust.

Cirrus owners ought to be right at home in landing the 500/550. The final touchdown works best with a relatively flat sight picture, just like an SR22. We flew the approach into Orlando Executive at V_{ref} plus 10 knots or 102 knots and about 90 knots over the threshold. The touchdown feels fast, but brakes down easily without too much drama.

Eclipse says with anti-lock brakes, the airplane can stop from touchdown speed in 700 feet. Given its cabin size, Eclipse is after a specific slice of the market: Owners who want a jet, want to go fast, but don't care much about carrying a lot of people or stuff. Would someone considering a TBM also look at an Eclipse? We're not so sure. They appear to have different market appeal.

At $2.7 million, the 550 appears to us to be more right priced than not. Even at a distance, the original company's business plan of low price and high volume drew skeptical comments from industry insiders and even some buyers.

In our view, Eclipse Aerospace has put the pieces back together for a credible program. We'll see if the idea sticks this time and if they can generate operating capital to make it go.

CRAZY NUMBERS? NOT THIS TIME

If anyone believed the original Eclipse's claims of 2500 airplanes in the order book, they're probably not willing to admit it now. Mason Holland says Eclipse Aerospace has a more realistic production rate in mind: 40 to 60 sales a year, worldwide.

He says that demand appears to be an even split between U.S. domestic sales and offshore sales, with significant interest in Europe, Brazil and some in Asia.

"I see the market in a couple of ways," says Holland. "One is the owner who's stepping up from the Cirrus-type aircraft or a Columbia 400. That's a definite market for us. There's got to be at least 300 or 400 people who have the ability, the means and the desire to step up into a jet. So our entire market could be just that alone."

But Holland expect sales from small businesses and charter companies—not the air taxi model that Eclipse originally claimed would drive volume, but traditional on-demand charter for indviduals and small groups. And maybe some step-down customers, too.

"I was talking to the CEO of a major company last week and he said it's just getting too expensive for them to fly their Gulfstream with two people in the back. We think we have the perfect airplane for them for regional travel," Holland said.

In Europe, he believes the 550's appeal will hinge on enviromental considerations. Because it's so economical, the 550 will avoid an entire layer of taxation related to carbon emissions. Eclipse is also courting the Air Force for a potential order for specialized undergraduate pilot training aircraft.

For the moment, Eclipse has the small jet market to itself, the so-called VLJ segment. With its Mustang, Cessna never conceded to the VLJ label while the Cirrus Vision is still a long way from the market. Diamond has temporarily suspended its D-jet, pending more financing.

At the Teal Group, where Richard Aboulafia follows market trends, the view toward Eclipse is neutral. Aboulafia says Eclipse's production goals are quite reasonable. But demand in the light jet segment is tepid at best, although he thinks it could come back. "There's definitely a niche for the Eclipse. The problem isn't on the demand side. Rather, it's a demand side issue. Can a niche producer bring a product to market, support it, and survive?" asks Aboulafia.

Aircraft Tugs: A Model for Every Budget

For moving airplanes under 6000 pounds, there's plenty of choice. Aero-Tow, 40EZ and Tail-Dragger Dragger are our top picks this round.

by Rick Durden

We hear a bad news about the aging pilot population and its effect on the decline of general aviation. For one segment of the market, aging is, in the short run, a good thing. Aircraft tug sales are up because pilots who used to be willing to shove their airplanes up uneven ramps into hangars have decided that doing so isn't as easy as it used to be. The airplane's obviously been getting heavier, so it's time to buy a tug.

We surveyed available tugs for airplanes weighing up to 6000 pounds and found a wide variety with competitive prices. Battery-powered tugs are increasingly popular because of simplicity of operation and improved battery technology. We also found that the combination of the airplane and the environment means that no one size fits all when it comes to selecting a tug. What may work for a Bonanza on a flat ramp in Tucson may not for that airplane on a sloping ramp in Duluth.

The purpose of a tug is to make a pilot's life easier and reduce the risk of jamming some part of the airplane against the side of the hangar when maneuvering it on the ground. A tug that strains to do the job, no matter how inexpensive, doesn't make the pilot's life easier and increases the risk of hangar rash.

CONSIDERATIONS

Starting with the basics—the weight of the airplane to be moved and whether a slope is involved—are all-important. A Cherokee 140 can have the rolling resistance of a King Air if the tug is trying to push it up an incline or across hangar door tracks. If the surface is wet or covered with snow and ice, the movement equation gets worse.

In purchasing a tug, you get what you pay for. It costs money to move objects uphill, more as the object gets bigger or the hill gets steeper. Manufacturers said that the most common source of customer dissatisfaction was when one of the bottom-of-the-line tugs would not move the airplane up a slope or across a hangar entrance lip. A Cessna 172 has about 40 pounds of rolling resistance on level pavement if the brakes aren't dragging and the tires are properly inflated. Any degree of incline increases that amount significantly, as do surface discontinuities, hangar lips and door tracks.

Battery-powered tugs are growing in popularity as available batteries for them have improved due to the powered wheelchair and medical scooter world. If you have electrical power to your hangar, leaving them plugged in assures no shortage of power for most, even if you have to go several hundred yards to the fuel pump. For routine hangar in and out operations, owners tell us that even without electrical power to their hangars, they only have to recharge the battery three or four times a year, although it is frustrating to forget. Overall, figure on a battery lasting about five to seven years.

It must be kept in mind that batteries rapidly lose energy as the tem-

Battery-powered Priceless 701 swivels so the tug does not have to be picked up when steering.

CHECKLIST

- ⊕ Battery-powered tugs are increasingly popular due to ease of use.
- ⊕ Most gasoline engine tugs will use 100LL and start well in very cold temps.
- ~ Any slope makes a big difference in tug performance; don't underbuy.

perature drops and, at the same time, rolling resistance increases as bearings tighten up. Those who reported only charging their batteries a few times a year were in warmer climates.

Terry Railing head of battery-powered tug maker, Aero Tow, told us that he was surprised when he went to a purely electric line of tugs and his sales took off among women and in Alaska. Those users reported preferring not having to worry about starting a gasoline tug. The Alaska users simply keep the charger plugged in so that even in the coldest temperatures the battery has plenty of oomph to move the airplane.

The gasoline-powered tug makers are sensitive to the need for reliability and ease of operation. Most use engines that will readily run on 100LL, so owners use their tugs to recycle sampled fuel from their airplanes. Brian Kruh, designer of the PowerTow line of tugs, reports that its engines are required to start by the third pull at -28 degrees F.

Exceeding turn limits or side-loading a nose landing gear leg can be an expensive mistake. If your airplane has turn limits for the nose gear, say so when you talk with the tug manufacturer to see if there are any specialized needs for a tug for it. Some tugs elevate the nose wheel and then can swivel under it, leaving the nose wheel straight. This allows a very tight turning circle, but the trade off is potentially side loading the nose gear if care is not used.

Some tugs will not accommodate nose wheel pants or will require an attachment or modification to do so. If your airplane has a nosewheel fairing, particularly a Cirrus or recent model Cessna, with little space between the ground and the fairing, check with the tug maker before buying.

For winter operations, snow chains can be purchased for some tugs. We have heard positive feedback on using chains as well as complaints that they tear up hangar floors.

Most of the tugs in this class are effectively powered tow bars, which means the center of rotation when steering is the nose tire, so most tugs must be lifted or yanked sideways to make a turn. Some tugs have optional casters to ease that process and the Priceless Aviation Products 701 and 701L have a swivel arrangement so that lifting the tug is not necessary when steering.

Nose-Dragger Dragger, above, "cradles" the nose gear and can handle most wheel pants. SuperTow I lifts the nosewheel onto a lazy Susan, right, keeping the nose gear pointed straight ahead, allowing very tight turns.

POWERTOW/SUPERTOW

Northwest Manufacturing offers five tugs in its PowerTow line targeted at the under-6000-pound airplane market. Four are powered by gasoline engines and one uses a 12-volt DC system. All offer snow chains for their single-drive tire and a headlight as options. All except the SuperTow I will accommodate wheel pants, although a $40 adapter is needed.

The Supertow I lifts the nosewheel onto a lazy Susan that keeps the nosewheel straight when towing and allows pivoting the airplane on one main wheel. The other four tugs use lugs that attach to the nose gear and are opened and closed using a lever on the handle. Nylon adapters are available to avoid metal-to-metal contact. The power controls and clutch are on the handle.

Although primarily designed for nosewheel airplanes, the EZ series and 12 Volt DC Tug will connect to Scott tailwheels.

The 12 Volt DC Tug is battery operated and advertised for a max airplane weight of 4700 pounds. The website specifically identifies it as suitable for the heaviest piston singles and light twins such as the Baron, Seneca, Skymaster and Twin Comanche. It's priced at $1855. We agree with the Northwest's recommendation that it be used on flatter hangar ramps and warmer climates. It uses a deep cycle battery and comes with a float charger.

The 40EZ has a 6.75 HP Briggs and Stratton engine, is marketed for an airplane max weight of 5500 pounds, including twins up through the Baron, Skymaster, Seneca and Twin Comanche. It is priced at $1455. This has long been a popular tug. Owners report having them operate reliably for well over 15 years.

The Key EZ is essentially the 40EZ with a number of options as standard equipment including electric start, 12-volt battery, charger and floodlight. While it has the same engine as the 40EZ, the manufacturer advertises it for an airplane max weight of 6000 pounds, 500 pounds more. Price is $1655.

Aero-Tow Lil Sherman, above, comes fully equipped, including headlights. AC Air TrackTech, above right, with control box, is a remotely controlled, tracked tug.

The top of the EZ line of tugs is the 65EZ, with an 8.75 HP engine. It has a heavier frame and larger tire than the other EZs and includes caster wheels, which help maneuvering. Max aircraft weight is 7000 pounds; it's priced at $2055.

The SuperTow I uses the same engine as the 65EZ, but is rated for aircraft slightly lighter, 6000 pounds, however, it is a true tug with twin driving wheels and it raises the nosewheel off of the ground. It will not accommodate wheel pants. At $2795, the SuperTow I is targeted at the user who has to maneuver in tight spaces.

DRAGGER

The Dragger line of tugs includes a pair of gasoline and battery-powered tugs for both nosewheel and tailwheel airplanes up through 6000 pounds.

The Nose-Dragger Dragger tugs have two drive wheels. Once the forward roller of the tug is snugged up against the front of the nose tire, the operator moves a lever to latch a roller against the rear of the nose tire. The nose tire is "cradled" as Dragger owner David Scholtz described it, so the airplane is moved without metal-to-metal contact. The Nose-Dragger accommodates wheel pants, so long as there is at least three inches of clearance between the bottom of the wheel pant and the ground.

The gasoline model has a 6 HP engine, hand clutch speed control, is advertised for airplanes weighing 6000 pounds or less and priced at $1595. The electric version uses a 24-volt battery with a twist grip throttle, is for airplanes of 5000 pounds or less and is advertised for $1695.

The Tail-Dragger Dragger tugs also have two drive wheels, however, they clamp on to the tailwheel and lift it off of the ground. We like the way it works. The gasoline and electric versions are powered the same as the Nose-Dragger Dragger versions and advertised for the same weight airplanes, respectively. The gasoline Tail-Dragger Dragger is priced at $1595, the electric at $1695.

The Dragger website has what we considered to be a useful aircraft compatibility chart. Available options are an extended handle for $149 and snow chains for $69.

We were concerned about the rolling cradle arrangement of the Nose-Dragger Dragger when dealing with hangar door rails and lips between the hangar and ramp. Feedback we received was conflicting—some said it was a problem, others said it was not, however, Dragger does sell ramps for those who have to deal with lips or tracks. If you have a hangar with the older, large door tracks, this may not be the right tug for a nosewheel airplane.

AERO-TOW

Terry Railing, proprietor of Aero-Tow, takes a little different approach to manufacturing tugs. His website showing his line of three, battery-powered tugs, gives information on the E-200, Lil Sherman and E-1800, but does not list the prices or show the aircraft weights for which they are appropriate. There are also no options—his practice is to make sure that each tug is fully equipped, which includes a light, as standard equipment on the Lil Sherman and E-1800.

In the business for 40 years, Railing wants potential buyers to call and describe the type of airplane involved and the environment so that they don't buy a tug that won't work for them. He said that his dissatisfied customers have been ones who bought less tug than was needed. He has seen users have difficulty assembling tugs or installing options such as lights—as a result, he has cut the assembly required on receiving each tug to installing one bolt.

Railing said that his experience with Alaska owners and building his tugs in Wisconsin is that snow chains are more trouble than they

CONTACTS

AC Air Technology
855-844-7222
www.acairtechnology.com

Aero-Tow
920-648-8114
www.aero-tow.com

Dragger
800-972-5563
www.dragger.com

Minimax Aircraft Tug
812-455-6984
www.minimaxtugs.com

PowerTow Aircraft Tugs
800-635-5565
www.powertow.com

Priceless Aviation Products
877-206-5116
www.pricelessaviation.com

Robotow
800-874-4702
www.robotow.com

are worth. It's better, in his opinion, to throw some kitty litter or oil dry on the snow or ice. It provides more than adequate traction and can be swept up quickly when done.

All of the Aero-Tow tugs have two driving wheels with 24-volt electric motors that use two 12-volt sealed batteries and include an automatic battery charger. The E-200 and Lil Sherman have lugs that attach to each side of the nose wheel strut, the E-1800 has a hydraulic lift that picks up the nose wheel.

The E-200 develops approximately one HP and is priced at $1425; the Lil Sherman's motor puts out approximately 3 HP, it's priced at $2425 and the hydraulic lift-equipped E-1800 also puts out about 3 HP and is priced at $6250.

PRICELESS AVIATION

Priceless Aviation Products offers two models of its 24-volt, battery-powered tug that it advertises for moving airplanes weighing up to 4500 pounds on a level, paved surface. Both have motors developing 400 watts—battery life on the 701's two 12 volt, lead-gel batteries is claimed at approximately one hour, while on the 701L it's 1.5 hours.

The two-drive wheel units clamp onto the nose gear strut but differ from other tugs in that there is a swivel attachment between the clamp and the tug itself, making steering easier.

The tugs are capable of handling tail wheel airplanes, although a longer clamp may be needed on some. The website contains a list of airplanes for which the tugs are compatible and adapters are depicted for various types as well as for those with or without gear fairings. Directional control is via a rocker switch and the throttle is lever-operated.

Prices are $2495 for the 701 and $3245 for the 701L.

For airplanes up to 6000 pounds, the Model 703, with a 190cc Honda engine is offered. It has a single drive wheel and, with adapters, its clamp will attach to most nosewheel and tailwheel airplanes. It's priced at $3795. Options include a headlight, battery tender, snow chains and a fire extinguisher.

AC AIR TECHNOLOGY

The AC Air TrackTech from AC Air Technology is a remotely controlled, battery-powered, tracked tug that lifts the nosewheel clear of the ground. It is capable of moving airplanes through the size of a Turbo Commander.

There is no lifting or shoving to steer this tug—the operator gives commands via a control box and can stand in the best position to watch wing and tail clearances, something we think is important when dealing with tight clearances.

Power is provided by a 16-volt battery and will handle airplanes with nosewheel pants. Battery life is estimated to be at least 1.5 hours without recharging.

Driving tracks rather than wheels, the manufacturer told us that customers have had good experience with operation on snow and ice. Price is $3750.

CONCLUSION

Bad tug-buying experiences seemed to us to be connected with a pilot lapsing into traditional tightwad mode and buying a low-powered tug when a bigger one was needed to deal with a slope or hangar door tracks.

We like the increasing capability of the battery-powered tugs, especially if the hangar has electricity and the battery can be plugged into the charger between uses. Without hangar electricity, we'd probably stay with a 100LL-capable gasoline engine tug so as to avoid having to haul batteries to a charger.

We're a little leery of the Nose-Dragger Dragger tug if there is a hangar lip or door tracks to wrestle with, as we would prefer not have to

continued on page 32

POWER DRILL TECHNOLOGY

Two manufacturers use what is effectively a power drill to run a powered tow bar that can handle a wide variety of piston singles and light twins for routine in and out of the hangar movement on flat surfaces.

The Minimax Aircraft Tug series (inset photo) uses a 20-volt Dewalt lithium-ion power system. We were told that a full charge would move a Bonanza the length of a football field.

All of its tugs consist of the power drill at the operator's end, a handle, drive shaft, transmission and attachment to the airplane. The transmission either drives two small "tractor tires" along the ground or a wheel that physically presses against and turns the nosewheel tire.

On a dry, level surface the nosewheel drive works a little better simply because of mechanical advantage. Once things get wet or snowy, performance can deteriorate pretty rapidly for both driving arrangements. Prices range from $729.95 to $829.95—although the nosewheel Maule tug is $1149.95.

Robotow offers a battery-powered 28-volt, 24-volt and a corded, 120-volt powered towbar that drives most nosewheel airplanes that do not have wheel pants. All versions drive the nosewheel tire.

The 28VL model uses a lithium-ion battery and is priced at $1299, the version for Mooneys is a little more expensive, $1341. The 24 SL model uses a lead acid battery and is priced at $1325. Prices for the battery-powered models include a charger. The corded 120v Millennium includes 100 feet of cord, which we've found is plenty long for most applications, and is priced at $1133.

So long as there isn't much incline or lip to deal with or a long distance to cover, these powered tow bars may be an economical way to move your airplane—just keep the mains properly inflated.

Engine Heaters: Probes, Bands or Pads?

Tanis probes heat the engine more quickly, but Reiff band heaters are cheaper and easier to install. Oil sump heaters are surprisingly effective.

Staff report

Unless you operate your aircraft in a warm climate, we think fixed engine heaters are essential accessories. Even if you store the aircraft in a heated hangar, there could be times when you're faced with an engine-stressing cold start.

Not all systems are alike and the one you choose might depend on climate. We took advantage of a harsh New England winter and evaluated the performance of three systems.

Our evaluation included a system from Tanis, which uses cylinder heating probes, the popular E-Z Heat system, which heats the oil using adhesive oil sump thermo pads, and a Reiff system, which includes heated bands that wrap around the cylinder base.

COLD SOAKED

In our estimation, engine heaters shouldn't be judged solely on how warm they heat the engine. Instead, it's how effective the system is at increasing the engine temperature above ambient and the amount of time it takes to do so.

CHECKLIST

- Reiff cylinder band heaters are an easier install than Tanis probes.
- Oil sump heating pads heat the oil to safe starting temperatures.
- Heating without flying can lead to condensation and corrosion.

We gathered three engines: a Continental IO-520, which was equipped only with an oil sump pad heater; a Lycoming IO-360, which has cylinder band heaters plus an oil sump heater; and a Lycoming 0-360, which has the Tanis heated cylinder probes and an oil sump heater.

The engines were cold soaked in temperatures ranging from 20-35 degrees F. We attached K-type temperature sensors to the base of a cylinder and to the top of the block. We also installed a dipstick temperature probe into the oil pan.

Each engine heater was turned on for eight hours overnight while onset HOBO dataloggers recorded the increase in temperature. We covered the engines with a blanket, installed cowl plugs and closed the cowl flaps. One engine—the Continental with sump heater—was parked in an unheated hangar and the others were parked outside.

E-Z HEAT

The E-Z Heat is the most basic system. It's lightweight and includes a flexible heating pad, which adheres to the surface of the oil sump with RTV silicon. E-Z Heat claims that these pads provide heat to other parts of the engine, through convection and conduction.

E-Z Heat is thermostatically controlled for monitoring oil temperature. When the temperature reaches

Blankets and insulated cowl covers, like this Cunningham, increase the efficiency of engine heaters. Before plugging in, install cowl plugs and close the cowl flaps.

110 degrees, the system shuts down to eliminate oil carbonization.

The Continental IO-520 in our evaluation had the pad installed on the oil sump. Its oil was heated to nearly 100 degrees F, which was 75 degrees above ambient. The heat radiated to the cylinders, increasing the temperature to 66 degrees F—nearly 35 degrees above ambient over the sampling period.

The McFarlane Aviation SAFE Heat pad—a product we didn't test because we didn't have access to an equipped aircraft, is thermostatically controlled to maintain oil sump temperature less than 160 degrees F. It sells for $198, or $323 with a temperature controller.

McFarlane makes a point that we once validated by placing a 100-watt light bulb inside the engine cowling. It can provide a similar radiant heating effect as a sump pad. That's because when the oil and oil sump are warm, the air inside the engine rises and warms the upper engine, cylinders, crankcase and steel parts.

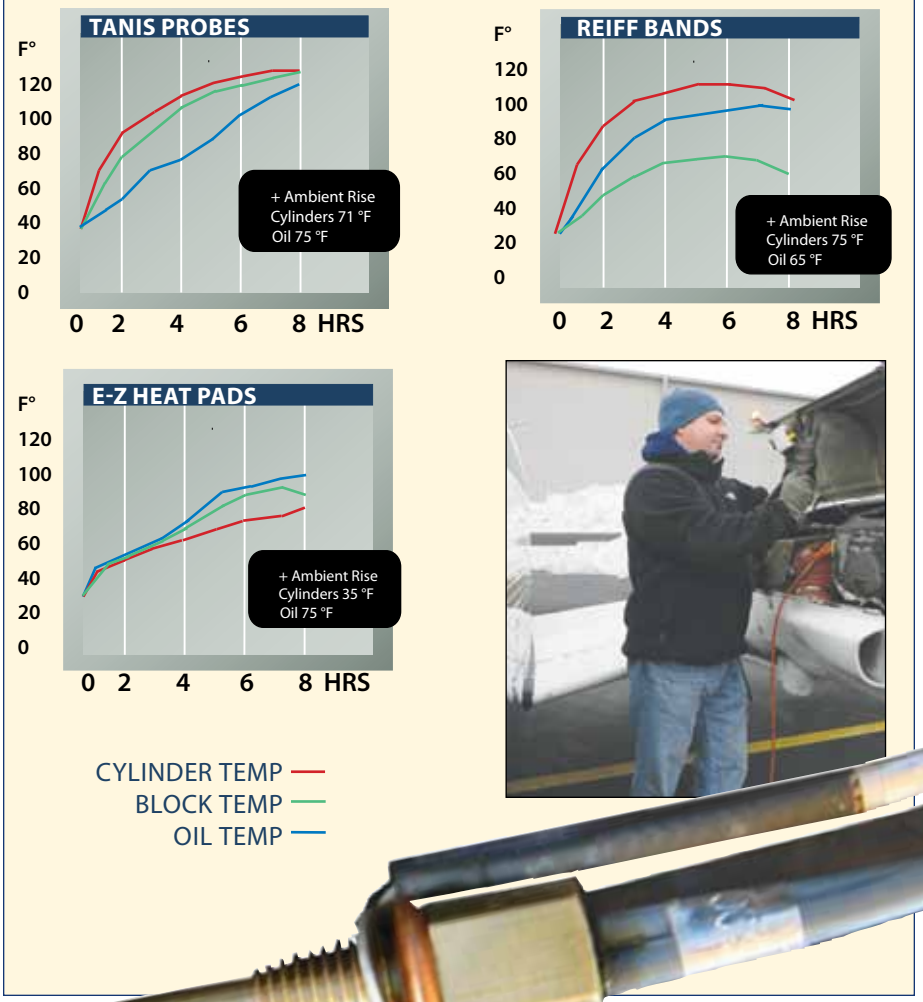
TANIS SYSTEMS

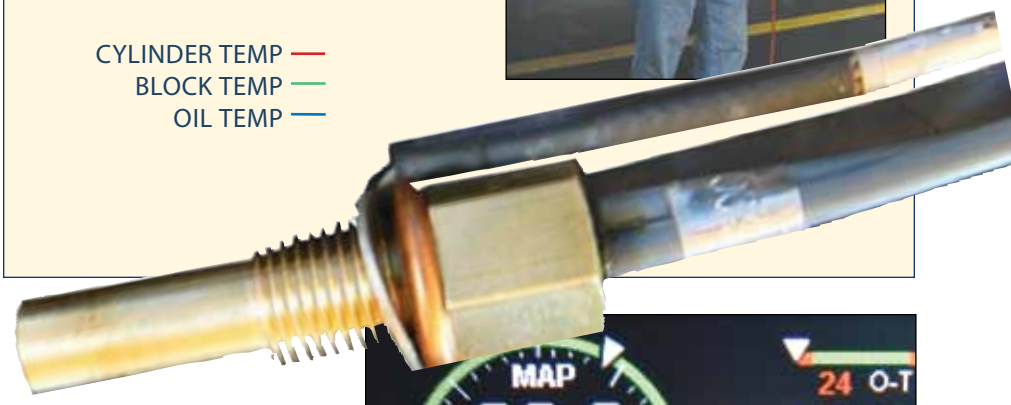
The Tanis system uses heater elements that thread into cylinder CHT ports. The system also includes a single oil sump pad. System wattage varies, from 240 watts for four-cylinder engines, to 720 watts for larger six-cylinder engines. For engines equipped with engine monitors—which have probes that occupy the CHT ports—Tanis offers a kit with threaded heat elements for replacing one of the rocker cover bolts in each cylinder.

We evaluated the Tanis system on a Lycoming engine that had a JP Instruments engine monitor and the rocker bolt probes. The Tanis offered the most rapid heating of all the systems, raising the temperature nearly 40 degrees F above ambient in the first hour.

Engine manufacturers, including Continental Motors—don't recommend leaving a preheat system on for more than 24 hours. If you are flying on a regular basis—which is once a week or more—Tanis says you can leave its system plugged in all the time because the heater elements keep the cylinder heads above the internal dewpoint of the engine. Controlling dewpoint, according to Tanis, eliminates condensation building at the top of the engine, a claim we couldn't verify. On the other hand, we're about saving energy whenever possible. Keep in mind that a Tanis system for a larger engine draws 500 watts. That's enough draw to get the attention of your landlord.

PREHEATER PERFORMANCE COMPARISONS





Low oil temperatures might reduce oil flow, which can put the oil filter into bypass. But oil isn't the only concern. Cold fuel and frosted spark plugs can lead to difficult engine starts.

MORE THAN JUST HOT AIR

One engine heater we like and have used for some years is the electric forced air system from Aerotherm—called The Deuce.

The Deuce works like the forced air furnace in a house—a fan blows air over a heating element, through a hose and into the engine compartment. For efficiency, the air blown into the engine compartment is recycled back to the heating element, via another hose.

The Deuce has two 800-watt heating elements, so it can be operated at either an 800- or 1600-watt output. It also has a thermostat that can be set for a specific engine temperature. The unit runs until the temperature is reached and then cycles off and on to maintain it, just as a furnace does. The fan runs constantly, keeping the air moving, which maintains the engine temperature more efficiently than if it cycles on and off with the heating element, just as with a house.

The Deuce can be hung on the prop via its attached strap, however, our practice has been to set it on the small step ladder used for checking the fuel tanks. The two hoses, appropriately labeled "suck" and "blow," are inserted into the cooling air openings on either side of the prop and sealed with the sponges that come with a unit. Aerotherm says that a perfect seal is not necessary, which has proven to be the case during our use. It looks a little primitive, but it works.

In a closed, unheated hangar Aerotherm advertises that the Deuce will heat the entire engine, including the oil, to 70 degrees in three hours and then maintain the temperature. That is consistent with our experience. Aerotherm recommends setting the thermostat at 70 degrees and simply leaving it there.

We have followed that practice, starting with the first cold days of fall and ending when we're convinced spring has arrived. Because the engine stays warmer than the dewpoint, there is no worry about condensation and corrosion in the engine.

The Deuce comes with a duffle bag. At 11 pounds, it's easy to package up and toss into the back of the airplane to take along on a trip. For heating the engine outdoors, it's necessary to have a blanket or cowling cover that also covers the lower cowling openings or the engine will not come up to temperature.

Aerotherm recommends that the thermostat not be set at 90 degrees or above for extended periods as the more than 300-degree air going through the "blow" hose and the heat of the returning air into the unit can damage the "blow" hose and the heating element. Why anyone would set the thermostat above 70 degrees is a mystery to us, unless they simply don't understand how a thermostat works.

The Deuce sells for $599 plus $25 shipping, and it comes with a five-year warranty.

For those who wish to heat the engine faster, Aerotherm has the Alien line of heating units— putting out from 1800 to 2200 watts and as much as a 47-MPH air flow.

The top-end, Alien X Turbo model, is advertised to heat the engine and oil in 30 minutes from a starting temperature of 0 degrees F. It sells for $949 plus $30 shipping.

As this article was being prepared, Aerotherm was beginning its end-of-season sale and had reduced the prices of all of its products by $150.

If you don't mind the extra chore of setting up and tearing down the system—not a huge deal, really—than we think the Deuce is a good alternative to electric element heating. Contact Aerotherm at 800-401-4397, www.aerothermheaters.com.

On a side note, heater-induced condensation and eventual corrossion is an ugly side effect. Continental's Bill Moss described such damage to the engine on a newer Cirrus. A proactive borescope inspection of its IO-550 revealed heavy corrosion, the result of the owner leaving the heater on for an entire winter.

Tanis Aircraft's Doug Evink told us that his company's system is intended to heat the entire engine, which he feels is in line with engine manufacturer recommendations. Further, Tanis does not sell or endorse systems that heat only the oil. As a result, all Tanis systems include an oil sump heating element, cylinder heating elements plus wiring harness and installation hardware.

Tanis also offers ancillary preheat products—including insulated blankets, to make preheating more efficient. Speaking of efficiency, we think any system will be more efficient if the cowling is covered.

REIFF HOTBANDS

Unlike the Tanis heated probes, the Reiff system heats each cylinder from the outside. The HotBands are stainless steel clamps with heating elements bonded to them. The bands install around the cylinder base, between the deck and the first cooling fin. The oil is heated with the thermostat-controlled HotStrip,

CONTACTS

E-Z Heat, Inc.
800-468-4459
www.e-zheat.com

Reiff Preheat Systems
262-593-5292
www.reiffpreheat.com

Tanis Aircraft Products
800-443-2136
www.tanisaircraft.com

McFarlane Aviation
866-920-2741
www.mcfarlane-aviation.com

Reiff's heated cylinder bands, top left, are effective and easy to install. The Tanis system conducts heat inside the engine with thermocoupled cylinder probes. Tanis also offers heated intake collar bolts, upper right. E-Z Heat oil sump pads, right, effectively heat the oil while conducting heat to the cylinders.

which is included as part of the complete heating system.

Reiff offers a la carte selection of the HotStrip pad, the HotBands or both. The systems are available in three tiers, based on wattage.

For example, the entry-level Standard system outputs 50 watts per cylinder band and includes a 100-watt sump pad. The Turbo increases the pad output to 100 watts, while the Turbo XP outputs 100 watts per cylinder and includes a 200 watt sump pad. We evaluated the Standard system on a Lycoming IO-360.

Unlike Tanis, Reiff advocates owner installation of their products, although we're not sure all owners will embrace the task—or possess the skill. It's not difficult work, but it does require drilling a hole through the aft engine baffling and installing a grommet. The grommet feeds the plug-in assembly back into the non-pressurized side of the baffling. The HotBands are plugged into a supplied harness and secured with Adel clamps to the case bolts.

Reiff provides JB Weld epoxy to hold the metal heat pads in place. Like the other manufacturers pads, it requires a thoroughly prepped surface for proper bonding—which is easier said than done.

Compared to the Tanis, we saw a similar rise above ambient for cylinder temperature and like the Reiff bands won't interfere with existing CHT probes.

COLD CRANKING

There's plenty of theory but little proof about the damage done during cold starts—including main bearing and crankshaft damage—due to lack of lubrication. There's also the potential for piston-to-cylinder clearance issues, resulting in metal-to-metal scoring of the piston and cylinder walls, when the pistons tend to warm more rapidly than the cylinders after engine start.

On the other hand, we think it's unrealistic to preheat every time you start a cold engine, especially between seasons when there could be vast temperature swings. Still, our rule of thumb is to not start a piston engine without a preheat below 25 degrees F.

Both Continental and Lycoming have service letters on the subject. Continental's SIL 03-1 says that preheating is required whenever the engine has been exposed to temperatures at or below 20 degrees F, for a period of two hours or more. They say this results in oil congealing within the engine, oil hoses and oil cooler, with subsequent loss of oil flow and subsequent engine failure. Lycoming's service letter 1505 requires preheating below 20 degrees F for the 76-series engines.

Unless it's colder than 20 degrees F, we're convinced that an oil sump heater—when used with a cowl cover—sufficiently heats the oil, with the added benefit of radiant heat to the upper engine, cylinders, crankcase and other components.

But for colder temperatures, we think both Reiff band heaters and Tanis probes are more effective. Reiff bands offer an easy and cheaper installation while Tanis heats the engine quicker, but with a more complex and costly installation.

In a future article, we'll cover remote starting systems designed for preheaters and look at McFarlane's preheating temperature controller.

TYPICAL SYSTEM	TANIS	TANIS ENG MONITOR	REIFF STANDARD	REIFF TURBO	REIFF TURBO XP	E-Z HEAT
FOUR-CYLINDER	$495	$720	$435	$535	$635	$169.95
SIX-CYLINDER	$730	$1080	$595	$695	$795	$169.95

Professional aircraft detailers like this technician at Immaculate Flight, left, are trained and experienced technicans. Automotive and marine detailers might lack the knowledge, training and liability insurance that's appropriate for working on aircraft.

Aircraft Detailing: More Than a Wash

Professional detailing can revive and protect aging paint, but even pros can't perform miracles on neglected surfaces.

by Larry Anglisano

One of the joys of ownership might be an afternoon spent at the hangar, sipping cold ones and shining up the airplane. But the effort might not be enough to protect the paint and other surfaces from long-term damage. Neglected surfaces may be too much to handle.

That's why hiring a professional detailing service can create a starting point—rejuvenating the finish while making routine post-flight cleaning easier. Detailing work is pricey, but might be paid during resale.

In this first in a series of articles on paint and interior upkeep, we'll look at professional detailing maintenance and explain why all providers are not created equally.

A TOUGH LIFE

Even for hangared aircraft, the surface of airframe components take a beating. It's bad enough that ultraviolet rays damage the paint while parked, but the real damage might happen in flight—even at low altitudes. Icing, rain and engine exhaust blow-by create added stress for paint and bare aluminum accessories.

When it comes to aircraft polish, forget everything you know about waxing the family sedan. Carnauba, the main ingredient in many automotive waxes, just isn't as effective as the sealants used in aviation-grade treatments. Plus, aircraft paint care is far more involved. Whether performed all at once or spread out over time, there are numerous steps involved in a professional treatment.

The first and basic step might be a thorough wet wash with an aircraft-appropriate soap—although there's valid arguments against wet washing, given the presense of flouride and other additives in local water supplies. The concern here is the potential for damage to landing gear component seals, corrosion on electrical connectors, and injecting water into pitot and static systems. There's also an increased EPA involvement with airport wash pits and a movement to stop harmful degreasing agents from flowing into airport drains. For these reasons, many professional detailers are switching to dry wash products, which we'll cover in a future article.

LABOR INTENSIVE

Owners with sticker shock naturally attempt the detailing project on their own. But before you tackle a worn paint finish, understand that the process isn't going to be quick and easy. Some finishes may be too far gone to gain any improvement.

First, make an honest evaluation of the paints condition. If it's chalky, peeling or down to the metal, it's likely time for a new paint job. But in many cases, skilled detailers can bring some finishes back to life. Still, rejuvenating an aircraft's finish is more than a wash and wax-job. Without the proper tools and process, amateurs end up doing more harm than good. For starters, don't rely on polish or wax to shine the paint finish because you'll first need

CHECKLIST

- ✚ Yearly polish and sealant treatment helps protect against the elements.
- ✚ Detailers create a finish that you can maintain on your own.
- ⛔ Pro detailers aren't miracle workers—paint won't last forever.

to prepare and rejuventate the surface. This process creates the brilliant shine that owners are looking for.

In most cases, you'll need a machine buffer to accomplish the compounding process. This removes old wax, paint oxidation and contaminants. Depending on how involved the decontamination process was, a second wash or rinse may be necessary.

Once the project is finished, it's up to you to maintain it. Set your flying schedule so you have time to wipe off the bugs, grease and exhaust contamination after every flight. Remember, preventive paint maintenance is always cheaper than replacement. Many detailers recommend a wash and polish twice a year, after bringing the paint back to life. Climate considerations, of course, can affect this maintenance interval.

But paint isn't the only upkeep. There's also brightwork—which addresses the bare aluminum accessories on the airframe, to include some exhaust stacks, leading edges and propeller spinners. Deicing boots require care, too. It's important to periodically remove debris and old sealant from their surface. Not only will the boots look shiny, protecting them from the elements could extend their useful life while helping them shed more ice.

LESSONS FROM THE PROS

We talked with several professional aircraft detailing specialists, including Stephen Clark with Immaculate Flight. Clark is the marketing manager at Immaculate's Seattle location, which works with Boeing, major fractional jet operators and private and business aircraft owners. Immaculate is a mobile franchise business, with over 80 locations scattered around the country.

Clark warned about the pitfalls of hiring amateur detailers to care for your aircraft. These may be one-man operators working out of the back of a truck, students making spare money to pay for flying lessons or automotive detailers trying to move up in the industry.

"Our team of detail professionals are highly trained. They don't just start detailing aircraft their first day on the job. Moreover, detailers that work in the marine and automotive industry are often limited by knowledge, tools and the products that are required for working on an aircrafts finish," said Clark. While we agree, it's important to note that many talented detailers are one-person operations. They have lower overhead which could benefit your checkbook.

On the other hand, Clark stressed that you want to work with a company that has plenty of insurance. According to him, one of the biggest problems in the detailing industry relates to the value of newer aircraft, noting that some detailers don't

It's not all about status. Jet operators recognize frequent detailing work as an essential maintenance item to protect against paint-killing ultraviolet rays. Speaking of killing paint, the soot-spewing smoke stack from a garbage plant destroyed the neglected and unprotected finish on this Cessna, center photo. Treating-deicing boots, lower photo, is an add-on detailing service that could save you money later on.

AIRCRAFT DETAILING 101

- **Wash/Degrease:** Remove surface contaminants, oil, soot
- **Compounding:** Remove oxidation, old polish, shines paint
- **Polish/Sealant:** Protects shiny paint, eases bug removal
- **Brightwork:** Treat bare aluminum accessories, spinner, etc.
- **Bootwork:** Treat and restore all deice boot surfaces
- **Interior:** Treat leather, clean vinyl/fabric, vacuum carpet

JUST HIT IT REAL QUICK

Those are the words I would hear when an aircraft owner or a maintenance director would usher me in front of an aircraft that had a worn paint job—expecting me to perform miracles. Yes, sometimes a miracle was possible. Other times, it was time for the owner to open the checkbook and buy a new paint job.

As an owner of an aircraft detailing business and detailer for a large FBO, I spent years doing nothing but shining surfaces. Wet washing, dry washing, aluminum polishing, paint polishing and interior cleanings. Detailed detailing. Our company buffed Grandpa's Piper and cleaned up rock star Pink's Gulfstream G4.

A thousand jobs later, I still couldn't answer the facetious "you missed a spot" chiding, without sounding indignant. But I have learned a great deal from all those years in the business.

My advice to owners has always been to hangar the aircraft whenever possible. That's because the sun, like other elements, is a paint killer. Ultraviolet light is absorbed by the paint, breaking down the paint's chemical bonds. This dries out the paint and accelerates the total break down of the finish. Left unchecked, it leads to total paint failure. Unfortunately, this is when a majority of the owners would bring their planes to me. I would look at the oxidized finish, immediately recognize how involved the job was going to be and cringe at the quote I was going to have to give. Owners with neglected paint finishes would counter, often asking for a quick wax application. Unfortuntely, I would have to explain that a wax job wasn't possible because you simply can't wax over oxidation. It will streak the finish into a mix of shiny and dull spots—making it look even worse. The relationship would become stressed when I would tell the owner that unless it's done properly, it's better to just leave it the way it is.

In most climates, an aircraft that has been sitting outside for more than several months—without even having a basic wash, is going to require many more man hours to detail than a periodic, scheduled polish and protectant job on a maintained finish. Hitting it quick just isn't an option.

What many owners don't realize is that detailing work should always be factored into the budget. It's a real operating cost—and one that's far cheaper than writing a check for a new paint job. *—Marc Gunther*

carry enough liability insurance.

Robert Pavone, at principle at Down to the Last Detail in Chicago, views his around-the-clock detailing service as an important way for owners to protect their asset.

"In the 20 years of running my business, I've never had a customer question the value of our professional detailing service. A quality detail job offers pride in ownership, while protecting the aircraft's value. It's also an important maintenance event for preventing corrosion," said Pavone.

Mike Pride, the owner of Leading Edge Aviation in Dallas, Texas, had convincing reasons for developing a relationship with an aircraft cleaning company.

"Completely and properly detailing an aircraft is extremely hard work that can take one person up to two full days to accomplish. Our process is extensive. All surfaces are first compounded with rotary polishers and wool pads to remove exterior surface oxidation and fallout. A specially designed aircraft paint sealant is then applied to protect the paint from the elements," said Pride. This treatment typically lasts for roughly one year, depending on flying time and conditions. He recommends quarterly dry washes, since most dry wash products have a little bit of sealant in them, which helps bolster the paint protection in between annual treatments.

As for using automotive wax, Pride advises not to bother.

"Due to the friction that can build up during flight, an automotive wax will probably last one or two flights. Additionally, automotive waxes may contain carnauba and silicones, which can cause a buildup of static electricity and possibly cause interference with flight instruments."

When it comes to the interior, Leading Edge recommends treating all carpets with a fiber protectant, which in effect seals the fibers and makes it more stain resistant.

FBO SERVICES

You'll find detailing services available at many FBO's, which can be a good and cheaper alternative to a detailing company, especially if you base the aircraft in the servicing FBOs hangar. But we suggest inquiring about the experience level of their detailing staff.

Maria Tari, who manages multiple Atlantic Aviation locations in Connecticut, told us that her detailers are trained from other detailers in the business. "Our lead tech was trained by a pro detailer and he, in turn, trains select members of our staff," said Tari. As a large FBO, Atlantic has liability insurance.

Atlantic's pricing structure varies, depending on the size of the aircraft and the condition of the paint. For example, the wet washing and polishing service for a Baron runs $375, not including brightwork, interior cleaning and boot treatment. Full treatment could yield a price nearing $700. We got ballpark quotes of around $1000, from full-time detailers, for the same treatments.

Speaking of treatment, every detailer we spoke with stressed the importance of carefully treating the finish on composite aircraft. The strong chemicals in some cleansing agents can be harsh on life-limited composite structures. Similarly, you don't want an inexperienced detailer to douse the screens of your flight displays with chemical cleaners. The pros know better, and if they don't, they'd better have good insurance.

GPS for iPad: Garmin GLO a Good Fix

Cockpit apps need GPS position. Garmin's GLO offers impressive lock-on while a new Bad Elf brings flight data logging.

by Larry Anglisano

CHECKLIST

- GPS receivers for iPad are compact enough to manage in the cockpit.
- Bad Elf GPS Pro is smart—logging your flight tracks for download later.
- Apple's GPS-assist doesn't provide bullet-proof position.

The performance of the internal GPS in Apple's iPad can be hit or miss when used in many aircraft cabins. Some earlier flavors of the iPad don't have GPS at all. For apps that offer navigation, you'll need to ensure an uninterrupted GPS position fix. A remote GPS is the answer.

We collected four of the most popular lower-cost external GPS receivers and put them to the test. Here's how they performed.

WHY YOU NEED THESE

Apple's built-in Location Services allows location-dependent apps to use position information derived from cellular, Wi-Fi and GPS. Apple calls this Assisted GPS. Obviously, there will be times when none of these position sources are available. Cellular coverage may be available at some altitudes, but it's hardly a reliable source for the fix that's required for most mapping apps.

Moreover, even iPad 2 and higher models with Wi-Fi, 3G cellular capability and internal GPS with Glonass have proven less than reliable for use inside of the cabin—requiring long periods of time to acquire a fix, while experiencing signal dropout. If you use the device as a kneeboard—where it's sitting low, performance will likely be worse than when it's mounted next to a window.

OUR EVALUATION

We used the units with Apple's new iPad mini and with a first generation iPad—observing make or break performance characteristics, including ease of Bluetooth pairing and connectivity between the receiver and iPad, plus battery endurance. We used each receiver to feed position to several aviation apps, including ForeFlight Mobile, Jeppesen FD, AOPA FlyQ and Garmin Pilot.

The acid test for a remote GPS receiver is its ability to provide seamless connection when switching apps on the fly. The other requirement is quick signal lock-on and the receivers' ability to maintain adequate signal strength to keep the app moving.

We used the receivers in a Beech, a Piper and in a high-wing Cessna. For

The pass through, plug-in Bad Elf GPS, right photo, requires Apple's Lightning-to-30-pin adapter for use with the iPad mini, but plugs directly into full-sized iPads. Garmin's GLO, above, connects via Bluetooth.

Stick em' up. And in. The Dual Electronics XGPS150A, top, stuck like glue to every glareshield we tossed it on. Garmin's GLO, middle, had a tendency to slide around unless the surface was flat and smooth. We ended up laying its rubber mount on the seat, where—thanks to its GLONASS receiver—it worked. We think the plug-in Bad Elf GPS, bottom, is vulnerable to connector-snaps while knee-mounting a full-sized iPad.

times when Wi-Fi might not be available, we observed the performance indoors—by a window, and inside a vehicle. The good news is that all of the units we evaluated provided rock-solid GPS position.

How you use your iPad might determine which receiver you buy. If the iPad will be passed around the cabin, you'll want a Bluetooth receiver.

GARMIN GLO

Based on specs alone—and a $99 retail price, we think the GLO is a solid value. It's a good performer, too. That's because it receives both the U.S. GPS Constellation and the Russian GLONASS system, both of which have 24 satellites in orbit.

According to Garmin, this gives GLO a 20-second faster lock-on compared to a GPS-only receiver. The position updating is 10 times per second and 10 times faster than the GPS receivers used in most consumer electronics. We can attest to this claim—the unit never lost lock in any of our test aircraft, including one with a heated windshield.

The availability of all the satellites in view can only help its performance. In our view, this helps ensure solid navigation on consumer portables with marginal GPS performance.

The GLO can be placed in a rubber housing, which acts like a suction cup, but only on smooth surfaces. This pad-like mount worked on most flat and smooth surfaces but didn't grip well to a contoured glareshield. In fact, after fighting with the unit's mediocre anti-skid mount, we ended up laying it on a seat. Even down low, the reliable GPS receiver never lost lock.

Out of the mount, the receiver is small—3 inches by 1.5 inches—and it'll drop right into a jacket pocket. Once we forgot it was there, until it automatically connected to the iPad while setting up another unit in the cockpit. We kept it under cover to see if it would lock on and sure enough, it did.

In flight, the GLO didn't disappoint—maintaining lock, no matter where we placed it in the cabin.

The GLO uses a rechargeable lithium-ion battery which Garmin says will power the unit for 12 hours. Plug it into a computer USB or external power for charging.

DUAL XGPS150A

The $99 Dual unit is endorsed by Apple, for working with all models of the iPad, iPod touch and iPhone. It's also compatible with Android devices, using a switch on the side of the case for selecting the appropriate operating system.

The new A-series model replaces the original XGPS150. It comes with an improved cigarette lighter adapter that handles higher input voltages up to 30 volts, while providing 2.1 amps of current. The benefit here is its ability to handle 28-volt electrical buses. When it's not plugged in, a fully charged battery has a reported 8.5 hours of endurance and recharges in 2.5 hours by USB.

The Dual—housed in a 2.5 x 0.75-inch case, uses a 65-channel SkyTraq GPS engine, which has an advertised location acquisition time of 30 seconds or less—performance we can attest to. It locked on well before we were ready to start an engine.

What impressed us was the Dual GPS status app. The program tells you everything you would want to know about the unit's status, including GPS signal, accuracy, battery level, connectivity and a nifty pictoral of your present location on earth.

The unit comes with a non-skid rubber mounting pad, which per-

formed well. It ended up in our lap once while in turbulence, but the day was exceptionally bumpy.

Also included is an arm strap for taking it along for sporting activities. We took the receiver hiking in the woods and while paired to an iPod, it maintained reasonable signal.

During our evaluation, the Dual wouldn't work with Jeppesen's Mobile HD app. Despite having solid GPS lock and Bluetooth connection with an iPad 2, we couldn't use it for position on Jeppesen's map. We reported the issue to Jeppesen and they're looking into it. The unit worked fine with ForeFlight and with all of the other apps we used during our trials.

BAD ELF

The $130 Bad Elf GPS connects directly into the 30-pin connector on the iPad, iPhone and iPod touch. It's a no-hassle device with just one wart—it's susceptible to breaking off at the connector. For careless pilots who toss a full-sized iPad around the cabin—us included—the 30-pin connector may prove vulnerable to breakage. We preferred it paired with a iPad mini, but that has its challenges, too. That's because the mini doesn't use the familiar 30-pin port. Instead, you'll need to plug the Bad Elf into the Lightning pigtail adapter, which then dangles the receiver a few inches off the device. For a fixed-mounted mini, it's not a real issue, but we found it awkward when handling it.

The 66-channel WAAS receiver is roughly the size of a quarter and has an LED status lamp, which lights if there's an app that's using the current location fix. Position lock-on was fast—under a minute inside the aircraft, no matter where we put it. Configuring Bad Elf products is simple once you download the Bad Elf firmware. Bluetooth connectivity is reliable and seamless.

Think of the lanyard-mount Bad Elf Pro as a personal GPS tracker and datalogger. It can record and download trip data, while feeding WAAS GPS position to multiple devices in the cabin.

The newly-introduced, $180 Bad Elf GPS-2200 Pro is both a GPS receiver and a datalogger, with a GPS reporting rate of 10 times per second. Its water-resistant case—which measures 3 x 2.4 x 0.7 inches and weighs 3.2 ounces—is designed to hang around the neck, which we found convenient in the cockpit and for taking it on the go. In Bad Elf tradition, setup is easy and GPS performance was exceptional.

Speaking of exceptional, that's how we describe the unit's battery endurance. It offers nearly 17 hours of life when in Bluetooth mode and upward of 32 hours when used as a standalone datalogger.

We struggled, however, with its LCD screen in certain lighting conditions. The backlighting helps, but we wish it were brighter. The display shows your location, speed, heading, altitude and GPS lock-on status.

The Elf GPS Pro can be used by up to five devices simultaneously—connecting to any combination of iPads, iPhones or iPod touch devices. In our view, this is a huge convenience for both crewed and passenger-carrying missions.

Datalogging is accomplished by pressing the GPS button on the left side of the unit, which serves double-duty as a position marker. At the end of the flight, the logged data can be transferred from the Bad Elf app via email and through social media, including Facebook and Twitter.

DOLLARS AND SENSE

Buying a 3G-equipped iPad 2 or mini in hopes of better GPS-assist performance doesn't make sense for cockpit use, in our view. 3G capability adds $130 to the base price. We think the money is better spent on any of the dedicated receivers covered here.

Since you'll have to choose, we like the compact design of Bad Elf plug-in GPS but didn't like the awkward Lightning adapter cable that's required for the iPad mini. It just got in the way.

The lanyard design of the Bluetooth Elf GPS Pro impresses with long battery life and solid GPS performance, with GPS tracking and data logging capability as a bonus. It also has a distinct advantage over the others, since it can drive multiple devices in the cabin.

In the end, we favor the Garmin GLO because of its flawless GPS performance—thanks to the added GLONASS capability. It's also priced right. Bad Elf is currently working on a new unit with GLONASS. We'll look at it in a future issue.

CONTACTS

Bad Elf
602-326-7374
www.bad-elf.com

Dual Electronics
866-382-5476
www. dualav.com

Garmin
800-800-1020
www.garmin.com

Paper VFR Charts: Good Options and Prices

A subscription means always having a current chart. Sky Sectionals provides printable charts, and Tri-Nav sells easy-to-use books of sectionals with updates.

by Rick Durden

Despite all the developments in the world of electronic charts, many pilots still like paper. Reasons include avoiding what can be pricey electronic device updates, a perceived ease in keeping track of the geographic "big picture" beyond the magenta line and not being quite convinced that electronics are infallible, are infallible, are infallible.

No matter what chart is used, the important factor is making sure that the most current information regarding a proposed flight is easily available—cost is a close second. For a paper-preferring pilot who routinely flies within an area covered by four to six Sectional Aeronautical Charts (sectionals), we think the best approach is to simply purchase a subscription for each.

If a pilot is routinely buying six or more sectionals, the equation changes to buying an annual subscription offered by one of the companies that print sectionals in spiral-bound volumes and provide an update service to allow the pilot to keep abreast of changes.

Part 91 pilots are not required to have current, or any, charts on board. However, they are required by Part 91.103 to become familiar with all available information concerning a flight prior to departure. A current chart or annual chart service that provides updates is, in our opinion, an easy way to comply.

TYPES

As it has been almost since Wilbur and Orville, the two main types of VFR charts are sectionals, with a 1:500,000 scale and World Aeronautical Charts (WAC), with a 1:1,000,000 scale. Both are supplemented, for areas covered by Class B airspace, with Terminal Area Charts (TAC), which have a scale of 1:250,000.

Because of the scale and lack of surface detail of WACs, their most common use seems to be in Part 135 operations where current charts are required, and VFR charts have to be on board when there is some portion of a flight that is not on an IFR clearance. For space and cost considerations, operators subscribe to the appropriate WAC charts.

The workaday chart is the sectional. For paper chart pilots, the question is the most economical method of maintaining a current collection that covers the right area.

BUYING SECTIONALS

The current, standard price of a sectional chart is $9. If you are fortunate to have a pilot supply shop nearby, it's easy to stop in and buy what you need. Barring that, a sectional may be purchased from the FAA (the AeroNav folks at the FAA produce the charts) through the faacharts.faa.gov website. For $34.20, you should be able to buy a subscription that ships you the most current chart as it is issued over the next two years, saving you $1.80 and that "Aw, nuts, my chart's out of date" feeling. Unfortunately, our experience with trying to order a chart through the user-unfriendly website was so frustrating that we eventually gave up.

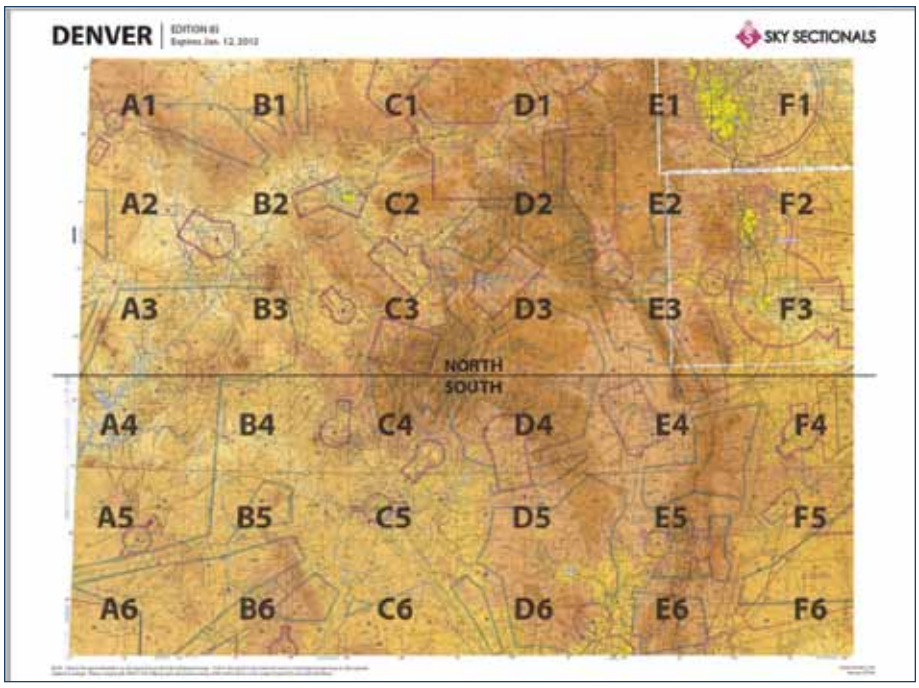
Mypilotstore.com sells sectionals for $7.50, a one-year subscription for $15.00 and has free shipping. Aircraft

Sectionals and WACs, as well as Tri-Nav and Air Chart Systems bound sectionals.

CHECKLIST

- Chart subscriptions save money and assure you have current charts.
- For wide-area coverage, bound books such as Tri-Nav's are economical.
- We like using Air Charts, but the website provides no way to place an order.

Sample SkySectional.com chart showing individual panels that can be printed full size.



Spruce (www.aircraftspruce.com) also charges $7.50 for an individual sectional and offers free shipping. Spruce's website said subscriptions were available, but every time we tried to set up a subscription, it only gave us one chart. Sporty's (www.sportys.com) sticks with the $9.00 FAA price, offers subscriptions and charges $4.95 for shipping. Sporty's also only gave us one chart when we tried to set up a subscription.

NO FOLDING

While we believe that a part of pilot training should include unfolding and folding charts, there is hope for the folding impaired. Sky Sectionals sells downloadable sectionals for $9.99. Each sectional is broken into panels, which can be printed, full-size, on a standard sheet of paper. You keep a current sectional on your computer and print out the portions you wish, including potential diversions, for each trip.

Sky Sectionals also breaks the continental U.S. up into thirds and offers a subscription service for all of the sectionals in that third for $139 or the full lower 48 for $239 a year. If you want TACs as well, it's a little more.

For the pilot who either lives near the corner or edge of a sectional or does a fair number of cross-countries a year, a subscription to the relevant sectionals can get pricey, and the number of folded maps can become unwieldy. A better solution may be a subscription to one of the companies that provides sectionals in a spiral-bound format.

BUY THE BOOK

Tri-Nav Aviation Charts break up the continental U.S. into four regions, and present all of the sectionals in each region in a format that is only slightly larger than a standard sheet of paper. For $59 you get a book and updates every 28 days. You refer to the updates for the most current information—they tuck into a pocket in the back. The book includes all of the legends and associated information for the sectionals in the area such as MOAs, restricted airspace and ATC frequencies. Coverage of all of the lower 48 is $236. TACs are not included.

Air Chart Systems breaks the continental U.S. into east and west at the western border of Minnesota for its VFR Sectional Atlases. Its book is about 11x11 inches. Updates are provided every 28 days and are cumulative, so only the most recent needs to be kept. TACs are not included.

A chart locator key inside the front cover makes it easy to quickly find the appropriate page needed and draw a line for a trip that is going to cover more than one page.

We were surprised in researching this article that the website does not show prices, a phone number or any way to order charts. The "contact us" page does not even give an email address; you must fill out your contact information and then enter a code designed to fight spammers. However, the letters are so difficult to read that we apparently never got them right.

Repeated attempts to reach Air Charts did not elicit a reply. We cannot recommend a purchase currently as we cannot determine if the company is still viable.

CONCLUSION

Paper charts have long helped pilots get the "big picture" when flight planning and dealing with diversions in flight. Even for dedicated users of electronic charts, a paper backup is good insurance. For pilots who routinely fly in an area covered by six or fewer sectionals, we recommend getting a subscription for the sectionals, as well as TACs, through Mypilotstore.com or Aircraft Spruce as they have the best prices and free shipping.

If you don't want to wrestle with folding charts, the prices are reasonable and it's easy to download and print off the sectional panels you need from SkySectionals.com.

Should you routinely travel more than a couple of hundred miles, the bound book of sectionals is, in our opinion, the convenient and economical way to go, so long as you are willing to check the updates. For that we like Tri-Nav's size, arrangement and pricing.

CONTACTS

AeroNav (FAA)
faacharts.faa.gov

Tri-Nav Aviation Charts
772-812-7540
www.trinavcharts.org

Air Chart Systems
www.airchart.com

Sky Sectionals
www.skysectionals.com

Piper Apache-Aztec

An Aztec may not be cheap to operate, but it's an affordable buy. The purchase price includes excellent handling and as much as a ton of useful load.

Some insist it began production as the world's largest flying sweet potato and evolved into Snoopy crouching as he waited for his supper. The original PA-23, the Apache, seemed almost round and had such modest powerplants that single-engine operation could be hazardous—just as with other twins with small engines. The last versions, the Aztec series, by contrast, are capable load-haulers with very good short-field performance.

The Apache is largely relegated to the training function for those looking for cheap-to-fly time builder but the Aztec remains one of general aviation's stalwart twins and although it has high operating costs, it can be bought relatively cheaply.

MODEL HISTORY

In the early 1950s, the major aircraft manufacturers that had survived the post-war boom and thud scrambled to come up with a light twin. Beech and Aero Commander were first off the mark and Cessna was rumored to be coming out with one as well. Each was all-metal and of semi-monocoque construction. Until then, Piper had been a builder of steel tube-and-fabric machines but had acquired the Stinson Division of Consolidated Vultee. With it came the tube-and-fabric Twin Stinson, with 125-HP engines and twin tails. Piper installed 150-HP engines, changed to a single vertical fin and rather than redesigning the fuselage, simply covered the steel tubes with aluminum, creating the PA-23 Apache. It went on sale in 1954. Its fat, constant-chord wing allowed it to use the abundant short runways of the day but, with the chubby fuselage, kept cruise speeds leisurely.

All versions of the Aztec are capable load-haulers with good short-field performance.

The original Apache had five seats, Lycoming O-320-A1A engines of 150 HP each, swinging two-blade props. Maximum gross weight was 3500 pounds (to put this in perspective, it's only 100 pounds more than a V35 Bonanza and less than most of the big six-place singles), with a 1320-pound useful load. Top speed was 157 knots, with a published but optimistic cruise of 148 knots, while 135 to 140 knots proved to be more realistic. Average equipped retail price was $36,235.

Three years later Piper put 160-HP O-320s on the airplane and equipped it with full-feathering props. The primary benefit of the change was a 300-pound boost in gross weight.

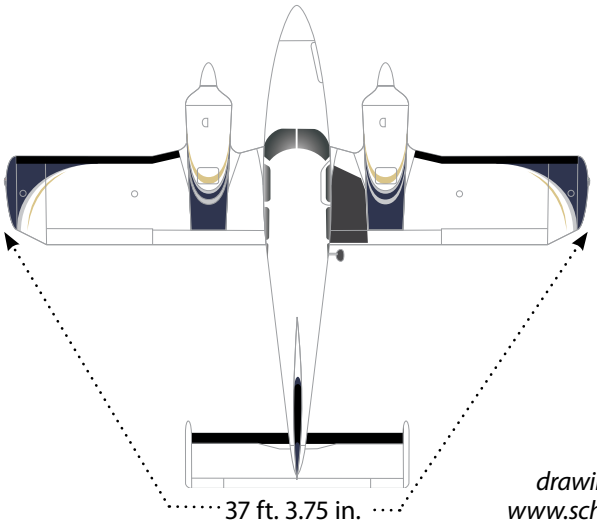
Other specs remained much the same, although single-engine performance actually suffered due to the higher allowable weight.

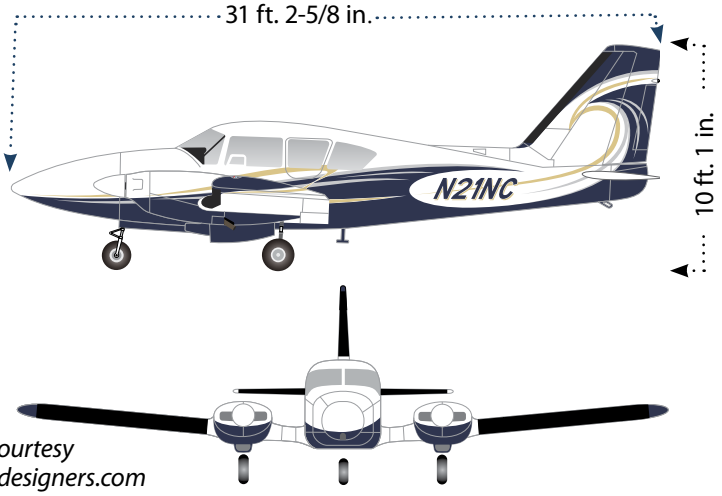
In 1960, Piper introduced the Aztec, a stretched PA-23 airframe with 250-HP Lycoming O-540-A1B5 engines and a larger tail with stabilator. Max gross weight was 4800 pounds. The Aztec was sold side-by-side with the Apache, and hurt the lighter airplane's sales badly. In 1959, 368 Apaches were built. In 1960, only 141 Apaches rolled off the line, compared with 363 Aztecs. In 1961, Apache production had fallen to 28 airplanes.

In a questionable attempt to resurrect sales of the Apache, Piper hung low-compression, 80-octane versions of the O-540 on the airplane in 1962, calling it the Apache 235. It hung on through 1965, with a total production run of 114.

Also in 1962, Piper added a longer nose to the Aztec, housing a baggage compartment. This airplane, the Aztec B, came with six seats, a pop-out emergency exit window and was

PIPER APACHE-AZTEC



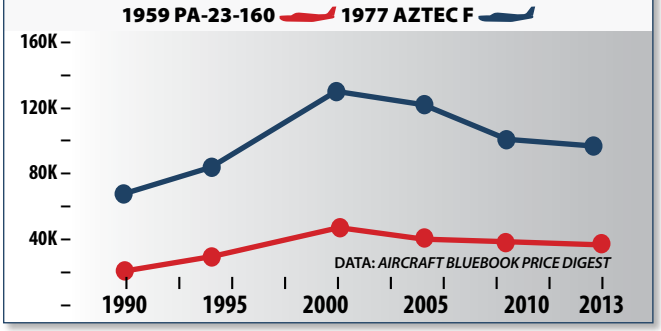


drawings courtesy
www.schemedesigners.com

PIPER APACHE-AZTEC SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1954 PA-23-150	150-HP LYCOMING O-320-A1A	2000	$21,000	72/108	1300 LBS	148 KTS	±$30,000
1959 PA-23-160	160-HP LYCOMING O-320-B3B	2000	$21,000	72/108	1450 LBS	150 KTS	±$33,000
1962 PA-23-235	235-HP LYCOMING O-540-B1A5	2000	$30,000	140	1900 LBS	178 KTS	±$50,000
1962 AZTEC B	250-HP LYCOMING O-540-A1D5	2000	$28,000	140	2025 LBS	178 KTS	±$32,000
1972 AZTEC C	250-HP LYCOMING IO-540-C4B5	2000	$35,000	140	2270 LBS	178 KTS	±$55,000
1972 AZTEC E	250-HP LYCOMING IO-540-C4B5	2000	$35,000	144	2158 LBS	180 KTS	±$72,000
1977 TURBO AZTEC E	250-HP LYCOMING TIO-540-C1A	1800	$50,000	144	1980 LBS	204 KTS	±$82,000
1977 AZTEC F	250-HP LYCOMING IO-540-C4B5	2000	$35,000	137/177	2150 LBS	176 KTS	±$95,000
1977 TURBO AZTEC F	250-HP LYCOMING TIO-540-C1A	1800	$50,000	147/177	1880 LBS	215 KTS	±$105,000

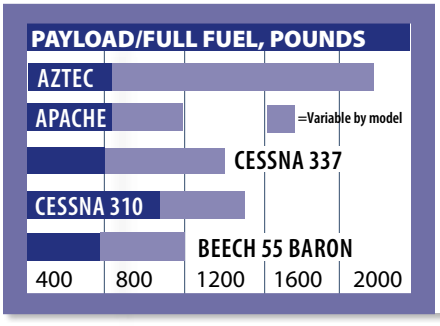
RESALE VALUES

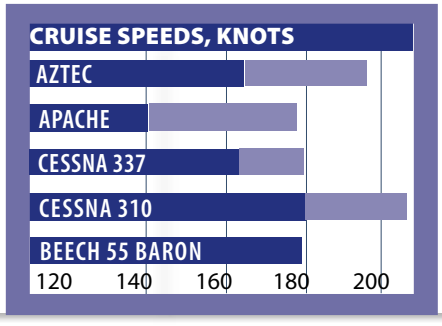


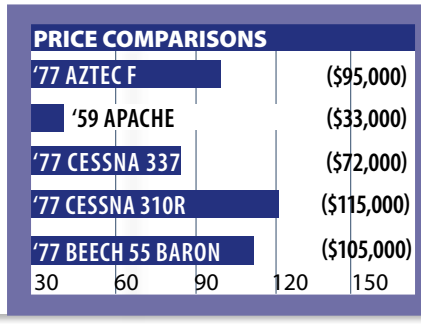
SELECT RECENT ADs

AD 2009-13-06	INSPECT/REPLACE NOSE BAGGAGE DOOR COMPONENTS
AD 2003-09-13	FLAP CONTROL TORQUE TUBE INSPECTION
AD 99-05-09	INDUCTION AIR FILTER REPLACEMENT
AD 96-21-04	INSPECT/REPLACE HYDRAULIC HOSES
AD 81-04-05	INSPECT/REPAIR FLAP SPAR HINGE ATTACHMENT

SELECT MODEL COMPARISONS







The original Apache almost appeared to be a collection of eggs flying in formation, left. The Geronimo conversion, below left, includes larger engines and a major aerodynamic cleanup.

available with optional fuel injection and AiResearch turbochargers.

In 1964, with the Aztec C, fuel injection became standard, and there was another boost in gross weight, to 5200 pounds. In 1966, the turbo option became a full-fledged model, with a standard oxygen system. During the run of the Aztec C, the engine TBO went from 1200 to 2000 hours, a benefit retrofittable to the older engines with the installation of half-inch exhaust valves.

The D models had minor improve ments, including instrument arrangement. The E and F models have a nose extension with a fiberglass cap. The longer, pointed nose is a detriment from the radar standpoint, according to Aztec expert Tom Baum. The more tapered nose allows only a 10-inch radar antenna, not a 12-inch.

The big changes in the PA-23 all happened in the early 1960s. After the Aztec C, the alterations were mostly refinements. During the 26-year history of the PA-23, 2036 small-engined Apaches were manufactured, 114 Apache 235s and approximately 5500 Aztecs.

MARKET SCAN

The PA-23 should be thought of as two different airplanes—the Apache and the Aztec. With such a variety of power, weight and age, a buyer can find a PA-23 to fit almost any budget. Original Apaches in average condition carry price tags around $30,000, and it's not hard to find one for much less.

It's likely, however, that a PA-23, either Apache or Aztec, bearing a used-car price tag has had quite a tough life, including use as a multi trainer or cargo-hauler and eventually retiring into neglect and disuse. The irresistibly low prices on some of these airplanes could be siren songs and due to the complexity of the systems, keeping one of the neglected birds airworthy has proven to be expensive to more than one buyer seduced by the low price. Twins aren't cheap to operate and the PA-23 is no exception. Figure about $275 per hour, wet, to run a normally-aspirated Aztec, based on 150 hours a year.

On the other hand, there are Apaches and Aztecs that have been flown regularly and kept in great shape and although not exactly steals, they can be purchased for the price of a late-model, four-place single. Prices on Aztecs are generally much lower than those on other light twins, such as Beech Barons and Cessna 310s. Owners assert that their Pipers may not be as pretty, quick or fuel-efficient as other light twins, but they are generally easier to fly, reliable and better at hauling heavy loads and operating out of short fields. We have consistently been informed that a good experience in owning an Apache or Aztec depends on having a thorough prepurchase inspection and good initial and recurrent training.

ACCOMMODATIONS

The fifth seat in Apaches and early Aztecs is relegated to the back of the cabin, where it takes up a lot of space in the 200-pound capacity baggage compartment. A few Apache owners even remove the seat from the airplane, as it is virtually unusable and is just excess weight. Beginning with the B-model Aztec, there are three full rows of seats and 150-pound capacity baggage compartments fore and aft.

The PA-23 cabin is spacious and comfortable, with plenty of elbow, head and leg room. The airplanes can haul a respectable load, although they can't, as some owners would suggest, fly with anything you can close the doors on. Still, even well-equipped Apaches and Aztecs can carry full fuel, four or five adults and baggage, despite zero-fuel-weight restrictions imposed by an Airworthiness Directive (83-22-01) that was issued to prevent damage to wing-attach fittings.

The Apache 235 and the original Aztec have zero-fuel-weight limits of 4000 pounds. In naturally aspirated B through F models, any load above 4400 pounds must be fuel. The limit in turbo models is 4500 pounds. We have found that a surprising number of owners are not aware of the limitation, so wing attach fittings should be a checklist item on a pre-buy inspection. While there, check for corrosion in the tubes in the bottom of the fuselage.

SYSTEMS

All Apache 150s and 160s have one 36-gallon fuel bladder in each wing and many have an 18-gallon aux tank on each side, too. Apache 235s and Aztecs have two 36-gallon cells in each wing. The F model, as mentioned earlier, could also be fitted with 20-gallon internal tip tanks.

Hartzell's scimitar-blade "Top Prop" mod even allows the tips to be painted to match the airplane.

As fuel bladders age, owners report a frustrating frequency of leaks, so periodic inspection and replacement has to be included in the budget.

Also on the Aztec F's options list was an auxiliary hydraulic pump on the right engine. Earlier models came with only one pump on the left engine to operate landing gear and flaps. If the left engine goes kaput, there's a hand pump underneath the control console that requires 30 to 50 strokes to get the gear up or down, a significant challenge during a real emergency. There's also a CO2 bottle to blow the gear down if the emergency pump doesn't work.

The gear and flaps are hydraulic, meaning that the aging system will provide the owner with the joy of tracing leaks on a regular basis. One owner reported that he replaced some valves, hoses and fittings every year so that everything was changed over five to six years.

To check the level of the hydraulic fluid, the airplane must be up on jacks with the gear retracted and flaps extended. Otherwise, adding fluid overfills the system, leading to a very red airplane when the gear is retracted after takeoff. Many, but not all, Apaches have been upgraded with dual alternators and vacuum pumps; avoid those that have not.

Reports of adequacy of cabin heat vary, with one owner stating that his passengers had to wrap up in sleeping bags to stay warm during winter flights. That airplane turned out to have crushed heat ductwork requiring many hours of labor to fix and even then, the result was not adequate, despite also plugging the many leaks in the aft cabin bulkhead. (Airflow in the fuselage is from the tailcone forward.) Some models of the gas-fired heater have maximum hours between overhaul limits, so a Hobbs meter on the heater is a good investment.

PERFORMANCE, HANDLING

The fat, high-lift airfoil has a lot to do with the PA-23's docility and good low-speed performance, but it costs more than a few knots in speed. Owners of 150- and 160-HP Apaches report 135 to 145 knots on 16 GPH at 75 percent power. The big-engined Apache is faster but is a glutton for avgas. Figure on about 160 knots on 29 GPH at high cruise for the Apache 235. Early Aztecs claim 178 to 182 knots while burning about 26 to 28 GPH at 75 percent, more realistic cruise is 160 to 165 knots. The E and F models are a few knots slower on the same fuel. Up high, around 24,000 feet, a Turbo Aztec can sizzle along at 190 to 200 knots with fuel gushing at 30 to 35 GPH.

As mentioned earlier, the airplanes are exemplary short-fielders. The Apache models need less than 1100 feet to get in or out over a 50-foot obstacle, although the published Vx is very near Vmc. Early Aztecs require less than 1250 feet. Newer, heavier Aztecs use up a bit more real estate, but not much: Figure on about 2000 feet to leave and less than 1600 feet to arrive over a 50-foot obstacle in an E or F model.

Single-engine performance is on par with other light twins; that is, it's pathetic. Published single-engine rates of climb vary from 180 FPM for the Apache 160 to 240 FPM for the Apache 150 and naturally aspirated Aztecs.

The Apache 235 and Turbo Aztecs climb at about 220 FPM on one mill. However, some Apache owners have told us they'd consider themselves lucky to hold altitude at gross weight with only one fan turning, and we saw barely 100 FPM while getting single-engine practice in a lightly loaded Apache 160 on a warm day. We saw little better during a workout in a Seneca III under a hot Florida sun.

In our opinion, the edge of the single-engine performance envelope on light-light twins—those with normally aspirated engines of less than 200 HP—is really too close to being unsafe for comfort. There simply isn't enough horsepower available to produce anything but a barely flyable airplane. A positive rate of climb depends on perfect technique and on top of these demands, the pilot is presented with the specter of engine-out handling difficulties, such as the tendency to roll over towards the dead engine.

In this respect, the Apache is no worse than more modern designs. For example, Piper's own PA-44 Seminole, a late-1970s design, has 180-HP engines and a useful load of about 1400 pounds. The original Apache, with 150-HP engines and a useful load of 1320 pounds, has a higher single-engine ceiling (5300 feet versus 3800 feet), higher service ceiling (17,000 feet against 15,000 feet) and better single-engine rate of climb (240 FPM versus 212 FPM). Proper recurrent training is the best protection against these shortcomings. It also helps to fly as much below gross weight as possible, and to install vortex generators.

In the air, with everything working properly, the twins feel like big Cherokees, but with more responsive controls. However, the ailerons are somewhat heavier than the rudder and stabilator (elevator in early Apaches). One idiosyncrasy that will present itself to the transitioning pilot is the tendency of pre-1976

PA-23 ACCIDENTS: ENGINES AND FUEL

While researching 100 random NTSB accident reports for the Aztec and Apache, we couldn't help but wonder if the second engine on a twin really is there to fly to the scene of the crash. That's because 20 percent of the accidents we looked at were the result of engine failures.

Whether on takeoff, in cruise or during landing, there were plenty of instances where pilots simply did a poor job of flying the airplane on one engine. We found several eye-rolling examples that prove it's a bad idea to intentionally shut down an engine in flight for the sake of training.

There were several instances where engines were shut down and feathered, but failed to restart. Such was the case on a multi-engine flight check, requiring the designated examiner to take command of the airplane to return it for landing. All was fine until the landing gear couldn't be verified as locked, prompting the examiner to initiate a go-around—exceeded the airplane's engine-out climb capability in the gear-down configuration at a high density altitude.

Then there was a CFI who zero-thrusted the right engine in preparation for a single-engine landing practice, causing the Apache to abruptly enter a half roll to the left, pitch down and collide with the terrain. Such Vmc rolls can ruin a good day of training.

Coming in a close second, at 19 percent, were fuel-related crashes. There were a handful of fuel mismanagements, including an Aztec pilot who passed up a few potential fuel stops along his route and subsequently ran the tanks dry before reaching his destination.

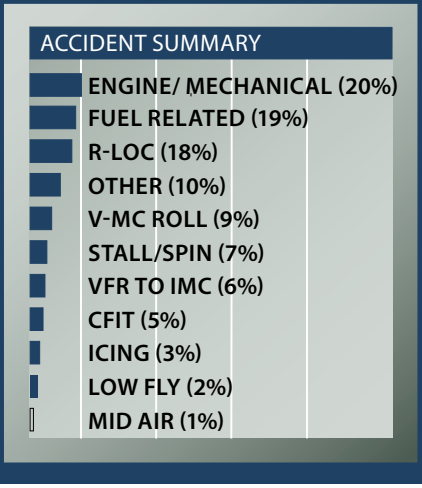
Another Apache suffered dual engine failure and crashed due to fuel starvation, the result of the restricted movement of the fuel selectors. If the pilot had summoned a mechanic to investigate the cause of power loss on the previous flight, an inspection might have spotted the corroded and seized fuel control cabling.

As expected, there was a healthy number of R-LOC, or runway loss of control crashes, where pilots misjudged landing and takeoff distances, botched crosswind landings and one Aztec pilot who, according to the NTSB, intentionally planted his PA-23 on a taxiway and unintentionally into a hangar because the winds were, as he put it, too tremendous to correct for the aircraft drifting from the runway centerline.

We planted some accidents in the "other" category, due to some usual ambiguous circumstances. There were a few accidents where Aztec and Apache pilots lost the battle with thunderstorms, including an airline pilot who took his first and last flight in his newly purchased Aztec through a Level 4.

Another NTSB report made specific mention of a deceased Aztec pilot's toxicology report, which showed evidence of a high concentration of anti-depressants. He crashed for undetermined reasons.

What really got our attention was the number of fatal crashes—32 in all, proving that the utilitarian PA-23 deserves a healthy amount of respect, especially while piloting it on a failed engine.



models to pitch up strenuously when flaps are lowered. In 1966, Piper published a service letter (No. 474) suggesting the deployment of small amounts of flap, rather than stabilator trim, to counter nose-heaviness in the pattern; it works. The manual pitch trim control, by the way, is a large crank on the ceiling with a smaller crank (a knob in later models) inside it for yaw trim; both are very sensitive. Another idiosyncrasy is the location of the gear lever on the right and the flap lever on the left of the center pedestal. Pilots do get these mixed up, and the latch that's supposed to prevent inadvertent gear retraction doesn't always work.

The ability of the bulbous airplanes to bleed off speed rapidly comes in handy when it's time to get into landing configuration. Maximum speeds for lowering gear and flaps in Apaches built before 1960 are a ridiculously low 109 and 87 knots, respectively.

Limiting speeds in later models are a more manageable 130 and 109 knots. Also, in 1965, Piper came out with a modification kit for Aztecs and Apache 235s, allowing quarter-flap deployment at 139 knots and half flaps at 122 knots.

Pre-1971 Aztecs tend to thwart the pilot's best attempts at trimming and roam a bit in altitude. A stronger stabilator down spring in the E-model improves longitudinal stability, but control pressure in the flare suffers as a result. The stabilator and stabilator-balance system were changed with the introduction of the F model, but Piper later switched again from external to internal balance weights after AD 79-26-1 targeted cracks and attachment problems. Another change in the F model was incorporation of a flap-stabilator interconnect to reduce the pitch-up tendency.

MAINTENANCE, PARTS

Reports of parts availability are mixed. Some say certain parts are becoming difficult to find, while others told us everything is readily available from Piper, PA-23 specialty shops and salvage yards. Owners also tend to be very picky about who maintains their airplanes. Indeed, many owners do much of their own work under the supervision of IAs. "You can spend a fortune having a

Garmin G500 installed in an Aztec panel, original autopilot at lower left.

mechanic learn your systems," one owner said.

Several ADs require repetitive inspections and work, and some are quite expensive. In our check of ADs for the PA-23, we found 108 listed. The most recent, 2009-13-06, applies to all models with a nose baggage compartment and requires inspection and replacement of door and latch components following fatal accidents resulting from a door coming open in flight.

Among the others on the list are: AD 63-12-2, on elevator butt ribs and doubler plates; 63-26-3, elevator and rudder castings; 72-21-1, control pedestal support bracket; 74-10-1, flap hinges; 78-2-3, stabilator tip tubes and weights (on Aztec F); 78-8-3, rudder hinge brackets (Apache 150 and 160); 79-26-1, stabilators (most F models); 80-18-10, fuel selector valves and cables; 80-26-4, cabin entrance step support frame structure; 81-4-5, flap controls and hinges; 85-14-10, Hartzell blade clamps; and 88-21-7, fuel lines, caps and filler compartment covers. In many cases, the repetitive inspections are no longer necessary after affected parts are replaced or modified.

MODIFICATIONS, SUPPORT

There are an astounding number of modifications available for the Apache and Aztec series. The Geronimo conversion of the Apache ups the power to 180 HP a side, reworks much of the fuselage and turns the airplane into a reasonable performer on one engine. Diamond Aire (www.diamondaire.com) performs the Geronimo mod, and offers a number of other mods for the Apache-Aztec line including redesigned noses, dorsal fins, a speed-slope windshield, gap seals, vortex generators, tip tanks and inflatable door seals.

Met-Co-Aire (www.metcoaire.com) offers tip tanks that increase fuel capacity by 48 gallons as well as new wing tips, turbochargers can be had from Rajay (www.rayjayparts.com) and vortex generators from MicroAerodynamics (www.microaero.com).

Hartzell (www.hartzell.com) has recently certified a two-blade scimtar "Top Prop" for most of the Aztec models—its data shows a two-knot cruise speed increase.

Considering the number of Aztecs built, it's curious that there is no organization devoted to their owners. The Piper Apache Club (www.piperapacheclub.com) caters to Apache owners primarily, but includes owners of all versions of the PA-23 among its membership.

OWNER FEEDBACK

I operated a 1974 Piper Aztec E Model for about two years. I flew it 150

A Geronimo conversion on short final. All of the airplanes in the series display excellent manners on landing.

hours in that time and found it to be a docile, easy to fly, very comfortable airplane. The best thing about it is its load-carrying capability. You truly can fill the seats, baggage and fuel (assuming your family all weigh about 150 pounds or less). The worst thing about it is it is slow, about 160 knots, especially for the fuel it consumes—somewhere around 14–15 gallons per side per hour. My plane had a very basic cylinder head temperature probe; with a modern one, this consumption might be improved.

The first annual was hugely expensive, around $12,000, but covered a lot of deferred maintenance, the nose landing gear replacement being the largest item. The following year, the annual was under $2,000.

I replaced it with a Cessna 210. The Cessna had the 310-HP Atlantic Aero IO-550 engine, flew faster than the Aztec on much less fuel (9 to 13 GPH depending on altitude) and carried a similar load. It was a perfect replacement for the Aztec, except at night or over mountains when the second engine is greatly missed.

John Warrington
Via Email

We purchased our 1969 D Model Aztec in 2002. 1500 hours later, we still find it to be a comfortable, stable, safe and reliable transport. My wife, starting with 100 hours of SEL time, earned her multi-engine and instrument ratings in the Aztec so our flying is almost always two pilots swapping legs. The plane is not that busy, but never turn down a copilot.

Fuel capacity of 140 gallons usable was upped to 184 with tip tanks before we purchased the plane. I figure on 7½ hours to dry tanks. It makes those long IFR flights with alternates a snap.

We cruise at 165 knots at 65 percent power, burning 25 GPH, rich of peak. Most of our flying is between 8000 and 10,000 feet. Above 15,000 feet the climb rate gets a little weak, but it gets up there. A great heater keeps the whole cabin warm.

Gross weight is 5200 pounds, useful load 2000 pounds, max cabin load 1200 pounds. In our airplane, 133 gallons of the 140-gallon main fuel load gets you to gross with the max cabin load. We carry six people easily or five with baggage and golf clubs. We usually run out of room before we hit gross weight unless we've got the tip tanks full of fuel.

CG is seldom a concern unless we put really big people in the rear seats. The fore and aft baggage compartments mean it's easy to stay in CG. There are zero fuel, max landing and max landing tip tank weights to consider, but with a little planning they seldom are a concern.

The aircraft has hydraulic flaps and gear with manual pump and air bottle as back ups. You can expect to replace a seal every year or so. Since these are older aircraft, be sure to check the shuttle valve between the hydraulics and air bottle in the landing gear system. Everything else is pretty normal.

If you want two engines for those over-mountain, night, IFR flights, it is tough to find a more capable and forgiving airplane.

Name withheld by request

My wife and I have had the pleasure of owning two different Apaches. Our first was a 1955 PA23-150 that had an updated panel and interior, but completely original airframe. It was a wonderful airplane to fly and while it was not going to blaze a path through the sky, you could carry quite a load and the cabin size was very comfortable. We would plan on 135 knots burning 14–15 GPH total.

Of course, single-engine performance was anemic, but the vast majority of our midwest flying left the terrain well below the Apache's drift-down altitude.

Maintaining a classic twin can quickly drain the wallet if an owner is not an A&P or actively involved with maintenance. The Apache is very well built, but ease of servicing may not have been a priority, as many maintenance tasks require a lot of labor.

For example, the original nacelles offer quick access to the engines, but to gain access to the oil screen one must drop the lower nacelle assembly. That task can take quite some time, leading many mechanics or owners to skip checking the oil screen.

Parts availability for some airframe parts can be a challenge, but the vast majority of consumable parts are readily available. There are quite a few ADs on the early airframes, but most of the ADs are inspection based and not egregious. The Hartzell propeller AD is a notable exception. If looking to purchase an Apache, I would seek out an aircraft that had the new style props installed.

Our current Apache is a 1960 model with all of the Geronimo Mods. It has the O-360 (180 HP), long nose with baggage, aux electric hydraulic pump, aft baggage, flap gap seals, aux fuel tanks (108 gallons total), squared-off tail and fiberglass nacelles. We flight plan for 150 knots burning 18–20 GPH total.

As much of an Apache purist I was when we had our 1955 Apache, the Geronimo is a better aircraft. It is faster, carries more and is easier to

There's a lot of real estate available on the panel. A Geronimo owner has nearly filled it.

maintain. The new-style nacelles allow total access to the engines in less than five minutes.

Parts support for the Geronimo mods is excellent. John Tamage of Diamond Aire in Montana (the current holder of the Geronimo STCs) has always been very responsive about parts or support. I would also *highly* recommend an Apache owner join the Piper Apache Club run by John Lumly. The forum is a fantastic resource for parts and maintenance advice.

Our Geronimo has a modern panel centered on the Garmin G500 driven by a GNS430W. We added a GDL69 for weather and installed PlanePower dual alternators to supply adequate and consistent power. For fuel efficiency and cost in a twin, it's hard to beat the Geronimo.

Florian Kapp
Via Email

I bought into an E-model Aztec after discovering I couldn't afford the twin I really wanted, a Cessna 310. I was reluctant to get involved with an airplane that seemed to be on the trailing edge of technology, with a welded frame structure and systems that seemed about five years behind a 310 or Baron of the same vintage—plus, for the same fuel burn, it was 20 knots slower.

The more I got to know the Aztec, the more I liked it. It is absolutely rock solid on an ILS. Unlike the Baron or 310, it almost feels as if you point it in the right direction and fall asleep until time to flare.

Maintenance is not user-friendly. It takes eight hours for one person to remove and replace the cowlings; to me, that's an incredibly stupid design. The hydraulic lines and valves build up a varnish with time; figure on replacing everything over about a 10-year period. The steel tube frame is subject to corrosion, so inspect carefully, especially under the cabin. If you catch it early, the fix is merely expensive.

The cabin is more passenger-friendly than the 310 or Baron. It is not a fill the tanks and fill the seats airplane, but it's amazingly close. I eventually took one of the middle seats out, which turned the rear seat into a very comfortable spot with great legroom. It also saved on insurance, as my carrier had a price break between five- and six-seat cabins.

The airplane short fields well. I routinely go into fields less than 3000 feet long, with obstacles. When getting on the brakes after landing, if you lower the nose as you would a 310 or Baron, you'll just slide the tires because the wing is lifting and there's no weight on the mains. Keep the yoke well back to keep weight on the mains and retract the flaps right away.

I've come to have a great deal of affection for the Aztec, even though it frequently seems to know how much money I have on hand and breaks something that costs that much. I wish it were as fast as a 310. But for honest handling in a twin and reasonable single-engine performance, it's one of the best out there.

Chuck Guard
Via Email

The Aviation Consumer

OXYFLY Revisited

(continued from page 2)

provements, our engineering is working on it."

I was critical of wire bundling and chafing. Durr Technik's response, "Accepted. This is especially apparent on the prototype we presented to you. The current production models show much improvement to the acceptable level."

I criticized the electrical connectors as not being aviation quality. Durr Technik's response, "Partially accepted. The power cord and the locking connectors we used in the system are military grade and generally used in transportation/aviation products in Europe, however, they are not FAA certified."

I said the cooling fan appeared to be a computer cooling fan, not up to aircraft standards. Durr Technik said, "Partially accepted. The fan is a heavy-duty industrial type, even though the look is deceiving. It has been used in many transportation-related applications, in fact it's tested for EMC, vibration, shock, environmental, salt and fog endurance, however, it does not carry an FAA certification, even though it might be fully compliant."

I was concerned that something loose in the aircraft could come into contact with the hot compressor during flight. Durr Technik disagreed, "Disputed. The OXYFLY Light was especially designed to be a permanent accessory on the plane, with a dedicated location where foreign objects cannot come into contact with the hot surfaces. In situations where the open frame model is not appropriate, the fully enclosed, standard OXYFLY is recommended.

I noted that the soft shock mount of the compressor would allow it to impact the casing in turbulence. Durr Technik agreed in part, "Partially accepted. Optimizing the vibration absorption is a complex challenge with two major scopes: vibration transfer to external and internal parts, with the latter one aiming to prolong the life of the compressor. With the tight space allocated, it is challenging, but our engineering staff has already made improvements in this area on the production units, so the movement of the compressor is less pronounced."

Durr Technik is not a novice in the air compression business. It has been manufacturing air compressors, compressor systems and customized air systems for 32 years. It supplies compressors and complete systems to the railway/transportation and telecommunication industry, medical and laboratory instrument manufacturers and nitrogen generator manufacturers.

It takes some degree of courage to expand a business into making products for aviation. It's highly regulated and the financial penalties for making a mistake can be significant. Based on what Durr Technik has said, it appears to me that it is determined to do the OXYFLY series right and it will be making improvements. I'm looking forward to reviewing the OXYFLY again in six months or a year. I keep thinking that, while expensive, when someone refurbishes a six-place single or twin, replacing the factory oxygen system with an OXYFLY might be the way to go to get the most out of the airplane without having to mess with oxygen bottles.

—Rick Durden

FEEDBACK WANTED

MOONEY OVATION

For the June 2013 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Mooney Ovation, the big-bore, normally aspirated speedster from the land of Texas. We want to hear from owners and users about what it's like to fly and own these planes, how much they cost to operate, maintain and insure. If you'd like your airplane to appear in the magazine, send us any photographs you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the Mooney Ovation by April 1, 2013, to:

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

Tugs

(continued from page 11)

deal with ramps to get over them. We like the Tail-Dragger Dragger method of lifting the tailwheel off the ground for movement.

We also liked the Aero-Tow philosophy of including all options in the base price—no nickel-diming to get to the final price—and the user-friendly assembly that involves only the insertion of one bolt.

We think that for $2500 or less, the owner of an airplane up to 6000 pounds can find a tug that will meet most of the tougher slope and hangar lip requirements and be able to pull the airplane 300 yards to the fuel pump and back at a reasonable speed without breaking a sweat.