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FIRST WORD

Renting: What's Reasonable to Expect?

I just received an e-mail from an acquaintance outlining the stunningly bad experiences he had with airplane rental at an FBO near his new home. He loves to fly but according to more than one pilot, the only FBO near him is utterly indifferent to its rental fleet and customers. He's about to take his considerable discretionary recreation money and spend it on something else.

With all of the hand-wringing we do about pilots who quit flying, I've wondered why one of GA's significant business problems—crummy, unprofessional rental experiences—continues unabated. I've watched too many pilots quit flying because the only operator in the area made the rental experience a pain in the whasis rather than fun.



Sure, renting is expensive, but it's cheaper than ownership. Yes, I've heard the constant background bitching about the high price of the rental airplanes that has been going on since the Wrights opened a flight school. It will never stop.

In reality, every pilot I know was aware from the beginning that flying wasn't cheap. Invariably, they were willing to pay for what they thought was going to be a heck of a lot of fun.

Too often what they got was an operator who considered airplane rental a losing proposition and only did it because it was required under the airport's FBO contract. Too many times the airplane interior was filthy, the squawk sheet hadn't been addressed for weeks, upon getting to the airport they were told, "Oh, yeah, the airplane broke yesterday, it should be back on the line tomorrow" or walked out to find an unairworthy airplane.

At the risk of coming up with a cliché "bill of rights" for renters, there are some basic, reasonable customer expectations that an FBO should meet with its rental business. I'm not advocating a concierge-style arrangement, just that the business should be customer-friendly, professional and profitable—the rental rate must be at a level that will generate a profit for a well-run business, pilot complaining notwithstanding.

The airplanes should be clean, inside and out.

If an airplane goes out of service, the upcoming people on the schedule should be contacted immediately so they don't waste a drive out to the airport. If there is another airplane available and the pilot is qualified for it, even if \$10 or \$20 more per hour, it should be offered to the customer at the rate of the airplane that he was scheduled to rent.

Customers should be encouraged to note squawks and they should be worked off as soon as possible.

Refurbish interiors every few years. There's nothing wrong with old airplanes. Nevertheless, the customer is stepping up to pay for a quality rental; airplanes of any age should work well and look good.

Have a system in place so that a pilot who will be carrying a full cabin load can make certain the airplane isn't topped off just before her turn to use it.

Make it convenient and secure to depart or return outside office hours.

Have a comfortable area for passengers to wait, with clean rest rooms.

Make it easy to understand how your insurance is set up and be honest in explaining what your renters might want to do to further protect themselves.

Make it fun. Do such things as organize, not pay for, a monthly evening at a local restaurant so renters can socialize with others of like interests. Make sure one of your instructors is there to talk up flying and be a mentor. Use social media to alert users to events they might like or would want to rent one of the airplanes to attend.

Pilots who have good experiences come back and help make the rental business profitable and an integral part of a successful FBO. —Rick Durden

The Zen of Spark

I maintain 13 airplanes for a flying club averaging 500 hours monthly. We have transitioned to Tempest plugs, having used Champions for 50 years. The reasons are exactly as you outlined. Center electrode cracking was getting annoyingly significant, but the real straw on the camel's back was the resistance issue. Both have been completely solved by changing plug brands.

High resistance was showing up as hard starting, primarily on our 152 training fleet, and to a lesser degree on our Warrior fleet. We first noticed it several years ago on a newly overhauled engine with new Champion REM37BY plugs. Within 150 hours, it was almost impossible to start, although once it did start it ran just fine.

Troubleshooting eliminated all other engine and mag problems. When we finally changed out the plugs with new (Champions), it started instantly. Two hundred hours later, it was back to burning up the starter. At the time, I heard that Cirrus owners were having similar problems.

We then began having the same problem with the other three Cessna 152s. It was solved with new plugs.

That caused us to start checking the resistance in the plugs. We immediately had to discard many Champion plugs with resistance of over 15,000 ohms. We have gone to Tempest plugs and have completely eliminated the problem.

John Hunter
Via e-mail

I own and operate a Beech Duke. GAMInjectors are not offered for the 380 HP turbocharged, intercooled Lycomings installed. I use a very nice engine monitor, do not run LOP and do no shock cool. I can promise you that the plugs I have dropped—and I have dropped a few over the years

just as everyone has—I have thrown out with a tear in each eye.

Two years ago, I found one Champion fine wire with half of the insulator missing. My fear was the damage it may have caused to my turbocharger vanes on its way out. CHTs were normal, so I failed to consider the more damaging detonation issue. This year I found another fine wire Champion with half the insulator missing and yet another with a cracked insulator that was only seen under the magnifying lamp at my spark plug cleaning/gapping station.

These incidents were on different cylinders and not on the same engine.

After reading your article, I say with a gasp in my spark plug replacement checkbook, all Champions—fine wire or not—are being replaced with Tempest massives.

I strongly recommend focusing the investigation on material, engineering and manufacturing processes at Champion, not on operating conditions. Find the differences between the two companies' plugs and you will find the guilty component.

K. Dingman
Via e-mail

In a sidebar to your spark plug article you quoted Champion's Kevin Gallagher as stating that measuring resistance on a 9-volt ohmmeter doesn't give a true reading of the resistor's performance. To the contrary, Military Spec MIL-S-7886B, Section 4.7.2 states, "Each spark plug shall be checked for stability of internal resistance and contact measurement of the center wire resistance by use of a low voltage ohmmeter (8 volts or less)."

John Herman
Tempest Plus Marketing Group

Supplemental Oxygen

In reading your November 2012 article on oxygen systems I ran across,

"The FAA requires using a mask instead of a cannula above FL180."

I've read this many times, but it is not in the FAR Part 91 regarding operations. It only appears in the FARs in Part 23, which applies to aircraft certification, and then requires a mask be provided for systems used above FL180. It says nothing about what a pilot or passenger must use.

There is not a limit of FL180 for passenger or pilot use in operational sections of the FARs.

With a reservoir cannula and pulse oximeter, there is no reason a cannula cannot safely be used above FL 180.

Charles Robertson, MD
St. Louis, Missouri



CORRECTION

In the Garmin G500 versus G600 article, July 2012 *Aviation Consumer*, we included the L-3 WX500 as an available remote input. Garmin tells us the interface won't work yet, but it will with a future software release, expected later next year.

Our advice to those installing these two systems—have your shop add the data wires now so they won't have to tear the installation open again next year.

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ANR on a Budget: Lightspeed, Telex Tops

You don't have to spend big for a good-performing ANR headset. Our tests of the market's mid to lower-end found models that deliver comfort, quality and value.

by Larry Anglisano

Got \$1200 to spend on a headset? That's what you'll have to pony up for a Bluetooth-equipped Bose A20—a high-end model that easily ranks at the top of the ANR food chain. Don't get us wrong—we think the flagship Bose A20 continues to set the standard by which all other aviation headsets are judged. If we had the dough, we'd buy a set for every seat.

On the other hand, our recent sampling of a half dozen lower-cost models proved that there are worthy alternatives. Whether it's a spare set to toss around the back cabin or for primary use in the left seat, we found a variety of models that offer solid performance without draining the budget.

OUR EVALUATION

We reeled in over a dozen ANR models to test—and even that didn't cover the entire market. While we used every one of them, there's no way we could effectively report on so

many models in one article. Instead, we consulted with retailers who sell a lot of headsets, including the folks at Gulf Coast Avionics, who graciously sent us some models they think represent the current buying trend in budget ANR. We also talked with Sporty's, for their view of the market. Last, we surveyed a handful of buyers who had their sights on particular brands. Ultimately, we chose six models, the lowest-priced unit selling for around \$200 with the highest-price model discounted to \$799. The sample group included one unique, non-ANR model.

Our testing process was basic—we tested them the way you would use them in the real world. We skipped geeky lab analysis and complicated audio engineering data. Instead, we assembled a diverse test group of a half-dozen active pilots and handed these things out like candy on Halloween. Our group included flight instructors, charter pilots, go-places aircraft owners and even

We put our high-priced ANRs away and lived with a variety of lower-cost models for a couple of months. All survived our abuse.

maintenance technicians, who use headsets every day for ground and flight testing. We also passed them to back seat passengers, including picky teenagers. Some of the pilots in our sample group own the high-priced Bose A20—which escalated expectations. Without revealing sell prices, we asked our testers how much they would pay for each model, if they would buy them. Each tester was given an evaluation checklist that, on a four-point scale—poor, fair, good, excellent—rated four major categories, to include comfort, styling, audio performance and durability. We then took the average of all the categories and issued each model a final overall score.

COMFORT FOR ALL

We learned early in our testing that headset evaluation is subjective, particularly when it comes to comfort. For example, good fit and comfort for one pilot was excellent to another. For instance, one tester always flies with a ball cap, so he graded comfort based on the pressure point at the top of the hat. Another always flies with earrings, so she focused on how the ear cups pressed the earrings.

The other subjective and mission-specific category was durability and for this, we listened closely to the flight instructors in our group. They plug and unplug these things many times every day, toss them on top of cowlings and wings and hastily shove them into their flight bags. Like some of our testers, if your headset never leaves your airplane, you don't subject them to such rigor.

Our advice is to buy a headset from a vendor that can offer an exchange, if it turns out you don't get along with it.

LIGHTSPEED SIERRA

While we hate to spoil a surprise, the Lightspeed Sierra was the hands-down favorite of every tester in our group. The Sierra weighs in at 16 ounces and has a high-quality and rugged feel, in our view. It also

earned cheers for comfort, much in part for its oblong headband design that limits clamping pressure.

The Sierra is one of the higher-priced models in the sample group, street-priced at around \$600. We think it's a good value, given a long list of standard features. These include an integrated cell phone Bluetooth interface that at times flunked the pairing test—ignoring more than one iPhone handshake. It also has a stereo music input, but you'll have to hard-connect a music device because the wireless Bluetooth only works for telephone input. Speaking of music, the headset has a smart music muting function that lowers the music volume for incoming radio transmissions. The set runs on two AA batteries that should last upwards of 40 hours. There's auto-shutoff, a low battery indicator and accurate dual volume controls that are built into a modern control module that earned cheers for having a sturdy, high-end feel.

There were a couple of complaints on the Sierra's performance when the ANR circuitry was shut off. More than one tester noted that this passive use created muffled phone audio. "I wouldn't want to fly with these long distance without the ANR," said one tester. On a side note, we've used the Bose A20 with the ANR circuitry turned off, and had similar results. Lightspeed throws in a sturdy, padded carry case, music patch cable and a five-year warranty.

TELEX STRATUS 30XT

With a focus on battery power management, the 18-ounce Telex 30XT earned a reputation in our test group for its durable and handsome design. It feels sturdy, too, with rubber-capped volume controls that are located on each ear cup. Speaking of ear cups, the cups on the 30XT offered a solid seal on ears of all sizes without excessive clamping pressure. The Telex offers three adjustable pressure clamping settings with its Comfort Cam lever, where dialing in more pressure offers a tighter seal on the ear and increased noise reduction. The obvious trade-off here, which we confirmed while wearing sunglasses, is less comfort. We noted ANR circuitry-induced white noise with the Stratus, but this went unno-

Back-seaters demand ANR comfort, too. The Beyerdynamic HS800, top right, got raves for high-end audio quality and German ergonomics. The dirt-cheap Gulf Coast GCA-ANR, lower right, were a comfy fit on small heads.



ticed after engine start in our test Bonanza, which was equipped with a Garmin GMA340 audio panel. Microphone audio performance was accurate while the phone audio was a bit trebly, as one tester commented. We took the 30XT on a multi-hour trip and hardly noticed that they were on our head. We especially

BEST ANR CONTROLS



Clockwise from left, the user controls on the Beyerdynamic, Lightspeed and Flightcom were favored for their high-end feel and modern ergonomics. These modules serve double-duty as power supply, entertainment input and power control. As a rule, lower-end models had lesser-quality control sets.



The Flightcom V90ANR, top, scored well for durability but its microphone performance was lacking. The Telex Stratus 30XT, middle, topped in styling and ergo's. The Lightspeed Sierra, bottom, was favored for doing nearly everything well.



liked the sturdy microphone boom and thick wind muff.

The 30XT runs on two supplied NiMH rechargeable batteries that we found to have good endurance, although for long trips, we prefer to use Alkalines, which the unit can accommodate. Telex supplies a variety of wall charging plugs, music input patch cable and a headset storage bag that proved to be way too small.



FLIGHTCOM VENTURE 90

The V90 got high scores for durability, particularly for the washable polar-fleece head pad and thick leather ear seals. It ranked high for modern styling, with its carbon fiber print design on the ear cups. The 17-ounce V90 also scored well for its control module, which is both durable and functional, with an accurate battery life annunciator. But for audio performance, our testers carried them in with mixed results. "There was an odd background noise

present in the phone audio," said one, while another reported that the microphone audio had a tendency to clip. The dual, earcup-mounted volume controls, however, worked with linear accuracy.

The V90 comes with generous auxiliary input capability, including dedicated music and telephone audio that automatically mutes with incoming radio communications. The headset runs on two AA batteries that are preserved by an automatic shut-off circuit that Flightcom calls the Sure Power System—chopping the power after 15 minutes of lifeless audio.

There's no Bluetooth on the V90, but instead, a cable-required cell-phone interface jack, which worked well in our trials, as did the auxiliary input jack for music input. Street-priced at around \$430, we think the V90 could be a better headset if it had a slightly smaller profile and loses the old-fashioned metal frame.

GULF COAST GCA-ANR

The \$205 GCA-ANR was the least expensive set in our group. It held its own against models that cost nearly three times as much. It weighs 19 ounces and while some of our testers complained of the headset's clamping pressure, it fit comfortably on smaller heads. While marketed as an entry-level model, it doesn't skimp on useful features including a stereo and mono select switch, automatic shutoff, plus cell phone and music input interface. Gulf Coast says the two AA batteries can power the ANR circuitry for 30-40 hours. The headset comes with gel ear seals and ear seal covers. The ANR control module has a no-frills feel but for an ANR

MODEL	SCORE	+ HITS	- MISSES	PRICE
BEYERDYNAMIC HS-800	GOOD	COMFORT, HIGH-END MUSIC INPUT	WHERE'S THE BLUETOOTH?	\$799
FLIGHTCOM V90ANR	FAIR	DURABLE EAR SEALS, RUGGED BUILD	MICROPHONE CLIPPING ISSUES	\$429
GULF COAST GCA-ANR	FAIR	GOOD FIT FOR SMALL HEADS	CONTROL MODULE FEELS CHEAP	\$209
LIGHTSPEED SIERRA	EXCELLENT	COMFORT, AUDIO, STYLING, VALUE	FINICKY BLUETOOTH CONNECTIVITY	\$600
TELEX STRATUS 30XT	EXCELLENT	MODERN ERGONOMICS, STYLING	TINNY PHONE AUDIO, RASPY MIC	\$569
CLARITY ALOFT CLASSIC	GOOD	EXCELLENT AUDIO PERFORMANCE	FINICKY FIT FOR SOME SMALL EARS	\$525

that sells for under \$200 and performs to reasonably high standards, we're not complaining.

BEYERDYNAMIC HS800

To many, Beyerdynamic is an unfamiliar name in the aviation headset arena. Founded in Berlin in 1924, the company developed dynamic studio microphones in the late 1930s and in 2008 developed the first aviation headset with DANR, which is Digital Adaptive Noise Reduction. Digitally-controlled ANR circuitry uses high-speed clocked microprocessors which, according to the company, combines feedback and feedforward algorithms for a noise reduction performance found in no other aviation headset.

How did it perform in our testing? Quite well, although we initially had some doubts. Energizing the ANR circuitry in the HS800 produces a noticeable digital-like white noise, which the company describes as a counternoise to unwanted noise. We couldn't quite wrap our heads around the theory but we can attest to excellent noise-cancelling qualities, which is what matters the most. Speaking of head-wrapping, most of our testers spotted the set's obvious quality finish. The genuine leather-wrapped earcup and headband surfaces reek—literally, of high-quality leather. "They smell like the leather interior in my BMW and are just as comfy," noted one tester. But some of the testers noted more clamping pressure than they would like. "They are far from uncomfortable, but I wouldn't give up my Bose A20s for them," said one tester.

Battery endurance of two AA alkalines is fair, lasting 25 hours and are preserved by automatic shutoff. Strutting its studio roots, the HS800 offered the best music input quality of any in the group—with a bass reflex system that rivals high-end audio control panels, while a selectable music automute circuit stifles the input when you don't want to miss a radio call. As much as we liked the HS800, we think buyers should demand a Bluetooth from a headset that's priced at nearly \$800.

WRAP IT UP

We started this review expecting the



CLARITY ALOFT IN-EAR HEADSETS

Because many ANR buyers consider them, we included the entry-level, in-the-ear headset from Clarity Aloft in our tests. We compared in-ear models in the February 2011

issue of *Aviation Consumer*. The \$525 entry-level Classic model from Aloft easily held its own against every ANR model we tested. In fact, we think the set matched and in some cases bettered the audio quality of every other model. The Aloft Classic unit is passive, which means it has no ANR circuitry. Instead, expandable foam ear canal tips are stuffed inside the ear canals to provide 35-45 dB sound damping, similar to what ANR can offer. The frames, which wrap behind the head, are connected to ear hooks that fit over the ear, are eyeglasses-friendly and lightweight. A controller houses a

volume knob, music input jack, and stereo/mono switch.

Every tester in our group embraced the freedom of the design over any traditional models, although two tiny-eared female testers struggled to obtain a good fit, despite bending the flexible earband. If you are sensitive to stuffing earbuds in your ears, you'll likely snub the ear canal-stuffing design.

It's important to insert the foam buds completely in your ear or you'll lose considerable sound damping. Speaking of sound damping, don't necessarily expect the in-ear design to always match the sound-proofing afforded by high-end, full-ear enclosures. We had no complaints while using them in any of our test aircraft and noted excellent microphone audio performance—proving that you don't necessarily need ANR circuitry for canceling noise.

German-made Beyerdynamic HS800 to come up on top, based on its price. We shopped mail-order retailers and found the HS800 discounted to \$799, but it was still the most expensive in our group. While we think it pushes the boundaries of budget pricing, we used it as a benchmark, based on price. Did it live up to its high price tag? We think so, with fine fit, finish and exceptional ANR. Speaking of music, the HS800 will deliver serious hi-fi on the fly—better than any

in the group. Still, our test group still preferred the Lightspeed Sierra, which sells for \$200 less. Based on its performance, comfort, features and styling, we declare it a solid winner—with the Telex 30XT winning a close second, based on their overall performance, build quality, comfort and value.

Last, we think you'll be happy with any of the units we sampled, but as with any headset, you really need to try them before you buy them.

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Piper Matrix: Speed Sans Complexity

Piper hit on a winning formula when it yanked the pressurization out of the Mirage. It continues to be a brisker seller, even in a soft market.

by Paul Bertorelli

When Piper introduced the Malibu in 1984, it was a stunning success because of its high performance, tony club seating and pressurization—nose hoses were no longer required to live in the

flight levels. Almost 25 years later, it decided to revise the model downward by yanking the pressurization, defying the fundamental notion that high-priced features are what buyers want.

The Matrix was, as were the Malibu and Mirage, an instant sales success, selling more than 100 during the first year to a market that everyone else had missed: high-performance piston owners who wanted a step-up, but who couldn't afford a turboprop or felt unqualified to fly one.

As of 2012, the Matrix is in its fifth model year and although sales for all the OEMs have tanked, the Matrix and its pressurized stablemate, the Mirage, continue to be strong sellers for Piper, accounting for more than a third of its total sales by units. In 2008, the introductory year, the

Matrix outsold the Mirage five to one because, dealers say, it had a substantially lower price. So much for price sensitivity.

DEFLATED MIRAGE

When Piper announced the Matrix in the fall of 2007 for the 2008 model year, we thought they had come adrift from market reality. If a buyer could afford an expensive cabin-class single, who would opt for a non-pressurized version over one with pressurization? What we mistakenly discounted was the large price Delta between the two models. In 2008, a new Mirage sold for \$1.1 million against \$785,000 for the Matrix.

Piper convinced dealers that it could deliver at the lower price if the volume was right. It worked. The company produced 101 Matrix aircraft the first year, but that fall, when the financial meltdown occurred, sales nosedived. Still, Piper managed to move 33 airplanes in 2009 and another 23 in the blackest recent year, 2010.

What's the appeal? The lower price

With stretched nose and wide gear stance, above, the Mirage and Matrix are unmistakable but also indistinguishable from each other at a distance.

CHECKLIST



Who needs pressurization? Evidently many buyers don't.



Matrix doesn't quite deliver turboprop performance, but operating costs are low.



At \$903,000-plus, equipped price has escalated substantially.



Garmin's G1000, top photo, is standard equipment in the Matrix/Mirage. So is a GFC700 autopilot, right, whose control panel lives under the MFD. G1000 keyboard is on the lower shelf of the power pedestal, bottom photo.



is one, but the Matrix delivers equivalent performance to the Mirage, without the complexity of pressurization. And without the weight of cabin plumbing, it has slightly better payload. Dealers and owners say it's marginally less expensive to maintain, although we're not sure that's a significant draw for a buyer who can afford most of a million bucks for a new airplane.

The Matrix is essentially identical to the Mirage. It has the same fuselage and wings, the same control system and the same powerplant, a Lycoming TIO-540-AE2A at 350 HP with a pair of turbochargers. The interior is identical as well.

When the Matrix appeared in 2008, Piper was still wedded to Avidyne and the early airplanes have Entegra suites with dual Garmin GNS430s, GTX 330 transponders and an STEC 55X autopilot. The high-aspect ratio wings are equipped with optional speed brakes and the airplane needs them, because even in the non-pressurized version, it's often asked to come down fast from on high. The boards make that practical without reducing the engine to a cylinder-chilling idle. (Even if you don't believe in shock cooling, gentle power changes make more sense than abrupt ones.)

For the 2012 model and since 2011, the Matrix has Garmin's G1000

avionics, with two PFDs and a central 15-inch MFD with a keypad control panel that resides in a new extension of the power pedestal. Along with the G1000 comes a GFC700 autopilot, the AP of choice these days. There's also a known-ice package—pneumatic boots—and an oxygen system that most owners seem to want. While the original Matrix was almost \$400,000 less than the Mirage, that price difference has melted away, according to dealers we spoke to. It's now about \$150,000—still less money, but less of a no-brainer decision against the Mirage. Pilot qualification and insurance may determine which way the deal goes.

EXTRA POUNDS

One of the original selling points of the Matrix was Mirage-level performance at equivalent fuel economy with about 50 more pounds of payload. The original Matrix we flew in 2008 had an empty weight of 3071 pounds against 3121 for the 2012 model, which was equipped with air conditioning. Max gross weight is 4358 pounds for a useful load of 1236 pounds.

Even though it's not exceptionally thirsty, the Matrix tankers a lot of fuel—122 gallons total in two wing

tanks, with only two gallons unusable. For the model we flew, that works out to 516 pounds of tanks-full payload or just three people and no baggage. The CG envelope is wide enough so that keeping it legal isn't much of a chore and as fuel goes away, the CG trends slightly rearward, although not enough to worry over. The Matrix has a zero fuel weight of 4123 pounds, which happens to be the same as its maximum land-



The Matrix's TIO-540-AE2A swings a three-blade scimitar prop, left. Like most manufacturers, Piper has converted exterior lighting to low-draw LEDs, lower photo.



ing weight. Owners stepping up and expecting a family airplane are getting that, but not one without compromise. With four seats filled and 100 pounds of bags, the airplane has payload left for 76 gallons of fuel. That's about 3.5 hours with minimal reserve for about 650 miles of still-air range. With six aboard, the fuel load can be 36 gallons, but will bump above the zero fuel weight, unless the passengers are especially svelte or

kids. And for many buyers, the pax are kids, hence the family appeal. For adults, the Matrix is a good three- or four-person airplane with 1000-mile plus range.

Cirrus owners stepping up—depending on the model—aren't getting much of a speed bump in the Matrix. Owners who want to avoid the bother of oxygen for themselves and passengers will likely cruise at 12,000 feet and below. The Matrix is happy here and will turn in 180 to 190 knots on about 18 GPH, at what Piper calls normal cruise. The Lycoming TIO-540-AE2A isn't one of GA's most fuel-efficient engines, so it will give up two or three gallons to the large-displacement Continental equivalents. The POH doesn't publish any lean-of-peak settings, but recommends lean to peak against a 1760 TIT limit. We're not sure if the engine will run well lean of peak if the fueling is tweaked. (General Aviation Modifications, Inc., does offer GAMInjectors for this engine.)

At economy settings, fuel consumption drops to as little as 11 GPH, for a 40-knot give-up in speed. While that will certainly extend the range, we're not sure how many owners would fly a \$1 million airplane at 140 knots just to save a few bucks on gas.

If you want to drag it into the flight levels, the Matrix will take you there. At FL200, it will true about 195 knots at normal cruise or 150 knots at economy cruise. As with the Mirage and Malibu, maximum approved altitude is 25,000 feet.

CABIN, FLIGHT

The Matrix comes into its own as a luxury liner

immediately on ingress. The airstair is wide and easy to enter and the two rear seats are easily accessible. There are two baggage areas: a large one in the nose and a smaller one aft of the rear seats. Getting into the cockpit is a squeeze, especially for tall pilots or those large of girth. But once the muscle memory is ingrained, it's doable.

The Matrix/Mirage cockpit has come a long way in 28 years. Thanks to glass, the basic panel is free of clutter, with the G1000's three screens dominating the panel, the gear switch in easy reach and breakers on the lower left panel and left sidewall. Since G1000 has a keyboard, Piper extended the power pedestal to provide a mounting point. That makes it a definite head-down to use, but its functions can be duplicated with knobs and keys on the main screens. The original Malibu had its primary electrical switches as rockers right on the panel, but with the Mirage and Matrix, Piper moved them to the overhead. Not the best solution, in our view, but at least they're placed forward enough to be easily readable.

The air conditioning in the airplane we flew was welcome on a hot Florida day in August. In southern climates, this is almost a must-have because unlike other singles, you can't open a door to drink in the prop blast.

Before you can fly a Matrix, you have to taxi it. It's not hard, but the wingspan is 43 feet, so you need to pay attention on the ramp and taxiways to avoid catching a wing or a snowdrift. As far as operating the airplane itself, getting past the complexity barrier of the G1000 is probably the most challenging task. If you're current on the G1000, fine. If not, bring someone who is.

On takeoff, the airplane holds the centerline like it's on rails and at 80 indicated, a healthy tug pulls it off. Visibility over the nose is good and the airplane climbs at 700 FPM. The sight picture gives the impression of the prop being a long way forward—it is—and with the baggage between you and the engine, the cabin is quiet.

Flying with Piper's Bart Jones, we did some

TV MATRIX VIDEO



AVweb
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slow flight and maneuvering and for a 4000-pound airplane, the Matrix is surprisingly light on its feet. The long wings make for stable, predictable slow flight, but also some breakout inertia that increases perceived roll force. Pitch feels relatively heavy for a single, but aggressive trim keeps it from being objectionable, in our view.

We climbed to 12,000 feet and found the airplane cruised a bit above book on a warmer than standard day: about 187 knots and 19 GPH. Cylinder head temperatures during climb never

exceeded 400 degrees, but settled down to a high of 380 degrees in cruise.

Bart Jones told us that one thing he and owners like about the Matrix is its operat-

ing flexibility. "If I need to stay low because of the wind, I can do that. My fuel flow doesn't change, but my airspeed does. I think I've got more flexibility than a turbine. Westbound in the winter in a 260-knot turbine is just painful," Jones says. You have to stay high into the wind because flying lower will tank the range.

Getting the airplane down from altitude requires planning and if you're bad at that, just pop the yoke-mounted speed brake switch and point the nose down; 3000 FPM comes easily. Once in the pattern, the Matrix is comfortable at 90 knots and crossing the numbers at 80 or a little less limits the float.

CONCLUSION

Although the reduced price difference between the Matrix and the Mirage makes it less of a value than it once was, we think it's still an impressive performer for step-up owners who don't want to fool with pressurization and/or who aren't customers for a single-engine turboprop.

Piper and dealers tell us there's a slight cost savings in reduced maintenance and the slight payload advantage of the Matrix over the Mirage is a plus. Insurance is also cheaper, especially for low-time pilots.

MATRIX MARKET: BRISK, BUT NO FRENZY

With the Matrix, Piper created somewhat of a topsy-turvy market. The airplane was introduced at such a low introductory price—fully \$400,000 below the \$1 million Mirage—that it found plenty of buyers in the introductory year.

"For the 2008 economy, the Matrix was a very successful airplane," says Mike Fitzgerald, of SkyTech, Inc., a Baltimore Piper dealer and Mirage/Matrix specialty shop. Two

things have changed that. The financial meltdown of late 2008 reset sales of everything (including expensive airplanes) and Piper pushed the price of the Matrix up 16 percent,

effectively closing the gap with the Mirage. If the Matrix was supposed to fill the void left by ending production of the Saratoga, it may be too rich for that.

What does this mean for buyers of late-model Matrix aircraft? Oddly, while Piper's higher prices for new airplanes should have propped up the value of the original 2008 airplanes, they've depreciated nonetheless and there are some exceptional values on the market.

"You look at new one and it's well over a million, but you look at a 2008 and it's selling for not much more than half a million. I know of one that sold here in town recently for \$540,000," says Chris Kirk of Kansas City's WildBlue LLC, which also specializes in Piper's M-class airplanes.

To put that in perspective, a 2011 Cirrus costs barely \$100,000 less, making a four-year old Matrix a lot of airplane for the money. Of course, it will be equipped with Avidyne's Entegra rather than the Garmin G1000 and even though buyers prefer the Garmin suite, the two are functionally similar. "In reality, it can't do anything less than the new

ones can do," says Kirk of the older glass systems. Whether it's a buyer's or a seller's market for the Matrix is debatable. Fitzgerald thinks sellers have the advantage. "There are always sellers out there who will let their airplanes go if they think someone will pay too much for it.

The key is to price it right and it will move within three weeks," says Fitzgerald. Over-priced airplanes and beaters will languish because although the market is brisk, there's no buying frenzy.

Wait, beaters? Are there really \$700,000 airplanes out there that have been run into the ground by cruel owners? "With every airplane, I am always surprised in the disparity with maintenance. I'm always amazed at the owners who will, shortly after the warranty runs out, have just the local guy maintain the airplane instead of a shop that knows the model and has a lot of experience working on it. I don't think they give much thought to how that's going to impact the value of the airplane," says Kirk. And that can easily lead to a \$50,000 pre-buy or a gulf between buyer and seller that tanks the sale.

Kirk says a pre-buy on an M-class airplane shouldn't be done by just any shop, but by a specialist such as Mead Aircraft Services or SkyTech. Ferry and inspection charges for those shops might be a fraction of paying for an expensive repair missed on a cursory pre-buy.

Neither Kirk nor Fitzgerald are certain where the Matrix market will go from here. The price Delta between the Matrix and Mirage is only about \$100,000 and Matrix owners tend to be transient: They fly the airplane for a few years, then move up to a Mirage or a turboprop.

Some, says Kirk, are moving out of airplanes entirely, not as a function of the Matrix but the buyer. Matrix buyers tend to be older and financially established. As some near retirement age, they aren't interested in maintaining half-million dollar assets.



Boot Replacement: Minimal Competition

Stick with an experienced shop. A little homework can keep your price down as discounts vary in a competitive market.

by Rick Durden

When your airplane's in annual, you probably monitor the caller ID with dread, living in fear of a call from your A&P that portends something expensive. If your airplane has de-ice boots—approved for known icing or not—they could easily be this year's money hole. A full-up replacement set can cost, installed, anywhere from \$11,000 for a single to \$20,000 for twins.

We'll talk about expected boot life in just a moment, and there are ways to extend it. However, what we did learn from our investigation was that when it's time to replace one or all of the boots on your airplane, procrastinating is likely to increase the cost. When boots have significant air leaks, it not only means the vacuum pump works harder to inflate them, but the entire system is working constantly to keep them sucked flat against the airframe. That means that moisture is getting sucked into the system.

The result is that the valves, hoses, relays and other components, which ordinarily last longer

CHECKLIST



Reports of quality of B/E Aerospace and Goodrich boots were all positive.



Process is demanding and requires skill—use an experienced shop.



Delaying replacement can increase cost as system components fail..

than the boots themselves, are more likely to suffer from early retirement.

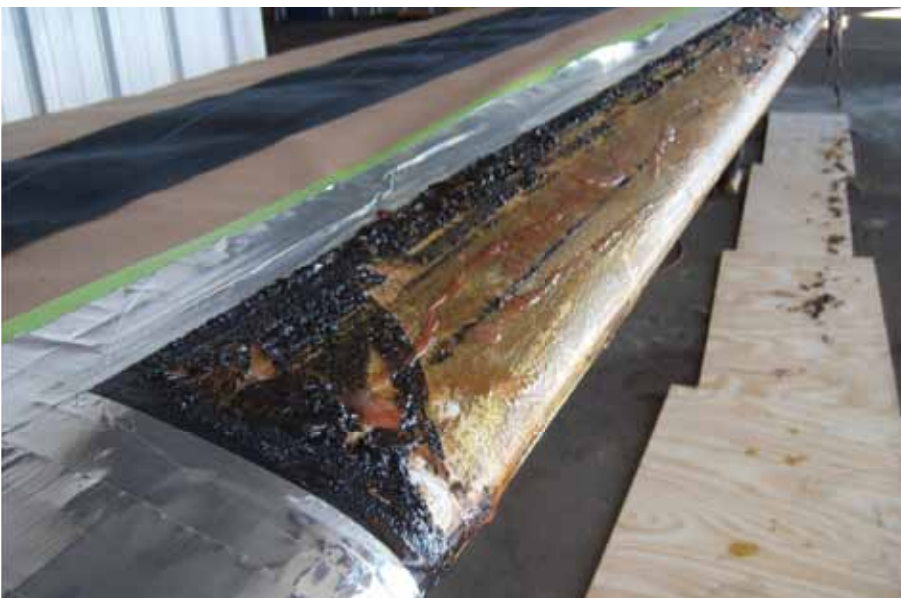
In our conversation with Steve Mayer of BE Aerospace, maker of the Ice Shield line of boots, he described a situation he sees too commonly: The owner flies his airplane about 100 hours a year, getting into ice two or three times and uses the boots to handle it. He puts off replacement and either runs into a serious problem in ice when one wing boot works, but the other doesn't because a corroded valve has failed, or he's shocked by the cost when he does replace a boot because so much of the underlying system has to be repaired.

Rubber de-icing boots have been in use since 1932 when Goodrich (now UTC Aerospace Systems, but we'll use the Goodrich name because it's familiar and the change was so recent) developed them for the Northrop Alpha airliner. Boots have become increasingly sophisticated and now consist of a number of layers of neoprene rubber and polymers that have been impregnated with ingredients designed to protect against the effects of ozone and UV light, the bane of rubber products.

EXPECTED LIFE

The life of de-icer boots is affected by frequency of use, how much and how high the airplane to which they are attached flies, exposure to sunlight and

The old and the new, upper left. Red-capped hose is the air hose that goes into the wing and connects to the rest of the system. Getting the old boot off can be a messy, demanding process, left.



the radius of the wing leading edge. Over time, the anti-aging chemicals migrate out of the rubber. Everyone we spoke with recommended using Agemaster #1 semi-annually to replenish the anti-UV and ozone ingredients and extend the life of the boots.

After 40 years in the business, Bob Hayes, QA Manager at Yingling Aviation, Wichita, Kansas, expects the shortest boot life to be on commuter airliners. In his experience, boots in that environment—never hangared, flying in the flight levels and being activated often—will last three to four years.

Ken Fisher, manager of the Goodrich Service Center in Akron, Ohio, a facility that does nothing but install and repair de-icing boots, said that boots on airplanes that are hangared so they are kept out of sunlight when not operating, washed regularly with warm, soapy water and are maintained with Age Master will last as long as 20 years. He also said that aircraft with larger radius leading edges do not stress the boots in operation as much as those with tighter radius leading edges, so the boots will last a little longer.

There are two manufacturers of de-icing boots, Goodrich, and B/E Aerospace (formerly SMR). Each publishes repair manuals for its various models which, along with reference to the maintenance manual for the specific type of airplane, provide maintenance instructions and set limits as to whether damage or wear can be repaired or the boot must be replaced.

REPLACEMENT GUIDELINES

In general, damage or wear that does not leak air does not need to be repaired, pinholes and tears can be repaired, but replacement is mandated once there are cuts, tears or ruptures of an inflatable tube or that exceed a given size, there is excessive air leakage, pinholes at the leading edge of the boot or there is debonding or bulging.

Once the time comes for replacement of a deicer boot, our recommendation is to have it done at a shop that either specializes in the process or does it regularly. This is not the time to trust your airplane to someone who says that he's always wanted to replace a set of boots. Not only can much go wrong, it can get expensive paying for someone's learning curve.

DE-ICING BOOT CARE AND FEEDING

Both de-icing boot manufacturers make products designed to enhance the life and performance of the boots.

The composition of the boots includes chemicals that fight the destructive effects of UV and ozone on rubber materials. While those chemicals help extend the useful life of the boots, they eventually lose effectiveness, largely because they either break down or the molecules migrate out of the rubber.

Age Master #1 is designed by Goodrich to be applied to the boot surface, where it penetrates to restore the neoprene rubber protective chemicals. The shops we spoke with were unanimous in recommending Age Master and said to apply it twice a year (Goodrich recommends twice a year or after each 150 hours of flying time, whichever comes first). Cost is \$190 a quart.

IceShield Plus is a silicone-based coating designed by B/E Aerospace to increase boot effectiveness by making it slicker so ice does not adhere as well. One B/E employee recommended it for increasing the life of boots, but none of the other people we contacted used it for that purpose, nor did B/E literature reference boot longevity. Recom-

mended application is every 50 flight hours during icing season. A quart covers 400 square feet—list price is \$300.

The overwhelming recommendation we received from users, and the product we have used, for enhancing the effectiveness of de-icing boots is ICEX II. As with IceShield Plus, Goodrich recommends application every 50 flight hours during icing season. A quart covers 400 square feet—list price is \$294.

Goodrich also makes ShineMaster, a two-part cleaning and cosmetic product to improve the appearance of de-icing boots. Covering about 200 square feet, ShineMaster Prep sells for \$59.95 at Aircraft Spruce, with ShineMaster Gloss priced at \$87.50.

One of the cheapest ways to improve boot longevity is to wash them frequently with warm, soapy water.

We are aware that a number of pilots use such household products as Pledge to make the boots slicker and help them shed ice. Based on our research, we recommend against this practice as such products contain chemicals that can and will attack the rubber and reduce boot life.

For example, Kevin Mead, proprietor of Mead Aircraft Services, which specializes in the Piper PA46 series, has seen installation errors that ranged from lumpy or crooked boots to one coming off in flight.

Experience matters—it takes Mead 11 hours to replace one wing boot on a Malibu while some shops take 20.

What's involved in replacing boots? Step one is simply to cycle the boots and make sure they work—all of the system components are functioning properly. A routine boot replacement does not include any work on the internal system components and is priced accordingly.

Once the integrity of the inflation/deflation system is confirmed, the boot work can start by protecting

the paint on the wing and fuselage around the boot, which means carefully masking the area. Then the technician notes the location of each stall strip, as they will have to be replaced once the new boot is on. Next, the fun part—tearing off the old boot.

That usually starts with a razor blade cut along the leading edge, being careful not to nick the metal of the wing itself, and then physically ripping the boot off.

Once the boot is off, care must be taken to then clean the area completely to remove all traces of old boot and adhesive. This is the first area where inexperienced installers get it wrong. Every shop we spoke to emphasized the need to clean down to shiny, bare aluminum (or paint, if such is the



Preparing for boot installation means cleaning the area down to bare aluminum, top. Installing a FASTboot on a King Air at the Goodrich Service Center.

case). The newly installed boot will show every bump, so getting the wing clean is a matter of assuring a good bond—any failure to do so is cosmetically obvious.

If any corrosion is found, it must be treated before the new boot is installed. All dents must be filled or fixed as well. So long as corrosion is within tolerance for treatment and

dents are minor, no bird strikes, we found that this work was generally included in the quoted price of replacement, although some shops added the cost of this labor to the final bill.

The first step in the installation is to use a chalk line to mark the precise leading edge of the wing, as it is the basis for aligning the boot. The remainder of the installation procedure depends upon whether you have selected a “conventional” boot or Goodrich’s FASTboot. A FASTboot has the adhesive already applied to the boot, requiring only that the protective paper be peeled off before putting the boot on the wing. Once clean, the wing needs only to have a primer applied before FASTboot installation. A conventional boot, either B/E Aerospace or Goodrich, requires a process of application and activation of

a liquid adhesive.

Two coats of 1300L adhesive are applied to the wing and the boot, with a half hour drying time allowed after each coat. The adhesive is then activated with toluene. This is another spot where experience matters. We heard of problems that arose from technicians who thinned the adhesive too much or got it too “wet” in the activation phase, so that the boot did not adhere well.

The boot is then pressed onto the wing, boot centerline to wing centerline, and a metal roller is used to assure there is a good bond with no wrinkles or air bubbles. This step is the same for both a conventional or FASTboot.

Once the boot is on the wing to the satisfaction of the technician, a conductive cement is applied around the edges of the boot. This allows the electrical charges that build up in

flight to equalize between the boot and airframe, otherwise there will be static discharges, resulting in pinholes in the boot. Conductive cement loses its conductivity over time and may need to be reapplied if pinholes start to appear in a boot.

Kevin Mead advised us that he has observed corrosion under the conductive cement on Malibus, so he now uses Brushable Black from Sterling Lacquer, a conductive polyurethane that seals out moisture.

Once the conductive cement has been applied, the stall strips are reinstalled and the airplane is ready to go. There is a cure time before the boots can be fired—for FASTboots it is one hour; for conventional boots the time we were told varied from 24 to 48 hours.

COST

For a high-performance piston single, prices for replacement of a set of boots is in a range from \$11,000 to \$16,000; for light twins, the range is \$12,000 to \$20,000. Prices for the boots themselves were quite close between Goodrich and BE Aerospace. Goodrich makes boots for all types of de-iced GA aircraft; BE Aerospace does so for about 85% of the fleet.

We found that shopping around can make a difference because the labor time and price varied between installers, different shops could get different discounts on the boots and B/E Aerospace and Goodrich seem always to be offering some sort of deal. These factors accounted for the wide range of prices we quoted at the beginning of the article. Further, installed, FASTboot and conventional boots were competitive in price.

B/E Aerospace has a line of distributors and installers and has dedicated personnel who train personnel at its approved installers.

Goodrich provides its boots through a single distributor, Aviall and does not approve installation facilities except for its own Goodrich Service Center on Akron-Canton Airport. It has been in business some 60 years and offers same-day boot replacement for most aircraft. Its prices were within the ranges quoted by other installers.

It also offers some incentives: Any airplane that has a boot replacement

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CONTACTS

Goodrich (UTC Aerospace Systems)
330-7840-5477
www.goodrich.com

B/E Aerospace
304-846-2554
www.beaerospace.com

Garmin's GDL 88: ADS-B In and Out Now

The new GDL 88 does ADS-B Out, receives both In frequencies and is compatible with non-Garmin boxes.

by Rick Durden

Garmin describes the GDL 88 as the "first dual-link solution for certified aircraft that not only provides a path to ADS-B Out compliance for many pilots, but also brings subscription-free weather and advanced traffic display to the cockpit."

While we're more than a little tired of hearing marketing types trumpet everything from a cup of coffee to software version umpty-dot-twelve as a "solution," we found that the GDL 88 is currently the easiest way to get a full-up, self-contained ADS-B-compliant system. (See the sidebar on page 16 for ADS-B basics.)



CAPABILITIES

The GDL 88 complies with the ADS-B Out requirement via the Universal Access Transceiver (UAT) route, however, it is also capable of tying in with a number of different, ADS-B Out compliant transponders and assuring that the same squawk code is being transmitted by the transponder and the UAT equipment without needing some sort of separate control panel to do so. While the GDL 88 uses the UAT ADS-B Out compliance route and does not contain a transponder, its

ability to link to an ADS-B compliant transponder gives a reasonably easy way of avoiding the limitation of flight below 18,000 feet and in no other country other than the U.S. of using a UAT.




WEATHER

Flight Information Service-Broadcast (FIS-B) weather is sent by the FAA through the ADS-B ground stations free of charge. Using the GDL 88 and a compatible flight display, the user can see graphical NEXRAD radar, METARs, TAFs, SIGMETs, AIRMETS, NOTAMs and TFRs as well as some other information such as winds and temperatures aloft.

AIM section 7-1-11d lists the information available and coverage radii.

There are some limitations such as NEXRAD is higher for 250 miles around your location and low-res outside that and NOTAMs many only show for a 100-mile radius. Such limited limitations are not a reason to keep paying for subscription

CHECKLIST

-  Provides a full-up, self-contained ADS-B-compliant system.
-  Receives both ADS-B Out frequencies, 978 MHz and 1090 MHz.
-  Requires major installation with little room for shortcuts.

weather rather than taking early advantage of ADS-B.

The dual-linked receiver in the GDL 88 means it receives all information on all ADS-B Out-equipped traffic in the area, no matter whether they are transmitting via transponder on 1090 MHz or UAT on 978 MHz. It is also compatible with active traffic systems and when receiving information regarding multiple aircraft, it assigns priorities to each and identifies and removes any duplicate reports of other aircraft.

TRAFFIC

Ground stations also transmit Traffic Information Service-Broadcast (TIS-B), which is received by the ADS-B In capabilities of the GDL 88. That traffic information is the same as ATC sees from radar and ADS-B, so it is not limited to ADS-B-compliant aircraft. The GDL 88



A GDL 88 unit, above. FIS-B NEXRAD radar received via ADS-B In by a GDL 88 and displayed on a Garmin GTN 750, right.

A LITTLE BACKGROUND ON ADS-B

As of 2020, nearly every aircraft flying in the U.S. will be required to have appropriate ADS-B Out equipment. That means, simplified, the ability to transmit WAAS GPS-generated position, 3D velocity, altitude and some other information approximately every second while in motion to ground stations for ATC use and to other aircraft in the area.

There are two methods of complying with the transmission requirement, a Mode S transponder with “extended squitter”—it’s okay, this really is a family magazine, we’ll explain in a moment—or a Universal Access Transceiver (UAT)—only it isn’t universal, only the transponder option is—yes, we’ll explain.

A squitter is a device that transmits packets of data, squirts it, at regular intervals without being prompted to do so. Mode S transponders have a squitter to send out a limited amount of data regarding the aircraft. An extended squitter is capable of sending more data in each packet.

Some current Mode S transponders can be modified to extended squitter status for a fraction of the price of buying a new, compliant one. The transponder with extended squitter transmits data on a frequency of 1090 MHz and receives TCAS information on a frequency of 1030 MHz.

The transponder with extended squitter is the truly universal method of complying with the

mandate of ADS-B Out because it can be used at all altitudes and in other countries.

We suspect the Universal Access Transceiver (UAT) was named by the same person in charge of placing misleading names on bills in Congress. It isn’t universal. It cannot be used for ADS-B Out compliance in any other country or above 17,999 feet in the U.S. That’s the downside.

The upside is way up, however, it not only transmits the required data for ADS-B Out—on a frequency of 978 MHz—it allows ADS-B In, that is, it receives, also on 978 MHz, the stuff being sent out by the FAA ground stations and by other aircraft using a UAT to send out position and movement information.

That means you get weather information that is nearly as good as what you are paying a monthly fee to get right now and it’s free. Plus you get traffic information regarding other airplanes around you that are ADS-B Out compliant, the percentage of those that are will steadily be increasing.

Receiving free weather is a significant carrot offered by the FAA to encourage ADS-B compliance early. Over the next few years, the savings on the price of an airborne weather subscription will pay some of the ADS-B equipment installation.

Garmin has created an “ADS-B Academy” (www.garmin.com/us/intheair/ads-b) within its Website where you can learn more of the basics of ADS-B and how it will affect your flying.

allows the traffic information to be observed on a compatible display. The user sees what a controller sees.

Garmin has developed a new display feature with the GDL 88, which it is calling TargetTrend. It takes into account the fact that your aircraft is moving through space and provides a velocity vector display that shows how ADS-B Out-equipped aircraft are moving with relation to you, which allows faster threat assessment. It does not apply

to all TIS-B traffic information, only with regard to aircraft that are ADS-B Out equipped.

In aircraft with Garmin GTN series avionics the GTN will automatically declutter the traffic display and show those that are the highest priority and will group targets. If you want more information about targets in a group, you touch the group and it then shows all the targets. You can select any target displayed and call up its closure



Traffic information received by the GDL 88 as displayed conventionally on a GTN 750, top. Using TargetTrend, the movement of other aircraft relative to yours is displayed, above, allowing faster threat assessment.

rate and groundspeed.

When on the ground, other ADS-B-equipped taxiing aircraft and moving vehicles are displayed.

We like that Garmin recognizes that not all aircraft have a compatible flight display to view traffic data. The GDL 88 is set up to activate an indicator light to advise that traffic is in the immediate area and give a voice alert that calls out distance, bearing and relative altitude (if the aircraft is squawking altitude or is ADS-B compliant).

Garmin also recognizes that getting up to speed on ADS-B is not intuitive and involves a learning curve so it has created a “Learning Academy” on its Website. While it gently pushes its own products, we felt that it was objective, unbiased and accurate and a good way to begin to understand this new system



A Garmin SafeTaxi diagram showing ADS-B-equipped aircraft and vehicles on the ground as displayed on a GTN 750.

we're going to be living with before long.

PRICES

The GDL 88 comes in four versions: for aircraft with a WAAS GPS source and not desiring "diversity," an antenna on the top and bottom of the airplane, the basic GDL 88 is \$3995; if there is a WAAS GPS source and the reception advantages of diversity are desired, the GDL 88 with diversity is \$4495; a unit with built-in WAAS and without diversity is \$5143; the GDL 88 with WAAS and diversity is \$5643. Prices do not include antennas.

CONCLUSION

We like what we see for functionality of the GDL 88 in that it allows reception of both ADS-B Out transmission frequencies so that it reads all ADS-B traffic, something that is going to become increasingly important, that it is compatible with more than just other Garmin displays and transponders and provides a way to transmit on both ADS-B Out frequencies even though it does not itself contain a transponder.

CONTACTS

Garmin
866-739-5687
<https://fly.garmin.com>

GDL88D: ANTENNA CHALLENGES

One of the many challenges technicians face in planning a modern installation is placing critical antennas. A GDL 88 retrofit, or other permanent-mount ADS-B system won't be an exception. That's because the antenna farm that exists on the airframe might need to be reconfigured to accommodate the critical ADS-B antennas.

First is the required GPS antenna. Like any GPS antenna installation, the mounting geometry, location and surrounding interference on the airframe can affect system performance.

Proper installation means respecting at least two feet of clearance from communications antennas or any other antenna that emits 25 watts or more of power.

Further, to minimize the effects of shadowing, Garmin doesn't want the antenna closer than nine inches from any antenna—either active or passive. Technicians are accustomed to working with these challenges but the fact is, they're running out of available antenna real estate on small and medium-sized airframes.

Installations that use an existing WAAS GPS navigator for the ADS-B position source will have the advantage, since the antenna will already be installed on the airframe. Since a popular dual-link GDL 88 installation will include the GDL

88D Diversity model, it will require dual L-Band blade antennas, one installed on the top and the other on the bottom of the airframe.

But antennas aren't the only challenge in a full-up ADS-B interface. The GDL 88 is a stand-alone box that needs to be mounted remotely in the airframe. Garmin has done a nice job of making the GDL 88 compact, measuring six inches high, less than two inches wide and seven inches deep. It's a box that can be mounted horizontally or vertically under the panel, in the tail, or in a dedicated avionics bay.

When the wiring tools come out of the toolbox, the GDL 88 has a liberal and rich interconnect architecture, capable of playing ARINC 429, RS232 and Ethernet. For GDL 88 flavors that don't utilize a built-in GPS, the unit will need to be interfaced with a GNS or GTN-series navigator.

This means the shop will need to open the radio stack to gain access to wiring. Of course, they'll need to do this anyway, to interface the GDL 88 with a compatible display and with the transponder systems.

To be sure, we think the dual-link GDL 88 represents one of the most worthy full-up ADS-B interfaces we've seen to date, but it will require a major installation with little room for short-cuts, as critical performance hangs in the balance.





Cirrus CAPS Repacks: Expense, Depreciation

The fleet of older Cirrus airframes could face further depreciation because of pricey parachute upkeep. We look at the economics and the CAPS repack process.

by Larry Anglisano

Cirrus owners rave about having the CAPS parachute system as the ultimate safety backup, but if you're shopping for a used Cirrus, know this: Many used airframes are coming up on the required 10-year parachute repack cycle. This work is expensive, requires considerable down time and can only be accomplished by select and highly specialized shops.

This should be taken into consideration when negotiating the sale price and if you pull the trigger on an airplane that needs the repack, you should know what you're getting into first. In this article, we'll take a look at this major service event, including the mandatory repack requirement and what you should expect for costs. During our research,

we discovered that all repacks aren't created equally.

CONTROLLED DESCENT

The airframe parachute that's part of every certificated Cirrus is courtesy of Cirrus Design co-founder Alan Klapmeier, who lived to tell about his own midair collision early in his flying career. He wanted the original SR20 to have a life-saving device for such an emergency or any other situation where a pilot loses control of the airplane. In a nutshell, the CAPS, made by BRS Ballistic Recovery Systems for Cirrus, consists of a 51-square-foot packed parachute that's installed mid-fuselage in a storage bay. The parachute is connected to an extraction harness that's driven by a solid propellant rocket motor

Buying a Cirrus means accepting the 10-year and \$10,000-plus parachute repack interval. Tearing off and then repairing the fiberglass parachute hatch is major work on first generation models.

that's roughly the size of an aerosol paint can.

As for pilot interaction, it's supposed to be a simple concept—pulling the parachute handle in the headliner deploys the solid-fuel rocket out of the hatch that covers the concealed compartment where the parachute is stored. As the rocket carries the parachute rearward from the back of the fuselage, the embedded airframe harness straps release from the fuselage. Within seconds, the parachute canopy inflates, controlling the aircraft to a safe rate of descent. To date, there have been close to 40 CAPS deployments, according to a running tally kept by the Cirrus Owners and Pilots Association.

The CAPS falls under the Type Certificate of every certified SR20 and SR22. Interestingly, BRS doesn't own an STC for the system they build, but we're told this could change and may simplify maintenance procedures. Cirrus owns the rocket design and rigs, packs and ships the parachutes. The 10-year repack requirement can be satisfied by installing an overhauled parachute or a new one. Owners rarely chose then latter given the approximate \$15,000 cost, according to the shops we interviewed. An overhauled kit costs approximately \$9000, not including labor. Further, the 10-year

CHECKLIST



G2 models won't require time-consuming fiberglass work after repack.



Shops have done enough repacks that cosmetic work quality is improving.



Total costs for a G1 repack could approach a whopping \$14,000.



CAPS REPACK AT A GLANCE

You're going to do what to my airplane? Accessing the parachute on G1 models, lower right photo, is a crude process that requires a drill and a slide hammer to break open the fiberglass hatch. The fiberglass repairs and paint work that follow are time-consuming steps that only specialized shops can handle.

repack isn't the only CAPS maintenance to deal with. There's also a six-year replacement of the line cutters used in the parachute deployment. All of the shops we spoke with said they complete the repack within 20 to 30 hours for pre-2004 aircraft, which are the first-generation SR20 and SR22s. The job on second-generation aircraft are expected to be a lot easier, thanks to direct parachute access. More on that in a bit.

SPECIALIZED WORK

Many owners naturally assume the CAPS replacement can be performed by any Cirrus service center, but this isn't the case. That's because of the specialized work and certified training that tags along with the parachute repack. Due to the propellant-powered rocket that's part of the parachute deployment, the work is partially governed by the

Bureau of Alcohol, Tobacco, Firearms and Explosives. As if FAA oversight isn't enough government to answer to, the ATF performs regular inspections of the shops, who are required to have special facilities equipped with cabinets to securely store the rockets, among other requirements. Techs who handle the rocket are background checked. Further, each technician that performs a CAPS replacement is exclusively trained and licensed by Cirrus. Unlike most airframe work, the parachute repack process can't be taught from one technician to the other on the shop level. Each needs to receive specialized training at Cirrus.

The other prerequisite for a CAPS repack includes the shop's ability to perform a bonding repair to the airframe's composite structure following the CAPS replacement. This is true for first-generation aircraft

only. Thanks to a redesigned parachute access panel that was designed in the baggage area bulkhead of second-generation Cirrus models, the finishing work that follows a CAPS replacement on these is greatly simplified—almost making the service event a while-you-wait process. In these aircraft, the parachute is accessed and fished out from a bulkhead in the baggage bay. But for G1 models, cosmetic work is a critical part of the process that often requires a minimum of five days downtime.

We surveyed several shops who've accomplished a fair number of repack jobs, and all stressed the importance of delivering an aircraft that has exceptional paint and fiberglass work. Steve Miller, Director of Maintenance at Leading Edge Aviation in Tampa, Florida, seemed meticulous when it comes to this work. His shop

USED CIRRUS MARKET: CAPS MATTERS

Looking to score a sweet deal on a used Cirrus? A pending 10-year CAPS repack may be a feather in your bargaining cap. That's what we heard from more than one Cirrus buyer, after they either negotiated the cost of a pending CAPS repack from the asking price, or convinced the seller to accomplish the repack as part of the deal. Face it, dropping \$12,000 or more for this pricey service within the first couple years of ownership is a sure way to stress the budget.

To get a feel for the current sales climate of preowned Cirrus, we talked with Jaime Steel from the respected Steel Aviation Aircraft Sales firm in Ohio. When it comes to resale, Steel is the Cirrus expert—selling nearly 800 Cirrus models in her career. She said there's a certain amount of airframe depreciation that tags along with the cherished Cirrus parachute system.

One quick way to figure out the possible CAPS hit at resale is to divide an average \$12,000 service cost by 10 years, which generally values the parachute usage at \$1200

per year. "A 2001 SR20—that might be valued at \$100,000—may really be worth around \$90,000 if its 10-year repack is coming due in a year or less. If it's been accomplished, the CAPS value holds its own," Steel told us.

Aircraft Bluebook makes reference to the CAPS service. It says, for a 2003 SR22, to deduct \$11,250 wholesale and \$15,000 retail if the required 10-year BRS inspection hasn't been complied with.

Last, given the high volume of Cirrus models that Steel Aviation has worked with, they made it clear that there can be significant differences in the quality of the finishing work that's required of G1 CAPS replacements.

You can bet this cosmetic work will have at least some effect when it's time for resale—a reason to choose a shop that pays attention to this detail.



cian removes the line cutters and the two primary straps are disconnected from the parachute so it can be removed from the storage bay and a new parachute cover can be fitted. This is a critical step because the CAPS cover has a reinforced strike plate on its underside—the area where the deployed rocket hits, causing it to break away from fuselage.

In some earlier aircraft, the parachute straps were chafing due to undersized holes in the structure. The repack project is when most shops enlarge the access hole and provide chaff protection as necessary.

Once the new parachute, hardware and rocket are fitted into the bay, the new cover is bonded into place using a low-level adhesive so it's firmly attached but can still break away during deployment. An inexperienced technician may slop too much filler around the cover, which can induce high resistance between the cover and fuselage. From here, basic body work and painting techniques are utilized to obtain the finished product. If you are considering changing your tail number, now may be the time to do so, unless your shop masks the existing numbers.

PREPARE FOR SERVICE

Aside from putting money away for a parachute repack, first-generation Cirrus owners can plan for the event by keeping the composite surfaces clean and when possible, storing the aircraft out of sunlight. That's the advice we were given from two shops who are seeing some neglected aircraft. "We've had a couple of aircraft come in for the parachute repack with faded and stained paint, which made the new fiberglass and paint work stand out like a sore thumb," said Luke Jean of Heritage.

Of course, one way to avoid these hassles altogether is to buy a second generation Cirrus that won't require fiberglass and paint work. It will still require the 10-year repack, but the process will be much easier with less downtime, limited cosmetic concerns and lower labor costs.

is a busy Cirrus certified service center and one of approximately 150 shops in the country approved for the CAPS replacement. According to him, not all repacks are performed to the same standards, at least when it comes to the airframe repair and paint work that follows a CAPS replacement. As he put it, "If an owner can see evidence of fiberglass and paint work, it means it wasn't done right." Leading Edge has certified, professional aircraft painters on staff that, unlike some other shops we spoke with, don't believe in tape masking around registration numbers when reworking the fiberglass. Instead, his shop often replaces the tail numbers as part of the refinishing work. Leading Edge currently charges around \$11,500 for a G1 repack.

Luke Jean, who heads the maintenance division at Heritage Aviation in Burlington, Vermont, described the increasing costs of consumables,

including paint, primer, sanding wheels and other finishing materials. He also noted the high costs of shipping the parachute kit. Owners will pay for these shop expenses, which is included in the current price of around \$11,750 that Heritage currently charges.

CRITICAL PROCESS

No matter where you go for the work, the first step is a crude one—removing the parachute rocket and related small components from the airframe. For G1 aircraft, the CAPS access cover is removed by drilling a hole into the fiberglass cover and using a slide hammer to break the bond between the fuselage and the cover. This is an ungentle process that essentially damages the surrounding fiberglass and requires subsequent structure and cosmetic repair.

Once the cover is removed and the parachute is exposed, the techni-

myWingMan For iPad: Bendix/King Simplicity

Bendix/King is convinced that pilots need avionics that are easier to use. This new tablet app is its idea of simple navigation.

by Larry Anglisano

Bendix/King sees its potential market slice as building avionics that are easier to use than a Garmin. While it has yet to deliver any clean-sheet designs of its own since announcing its comeback over a year ago, the newly introduced myWingMan tablet app could be the launch pad for a fresh product line.

Despite a market that's flooded with aviation navigation apps, the company thinks myWingMan sets a new standard for what pilots can expect from future mobile flight planning and navigation tools. We think it's a start.

FLAT APPLICATION

The myWingMan app attempts to present the user with oodles of information without having to hop around numerous screens. This drag-and-drop flat application design avoids the trap of getting lost in menu structure, which we found to be mostly true. On the other hand, we initially found ourselves head down and staring at the screen, wondering how to accomplish rudimentary tasks, such as building a flight plan or fetching a frequency.

But once your fingers do some walking on the map, flight planning is straightforward. Simply touch the map and you're greeted with a list of surrounding airports, nav aids and fixes. Select any of them from the list and you'll have the option of adding them to the flight plan. Modifying a flight plan from the map is the expected drill of holding and dragging.

A major part of navigating the app is using the on-screen function wheel tab that lives in the lower

right corner of the screen. This is for selecting the data to be displayed in the active window. Since the program has up to three-way split screens, the larger window is the active window, while smaller ones are reference windows.

The app interacts with DUAT for filing flight plans, using preset aircraft and user profiles. Once in the cockpit, the user can select customizable screen modes for all phases of flight—from pre-flight to approach, accessed with the flight mode tab at the top of the screen.

SYN VIS AND WEATHER

When connected to the Levil AHRS unit, myWingMan provides a virtual chase plane and traditional forward view synthetic vision display. There's also a nifty G-meter as standard which, in our view, is nothing more than amusing.

We used the Internet

myWingMan excels in flight planning and is easily configurable to display up to three pages of data. A simple function wheel menu tab cuts to the chase for selecting data on the fly.



CHECKLIST



A well thought-out app that offers decent flight planning with DUAT.



We like the shallow menu structure and AHRS interfaceability.



Come on, guys, how about building portable ADS-B hardware for this?

weather interface but not the optional WxWorx XM in-flight weather. For pre-flight planning, the radar, satellite, Metar, TAF and winds aloft data capabilities are sufficient, but we wish the radar images can be put into motion. A myWingMan subscription includes Seattle Avionics charts, VFR sectionals, enroute charts plus 3-D terrain data.

Available from iTunes now, the VFR version of the app is \$99 and the IFR version is \$149, not including a weather or AHRS unit. Bendix/King is planning to connect myWingMan with the in-development KSN770 navigator, through the Aspen Connected Panel interface. There's also a planned version of the app for the Android platform.



FSS Revamp: Web Access, Hazard Alerts

The new Lockheed Martin website gives access to nearly everything a briefer can see and will send post-briefing adverse condition alerts to the pilot.

by Rick Durden

Lockheed Martin Flight Services (LMFS) has created a website for flight planning, filing flight plans and adverse condition alerting. It's mostly easy to use, we like what we see and are looking forward to planned increased capabilities.

One of the larger displays at AOPA Summit this year was created by LMFS to announce the rollout of its new website for flight planning and adverse condition alerting. Our first reaction was, so what? After all, with the plethora of flight planning apps available today, who cares about another one? Besides, given all the attention to flight planning apps, do pilots even make phone calls to 1-800-WX BRIEF any more?

It turns out that thousands of pilots call FSS every day even if they self-brief via their computers or digital devices, and LM's web portal is a handy tool that looks to get even more useful over the course of the next year or so.

Privatization of the FSS network via a 10-year contract between the FAA and LMFS has saved the taxpayers some \$1.7 billion according to Jim Derr, LMFS's director of flight services. As part of the contract, LMFS has been working with the FAA to come up with ideas through which the FSS system can help reduce the stubbornly high general aviation accident rate. The result is the new website (<https://www.lmfsweb.afss.com>) that allows a pilot to self-brief using about 98 percent of the material that an FSS specialist looks at in a telephone briefing, file flight plans that go into the system immediately and sign up for LMFS's new Adverse Condition Alerting Service (ACAS).




ALERTS

According to Derr, ACAS uses a "four-dimensional model, three-dimensions plus time," to send alerts to pilots of adverse weather conditions, TFRs and urgent PIREPs that arise between the time the pilot files a flight plan and launches on the flight. This service is free and available for any pilot who requests it, whether the flight plan is filed via telephone with a briefer or on the website. Alerts are sent via e-mail, text message and/or iridium satellite device (currently

LMFS announced its new website at AOPA Summit.



CHECKLIST

-  Access to nearly all the data available to a FSS briefer.
-  Alerts of new adverse conditions can be sent to the pilot after briefing.
-  Relatively limited features currently, new ones are promised.

Spider Tracks). It will eventually use ADS-B. Because the system is set up to consider an area about 50 miles on each side of the flight plan route, over the time in which the aircraft should be at a given point on the route, it is anticipated that relevant alerts will eventually be sent during the flight itself.

PERSONAL HOME PAGE

The website proved easy to use with some shortcuts we liked and a surprisingly large geographic weather coverage area. On initial use, you tailor a home page with as many as four weather charts of your choice and the METARs, TAFs and NOTAMs at as many as three airports. From then on, that weather info displays when you sign in. On your initial visit or at any later date, you can also sign up for, although we were frustrated that once we had signed up for alerts—in the "Account Preferences" tab—we could not go back and see what we had signed up for and confirm what we had done.

The "Weather" tab opens up virtually all of the information available to an FSS briefer and includes all of North America, Central America, the Caribbean, northern South America, the Atlantic and Pacific.

The "Flight Planning and Briefing" tab gives you a choice of an FAA or ICAO flight plan form. Once you have filled in the required fields you can hit the "brief" button and generate a full briefing, much as you would receive from an FSS specialist. We eventually figured out that pop-up blockers have to be turned off to get the briefing pages to show. The first page of the briefing generated is Alerts and Hazards to Flight, including TFRs. Of those, presidential TFRs, the bane of so many pilots, are

the first thing to appear, something we liked. Some other services bury TFRs in pages of data as pilots have discovered to their dismay after a TFR bust.

Going back to the flight plan page allows you to tailor your flight plan as you wish based on your briefing and then file it. Because you have filed it through LMFS and it goes directly into the system, it is immediately available to an FSS specialist should you need to call up and amend it. Many of us have learned that is not the case when filing through another service, as many hold the flight plan until a fixed time before proposed departure before putting it into the system.

The "Airports" tab pulls up much of the information you might want about an airport, including approach charts, except for the identity of FBOs and information on fuel prices. Under "Tools," you can find a guide to abbreviations, which we found ourselves relying on because MET-ARs and TAFs are not presented in decoded form.

The "links" tab takes the user to Sky Vector's aeronautical chart website, which we found easy to use, includes weather information and graphical TFRs. Currently a flight plan created on Sky Vector does not automatically transfer to the LMFS site, however, we were advised by LMFS chief architect, Mike Glasgow, that the two companies are working on a way to gather the route elements so they may be pasted onto the route field on the LMFS flight plan.

SEARCH AND RESCUE

We like what we have seen so far. We are looking forward to see what LMFS does with the capabilities of the site in the next year. Flight Services director Derr gave us an outline of what we might expect. He first explained that LMFS is involved with over 10,000 search and rescue events annually. SAR is not initiated until an airplane is at least 30 minutes overdue. The first step is usually a series of telephone calls to see if the airplane has landed, and the pilot simply forgot to close the flight plan.

The start time and initial calling process also means that an airplane that goes down 20 minutes into a three-hour flight is not going to be the subject of a search for some time

The first page that pops up in an LMFS briefing shows TFRs, right—they aren't buried in pages of text. Charts, with color-coded weather and TFRs are available through a link to Sky Vector, below right.

after the accident, time that may be critical. According to Derr, LMFS will introduce Surveillance Enhanced SAR in the spring. Through an aircraft's iridium satellite device (the vendor will charge a fee—LMFS will not) SAR will be triggered if the airborne unit stops transmitting, pings stationary or the pilot pushes the emergency call button on the device, significantly cutting down the time until the real search is underway.

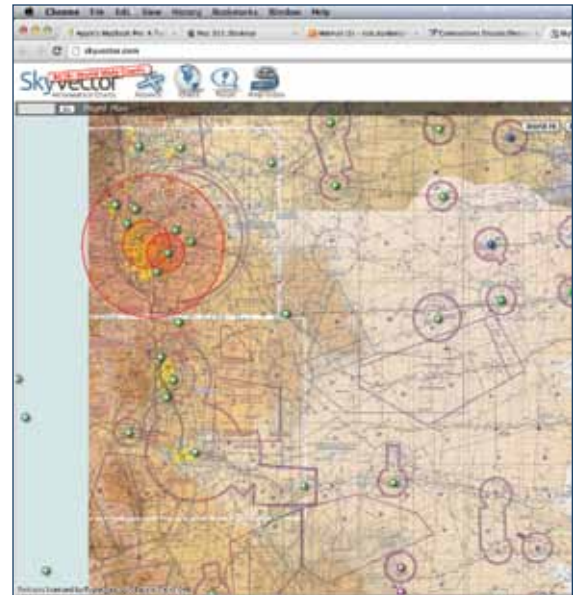
Derr said that another early development will be "live meeting" capability on the website so that a pilot on a telephone briefing with a Specialist can share the same screen image, allowing what almost amounts to the long-lost and popular in-person briefing.

"Auto-summarization" should appear on the website in 2013. A printout of a full briefing can involve dozens of pages of material—when a pilot calls FSS, the specialist summarizes the data for the pilot, culling out the extraneous material. An algorithm developed by LMFS will do this automatically on the website, saving time for the self-briefing pilot. If the pilot desires more, it is still available with a few clicks.

Chief architect Glasgow said that decoded weather and a nav log are also coming to the website as well as upgraded ACAS so that alerts will appear on the pilot's home page.

CONCLUSION

Especially for those who prefer to



talk to a FSS briefer, the LMFS web portal provides flight planning information in a format that is familiar and easy to use. We don't know how many times we've filed a flight plan a few hours prior to departure and, once aloft, discovered that thunderstorms had popped up unexpectedly along our route, so we are looking forward to taking advantage of the ACAS.

We are also very interested in the upcoming enhanced SAR and other features and will be reporting on them when they come out. LMFS has some innovative ideas that may enhance safety. We're hoping it can deliver.

CONTACTS

Lockheed Martin Flight Services
800-WX-BRIEF
<https://www.lmfsweb.afss.com>

Cessna 206

A broad-shouldered load hauler that's at home everywhere from the bush to a family outing.



We Americans like our stuff. We accumulate it madly and take it with us when we go places. We happily buy and jam our highways with SUVs, minivans and gigantic pickup trucks, each able to comfortably swallow several people and their stuff.

Yet, when it comes to airplanes, it's tough to fulfill the deep-seated desire to haul our stuff. Some are optimized for speed, with little flexibility in loading. Some aren't, their designers preferring to carry people and things reliably over long distances or into small areas. Compromises can be made, but the results sometimes please few customers. Perhaps the poster-child exception is an airplane such as the Cessna 206 Stationair, which carries the SUV/minivan/pickup concept to a capable conclusion.

It's not fast, nor is it that slow, but it is stable, rugged, reliable, has six real seats and is remarkable for being able to carry a half-ton or so after the tanks are filled. You can put it on

floats, turbocharge it, dump skydivers from it, and carry small packages or just your family. It has proven tough and reliable enough to be a fixture in the bush throughout the world, holding on even as turbines shoulder out piston-power.

So popular has been the 206's combination of simplicity and load-carrying that it's one of three

cally known as the 210-5. It had two doors up front and a relatively small rear door on the left side. The engine was a 260-HP Continental IO-470. This airplane was a fixed-gear version of the recently revamped 210; it was produced for two years, with 577 delivered.

In 1964, Cessna responded to demand for more utility and created the U206 (U for Utility) Super Skywagon, with a 285-HP Continental IO-520A, redesigned wing and bigger flaps. Intended as a flying pickup truck, even the seats were optional. There was one door for the pilot and a big double door aft on the right side.

The next model year saw the 205 become the P206 Super Skylane, with "P" representing "personal" or "passenger," depending on with whom you're speaking. The P206 had the same door arrangement as the 205, but with the bigger engine from the 206. The U206 was by far the more popular of the two.

In 1967, the U model got a take-off-weight boost and a new engine,

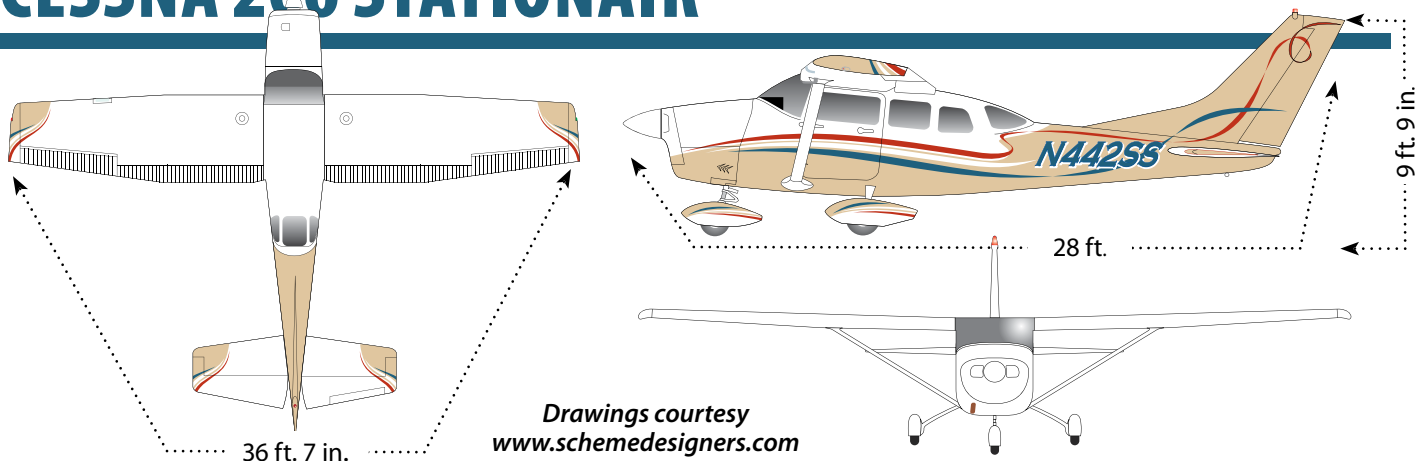
Known for its ability to carry heavy loads in and out of tight spots, Cessna's 206/Stationair is also a rock-solid instrument platform.

piston-powered singles Cessna saw fit to bring back to the land of the living. As a result and in addition to a wide range of mid-1960s and later airframes on the market, one can also opt for a brand-new one.

HISTORY

Cessna's biggest fixed-gear piston single is really three models, though all are essentially the same airframe. It was originally introduced in 1963 as the 205, a fixed gear 210, techni-

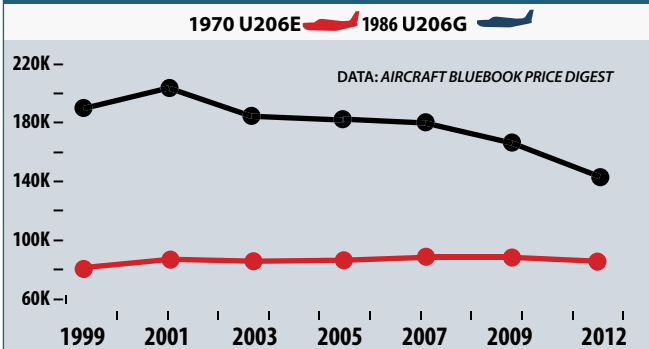
CESSNA 206 STATIONAIR



CESSNA 206 SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1965 U206 SUPER SKYWAGON	CONTINENTAL IO-520-A	1700	\$30,000	65	1540 LBS	144 KTS	±\$68,000
1965 P206 SUPER SKYLANE	CONTINENTAL IO-520-A	1700	\$30,000	65	1510 LBS	143 KTS	±\$63,000
1970 U206E STATIONAIR	CONTINENTAL IO-520-F	1700	\$26,000	65	1575 LBS	143 KTS	±\$84,000
1970 P206D SUPER SKYLANE	CONTINENTAL IO-520-A	1700	\$30,000	65	1480 LBS	142 KTS	±\$70,000
1980 U206G II STATIONAIR	CONTINENTAL IO-520-F	1700	\$30,000	92	1598 LBS	147 KTS	±\$128,000
1980 TU206G II TURBO STATIONAIR	CONTINENTAL TSIO-520-M	1600	\$40,000	92	1534 LBS	152 KTS	±\$135,000
1986 U206G II STATIONAIR	CONTINENTAL IO-520-F	1700	\$30,000	92	1598 LBS	147 KTS	±\$157,000
1986 TU206G II TURBO STATIONAIR	CONTINENTAL TSIO-520-M	1600	\$40,000	92	1534 LBS	152 KTS	±\$175,000
2004 206H STATIONAIR	LYCOMING IO-540-AC1A	2000	\$45,000	92	1249 LBS	142 KTS	±\$230,000
2004 T206H TURBO STATIONAIR	LYCOMING TIO-540-AJ1I	2000	\$52,000	92	1249 LBS	150 KTS	±\$260,000

CESSNA 206 RESALE VALUE



SELECT RECENT ADS

- AD 2011-10-09 SEAT RAILS AND ROLLER HOUSING INSPECTION
- AD 2008-05-09 ONE-TIME SEAT BASE/BACK ATTACH BRACKETS MODIFICATION (206H)
- AD 84-10-01 INSTALL QUICKDRAINS; REPETITIVELY INSPECT FUEL TANK FILLER AREA
- AD 79-08-03 DISCONNECT CIGAR LIGHTER OR INSTALL CIRCUIT PROTECTION

SELECT LATE-MODEL COMPARISONS

PAYLOAD/FULL FUEL

1970 U206E STATIONAIR	~1350
1970 TU206E TURBO	~1150
1970 PIPER PA-32-300	~1100
2004 T206H TURBO	~1100
2004 PIPER PA-32-301 6X	~1350

CRUISE SPEEDS

1970 U206E STATIONAIR	~125
1970 TU206E TURBO STATIONAIR	~135
1970 PIPER PA-32-300	~130
2004 T206H TURBO STATIONAIR	~135
2004 PIPER PA-32-301 6X	~145

PRICE COMPARISONS

1970 U206	(\$84,000)
1970 TU206E	(\$91,000)
1970 PIPER PA-32-300	(\$68,000)
2004 T206H TURBO	(\$200,000)
2004 PA-32-301 6X	(\$245,000)



The panel of this 1980 model 206, above left, shows avionics upgrades one might expect to find on the current market. The G1000 panel of the most recent version of the 206, lower left.

the 300-HP Continental IO-520-F, while the P model kept the 285-HP IO-520-A. Turbocharging became available on both variants in 1966, with a 285-HP Continental TSIO-520C. The P206 was discontinued in 1970, with a total production run of 647. The remaining U206 and TU206 were offered with either a utility or passenger interior, and renamed Stationair.

A stretch of the fuselage brought into being the 207 Skywagon in 1969, powered by the 300 HP IO-520-F. One more seat was added, bringing the number available to seven. Useful load went up by about 30 pounds. An additional bonus was a nose baggage compartment, easing the task of getting the CG in the proper place during loading. The turbo model of the 207 was powered by a TSIO-520-G, also with 300 HP.

Camber-lift wings, which feature a slightly cuffed leading edge, were added in 1972. These improved low-speed handling at almost no cost to cruise speeds. At the same time, the baggage compartment got a seven-inch stretch (more on this later). An aerodynamic cleanup in 1975

boosted cruise speed by about six MPH. The cleanup included more-streamlined wheel pants and improved cowl flaps.

In 1977, the horsepower of the turbo engine was upped to 310 (for takeoff only) on both the TU206 and the T207. A wet-wing fuel system was introduced

in 1979.

In 1980, the seventh seat of the 207 was widened to hold up to eight passengers. This created the Stationair 8, but the designator remained 207. The world would have to wait for the Caravan to see the 208 and the ultimate evolution of the high-wing, strut-braced single. The 207 was discontinued in 1984, and the 206 two years later.

It was a great run. Along the way, 206s saw several suffixes added, starting with the 206A in 1966 and culminating, temporarily, with the 206G in 1986. More than 7000, by serial number, U206s had entered the market, along with 647 P206s, the 577 aforementioned 205s and another 788 207s.

But then a funny thing happened: In the mid 1990s, Cessna started making piston-powered airplanes again. After starting up assembly lines for the 172 and 182, the Model 206 returned in 1998, powered not by a Continental IO-520 but by a 300-HP Lycoming IO-540-AC1A. Offered only as the 206H Stationair and, thanks to a 310-HP Lycoming TIO-540-AJ1A, available with

or without turbocharging, Cessna wants in the neighborhood of \$500,000 for a new one.

MARKETPLACE

Enormous fixed-gear singles aren't all that common in the marketplace. In terms of mainstream aircraft, the choices are pretty much limited to the Cessnas and Piper PA-32 Cherokee Six/Saratoga. Prices are comparable, and which makes the better choice depends in part on your needs. The big Pipers have a wing spar running through the cabin right behind the front seats, disrupting the loading area somewhat, and the Cessna is definitely the airplane of choice for floats. Both companies' products have proven reasonably reliable over the years.

The Pipers do have an edge in TBO. While the best one can hope for from any Stationair model is a 1700-hour TBO, the -540-series Lycomings bolted on the Pipers have a TBO of 1800 hours (for the TIO-540-S1AD), and as much as 2000 hours in the case of the IO-540-K1G5 on the Saratoga and Cherokee Six. Piper's TBO advantage is erased if one is considering a '98 or later Lycoming-powered 206.

LOADING

This is the name of the game for Stationair pilots. While no airplane can handle anything you can fit in it, the Stationair comes closer than most. Full-fuel payloads of 1000 pounds or better are not at all uncommon.

The big rear cargo doors—creating an opening more than 44 inches wide—make getting bulky cargoes inside less of a chore than in other aircraft. Another nice touch is the lack of a lip at the doors, so cargoes don't have to be maneuvered up and over to get them inside.

The airplane can be flown with the cargo doors off which, combined with solid low speed handling, makes them popular with aerial

photographers and public benefit flying organizations involved in conservation research and monitoring. Public benefit flying organizations LightHawk and CAVU are 206 owners and use them in remote areas of North, Central and South America.

Specialty kits were made available so the Stationair could take on such jobs as glider towing, parachute jumping and even aerial hearing service. There also is a cargo pod available.

With or without the cargo pod, the Stationairs offer ample loading flexibility. The allowable CG range is fairly wide, making cargo/passenger positioning less of a juggling act than with many aircraft. However, despite some pilots' assertions that, "If you can get it in, you can take off," weight and balance computations are not optional. Several accidents over the years show it is possible to load a Stationair outside its envelope.

COMFORT

While the Stationairs have large cabins, they're not long on comfort with a full load of passengers. Noise levels, particularly during takeoff and climb, can be fairly high as piston-engined singles go. And the rear-most seats—row three in the 206, rows three and four in the 207—leave little in the way of leg room.

Another comfort consideration is the baggage compartment. In spite of Cessna's best efforts, it doesn't quite match the capabilities of the passenger compartment. As a result, passengers may find themselves sharing space with their bags.

PERFORMANCE

Top cruise speeds will run in the 145-knot area while burning 15 gallons per hour or more. Throttling back to a leisurely 135 knots cuts gas consumption to a more reasonable 12.5 GPH.

Handling matches the aircraft's size. Pilots who enter the Stationair after climbing the Cessna model ladder may find the aircraft is just more of the same—only heavier, although the ailerons are notably responsive, even at slow speeds. Few owners seem to mind the fairly heavy controls: Snappy handling is not why they bought the airplane.

This is not without its benefits,

The right-side cargo doors make access to the rear seats easy, right, especially when the Greisman family of six, middle right, goes to visit relatives, although baggage is limited to the area behind the rear seats.

With passenger seats removed, the 206 hauls a tremendous volume of cargo, bottom right.

though. It makes the Stationair an excellent IFR platform—stable and rock-solid. It also makes for a relatively smooth ride in turbulence.

Another benefit is that the Stationair is reluctant to stall. Pitch forces are fairly heavy to begin with. Compounding this is the generally nose-heavy loading of the airplane. Since the CG envelope is so long, and most everyone wants to sit up front, the CG is often at or near its forward limit. Also, with power on, the deck angle required for a wings-level stall is alarming. Put it all together and the Stationair is not generally a willing participant in stalls.

A drawback of this nose heaviness is a tendency to arrive nose first during landing, especially at light weights. It takes a hefty pull on the yoke to flare properly. Thus, Stationairs are no strangers to hard, nose-first landings that sometimes damage the aircraft. In the 207, the nose baggage compartment can simply add to the nose heaviness. However, using less than full flaps for landing (say only 20 degrees) can ease the control forces required to flare. Also, as one reader aptly put it, "That is what trim was invented for: Use it."

Like most Cessna singles, the 206 does pretty well in short/soft/rough field operations, a big factor in the purchase decision for many of our respondents. Early models had 40



degrees of flap, which helped tremendously for short arrivals. However, the airplane just won't climb with that much aluminum hanging out in the breeze. Cessna later limited flap travel to 30 degrees.

MAINTENANCE

Simplicity is a good thing, and helps keep maintenance costs down...but on the other hand, Stationairs are working airplanes by and large, and wear and tear can easily turn the tide in the other direction.

We've seen problems with the tail, mostly corrosion caused by the foam-filled elevator and trim tab getting soaked with water and pulling of rivets, screws and nuts. Obviously a concern if the airplane was ever on floats.

Some of the brackets in the tail can crack. There have also been some

ACCIDENTS: MUNDANE TO THE BIZARRE

To gauge the Cessna 206's accident record, we looked at the most recent 100 accidents in which the NTSB assigned a probable cause. The pattern emerging confirms for us that pilots of airplane with great utility sometimes are a little too optimistic regarding what the airplane will do.

Unsurprisingly, runway loss of control was the number one cause of pilots and airplanes coming to grief, however, we were impressed that a couple of those events included criticism from the NTSB regarding the site chosen for the landing and not because the site was off-airport, but because the surface was so bad.

We did find it interesting that the category "other" was tied for number one. Those accidents included four 206s on amphibious floats that landed gear-down on water, which generally means the airplane inverts violently. Fatalities were always involved.

There was one suicide and one in-flight breakup in a thunderstorm. One pilot misjudged his turn to final at a remote strip and hit a cliff with the right main gear, which separated from the airplane. The result of the subsequent landing back at home base was predictable.

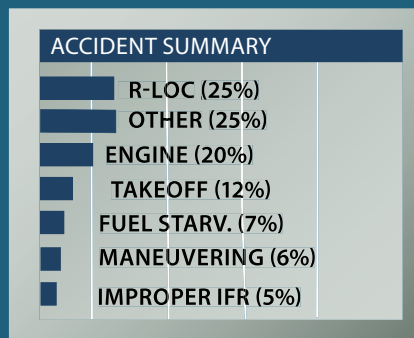
There were 20 engine power

losses and six maneuvering crashes, including one in which the purpose of the flight was to conduct terrain following maneuvers at low level and gross weight. The airplane hit a mountain.

Takeoff accidents included attempted departures from frozen, rough, soft or short surfaces, and either failure to keep the airplane on the "runway" or hitting something once in the air.

One airplane was so overloaded with building materials and people, some without seatbelts, that witnesses said the tires were nearly flat. It stalled, crashed and burned after takeoff.

What we didn't find among the NTSB data was a smoking gun, unless it's news that pilots fly the 206 into unusual situations. As a result, don't be surprised if your insurance agent asks how you plan to use your new-to-you 206.



RICHARD GREISMAN

instances of cracking door posts, though these problems have not proven to be a safety issue.

Given the number of respondents who routinely operate out of short and rough fields, combined with the nose-heavy landing tendency, we recommend paying close attention to the landing gear (particularly the nose gear), brakes and the prop for erosion from the detritus on back-country strips.

There have been a couple of 206/207 specific ADs: 85-2-7 calls for inspection of a roll pin in the fuel selector, and 85-10-2 mandates recurrent inspection or modification of the induction air box. Other ADs of note are 91-15-4 and 82-27-2, inspection of the prop; 97-26-17, ultrasonic inspection and possible replacement

of the crankshaft; 96-12-22, recurrent inspection of the oil filter adapter and 2011-10-09, seat rails and roller housing inspection.

The 206/207 is also subject to the infamous 84-10-1 fuel tank bladder AD.

MODS, CLUBS

There's probably a modification available for the 206/207 to allow it to do most anything someone might want. This includes skis, floats, long-range tanks, STOL kits, vortex generators and various speed mods.

One can even opt for an STC'd 450-SHP Rolls Royce turboprop engine, courtesy of Soloy (www.soloy.com). If that is too much, and the factory IO-520 isn't enough, maybe an IO-550 from Texas Skyways

(www.txskyways.com) or Atlantic Aero (www.atlantic-aero.com) would be your mama-bear solution.

As far as type clubs, the Cessna Pilot's Association (www.cessna.org) is your one-stop shop for all things Cessna. The Cessna Flyer Association (www.cessnaflyer.org) also comes highly recommended.

OWNER COMMENTS

I bought my 1980 U206 in 2006 for \$185,000. It had a new interior and upgraded avionics. I bought it for personal use as there our six of us in our family, including my six-foot-four-inch son. We live in Oklahoma and fly it regularly to Arizona. I've averaged putting about 70 hours a year on the airplane.

Insurance was initially over \$7000 a year as I was a 58-hour pilot. Once I got my instrument rating the rates went down to where I now pay \$2004 for a \$1M smooth policy. Average cost for five annuals has been \$1539. I've added some avionics and GAMInjectors. In the time I've owned the airplane I've only had to replace the spinner, EGT probe, battery, a fuse and repair the beacon the brakes.

I normally cruise between 9 and 11,000 feet, LOP, burning 12 GPH at a true airspeed of 138-140 knots.

I purchased the airplane so the entire family could travel together. I looked at the 206, 210, Cherokee Six and the Lance/Saratoga retractable. I opted for the weight carrying ability of the 206 and a non-retract because of my limited flying time, plus the high wing matters when dealing with the Arizona sun. I did not look at 206s with fuel bladders as I did not want to deal with their potential problems.

The ability to carry a great deal of weight is important to me because I prefer to fly with full fuel for safety, and can do so in the 206 and still have a big load in the cabin. It is slow, but I do not feel as if it ever gets ahead of me. It is a great instrument platform but it is also a lot of fun to just fly around for sight-seeing or in the pattern shooting landings. I think the slow speed, especially at the stall, makes for safe touch and goes.

My best story came out of a sad event—my daughter was badly injured in a skiing accident, suffering



The 206 can be flown with the cargo door removed, making it ideal for skydiving as well as aerial photography and natural resources monitoring. Here observers on a LightHawk flight are documenting flamingo nesting sites in the Yucatan. (Photo by LightHawk.)

numerous fractures. Driving to the airport for the trip home was agonizing for her. The 206 proved to be the best airplane ever. We used the big cargo door opening to easily get her into the fully-reclined rear seat, strapped her in and stuffed pillows around her. She slept comfortably all the way home.

Richard Greisman
Via email

I purchased a new turbo 206 in early 2008, base the airplane in Denver and use it for business and personal travel around the western half of the U.S., often crossing the high mountain ranges of the west. When I was evaluating alternatives, I considered a variety of cabin-class twins and six-place singles. Ultimately, I decided to go with a new 206 which provided a platform for gaining experience flying with a glass cockpit and would give me decades of reliable service, hopefully following me into retirement.

Some of the add ons to the airplane were extended range/tip fuel tanks, gap seals, active traffic (TAS) and XM weather. The extended fuel tanks provide an interesting combination of higher useful load (1420 pounds), increased range with nearly

120 gallons of fuel on board, higher cruise speed and lower stall speeds. I don't usually fly with fuel in the tip tanks, except for very long trips. The full flap, power off stall speed has dropped to an unbelievable 35 knots indicated when lightly loaded.

The TSIO-540 engine seems to be happy at 18 gallons per hour at maximum cruise at nearly all altitudes giving speeds from 160 knots at 12,000 feet to 170 knots at 18,000 feet. The plane is certified to 27,000 feet with speed increasing slightly and fuel consumption dropping at higher elevations.

Annual inspections have been predictable so far, averaging just over \$2000. The main problem that I've had is that the Garmin G1000 software is updated every year during the annual and creates an interface problem with the Ryan TAS. This seems to always take a bit of extra effort to get everything re-integrated.

Insurance has been slightly higher than I was expecting at \$5000 per year, but is mostly related to the hull value.

As an instrument platform, the airplane is exceptionally stable in every weather condition that I've encountered, no sick passengers, yet. It took some effort to become proficient with the G1000, but it was

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Even with all six seats occupied, there is a surprisingly large space for baggage.

worth every minute. Landings are predictable and smooth, even in the high cross wind conditions that Denver enjoys every once in a while.

So, obviously, I'm pretty high on the 206. It provides a great combination of huge loads, reasonable speeds, crazy endurance and good maintenance costs that are common to Cessna products.

Mike Henderson
Denver, Colorado

For the past four years I have been the "crew chief" for LightHawk's 1977 Cessna U206. LightHawk is a non-profit, public benefit flying organization that makes use aircraft and volunteer pilot in support of conservation throughout North and Central America. LightHawk's 206 spends six months of the year being flown by volunteer pilots in Central America and Mexico, where it averages about 500 hours of use each year in some challenging conditions.

We fly with five seats in the airplane to leave room and weight for a life raft, survival gear and the specialized equipment often carried by our conservation partner passengers. The ability to fly with the cargo door removed has made the airplane popular with photographers, scientists and journalists.

Upgrades to the airplane include

a Garmin 430, S-Tec 50 autopilot, JPI 830 engine monitor, GAMJectors, VGs and a Maxpulse pulse landing light.

Our most common maintenance cost is from prop erosion from gravel aprons and runways. We have had to replace the prop once in the last four years. We download the engine data about every two weeks to monitor the health of the engine.

Operations are almost exclusively LOP with fuel burns about 10 GPH—speed is not important and fuel is very expensive in Central America. This has allowed us to keep the engine running cool and healthy to well past TBO—we only recently replaced it with a factory reman. Operating costs run \$155 per hour, not including engine reserve.

Our 206 is a workhorse, not a show horse. It does yeoman work for us and is a favorite of our volunteer pilots and the passengers we fly.

Will Worthington
Via email

I have flown several 206s on floats, one on PKs, the rest on Edos. The Edos seemed to be a good design for the 206, almost always easy to get out of the water even when loaded, the 206 with PKs was a dog. My flights were in and out of lakes and

rivers in Alaska and in salt and fresh water operations from Seattle north to the Inside Passage in British Columbia, Canada. On floats, the 206 with the IO-520 engine required that the cowl flaps be open at all times to get appropriate cooling. The operator I flew for called for takeoffs at 25 inches and 2500 RPM, mostly to keep the noise level down. Unless the airplane was heavily loaded, or the area was tight, the reduced power takeoff was manageable.

Heavy, full power was necessary, sometimes pressing against the five-minute limit, especially on glassy water. An issue that came up regularly was carrying too much in the back end, either passengers or baggage. Even though the airplane was in CG, it could be a real challenge to get the floats up on the step on takeoff. If you couldn't get on the step the CHTs would redline and the five-minute limit on full power would get hit and you'd have to go back and do something to change the loading.

The rule of thumb most of us used was that if the tails of the floats started to look even with the surface of the water before the pilot climbed on board, you were headed for a challenging takeoff. This is where the 206 on Edo floats mattered to me.

If I could get the airplane on the step, it would eventually come off the water, even if you had to lift one float at a time on glassy water. On PKs, getting on the step did not guarantee the airplane would come off the water, I might end up just high-speed taxiing.

The 206 flew well on floats with a good load, handled turbulence well but didn't seem to like flying too slowly on final approach as it would develop a very high sink rate. The pilots I flew with and I found that a power-on approach was the best for managing gusts and sink rate, with a little bit of power carried all the way to touchdown.

Greg Bedinger
Via email

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De-icing Boots

(continued from page 14)

at its facility gets free labor on all boot work—including further replacements—for the life of the aircraft, and until the end of the year, a boot replacement includes a free fuel top off.

B/E Aerospace guarantees 48-hour delivery of boots from the time the order is received, with shipping included in the boot price.

Goodrich does not give a delivery time guarantee but stated that if the boots are in stock at the distributor, they can go out overnight. If they are not in stock, delivery time is generally 30-60 days. The Goodrich Service Center states that it is generally able to schedule airplanes in for replacement within a week or two.

The Goodrich Service Center has the equipment and does boot work on airplanes dating from the 1930s,

however, it is not equipped to replace the internal components of de-ice systems or repair major corrosion or airframe dents.

RECOMMENDATIONS

Our inquiries led to an even split between preference for Goodrich and B/E Ice Shield boots. Bob Hayes said he prefers Goodrich, but admitted it was because he'd been installing them for so long that it was purely a personal preference, that he'd installed a lot of Ice Shield boots and thought they were every bit as good.

We did hear some complaints about delays in obtaining Goodrich boots, which may be why B/E makes a point of advertising and promising 48-hour delivery of Ice Shield boots to your installer. We received no indication that either company had the edge on quality—both were well liked.

As to FASTboots versus conventional—the operators who needed a fast turnaround and the ability to use the boots right away, notably commuters, corporate and air taxi operators like FASTboots.

Some shops told us they prefer conventional boots because the adhesive arrangement on the FASTboot means that once it's on the wing, it tends to be on for good and it's difficult to fix a misalignment. The wet nature of the adhesive on a conven-

Finishing touches on an installation.



FEEDBACK WANTED

CESSNA T303



For the March 2013 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Cessna T303, the 1980s twin Cessna developed to replace the 310. We want to know what it's like to own these planes, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the T303 by January 1, 2013, to:

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tional boot means there is some play so it can be "finessed" during installation, as Bob Hayes put it, if the initial contact isn't spot on.

That being the case, unless you are in a hurry to use the boots right out of the shop, it appears to us that conventional boots allow a little more margin for error during installation.

No matter what, we strongly recommend going with a B/E-approved installer or an FBO who has installed a lot of boots.

Finally, we think that a shop should provide a firm quote and stick to it so long as needed corrosion and dent treatment is reasonable. We liked the policy of Goodrich's service facility: Its manager, Ken Fisher said, "What we quote—that's what you pay."