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The Aviation Consumer®

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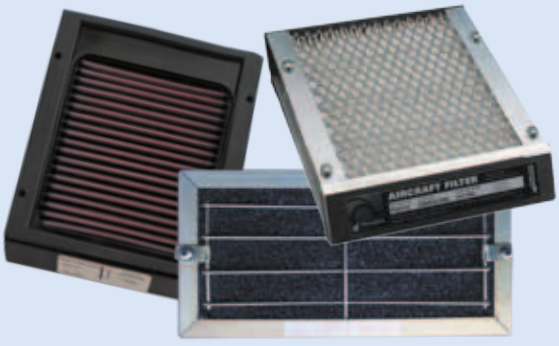

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The Aviation Consumer

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SHOULD SHOPS TAKE ON A TRAINING ROLE?

A recent spirited discussion with Frank Bowlin, my counterpart at sister publication *IFR* magazine, got me thinking about the largely ignored aftermarket avionics training market. Bowlin pointed out that a sizable part of the critical training market is underserved, and we missed an opportunity to expose this industry failure in the glass cockpit training article in the June 2014 issue of *Aviation Consumer.*

That article focused on training solutions—mainly apps and desktop programs—that could save some time and money when transitioning to glass-equipped aircraft. While there are plenty of Garmin G1000 training products, our research uncovered few options for learning retrofit systems, save for a Sporty's app that covers Aspen's Evolution PFD. Still, I'm not convinced there can be a one-size-fits-all training solution given the variations that exist in wiring and interface configurations.

This was reinforced when I attended Garmin's G500/GTN retrofit training course last year. The course (presented at Garmin's Olathe, Kansas, training center) was a two-day cram session targeted at learning the ins and outs of these systems. Each student received a training manual, functional GTN750/650 navigators and a G500 flight display to use while the instructor presented real-world button-pushing scenarios as if we were programming the system in the real world. It was about as realistic as classroom training can be.

The session came to a roadblock when a discussion unfolded over programming the systems with aftermarket autopilots in the mix. For instance, several students had the G500, GTN750 and S-TEC 55X autopilot installed, but there were variations in how the systems were interconnected, particularly the way installers wired the GPSS digital steering portion of the interface. There was no way the instructor—or several product support specialists that were called to the class—could effectively teach this critical portion of the user interface because not all interfaces are wired alike. Ultimately, it's install-specific nuances like this that put avionics shops in a training role.

When I worked as a shop-level avionics tech, it wasn't uncommon to be thrown into training situations when frustrated owners couldn't grasp the concept of advanced interfaces. Autopilot programming was a common snag and I heard my share of harrowing accounts of near-augers in the clag because of button-pushing confusion. But is it the shop's duty to provide avionics training? Geoff Hill at the Aircraft Electronics Association (AEA) hinted that familiarization training is part of customer service and should tag along with a major retrofit. All indications are that the better shops are trying.

John DenDekker at Carpenter Avionics in Smyrna, Tennessee, told me that he uses the post-installation flight check as an opportunity to provide the aircraft owner with at least some training to learn the basics, although the shop isn't equipped to provide structured training. DenDekker admitted that since his shop primarily installs Garmin equipment, including the GTN750, he points his customers to Garmin's GTN750 iPad training app.

Duncan Aviation's Gary Harpster noted that avionics upgrades for larger Part 25 aircraft include orientation training in a classroom setting, in addition to continued orientation on the flight line. He acknowledged that while most shops can install systems per the manufacturers' guidelines, there are few that can fully demonstrate the capabilities of the system. That could change.

An FAA inspector once told me that the administration will ultimately require repair stations to providing customer training. While that's asking a lot—especially with the predicted last-minute ADS-B demand—it may be the only solution in a lacking avionics training market. —*Larry Anglisano*

LED LIGHTING REJECT

I read the LED lighting upgrade article in your July 2014 issue and thought the following would be of interest. LED lighting is superb. Once you have LED landing lights, you will never be satisfied with incandescent bulbs. Conspicuousness is improved. You need not turn any lights off due to much lower current drain, and LEDs will likely last longer than you can ever fly your airplane.

However, there can be electrical and administrative problems as you alluded. I had excellently performing Lopresti Boom Beams on my TBM 700 perhaps 10 years ago. But, attempts to add them to my TBM 850 five years ago were defeated by significant magnetic flux errors. The plane was not flyable with them activated.

I switched to Whelan LEDs for landing, taxi and position lights. These were installed without difficulty and the plane passed several annuals uneventfully. However, this February the local FSDO inspector decreed they all had to be removed and replaced with original incandescent lighting, or my aircraft would not pass the annual. I had to purchase new outmoded bulb lighting, and underwrite the exchange at a total cost of about $2500. Meanwhile, the same LEDs were being installed by facilities in other states on TBM 850 aircraft. I hope other owners have not had this restriction imposed.

The issue has since resolved, as my current TBM 900 is factory equipped with LEDs. Let's see an FAA field inspector say they do not pass muster.

Ian Blair Fries, MD
via email

ADS-B LEGALITIES

As apparently one of the few pilots actively talking to avionics shops about ADS-B Out equipment upgrades, I found two issues with the ADS-B article in the July 2014 issue of *Aviation Consumer*. First, you did not mention that the ADS-B Out mandate requires all components to be installed by an STC. That means no field approvals and no FAA 337 forms. So I find your recommendation of the Freeflight Rangr ADS-B transceiver off base since its STC only includes about 400 aircraft models. I have tried repeatedly for the last three months to find out from FreeFlight when it will expand the STC applicability, but have gotten no replies. The company's attitude seems to be that if you aren't flying a Cessna, Piper or a Bonanza, they don't care about you.

The Garmin GDL 88 ADS-B transceiver has an STC that includes over 1600 models—a major plus for the rest of us. Second, you mentioned the NavWorx ADS600-B as a suitable solution when in fact the 600-B does not have a certified GPS and the NavWorx website specifically states it does not meet the ADS-B Out mandate. The ADS600-BG, at a list price of $3600, is required to meet the 2020 mandate.

Jack Becker
via email

You're only partially correct, Jack. If you need an integral WAAS GPS position source, the NavWorx model ADS-600BG is the NavWorx unit you'll need. As we said in the article, NavWorx didn't have final approval on these systems when we went to press, but they do now.

As for ADS-B installations being off-limits to FAA Field Approval, FreeFlight's Peter Ring says that's not the case:

"Field Approvals have been authorized and completed (including a PA-24-260 Comanche, a Citabria and several others) since October 2012. We are actively adding more aircraft makes and models to our STC list since we completed the AML covering the common aircraft that Mr. Becker mentions.

"That process takes time in part because our systems work with most existing avionics (such as Mode A and C transponders) instead of requiring the expensive replacement of perfectly good gear," he told us.

ANDROID FANS

I enjoyed your article on FlightPro for Android in the July 2014 issue. Those of us who fly with Android tablets have been waiting several years for *Aviation Consumer* to look at hardware and software alternatives to the Apple world.

I've been using Naviator for a couple of years with good results. Based on your latest review, it appears that FlightPro has much of the same feature set as Naviator, but at a 50 percent higher subscription price. How about doing a head-to-head comparison between the two apps?

Steve Kendall
Auburn, California

Kudos to *Aviation Consumer* for digging deep into the FlightPro Android aviation app in the July issue. While so many publications gush over iOS apps, I knew I could count on you guys to look at a worthy alternative.

Gregory Mathews
via email

We recognize the emerging Android market as a worthy alternative to iOS and plan more coverage and comparison articles moving forward.

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Lightspeed PFX Headset: Acoustic-Mapping ANR

Lightspeed's new aviation headset is clearly the most advanced model to hit the market, but we give the Bose A20 a slight edge in ANR performance.

by Douglass P. Fields, Jr.

The market for high-end noise-cancelling aviation headsets has become crowded over the last few years. At $1100, high-end aviation headsets are expensive, but in inflation-adjusted dollars, they're half what they cost when Bose introduced them in 1988.

Near the top of the ANR headset food chain has been Lightspeed's Zulu.2, a model that's stolen plenty of sales from the market-dominant, but aging Bose A20.

After almost a year of delays, Lightspeed released its new $1100 flagship Zulu PFX. Here are our first impressions, based on several days of evaluation.

WHAT YOU GET

Lightspeed offers three versions of the PFX at the same price point: The common dual-plug configuration, a U-174 plug for helicopters and a panel power plug with LEMO or Redel connectors. We reviewed the dual-plug model.

The unit comes standard with a hard-shell carrying case, a quick-start guide and full user's guide. That's refreshing in a world where you have to go hunting online for them. There's a coupon for a free pair of earseals and a micro-USB cable is included for firmware upgrades. More on that in a minute. You get two audio input cables, one for iOS with an inline button and one with a standard 2.5mm audio jack, a single cable clip, a screw-on belt clip and four AA batteries.

The size of the PFX's control module, which Lightspeed calls a CPU, immediately jumps out. It is over twice the size of its Zulu.2's svelte box, rectangular design and both cords feed into the top of the module. The PFX uses four AA batteries and the micro USB connection is built into the battery compartment. The back of the CPU has holes for attaching the belt clip, which is handy given the size of the CPU.

CHECKLIST

- ✚ Audio and functions are configurable with the Flightlink app.
- ✚ ANR quality is a step above the already good-performing Zulu.2.
- ⛔ We think Lightspeed still needs to work out some minor warts.

The cords received a nice make-over. They're dressed in a rope-like sheathing, have a tactile feel and are extremely flexible. The dual plugs feed into a hard rubber "Y" junction that seems engineered to endure many years of abuse.

The headset itself has nearly unchanged ergonomics from the Zulu.2. There are minor aesthetic changes to the egg-shaped earcups, which are now smooth and rounded compared to the more angular predecessor. The removable ear cushions are identical to the Zulu.2, and the earcups still swivel flat. The padding inside the earcup is almost unchanged, with a slightly different and thicker fabric covering the much different internal electronics.

The top headband still sports a removable cushion, while the microphone and boom are anchored off the left ear cup. All in all, it appears that Lightspeed didn't want to change an aesthetic formula that has worked well on the Zulu.2. Ergonomics, fit and finish is what we would expect from a headset in this price range.

TUNED ANR

The standout, bold new feature is Lightspeed's acoustic response mapping, which seeks to optimize the headset's noise-cancelling signature to the shape of your head and ear. This is analogous to a home receiver's room audio mapping technology such as Audyssey. When activated, the headset plays a number of tones

The $1100 Lightspeed Zulu PFX, left photo, might resemble the older Zulu.2 ANR model on the outside, but its noise-cancelling electronics were completely reworked. We think the fit and finish is excellent, in Lightspeed tradition.

into the earcup and uses a microphone to determine how the shape of your ear modifies and reflects the sound.

Using this acoustic map, the PFX calculates a digital filter that attempts to provide the absolute best possible sound quality and noise-cancelling result. This sort of signal manipulation takes a lot of processing power, but once the capability for signal manipulation is there, many other possibilities open up and are used to good effect by the accompanying Flightlink iOS app. PFX stands for Personal Flight Experience, which we think is fitting.

To start the noise mapping, tap the action button, located under the power button. The tones will play and the headset will remember the most recent mapping until it is overwritten again. There is a switch on the side of the CPU that disables the mappings and other customizations that can be done with the companion app, perhaps in case someone reconfigured a shared headset or if it was used in an unusual operating situation. Tapping the action button twice toggles ComPriority, which is a fancy term for auto-muting Bluetooth (and wired) audio when the aircraft radio audio is coming in. Lightspeed recommends remapping after any significant changes, such as putting on thick sunglasses.

PERFORMANCE

So, with all this technology, how does the headset stand up to cockpit use? We evaluated the set in both a G1000 Cessna 172 and a Cessna 310 twin, which is equipped with a PS Engineering PM8000C audio system. We wore the headset with and without eyeglasses and ballcaps, put the set on both male and female heads and we evaluated the performance of its Bluetooth connectivity using an Apple iPhone 5S and two later-gen iPads.

We took the PFX flying with the Zulu.2 predecessor (a product that will remain in the Lightspeed lineup), in addition to a Bose A20 for comparison. We also brought along the AKG AV100 (reviewed in the June 2014 issue of *Aviation Consumer*), which we think sets a new bar in entertainment audio quality. To compare headsets, we would wear one pair, close our eyes and get used to its sound quality, and then use the next pair to slide the previous pair back off the ears and get an immediate comparison. This was repeated many times.

Yes, the PFX's control module is longer than the width of a McCauley propeller blade, top, which means it's a handful in the cabin. It dwarfs the Zulu.2 module, lower photo.

When first turning on the PFX in flight, the headset goes through three distinct phases, which initialize the ANR circuitry. The system boots up for about four seconds before the noise cancelling comes on. About 15 seconds later, the ANR quality markedly improves. The PFX is continuously adapting and adapting its ANR through a process called Streaming Quiet, although not all the refinements will be apparent to the user. This takes a lot of computing power and hence the latencies in startup.

We reran the acoustic mapping algorithm every time we changed a hat or eyeglass configuration. This didn't make a particularly noticeable difference, but since there is a delay between the old and new ANR profiles, it would be difficult to detect such a subtle improvement.

Compared with the Zulu.2, we think the ANR quality of the PFX is greatly improved. This headset is noticeably quieter, with much less hiss and a marked reduction in low-pitch engine sounds. Even in the unit's Home mode, which disables some of the newer mapped ANR algorithms, the PFX sounds a little better. Turn on all the features in Favorites mode and we think the PFX is a hands-down winner over the Zulu.2. Even with Voice Clarity turned off, the aircraft radio quality was improved and with it on, the PFX was better.

The PFX's comfort was good and seemed identical to the Zulu.2, probably because of the similar earcup cushions and headband design.

On the ground, we noticed an occasional rumble would sneak through the ANR circuitry at low RPM. In flight at around 2200-2300 RPM, there was also an occasional low-pitched fluttering sound—perhaps some sort of ANR resonance—that was apparent at perhaps 5-20 Hz. In flight, we found that the ANR performance was quite impaired by turning the head (or whole body) 30-60 degrees to either side; this was especially pronounced with the left earcup toward the front of the airplane.

With power off (passive mode), the noise reduction was decent and radio volume was good; the panel volume didn't need immediate adjustment. Better yet, the volume sliders continue to work.

Switching between Home and Favorites mode (Home disables some of the ANR effects and can be used as a failsafe) caused a reduction in the ANR quality. However, Favorites came with a lag of about six seconds. We believe this is because the headset is calculating its ANR response curves and filters, requiring sizable calculation to achieve.

We removed eyeglasses and ballcaps several times to see how the ANR was affected, with acoustic remapping after each change. In the general case, acoustic mapping seemed to improve the ANR and sound quality over the factory default, but again, there was a delay between running the mapping and when the ANR quality adjustments

The PFX's acoustic mapping adapts the performance for any head size and shape. The noise-cancelling circuitry performed better with eyeglasses that had thinner temples, left photo.

kick in. However, remapping didn't seem to improve the ANR noticeably when switching glasses/hat configurations. With a ballcap and glasses, ANR was noticeably impaired as compared to glasses alone, even with acoustic re-mapping. Glasses alone seemed to cause only minor impairment in noise-cancelling quality, but glasses with thick temples have a greater negative effect. On a few occasions when taking the headset off to put on a hat, the headset would allow more low-pitch noise to sneak through for a short period of time.

Our evaluators unanimously felt the Bose A20 was quieter than the PFX, even with all the PFX's ANR options enabled and acoustic mapping completed. One evaluator—an experienced pianist—felt that the Bose was better at blocking the lowest frequencies of noise, which seem to be the most fatiguing during a long journey. High-frequency hiss seemed identical between the two.

For sure, the PFX excels at radio clarity and volume, even with Voice Clarity disabled. With ANR off, the noise reduction is similar, although the PFX may have a slight edge at muffling the low frequencies. The PFX again has crisper and louder radio volume with the ANR off. Two evaluators affirmed that the Bose was more comfortable, with less clamping pressure.

BLUETOOTH CONNECTIVITY

The Bluetooth music stream worked well in flight. However, we occasionally experienced periods of pairing difficulty while switching devices in flight—something we've also experienced with the Zulu.2. There's plenty of gain when piping in music—with volume levels capable of exceeding a reasonable comfort level.

Enabling the Front Row Center mode really adds to music quality and makes the music "pop." The ability to adjust the bass and treble using the Flightlink app was fantastic in finding a setting that appealed.

With music playing via Bluetooth, enabling ComPriority causes the music to recede in volume when any panel audio is present. The music is not entirely muted and can be faintly heard in the background, which is a nice touch, in our view. The performance of the muting and unmuting is responsive; the music would even come back to full volume for a few moments in the gap between loops of a human-recorded ATIS broadcast.

In the twin, ComPriority was a little too sensitive and sometimes played back during quieter parts of a radio call. ComPriority is easily toggled using a double-tap of the action button on the CPU. Unfortunately, there is no audible notification of the new status of ComPriority, just a flashing (or not flashing) pair of red LEDs on the CPU. We think the set can benefit from voice prompts.

It's prudent to compare the PFX's Bluetooth music quality to that of the Harmon AKG AV100, which in our estimation still has better music quality, with a pleasing response curve and better bass compared to the slightly hollow PFX. However, enabling Voice Clarity and Front Row

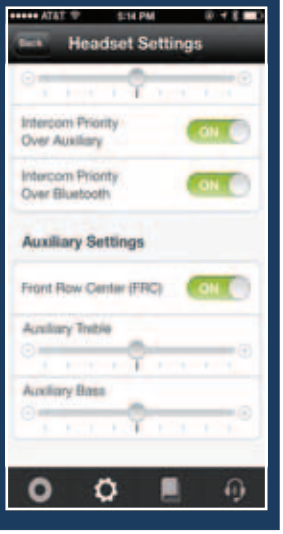
FLIGHTLINK iOS INTEGRATION

Lightspeed pioneered the headset companion app with its free Flightlink app for iOS back in 2012. Now the PFX brings much tighter integration with iOS and Flightlink. The headset can be fully configured via the application, while the battery status of the headset is clearly displayed.

The PFX can record headset audio over Bluetooth using this app, which is more convenient than using a cable, although we found that the playback audio level is too low. One touch starts recording, at which point a waterfall display creeps down the screen, making it apparent when quiet periods are punctuated by audio. Any portion of the audio can be replayed into the headset by dragging a green bar down to the appropriate portion within the last two minutes; playback can be terminated by tapping the green bar.

The PFX has a dedicated options screen. The most prominent feature is a graphical display of the remaining battery life. Auto power-off can be turned on with varying timeouts and an audible low-battery warning can be enabled.

There are two sections of audio settings, one for intercom/panel audio and one for auxiliary input audio. Both sources have separate bass and treble controls, a first in an aviation headset. For the intercom, a feature called Voice Clarity processes the audio to make voices more understandable. In our trials, this improved the volume and also made voices sound as if they were in stereo in a very marked effect. Whether it improves clarity is up to the user's preference.



With the ability to update both the PFX's firmware and the iOS app, Lightspeed will add features over time and allow today's investment in a PFX to keep up with tomorrow's advancements in ANR technology. Lightspeed asks owners to offer their opinions on what features and enhancements should be made first. They are also exploring ways to bring this functionality to non-iOS platforms.

Center, while tweaking the bass and treble controls drastically changes the sound. Now the PFX sounds to our ear clearly better than the AKG. Even radio calls come through with better clarity and music has a much better feel, with a surround sound effect and enhanced low and high-end response.

To a true audiophile, the AKG will likely have better sound due to its uniform response rate and good native bass and treble reproduction. We also think the AKG has a slight edge in comfort, with less clamping pressure and softer ear cushions. However, for customized in-flight music listening, the PFX has a clear advantage thanks to the Flightlink app.

With the engine at typical ground RPMs, the Bluetooth phone interface works as expected and the called parties had no complaints about voice quality. Tapping the Bluetooth button once brings up the iPhone's voice control menu.

QUIBBLES, BOTTOM LINE

We think the PFX should be hardwired for ship's power whenever possible. The four AA batteries (rechargeable aren't recommended) last only a claimed 20 hours, and using Bluetooth will reduce that even further. Lightspeed has clearly put a lot of digital signal processing power into this headset, explaining why it burns four batteries in half the time the Zulu.2 uses two.

The supplied cords are too short, especially since placing or mounting that big CPU will be a challenge. Bluetooth phone calls don't work properly when ComPriority is enabled, which pilots will likely leave enabled. This seems like a common use case for getting last-minute briefings or clearances at uncontrolled fields. Having to toggle it is inconvenient. Hopefully, Lightspeed will address this issue in a future update.

Finally, given the confluence of devices in a modern cockpit, the inability to pair to multiple Bluetooth devices is a curious oversight. The Jawbone line of Bluetooth devices, for example, offer the ability to connect to two devices simultaneously.

At the $1100 price point, we suspect some buyers may opt to wait for Lightspeed to address the quirks our evaluation uncovered.

Existing Zulu.2 headset owners that upgrade will appreciate that the ergonomics carry on in the history of the well-received Zulu.2.

In our view, the PFX's overall ANR performance doesn't best the Bose A20, but compensates with more features and configurability. Worth mentioning is that the Bose A20 doesn't stream Bluetooth music (it requires a patch cable), proof that the model is aging.

The bottom line is that we found enough to like to recommend the Zulu PFX as an investment that, given the technology that's behind it, can only improve with time.

Contact www.lightspeedaviation.com, 800-332-2421.

FIRST IMPRESSION: NOT BLOWN AWAY

by Larry Anglisano

A utilitarian at heart, I judge a noise-cancelling aviation headset by using simple criteria. It has to be rugged, have good microphone gain, comfortable when fitted with eyeglasses and it has to have music input so I can listen to my jazz on the fly. That's not asking much and as expected, the PFX easily delivers. But overall, I wasn't blown away.

I bought a Lightspeed Sierra when it won our budget ANR roundup a couple of years ago and this turned out to be a wise purchase. But the new $1100 PFX is a different animal that brings serious amounts of complexity and features that—like it or not—define the future of high-end aviation headset.

Flying shotgun with Doug Fields in his Cessna twin one evening, the PFX and I got off to a bad start during taxi. Depending on how I turned my head, there was an annoying ANR rumble in one ear that's not uncommon in a piston twin, but wasn't what I expected from the PFX. And that huge control module...making way for the runway, I wondered where I might put it, but couldn't find a map pocket large enough to stash it in.

After takeoff and machine-gunning the comm transmitter during a busy RNAV approach to the international airport, the PFX's ANR performed flawlessly, with just the slightest amount of background hiss. I tend to judge a headset by its microphone gain and sidetone quality and the PFX exceeded my picky expectations. There was some earseal leakage when I put on my eyeglasses, and initiating the acoustic mapping procedure didn't seem to help a whole lot.

What I liked most was the Bluetooth music quality. My favorite Paul Hardcastle jazz sounded better than it ever has in any airplane—including jets. But the buzz-kill was when I struggled to pair the headset with my iPad to play with the music settings in the Flightlink app.

Finally, I put on the Bose A20. And I liked it better. It was more comfortable, its ANR circuitry seemed to do a better job at blocking noise I didn't want to hear, plus it fit better over eyeglasses. For certain, the PFX's music quality easily outperformed it and the PFX wins for advanced features, including all of that fancy customization that you can accomplish in the Flightlink app. That's forward-thinking.

You know, I really tried to love the PFX, but I'm still happy with my Lightspeed Sierra. It doesn't have the PFX's advanced features or the gee-whiz factor, but I'm a utility-over-features kind of guy.

Garmin Flight Stream: Portable Connectivity

Garmin's Connext wireless interface provides a two-way data stream between tablets and certified panel avionics, breathing new life into the GNS530/430.

by Larry Anglisano

What does Garmin's new Connext wireless cockpit-technology have to do with its Connected Bike cycling interface? More than you would think. We've noticed that Garmin's recently introduced aviation portable gadgets—from the D2 pilot watch to the VIRB cockpit camera interface—trickle down from its other markets.

In its fitness market, Garmin's new Connected Bike technology uses a central digital hub to create a completely wireless integration of all sensors that are on the bicycle. While these sensors share little if anything in common with aviation components, the new Flight Stream Connext is part of a new connected concept that echos throughout all five of Garmin's market segments.

Garmin didn't pioneer the concept, at least for aviation. It was Aspen Avionics—with its FAA-approved, but feature-limited Connected Panel—that started the trend a couple of years ago.

Garmin's new wireless interface is FAA-certified and solves a major ADS-B interface dilemma, while also advancing the discontinued GNS430W and GNS530W navigator interface.

FLIGHT STREAM

That's the name of the remotely mounted Bluetooth transceiver that enables the flow of data to and from the permanently installed sensors in the aircraft. These include the GDL88 ADS-B transceiver and the GDL69 XM weather and entertainment receiver, in addition to panel-mounted radios, including the GTN750 and GTN650 touchscreen navigators and the GNS430W and GNS530W WAAS navigators.

There are two models to choose from. The $549 Flight Stream 110 is the entry-level transceiver that has integral WAAS GPS. Using Bluetooth connectivity, it sends GPS position, FIS-B ADS-B weather and TIS-B ADS-B traffic data received from Garmin's GDL88 ADS-B receiver to an Apple and compatible Android tablet that run Garmin's Pilot app.

This interface potentially solves a huge problem because the GDL88, while a one-box ADS-B solution, still requires a cockpit screen to display weather and traffic data. In lesser aircraft (and for lesser budgets) that can't support a compatible panel display, the Flight Stream device is an economical solution for playing the GDL88 data on a tablet display.

When the Flight Stream 110 is interfaced with the GDL69 XM receiver, satellite broadcast weather data is sent to the Garmin Pilot app—displaying Nexrad graphics in better resolution than it does on a GNS530

The $999 Flight Stream 210 hub, left, has integral WAAS GPS, AHRS for outputting attitude data and is compatible with the GNS430W and 530W navigators. It also has two-way flight plan transfer through the Garmin Pilot app, far left.

CHECKLIST

- Flight Stream connects the ADS-B-compliant GDL88 with a tablet.
- It enables flight plan upload/download with the GNS430W and 530W.
- Oddly, Flight Stream doesn't provide an ADS-B-compliant WAAS position source.

or GNS430. When it's connected with the GDL69A, SiriusXM Satellite Radio can be controlled—including changing channels and volume—directly from the Garmin Pilot app.

The $999 Flight Stream 210 takes the interface to a higher level. Since it has an internal AHRS sensor, it provides attitude data to the Pilot app—a feature that's already available with the GDL39 3D portable ADS-B receiver. The real utility, however, is recognized with an interface that connects the tablet with Garmin's panel mounted navigators. That enables flight plan transfer to and from the navigator.

"What we're trying to do with the Connext interface is create a new freedom in flight plan execution where pilots can flight plan in advance at home and then go out to the airport and push the flight plan into the panel navigators with one button," said Garmin's Jessica Koss.

Essentially, pushing the flight plan into the navigator is as simple as turning on the avionics, establishing a Bluetooth connection with the Flight Stream device through a Connext tab in the app and transferring the flight plan that was created in the Pilot app. In a GNS430W/530W interface, that means finally having the ability to load victor airways into the flight plan, rather than entering the associated fixes.

You can also set the Garmin Pilot app to watch for changes made to the active flight plan in the panel navigator. This means any changes made to the flight in the GNS or GTN navigator instantly appear on the tablet or you can have the option of updating the flight plan manually. Flight Stream can also push limited data to the D2 pilot watch.

FAILSAFE, COMPATIBILITY

Although the Flight Stream 210 has an integral WAAS GPS receiver, it's designed to always use the best possible position source. That means when it's connected to a WAAS panel GPS it utilizes the position data from these systems first, using its own source as secondary. While that's a lot of redundancy, there is a rub: The Flight Stream isn't an approved ADS-B WAAS position source. That means customers who don't have an approved panel-mount WAAS navigator will need to buy the GPS-equipped version of the GDL88 ADS-B receiver, which requires an external antenna and a more complex installation. We think a mandate-approved WAAS position source would add more utility, but it doesn't exist.

Aside from connecting Garmin's GDL88 ADS-B and GDL69 XM weather systems to a tablet computer, Flight Stream allows you to enter victor airways into the GNS430W flight plan function. That's a screen capture of the Connext utility on the Garmin Pilot app, bottom.

The Flight Stream interface has the ability to connect with up to four tablet computers. The benefit? When a GDL69A XM receiver is connected, passengers can control the entertainment stream with their own tablet. In our view, this can get dicey because since there is no "master" tablet, any connected tablet in the cabin has the same level of control.

Garmin says there failsafe built in by design as there can never be a situation where a passenger could load anything the pilot doesn't want into the navigator. That's because the pilot has to review and accept the flight plan on the panel navigator before any changes are made to the active flight plan.

Incidentally, this interactive acknowledgment of data flow was a stipulation in Aspen's Connected Panel certification process. As you might expect, the wirelessly connected concept is enough send an FAA inspector into a convulsive state.

Speaking of FAA certification, the Flight Stream is covered under the Approved Model List (AML) STC of the already certified GTN700/600-series, GNS400W/500W-series, GDL88 and GDL69 systems. This means shops won't have to deal with field approval as long as the aircraft is on the AML and they follow the STC.

As we go to press, Garmin didn't have an installation manual for us to evaluate so the exact details of the installation is unknown. We do know that the Flight Stream would have to interface with an unoccupied serial data port when connecting with a panel navigator. That could be challenging in a GNS430W and GNS530W interface that already has occupied serial data connections.

The Flight Stream interface is only compatible with WAAS-enabled GNS units after a no-cost software upgrade. It's not compatible with the G1000 or the G500/600 retrofit MFD.

It is compatible with later Apple iOS devices and some Android devices, to be announced when the system is launched this August. Garmin says that the Garmin Pilot is the only compatible tablet app, for now.

Contact www.garmin.com, 800-800-1020.

Centurion engines cross the finish line with wiring and plumbing installs, left. The plant is producing about two engines a day, plus other products and spares.

ENGINE TECHNOLOGY

Continental Motors: Aggressive on Diesel

With a new six-cylinder in certification and a capital infusion into the Germany factory, Continental is making a huge bet on Jet A-burning piston engines.

by Paul Bertorelli

When Diamond Aircraft surprised the 2002 Berlin airshow with an out-of-the-blue new twin powered by a pair of converted automotive diesel engines, there weren't many visible reasons why it should succeed and a lot of reasons why it couldn't. The twin market was flat. A new engine married to a new airframe can be the shortcut to disaster and no modern engine maker had commercially converted gasoline automotive engines for aviation use. A diesel conversion? Are you kidding?

A decade-and-a-half later, Diamond's DA42 still sells, albeit at a fraction of the production volume it once enjoyed. And the factory that built the diesel engines, the former Thielert Aircraft Engine company, now owned by the Continental Motors Group, itself a subsidiary of the Chinese AVIC International, is still perking along.

Even before AVIC injected badly needed capital into the insolvent Thielert works last year, the landscape for the diesel maker had shifted. In 2006, it was booming, thanks to high demand for the DA42. But two years later, it was bankrupt and in 2009, the entire industry tanked, taking sales of aircraft diesels with it.

Although the volume hasn't recovered, the diesel manufacturing at Continental's plant in St. Egidien, Germany, sustains. When I visited the plant early last summer, it was building a couple of new engines a day and with spares, ramping up the volume. To its credit—and perhaps the credit of German bankruptcy laws—the plant never stopped building engines and parts, even if customers weren't always happy about the prices.

Today, the infusion of new capital has charged the factory with new energy; there's money to resume technical projects, a new six-cylinder diesel is in testing and Continental is aggressively pursuing the modification and conversion market. The factory is geared to build 2000 engines a year; it's simply waiting for the demand to materialize.

GOOD START, ROCKY FINISH

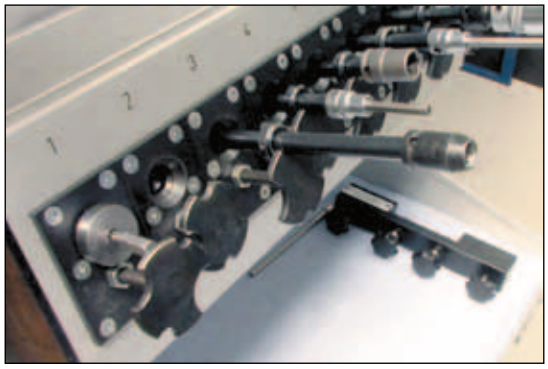
What is now the Centurion diesel engine began life around 1999 as the Mercedes-Benz OM668, a state-of-the-art automobile diesel engine. Thielert Aircraft Engines, which had expertise in high-performance automotive and racing, converted the engine for aviation use by developing a clutch and gearbox system and modifying various components, mainly the fuel system and related hardware, to be more suitable for Jet A.

At the time, the all-aluminum OM668 was the lightest diesel available and even with the addition of the gearbox, it retained a power-to-weight ratio suitable for light aircraft, although it was still heavier than an equivalent gasoline aircraft engine. The engine, which became the TAE-125, had good enough fuel specifics to offset its weight. Despite the daunting regulatory barriers, by 2001, Thielert had the first modern aircraft diesel certified and Diamond found demand for the DA42 as a trainer and some demand for a single-engine version, the DA40-TDI.

The earliest iteration, the Centurion 1.7, was still largely a Mercedes engine. MB was casting blocks and heads in aluminum and the engines were arriving at Thielert's factory complete, where they were modified

OLD VS. NEW

At the St. Egidien factory, Centurion engines were originally assembled as they are in overhaul shops, from a kit arranged on a cart. Newer system, right, uses a computer-supervised seven-station assembly line with scannable parts in trays along the line, kanban style. Each production step is checked off on a screen, top photo, and the system won't release locked tools until the previous step has been completed. Torque wrenches automatically set and record torque for each fastener.



with the gearbox and fuel components. Out of the box, the engine—which was expensive to manufacture and reconfigure—had only a 1000-hour replacement cycle, which Thielert pledged to eventually extend to 2000 hours. (Twelve years later, it's still limited to 1500 hours, but may soon rise to 1800 hours.) Moreover, the Centurion had an onerous 300-hour gearbox inspection and replacement cycle, which has only recently been doubled to 600 hours.

Thanks to sales by Diamond and some conversion projects, Thielert did well with the Centurion 1.7, at least by 2005 standards, and the engine evolved into the improved 2.0 and eventually the 155-HP 2.0S, which Cessna planned to use in a diesel Skyhawk it announced in 2007.

But by then, Thielert was in trouble. Although the engines had teething problems, the core engine, according to tech sales director Niels Mundt, who joined the company at the beginning, was sound and performed well. In supporting the inspections and gearbox replacements with overbroad warranty support, Thielert had simply constructed an economic house of cards complicated by management and stock irregularity issues when it went public in 2006. The cards folded in early 2008, ahead of the financial crisis that devastated the rest of the industry later that same year. Fortuitously for Cessna, it bailed on the Skyhawk project ahead of the fall and Diamond, Thielert's largest OEM, eventually began building its own diesel engines, the Austro AE300.

AVIC BUY

The original company remained in bankruptcy for five years, during which time little R&D was conducted and funds were even lacking to field an improved gearbox. Other companies—including Rotax—looked at buying Thielert's assets, but with its bullish attitude toward heavy-fuel piston engines, the AVIC-owned Continental Motors was the successful suitor, closing the deal in the summer of 2013. Continental had already made a deal with SMA to use its SR305 as base technology for what has become the TD300 diesel, an engine that has yet to find much of a market for SMA or Continental.

The Germany diesel factory is now a division of the re-organized Continental Motors Group. The factory hasn't physically moved, but due to a tax squabble between neighboring towns, it's now located in St. Egidien, Germany, rather than Lichtenstein. In the nearby town of Altenburg, at a former East German MiG base, Continental has a new hangar where it does test flight work and assembles kitted engines for the conversion business. It's clear that both the hangar and the factory are configured for much higher volume. And it's no accident why they're where they are.

"This is the traditional machine building area here from the GDR (German Democratic Republic) times," says Mundt, "so we have a lot of technology here. We have a lot of very specialized companies here with a lot of history."

That means that the Continental

The St. Egidien factory has extensive inhouse machining capability, top, although pistons are outsourced, center. The Centurion uses automotive style "cracked" connecting rods.

plant has a strong, locally trained workforce to draw on and a number of automotive manufacturers to provide the primary casting, founding, heat treating and plating processes that its low volume doesn't support conducting inhouse. To a degree, it's the same model that Continental in Mobile, Rotax in Austria and Lycoming in Pennsylvania follow. All of them outsource some of their manufacturing. But there the comparison ends. Continental's Centurion plant has much more in common with a modern automotive plant than it does engine building in Mobile.

More than half of the factory is devoted to large primary machine cells capable of building inhouse most of the parts the Centurion engines require. The former Thielert brought in a lot of small-lot and automotive specialty and prototyping work and the new company still does.

The plant specializes in short-run machining of crankshafts. During our factory tour, Mundt showed me a crate full of giant cranks intended for large heavy diesels, stacked next to a cell machining cranks for high-horsepower racing engines. The machinery is modern CNC equipment that's just now finding its way into other general aviation plants in meaningful numbers.

Large-volume automotive manufacturing supports—and demands—a level of quality control not often apparent in aviation, so when Continental bought Thielert, it got sophisticated metallurgical labs and production quality systems spun directly out of the automotive world. Not many GA manufacturers have scanning electron microscopes in the back offices. In some ways, it's parallel to what I saw when I toured the Rotax plant in Austria, where the large-volume recreational engine business informs the low-volume aircraft engine manufacturing side.

JUST IN TIME

The automotive influence is no more evident than in the engine assembly area. On my first visit to this factory in 2005, the new engine volume was higher, but the engines were being assembled one-off in individual assembly bays. In 2006, the company invested heavily to install the same kind of Alfing production line that Mercedes uses to produce low-volume, high-performance engines in its AMG division.

The Continental line is no more than a few dozen meters long with seven stations. But unlike a moving assembly line with each worker doing a separate task, here, one guy does it all, moving the engine from station to station on a production trolly. It's deliberate work, but it moves right along, with the engine and assembler spending about the same amount of time at all the major stations.

Most manufacturing these days uses the Japanese-developed kanban system relying on just-in-time inventory. That means the short Centurion assembly area is lined with bins and shelves containing components. Subassemblies such as pumps, oil filter carriers, alternators, cylinder heads and the like are built separately and placed on angled shelves or carts for the assembler to grab when he needs them. In the automotive world, just-in-time literally means that. Inventory is measured in minutes because manufacturers have learned that piles of unneeded parts erode profitability. It's a nice theory, but one that's continually frustrated by the low volume in aviation.

Says Ken Suda, general manager at the St. Egidien plant: "In order to be visible to automotive suppliers as a potential customer, you need to order a certain volume. Once you can order that volume, you can make use of the benefits and that means you can have a very high-quality product at a relatively low price."

But it also means ordering and inventorying larger quantities than are needed, "ordering against forecast" as the supply chain guys might say. The inventory chews up the volume savings and runs counter to just-in-time supply. Suda says the challenge is to get the balance right and sometimes that means cutting back on other inventory. This is but one minor example of how aviation's low volume makes it ever more expensive and complex to manage in manufacturing.

Although the tort environment in Europe is less worrisome for manufacturers than it is in the U.S., many automotive suppliers simply won't build parts for aircraft engines. "And

we still have to pay for the insurance policies," Mundt says.

THE BASIC BUILD

If the Centurion began life as a converted automotive engine, Continental says it is now an aircraft engine. When Mercedes abandoned aluminum cases in 2005, Thielert had its own aluminum castings designed and manufactured. Now, Continental either builds all of the engine parts it needs inhouse or sources them through automotive manufacturers. "This is no longer an automotive engine. It is all by us," Mundt told me.

Suda and Mundt explained that the production line, installed in 2006, was designed with quality assurance built in and I spent part of two days watching it work. Like all engines, the assembly starts with the crankcase and crankshaft assembly at one end of the line. Using bar codes on individual parts and bins, the production system creates a dense web of traceability and is interactive with everything the assembler does. Each tech has his own ID card, which the system matches to each assembly sequence.

The computer overseeing production knows, for instance, if the right part has been selected and the right number of screws are installed. Electric torque wrenches are automatically programmed at each stage of assembly and they record the torque applied to each fastener. If a tool has to be manually attached to the torque wrench, it's stored in a locked rack that won't release the next tool until the previous operation has been completed.

Watching an assembler torque the 10 beefy cylinder-head bolts, I asked how the system monitors the tightening pattern. It doesn't, Mundt said. The assembler knows the pattern, but a diagram is available if he needs it.

Although the system requires checking off each production step, it can't know, for example, that the timing chain was correctly installed. For such critical operations outside the computer's electronic gaze, Continental relies on the so-called "four-eyes" approach that's standard in the industry; another trained worker inspects the work.

At each step, the assembler has to check off the task on a computer monitor, otherwise, the system red flags until the work is done. If an assembler begins an engine just after breakfast, it's done and ready for final dressing and wiring just after lunch. Continental figures one skilled assembler can build an engine-and-a-half a day. The current line has the capacity to build 2000 engines a year, based on a single shift. After assembly, the engine goes into the test cell for 90 minutes worth of initial wring-out and break-in, generating more data that lives with the engine serial number for its entire life. It also builds data points to support Continental's engine life extension program, as it attempts to raise TBRs to 2000 hours and

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ABOUT THAT GEARBOX...

Other than radials, geared engines haven't enjoyed what we would call happy times in aviation. So-called GITSOs often appear in the same sentence with the words notorious or troublesome. But with the automotive engine that forms the Centurion core engine, a gearbox is unavoidable to reduce engine RPM to something a prop can ingest.

Further, because diesels have sharp torque pulses, the gearing has to be isolated to reduce wear on the component parts. The original Thielert company solved this problem effectively, if not durably. The original engines had what was basically an automotive-style clutch plate on the flywheel between the crankshaft output shaft and the gearbox input. It was designed to—and did—slip enough to knock the peaks off the torque pulses. The clutch itself worked well enough, but it was a replacement item in the engine's initial 300-hour gearbox inspection/replacement cycle. Continental's Niels Mundt said there were issues with leaking oil seals that trashed the clutch friction material, but these were addressed.

New engines are equipped with a dual-mass flywheel arrangement that uses captured springs to isolate torque pulses and this part is good for the 1500-hour current TBR of the 2.0 engines. But the gearbox still requires a 600-hour inspection and replacement.

The new gearboxes are cast rather than machined from billets, as the originals were, and, surprisingly, it's not the gears that need replacement but three bearings that contain the shafts, one from the crankshaft, one to the prop and one an idler gear. In fact, most owners get overhauled gearboxes—at $3450 a pop—with used gears, but new bearings. So clearly, the gears can go the distance

on the current TBR, or at least more hours. Mundt said Continental is still collecting wear data on the bearings toward life extension of the gearbox. No promises on when that will be. Continental CEO Rhett Ross said the company would like to get the gearboxes to half the life of the engine.

It's not a trivial consideration, either. Even if the gearboxes went to the current life of the engine, that's worth more than $4 per operating hour. On a 2000-hour engine—a lifetime gearbox—that saves more than $5. That might not sound like much, but it's $10,000 over the life of the engine—half what it costs to overhaul a Lycoming O-360.

ForeFlight Mobile 6.1: Terrain, ADS-B Replay

ForeFlight's latest revision advances the Stratus 2 ADS-B interface, adds a clever flight data analysis function and finally includes terrain profiling.

by Larry Anglisano

Feed the machine. That's what app maker ForeFlight needs to do to maintain its 75 percent share (by its own estimation) of the GA cockpit app market. ForeFlight's popularity creates a tremendous task of adding new features and improvements on a regular basis because the nature of the app market is such that the more features you add, the more users will demand. There's also stiff competition from other companies, including Hilton Software with its WingX Pro 7 app, and Garmin, with its Pilot app, to name a couple. There's also a growing Android market. It's a vicious cycle that we think is spinning out of control, but that's a different matter.

What does matter is ForeFlight's obvious commitment to improving and advancing its Mobile app while answering the demand for features that were seemingly missing from previous versions of the app, including advanced terrain mapping and better file and brief functionality through Lockheed Martin. It also wisely invested in its own cartography and produces airport diagrams. As the industry worries about increasing data costs, this independence is encouraging. Here's an overview of the major enhancements available in the latest version 6.1.

PACKING FOR YOUR FLIGHT

If you've ever been enroute to a destination and had some extra fuel to fly further than you planned, but didn't download the charts and other data needed before you took off, the new Pack function (as in packing for the flight) solves the dilemma. Tapping the Pack button analyzes your route of flight and determines which charts, airport information, NOTAMs, weather data and procedures you'll need to make the flight before you even take off.

In addition to enhanced terrain mapping, ForeFlight has a new terrain profile feature that allows finger-panning to see what's ahead, left screen shot.

CHECKLIST

- We like that ForeFlight is investing in its own charting and cartography.
- Stratus Replay function saves iPad battery life without missing WX data.
- The Android market is gaining popularity, but ForeFlight won't play.

For example, if you're planning a flight from Trenton, New Jersey, to Greenville, South Carolina, enter the route and tap the new suitcase icon that's in the route editor page. Pack analyzes the planned data against the data you've already downloaded and prompts you to download the remaining data you'll need for offline, inflight access. A red exclamation icon over the suitcase warns that you need to pack before your trip. There's also a feature for turning autocheck on (automatically starting the analysis process) or off.

If you're not sure you're going to stop in Charlotte, North Carolina, on the way to the planned Greenville airport, for example, any modification you experiment with by modifying the route will prompt the Pack function to analyze the needed data to get there.

If you're concerned about the size of the files and overall storage capacity, you have the option of downloading all of the required data (tapping the Pack button) or by separate line item (approach chart, enroute chart, etc.) by tapping each line item on the page. We like that each line item is labeled with a file size so you can keep tabs on the amount of data you're loading to the iPad.

Speaking of charts, ForeFlight's charting enabled it to release airport diagrams for airports that aren't supported by the FAA. This includes georeferenced diagrams for nearly 1500 United States airports and 200 airports in Canada.

STRATUS REPLAY

If you're considering the $899 Appareo Stratus 2 portable WiFi ADS-B receiver, ForeFlight Mobile is the primary compatible app—that's only compatible with the iPad—and will

display air-to-air, ADS-R and TIS-B traffic and FIS-B textual and graphical weather products. The ForeFlight/Stratus interface has been a popular combination that ForeFlight continues to enhance. The new version of the app brings the Stratus/ForeFlight interface to a higher level.

For instance, the new Stratus Replay function enables the Stratus receiver to store 30 minutes of FIS-B weather data in its onboard memory. Initially, we weren't sure what logistical value this brings to the interface, but we can see a useful advantage.

If you use your iPad for retrieving and displaying in-flight ADS-B weather data, you'll know that hopping between apps or sleeping the iPad creates a situation where you can miss some of the weather (and traffic) data. There's also the cumbersome and time-consuming task of refreshing the data once the iPad wakes up or once you get back into the ForeFlight app.

But the real advantage is the ability to capture, store and analyze 30 minutes of animated ADS-B weather radar within the app. According to ForeFlight's Tyson Weihs, Replay solves more than one problem.

"Most ADS-B receivers simply receive the FIS-B weather stream and immediately blast it across the WiFi to the listening tablet computer. If the tablet is asleep or if the app isn't running, the stream is missed. Now, you'll always get the data, even if the iPad is asleep," he said.

This means that in a situation where the iPad was running low on battery power, you could still fetch reasonable amounts of missed weather from the Stratus even after a power-conserving shutdown.

If there is more than one iPad connected to the Stratus, the receiver will intelligently negotiate the retransmission to each listening iPad. This allows each unit to replay the same data.

As it has in the past, the Stratus 2 interface also enables a full or split-screen AHRS interface. This feature isn't available on first-gen Stratus receivers. As we go to press, ForeFlight is in the process of advancing the AHRS interface even further.

FILING AND BRIEFING

ForeFlight now uses Lockheed Martin as the primary flight planning gateway. ForeFlight acknowledges that the disconnect between DUATS and Flight Service was a big source of frustration for users not aware of its idiosyncrasies. ForeFlight added ICAO planning support and the ability to activate and close a VFR flight plan with a push of a button, in addition to amending or unfiling flight plans. The app also uses Lockheed Martin textual briefings.

Our home base at Brainard Airport in Connecticut, is across the river from the UConn college football stadium and we've lost count of the times that a hot stadium TFR wasn't mentioned on any preflight briefing. It's generally not until a helpful tower controller mentions it before departure that pilots are aware of it. ForeFlight has a dynamic stadium TFR system that, according to ForeFlight, shows more accurate stadium TFR depictions. It also expanded its charting coverage, adding IFR planning charts, enroute charts for the Caribbean and Mexico, oceanic planning charts and worldwide Department of Defense terminal and enroute procedures. There's also an improved FBO directory called ForeFlight Directory. It has information on expanded ground service and FBO information (rental cars, fuel brands and prices), in addition to photos and user comments.

We're impressed with the added terrain profiling function that was born from the requirements of EMS helicopter pilots. EMS and law enforcement crews have limited time to evaluate terrain clearance data before launching on a mission. The terrain profiling function enables you to place your fingers on the map and while the terrain profile view is visible at the top of the map, pan across to see the terrain profile update. Peaks in terrain are color-coded in typical terrain awareness colors.

A one-year ForeFlight Mobile subscription is $74.99, while ForeFlight Pro, which adds TrueTaxi and TruePlates for the United States is $149.99 per year. Visit www.foreflight.com or download a trial from the iTunes store.

Clockwise from upper left: The Plates on Map function overlays an approach chart on the map display and terrain and weather over it. Pack automatically analyzes the route and fetches chart and local data you'll need prior to departure. The enhanced interface with the Appareo Stratus 2 ADS-B receiver stores 30 minutes of FIS-B ADS-B weather in the receiver's internal memory for replay after the iPad comes out of sleep mode. It also allows for animated weather data.

Portable Cabin Coolers: Comfort From Ice

It's not air conditioning, but for under $660, ice, cold water, a heat exchanger and fan really can increase cabin comfort on a hot day. B-Kool tops the list.

by Rick Durden

While number four for takeoff on a 95-degree day, windows and doors open to catch any puff of moving air, every pilot ever minted has wished for air conditioning. With installed units starting at over $4500 and eating up at least 50 pounds of useful load, most owners are willing to sweat a bit and then climb to cooler air.

There is a much lower price alternative—portable aircraft coolers made from modern ice chests/coolers that use a fan to blow air across a heat exchanger full of cold water from ice (never, ever dry ice) to circulate cool air through the cabin.

At prices from $299 to $650, and weights of 30 to 63 pounds when loaded with ice, we wondered whether portable aircraft coolers are a viable option to installed air conditioning.

After using three of the most popular on hot days, we think that if an owner has reasonable expectations all of the units do a good job of cooling—after all, one pound of ice provides only 144 BTUs of cooling versus the 5000 to 10,000 BTUs from installed air conditioners.

THE REVIEW

The coolers were placed in the baggage compartment (except for the Arctic Air—the power cord was too short) of our test airplane, a Cessna T210, and flown out of Denver's Centennial Airport. In each test the airplane was parked in the sun until the cabin exceeded 95 degrees F. Each unit was not turned on until the aircraft engine was started—the units plug into the cigarette lighter.

Our conclusion is that realistic use of a portable cooler is for taxi, takeoff and climbout to more moderate temperatures at altitude. It is then shut off. On descent, the cooler is turned back on and will keep the interior cool through landing and taxi in. Realistic cooling time is on the order of two to three hours—plenty for most flights.

All of the units require some water to be added with the ice when the cooler is filled. Each uses a marine bilge pump—which must be mostly submerged—to pump the cold water through a heat exchanger and back into the cooler. A fan pulls in cabin air, blows it across the heat exchanger and the ice and exhausts it through louvers or a duct, into the cabin.

Keeping the bilge pump submerged is essential—meaning adding the right quantity of water and making sure the bilge pump is at the low spot for the deck attitude of the airplane during taxi and climb.

We tested the B-Kool, the Crosswind Cooler and Arctic Air Pack 52. We felt that all were satisfactory at providing an acceptable stream of cold air (temperature at the outlet was in the 45-50 degree F range).

Coolers, from left, Arctic Air Pack 52, B-Kool and Crosswind Cooler (with Arctic Air duct).

CHECKLIST

- All performed well—we liked B-Kool best because of its ease of use.
- Pump out feature avoids spills when taking the cooler out of the airplane.
- Keep expectations reasonable—it's ice, not real air conditioning.

We felt that the B-Kool was the best of the group due to its size—easy to get in and out of the airplane—the high velocity of the cold air from the duct and that it was the most user-friendly (everything was there and ready to go).

Arctic Air came a close second; while it was user friendly and held the most ice for slightly longer cooling, the power cord was too short to reach to the baggage compartment—which mystified us—and getting it into the rear seats of a Cessna 210 was an ordeal.

The Crosswind cooler worked well, but it was not user friendly—it requires a separate trip to a hardware store to buy ducting and paying $49.95 plus shipping for a 24- to 12-volt converter (it only comes as a 12-volt model). Also, it was hard to load with ice and keep the bilge pump submerged, and the extendable handle of the cooler kept opening and snagging when trying to put it in the baggage compartment.

B-KOOL

The $299-$429 B-Kool Portable cooler series holds 25 pounds of ice and promises over two hours of cool air. At 11x18x16 inches high, it is the smallest of the units reviewed. The unit arrived ready to go—it was simply a matter of unpacking it, putting in ice (we used a 20-pound bag) setting it in the baggage compartment, adjusting the included flexible air duct to point forward over the back of the third row of seats, adjusting the baggage net and plugging the power cord into the cigarette lighter. It was the easiest-to-use unit of the three we tested.

As with the other units, the B-Kool struck us as being well constructed. The flexible ducting that came with the unit proved simple to use—it fit firmly, while being easy to remove, something that was necessary for getting the unit in and out of the baggage compartment of the test airplane.

The bilge pump fits into a receptacle in a bottom corner of the cooler—the best of the cooler designs. The ability to latch the bilge pump to the bottom of the cooler helped assure that it remained submerged. A longer hose returns water from the exchanger to the body of the cooler. It also functions as a drain hose to pump the water out of the cooler at the end of a flight—just hold it outside of the airplane and run the cooler for about two minutes. The unit can be turned on and off with an optional remote control—handy when pumping it out, but it adds $100 to the price.

The empty weight of the B-Kool is just under 10 pounds. With 20 pounds of ice in the unit, we found it was no problem getting it into the baggage compartment. The size should allow it to fit through most baggage doors.

B-Kool recommends completely draining the unit after each use. We agree—unless it's clean and dry, interesting things grow where they are likely to cause problems.

The unit requires at least a cup of water to be in it on startup to work properly—the least of the three units.

The instructions are concise and clear. The warranty is one year on parts and a full refund if the unit is returned in original condition within 30 days.

Arctic Air cooler, right, has bilge pump on flexible hose that allows it to be placed on the floor of the cooler before adding ice and water. Crosswind Cooler, below, has bilge pump on a rigid hose that swings open with the lid and makes it difficult to get the pump to the floor of the cooler when adding ice.

CROSSWIND COOLER

The $499 Crosswind Cooler comes only in a 12-volt model (the website directs a customer that has a 24-volt system to a $49.95 converter from Sporty's) and is built into a rolling Igloo cooler that has a handle that folds out of one end. The 16-pound unit is 13x23x20 inches tall and draws 6.5 amps. It does not come with ducting; instead the website and instructions direct the customer to purchase ducting and gives photos of various kinds, with costs ranging from $10 to $16. As the two other coolers included the ductwork and came in 12- and 24-volt models, we graded the Crosswind Cooler down from a user-friendly and cost standpoint. For our review, we omitted the trip to the hardware store and used the duct from the B-Kool cooler.

In use, following the instructions provided with the cooler for 10 pounds of block ice, 20 pounds of cubed ice and a half-gallon of water, the unit weighs 50 pounds.

The lid of the Crosswind hinges

B-Kool unit has long, flexible hoses and the bilge pump latches into a receptacle on the floor.

along the narrow side and the bilge pump and hose are connected rigidly to the heat exchanger on the underside. Once the lid is raised, the bilge pump swings up from the floor of the cooler. That made it difficult to add ice and then get the bilge pump back to the bottom of the cooler.

The inability to get the bilge pump to the bottom of the cooler may explain why so much water is required initially. It took us a few tries before we could get the bilge pump submerged enough for water to go through the heat exchanger and cold air to come out. Once it did, the outflow air was 48 degrees F; the velocity was satisfactory to reach the occupants of the front seats of a Cessna 210 from the baggage compartment.

There is no pump-out arrangement for the Crosswind cooler. After our test, the process of turning the Crosswind cooler on its side and getting it out through the baggage door meant a lot of spilled water and a soaked baggage compartment carpet.

The instructions included with the Crosswind cooler are terse, but adequate. The cooler is turned off and on by inserting and removing the power plug in the aircraft lighter. The cord is in two pieces—a short piece attached to the cooler itself and a long piece to the power receptacle—that are joined by a simple connector that was easy to use. In use, we did have the cord disconnect when an occupant inadvertently pulled on the cord while moving around.

There is a 120-day warranty on parts of the Crosswind Cooler—purchase price, minus $50 restocking fee, will be refunded if it is returned within 30 days.

ARCTIC AIR

The big dog of the portable cooler pack is Arctic Air, which makes a line of 12- and 24-volt portable coolers ranging in price from $495 to $650 depending on size (30 or 52 quarts) number of fans and whether they have ducts or louvers. The maker promises from one to four hours of cooling time, depending on size.

We reviewed the 24-volt Air Pack 52 with one fan and ducting. Everything was included in the package, including a second duct, power cord and drain line so the unit can be pumped out while in the airplane. The instructions were clear and concise.

As with the other portable coolers, the Arctic Air Pack 52 is based on a cooler, although it has an additional protective, insulating cloth jacket. There is a flap over the intake air vent on the top—it must be secured in the open position prior to operation. Comparatively, the Arctic Air Pack 52 is big: 14.5x24x17 inches high. Empty it weighed 23 pounds—we were able to put 40 pounds of ice in it, bringing in-use weight to 63 pounds. On its side, it fit through the baggage door of a Cessna 210. As the sides were smooth, maneuvering into position was easier than the smaller Crosswind Cooler.

However, once in position, and after attaching the power cord (it clips on and should not come off with an inadvertent pull), we were stunned to discover that the power cord was too short to reach from the baggage compartment to the instrument panel. That meant we had to maneuver the unit into the rear seats of the airplane—a major, unpleasant exercise.

There are two power switches on the power cord for the Air Pack 52, one for the fan and one for the pump. The instructions say that running the fan is the "low cool" position. It pulls air over the ice in the cooler and circulates it through the cabin. With the pump on, cold water is circulated through the heat exchanger, and is the effective cooling position, referred to in the instructions as "high cool."

The Arctic Air cooler's bilge pump is on a flexible hose—we had no trouble keeping it on the floor of the cooler as we added ice.

In use, the Air Pack 52 moved cool air through the cabin effectively—output air temperature averaged 48 degrees.

Due to the size, weight and need to position the unit in the back seat, the pump out feature proved valuable, although trying to hang on to the drain tube and then reach for the pump switch made us appreciate the B-Kool remote control.

CONCLUSION

At $299-$429 including everything, two hours of cooling and user friendly, the B-Kool series gets our vote for best of the coolers we reviewed. However, all of them were effective in use, providing a cooling flow of air through the cabin.

Going in with an appropriate level of expectations—ice does not replace installed air conditioning—we think these portable aircraft coolers are all a good way to make warm weather flying more comfortable.

CONTACTS

Arctic Air
229-271-7095
www.arcticaircooler.com

B-Kool
928-300-4045
www.b-kool.net

Crosswind Coolers
480-272-5082
www.crosswindcoolers.com

Engine Air Filters: Dry Pleats or Oiled

Since performance gains are minimal, think in terms of serviceability, cost. We favor Donaldson's dry media design for simple upkeep and good airflow.

by Larry Anglisano

CHECKLIST

- A dry filter is less restrictive than an oiled foam insert, lending to better engine performance.
- Brackett's foam element is dirt-cheap to replace—under $10 for some models.
- Any filter will need to be serviced more frequently when operating in dusty conditions.

Ask a typical owner what type of inlet air filter he has and you'll likely get a shoulder shrug. It's one of those service items that many rely on the maintenance shop to look after.

But we think it's critical enough to at least know what type of filter is on your engine and that it's being properly maintained. It's a required component to check during annual inspection, but we once spotted a paper air filter on a Cessna 210 that was so dirty and deteriorated we wondered if it was ever replaced. Incidentally, that engine needed overhaul long before its new owner planned. Clearly, air filter maintenance is an easy way to help protect the inside of an engine. According to Lycoming, dust or some form of dirt is frequently the principal factor in premature piston ring and cylinder wear.

There are only three brands of FAA-approved air filters—Brackett Aero Filters, Challenger Aviation and Donaldson Filtration. We sampled one of each (approved replacements for Cessna part number 120009, used on the 172-series) to look at design, build quality and each manufacturers performance claims. We didn't perform laboratory testing, given the costs, but instead collected manufacturers' performance data, based on its claimed lab testing. We also did some basic experimenting of our own and talked with maintenance shops, aircraft owners and engine shops.

FILTERING MEDIA

There are two major differences in engine air filter design—dry media and wet media. The dry media design used by Donaldson uses a more traditional pleated synthetic fiber element, while the wet media filters from both Challenger and Brackett are drenched in a tacky oil solution.

Wet filters rely primarily on the oil to trap the dust particles and other contaminates, while a dry filter uses the filter fibers to trap contaminates, as most traditional air filters are designed to do.

There's an ongoing FAA Airworthiness Directive (AD 84-26-02)—dating back to the 1980s—that applies to all paper induction air filters. It says, in summary, that filters must be replaced at 500-hour service intervals. The replacement filter must be FAA-approved, of course, and the AD doesn't override instructions for continued airworthiness, which requires 100-hour and annual inspection of the filter. It's the deterioration of the paper element and ultimate digestion and engine stoppage that's of concern. There's also the potential for a paper filter to catch fire during engine backfire.

None of the filters evaluated here fall under the paper filter AD (technically, none of them use paper media), although Donaldson's instructions for continued airworthiness is in line with the AD, recommending that it's replaced at 500 flight hours.

FILTERING

The key is that no matter which filter you use, a restriction in airflow will be detrimental to engine power. Some argue that surface-loading pa-

Intake air filter construction has gotten a lot better since the FAA's AD appeared in the 1980s. Neither the Challenger, top, or the Donaldson, lower, use real paper elements.

The tacky, dense, twin-layered Brackett foam filter, left, has plenty of depth and surface area even when it's stuffed in the metal housing.

per elements are more restrictive to airflow by design because the filtering fiber must be tightly compressed and dense enough to effectively trap the harmful contaminates. It's also said that ingested contaminates of 10-20 microns are responsible for the most damage (the industry standard SAE J726 air-filter test uses 0-to 5-micron test dust as a benchmark). Keep in mind that once a surface-loaded filter becomes clogged, it's pretty much spent and the engine—starved for air—can ingest pieces of the filter.

Every technician we spoke with noted the first item to check when an engine doesn't make full static power is the air filter. If it's wet, plugged with dirt and debris or has any restriction, it will starve the engine of air, likely creating a rich mixture. But what about gains in performance? Challenger was the only filter manufacturer that definitively told us that years of flight testing (during the STC approval process) revealed slight increases in horsepower.

"In our testing, we found increases in performance, but there are many variables that come into play when you get out in the field. While we get claims from some owners boasting of higher performance numbers, we can only speak to what we have seen in our tests," said Linda Rocco, Challenger's president.

She told us that some engines could gain two to four horsepower, but concedes that depends on restrictions in the air intake system. The company provided flight test results that show slight increases in manifold pressure during its initial STC testing in a Mooney M20J and also in a Cessna.

Additionally, Challenger provided airflow versus restriction data that was in line with test data provided by Donaldson. As the chart in the sidebar on page 21 shows, the Challenger and Donaldson filters share similar pressure drop characteristics.

Such slight changes in manifold pressure may be difficult to see on some stock gauges. Additionally, at wide-open throttle there is less than one inch of mercury drop between the ambient and the pressure inside the manifold. Regardless, restrictions in airflow can adversely affect performance characteristics that you might notice on takeoff, in climb and during cruise. See the sidebar on page 21 for more on intake restrictions.

The Challenger's K&N element, lower photo, has to be cleaned and re-oiled annually or every 100 hours. That's good for at least one hour of shop time.

BRACKETT

Filters from Brackett Aero Filters have been in service since the late 1960s and are installed as original factory equipment on a wide variety of aircraft. There is PMA approval in place on 88 different models.

The Brackett filter consists of a dual-stage throwaway foam element that fits into an aluminum frame with a stainless steel screen. The filter assembly is sealed to the airbox with a gasket, while a removable grill fits over the foam element.

The current Brackett design has been improved in response to earlier ADs that were issued on Brackett filters due to failing gaskets and filter screens that were coming loose and being ingested into engines.

For example, there's now a protective lip that surrounds the edges of the airbox gasket should the glue fail and the gasket becomes loose. Since the Brackett filter element is foam, the paper filter AD doesn't apply.

The oiled (saturated, really) element is required to be replaced yearly, for a minimal cost. We purchased a replacement foam element that fits a Bonanza for under $10—that's a huge savings compared to the others that cost hundreds of dollars. Aside from getting your hands gooped up with sticky oil, replacement is painless and straightforward. The same can't be said for the K&N element in the Challenger assembly. It requires cleaning, drying and re-oiling. More on that in a minute.

The Brackett foam element has a shelf life of four years, even if it's been stored in the original bag.

DONALDSON

The company provided us with laboratory test data that said one

of its synthetic fiber filters (for a Cessna 172) had the lowest restriction—or best airflow—compared to the Brackett foam and Challenger gauze-type filters. Donaldson says it's more filtering media and less frame area, plus deeper filter pleats and the evenly distributed size and shape of the fiber that contributes to better air flow. Plus, there's no layer of oil to restrict the flow.

On the other hand, Donaldson doesn't specifically state a value for gains in horsepower. Instead, it notes the obvious: A lower air restriction would theoretically provide a fractional performance advantage. Donaldson told us that the difference in airflow restriction between filters must be significant to realize even a one percent gain in horsepower and that sizable difference didn't exist when it tested its synthetic filter media filter against the Challenger's K&N gauze filter. Donaldson said there was, however, a significant difference in pressure loss when it tested its filter against a foam filter. This loss in pressure, or delta-P, can be detrimental to performance. This jives with field reports we got from a variety of owners that used both style filters.

The Donaldson filter is rated to last 500 hours and while the synthetic filtering media isn't governed by the air filter AD, it still must be replaced at 500-hour intervals, after three years or after five cleanings—whichever comes first.

The filter can be cleaned either by compressed air when there's dust on it or washing it in a solution of water and general purpose detergent when there's a combination of dust and oil or carbon.

When it's clean, Donaldson claims that the filter delivers 98.5 percent or greater filtration efficiency (according to the ISO 5011 requirements) and the filter meets or exceeds FAA induction air filter fire safety regulations (FAR 25.853 and FAR 23.1107).

The Donaldson filter for the Cessna 172 application typically sells for around $140 and the company offers over 75 approved filter mod-

AIRFLOW AND DELTA-P

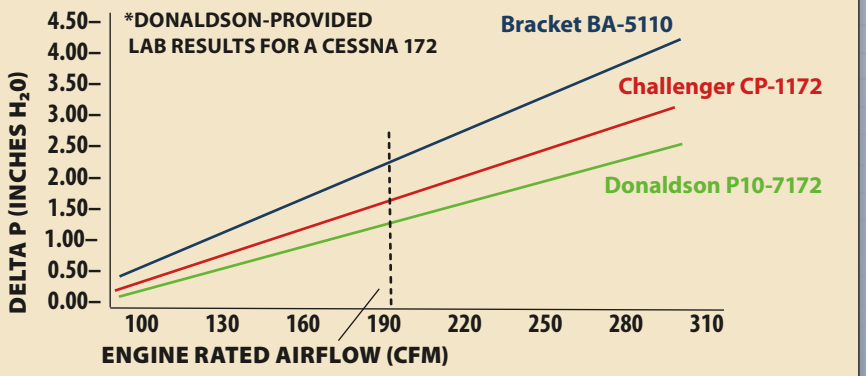
In the world of aircraft engine inlet air filters, the operative term is delta-P loss. That's the atmospheric pressure drop across the air filter when the engine is producing power. Moreover, as paper filters become clogged, the pressure inside the filter drops while the atmospheric air pressure outside the filter remains the same. Pressure drop isn't as critical in a turbocharged engine, and even for a normally aspirated engine flying at a low enough altitude where the throttle setting is anything less than full. But for a normally aspirated engine flying at higher altitudes with a wide-open throttle, delta-P can be a significant issue, given the loss of manifold pressure and power. Reduced airflow can also rob takeoff and climb performance.

Unfortunately, outside air temperature, barometric pressure, throttle position, RPM and forward speed are a few of the variables that make it extremely difficult to achieve a quantitative assessment of one filter versus another, in terms of power gains. In the world of performance automobile and motorcycle engines, a test cell equipped with a dynamometer is the primary means for accurate power measurement. We didn't dyno the engines we used for our filter evaluation, but instead looked for differences in full throttle performance. Some owners we surveyed made the switch from oiled Brackett foam filters to the dry Donaldson filter because of perceived performance loss (including increased takeoff ground roll) and reported slight increases in manifold pressure, takeoff power and climb rates while at wide-open throttle.

To see for ourselves, we installed a Donaldson and a Brackett filter on a Bonanza for comparison. Since swapping a stock air filter with one that isn't on the aircraft type certificate is considered a major alteration (requiring an FAA form 337, previously approved on our test aircraft), we limited our evaluation to high-speed ground runs.

With equal conditions—consistent temperature and dewpoint, winds blowing directly down the runway at less than seven knots—we performed timed rolls from 0 to 60 knots at wide-open throttle power settings (noting similar cylinder head temperatures for all runs). To our surprise, there was nearly a 10 percent decrease in time-to-rotation with the Donaldson filter installed, requiring 10.71 seconds to reach the 60 knots, compared to a longer 12.34 seconds when the Brackett was installed. We wouldn't even try to guess how much horsepower the dry filter afforded over the oiled foam, but we think this basic evaluation proves that inlet airflow plays an integral role in optimizing performance, or at least knocking a couple of seconds off a takeoff run.

AIRFLOW VERSUS RESISTANCE*



Aside from airflow, cowling design plays a role in the longevity of the inlet filter. That's why it's important to use a filter that's approved for your exact model and any mods to it.

els for a wide variety of aircraft. It's worth noting that Donaldson filters have been stock equipment on many Cessna, Beechcraft, Mooney and other aircraft for decades.

CHALLENGER

These filters use the K&N oiled filter media. Most anyone that's familiar with high-performance engines will recognize the K&N name and its High-Flow air filters and air intake systems. For automotive and motorcycle applications, K&N claims that its filtering media will generally increase horsepower by one to four percent, compared to OEM filters.

The filter is made of four to six layers of cotton gauze sandwiched between two epoxy-coated aluminum wire screens. The cotton is treated with oil, causing tackiness throughout the cotton's microscopic strands.

K&N claims that the nature of the cotton allows high volumes of airflow, and when combined with the tackiness of the oil barrier, creates a more effective filtering media—achieving an overall filtration efficiency in the range of 96 to 99 percent, based on its ISO 5011 testing procedure. Of course, there are factors that can deteriorate the filtering efficiency, particularly the oil saturation (wash-off) that can be affected by flight in rain, for example.

Even the location of the airbox in relation to the aircraft cowling can have an effect on filter performance and longevity. After a while, the wet, sticky oil that coats the filter begins to dry and excess might even get drawn into the intake.

Depending on what you fly and the conditions you fly in, Donaldson's Scott Petersen makes a good case for selecting a dry filter. "If the filter is in close proximity to the propeller, as it often is on a Cessna single, for example, the filter is being impacted by rain, snow and moisture. That can cause an oiled filter to dry out, drastically reducing its effectiveness," he told us. We concur, based on our experience using K&N filters on two motorcycles. In one application, the filter is bolted to a naked high-flow airbox that's unprotected from rain. After distance-riding in a few rainstorms, it's clear that some of the oil washes off. In another application where the filter is in an enclosed airbox, it's notably wetter for longer periods of time.

Petersen also noted that the K&N media used in the Challenger has lower resistance for better airflow, but because the Donaldson filter has more surface area for the air to flow through, it has a slight advantage.

CONCLUSION

Our thanks and appreciation to reader Bill Foley who bravely offered up his V35B Bonanza for a series of eye-widening aborted-takeoff time trials. Incidentally, Foley is an A&P that made the switch from the Brackett to the Donaldson filter a few years ago for the perceived improvement in performance and simplicity and has never looked back.

"I have been making frequent trips out West from Connecticut and, hence, need all the inlet ram air I can get. I'm satisfied that a slight overall performance improvement is there. The filters are easy to clean, the messiness is gone and there has been no increase in silicone in the oil when I get oil analysis at each oil change," he told us.

Based on our evaluations of the three filter designs, we think choosing one might also depend on the environment you operate in.

If you fly in an area that has a lot of dust, including the desert, for example, or operate in and out of dirt and unpaved runways, our sense is that a well-maintained Brackett foam element is going to catch nearly any piece of impurity your inlet is likely to encounter, but with a performance penalty. We like its inexpensive price and that it's a throw-away, easy drop-in replacement. That saves money during annual inspections.

Based on K&N's long-standing reputation for increasing horsepower in non-aviation applications, we don't doubt Challenger's claims of slight gains in horsepower for some applications. If performance was everything—and for some folks it is—we'd likely try one. Plus, we like its high-quality build, including the frame that's built and assembled by Challenger. But for basic applications, we're not convinced the claimed performance gain is sizable enough to justify the initial acquisition cost (the CP-1172 filter for a Cessna 172 is a whopping $219), in addition to the time-consuming effort and cost to service it.

While the Donaldson, at around $140, isn't exactly cheap, we think it offers decent airflow, good filtering properties and is convenient to service.

CONTACTS

Brackett Aero Filters, Inc.
928-757-4009
www.brackettaerofilters.com

Challenger Aviation Products
937-387-6500
www.challengeraviation.com

Donaldson Filtration Solutions
866-323-0394
www.donaldson.com

TV AIR FILTER VIDEO

AVweb
www.avweb.com

Mutt Muffs: K-9 Hearing Protection

Protecting your dog's hearing in the high-noise environment of the cockpit is important. Mutt Muffs will help if they will stay on your dog's head.

by Rick Durden

If part of your flying family includes a pooch, I think that protecting your dog's delicate hearing in a 92-, or higher, decibel airplane cabin is part of responsible pet care. Shortly after our family acquired a puppy, I ran across Mutt Muffs, from Safe and Sound Pets, at Sun-n-Fun. I had a long talk with the knowledgeable representative in the booth and bought a pair.

Mutt Muffs are ear defenders for dogs. Triangular in shape, they come in five sizes from "X-small" for 5-10-pound dogs to "X-large" for dogs over 95 pounds. Each pair is attached with adjustable straps and come in an assortment of colors, although if you want other than black, it costs a bit more than the basic $55 to $58 price—depending on size.

The user-friendly, informative website states that the inner foam of each ear cup is made of the "same ester resin used in many high-end commercial headsets designed for humans." A 25-28-dB sound reduction is claimed. Mutt Muffs are worn over the dog's ear flap, not under, increasing their effectiveness.

The website explains that dogs understand cause and effect and will wear Mutt Muffs because they can tell that they make a difference in the noise level. The rep I spoke with suggested having the dog wear them around its neck on the drive to the airport—to get used to the smell and feel. Once in the airplane, wait until the engine is running to put them on the canine so he or she will recognize the sound difference and be less likely to refuse to wear them.

IN SERVICE

Using Mutt Muffs proved less than ideal—over several flights. Our dog was willing to wear them, but it took repeated adjustments to get them to fit correctly—and they are difficult to adjust.

A worse problem presented itself rapidly. Dogs move around. In the confines of the middle row seat of a Cessna 210, ours kept hitting one ear muff or another against something—and the headset would promptly fall off. After repeatedly picking up and putting the Mutt Muffs back on during a number of flights, my wife and I eventually gave up.

CONCLUSION

I like the concept and the quality of construction of Mutt Muffs. I was not satisfied with how hard they are to adjust and how easily they get knocked askew or off the dog's head.

I think hearing protection is important, so I'm going to keep trying to use them for a few more flights—maybe as our dog matures, he won't move around as much.

Get Mutt Muffs at www.safeandsoundpets.com, 443-536-6287.

CHECKLIST

- ⊕ Mutt Muffs provide a dog with protection against cockpit noise.
- ⊕ Wide range of sizes and liberal return policy mean muffs will fit most dogs.
- ⊖ Muffs are difficult to adjust and get knocked off easily.

Mutt Muffs are triangular ear defenders that are worn over a dog's ear flap.

Piper/Ted Smith Aerostar

It's as fast and complex as it looks, which means it burns lots of fuel, demands proper training and requires high-quality maintenance.

The Aerostar—with plenty of ramp appeal and utility—has a deserved rep for being blazingly fast with good range. And unlike most piston twins, it has enough power to actually climb on a single engine.

But bring a Visa with high limits. The airplane's Lycomings are somewhat thirsty and although it's hardly a maintenance hog, the Aerostar fleet is aging and getting expensive to maintain. But for owners who can afford it, the model is hard to beat for getting from A to B faster than anything that doesn't burn Jet A.

The Aerostar is the product of famed aircraft designer Ted Smith, whose name is attached to such classics as the A-20 twin-engine bomber and the Twin and Jet Commander lines. In 1963, Smith formed his own company to build a family of fast fliers, all built around the same fuselage, wings and tail. Five years later, the Model 600 emerged in 1968, with normally aspirated Lycoming IO-540 engines and a takeoff weight of 5500 pounds. A year later, the 601 appeared, with a pair of Rajay turbochargers and manually controlled, electrically actuated wastegates on each engine. With turbos, the engines could maintain 290 HP from sea level to 16,000 feet.

> ***The Aerostar is hard to beat for getting from A to B faster than anything that doesn't burn Jet A.***

SELLING OUT

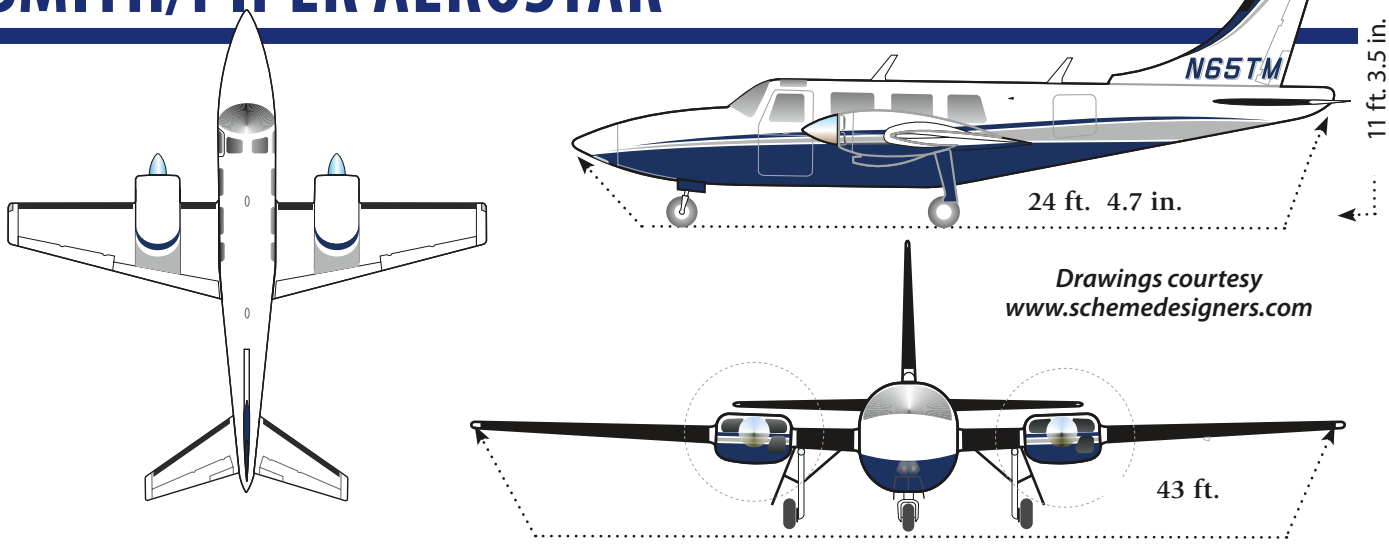
By this point, Smith had sold out, first to American Cement and later to Butler Aviation, which acquired both Aerostar and Mooney and moved them to Kerrville, Texas. A squabble between the new owner and the old over corrosion idled the line for two years. Unwilling to let his idea wither, Ted Smith organized a group of investors and bought the company back, setting it up in Santa Maria, California. The new company began building the 600A and 601A in 1973. The A models had Lycomings with heavier crankcases and crankshafts and engine TBO was boosted from 1400 hours to 2000 for the 600A and 1800 hours for the 601A.

The first pressurized Aerostar, the 601P, appeared in 1974, with a max differential pressure of 4.25 PSI, good for an 11,000-foot cabin all the way to 25,000 feet. The tenth 601P emerged with a longer wing (stretched from 34.2 to 36.7 feet) and higher max takeoff weight, 6000 pounds. These changes were incorporated in the unpressurized turbo model in 1977. The engines on the new B-model 601 were fitted with an automatic wastegate control, dumping the electric version.

Ted Smith died in 1978 at 70 years of age, after open-heart surgery. Plans for nine-seat Aerostars with 450-HP piston engines and turbines died with him, unfortunately. Later that year, the company was acquired by Piper Aircraft, which moved it from Santa Maria to Vero Beach.

Piper kept at it, despite a soft market. It improved the wastegate system in the 601B and 601P, increasing critical altitude from 16,000 to

SMITH/PIPER AEROSTAR

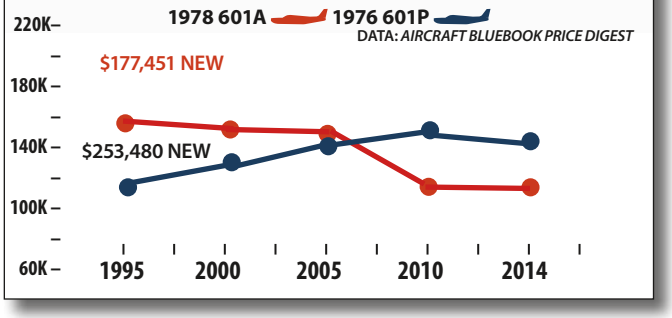


Drawings courtesy www.schemedesigners.com

PIPER/TED SMITH AEROSTAR MODEL HISTORY

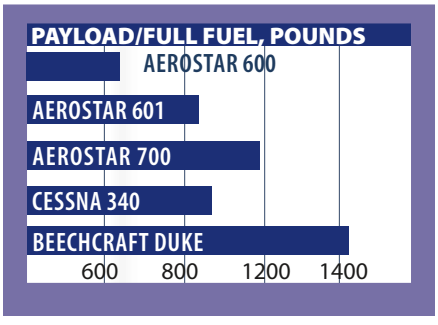
MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1969-70 AEROSTAR 600	LYC 290-HP IO-540-G1B5	1400	$40,000	165	1965 LBS	211 KTS	±$78,500
1973-75 AEROSTAR 600A	LYC 290-HP IO-540-K1F5	2000	$40,000	165	1965 LBS	211 KTS	±$90,000
1976-78 AEROSTAR 600A	LYC 290-HP IO-540-K1F5	2000	$40,000	165	1965 LBS	211 KTS	±$105,000
1979-81 AEROSTAR 600A	LYC 290-HP IO-540-K1J5	2000	$38,000	165	1965 LBS	211 KTS	±$120,000
1969-70 AEROSTAR 601	LYC 290-HP IO-540-P1A5	1600	$40,000	165	1970 LBS	237 KTS	±$92,000
1973-76 AEROSTAR 601A	LYC 290-HP IO-540-S1A5	1800	$40,000	165	1970 LBS	237 KTS	±$109,000
1977-78 AEROSTAR 601B	LYC 290-HP IO-540-S1A5	1800	$40,000	165	2025 LBS	233 KTS	±$128,000
1974-76 AEROSTAR 601P	LYC 290-HP IO-540-S1A5	1800	$40,000	165	2025 LBS	232 KTS	±$130,000
1979-81 AEROSTAR 602P	LYC 290-HP IO-540-S1A5	1800	$40,000	165	1900 LBS	232 KTS	±$180,000
1982-83 AEROSTAR 602P	LYC 290-HP IO-540-AA1A5	1800	$40,000	165	2025 LBS	229 KTS	±$195,000
1984 AEROSTAR 700P	LYC 350-HP TIO-540-UTA	1800	$73,000	165	2135 LBS	258 KTS	±$345,000

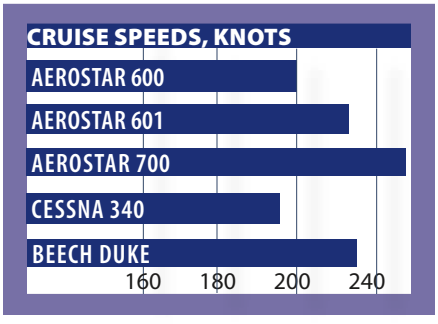
RESALE VALUES

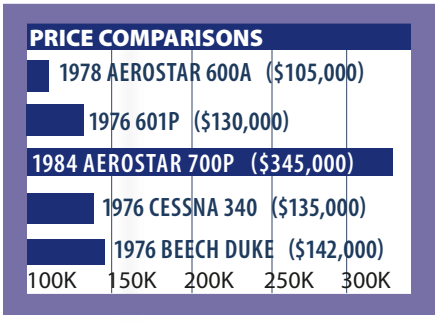


SELECT RECENT ADs

AD 03-22-01	AUX FUEL PUMP TRANSFER
AD 01-08-10	MAIN GEAR SIDE BRACE ASSEMBLIES
AD 98-24-29	UPPER SPAR CAP INSPECTION
AD 94-15-13	NOSEGEAR DRAG LINK CORROSION
AD 90-01-02	FIRE DETECTION KIT/RETROFIT







The Aerostar's instrument panel wasn't designed for big-screen glass avionics, but the aircraft deserves as much as you can fit, top. That's a Smith 600A, bottom photo, that belongs to Howard McComass.

21,500 feet. A known-icing package—boots—was also added.

In 1981, the 602P was introduced, with engines and turbos certified and installed as a package by Lycoming. (Previously, turbos and wastegates were tacked on at the Ted Smith and Piper shops.) The last model, the 700P, was introduced by Piper in 1984 and had intercooled, 350-HP engines, cowl flaps and outward-rotating propellers. With only 25 built that year, the 700P is the rarest model. The most prolific model was the 601P, with 454 built by both Ted Smith and Piper.

The 600A remained in production the longest—10 years—but only 206 were built. Piper's figures show 59 600s, 68 601s, 48 601As, 41 601Bs and 110 602Ps built before the line closed for good. Although Piper exited the cabin twin market by the late 1980s, the Aerostar line endured.

In May 1991, Piper sold the type certificates and STCs to Aerostar Aircraft Corp., headed by Stephen Speer and James Christy, both of whom had been involved in the Ted Smith days. The new owners pledged to keep Aerostar parts and support flowing and they've done just that.

One upgrade they offered is called the Super 700 Aerostar, which takes 601P and 602P Aerostars and fits them with 350-HP Lycoming TIO-540-U2A engines turning three-blade Hartzell props.

The airplane gets a gross weight boost to 6356 pounds ramp weight. Claimed 75 percent cruise is 261 knots, and initial climb rate is 1875 FPM. At economy cruise (55 percent), the fuel burn is 32 GPH and claimed speed is 225 knots. Owners report that the mod is worthwhile and the speed claims realistic.

MID-WINGS

Ted Smith evidently liked mid-wing designs, as anyone who has seen a photo of an A-20 would surmise. The Aerostar's wings are mounted midway along the oval fuselage and are the same NACA-64 series used on the Learjet. External skins are butt-joined and flush-riveted. Primary flight controls are via push-pull tubes, torque tubes and bellcranks.

Like larger aircraft, the landing gear, main gear doors, flaps and the nosewheel steering system are electro-hydraulic. The nosewheel has its own steering control and isn't connected to the rudders. Fuel-selector valves and elevator and rudder trim systems are also electric.

The engines are supposed to draw fuel from the two 62-gallon wing tanks and from the 41.5-gallon fuselage tank at the same time and at a rate that leaves 12 gallons in the fuselage tank when the wings have been emptied. But this only works in straight-and-level flight. The thin wing tanks easily become unbalanced—there are only two degrees of wing dihedral—and crossfeed must be used to bring them back in synch.

This shortcut led to trouble if the single fuel pick-ups in the wings became unported and electrical power was lost, leaving no way to reposition the valves. AD 79-1-5 sought to solve the problem by placarding crossfeed procedures and installing a low-fuel warning light and individual tank quantity indicators.

The 601 models have relatively high-compression turbonormalized engines, producing 290 HP. The 601P is especially prone to detonation if leaned to peak EGT at altitude. The 602P's engines have a lower compression ratio, alleviating the detonation problem, and are

Many owners remove a middle seat to make more room in the cabin, while high wing loading tames the bumps. With counter-rotating 350-HP engines, the Aerostar offers decent single-engine climb.

ground-boosted to maintain 290 HP at 37 inches MP.

Alternators on most Aerostars are rated at 70 amps, but can actually put out only about 55 amps due to heat. Potential buyers should be wary of any airplane with an electric air-conditioning system. It's heavy, has four motors that draw a lot of juice and cannot be used at night or in IMC. A better bet is an engine-driven-compressor system.

PERFORMANCE

If you want speed, look no further than an Aerostar. The normally aspirated 600s will easily steam along at 210 knots on 34 GPH at 70 percent power. The 601s model can turn in an amazing 233 knots on 36 GPH at 70 percent power at 20,000 feet. The higher-powered 700P trues at a whopping 260 knots on an equally impressive 51 GPH at 81 percent power and 25,000 feet; throttled back to 65 percent power, a 700P can do 230 knots on 36 GPH.

As if the stock airplane weren't fast enough, Machen conversions make them even faster. At 75 percent power and 25,000 feet, a Machen Superstar 650 cruises at 240 knots on 42 GPH; a Superstar 680—intercooled—does 250 knots on 40 GPH. Machen conversions also improve single-engine performance.

Maximum published single-engine rates of climb are 360 FPM for the 600, 240 FPM for the 601s and 602P, and 320 FPM for the 700P. Accelerate/stop distances—with 20 degrees of flaps for takeoff—are about 3100 feet for the 600 and unpressurized 601s, 3400 feet for the 601P and 602P and 4000 feet for the 700P.

Since it was intended to become a jet one day, Aerostar handling can be said to be jet-like. That means high flap speeds—174 knots indicated for most models—and fairly high gear speeds of 156 knots. The Aerostar's wing loading is an eye opener: 35.4 pounds/square foot. High wing loading translates to high speed and a soft ride in turbulence, but also a brisk stall and a narrow slow-speed envelope. Crossing the fence at 100 knots, the Aerostar isn't a terrific short-field performer but owners say it's adequate.

Both Piper and the factory have modifications to improve the Aerostar's stall behavior at aft CG and alleviate the restrictions imposed by AD 83-14-7. Most owners prefer Machen's vortex generators to Piper's water rudder. Stall behavior has been the focus of attention, thanks to tendencies to stall sharply when held into the break. The AD was issued to improve stall controllability with flaps extended with aerodynamic kits like those mentioned above.

CABIN COMFORT, LOAD

Passengers are sometimes taken aback by having to enter the cabin by clambering over the pilot's seat; that's the only door in the airplane. Once inside, an Aerostar is reasonably comfortable, but no one would mistake it for a chapel; the noise level is quite high, especially in models without pressurization.

The cabin is more than 3 inches wider than a 55-series Baron's, but 3 inches narrower than a Cessna 310's, and has 2 inches less headroom.

AEROSTAR WRECKS: LACK OF PRECISION

Our search of reported Aerostar accidents turned up 65 in the last 20 years. Their causes matched our experience that the airplanes have performance that will reward a competent pilot, but won't forgive a sloppy one.

The most common Aerostar accident couldn't be pigeon-holed into anything but the "other" category—of which there were 21. We'll discuss them in a moment.

What we did see were pilots who couldn't meet the airplane's demand for precision: there were eight loss of control crashes; four badly blown instrument approaches; six crashes that started from landing long and either continued into obstructions off the end of the runway or a crashed while trying to take off again; four landings were so hard they tore up the airplane and four were stall/spin crashes. If imprecise piloting were a category, it would have 26 items in it.

An indication that Aerostars have more-than-adequate control authority was shown in the low number of runway loss of control (RLOC) accidents—only four—we're used to seeing a higher proportion.

Seven accidents began with an engine problem and progressed into ground impact when the pilot failed to deal with the situation appropriately. In one case the pilot shut down the wrong engine.

There were six fuel-related accidents, two because of mispositioned fuel selectors and four from running out of gas—although one pilot with tranquilizers in his bloodstream could not follow the controller's vectors. He flew random headings until the tanks ran dry.

Aerostars have to be sitting level when fueled to take on a full load. One pilot found that out the hard way on a max range trip—after fueling on a sloping ramp. He ran out when the totalizer showed he still had 15 gallons.

In the other category: One pilot took off into IMC, cleaned up the airplane but then let the nose drop. He pitched back up, hit a tree and flew on to his destination. Once there, he found damage to the right wing leading edge, nacelle and prop spinner—and a cracked right rear wing spar.

A foggy day led one pilot to have his passenger walk the runway to check for obstructions. He then started his takeoff roll, only to realize he was using a relatively short taxiway. He unsuccessfully tried to swerve onto the runway it intersected and tore up the airplane.

Not much is known about the pilot of one damaged Aerostar that overshot a landing. He beat feet after the airplane stopped and was never found. Authorities did, however, manage to locate 250 kilos of cocaine in the airplane.

Because of their speed, Aerostars have long been used to haul cargo. Two crashes were attributed to Part 135 pilots who were simply exhausted and fell asleep.

In the "it sometimes catches up with you" department, a pilot was killed when he tried to clear obstructions in a distance only 100 feet longer than the book said was required—without using short-field technique. Investigators found that the pilot had previously had his certificate suspended for "using an airplane in an unsafe manner" and had blown off an FAA demand for a "709" re-examination flight following a recent crash he'd survived.

Finally, the Aerostar pilot who got our attention was one who didn't have charts with him, so he estimated a heading to, and pattern altitude of, his destination on a VFR night flight. Arriving at what he thought was the place, he let down and tried to activate the runway lights. When unsuccessful, he figured he'd better start climbing as he might be in the mountains. He was. He hit one and survived the crash. He was surprised to discover that his navigation was a bit off—he wasn't even in the right state.

Many owners have taken out one of the middle seats to make more space in the cabin. For a cabin-class airplane, it's on the tight side.

It's also not a great carrier. An Aerostar is hard-pressed to carry even five adults, their bags and a reasonable load of fuel. Real-world useful loads vary from a meager 1600 pounds for a lavishly equipped Aerostar to a marginal 1800 pounds with average equipment. Also, the airplane has a relatively narrow CG range and it's easy to bust the limits. Weight-and-balance calculations are a good idea for takeoff and landing profiles, because the CG moves forward as fuel is burned. And in a twin, CG is always a worry for engine-out operations.

MAINTENANCE

No surprises here. The Aerostar can be a hangar queen, but owners who say it's a wrench hog also say that this is to be expected in any aircraft of this class and age. Even so, the Aerostar has a couple of marks against it. For one, it's a compactly built airplane, so its systems are tightly packed and difficult to get to. Second, the systems themselves are complex. One owner reported dozens of individual failures in his first 18 months of ownership and another said elevating the airplane to squawk-free status is hopeless.

Since the type certificate is owned by a solvent business, owners do have a place to go for support. Aerostar Aircraft Corp. is holding up its end of the bargain, picking up on the task of issuing service bulletins. Some 18 have been published since the company bought the TC. All are conveniently listed on the Aerostar website. A critical one—SB600-136—describes visual inspection of the wing attach fittings. Contact the factory at 800-442-4242 or www.aerostaraircraft.com.

MODS, OWNER GROUPS

Interestingly, the factory offers the most mods for the Aerostar. These range from service bulletin kits to factory options available at the time the airplane was built, but not installed. The Machen Superstar upgrades are still available—the Aerostar factory website has a complete list—and given the low purchase price of the airplanes, many

owners may find the prices attractive. Machen, by the way, still exists as a manufacturing company, but all of its mods are provided only through the Aerostar factory.

The Aerostar Owners Association publishes a magazine and holds regional meetings that focus on safety and maintenance. Contact the Aerostar group at 918-258-2346 and www.aerostar-owners.com.

READER FEEDBACK

I have flown a lot of different planes and just finished an eight-year love affair with a Mooney, which I sold the because I needed more room as my son, at 14 years old, was passing 6 feet tall. I use a plane for my law practice, so speed and air conditioning are two things that are essential. I noticed that the prices of twin-engine planes has been depressed, so I decided to look at Barons, Cessna 414s and Aerostars.

After looking for a while, I bought my Aerostar, N702RJ, in February 2014. I have always been attracted to the Aerostar because of the pilot door, which in my opinion is the way every plane should be designed. I have yet to taxi up to a ramp where someone doesn't comment that the airplane is beautiful. I should have been prepared for that because when I went to see the plane for the first time, various people at the airport stopped by and checked out the plane. My wife—who is a nervous flyer—even likes this plane, which thrills me to no end.

My Aerostar is a 700P and one of the 25 or 26 planes manufactured in 1984 and sold by Piper. Some people call these planes a factory 700 and they are not to be confused with the other Aerostars carrying the 700 moniker—they are different planes. My 700P was the final development of the breed having incorporated much of what was learned in the earlier models. Two of the most important improvements were the relocation of the pitot tube from the vertical stabilizer to the side of the fuselage, plus the addition of a stall warning horn. My Aerostar is basically in the same configuration as delivered, save for a few important mods.

In my opinion, the best mod is the winglets. Aside from looking incredibly cool, they add considerably to slower-speed handling. I flew an Aerostar without the winglets and I could definitely tell the difference. The other major mod to my plane is its 5.5 pressurization increase—offering a 5000-foot cabin at 25,000 feet. Having a cabin capable of maintaining that pressure means that I arrive at my destination without any of the fatigue I would ordinarily get in a higher cabin altitude. The mods were done at Aerostar Aircraft and I would encourage anyone to go there if you need any service—I found its work to be impeccable.

In terms of used Aerostars, I was extraordinarily lucky because my plane had low time (only 2200 hours). The seller of the plane passed away unexpectedly and was someone that had done things right and spared no expense. The seller, lucky for me, had not been planning to sell the plane when he passed away, which meant that everything was top notch. The instrument panel had already been upgraded with a Garmin G600, GTN750 and GTN650 navigators, GTX32 transponder and GMA35 audio system—clearly state of the art. The plane was painted a few years earlier in a very modern scheme, but was still in perfect condition and the interior looked, for all practical purposes, like new. No one believes that the plane is a 1984.

I have flown the plane a lot in the few months that I have owned it. It's incredibly easy to fly if you fly by the numbers. In the last two months alone, I have put almost 150 hours on the plane and I have yet to make a landing where I needed to apologize to anyone.

In my total operating time of 200 hours, I have only had an alternator failure, which speaks pretty well for the condition of the plane. I change the oil myself, so I am pretty knowledgeable about its current maintenance. Having owned a Mooney for years, I would say that if you multiply every bill by two, you would get a fair estimate of the expense of owning a plane like this. I can tell that if this plane had been in bad condition, the cost of making it right could be prohibitive.

The most eye-opening part of owning the Aerostar is how much fuel it burns. At level cruise, with about 230 knots true, it burns about 44 GPH. I have become the best

friend of just about every 100LL-selling FBO in Texas. Kudos to Business Jet in Dallas—they are an awesome business.

I think any Aerostar owner is making a real mistake if they don't join the Aerostar Owners Association (the AOA). The AOA has a gentleman named Ken Bacon who is truly an authority on Aerostars. He is only a phone call away and always ready to help. Jim Christy, one of the owners of Aerostar Aircraft, also stands ready, willing and able to lend a hand. I don't think there is another airplane brand where you could call the factory and get the owner on the phone for a speedy consult. I can tell that Jim Christy is there to help and I enjoy talking with him.

I hired Advanced Flight Training to do my transition training. It wasn't cheap, but they came to my hangar and did a 3.5-day combination of ground school and flight training. I have done a lot of training over the years and I can definitely say that AFT has a great product. By the time I finished the 3.5-day course I was greasing the landings and could very comfortably fly and land the plane on one engine. AFT was recommended by my insurance agent at NationAir in St. Louis, Missouri. It was a great referral. My insurance is about $5000 per year for $350,000 hull value and $2 million smooth. I had about 500 hours of multi-engine time and 3500 hours of complex when I bought the Aerostar.

If you are in the market for a cabin-class pressurized twin, I think this is the plane. It's fast, good-looking and reasonably economical—for a twin.

Eric Lipper
Houston, Texas

I own a 1977 Aerostar 601P and fly it regularly (weekly at least) for business trips ranging from 250 NM to 800 NM. Most flights are fairly lightly loaded with full fuel, some are max gross with less than full fuel. I purchased the airplane after a 10-month research mission to find the fastest, most economical aircraft to fly my specific missions. Candidates were narrowed down based on full fuel payload, maintenance estimates, IFR capabilities and most important, speed.

I chose the Aerostar because it offered 225 knots true in the low flight levels at 36 GPH fuel burn. This was far a better speed/fuel combination than any other aircraft that fit into my budget. After another four months of looking, I chose N981MC.

I have since flown it about 200 hours and can offer its true performance and fuel burn as follows: I almost always will true at 230-233 knots anywhere above 17,000 feet and I burn 40 GPH doing so. Speed is very important to me, so I fly that way. I run at 26 inches MP and 2250 RPM and adjust fuel for 1550 TIT on the hottest turbo, on each engine. My particular aircraft has the Century IV autopilot/flight director, which makes light work of the approaches, often to minimums.

The aircraft is perfect for my missions and has taken many hours off my trips I had been flying in a Cessna 210. The recent annual cost a little over $4000. Maintenance has not been a big issue thus far, with the airplane mission-capable for most flights. Parts are a little tough to find, however, they are out there. The Aerostar Owners Group is a must for help in operating the aircraft as well as keeping it maintained. The only other advice I can offer to any prospective buyers out there is training, training, training. The airplane is busy and fairly complicated compared to other light twins. I strongly recommend hiring an expert to do hands-on training because most insurers will require it anyway. I will say its single-engine performance and handling is superior to most others.

David Weilert
via email

I have owned a 1976 601P/700 Ted Smith Aerostar for 19 years. Over the years, insurance for my Aerostar has varied from year to year. I have $1 million in coverage with sublimits of $100,000 per person. My hull value is $175,000. Two years ago the premium was $4500 per year. Last year it was $2900. Go figure! My advice to any prospective Aerostar owner is to carefully evaluate potential costs of insurance coverage and availability before even beginning the search for an aircraft. I have almost 4000 hours of multi-engine time and I'm ATP-rated. You can bet that anyone with lower ratings and time will pay more for insurance.

Maintenance and parts are not cheap, but high-quality parts are readily available from Aerostar Aircraft. The overall maintenance costs is pretty much the same as other cabin-class, pressurized piston twin aircraft. Typical annual inspections might cost roughly $8000, not including any unscheduled costs.

As with any aircraft maintenance, an experienced A&P mechanic is absolutely essential. Any prebuy inspection should be accomplished by an experienced Aerostar technician, even if it means traveling for the inspection.

Last September, my left engine started making metal. It had 1840 hours since overhaul and it, along with the right engine, had been in service for 25 years since the prior overhaul and a conversion to a 700-series.

The first estimate for a new cylinder overhaul was $40,000. However, after teardown, other problems were found and the crankshafts failed inspection due to cracks. I ended up buying two factory rebuilt engines through Air Power, at $58,000 each. Expensive, but the new engines were zero time and the U2A-series—designed originally for 350 HP, rather than converted from 290 HP as my original engines were.

The overhaul/replacement expense does not end with the engines. Labor to remove and reinstall the engines was approximately $10,000. Due to condition, four wastegates had to be replaced and four turbochargers had to be overhauled.

Depending on the condition, items such as hoses, engine mounts, engine rack, oil coolers and intercoolers may have to be replaced or overhauled. I would advise any potential owner to budget at least $15,000 per engine over and above the engine overhaul/purchase cost for labor and accessories.

Frankly, this estimate is at the very low end. Again, depending on condition, the cost—in addition to the engine overhaul/purchase—could easily exceed $20,000. Any potential owner must be aware of true overhaul/replacement costs if he or she is considering the purchase of an Aerostar with high-time engines.

What looks like a good deal might be a big financial surprise.

Finally, the performance. I think there are few if any stock piston twins that can outclimb or outrun an Aerostar. It is stable in turbulence and on approach, which makes for a fine IFR platform. Cruise speeds in the 15,000- to 18,000-foot altitude range average 225 to 235 TAS at 65 percent power. Range with full fuel at 65 percent power is approximately 800 NM, with IFR reserves.

The Aerostar's reputation as a difficult—or even dangerous—aircraft is nonsense. With proper recurrent training, it is a safe and reliable aircraft. I look forward to many more years of high-performance flying with my Aerostar.

Robert A. Muhlbach
via email

I have been flying since 1969 and I'm getting to be an old guy. I'm a single- and multi-engine, instrument, and commercial-rated pilot with over 6500 hours of flight experience. I was trained by Emory Wheat in 1969 through 1970 at Aldino Airport (0W3) in Churchville, Maryland, and he was my aviation mentor my whole life until his death last year. At the time, he was a charter and demo pilot, flying the Aerostar 600 for Henry Weber Aircraft—an East Coast sales center in Pennsylvania.

While moving up through the ranks as a single-engine pilot, I was able to fly right seat with Emory in the Aerostar and accumulated over 100 hours. I cut my teeth as a new single-engine pilot in a Mooney Super and then in a Mooney Executive. Next came a Piper Cherokee Six and then a Piper Saratoga, which allowed me to fly an air hearse service for my funeral business.

In 1992 I moved up to N444HM, a Smith Aerostar 600A. It was a fix-up project, but a good, solid airplane. I had the engines overhauled by Columbia Aircraft in Bloomsburg, Pennsylvania, in 1993 and had it painted by Cimarron Aircraft Painting in Oklahoma City, Oklahoma, in 1994. The paint job was excellent, but I had questions about the engine overhaul after experiencing a deer strike while landing in Ocean City, Maryland, in 1997. While having both engines torn down, we found problems with the cam shafts in both engines after only 300 hours on the overhaul. Needless to say, I would not return to Columbia, if they are still in business, for my next overhaul.

The Aerostar 600 has served me well as I basically fly around the eastern half of the United States. Henry Weber Aircraft in Lancaster, Pennsylvania, still performs my annual inspections and maintenance. I would recommend them to any Aerostar and Mooney owner. Steve, Doran and Larry at Weber's have many years of experience with both aircraft and know them inside and out.

The Aerostar is definitely a pilot's airplane and anyone transitioning up to it should seriously consider initial training by an experienced Aerostar instructor. Even after the initial training, I recommend annual refresher training as the Aerostar is a high-performance, semi-complex aircraft. I use Lester Kyle in Vero Beach, Florida, for annual training. Even after 25 years and some 2000 hours in the Aerostar, I always learn something new during each session.

Thank you for allowing me to ramble about the Aerostar. I hope something I have said will help other *Aviation Consumer* readers that are considering an Aerostar. You do a good job with the publication and I look forward to receiving it every month.

By the way, I am one of the aircraft owners that put money into Avidyne's IFD540 (that's been delayed for nearly three years now) and the IFD440 (delayed for nearly two years). So please keep readers up to date on the progress.

The latest info from my avionics shop, Lancaster Avionics in Pennsylvania (they do all of my avionics work and I recommend them) is that it now might be this fall before Avidyne is ready to ship my units. I am glad editor Larry Anglisano was able to fly with the IFD540, as we now know these radios actually exist.

Howard McComass III
Abington, Maryland

Avidyne said it expects to begin shipping the IFD540 by late July 2014 (by the time you read this), but some orders might not be filled until the fall, depending on when it was ordered.

The Aviation Consumer

Continental Diesel

(continued from page 13)

beyond. Speaking of which, with automotive quality and data tracking going into the Centurion engines, when will the TBRs increase, giving the engines the improved economics buyers are looking for?

"We had hoped to have 1800 hours by now. But we want to include some design improvements, so we're planning on 1800 hours by the end of the year," says Rhett Ross, adding that the higher TBR will apply to both the 2.0 and 2.0S models. This will substantially reset the economics for Piper's new 2.0S-powered Archer DX, announced in April.

As for gearboxes and other accessories, Ross said the goal is "half life," meaning the replaceable items would be replaced only once on the way to TBR. Continental is also exploring a factory overhaul program in lieu of replacing timed-out engines with new. It's been doing that for gearboxes for a number of years.

The company continues its integration of operating units and is trying to give customers a one-stop shopping experience that won't include the impression there's a Mobile division and a Germany division. The Germany factory, for instance, still operates under the Technify nameplate, a holdover from the Thielert days. Ross says Continental would also like to devise sales and delivery methods that would avoid the sting of Euro exchange rates, which many customers complain about.

As we were going to press this month, Continental was preparing to unveil a new 300-HP six-cylinder diesel, again based on a Mercedes design. Although I wasn't shown this at Altenburg, the engine is about to fly—probably in a Cirrus—and was scheduled to be shown in mock-up form at AirVenture in July.

Ross said Continental will soon drop the Centurion brand and refer to the engines simply as Continental diesels in the 135-, 155-, 230- and 300-HP ranges. The 230-HP version is the TD300, which Continental developed from base technology bought from SMA.

SUMMARY

Although most customers probably don't realize it, the Centurion diesels—despite some warts, such as short TBRs and high prices—represent aircraft engines manufactured to about the highest degree of quality the industry can support. Low volumes and high variability in aviation continue to frustrate both quality improvement and reduction in prices. In its Centurion diesel manufacturing, Continental has the volume problem, but the infusion of automotive technology appears to have addressed quality issues. Nor does it lack for efficient capacity.

Rhett Ross is blunt about this: "We are facing a reality, which is we have more engine capacity than the entire current and projected global market could ever command. So we have to actively modify our business model from being active manufacturers of piston aviation engines to manufacturers of piston aviation engines and other common products." That means the factory's capacity will also be devoted to other kinds of engines and products of the sort I saw on my visit.

In touring the factory and speaking with Continental executives, my conclusion is what this company most desperately lacks is what it cannot control: strong, predictable demand not just for diesel engines, but for all GA products. Piper's recently announced Archer DX (see July 2014 *Aviation Consumer*) is a start, but Continental still needs more market outlets for its engines. This remains elusive.

In 2000, diesel looked iffy, at least diesel based on automotive technology. More than a decade later, if Thielert/Continental (and Diamond) have proven anything, it's that this technology is a survivor even in the worst of business conditions. When—probably not if—the market turns upward, Continental is poised to build a bunch of them.

FEEDBACK WANTED

BONANZA 35

For the November 2014 issue of *Aviation Consumer,* our Used Aircraft Guide will be on the Beechcraft Bonanza 35 series. We want to know what it's like to own these airplanes, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your Bonanza to appear in the magazine, send us any photos 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 Beech 35 by September 1, 2014, to:

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e-mail at:
ConsumerEditor@hotmail.com