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*The consumer resource for pilots and aircraft owners*

# The Aviation Consumer®

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The Aviation Consumer

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## There's Good Stuff in the Glass

Managing editor Larry Anglisano took the accompanying photo as we were on final for runway 27 at Oshkosh. It was at 3:15 PM on Sunday, the day before the official opening of AirVenture, a time when the airport has historically been bursting at the seams with airplanes, regardless of the weather. I was astonished by the relative absence of airplanes on the right (north) side of 27.

I later learned that the overall number of visitors was consistent with previous years, and the vendors I spoke with said crowds and sales were good. Nevertheless, the aircraft parking areas told their own story through the show—there was room for a lot more airplanes. For many years, my private measure of overall general aviation health has been how full OSH gets at AirVenture.

I thought of the intro philosophy class discussion about the glass being half full versus half empty. Rather than debate esoterics, I feel that the more apt approach as to how to view our glass containing valuable general aviation essence is that of the Chicago Cubs fan: He's afraid that someone will knock the glass over. Our industry seems fragile in many ways—avgas is going away whether we like it or not, airports are under attack, costs continue to increase faster than inflation and pilot numbers are down. Yet, as I walked around Oshkosh, I saw that there were many hands doing their best not only to guard the glass but also pour in more elixir.

For the first time in many years, the crowd didn't seem to be made up almost entirely of older white guys. I saw more 20-somethings and teenagers than I was used to, more women and more of a racial cross-section. While it wasn't a big difference, it was encouraging, because the only hope of long-term survival of general aviation is to massively widen its appeal.

For years, the EAA has spoken of its welcome to visitors from other countries—who knew that it would become such a driver in selling U.S. aviation? Manufacturers and mod shops in this country tell me that a third to half of their sales are now overseas. I saw the evidence walking around at Oshkosh this year—flag pins and numerous languages spoken within my hearing.

Of course, it's not all good news. I spent time talking with some of the folks involved with getting an avgas replacement up and running. I came away of the opinion that we have at least two unleaded fuels that meet certification requirements right now. However, issues of manufacture, distribution, insurance, quality control along the distribution system and resistance by oil companies and some FAA employees mean that challenges of getting it into our tanks remain.

At the same time, the developments in the aero-diesel world seem to be coming about at an increasing pace. Will retrofit diesels offer a way to get universal aviation fuel availability and better fuel specifics than gasoline engines?

I keep hearing folks bemoaning the dearth of new products. Yet, the number of new apps or upgrades to apps that came out was eye watering. In the hardware world, the Cirrus G5 is being delivered and overall sales are up a reported 32 percent over last year. I think manufacturers are realistically looking at development costs and carefully researching markets before bringing out new hardware. For example, PS Engineering introduced its PAR200, a certified comm radio with built-in audio panel, for under $3000; the Skycraft SD-1, single-place, Light Sport airplane priced at $50,000 made its appearance; the Terrafugia flew and I'm looking forward to Avidyne's slide-in replacements for the Garmin GNS 430 and GNS 530.

I left Oshkosh not caring whether the glass is half full, half empty or how big it is. What matters is that there's good stuff in it. Yes, there are plenty of threats surrounding it, but there are determined people fighting for it—and we'll keep reporting objectively on all of it. *–Rick Durden*

## Piper Warrior

Thank you for the in-depth article on the Piper Warrior (August 2013 *Aviation Consumer*). I've owned mine for nearly 20 years and have long felt like it was the Rodney Dangerfield of airplanes. Your article did a great job of publicly destroying that image by bringing out the capabilities and flexibility of the Warrior.

I've flown mine all over the country, on and off of all types of airports and runway surfaces—paved, grass and dirt, and while I'm cautious about density altitude and recognize that the bird isn't going to set any speed records, it's reliable and I know I'll get where I'm going.

The ability to easily open up the entire side of the cowling during preflight on my Warrior paid for itself the time I opened it and found a bird's nest. It was tucked back where I could not have seen it in an Archer or a Skyhawk because those cowlings don't open easily for preflight. For me, it was just a matter of removing all of the nest, a five-minute job; in another type of airplane, where I hadn't been able to see it, there would have been a fire.

Thank you again for a good article about one of the little guys in aviation.

David Lewis
Via email

## Avidyne Indemnity

Avidyne is not the only company playing the indemnity game (August issue). A few charter operators and even a fractional program have a boilerplate that shifts the burden of lawsuits by the customer's guest to the customer to the extent that the loss is not insured or exceeds the limits of insurance.

Such shenanigans are indicative of a company that does not buy adequate insurance. If the guest indemnity is not deleted, my clients take their business elsewhere.

Dan Herr
Via email

## Aircraft Finance

In your article on aircraft finance in the August issue, you mentioned that you had problems with the ethics of the nonprofit AOPA competing with aviation businesses. I share your concern, particularly now that it has gone into business directly against long-established aircraft finance brokers.

I've worked with reputable aircraft finance brokers for many years. They are in a technical business that relies a great deal on personal relationships and integrity demonstrated over time. Having AOPA step into the business will not benefit its members or the aircraft finance business.

Because of AOPA's decision to compete directly with established aviation businesses, I cannot look to it for unbiased advice on aviation matters because it is pushing its own products. That's simply not right, and it's why I am not an AOPA member.

Ross Wilhelm
Via email

## Engine Shop Survey

The grievances expressed toward The New Firewall Forward by one of the respondents to the *Aviation Consumer's* engine shop survey (July 2013) were not entirely factual, and they were over two years old. Also, there were circumstances that weren't made public by the survey.

For example, the customer who said he paid $27,000—and was promised a refund—actually only paid $19,692.15, which didn't include cylinders. His engine received a complete bottom-end overhaul for the price he paid. The customer complained about not getting Superior cylinders. He was quoted new TCM cylinders because TCM is, historically, the only manufacturer of cylinders for the particular Continental 360-series engine on his aircraft.

This customer was accurate in his time frame statements, but some of that time was spent finding parts that he did not include when he sent his engine to us. Further, much of the downtime was the result of us waiting for FAA approval to get his specific engine added to our repair station license. The survey didn't address the high quality of our engines or the expertise that each of our technicians put into each engine.

The New Firewall Forward is one of the survivors of the recent recession. Many notable and sizable companies in the engine overhaul business did not survive the downturn of the aviation industry. One of the common practices in this type of business was to apply current deposits to past bills. As a result, many businesses got too far behind.

The New Firewall Forward has now adopted a policy of setting aside all deposits and specifically earmarking each dollar for the depositor's engine. This practice eliminates the possibility of getting behind and assures the customer that his or her engine will be done on time, using their dollars.

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*At its Fairhope, Alabama, facility, left, Continental Motors is finishing work on its TD300 diesel. It will focus on both OEM and STC conversion markets.*

JET A ENGINE TECHNOLOGY

# Continental Thielert Buy: Aiming for Dominance

*Rather than developing its own diesels, Continental Motors' purchase of Thielert and its tweaking of SMA's base engine makes it a major global Jet A player.*

*by Paul Bertorelli*

If Continental Motors ever had any doubts about the aero-diesel market, it erased them in July with the stroke of a pen with the company's acquisition of the bankrupt assets of Thielert aircraft Engines GmbH. Despite a rocky ending for Thielert culminating in the jailing of its founder, Thielert (and Diamond) put aircraft diesels on the map during the last decade. With its own in-house Jet A TD300 and the addition of Thielert, Continental instantly becomes the market volume leader in aircraft diesel.

The Thielert buy gives Continental four diesel products—the 135-HP and 155-HP Centurions, the 230-HP TD300 and the certified but not-yet-produced 350-HP eight-cylinder Thielert-developed Centurion. Continental and its Chinese parent, AVIC International, also inherit an installed base of some 1800 engines from a company that has manufactured about 3500 engines in total.

When we visited Continental's factory in Mobile, Alabama, we were told that it intends to integrate the Thielert assets under a common Continental umbrella with unified sales and customer service. The Thielert name will be dropped and the engines will be marketed under the model name Centurion. The main manufacturing plant will remain where it is now, in Lichtenstein, Germany, with service centers to be added all over the world, including the U.S. and China. In Germany, the operating unit will be called Technify GmbH.

*Overnight, Continental becomes the only engine company with diesels across three essential power ranges.*

In parallel, by mid-summer 2013, Continental was rounding out development on the TD300 and tooling the factory to produce it, although there are no promises on delivery dates. The intro TD300 will get another development round to increase the TD300's critical altitude with an improved turbocharger.

## GLOBAL VIEW

Continental CEO Rhett Ross is characteristically blunt in describing why the Thielert acquisition made sense: "We have just got to get out from under the U.S. market as the driver for us," Ross said, chiefly because with no unleaded 100-octane replacement in sight, U.S. market growth is flat and global growth is likely to be nonexistent in gasoline engines. When it announced its own diesel project in 2010 relying on base technology acquired from the France-based SMA, Continental said it wanted multiple solutions to accommodate both a global and a U.S. market that steadfastly refuses to decide on fuel preferences in a world market that already has: Jet A and mogas.

Continental now has more engines to match more fuel choices than any other manufacturer and across more horsepower ranges, even if some of those choices aren't yet developmentally mature.

In Thielert, Continental is getting a proven engine line, albeit one with minor warts in need of treatment, a healthy installed base, but customer service that some owners have called mediocre at best, although it has improved in recent years.

Thielert's relationship with its initial benefactor customer, Diamond Aircraft, grew so strained that Diamond CEO Christian Dries started his own company—Austro—to make diesel engines for Diamond

airplanes. In addition to Diamond's initially hot-selling DA42 twin, Thielert made its mark just as the UAV market was emerging and its engines are still found on drones, including the General Atomics Warrior.

That business financed and sustained a modern, state-of-the-art factory in Lichtenstein, Saxony, with a typically well-trained European workforce. Profitable though it may be, Continental will lose the General Atomics military business because of security issues related to its Chinese parent. "That leaves us with a hole we'll have to fill. We think the civil market is strong enough to do that," Ross says.

Off to a good start in 2004, Thielert ran into trouble in 2008 after a spate of maintenance issues with its engines gutted its finances because of an over-promised and ill-planned warranty program. Bankruptcy followed, leading eventually to an indictment of company founder Frank Thielert for allegedly systematically deceiving investors when the company went public. In June 2013, a German judge jailed Thielert as a flight risk during his trial.

Continental and the industry it serves is well aware of how the Thielert affair tarnished both the company and aerodiesels, thus the new company will be scrubbed of any identification with Thielert. Ross believes the Centurion nameplate wasn't besmirched by the Thielert name, thus it will be retained.

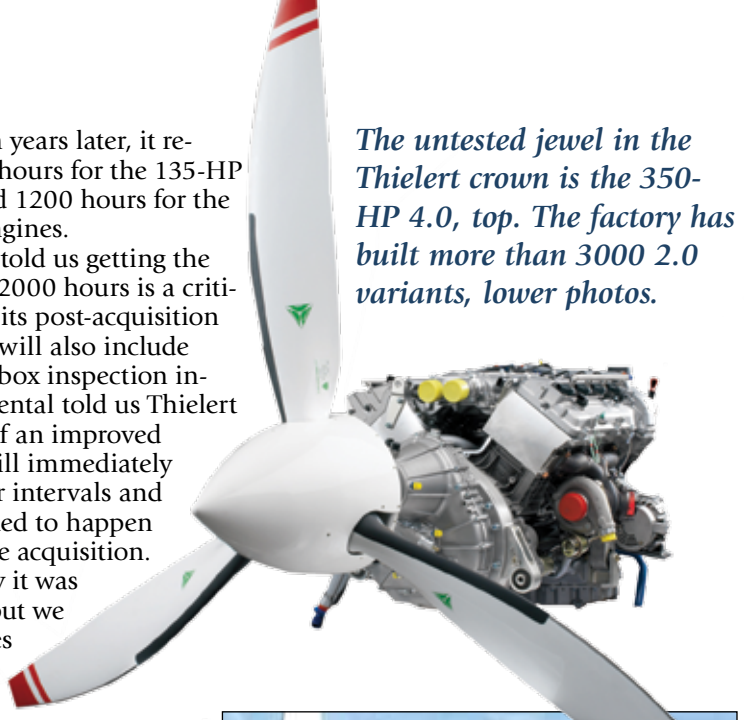
The larger issue is that the Thielert has been stewing in bankruptcy since 2008 with developmental energies that are unsurprisingly moribund.

## ENGINE FIXES

Many customers caught in the 2007 and 2008 Thielert meltdown felt stranded by both Thielert and Diamond. Thielert eventually solved some of the Centurion's shortcomings and, to its credit, it never stopped shipping parts, although it raised prices to what some customers considered usurious levels. The bankruptcy halted development toward a higher TBO and ridding the engine of disruptive gearbox inspections every 300 hours. When we interviewed Frank Thielert in 2005, a 2400-hour TBR—time between replacement—was promised by 2006, yet seven years later, it remains at 1500 hours for the 135-HP 2.0 engines and 1200 hours for the 155-HP 2.0s engines.

Continental told us getting the TBR to at least 2000 hours is a critical first step in its post-acquisition plans and that will also include increasing gearbox inspection intervals. Continental told us Thielert has on the shelf an improved gearbox that will immediately allow 600-hour intervals and this was expected to happen shortly after the acquisition. It's unclear why it was never fielded, but we suspect it relates to the company's bankruptcy stasis.

*The untested jewel in the Thielert crown is the 350-HP 4.0, top. The factory has built more than 3000 2.0 variants, lower photos.*



Increasing TBRs will be a taller hill to scale, but will be central to the competitive position of these engines. Our past surveys of owners suggest that thanks to diesel efficiency, even at the lower TBRs and allowing for repetitive gearbox inspections and high replacement costs, the Centurion 2.0 has eked out operating costs equal to or a little less than near-equivalent gasoline engines. Continental thinks the Centurion line is positioned to improve this, if it can reach higher TBRs and improve the gearbox.

As press time, Continental had not announced engine or TBR prices, but we're told to expect that data soon.

## HOMEGROWN TD300

As Continental was closing the Thielert purchase, it was also busy completing work on what will be the mid-power option in its diesel line—the 230-HP TD300. In 2009, Continental purchased from SMA the rights to use the SMA SR305 as a technology base for its own version. Last December, Continental certified the TD300, which addresses the original engine's shortcomings, specifically its unnerving tendency to quit when reduced to flight idle—especially in cold weather—and turbocharger limitations that hobble its altitude performance. Actually, as of July, the turbocharger improvements were still in the works, but these are expected to appear when the engine reaches the final production version. Continental declined to mark a calendar date for that, however. As aerodiesels go, the SMA engine qualifies as a genuine graybeard, having first appeared in the U.S. in 1998. It's a four-cycle, four-cylinder engine cooled by air and oil with Bosch-type inline pump injection and minimal electronic intervention. (A limited authority controller provides throttle-by-wire control of

# FACTORY: SHRINKING TO GROW

The first time I visited Continental Motors was about 1993—20 years ago. A colleague advised me to take a flashlight and he was right. In those days, the factory was a hot, dark cave straight out the 1940s, with row upon rank of discrete, hand-operated machinery for batch making of engine parts.

Twenty years later, few of those machines are still there and while the factory isn't exactly a gleaming clean room, it is well lighted and even air conditioned. It also resides in much smaller factory floorspace. Consistent with a general trend in manufacturing, Continental has made ongoing investments in modern CNC machining centers that are capable of dozens of different machining operations with greater repeatability and accuracy, displacing older machinery that had occasional trouble with both.

As Continental integrates production of the new TD300 into the Mobile plant, this kind of technology—and the continuing investment—should allow the diesel to flow through the production line seamlessly, sandwiched between gasoline engine parts production as customer demand warrants.

Martin Lee, Continental's senior manufacturing engineer, says that the plant is about $6 million into an $18 million capital improvement program that was actually started before AVIC International bought the company from Teledyne in 2011.

As volume in the aircraft engine business has declined, Continental has faced the daunting challenge of quality control in a low-volume, high-product-mix business. That requires frequent machine changeovers for batch production which, in addition to being expensive, presents the opportunity for errors of the sort that result in recalls and ADs. (That happened in 1999 with Continental crankshafts.)

On a plant tour, I was shown a pair of new Mori Seiki machining centers that form the core of the factory's new cam line. The economic impact just these two machines have on production is eye opening.

"It gives us more flexibility and faster changeovers," Lee explains. "When we're all said and done, it will take 10 days out of the total machining cycle for cams. It used to be 25 days with six to 12 hours for changeover;` now it's 15 days and 10 minutes."

In walking the plant and with the exception of cylinders, you don't see carts and bins full of parts, or at least you shouldn't. The idea is that flexible, fast-change machining allows the plant to build to demand, rather than storing large inventories. "In the past, we might have kept 200 cams in inventory. It required tribal knowledge to know when to run another batch, so if the customer called for a cam, sometimes we wouldn't have it," says Mike Gifford, director of factory services. Flexible machining, says Gifford, lowers inventory and shortens lead time to deliver finished parts.

The company also expanded another machining line used for crankcases that advances another trend made possible by flexible CNC: in-sourcing. "We've taken the four-cylinder crankcases, the 200 and 240, back in house," says Lee. That sets the stage for automated crankcase production on the TD300 diesel when demand materializes.

During my visit, I saw an assembly cell—again, flexible for expansion—with a unique visual method of assembling engines from trays as a means of quality control. Mike Gifford says that TD300 components are almost entirely out-sourced for now, but some will likely be brought inside when TD300 production ramps up. *—Paul Bertorelli*

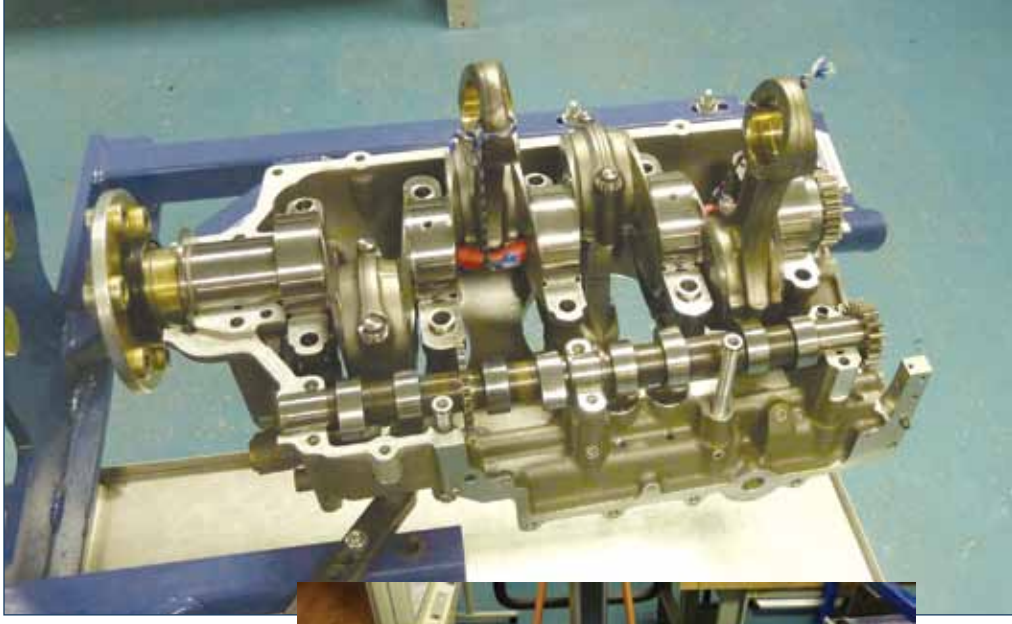
the fuel rack.) Although SMA flogged the SR305 at shows for years, it never did much to promote its engine other than limited STCs for Cessna 182 conversions. Only last summer did SMA finally land an OEM for the engine, Cessna, which is using an improved version called the SR305-230E in its new JTA Cessna 182.

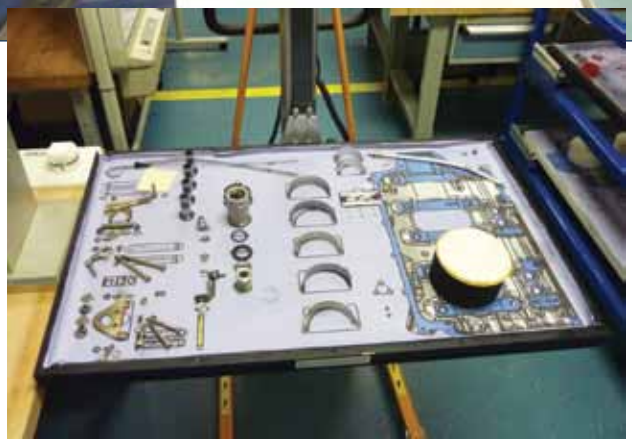
Given the inherent operational simplicity of diesels, it's no surprise that Continental came up with similar improvements to its version of the SMA base. Specifically, the engine couldn't maintain enough combustion heat to remain alight at low power settings and thus had a limitation requiring high throttle settings on approach. That translated into higher approach speeds than are ideal for a Cessna 182.

Continental addressed this with a series of tweaks, according to James Ray, the company's lead engineer on the project. New pistons increase the compression ratio to 17 to 1 from 15 to 1 and a new intake manifold improves the engine's breathing. Mechanically, Continental retained the SMA base, but added improved through-case bolts, critical structural components in both versions of the engine. Ray said Continental's tests indicated the original bolts were suffering from plastic deformation, so it increased the material yield strength and diameter.

One shortcoming remains on Continental's plate: an improved turbocharger. Although it's a good, economical performer at low altitude, SMA originally spec'd a turbo that lacked sufficient pressure ratio, so the engine's critical altitude was essentially sea level and its service ceiling was limited to 12,500 feet—anemic for a turbocharged engine.

In the SR305-230E for Cessna, SMA addressed this with a new turbocharger and Continental plans to do the same, although they're not there yet. For certification expediency, the version of the TD300 we examined in a Cessna 182 at Mobile in July is designated the B model. But the market introduction version will be the TD300C. It will have an





*The TD300's internals look like a gasoline engine, but they're far more robust, with five rather than three main bearings. Bottom photo compares diesel rod and piston to a gasoline version. For quality control, assembly will be aided by a visual parts tray, center.*

improved turbocharger, a critical altitude of 10,000 feet and a service ceiling of 20,000 feet. In our view, that makes it a considerably more competitive engine.

Continental considers the TD300 mature enough to commit to production and when we visited Mobile, it was doing just that. Assembly cells were being designed and tested in anticipation of a type production certificate. (See sidebar at left for more.)

Continental's Mike Gifford estimates the TD300 will sell for $85,000 to $95,000, with a TBR price of about 80 percent of that. The company hasn't yet decided if it will market the TD300 with a TBR, meaning replacement or remanufacture, or a traditional TBO. Either way, initial remanufacture or overhaul will be done by the factory.

## MARKET AIMS

In just three years between 2005 and early 2008, Diamond, using Thielert engines that hadn't yet revealed their foibles, proved a viable diesel market, selling nearly 500 DA42 diesel twins plus some diesel DA40 Star models, mostly in the European market.

Although the aircraft market was stronger then than now, even Diamond was surprised by the uptake. But it didn't last. The toxic combination of a world recession and Thielert's bankruptcy tanked diesel sales, even if a trickle persisted. Undaunted by the Thielert fiasco, Diamond remained bullish enough to launch its own subsidiary, Austro, to build diesel engines for its aircraft.

Continental seems equally bullish on diesel and somewhat wary of the gasoline engine market, at least in the U.S., where a future replacement for 100LL remains perpetually over the horizon. Continental still has a strong market in avgas manufacture and parts and Rhett Ross says it remains committed to sustaining that for both OEMs and end users.

But it also considers itself a global player and for Europe, Asia and Africa, that means diesel. When we asked Continental's VP for sales, Johnny Doo, for his estimate of diesel market penetration, he said it could be 25 percent by 2018. At current world production rates, that would be about 500 aircraft a year or, if the market expands by a third, as many as 650.

We're not sure if this is realistic or not, but Diamond, on its own, managed to gain about 4 percent marketshare in a mere four years before the economy skidded at a time when diesel wasn't accepted at all. With Cessna now in the diesel market, can Cirrus, Piper and others be far behind? Continental says it will maintain a dual focus on OEM and conversion markets, channeling through third-party STC houses. The U.S. market for diesel—OEM or conversion—remains uncertain and will be driven by fuel costs and worries about availability. In Europe, Asia and Africa, availability is increasingly the only driver: avgas just isn't to be found and regardless of what happens in the U.S., 100-octane's future in the emerging markets is bleak.

"Emerging market," by the way, has evolved into a euphemism for one place: China. "The way I see it," says Continental's Doo, "the one place that doesn't have many airplanes today is China. That market may not be tomorrow, but it may not be far away."

It looks like Continental is counting on that and it thinks it now has four engines to fill any conceivable market demand.

# EI's CGR-30P: Cluster Replacement

*Electronics International's space-saving, all-in-one engine monitor has a smart feature set and a price tag for lower budgets.*

*by Larry Anglisano*

Aside from requiring a complex installation, large screen engine monitors eat a lot of panel space. This often means having to relocate instruments and even building a new panel to accommodate the big screen.

Oregon-based Electronics International set out to tame that dragon when they designed the new CGR-30P—a primary monitor that fits a standard 3-inch instrument cutout. The idea here is to remove the existing tachometer (the system is approved to replace it) and use the blank cutout it leaves behind.

We looked at the certified CGR-30P at this year's AirVenture and were impressed by its simple feature set, sharp display and impressive low price.

## CHAMELEON INSTRUMENT

That's what Electronics International calls the CGR-30P because you can customize the data on the screens to show a variety of engine functions. Unlike other systems that display all parameters on a single screen, the CGR uses a total of four screens—much like a multifunction display.

The CGR is mounted from behind the instrument panel and measures 3.25 inches wide, 3.25 inches high and 4.36 inches deep. Unlike other models, the CGR won't overhang surrounding instruments because it mounts flush to the surface of the instrument panel.

Moreover, CGR stands for cluster gauge replacement because the unit can replace multiple primary instruments under its TSO approval. This includes the tachometer, manifold pressure, fuel flow, fuel quantity and a host of other primary functions. For aircraft with a round engine cluster gauge, the CGR is the perfect form factor for replacing it.

The color display is backlit for night operations and has a good side viewing angle. We didn't evaluate the unit in direct sunlight, but like most color displays, we suggest mounting the unit as close to eye level as possible.


*A total of seven different engine parameters are displayed on the CGR-30P main screen. The extent of the panel work during installation is simply dropping the flush-mounted control head into an existing 3-inch instrument hole.*

**CHECKLIST**

- ⊕ Flush, 3-inch instrument design makes for easy panel installs.
- ⊕ 4-cylinder packages are bargain-priced at under $4000.
- ⊖ Fuel level interface requires sizable effort to obtain accuracy.

## MAIN SCREEN

The unit replaces up to seven primary engine gauges and up to five secondary or non-limited gauges, including all EGTs and CHTs. RPM, EGT and CHT are all default functions, and the user can pick and choose other primary and secondary gauges they wish to add to the product before it ships from the factory.

The main page of the CGR displays engine manifold pressure and RPM, which is displayed side by side in both a numerical and graphical presentation, plus four other configurable primary functions. ECI told us most users select fuel flow as one of the other primary parameters. From there, you can add oil temperature, oil pressure and bus voltage, for example. These functions are approved for replacing primary instruments. For engines that don't have a manifold pressure gauge, the data field can be customized to display fuel flow, for example.

The lower half of the main page displays EGT and CHT in the familiar bar graph presentation. The CGR borrows some logic from the company's MVP-50 monitor—showing engine parameters via digital tape sliders or graphically.

There's a normalized mode for general health monitoring, a lean


SEVEN-FUNCTION MAIN SCREEN

SCREEN SELECT KEY

MENU SELECT KNOB

EXIT KEY

FLUSH BEZEL


*The GPS data screen, above, is configurable for up to six fuel and GPS-related parameters.*


*The fuel quantity screen displays the estimated fuel remaining for each tank, above.*


*The secondary screen, above, annunciates main page alerts while displaying six additional engine monitoring functions.*

mode for operating rich or lean of peak, plus an EGT and CHT graphical display. This is a bird's-eye digital pictorial of the engine with proper orientation of each EGT and CHT channel and includes the temperature of each.

The user can configure the unit to automatically scan each channel, display the hottest channel, or manually select each cylinder EGT or CHT value. You can also display the difference in temperature between the hottest EGT/CHT and the rest of the monitored channels.

The CGR utilizes only three user controls for simplicity. The 'E' key backs out of a screen and ultimately takes you back to the primary screen, the 'S' key advances through each screen, and the center menu select knob is used for editing and configuring data. Where other engine monitors might increase workload, we think EI did a good job of keeping workload at a minimum, thanks to a straightforward feature set. We also think the data is presented in a logical manner. Despite the compact screen, the data doesn't seem crowded.

## EXPANSION GALORE

Think of the secondary screen as an overflow for displaying additional data (the secondary display still shows RPM and manifold pressure). For example, the fourth primary engine parameter is displayed on this page, in addition to five non-primary instruments. You can select bus voltage, outside air temperature, flight timer and so on. This is also where caution warnings are displayed, should any function on the main screen become flagged.

Speaking of caution warnings, the CGR can annunciate a wide variety of alerts from external systems. Any temperature or resistive fuel level input channel on the EDC may be used to monitor the state of a switch, relay or output from a remote device. This output can be used to trigger an onscreen annunciator on the CGR display. This includes warning lights for a canopy latch, baggage door, pitot heat or other systems you want to monitor on the CGR's main or system screen. The CO Guardian remote-mounted CO detector can be displayed on the screen.



*The CGR-30P display, bottom, is designed as a replacement for the mechanical tachometer, manifold pressure and fuel gauges, top photo. While these factory gauges are often placed in the lower subpanel, your shop might need to find an alternate location that's in your direct field of view.*

The CGR can be interfaced with the AP-17V LED annunciator panel. The system includes a remote control box that drives various warning lamps. It has a list price of $195—likely cheaper than the labor it might take to install separate lamps on the panel.

If visual warnings aren't enough, the CGR can interface with the Electronics International AV-17 voice annunciation system. This remote system provides up to 17 verbal warnings through the headphones via the aircraft's audio panel or intercom.

The AV-14 is a compact control box that's connected to a panel-mounted remote switch. When a monitored alarm is triggered, the voice annunciator chimes and a female voice announcing phrases such as "check oil pressure." The AV-14 is compatible with a variety of remote systems, including landing gear, airspeed sensors and gyro vacuum systems, to name a few. The AV-14 is a $285 option and is compatible with most audio panels.

## FUEL COMPUTING

We think any fuel computer installation is incomplete without a connection to a GPS navigator. A GPS interface provides point-to-point fuel endurance for active flight plans and direct-to navigation waypoints. The CGR excels at this integration—offering a healthy level of automation on a dedicated GPS data screen. The unit interfaces with most panel GPS systems with serial data.

The CGR-30P is certified for displaying fuel flow plus primary fuel quantity. It can be ordered in a configuration to monitor up to four fuel tanks, including auxiliary tanks.

The unit is smart enough to know which fuel tank you are drawing from and can estimate how much fuel is remaining in each. A graphical onscreen fuel can depicts the total fuel remaining in all tanks.

We're impressed at the simple and thorough approach the CGR takes when monitoring fuel endurance. For example, on the fuel page you can scroll through fuel flow plus estimated distance/range based on the active flight plan or waypoint that's in the connected GPS.

Aside from fuel flow, there's an estimated quantity remaining when you arrive at your destination the fuel required to reach your destination, and the available reserve at the destination. There's total fuel used for the flight, fuel used since you last refueled and the current fuel economy. While this may seem like rudimentary fuel computer functionality, EI presents the data in a format that's easy to read at a glance.

An important note about fuel quantity

**TV CGR-30P VIDEO**

AVweb
www.avweb.com

interfacing with this system and any other: Older resistive fuel level senders are known to create inaccuracy that might require replacement or overhaul and calibration. That's because fuel sensors can become intermittent and change resistance with age.

Further, if the CGR has not been properly calibrated, it will not display accurate fuel levels. The fuel level calibration process can be tedious and will likely require flight testing. The drill is to go flying and perform the calibration with the aircraft in a cruise angle of attack, and then continue testing for accuracy at different angles of attack. We've heard from several owners of other systems who struggle with inaccurate fuel level measurements because the installer cut corners during the installation and calibration process. We suggest working with a shop that has experience in this area.

## PRICED PER ENGINE

The CGR30-P is fully certified and TSO'd. Since the CGR-30P is so customizable, pricing will vary based on options.

The entry-level package for 4-cylinder engines, which includes RPM, EGT, CHT, fuel flow and bus voltage, has a list price of $3596. Add the fuel flow and fuel quantity option, and the price jumps to $4217. The basic 6-cylinder package starts at $4342. The same 6-cylinder system with fuel flow and fuel quantity is $4714.

Based on 25 hours of installation effort (at an average of $100 per hour), total costs could easily come in below $9000. Of course, dealing with fuel senders and other variables can vary the bottom line.

Since the unit shouldn't require any cutting of the instrument panel or in many cases the relocation of other instruments, we suspect the CGR could save nearly $1000 compared to other units. When we looked at the unit this past July at AirVenture, it was backordered for several months.

EIectronics International still offers the MVP-50. This is a big-screen monitor that has a starting price of $5995 for 4-cylinder engines.

We'll look at the big-screen engine monitor market in a future issue. Contact Electronics International at www.Buy-Ei.com, 541-318-6060.

## INSTALLATION: NOT A SLAP AND GO

**While the CGR-30 hardware is designed for simplicity, don't expect a simple installation. That's because engine monitor installs require substantial teardown and interfacing, especially when connecting to the aircraft fuel system. The CGR monitor installation consists of four major components: the CGR display, the engine data converter (EDC-33P), the probes, transducers and modules, plus the wiring harnesses and extension cables. That's a lot of hardware, but Electronics International designed the system to help streamline the process, which includes a converter hub that connects the engine sensors to the display.**

**The engine data converter transfers and converts all of the engine and aircraft system sensor signals into serial data. This data is then transmitted to the CGR display via a one-wire 5-volt serial data bus. Up to two EDCs can be connected to the CGR display. The EDC measures 4.5 inches long, 3.5 inches wide and 2.2 inches high and is mounted on the cockpit side of the firewall or in an avionics bay. Electronics International says the EDC reduces the wire bundle to the instrument panel by over 100 wires—this greatly reduces clutter. There are three 37-pin D-sub connectors that interface the EDC to the various probes, transducers and modules. The wire harnesses for the EDC and CGR are pre-wired and are included in the standard installation kit.**

**Electronics International's Tyler Speed estimates that a basic installation can be accomplished in 15-20 hours, which we think is optimistic. For many aircraft, the task of accessing the GPS to connect the fuel computing wiring will be a job in itself, depending on how much of the radio stack needs to be removed.**

**It's up to the installer to ensure the instrument is installed in a proper location on the instrument panel, using FAA Advisory Circular 23.1311 as a reference. It recommends that a powerplant instrument be installed within a distance of 21 inches from the pilot's visual centerline to the center of the instrument. Further, if the instrument cannot be installed within 8 inches of the pilot's visual centerline, AC 23.1311 recommends that master caution and warning lights be installed. This obviously adds more panel work and additional wiring effort.**

**Last, the CGR was designed for streamlined calibration and setup. Much of the setup for the certified CGR is done at the factory and cannot be changed by the pilot or installer. This could save sizable amounts of time once the system is installed in the aircraft. This could shave as much as a day's worth of effort from a project.**

# BRS Parachute Retrofits: A Cost-Benefit Analysis

*Full-airplane parachute systems are becoming increasingly available as add-on mods. Here's a pragmatic look at the costs and benefits of the install.*

*by Rick Durden*

**CHECKLIST**

- Nearly 300 lives saved by BRS deployment is a number to be respected.
- BRS reduces the risk of ops at night, in IMC and over rugged terrain.
- Price and weight make risk-reward decision very personal.

Weight kept the whole-airplane parachute idea in the world of fantasy for the first 70 years of powered flight. It took a terrifying ride to earth aboard a broken hang glider and new materials technology to allow Boris Popov to found Ballistic Recovery Systems and develop a viable arrangement that could successfully deploy a parachute and lower an aircraft and its occupants to earth. BRS products (BRS, as "Systems," is the company; as "System," is the device) began saving lives in the ultralight world and expended successfully into FAR 23 airplanes with the Cirrus line and a retrofit for the Cessna 150/152. The number of lives saved as a result of BRS deployment is approaching 300, according to BRS company numbers. (Our research shows 48 deployments, of which 36 were "saves," with 76 lives saved in Cirrus aircraft—most, but not all, of the other saves were in ultralights.)

While everyone knows about the ballistic parachute included as standard equipment in a Cirrus, it's not as well recognized that owners of some LSAs and Cessna 172s and 182s can have a BRS retrofitted into their airplanes for under $19,000. We looked into the why, how and how much for a BRS retrofit.


*BRS canister and rocket take up about half the baggage compartment of a Cessna 182 (left). Activation handle is aft of the fuel selector (above).*

## COST-BENEFIT

We found that the cost-benefit analysis for the BRS mod decision is not easy—and it's definitely not a pure evaluation of dollars and weight. It is heavily affected by personal risk analysis and the type of flying an owner does. The installation of the system is less invasive than we thought.

The jury is still out when it comes to fully evaluating the "how much does it cost" question because there is no hard data on how the system affects the value of the airplane—plus the BRS has to be repacked periodically.

Further, the success rate for deployments for skydiver reserve parachutes is 98 percent; the BRS does not approach that rate, although a number of the failures were because the airplanes were too low.

## WHY?

The "why" question is a matter of personal and family risk assessment. Viewed objectively, the idea of being able to pull a handle to avoid a fatal crash seems to be a no-brainer. Yet, for a pilot to admit he or she can't handle a situation in flight and must bail out, somehow sticks in the craw of those who have not had formal training in when to eject.

In his book, *The Right Stuff*, author Tom Wolfe describes the actions of the best test pilots when something goes horribly wrong during a test flight. On the radio they calmly describe what's going on, list the corrective actions they've taken, say that none worked and demand to know what else they can do. "I've tried A. I've tried B. I've tried C. I've tried D. Give me something else to try."

A ballistic parachute gives those with the right stuff something else to try. More than 20 years of experience shows that the BRS usually—but not always—works.

During our conversation with Derek Kuefler of BRS, he told us that he'd seen two primary drivers for BRS retrofits: terrain and grand-

kids. The owner was routinely flying over mountains, large areas of water and/or at night—or was becoming a grandparent. Little faces in the airplane affect a person's risk/benefit equation.

Chris Garner of Sierra Hotel Aero of South St. Paul, Minnesota, who has done the majority of BRS retrofit installations on Cessnas, added two more reasons: successful businesspeople who wanted to continue to fly on business and found that their insurers would only insure the businesses if they installed parachutes in their airplanes, and spouses who would only ride along once the additional level of safety was installed.

## WHAT ARE THE RISKS?

So what are the risks that may be effectively mitigated by a BRS retrofit? Years of Nall Reports show that the high fatal accident risks are: VFR into IMC and something going wrong when in IMC or at night. Tangling with a thunderstorm also has a poor return. A full-airplane parachute may save lives in all of those scenarios.

A little further down the list of fatality risks are engine stoppages for any reason—survivability is dependent on a lot of factors outside the pilot's control, notably terrain and whether it happens at night. A BRS will turn many of those from a high risk of death to survivable.

Maneuvering accidents are always up there in the frequency and rate-of-fatality column. If it's a blown buzz job, a parachute won't help—but the more common stall/spin event could well have a happier outcome with BRS deployment.

Mid-airs are well-publicized but rare, and fewer than half are fatal. Nevertheless, owners spend a lot of money for traffic alerting systems, and the chance of surviving a mid-air goes up if a BRS is installed and used.

## SPACE

A final consideration is that the BRS canister takes up space. It occupies a little less than half of the baggage compartment of a 172 or 182. Unless an owner regularly carries bulky stuff, the fact is that at least one of the rear seats is probably going to be available to tie down baggage.

## ONE PULL

There has been one "pull" in a BRS-retrofitted Cessna. It suffered engine stoppage at about 400 feet up on takeoff. Rather than risking an attempt to return to the airport or stuff the airplane into the trees around the airport, the pilot made the BRS pull. He'd given up about 100 feet before he pulled the handle, however, the chute opened successfully, the airplane descended level into the trees and the pilot walked away.

We have little respect for the "keyboard warriors" (we like Derek Kuefler's phrase) who light up the Internet with Monday-morning quarterbacking following a successful BRS "pull." They weren't at the point of the arrow. The pilot who was made a decision regarding a specific situa-

## HOW MUCH DOES ALL THIS WEIGH?

A major player in the cost-benefit analysis for a BRS retrofit is weight—85 pounds for a Cessna 182, 79 for a 172 and between 28 and 33 pounds for an LSA such as a Skycatcher, Sport Cruiser or Flight Design CT series. We were advised that in the 10 years Sierra Hotel Aero has been doing BRS retrofits, the majority have been in Cessna 182s.


Looking solely at the weight variable, that makes a great deal of sense. A 172 generally has a full-fuel payload in the 600-pound range, while a 182 may be anywhere from 700 to 900 pounds. Taking away 85 pounds from a 182 is no big deal, while subtracting 79 pounds from a 172's useful load means doing a little more thinking before buying. For an LSA, the fact that the BRS may only weigh 30 pounds still requires some consideration when payload with full fuel may be only 300 pounds. That's similar to a Cessna 150/152 and the demand for BRS retrofits for those proved minimal.

We note that various studies over the years have shown that four-place airplanes are rarely flown with four people aboard; most of the time there are only one or two in the cabin. When looking at the real-life load, giving up 79 or 85 pounds in a 172 or 182 won't limit the utility of the airplane that much, and it may provide a significant extra margin of safety and peace of mind, especially when looking down on the Rockies. At night.

*Forward Kevlar parachute risers attach to the forward wing spar of a Cessna through the top of the wing (right, above) and then are routed together toward the aft cabin window and enclosed in a fairing on the top of the fuselage (right).*

*BRS canister and rocket during installation.*

tion and pulled—that decision meant everyone aboard survived.

Okay, you've decided to install the mod—how do you do it and what gets done to your airplane? Step one is to contact BRS to arrange to purchase the system. Their pricing has held steady for over a year: A 172 kit is $13,499; for a 182, the cost is $14,999. LSA kits range from $4599 to $6899. Your shop can do the installation, but the chances are you'll be paying for its learning curve. We suggest going to a shop that's done it before.

## INSTALLATION

Chris Gardner of Sierra Hotel Aero worked with BRS on the original certification of the 182 system. He explained that his first discussion with the owner involves finding out the year of the airplane (it has to be one with electric flaps because the activation handle goes on the floor just aft of the fuel selector), whether it has rear seat shoulder harnesses installed and what antennas it has on the top of the cabin.

It is common to need to move at least one antenna, and the reinforcing bar installed across the baggage compartment becomes a new shoulder harness mount. In general, the newer the airplane, the less costly the installation. Gardner recently did a BRS retrofit on a new-from-the-factory 182 for $3600, which included moving antennas. Although the installation is not terribly invasive, older airplanes may have issues that appear once they are opened up.

The parachute has Kevlar risers that attach to the airplane structure at four points and hold it in a nearly level attitude (after the first eight seconds of deployment). The forward two attach to the forward wing spar when it joins each side of the fuselage.

A bracket is installed, and a small hole is drilled in the top of the wing just above each attach point. The risers are routed inside a fillet on the top of the fuselage—they come together aft of the main spar and go back into the fuselage and BRS canister near the top of the rear window.

Aft of the canister, the fuselage is beefed up with gussets and a support bar that retains the two aft shroud lines for the parachute.

For the warranty to be activated, BRS requires that pictures of the installation process be sent in. We think it's a good idea for quality control.

## READY, SET, PULL

Should the pilot pull the handle, a blunt-nosed rocket punches out through the right side of the rear window and pulls the chute open. Max speed for deployment of the system for the 182 is 134 knots; for the 172, it's an impressive 163 knots. The patented dynamic reefing system has a slider that keeps the parachute from opening too rapidly at high speeds (but allows very rapid deployment at slow speeds—especially important near the ground). We suspect that a successful deployment could come about at speeds above those published. Let's just say that if we were out of control in a diving spiral, we'd give the system a try.

## REPACK

As with any rocket and parachute, nothing lasts forever. The repack cycle is every 10 years for the 172 and 182 BRS and six years for the LSA. Conveniently, it's the same life limit on the rocket. When time, everything comes out. Everything except the rocket is shipped back to BRS in South St. Paul—the rocket is turned over to your local ordnance disposal folks.

Currently, a full repack, which includes a new rocket, is $4500 for the Cessnas and $2000 to $2400 for an LSA, plus a small R & R cost.

For the Cessnas, the line cutters—pyrotechnics that fire at eight seconds to allow the airplane to be suspended in a level attitude—must be replaced every five years; that kit is $900. There are no line cutters on an LSA BRS.

We have no data as to how much a BRS retrofit adds to the resale value of a 172 or 182. We suspect that it will prove to be a little like any other upgrade such as avionics or a bigger engine—worth something, but not more than half what the upgrade costs. On the other hand, as we've seen with Cirrus aircraft, as the time for the repack draws nigh, the value of the airplane drops.

## CONCLUSION

In the small world of general aviation, nearly 300 lives saved is a number worth respect. We think the BRS is a valuable safety addition to an aircraft, provided the pilot spends some time considering risks and setting parameters for using it—and can get past the macho nonsense of not pulling because someone might say he has the wrong stuff.

Cost is always a consideration, especially as a $17,000 installation on a $35,000 172 may not come close to being recoverable at the time of sale. However, as we've said on retrofits and upgrades, an owner shouldn't make them to increase the sale value of the airplane—they are to improve the utility and safety of the airplane for the owner and the environment in which the owner flies—and intends to keep flying for some years.

## CONTACTS

BRS
651-457-7491
www.brsparachutes.com

Sierra Hotel Aero
651-306-1456
www.sierrahotelaero.com

# PAR200 Audio System: Feature Rich, Low Price

*PS Engineering's PAR200 saves panel space with an integrated audio panel, intercom and remote comm radio that's priced for small budgets.*

*by Larry Anglisano*

**CHECKLIST**

- PS Engineering recognizes a need for affordable audio solutions.
- The system packs useful features in a space-saving platform.
- Trig's comm transceiver is a solid performer.

While much attention is placed on high-end avionics upgrades, there are still simple aircraft in need of affordable upgrades. This includes modern audio systems that offer growth potential and useful features pilots want, but won't require a major teardown and a costly investment.

PS Engineering, in collaboration with Trig Avionics, recently introduced such a product with the PAR200. It's an audio panel, an intercom and a comm radio that's packaged in a two-piece system. We evaluated the PAR200 on an avionics test bench, where it earned high marks for having solid performance and generous features.

## TOTAL COMM

Not all aircraft need a panel that's decked out in the latest glass fashion, but many are in need of comm radio and intercom upgrades. Add a second comm and VHF nav radio to the interface and the need for an audio switching panel comes into play. This is where the project can snowball.

The PAR200 system combines an audio control panel with many of the features that have been successful in the company's higher-end audio panels—including a high-fidelity four-place stereo intercom with IntelliVox technology. There's also Bluetooth connectivity and a remote mounted FAA-certified VHF comm radio.

UK-based Trig Avionics is best known for building innovative and space-saving hardware, and has a line of remote transponders and comm transceivers.

The Trig TY91 and TY92 remote-mount radios are designed with dedicated panel-mounted control heads. But PS Engineering designed the PAR200 audio panel to handle the control and frequency channeling duties—eliminating Trig's control head. More on that in a minute.

The TY91—which is the radio that's part of the PAR200 package—is the lower-end radio in the Trig line and has a 6-watt transmitter. In the world of aircraft VHF transceivers, 6 watts of output isn't a powerhouse, but it's sufficient for lower altitudes as long the aircraft antenna system is kept up to snuff (the more powerful TY92 transceiver is rated at 16 watts, which is jet-caliper).

Still, we put the system on the avionics test bench at EXXEL Avionics in Hartford, CT, and noted solid transmitter and receiver performance.

The remote transceiver measures 5.5 inches long and stands 1.7 inches


*The Trig TY91 remote transceiver, right, is compact enough to fit behind tight panels. The PAR200 audio panel, bottom, is designed for simplicity, but we think it has good ergonomics and a solid feel.*


*On the avionics bench, top, the PAR200 system impressed. The Trig TY91 transceiver is rated for 6 watts of nominal transmit power, but we measured nearly 9 watts on a calibrated power meter. The IntelliVox intercom and the Bluetooth connectivity, bottom, worked well with all of the smartphones we paired.*


high, which should make it easy to mount in a variety of locations within the airframe. As compact as the TY91 chassis is, it has a high-end feel.

Electrically, the installation should be straightforward. The comm transceiver and audio panel connect with familiar 44-pin Sub-D connectors, using an RS232 serial interface. While the unit was on the bench, one installation tech spotted the TNC connector that's used for the RF antenna input and asked why Trig doesn't use the more common BNC connector that's used in most existing aircraft antenna systems. This is a minor nit, but a good question, since changing the connector on the existing antenna cable is an extra step.

## PANEL DUTY

The brain of the interface is in the new PAR200 audio panel, which packs a big punch in a minimal control set. We like that the interconnect between the audio panel and the remote comm radio is designed for failsafe.

For example, the remote radio has its own power supply, which PS Engineering wisely uses a secondary power input to the audio panel. Should the primary power to the audio panel fail, the power supply in the radio takes over, so it will continue to function.

As with all PS Engineering audio panels and intercom systems, the pilot headset will be connected directly to the primary comm radio in case of audio panel failure or should you have to shed electrical load.

Tuning the radio is accomplished with dedicate channeling knobs on the right side of the bezel, while pushing the outer button transfers the standby frequency to the active window.

The PAR200 has a five-frequency storage and memory bank, cabin speaker control and automatic radio squelch. There's also a frequency monitoring mode, where the system passes receiver audio from the frequency that's in the standby. Smarter yet is that both the active and standby frequencies are monitored at the same time for a signal—enabling simultaneous reception from both frequencies.

The frequency display is a green, backlit LCD screen that has automatic dimming. Since we didn't use the system in an aircraft, we can't say how good or bad the screen will perform in direct sunlight. The contrast on the LCD display can be controlled by a service adjustment that's located inside of the unit.

The audio panel accommodates two comm radios and two VHF navigation radios via momentary, push-button, backlit switches. The volume for the remote Trig radio is adjusted with the large knob on the right side of the bezel. We like the onscreen linear volume status bar that comes up when you change the volume. After five seconds of inactivity, the display will revert automatically to the frequency tuning mode.

The PAR200 can accommodate unswitched audio inputs for remote traffic and engine monitoring systems, for example. Unswitched input means the pilot has no control over this audio and we would like to see an auxiliary switched input, which allows the pilot to stifle traffic callouts.

## INTELLIVOX, BLUETOOTH

The PAR200 utilizes PS Engineering's proven IntelliVox technology. We recognized the company's IntelliVox as a game-changer in cabin intercom technology when we initially tested the company's first 7000-series audio panel because it eliminates the intercom squelch control. At the time, a squelch-less intercom was a bold proposition, given the noise that's present in many cabins. But it works—quite well—thanks to microprocessor control.

Through individual signal processors, the ambient noise present in the connected microphones is constantly being sampled. Nonvoice signals are blocked and the squelch remains closed. When

someone speaks, only their microphone circuit opens, placing their voice on the intercom. We've flown extensively with IntelliVox over the years in a wide variety of cabins and haven't been able to trick the system. For high-noise environments, shops can reduce the microphone input gain by configuring internal DIP switches on the unit's main board. Intercom volume control is through two concentric front panel knobs. The small volume knob controls the intercom level for the pilot and copilot, while the large knob controls the passenger intercom volume.

Like the company's higher-end PM8000BT-series audio panels, the PAR200 has Bluetooth connectivity as standard. This can be used for music or telephone input. Two music input sources can be hardwired to the panel, or you can stream entertainment from a Bluetooth device.

We easily paired Apple and Droid smartphones to the unit. When the PAR200 is paired with the Bluetooth device, the letters "BT" appears in the display. When the phone receives an incoming call, the PAR200 plays a ring tone. Simply answer the call from the handset, and the audio panel connects the phone audio and automatically hangs up when the call disconnects. The telephone function works with the intercoms Crew, All and Pilot Isolate modes. All of the stations on the intercom will hear the telephone audio when in All mode, and the pilot is in "telephone booth" mode when the intercom is in Pilot Isolate.

The ICS push-button switch on the left side of the panel provides the selection for these three intercom modes, while an LED annunciator behind the text shows which mode is active.

Streaming and controlling music through the system is just as easy. The left outer knob controls the volume of the music and all stations on the intercom will hear the aircraft radio and intercom. During any radio or intercom communications, the music volume automatically decreases and then increases gradually back to the original level after communications have been completed. But there's flexibility in how the muting functions, with a dedicated Mute control button.

For example, when the Mute On is selected, music will mute with either intercom or radio activity. In Radio Mute, intercom activity will not mute the music but radio chatter will. In the Intercom Mute mode, radio chatter will not mute the music, but activity on the intercom will. If you enjoy entertainment on the fly, the PAR200 offers you plenty of ways to configure it to your liking.

## BUDGET UPGRADE

That's exactly what PS Engineering's Mark Schauer had in mind when his team designed the PAR200.

"There are still plenty of basic airplanes—including Cherokees, Skyhawks and even Cubs, to name a few—that have outdated avionics. The owners of these airplanes might not want to invest many thousands of dollars to make a significant upgrade to the panel. That's the market we are addressing with the PAR200," Schauer told us.

"Because the missions of these aircraft are different from more capable airplanes, we tried to keep the PAR200 in the middle of the road as far as capabilities," Schauer added.

The PAR200 has a list price of $2995 and includes the Trig radio and the installation kit.

Based on our evaluation of the installation manual and the hardware, we estimate that a basic installation could require 25 to 30 hours of labor. That puts the total project at around $6000. This price, of course, doesn't include replacing or installing a new comm antenna and cabling, if required.

The PAR200 comes with a two-year warranty when it is installed by a PS Engineering dealer. Contact: www.PS-Engineering.com, 865-988-9800.

## GARMIN'S RADIO WITH 3-D AUDIO

**At AirVenture 2013, Garmin introduced a low-cost and full-featured comm transceiver of its own—the GTR200.**

**The GTR200 is another invention of Garmin's Team X, the engineering team that's in charge of designing cost-effective products for LSA and experimental applications. The GTR200 follows the redesigned G3X glass cockpit and autopilot suite that was introduced this past spring, while resembling the FAA-certified GTR225 radio that was introduced last winter.**

**The radio has 10 watts of transmit power, an integrated two-place stereo intercom with automatic squelch, stereo music input, remote alert inputs, standby frequency monitoring, on-screen frequency identification and a nifty feature that Garmin calls 3-D Audio.**

**The 3-D Audio function in the GTR200 trickles down from Garmin's high-end GMA350 audio panel, where digital audio processing creates a spatial dimension to the headset audio that more closely reflects how the human ear naturally hears and responds to directional sources. For example, when monitoring the active and standby frequencies in the comm radio, each frequency will seem to come from different locations (the active frequency will seem to come from the front left while the standby frequency will seem to come from the front right).**

**Further, intercom audio is also separated, relative to where each individual sits. Garmin says that the ability to monitor both frequencies in 3-D is almost like having two radios in one.**

**The GTR 200 is designed to interface with the G3X avionics suite. When connected, the GTR200 is able to receive a radio frequency directly from the G3X waypoint page and place it in the standby frequency position, while also displaying the airport identifier and frequency type on the GTR 200 display.**

**The GTR200 is expected to have a street price of $1199.**

# IFR Hoods: Jiffy Hood the Top Pick

*At only $8.10 and effective, Jiffy Hood is the overall best value, especially if you have bifocals or trifocals. Foggles and JeppShades are good alternatives.*

*by Rick Durden*

Hoods for practicing IFR are like umbrellas, tough to store and hard to find when you need one. We've used everything from duct tape on safety glasses through a folded sectional jammed under a baseball cap to a narrow strip of cardboard along the bottom of the pilot's windshield on a DC-3 (it works perfectly). Other than the DC-3 system, we prefer store bought, and we've used them all.

We examined seven commercial IFR hoods for comfort, bleed over of view outside (one peek is worth a thousand scans), ease of scanning the full panel, ease of getting it out of the way for a VFR landing and overall functionality. We found that price was not an indicator of value.

Pilots who do not wear glasses have a large choice of good hoods; the selection for single-vision glasses wearers is good as well. For the bifocal and trifocal set, the selection is small, but the choices are good.

For those who don't need glasses or just single-vision lenses, the winners were the Jiffy Hood, JeppShades and Foggles; for bifocal and trifocal wearers, the Jiffy Hood came in first, with the Super Hood as a good second choice.

We did our evaluation flights in a Cessna T210 and Beech Bonanza with pilots of varying backgrounds and experience.


*No stuffed animals were injured in the evaluation of IFR hoods by human pilots. Clockwise, from lower left, we examined: JeppShades, Viban IFR Hood, Super Hood, ASA Hoodwink, ASA Jiffyhood and Foggles.*

## RATINGS

The numerical ratings given by our reviewers (with 1 the lowest and 5 the highest) are shown on the table on the next page. We found that the JeppShades and Viban IFR Hood could not effectively be worn over glasses, so their ratings are without glasses.

## JIFFY HOOD

At $8.10 through Amazon.com, the Jiffy Hood is a view-limiting device reduced to its essentials—an elastic headband snapped to a curved piece of plastic. It's been around a long time because it's simple, inexpensive and it works. Downsides are that it takes up nearly the most storage space of the hoods we examined, and you have to remove your headset to put it on—although that's required for most.

It does not completely block the outside world on the left side, but it ranked high with our reviewers because they did not have to move their heads much to do a full instrument scan. All liked it—especially those who wore glasses (or just sunglasses).

One reviewer told us he'd had a terrible time flying precisely during an IPC because he was using Foggles and they blocked the area on his glasses best for focusing on the instruments. During his next IPC, he wore the Jiffy Hood and had no difficulty focusing on the instruments. He did so much better flying the airplane that his instructor commented on it at length during the debrief.

## FOGGLES

Foggles were a revelation when they came out several decades ago. They quickly replaced the standard, long-billed hood and were, rightfully, hugely popular. Their success seemed to trigger a realization that there was

| TYPE | COMFORT | BLOCKS VIEW OUTSIDE | EASE OF SCAN | EASE OF REMOVAL | OVERALL | PRICE | COMMENTS |
|---|---|---|---|---|---|---|---|
| JIFFY HOOD | 4.8 | 3.6 | 4.8 | 4.8 | *4.7* | $8.10 | Not easy to store; works well with glasses; need to move head only slightly for full scan |
| FOGGLES | 4.2 | 3.6 | 3.5 | 5.0 | *4.0* | $17.66 | Doff and don very easy; view outside peripherally and over the top not blocked; good for single-vision glasses, poor for bifocals or trifocals |
| ASA HOOD-WINK | 3.8 | 2.0 | 3.5 | 4.0 | 2.5 | $14.99 | Stores in very small pouch; fabric flaps blown around by cabin vents; does not block vision well, users felt silly wearing it |
| JEPPSHADES | 4.5 (WITHOUT GLASSES) | 3.6 | 4.6 | 5.0 | 4.4 | $20.86 | Unusable with glasses—info not disclosed in advertising; see six-pack well; visor came off repeatedly during handling |
| FRANCIS IFR HOOD | 2.5 | 5.0 | 3.3 | 4.8 | 3.5 | $29.95 | OK with single-vision glasses, poor with bifocals/trifocals; must move head a lot for full scan; excellent view limitation to cockpit |
| SUPER HOOD | 4.3 | 3.3 | 4.7 | 5.0 | 4.0 | $26.95 | Visor comfort varies and can affect noise-canceling feature of headset; creative clip system for doff and don; can see over panel and peripherally |
| VIBAN IFR HOOD | 4.2 (WITHOUT GLASSES) | 3.7 | 4.5 | 5.0 | 4.0 | $46.74 | Does not work with glasses; very comfortable without; lots of peripheral vision distraction; easy doff and don; not worth the price premium |

a market for different view-limiting devices, which has been nothing but good for pilots.

Foggles are easy to store—most models fold like glasses into a case that can be carried in a pouch. We saw various prices, depending on suppliers, but $17.66 at Amazon was the best.

The good: easy to put on or take off, lightweight, work well with single-vision glasses or sunglasses, not much problem with them blocking the view outside the airplane—any view leaks can be easily fixed with a piece of tape.

The bad: internal glare can be disconcerting and scratches that build up over time can make it worse. Some of our evaluators who had bifocals or trifocals had a great deal of trouble with Foggles and did not recommend them.

## ASA HOODWINK

A fabric hood that folds into an amazingly tiny pouch, the Hoodwink had our reviewers in stitches and saying that it looked so funny they were embarrassed to wear it. Priced at $14.99, it uses fabric stretched around a stiff wire oval to create what looks like a flat golf visor with two fabric swatches that make one think of blinkers on a horse.

It proved comfortable, but was not effective in blocking the view outside the cockpit. The cabin air vents caused the fabric flaps to flutter around. The Hoodwink was, however, quite good for those with glasses and it's easy to push up out of the way when it's time to look at the runway at the end of the approach.

To store, the wire frame must be coiled in a fashion similar to the way the wire mouth on a hot air balloon envelope is coiled on itself to make three loops. Some had difficulty with the process—it's an art—and eventually the wire frame bent.

## JEPPSHADES

Looking something like an oversize set of clip-on, flip-up sunglasses, JeppShades feature a headband with a Velcro closure that holds the Pince-nez-style frames on your nose. The view-blocking visor easily flips up or down—however, the attachment is shaky. In normal handling, the visor came away from the frames several times, leading different reviewers to fear the unit had broken.

The JeppShades came with a warning that included, "JeppShades are not designed for optimal use with eyeglasses." We agreed with the warning—they were unusable with glasses. The warning was not included in any of the advertising we saw; an unacceptable oversight, in our opinion.

Our reviewers who did not wear glasses or sunglasses rated JeppShades a close second, overall. They said they could see the "six pack" well,

## FRANCIS IFR HOOD

At $22.85 from Aircraft Spruce, the Francis IFR Hood is a compact, serious view-limiting device that reminds one of a set of padded safety goggles with a set of binoculars on the front.

It proved to be the best of the bunch when it came to blocking the view outside the cockpit and focusing on a specific area of the panel. However, it was graded down because of the head motion required to do a full scan. While it can be worn over glasses, our bifocal and trifocal users did not recommend this hood at all.

## SUPER HOOD

While we look at any product with a prefix of "Super" with a jaundiced eye, the $26.95 Super Hood proved popular and one that got a very good review from a flight school that has used them for years. It is a plastic golf visor with a view-limiting plastic

*continued on page 32*

*The Jiffy Hood in service.*


# Levil iLevil AW: Cut-rate ADAHRS

*If you're willing to fool with the plumbing, this portable ADS-B box will output honest, no-kidding airspeed. Still, it's not reliable enough for backup.*

Amidst the swarm of ADS-B portables we saw last spring was Levil's iLevil, which combines ADS-B with a MEMS AHRS for display on cockpit tablets. (See the June 2013 *Aviation Consumer* for a report.) Levil has followed up with the $1395 AW model, which adds pitot/static sensing to the basic AHRS. So instead of GPS groundspeed and pressure altitude, the device—running through a tablet app—will display indicated airspeed and pressure altitude.

The basic box is larger than the iLevil, measuring 3 by 5 by 1 inch, compared to 2.5 by 4 by 1 inch for the previous model. Two ports on the back accommodate pitot pressure and static input while two antenna jacks for ADS-B and GPS signal that this product is intended for remote mount. The antenna leads have plenty of length, so you could lodge it in the airplane anywhere, as long as it's away from ferrous metal and with its long axis aligned in the direction of flight.

On the front edge of the unit is a push on/off switch and a standard DB9 female connector. You can power it with ship's voltage—8 to 32 volts—or rely on internal power from an onboard battery.

This product pushes the limits of what a portable can do, given that the DB9 connector outputs serial data that can feed non-certified panel mount equipment, and it will accept data input from the Zaon XRA portable traffic unit. Like the iLevil, the AW communicates wirelessly.

Now about that plumbing. To read out indicated airspeed, you'll need at least pitot reference pressure. Unless you're a stickler for precision, the static port can be referenced inside the aircraft, saving an additional hose. Although the AW is intended for experimental and LSA use, an owner wanting to add it to a certified airplane might make do. You'll need your shop to finagle a temporary tap into the pitot system that will still pass FAR 91.411 checks if you intend IFR.

Given the plumbing and remote antennas, the mounting perch should be somewhere other than the glareshield. A hatrack mount might do, with the antennas placed in view of a window. For our test in a J-3 Cub, we fabricated a temporary pitot system and used static pressure inside the aircraft.

*iLevil AW, left, has a pair of ports for static and pitot reference and, top photo, remote antennas.*

## FLYING IT

Three apps support the AW, including Levil's own AHRS utility, Xavion and WingX Pro 7. The latter has a pull-up menu that enables pitot input and this is the only setting required for airspeed sensing.

In flight, the AW data behaves like the airspeed indicator on any ADAHRS-driven EFIS. Its response is linear and free of the spikiness evident on tablet EFIS displays that rely on GPS groundspeed for an airspeed indication. Indicated speed doesn't change according to wind direction, which GPS groundspeed does, of course. Performance wise, the AW isn't perfect. We had several data drop-outs that red-x'd the display for a few seconds during a trial flight. These cleared on their own without manual intervention. Levil couldn't say why they occurred.

So what's the AW good for? We'll stick by the same conclusion we offered in our June report. These gadgets aren't reliable enough for real IFR backup, but are suitable for sophisticated secondary position awareness, ADS-B weather, minimal traffic and—might as well be honest—the novelty factor. If that's worth $1395 and a few bucks in tubing to you, there are worse things to spend money on. For more, see www.levil.com.

# Remote Heater Controls: Switchbox a Top Value

*But there are other products to turn on pre-heating from afar if leaving heat plugged in all winter strains your budget and sensibilities.*

*by Rick Durden*

**CHECKLIST**

- Switchbox Control will independently switch two lines for $299.
- Some units are not flexible in antenna position.
- For nearly $300, a unit should be able to switch more than one line.

In our March 2013 article on external engine heaters, we noted that there is disagreement among pilots regarding keeping a heater plugged in all the time versus using it only in preparation for a flight. While we do not take sides on the matter, we note that a lot of pilots are concerned about engine corrosion caused by running an engine heater constantly, so they only want to use the heater in preparation for flight.

For those who want some way of controlling their engine heater without it running full blast all the time and don't want to drive to the airport several hours prior to a planned cold-weather flight, there's good news. There is not only a healthy market in remote switching units that allow firing up the heater from a distance, there is also a thermostatic control that will run your heater at an intermediate temperature.

Most of the remote switching units will handle two independent lines. All can be controlled via a simple telephone call (landline or mobile) or text message, while two will also respond to dedicated smartphone apps.

## REGAL WDR

The Regal WDR (Wireless Digital Remote) from FS Tech, LLC controls two 115-volt power lines, with loads of up to 15 amps and 1500 watts, via telephone call, text message or smartphone app. It will switch the lines on or off independently. It is programmed via a smartphone app, text messaging or the owner can put in stored programs when installing the unit.

The Regal comes with a sim card, activated cell phone account and $10 credit on the account. Carl Bumpurs of FS Tech, LLC told us that the user can easily add credit to the cell phone account online. As he's been in contact with his customers, he's found that many owners simply put a $100 credit into the cell phone account so they don't have to worry about it for several years. The only charges that



*Both Switchbox Control, right, and Regal WDR, above right, independently switch two power lines and can be controlled by phone, text or app. Switchbox is $295, Regal is $435.*

## REMOTE SWITCHING COMPARED

| UNIT | LINES CONTROLLED | MAX AMPS | MAX WATTS | CONTROL METHOD | PRICE |
|---|---|---|---|---|---|
| REGAL WDR | 2 | 15 | 1500 | TELEPHONE CALL, TEXT, SMARTPHONE APP | $435 |
| SWITCHBOX CONTROL | 2 | 15 | 1500 | TELEPHONE CALL, TEXT, SMARTPHONE APP | $299 |
| CELL SWITCH CS-100 | 1 | 10 | 1500 | TELEPHONE CALL, TEXT | $295 |
| AEROTHERM RCS | 2 | 30 | 1500 | TELEPHONE CALL, TEXT | $299 |

are incurred are when the Regal sends a text, 10 cents per—a rate we found to be consistent with the other switch systems.

Based on how the owner programs it, the Regal will send texts when it switches a line on or off, and it will answer questions as to the status of its programmable features and its operational status, as well as to simple inquires such as how long a line has been on.

We've observed problems with cell phone reception in various locations in a single hangar. The Regal monitors signal strength so it can tell you the best place to put it, or you can order the $48.50 optional remote antenna extension, which has 20 feet of lead and a magnetic mount. It's the largest of the units we looked at, an aluminum box weighing in at 3.2 pounds with two outlets on its face.

It is password protected and acceptable phone numbers can be programmed in. It is the highest priced unit we surveyed at $435.

### SWITCHBOX

Priced at $299, the Switchbox also independently switches two 115-volt lines on and off. It will handle loads of up to 15 amps and 1500 watts. It comes with a T-Mobile network sim card activated, with $3 on account.

The Switchbox can be controlled by calling, texting or through a smartphone app. As programmed by the owner, it sends confirmations of commands as well as answers to questions regarding such things as its signal strength and how long it's been on. The owner provides a security list of acceptable phone numbers. It will not respond to calls from any not on the list. It has a custom timer that allows a line to be switched on for as long as 18 hours, or the owner may choose to switch off the line at prior to the programmed time.

Because the system monitors cell phone signal strength, it also tells you the best spot in the hangar for reception. We like that the price includes a six-foot antenna extension with a magnetic mount. One satisfied user told us the antenna extension proved handy because cell reception varied within his hangar. He also said that the cord from the Switchbox to the wall plug was fairly short, so he tie-wrapped the Switchbox to a spot adjacent to the plug.

### CELL SWITCH CS-100

At $295, the Cell Switch CS-100 is priced competitively, but it is the only unit that will not control two independent power lines. That's a pretty big weakness given the price of the competition. Further, it is limited to handling 10 amps when the others will take care of either 15 or 30 amps.

The CS-100 is programmed via text messages. The company notes in its advertising that it does not require a computer to program the unit, yet neither do any of the others.

The unit has a security mode through which it will only act on calls from up to 25 telephone numbers that have been programmed into


*Aerotherm, far left, controls two lines of up to 30 amps. Cell Switch CS-100, left, will control one 10-amp line.*

its memory. If the user desires, the security mode can be shut off and the CS-100 will activate in response to all telephone calls.

A call to the CS-100 turns it on for a selected period of time. It can be turned on or off, without time limit, via text message. It requires a mobile phone SIM card (not provided) with sufficient credit to send text messages when programming the unit.

## AEROTHERM

The Remote-Control Starter (RCS) from Aerotherm will operate two lines with loads of up to 30 amps, the highest of the group we surveyed. At $299, it costs about the same and can be controlled by a phone call or text message—but not by a smartphone app, its one weakness.

For security, 199 telephone numbers can be programed into memory as safe. It can told to allow a line to stay on for up to 18 hours when activated by phone call or text. The unit sends a text when it shuts off. Alternatively, a text can turn a line on and tell it how long to stay on or to stay on until you turn it off.

There is no cost for activating the unit via phone call; it simply recognizes the number and drops the call. There is a per-text charge as with the other units.

## CONTACTS

FS Tech, LLC, Regal WDR
262-412-7580
www.fstllc.com

Switchbox Control
347-871-4353
www.switchboxcontrol.com

Cell Switch
440-781-8395
www.cell-switch.com

Aerotherm
800-401-4397
www.aerothermheaters.com

McFarlane Aviation, Inc.
866-920-2741
www.mcfarlaneaviation.com

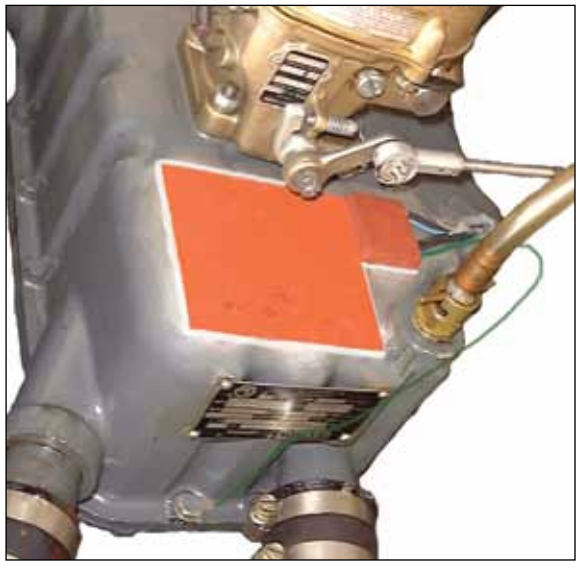
*McFarlane's SAFE-HEET pad, right, below, is designed to be used with its temperature controller, a thermostatic unit, right.*


The RCS comes with a T-Mobile SIM card and is estimated to cost about $3 for cell service per month. The antenna is attached to the unit itself.

## THERMOSTATIC CONTROL

McFarlane Aviation takes a different approach to preventing corrosion when using an engine heater. It sells a pad-type heater and thermostat combination to allow the engine to be heated to just above ambient, continuously, reducing the risk of corrosion.

When the pilot arrives to preflight, he or she turns the thermostat to the highest temperature, and the engine is heated to an easy starting temperature in the time it takes to preflight and load the airplane.



McFarlane's heater is called SAFE-HEET. The pad bonds to the engine sump.

The associated SAFE-HEET temperature controller not only functions as a thermostat, it is used during installation of the heating pad to allow the bonding adhesive to cure at a slower speed.

At a price of $259, we like the SAFE-HEET and temperature controller for those who either can't get cell reception at the hangar, don't want to mess with keeping track and paying for a cell phone account, or just want to keep the cost down.

We were advised by McFarlane personnel that its temperature controller can be used with any competitor's pre-heater. At $68 for just the temperature controller, it sounds like a viable option.

## CONCLUSION

We like the ability to remotely control our engine heater as well as other electrical devices in the hangar—such as a portable cabin heater—which may not need to run as long as the engine heater.

We also like being able to independently control two lines via a smartphone app and receive status reports on what's going on with each line and the switching unit itself. For $295, the Switchbox Control looks pretty attractive to us with the 30-amp Aerotherm as the one to choose should we have to handle heavier loads, even though it doesn't yet have a smartphone app.

# Piper Malibu-Mirage

*After a shaky start with numerous engine and system problems, the Malibu-Mirage series matured into a line of fast, comfortable traveling machines.*

When it first appeared in the mid-1980s, the Malibu rocked the GA world. Here was a pressurized, high-flying luxury ride capable of 200 knots and with impressive range to boot.

There was nothing quite like it and Piper soon found a loyal market for its new flagship product, mostly among well-to-do owners who could afford to sink a half-million bucks into a new airplane and who flew the kind of trips where the Malibu shined.

Pressurizing a single isn't easy—Mooney's Mustang was a bust. Cessna pulled it off using a proven airframe in the P210, but it had its growing pains. Piper's execution left something to be desired. Although owners generally raved—and still rave—about the Malibu's impressive capabilities, it gained a reputation as a problem airplane. The engine and systems were finicky to operate, and dispatch reliability ranged from barely acceptable to just awful for some years.

As the model evolved and became the Mirage, its reputation didn't improve. Indeed, some owners believe that with the Mirage, Piper jumped from the pan into the fire, especially with regard to engine longevity. (Or lack of it.)

Yet, with time and the application of money, most of the problems got sorted out, and the fact remains, nothing quite does what a Malibu does. As one owner put it, "It's expensive to operate for a piston single, but cheap for what it does." We think that fairly sums up the Malibu. Anyone contemplating buying one should be ready to pay what we consider to be substantial maintenance bills, with the reward being fast cruise speeds above the weather in pressurized comfort and reasonable payload.

***Anyone contemplating buying one should be ready to pay substantial maintenance bills.***

## MODEL HISTORY

The PA-46 is the last from-the-ground-up new airframe Piper has produced. The turbine-powered Meridian uses the same basic airframe the Malibu pioneered but with substantial modifications. The Matrix is an unpressurized Mirage. The Malibu prototype emerged from the Vero Beach plant in late 1982, amidst much fanfare and excitement.

No one had seen anything quite like it. It had a long, rakish snoot housing a six-cylinder Continental TSIO-520BE rated at 310 HP and with two turbochargers, providing enough bleed air to keep the cabin comfortably inflated at FL250.

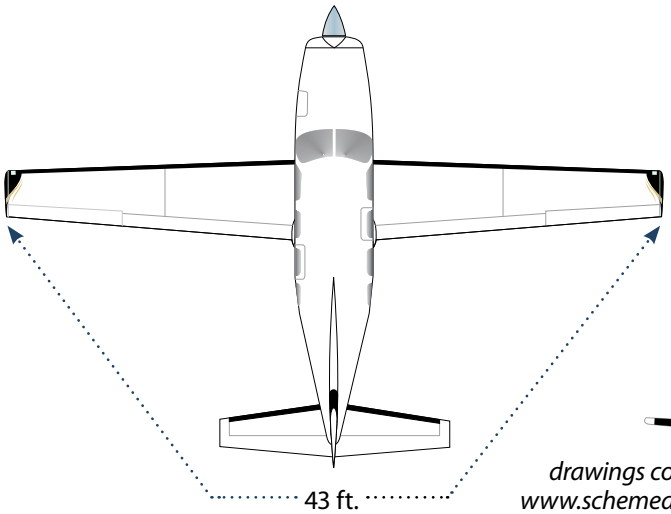
With its 43-foot wingspan, the Malibu looked as much like a glider as a powered aircraft. As one owner said, the thing looked like it was going 200 knots sitting on the ground. The base price was an eye-watering $275,000 but with accessories, the typical invoice swelled to more than $320,000, or $550,000 in 2003 dollars.

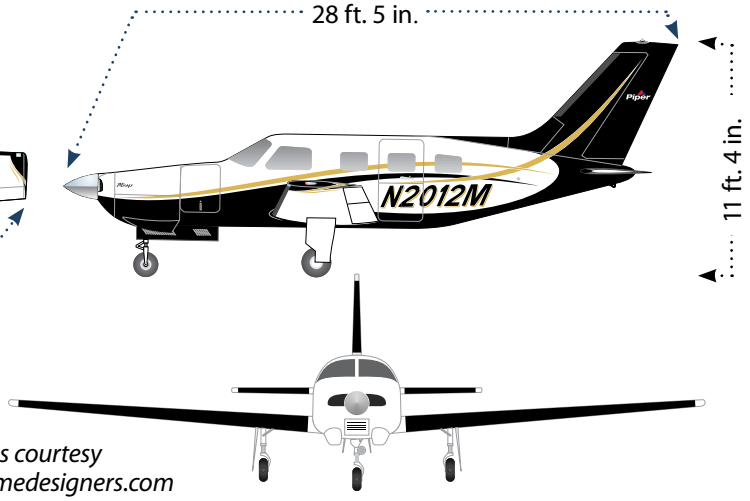
Ironically, Piper launched the Malibu in 1984 into what was an overall GA slump. Yet Piper prospered with the Malibu because of its capabilities and unusual luxury. Although the company succeeded, its success was haunted by engineering decisions made early in the program.

As is often the case, the production airplane was heavier than intended, but this was offset by a boost in takeoff weight. Useful load worked out to be 80 pounds less than planned; not a deal breaker, but a weight equivalent to fuel for IFR reserves.

For an airplane of the Malibu's ambitious leanings, the right engine

# PIPER MALIBU-MIRAGE



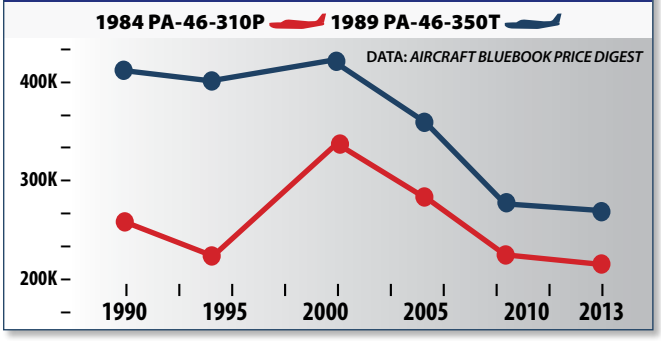




*drawings courtesy*
*www.schemedesigners.com*

## PIPER MALIBU-MIRAGE SELECT MODEL HISTORY

| MODEL YEAR | ENGINE | TBO | OVERHAUL | FUEL | USEFUL LOAD | CRUISE | TYPICAL RETAIL |
|---|---|---|---|---|---|---|---|
| 1984 PA-46-310P MALIBU | 310-HP CONTINENTAL TSIO-520-BE | 2000 | $55,000 | 120 | 1400 LBS | 205 KTS | ±$215,000 |
| 1988 PA-46-310P MALIBU | 310-HP CONTINENTAL TSIO-520-BE | 2000 | $55,000 | 120 | 1400 LBS | 205 KTS | ±$255,000 |
| 1989 PA-46-350P MIRAGE | 350-HP LYCOMING TIO-540-AE2A | 2000 | $75,000 | 120 | 1450 LBS | 215 KTS | ±$265,000 |
| 1993 PA-46-350P MIRAGE | 350-HP LYCOMING TIO-540-AE2A | 2000 | $75,000 | 120 | 1450 LBS | 215 KTS | ±300,000 |
| 1996 PA-46-350P MIRAGE | 350-HP LYCOMING TIO-540-AE2A | 2000 | $75,000 | 120 | 1400 LBS | 215 KTS | ±$360,000 |
| 1999 PA-46-350P MIRAGE | 350-HP LYCOMING TIO-540-AE2A | 2000 | $75,000 | 120 | 1400 LBS | 215 KTS | ±$430,000 |
| 2002 PA-46-350P MIRAGE | 350-HP LYCOMING TIO-540-AE2A | 2000 | $75,000 | 120 | 1350 LBS | 215 KTS | ±$495,000 |
| 2005 PA-46-350P MIRAGE | 350-HP LYCOMING TIO-540-AE2A | 2000 | $75,000 | 120 | 1300 LBS | 215 KTS | ±$595,000 |
| 2011 PA-46-350P MIRAGE | 350-HP LYCOMING TIO-540-AE2A | 2000 | $75,000 | 120 | 1300 LBS | 215 KTS | ±$899,000 |

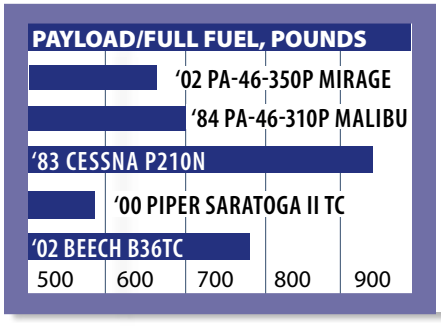
## RESALE VALUES

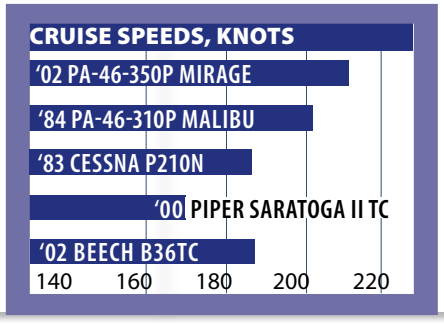


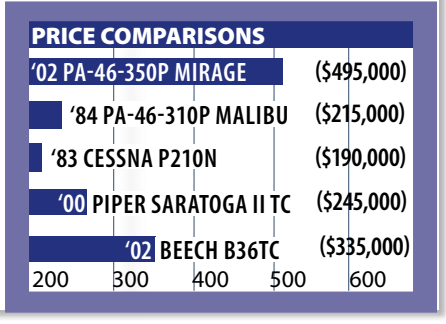

## SELECT RECENT ADs

| | |
|---|---|
| **AD 2013-13-01** | INSPECT/REPLACE CERTAIN FUEL VENT VALVES |
| **AD 2011-06-10** | CLEAN, INSPECT AND CALIBRATE T.I.T. GAUGES |
| **AD 2010-13-07** | REPLACE V-BAND EXHAUST COUPLINGS |
| **AD 2008-26-11** | INSTALL STALL VANE HEATER MOD KIT |
| **AD 2001-12-01** | INSPECT/REPAIR INBOARD FLAP DRIVE BELLCRANK ASSEMBLY |

## SELECT MODEL COMPARISONS



*At home in the flight levels; clean lines of the Malibu and Mirage mean impressive cruise speeds.*

is a must. Piper never seemed able to find the right powerplant, however. From the beginning, buyers favored a Lycoming because of a perceived reputation for reliability and robustness.

The would-be owners turned out to be correct, at least initially. The Continental package evolved into such a nightmare—piston pins and crankshaft bearings in particular—that in 1987, Piper asked owners to ground their airplanes voluntarily until the problems could be worked out.

Many owners maintain that the Continental was and is a superior engine for the Malibu but in 1989, Piper introduced the Malibu Mirage with a Lycoming engine. It was essentially the same airplane with a Lycoming TIO-540-AE2A of 350 HP. The new engine weighed 113 pounds more, but the maximum takeoff weight was boosted by 200 pounds. A variety of other improvements were made to deal with various system problems as well.

## CONTINENTAL WOES

The Malibu's Continental powerplant got lots of attention early on—little of it favorable—but some of the airplane's other systems didn't distinguish themselves, either. The complex nosegear, which rotates 90 degrees to fit into its bay, proved delicate.

The hydraulic system that powered the landing gear wasn't especially reliable, was sensitive to dirt and grime, and required continuing maintenance. The hydraulics also ran the flaps on early models. To make the airplane appealing to what Piper thought was its core market, the company called for exceptional range well beyond the fuel specifics of most six-cylinder engines. Continental thus specified operating requirements for the engine that were unusual at the time, specifically lean-of-peak EGT operation.

To beat down the fuel flow, Continental required pilots to lean the engine to 50 degrees lean of peak for all operations below 80 percent power, which is the maximum recommended cruise setting. That went against what most pilots had been taught before the current understanding of lean-of-peak ops—and a fair number ignored the instructions and ran rich of peak.

Whoever was to blame for Malibu engine problems, squabbles between owners, Piper and TCM grew heated and ugly at times. The irony is that the fixes applied to the Continental made it as good as the Lycoming installation. Both are sensitive to proper operating technique.

## MIRAGE

With the introduction of the Mirage, some of the systems were addressed. The hydraulic system was improved, the engine cooling system was redesigned, the cabin door was improved, the seats were strengthened and the flaps were changed from hydraulic to electric operation. (Actually, some of the later Malibu models got the electric flaps and improved hydraulics for the gear.)

The Mirage also got some big-airplane type features that owners appreciate: a dual-bus electrical system, internal windshield deice, standard dual alternators and vacuum pumps, and an auxiliary heater for the cabin. It needed it. It's cold back there in the flight levels, even during the summer. (Again, some of these mods appeared on later Malibus.)

## LYCOMING BETTER?

Substituting one engine for another didn't solve all of the Malibu's problems and it brought some of its own, not the least of which is higher fuel consumption.

Owners suffered through Lycoming's massive crankshaft recall of 2002 and 2003 and weeks to months of downtime.

The perceived reliability of the Mirage got so bad among some owners that a class action lawsuit was filed in 2000 against New Piper and Lycoming. The suit was settled after the court failed to certify the class.

Engine reliability has not been good, although the airplane is such a good glider that many events didn't become an NTSB report because the pilot was able to land safely on an airport. Our most recent survey of accidents showed that 17 percent were engine-related.

Maintenance is, as an owner told us, "a serious activity" for PA-46 owners, regardless of the powerplant type. Alternators, vacuum pumps and, in particular, the exhaust system are all items mentioned by our survey respondents and matched the Service Difficulty Reports reported to the FAA.

What we did see is that things have improved over the years. Ten years ago, an owner reported that the maintenance expenses for the first two years of ownership of his Mirage

*Club seating is standard—cabin looking forward (right above) and aft (right below).*

came to well over $46,000. While we have received reports of squawk lists on annuals reaching 25 percent of the value of the airplane, the majority of owners say that they recognize it's expensive to maintain a pressurized single and if they stay ahead of the game, the price is not outrageous. One reported that his annuals average $6500 for everything; another said $7000 to $10,000.

The PA-46 nosegear is tender and the hydraulic system continues to pose problems. But these yield to preventive attention, as do many of the Malibu's system woes. Even ardent supporters of the airplane admit that it requires frequent and ongoing maintenance. Owners emphasize the value of having a knowledgeable maintenance shop doing routine and ongoing work on the airplane. The Malibu is not an airplane that just any shop can fix.

More than a few owners have had experience with several Malibus and/or Mirages. Is one better than the other in terms of maintenance? Our impression is that they're about the same and that any owner contemplating buying a PA-46 should simply budget a pile of cash for annual maintenance and fix stuff as it breaks. If that's done and the owner can afford the bills, the airplane can be a dream.

## CABIN, COCKPIT

The PA-46's claim to fame is that it's a six-place airplane with cabin class comfort. Well, yes. Starting up front, however, the cockpit isn't exactly cavernous. Getting into the seats requires minor contortions through a narrow aisle between bulkheads walling off the rear cabin.

Pilots who are wide of girth and long of leg will be cramped up front; the seats don't slide back as far as they do in a Mooney or a Cessna. The cockpit is well designed in both models with well-placed gauges and plenty of room for all the avionics you could ever want. Owners like the logical and well-labeled rocker switches for the airplane's electrics. Later models have overhead switches which are a challenge for the presbyopic set and concern us from a crashworthiness standpoint.

The cabin arrangement is superb, with the Mirage somewhat better than the original Malibu. The airstair door is a plus, making for relatively easy entry and egress. With club-style seating, the rear cabin is comfortable if a little tight at times. Rear-seat passengers complain about too little heat—fixed with the aux heater—but the air conditioning/pressurization system is quite good, when it isn't broken. Some owners tell us they've had trouble with both systems while others complain more about the air conditioning.

Cabin and cockpit noise are on the low side as GA airplanes go. The Continental in the Malibu is noticeably less vibey than the Lycoming in the Mirage, according to owners.

Like most airplanes, the Malibu is not a fill-the-seats-and-tanks six seater. But it will comfortably carry

## PA-46 ACCIDENTS: ENGINES AND R-LOC

We surveyed 100 random PA-46 accidents from the NTSB database, which included the Malibu, Mirage and DLX Jet Prop conversions. While it can be said that landing the PA-46 is conventional, runway loss of control (R-LOC) accidents were the top cause, at 38 percent. As some reports prove, the aircraft's long wings demand quick control input and are sizable enough to hit obstructions—like snow banks, runway lights and buildings—when pilots do a lousy job of handling crosswinds, managing speed and maintaining directional control while on or close to the runway.

One pilot should have called in sick but instead flew his Malibu while dehydrated after being ill for several days. According to the NTSB, he had trouble maintaining altitude and aligning the airplane with the localizer. The aircraft touched down but sailed off the end of the runway and suffered substantial damage. Another Mirage pilot lost control on the takeoff roll, apparently overcorrecting too much for a wind gust. The airplane traveled down an embankment, passed through a culvert and came to rest in a drainage ditch, but not before the landing gear sheared off.

Then there were engine troubles—from partial power losses for undetermined reasons—to catastrophic failures of pistons, rods and turbochargers (including a turbocharger waste gate that jammed during takeoff). Of the 17 engine-related crashes we sampled, 10 were in Continental-powered Malibus and six were in Lycoming-powered Mirages.

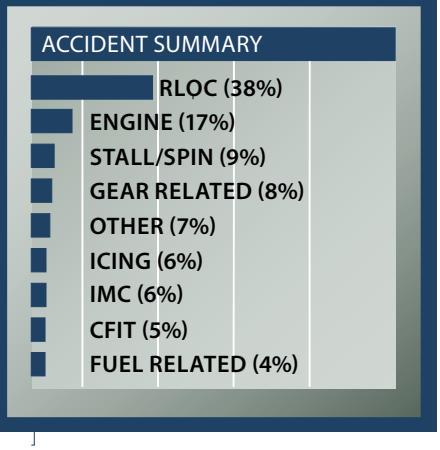
One report of a Continental TSIO-550-C failure revealed the engine had accumulated 265 hours since factory remanufacture. One of the connecting rods was found separated from the crankshaft, and a piston was found to have a hole burned through its crown structure.

Other crash scenarios that got our attention were stall/spin and IMC-related augers, where aircraft fell off the localizer on instrument approaches or fell off the radar while enroute in IMC. Speaking of losing it in IMC, one deceased Mirage pilot should have listened to his instructor, who recommended the pilot get 25 to 50 hours of flight experience in VFR conditions before flying in IMC in order to gain more familiarity with the radios, switches and navigation equipment.

There were plenty of head-shaking wrecks, in which Malibu and Mirage pilots attempted to take off while the aircraft was loaded over gross weight, loaded with excessive snow and ice, and a Jet Prop DLX that departed with a missing fuel cap. Its pilot crashed during the precautionary landing.

The strangest crash we found was the highly publicized event of the pilot who attempted to stage his own death. The NTSB said he was facing legal problems and intentionally pointed his PA-46 toward the Gulf of Mexico and then parachuted from the aircraft after telling ATC he was encountering moderate to severe turbulence, and lost the windshield and the cabin door. He was later apprehended after a getaway on his stashed motorcycle.

Of the 100 PA-46 wrecks we studied, a whopping 27 involved fatalities. Still, we don't believe that the capable, go-places Piper PA-46 is unsafe, as long as its pilots train for engine failures, bring their A-game for landings and respect the weather.




four people and baggage with full tanks, yielding a non-stop range of about 1400 miles for the Malibu and 1000 to 1200 miles for the Mirage. Typical useful loads are 1400 pounds and 1300 pounds, respectively.

Baggage space is generous, with two baggage bays, one just aft of the engine compartment and the other behind the rear seats, making loading within limits easier. Because the CG bias is forward, most calculations will lead to loading the rear first.

The Mirage's Lycoming engine is larger and the accessory layout is different, so the forward baggage bay in the Mirage is a bit smaller than that of the Malibu. The inclusion of an access panel in the firewall is a good tradeoff, since it makes it much easier to get at the backside of the powerplant.

### PERFORMANCE, HANDLING

Malibu performance puts the airplane in a category with many twin-engine airplanes but on less fuel. Malibu pilots report cruise speeds of 205 knots TAS at FL220 at 67 percent power and 210 knots true at FL250 at 75 percent. Mirage pilots pay more at the gas pumps but in exchange, they go a little faster, with speeds typically of 220 knots at FL230-250 at 75 percent power burning 18.8 GPH.

Owners of both models say they can fly 1100-NM trips with IFR reserves. But we have our doubts about the fuel-guzzling Mirage matching range with the Malibu in real-world conditions. The power setting and leaning would have to be right. The -310P, with its lower fuel consumption—as much as 4 to 5 GPH when flown by the book—has nearly 25 percent better range and is only about 5 percent slower. One owner cited this as the reason he chose the Malibu over the Mirage.

On trips of any length, most owners climb rapidly into at least the high teens, but the airplane is perfectly at home up to FL250. One place it's not at home is taking off from short runways. Initial acceleration is sluggish, although the airplane will get in and out of 3000-foot strips at sea level with relative ease. We would pause at operating out of 2500 feet or less.

How about handling? "A delight to fly, high or low," says one owner. The

*The nose landing gear has been an ongoing trouble spot for the PA-46 piston series—here a Matrix, the non-pressurized brother of the Malibu-Mirage line, has suffered a certain indignity.*

handling characteristics of the PA-46 are indeed excellent, although they lack the rocklike stability that many instrument pilots prefer.

We're not talking Bonanza handling here but the controls are responsive, with pitch the lightest and roll the heaviest. The PA-46's long, high-aspect-ratio wing is good for climb and high-altitude performance, but along with it comes a low maneuvering speed in the mid-130s KIAS at gross, decreasing as the airplane gets lighter.

The long wings produce another undesirable trait: The roll rate at slow speeds is somewhat ponderous compared to other singles. Sharp stick-and-rudder work in crosswinds is a must.

During descents, it's easy to get above maneuvering speed or even redline if you're not paying attention. This, along with the autopilot and weather factors, was implicated in a string of inflight breakups that led to a great deal of consternation (and an AD-mandated restriction on operations) in 1991. But no positive link was confirmed, and the airplane was given a clean bill of health.

Speed control is a must. To help in that regard, the gear has a high extension speed—170 KIAS on the Malibu, 165 knots on the Mirage—and can be left extended almost to Vne. The first notch of flaps can be extended at the same time as the gear. Pilots report that the gear makes an effective speed brake. Retraction speed is much lower, at 130 knots (Malibu) and 126 knots (Mirage) KIAS.

Many PA-46 incidents occur during landing. There isn't anything particularly difficult about landing a PA-46, but the long wing encourages floating and when lightly loaded, the CG is forward. These two characteristics sometimes lead to abuse of the relatively delicate nosegear.

As owners report, the PA-46 is well supported by one of the best owner groups in general aviation, the Malibu/Mirage Owners and Pilot's Association found at www.mmopa.com. The group has excellent information on ownership issues. MMOPA also tracks mods for the PA-46, which include three- and four-blade props, IO-550 conversions, long-range tanks, interior mods, plus the JetProp turboprop conversion.

## OWNER COMMENTS

I may hold the record for the longest ownership of a PA-46, having bought mine new from the factory in 1984. I like the airplane a lot and have flown it about 2700 hours. The Malibu is equally at home at FL250 on a 1000-NM trip as it is on a sightseeing flight around the San Juan Islands at 1000

*As would be expected in a sophisticated airplane, the panel can get busy. This Mirage panel reflects upgrades made by the owner.*

feet AGL. The Continental engine allows cruising at 180-210 knots, depending on altitude, on 14-16 GPH running LOP, which is required. I've found the cabin to be ideal for carrying Angel Flight passengers and their families.

As with most early production airplanes, mine has a relatively low empty weight and a very decent useful load of 1325 pounds. There's a lot of flexibility to trade off between fuel and passengers, especially with the low fuel consumption and 120-gallon capacity.

Maintenance is a serious activity—I figure $7000-$10,000 for an annual—and only use shops that really know the airplane and maintain a lot of them. Insurance runs $6000 per year for $300,000 in hull value and $2 million liability coverage.

Bill Ayer
Via email

After owning a Cessna 182T and T206, I purchased a 2010 Mirage. The Mirage owns a niche that no other piston single can compete with for comfort, pressurization, speed, FIKI and efficiency—and the ramp presence is pretty nice, too.

I found no surprises while transitioning to the Mirage, the airframe and flight characteristics were predictable and trustworthy. It sure is nice to fly above the weather.

Being a fairly low-time pilot at 550 hours when I purchased the Mirage, I found the initial training and support from MMOPA to be invaluable. As a pilot and owner, I rely on the Association for top-notch tech support, safety training, events and resources.

Chuck Basil
Via email

Over three years, I have flown my 2007 Mirage over much of the country. Costs for absolutely everything have run $850 per hour at 140 hours per year.

Dan Peterson
Via email

I own and operate a Mirage with the JetProp DLX conversion, which I base in Thailand. I was told this airplane is the best bang for the buck in its class, and I have not been disappointed during my five years of ownership. Dispatch reliability has been excellent—I average 250 hours per year.

I operate out of an 800-meter by 10-meter asphalt runway. How many other aircraft have a performance envelope that allows takeoffs and landings in that distance, on very hot and humid days, and then a climb to FL270 and a cruise of 260 knots burning 30 GPH?

The basic Malibu design has stood the test of time very well. Most ADs and Service Bulletins are historical, with very few recent issues. The support from the MMOPA is second to none. I spent an extensive amount of effort and time in the forums before I decided to buy. It was well worth the cost of membership.

Eduardo Loigorri
Via email

I own a Malibu as well as the world's largest PA-46 maintenance facility in the world. Occasionally a pilot will purchase a PA-46, thinking it is just a little more expensive to operate than his/her previous aircraft, only to find out that some of the systems installed on the plane are quite costly to maintain. For some of the early aircraft, it is not uncommon for an annual inspection discrepancy list to exceed 25 percent of the value of the airplane. On the flip side, there is no other aircraft that can do what the PA-46 does as efficiently and inexpensively.

It is important to get a prebuy from a competent shop. I've generated a discrepancy list of $180,000 on an airplane only three hours out of an annual at a Piper dealer. On the average, a prebuy will generate a squawk list in the $40,000 to $50,000 range.

Chad Menne
Via email

I have owned a 1990 Mirage for three years. After six months of ownership, I replaced the engine with a 460-hours-since-new surplus engine from Rocket Engineering (from a PA-46 that was converted to turboprop) and a three-blade prop conversion. The airplane will now do an ILS missed approach at Chihauhau, Mexico, without any circling or other gymnastics.

The airplane has been amazingly trouble-free, even when compared to a Cherokee. It is a pity Jack Riley is no longer with us; the airplane could do with a STOL conversion—our sea-level minimum runway limit is 3000 feet of pavement.

Jack Wybenga
Via email

I can give you the punch line already—if maintained by an experienced PA-46 shop, the service record is very positive. The learning curve for the inexperienced is pretty steep

*A G1000-equipped Mirage simulator at Legacy Flight Training.*

because there are more systems than usual in a piston-powered airplane and the common systems are frequently set up differently.

John Foster
Via email

I bought my 1999 Mirage in 2004. First engine went to 1800 hours—top between, of course, and the second engine is going very strong. I have 2300 hours on the airplane, now. I buy used engines from Rocket Engineering, who converts these airplanes to turbines and has extra, low-time engines around. Usually about 350 hours on a used engine and it comes with a mount, vacuum pumps, alternators, turbos, etc. Nice.

I went from a 1979 Cessna T210 to the Mirage and spend, all things considered, less to fly the Mirage. Insurance is $5800 a year for $2 million smooth coverage, and annuals run $6500 for everything.

This is the most reliable, comfortable and capable plane that I've ever had. Dispatch is 99.5 percent. Pressurization and the cabin is great. Weather capability is great, so long as the PIC knows the plane and pilot limitations. The ability to inflate the boots and pop off the ice is a real comfort builder.

Range is terrific. I have long-range tanks and rarely use them. The main tanks hold 120 gallons and yield a solid five-plus hours of flight. I can put another 25 gallons in the long-range tanks and did so when I flew from Iceland to Scotland in the plane, without thinking twice about it.

I most often cruise between 16,000 and 17,500 feet. It gets me over most weather, there is very little traffic and the cabin is at 3500 feet MSL. Speed is usually about 192 knots, burning 20.5 GPH. 1999 was the only model year that had the KFC225 autopilot, which I like. I've installed a Garmin G500 system, which is coupled to the autopilot, and have no regrets or complaints.

Gerald Blank
Via email

The good: comfort—I've had people with a fear of flying overcome it in the plane because it is so comfortable. It's stable and handles turbulence well; I love flying it.

The bad: The engine mount design has caused over 30 documented nose gear collapses. Piper has not fixed the design, although it has issued a Service Bulletin. My nose gear collapse was caused by a cracked engine mount that wasn't caught at the annual. There is an STC that fixes the problem. The airplane has so many specialized systems that you can't trust it to just any shop.

Dave Ferguson
Via email

The Aviation Consumer

## Letters

*(continued from page 3)*

Several of the company's managers have been replaced, and the new ones have a new set of rules to work by. The same salesman who sold the job handles each customer. All of the specific requests that have been agreed to are documented and will be enforced. The net result is the customer gets what he wants, in an agreed-to time frame, guaranteed.

We made a long list of changes in the company's personnel, responsibilities and internal policies and procedures. We did this to assure The New Firewall Forward customers that their project will be completed on time, with the same—or better—quality that has always been present at Firewall Forward. One gentleman in the survey who complained that he had to come to our shop (due to similar FAA and economic issues) to get his engine, made positive comments on the expertise and dedication of the employees who worked on his plane.

Tom Lawson, General Manager
The New Firewall Forward
Longmont, Colorado

### CORRECTION

In the Letters section of the July 2013 issue, we stated that FlightSafety International was no longer doing any piston aircraft training. That was incorrect—FSI provides Beechcraft Bonanza and Baron training in its Wichita, Kansas, Learning Facility.

## IFR Hoods

*(continued from page 19)*

hood that clips onto the bill. Donning and doffing the hood is easy.

It was ranked average in preventing intrusion of the view outside—both to the side and over the panel, but high in the ability to scan the instruments easily and doff quickly when needed. One of our reviewers said the plastic visor messed up the noise-canceling system of his headset by pulling the ear cups away from his ears and generating feedback in the system.

The flight school we discussed the product with said that, in time, the sides of the hood broke off, but were easily repaired with tape, and the visor eventually broke, so it was replaced with a Detroit Tigers baseball cap, which proved more comfortable than the plastic visor.

Glasses and sunglasses wearers gave this hood high marks. We were told that caps representing other sports teams were acceptable.

### VIBAN IFR HOOD

For $46.74, $15 more than the next most expensive hood, we expected the Viban IFR Hood to max out the scores. It didn't. It cannot be worn with ordinary glasses or sunglasses. For the non-glasses set, it was ranked high for comfort and did reasonably well at blocking the view outside, but not as well as JeppShades or Francis Hood—the $8.10 Jiffy Hood was as good.

To our surprise, the designers of this expensive hood recognized the shortcoming and included some confusing instructions and a piece of fabric for the user to attach to the hood to help shut out the world outside the cockpit. One reviewer referred to that as cheesy.

### CONCLUSIONS

If you have a place to store it, we recommend the Jiffy Hood as an inexpensive, workable hood for everyone. If you don't need glasses, we suggest JeppShades or Foggles (OK for single-vision glasses) for their ease of storage and use. We think the advertising for JeppShades and Viban should make it clear that glasses wearers should not buy them.

Finally, although our reviewers thought it looked "dorky," the ASA Hoodwink is good in a pinch and it stores in a tiny area.

**FEEDBACK WANTED**

### CIRRUS SR20

For the December 2013 issue of *Aviation Consumer,* our Used Aircraft Guide will be on the Cirrus SR20, the CAPS-equipped, two-place, low-wing speedster from Duluth. If you've owned or flown an SR20, we want to know what it's like to own this plane, how much it costs to operate, maintain and insure, and what it's like to fly. If you'd like your airplane to appear in the magazine, send us any photographs you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the Cirrus SR20 by October 1, 2013, to:

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