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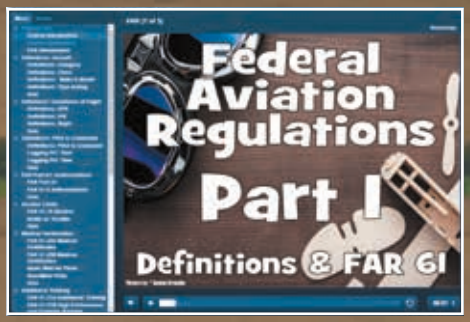

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The Aviation Consumer

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READY FOR A JET? ACCEPT TIGHT REGS, INFLATED COSTS

Spend even a short time on the floor of a National Business Aviation Association convention and you better forget everything you know about the cost of owning, upgrading and operating a small piston. Yes, the jet world is a major step up in the ownership experience and aviation's high end is elegantly and seriously represented at NBAA gatherings, and the high regulatory standards of the FAA's Part 25 are very much in place. Frankly, I think the regulatory stronghold is stifling innovation.

I should have known better, yet my head showed up at this year's NBAA-BACE gathering in Orlando, Florida, a little too assuming that STCs for installation and product certifications for jets are easy to come by. When it comes to autopilots, EFIS and other modern gadgetry for small airplanes, a growing number of systems for Part 23 retrofits are finally obtainable without having to reach deep into the kid's college fund. There's not much of that on the NBAA convention floor.

When I rattled the folks at Honeywell to expand the STC for its AeroVue integrated flight deck to aging jets and turboprops, BendixKing's Doug Hayden quickly set me straight that these days, just an ADS-B transponder STC for a Citation is a "good score." Really? I thought the FAA is trying to make it easier for business aviation to comply with ADS-B. By all accounts, the jet fleet is way behind and a lot of that has to do with available products and brand compatibility. Hayden showed me the Honeywell CNI5000 ADS-B Out/In retrofit for the CitationJet 525 and Bravo 550 series. The package uses two BendixKing KT74 transponders, a WAAS GPS module and an ADS-B In receiver. The price? Budget at least $25,000 with installation.

Over at Garmin, the bigger news is the $500,000 G5000 flight deck retrofit for aging Beechjets and Citation XLS jets. At the show's static display area, Garmin let me paw around the cockpit and avionics bay of its XLS test bed during a shoot for *Aviation Consumer's* video channel. I think the system is so well integrated, you'd think the jet came off the factory floor with it as stock.

Still, when it comes to integrated flight decks perhaps the best deal going could be Sandel's Avilon, a retrofit suite aimed at the turboprop market. Sandel's Larry Riddle assured me it will have a fly-away price of $175,000 when the company begins shipping it early next year. With enough dealer support, if Sandel earns the King Air STC (plus ones for other airplanes as it says it will) that's a steal deal that could challenge the $400,000-plus offerings from the competition.

On the shop level, the savvy ones understand the key to serving the jet market is with innovation in the form of diversity. One that gets that right is SureFlight in Coatesville, Pennsylvania. Company CEO Dan Watkins told me that adding avionics capability to its existing Part 145 repair station was the right complement to the company's paint and interior services. In close proximity to the Philadelphia and New York airspace, you can bet SureFlight will be putting in a few ADS-B systems to go along with the new paint work.

Still, If I had to pick an innovative product that impressed me the most it would have to be the Jet Shade—a removable tinted window shade that's proven to significantly reduce the inflight temperature in larger cabins. Kevin Duggan, the product's inventor and a light jet owner, well understands the regulatory restrictions of modifying the windows in certified aircraft—especially pressurized ones. "I studied the regs carefully and thus designed these shades so they don't even touch the existing glass, so there's no need for any FAA approvals," he told me. In my view, that's one smart and innovative man because there likely won't be any regulatory breaks for anything with a Part 25 stamp on it anytime soon. —*Larry Anglisano*

MOONEY ACCLAIM ULTRA AVIONICS

I read the Mooney Acclaim Ultra flight trial article in the October 2018 *Aviation Consumer* with interest, and have a couple of comments tangentially related to the airplane.

I have never explicitly seen it written anywhere that when one buys a glass panel airplane like the Garmin G1000-equipped Mooney Acclaim, the aircraft OEM owns the software for the avionics. This has been a problem with Mooney through its various bankruptcies and production hiatus. I don't know if it has been a problem with other OEMs, and I understand only Mooney Service Centers (which seem to be few and far between) can do the G1000 software upgrades.

This is obviously not an issue with Garmin's retrofit G500/600TXi and the GTN-series navigator support.

Luca Bencini-Tibo
via email

The G1000 NXi in the Mooney Acclaim Ultra (like every other G1000-equipped aircraft) is certified/encompassed within and governed by the aircraft's type certificate. Any modifications—including software upgrades—require an amendment to the aircraft's original type design. This takes time and costs money.

Garmin told us that the rights to the G1000 software (or updates to it) are proprietary and vary among OEMs.

Is it me or does the paint job on the new Mooney Acclaim Ultra look like it was inspired (or even lifted from) the mid-1960s Piper Comanche?

Mark Klebanoff
Worthington, Ohio

Everything old is new again, we suppose.

As an owner of a Mooney 231, I'm relieved that Mooney seems to be ramping up production, at least in small numbers compared to the competition. Does anyone know how many Mooneys were cranked out this year?

Rich Savarini
via email

As we go to press in early November 2018, the General Aviation Manufacturer's Association 2018 second-quarter shipments and billings data shows a total of six units for Mooney. This includes three M20U Ovation Ultras and three M20V Acclaim Ultras. And since you brought it up, contrast this to Cirrus Aircraft, which shows the total units at 197. That includes the SR20, SR22, SR22T and the SF50 jet.

FOR MORE ON AEROSTAR OWNERSHIP

In the Piper/Smith Aerostar used market review covered in the November 2018 *Aviation Consumer*, I think you did your readers a disservice in omitting mention of the valuable The Aerostar Forum. This active forum is a good web-based resource for Aerostar owners and individuals interested in learning more about this fine aircraft.

The forum—which was created and is sustained by Aerostar owners—is not related and is an alternative to the Aerostar Owner's Association. The forum is free, its quality of information high and there is an extremely resourceful reference library. The Aerostar Forum also has an active Facebook presence. Access the forum at www.aerostar-forum.com.

Forrest Ward
via email

TURBOPROP AVIONICS

I read with interest Larry Anglisano's flight trial of the BendixKing AeroVue for the Beech King Air in the October 2018 *Aviation Consumer*. His instinct is correct—the system could work in other turboprops besides the King Air. My company operates two Pilatus PC12NG aircraft, which are equipped with the Honeywell Apex avionics. We also operate a Piper Cheyenne II that's eating our lunch in avionics upkeep and the AeroVue seems like a logical choice for familiarity. Will there be more STCs?

Tim Frazier
Lexington, Kentucky

After a recent discussion with BendixKing, we're not confident there will be. The newer and less integrated AeroVue Touch will likely have more retrofit approvals.

At press time, that system is said to be in the AML-STC approval process. We'll have a flight trial report this winter. BendixKing is already selling the experimental version, the xVue Touch.

CORRECTION

In the Vulcanair V1.0 flight trial article in the November 2018 *Aviation Consumer* we incorrectly stated the wingspan of the Cessna 172 as 26 feet, 1 inches. It's actually 36 feet, 1 inches.

On The Cover: The formation flight photo of three Cessna 195s on the cover of this month's *Aviation Consumer* was taken by Deon Mitton. The Cessna 190/195 is this month's model featured in our monthly Used Aircraft Guide, which starts on page 24.

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New ADS-B Portables: Price for Every Purpose

New products from ForeFlight, Dynon and Appareo offer a few new features with improved battery life as a plus.

by Paul Bertorelli

CHECKLIST

- ADS-B portable features and performance continue to improve.
- Thanks to competition, prices on full-featured receivers have fallen.
- Because ADS-B Out is more prevalent, portable TIS-B traffic may perform better.

With the remorseless ADS-B deadline about to cast the unequipped into Next-Gen no-man's land, we figured the portable choices would dry up. But, surprise. At midyear, along came the three new entries we're reviewing in this issue.

This tells us manufacturers sense latent demand for portables, either because some owners just aren't going to equip with ADS-B before the deadline—or at all—or enough are contemplating the cheapest Out-only solution and may be trolling for a portable to do the In part.

Since our last mega review of the ADS-B universe in the May 2017 issue, 10 portables have either gone from the market or been displaced by new models and four new entrants have stepped into the fray. The result? There's more price stratification and capabilities have been marginally improved, especially battery life. It's thus more realistic than ever to snag the free weather and traffic with a portable and either do without the Out solution entirely or wait it out for something cheaper. (uAvionix, we're looking at you.)

NEW PLAYERS

The two new players in the portable market are Dynon Avionics and ForeFlight. The latter requires some clarification. Heretofore, ForeFlight had teamed up with Appareo Systems to market the Stratus 1 and 2 portables. These played only with ForeFlight and appeared to be strong sellers.

The Stratus is still out there, but now in its third generation and with open architecture so it works with other apps. ForeFlight's new product is the $499 Sentry, a diminutive box that combines a dual-band ADS-B receiver with a carbon monoxide detector, plus AHRS. uAvionix—they're the guys everyone is waiting on to deliver the wingtip- and tail-mounted ADS-B Out units—designed and builds the Sentry for ForeFlight. Once again, it works only with that app. In concert with its push to establish a market for midpriced panel-mount avionics, Dynon showed up at AirVenture 2018 with the DRX, which clearly aims to anchor the bargain end of the price spectrum. No frills on this one; just the dual-band receiver and a little case for $349 discounted, $395 list.

As Garmin scoops up most of the ADS-B panel-mount business, Appareo has been competing favorably with its Stratus ES and ESG transponders. The company leveraged that into the third iteration of the Stratus portable called the—what else—Stratus 3. At $699, it's what we would call a full-featured portable, to include the usual AHRS and a new wireless feature.

SENTRY

Not to snark it up too much, but none of these gadgets win prizes for design aesthetics—they're all some variation on a bland little white box. By a few fractions of an inch, the Sentry, at 3.25 X 2.25 X 1.25 inches, misses being the smallest. But uAvionix shows its chops as a maker of miniaturized drone avionics in the Sentry's light weight. It weighs only 4.2 ounces, compared to 6.8 for Dynon's DRX and a hefty 10.3 ounces for the Stratus.

Not that weight really matters much, but lightweight avionics evi-

Far left, Dynon DRX at $349, ForeFlight Sentry, center at $499 and Stratus 3 from Appareo at $699.

dently consume less power because two of these gadgets—the DRX and Sentry—have longer battery life than the first-generation portables did. The Sentry claims 12 hours and we believe it. It's barely warm to the touch when operating.

Mechanically, there's not much here. Just the white box with a power button, charging port and three monitoring lights for ADS-B, GPS and the CO detector. The Sentry sports a RAM suction cup mated to a purpose-made bayonet mount that's easy to use and quite secure. Just make sure the suction cup gets good purchase or you'll be fishing the thing off the floor.

The Sentry provides the usual suspects, including FIS-B for weather and TIS-B for traffic, plus the onboard AHRS gussied up with ForeFlight's version of synthetic vision. It has calibration capability so it can be mounted vertically on a window or perched on the glareshield.

The Sentry is equipped with sufficient internal memory to record for playback the past 20 to 30 minutes of weather and a future upgrade will include a flight data recording function. For the time being, you can record flights with ForeFlight's track logs feature.

The CO detector—which alarms aurally and by display through the app—is sensitive down to the required 50 PPM. It can also be silenced when necessary.

STRATUS 3

Six years ago, when ForeFlight was making inroads as a popular flight planning and navigation app, the company joined with Appareo Systems and Sporty's to offer the Stratus portable ADS-B receiver. It worked only with ForeFlight. That product evolved through a second and now a third iteration, but the Appareo marriage didn't do as well.

While the Stratus 3 still plays with ForeFlight, it's no longer limited to that app and will function with nearly a dozen more using the GDL90 data protocol.

Given the popularity of ForeFlight, we suspect Sporty's sold a pile of the earlier Stratus models, but it was due for an update. Appareo did itself no favors by declining to support earlier models that needed battery changes. At $699 retail, the Stratus 3 is $200 cheaper than the 2S model it replaces, yet it adds a few features. It's still the biggest and heaviest, however. It measures 5.8 X 2.5 X 1 inches in a rectangular format that's reminiscent of household wireless telephones. In the box are the usual charger and a non-slip gel pad for the glareshield. For $20, Sporty's offers a RAM suction cup for a window mount, but these have proven tender, popping off the glass even before you find the first bump.

Since it also makes certified ADS-B Out solutions, Appareo is positioned to pair its portable with the panel product. For example, if you buy either the Stratus ES or ESG 1090 Out transponder, the Stratus 3i version of the portable can be tucked under the panel to provide the In data your tax dollars bought. The portable has jacks for remote ADS-B and GPS antennas and power.

Otherwise, new features include an auto-shutoff, the expanded app

Dynon's DRX, left, and Appareo Stratus 3, right, can perch on the glareshield, but summer heat can be a problem. Sentry, photo at right, stays cool in a high wing if mounted on a window. Sentry's output to ForeFlight, lower photo, shows synthetic vision. Note that a traffic alert occurred at only 100 feet.

BUYING LOGIC IN AN ILLOGICAL WORLD

Even using my toes, I lack the ability to count up all of the ADS-B products—portable and panel-mount. How to make sense of any of this?

The starting place, in my view, is how much real instrument flying you do, if any. If you do enough hours a year, especially in actual IMC, you'll want two things that the portables provide: near real-time weather and AHRS backup.

But if you're flying real IFR, you're going to need ADS-B Out and real soon—like about a year from the time you read this. That argues for an end to the procrastination and a check to the avionics shop for a panel-mount Out setup. Many of these solutions combine In/Out—see the chart beginning on page 9—and obviate the need for a portable.

If IFR isn't on your plate, the buying logic smoothes out a little. It's not irrational to decide to (a) skip ADS-B Out entirely or (b) just limp along with a portable until well past the 2020 deadline and see how things shake out. If you don't fly in or near the mandated airspace, which is basically where you need a transponder now, you might not miss having ADS-B Out.

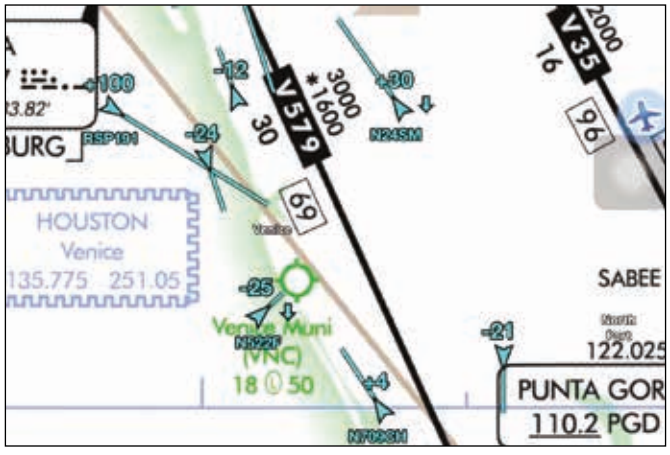
But portables are so cheap that even if, as a non-IFR pilot, you use the weather and TFRs two or three times a year, you've earned back the investment. There's another minor pot sweetener here.

Heretofore, traffic depictions from portables haven't been especially useful because they haven't seen all of the nearby UAT targets. However, as more aircraft are equipped with ADS-B Out, traffic performance of portables will improve because pilots using them will be more likely to be in range of Out-equipped aircraft that are getting the full broadcast package from the ground stations. If this sounds like a parasitic arrangement, it's exactly that. To help you get over the shame of that, just think about the five grand you didn't have to spend. That should ease the pain. *—Paul Bertorelli*

coverage mentioned above and what Appareo calls Smart Wi-Fi. It allows a cellular-equipped tablet or phone to use that capability without disabling the wireless link to the Stratus. Doesn't sound like much, until you realize it saves you the nuisance of going back into settings when you need to browse or check email.

Like all of the latest receivers, the Stratus 3 is dual-band and it has an onboard AHRS, so it has to be oriented forward for the gyros to initialize and calibrate.

Appareo says it functions with ForeFlight synthetic vision and will add new weather products coming through the FIS-B feed, including cloud tops, icing and turbulence forecasts. The Stratus 3 has an eight-hour battery and note that the charging cable is USB-C, not a micro or a mini. Lose it and your junk cable box probably won't have a spare. (The Sentry has the same cable fitting.)



DYNON DRX

Dynon's aesthetic variation on the pale white box is actually blue and gray for the DRX. It's the smallest of the bunch and the only one with an external antenna, a 3.5-inch whip that's articulated to tuck in parallel to the box for carrying purposes.

It has a power button, a USB micro jack for charging and three tiny annunciators for power, GPS and ADS-B lock. It also has a cooling fan that came alive after about an hour of run time and ran sporadically thereafter.

Dynon says the battery is sufficient for a "weekend's use" but that's hardy specific enough to suggest a number. Our guess is that it's about 16 hours. Dynon says the DRX will work with ForeFlight, but we had trouble keeping the two talking to each other. ForeFlight's device manager confirmed the connection, but did not offer data on battery status. The DRX performed seamlessly with WingX Pro, displaying traffic and FIS-B data.

FLIGHT TRIAL

We perched the DRX and the Stratus 3 on the glareshield of a G1000 Cessna 182. Using the RAM mount, the Sentry went on the copilot-side window, mounted vertically so the AHRS could orient. The Sentry and ForeFlight easily danced cheek-to-cheek and it delivered all the promised features.

The latest iteration of ForeFlight's synthetic vision is all but indistinguishable from the G1000's depiction, with good graphic detail and alerting. It locked onto the ADS-B feed at the foot of the runway and climbing through 100 feet, we saw the first traffic alert, matching the G1000's performance perfectly. (The 182 was equipped with ADS-B Out, so we benefitted from the local traffic package.)

The AHRS utility can be left to its own devices to orient correctly through an auto zero pitch/bank function or you can calibrate it manually by nudging the bank and pitch. Both worked well and gyro response, while not glass-panel smooth, would be adequate as a

Traffic depiction on ForeFlight, photo at left, includes relative altitude and 60-second vector. Portables see more traffic than they used to because more aircraft have ADS-B Out.

PRODUCT	PRICE	SIZE	ADS-B SPECS	BATTERY LIFE	MAJOR APPS SUPPORTED	COMMENTS
DUAL XGPS170D	$549	3.7 X 5.6 X 1.0	978 MHZ 1090 MHZ	5 HOURS	FOREFLIGHT, WINGX, EKNEEBOARD,DROID EFB,FLTPLAN GO, IFLIGHT-PLANNER, OTHERS	Dual-band ADS-B with WAAS GPS. Uses Bluetooth for tablet link, allowing wireless functions at the same time.
DUAL XGPS190	$849	4.3 X 2.7 X 1.0	978 MHZ 1090 MHZ	5 HOURS	FOREFLIGHT, WINGX, EKNEEBOARD,DROID EFB,FLTPLAN GO, IFLIGHT-PLANNER, OTHERS	Same features as 170D, but adds AHRS.
DYNON DRX	$349	3.6 X 2.0 X 1.25	978 MHZ 1090 MHZ	16 HOURS	FOREFLIGHT, FLYQ, WINGX AND ANY APPS COMPATIBLE WITH INDUSTRY STANDARD GDL 90 FORMAT.	Basic dual-band ADS-B with exceptional battery life.
ILEVIL BOM	$1995	9.8 X 1.8 (CYLINDRICAL)	978 MHZ 1090 MHZ	4 HOURS IN BACKUP MODE	WINGX, I FLYGPS, AEROVIE, FLTPAN, IFLYPLANNER, AHRS UTILITY, XAVION, AVARE, NAVIATOR, EASYVFR	Self-powered, self-contained ADAHRS and dual-band ADS-B driven by wind turbine with battery backup. Installs under NORSEE letter. Wireless feed to devices.
ILEVIL 3 SW	$1195	4.0 X 2.5 X 1.0	978 MHZ 1090 MHZ	5 HOURS	SAME AS BOM	Includes GPS, AHRS and data recording capability. Connects wirelessly to as many as 10 devices.
ILEVIL 3 AW	$1395	4.0 X 2.5 X 1.0	978 MHZ 1090 MHZ	5 HOURS EXTERNAL VOLTAGE	SAM AS BOM	Same features as 3 SW but adds pitot/static input for indicated airspeed and true ADAHRS. Can be panel installed in certified aircraft under NORSEE letter.
STRATUS 3	$699	5.8 X 2.5 X 1.0	978 MHZ 1090 MHZ	8 HOURS	FOREFLIGHT, FLTPLAN GO, FLYQ, WINGX, IFLY GPS	Third-generation ADS-B from Appareo. Includes AHRS and can be paired with ES/ESG Out transponders to provide inexpensive In solution.
FOREFLIGHT SENTRY	$499	3.25 X 2.25 X1.25	978 MHZ 1090 MHZ	12 HOURS	FOREFLIGHT	Designed and built by uAvionix.Can mount on glareshield or to a side window. Has a built-in CO detector and AHRS.
MERLIN/RXWX	$179 TO $249	5.3 X 1.1 X 2.5	978 MHZ 1090 MHZ	VARIES WITH BATTERY TYPE	FOREFLIGHT, FLYQ, WINGX AND OTHERS	The Merlin is sold by Seattle Avionics, the RXWX by Aircraft Spruce and others. Both are pre-built versions of Stratux kit ADS-B. Includes internal GPS and AHRS, but requires external power or battery.
SCOUT	$199	3.35 X 0.84 X 0.34	978 MHZ 1090 MHZ	EXTERNALLY POWERED	FOREFLIGHT ONLY	Basic small, light dual-band ADS-B. Doesn't include GPS, AHRS or onboard battery. Smallest of the ADS-B receivers and although it connects wirelessly, it requires a power cable.
GARMIN GDL 50	$849	4.9 X 1.3 X 3.0	978 MHZ 1090MHZ	8 HOURS	GARMIN PILOT, FLTPLANGO, FOREFLIGHT	Dual-band ADS-B with attitude sensing. Outputs to tablet via Bluetooth, G3X Touch and aera portables.
GARMIN GDL 52	$1199	4.9 X 1.3 X 3.4	978 MHZ 1090ES SIRIUS XM SATELLITE WEATHER	5 HOURS EXTERNAL VOLTAGE	GARMIN PILOT, FLTPLANGO, FOREFLIGHT	Combines ADS-B, SiriusXM datalink and attitude sensing. Outputs via Bluetooth to tablets, G3X Touch and aera portables.
STRATUX	FROM $100	VARIES WITH CASE OPTION	978 MHZ 1090ES	EXTERNAL VOLTAGE	FOREFLIGHT, WINGX, FLYQ, OTHERS	Assemble your own receiver and play the ADS-B data on a variety of apps.

backup. The Sentry has a pressure sensor so in a non-pressurized aircraft, the tape depicts pressure altitude or cabin altitude in a pressurized airplane.

The device manager has a tab to test the CO alarm, but not the sensor itself. The alarm is piercing all right, but it doesn't feed into the audio panel. In flight and through noise-cancelling headsets, one of us heard the test alarm, one didn't.

ForeFlight has added a weather playback feature that scrolls a playback of the previous 20 to 30 minutes of radar data. This function also works when using the Stratus, but only with the ForeFlight app.

We found that the Stratus 3 performs similarly to the Sentry, although its AHRS calibration is slightly different. We mounted the Stratus on the glareshield in the provided non-slip gel sleeve. But

if we were buying this product, we would recommend the RAM suction mount for a window. Operating on their own, these receivers become just warm to the touch, but in direct sunlight on the glareshield, they become almost too hot to handle and Appareo says the Stratus will shut down at 140 degrees F. Better to keep it in the shade. Appareo offers its own app for the Stratus called Stratus Horizon Pro, which is limited to calibration and display of the AHRS. In Beta, is an additional utility that connects to the audio panel and automatically transcribes radio transmissions. We'll try this when the hardware is available.

Last, Dynon's DRX performed well with WingX Pro, but spottily with ForeFlight, perhaps due to inference issues in the cockpit. On the ground, it connected reliably, albeit without receiving any tower data, although it did sporadically track high-altitude 1090 targets.If battery life drives the decision, the DRX seems to be the Energizer Bunny. A charge lasted for at least 16 hours.

RECOMMENDATIONS

For ForeFlight users on the hunt for full-featured portable ADS-B, the Sentry is the best choice, in our view. It's $200 cheaper than the Stratus 3, has better battery life and it's smaller. We found no warts in its performance. For a minimal ADS-B In solution for ForeFlight only, Sporty's still sells the Scout at $199. It has no internal GPS, no battery and just basic FIS-B/TIS-B. It is dual band.

Users of other apps might consider the Stratus 3 since it's relatively multilingual, albeit pricey in the current market, at $699. For half that price, the DRX does as much, unless the AHRS feature is a must-have backup. That may be true for owners who fly real-world IFR.

Buyers looking at the Appareo Stratus transponders as Out solutions might naturally consider the Stratus 3 for the In half. On the other hand, given what some saw as Appareo's foreshortened support of its original Stratus units, we're a little leery of recommending it for a long-term installation.

YouTube See a video review of portable ADS-B at http://tinyurl.com/j95ht2a

Avionics Market Analysis

ADS-B: THE CRUNCH LOOMS

As we go to press this month, the ADS-B deadline for mandated airspace is 420 days away, give or take a day or two. At this juncture, two things are evident: No one is quite sure how many aircraft are equipped thus far and the long-awaited installation logjam is beginning to materialize.

In June of 2018, MITRE Corp. estimated that only 25 percent of the GA piston fleet had installed ADS-B, based on observed data from ATC and the system's 800 or so ground-based towers. MITRE found that 41 percent of the turbojet fleet had equipped.

But Ric Perri of the Aircraft Electronics Association thinks those proportional numbers are too low because the number of eligible aircraft has been overestimated. Subtract the hangar queens and derelicts still on the registry, the non-electrical-system aircraft and airplanes that simply don't need ADS-B, says Perri, and AEA believes as many as two-thirds of the GA piston fleet may now have ADS-B.

But that still leaves a lot of airplanes to be equipped, possibly as many as 40,000 during the next year running up to the deadline. There's no argument that many owners are procrastinating, either not wishing to spend the money or waiting for that killer $1200 hardware. Still, shops are beginning to see the installation logjam everyone feared and they expect it to get worse after the first of the year.

"Toward the end of this, when most people figure out this is really gonna happen, I think you're going to see a backlog. I know a lot of my customers are holding out for the wingtip solution, but we don't know what's going to happen with the Garmin suit," says Stacey Jordan of Palm Beach Avionics. He's referring to the wingtip- and tail-mounted nav light replacements uAvionix introduced some months ago. The company is still working on STC approvals for these devices but market delivery may be delayed at least partially because Garmin has sued uAvionix over patent infringement.

Even ignoring that, say shops, ADS-B installations consume far more shop time than most had planned for the simple reason that few owners opt for just the ADS-B hardware.

"To be honest, I expected to be scheduling three- and four-day jobs, but right now I'm tackling major overhauls," says Gulf Coast Avionics sales manager Matt Schloss. Customers are opting for mapcomms, glass displays, engine monitors—in short, complete panel redos.

While that's a nice problem to have, it also means that techs are tied up on a single airplane four weeks, not four days. And some shops are having trouble finding qualified techs to do the work. That may get worse in 2019.

"I have no doubt there will be a lot of people grounded," says Chuck Gallagher of Cincinnati Avionics, Sporty's avionics arm. When we spoke to him in October, his shop was scheduling work as far out as February or March 2019 for major jobs and he expects that to telescope to midyear or beyond. Other shops we contacted reported modest backlogs of two to three months.

Shops also report that the current system of choice is the Garmin GTX345, primarily because it plays well with GNS430/530 navigators, of which there are thousands still in the field. (See the chart starting on the next page for details.)

Appareo's ES/ESG 1090 transponders are a popular second choice, since one includes a WAAS GPS position source. L-3's Lynx transponders are also finding some sales because they're unique for offering an all-in-one solution.

MANDATE-COMPLIANT, PANEL ADS-B PRODUCTS

PRODUCT	ADS-B SPECS	DISPLAY INTERFACES	PRICE	COMMENTS
APPAREO				
STRATUS ES	1090ES ADS-B TRANSPONDER	N/A	$2495	Requires WAAS GPS input (Garmin, Avidyne).
STRATUS ESG	1090ES ADS-B TRANSPONDER	N/A	$2995	Has internal WAAS GPS, interfaces with select Stratus portable ADS-B receivers.
ASPEN AVIONICS				
NGT-9000	1090ES ADS-B TRANSPONDER DUAL-BAND ADS-B IN	EVOLUTION MFD, SOME GARMIN AND AVIDYNE DISPLAYS	$2645	L3 Avionics product sold by Aspen. $795 software unlock required to interface traffic/weather with Aspen display.
AVIDYNE				
AXP340	1090ES ADS-B TRANPONDER	N/A	$3995	Partial plug-and-play with some existing BendixKing transponders. AXP322 is remote version.
SKYTRAX100	978 UAT IN	ALL IFD NAVIGATORS	$2199	Display compatibility with several third-party systems for ADS-B IN, including Garmin GTX345, L3 Lynx 9000 Series, and FreeFlight RANGR UAT.
BENDIXKING				
KT74	1090ES ADS-B TRANSPONDER	N/A	$2999	Partial plug-and-play with KT76A/C, KT78A transponders, requires WAAS GPS input.
KGX130	978 UAT IN	IOS TABLET MFD TRAFFIC ONLY	$1489	ADS-B In only, for use with 1090ES transponder.
KGX150 (G)	978 UAT OUT, 978 UAT IN	IOS TABLET MFD TRAFFIC ONLY	$4069	Has internal WAAS GPS.
KGX150	978 UAT OUT, 978 UAT IN	IOS TABLET MFD TRAFFIC ONLY	$3489	Version without internal WAAS GPS.
FREEFLIGHT SYSTEMS				
FDL-978-RX	ADS-B IN	MFD, TABLETS	$3161	Works with a Wi-Fi module for display on tablet computers and select panel displays.
FDL-978-RX/G	ADS-B IN	MFD, TABLETS	$3995	Same as the FDL-978-RX, but with a built-in GPS.
FDL-978-XVR	978 UAT OUT, 978 UAT IN	IOS TABLET MFD TRAFFIC	$3935	Single-box solution that works with Garmin GNS430W/530W navigators, works with a Wi-Fi module for connecting to tablets.
FDL-978-XVR/G	978 UAT OUT, 978 UAT IN	IOS TABLET MFD TRAFFIC	$4980	Same as FDL-978-XVR but with internal WAAS GPS.
FDL-1090-TX	1090ES ADS-B TRANSPONDER	N/A	$4495	Remote control head/processor design, requires WAAS GPS input.
GARMIN				
GTX330D W/ES	1090ES ADS-B TRANSPONDER	N/A	$8637	Diversity Mode S transponder with ADS-B Out when connected with an appropropriate WAAS GPS.

chart continued on page 10

GTX335	1090ES ADS-B TRANSPONDER	N/A	$2995	Internal WAAS GPS.
GTX345	1090ES ADS-B TRANSPONDER	GTN750/650/G1000, G1000TXi, TABLETS G500TXi, G600TXi	$4995	Internal WAAS $5795, GTX345-R LRU priced the same and works on G1000 NXi, G2000, G3000, G5000.
GDL82	978 UAT OUT	N/A	$1795	Designed to work with and connects to the existing Mode A/C transponder.
GDL84	978 UAT OUT, DUAL-BAND IN	IOS, ANDROID TABLETS	$3995*	Standalone ADS-B Out and In, wireless Bluetooth connectivity with Flight Stream 110/210. Requires Garmin Pilot, ForeFlight tablet app. *$4495 with Flight Stream 210 (built-in AHRS).
GDL84H	978 UAT OUT, DUAL-BAND IN	IOS, ANDROID TABLETS	$3995*	Standalone ADS-B Out and In, wireless Bluetooth connectivity with Flight Stream 110/210. Requires Garmin Pilot, ForeFlight tablet app. *$4495 with Flight Stream 210 (built-in AHRS), version for helicopters.
GDL88	978 UAT OUT, DUAL-BAND IN	GNS530W/430W GTN750/650 G600/500 *IOS/ANDROID	$3995	Requires WAAS GPS input, tablet interface requires Flight Stream wireless Bluetooth module, Garmin Pilot or ForeFlight app.
GDL88-W	978 UAT OUT, DUAL-BAND IN	GNS530W/430W GTN750/650 G600/500 *IOS/ANDROID	$5143	Has built-in WAAS GPS receiver, tablet interface requires Flight Stream wireless Bluetooth, Garmin Pilot or ForeFlight app.
GDL88-D	978 UAT OUT, DUAL-BAND IN	GNS530W/430W G600/500 GTN750/650 *IOS/ANDROID	$4495	Diversity model (requires top and bottom antenna installation), requires WAAS GPS input, tablet interface requires Flight Stream wireless Bluetooth module, ForeFlight or Garmin Pilot app.
GDL88-WD	978 UAT OUT, DUAL-BAND IN	GNS530W/430W GTN750/650 G600/500 *IOS/ANDROID	$5643	Has built-in WAAS GPS receiver, Diversity (requires top and bottom antenna installation), tablet interface requires Flight Stream wireless Bluetooth module, ForeFlight or Garmin Pilot app.
GDL88-DH	978 UAT OUT, DUAL-BAND IN	GNS530W/430W GTN750/650 G600/500 *IOS/ANDROID	$5395	Diversity and the version made for helicopters.
L3 AVIATION LYNX				
NGT-9000D+	1090ES ADS-B TRANSPONDER DUAL-BAND ADS-B IN	HAS WAAS GPS, TOUCHSCREEN, DISPLAYS TRAFFIC AND WEATHER ON SOME ASPEN, AVIDYNE AND GARMIN DISPLAYS	SEE DEALER	Supports diversity (top and bottom antenna), displays TIS-B, FIS-B ATAS (ADS-B Traffic Alerting System), includes Active Traffic (Interrogates Non-ADS-B Aircraft). Option - Terrain Vision $895. Option – TAWS $4000.
NGT-9000+	1090ES ADS-B TRANSPONDER DUAL-BAND ADS-B IN	HAS WAAS GPS, TOUCHSCREEN, DISPLAYS TRAFFIC AND WEATHER ON SOME ASPEN, AVIDYNE AND GARMIN DISPLAYS	SEE DEALER	Displays TIS-B, FIS-B ATAS (ADS-B Traffic Alerting System), includes Active Traffic (Interrogates Non-ADS-B Aircraft). Option - Terrain Vision $895. Option – TAWS $4000.
NGT-9000	1090ES ADS-B TRANSPONDER DUAL-BAND ADS-B IN	HAS WAAS GPS, TOUCHSCREEN, DISPLAYS TRAFFIC AND WEATHER ON SOME ASPEN, AVIDYNE AND GARMIN DISPLAYS	$5433	Displays TIS-B, FIS-B ATAS (ADS-B Traffic Alerting System), includes Active Traffic (Interrogates Non-ADS-B Aircraft). Option - Terrain Vision $895. Option – TAWS $4000.
TRIG AVIONICS				
TT31	1090ES ADS-B TRANSPONDER	N/A	$2225	Stack-mounted, requires WAAS GPS input.
TT22	1090ES ADS-B TRANSPONDER	N/A	$1989	Two-piece system, requires WAAS GPS input, compact.
UAVIONIX				
SKYBEACON	978 UAT OUT ONLY	N/A	$1849	Wingtip mount with WAAS GPS, LED nav light, LED strobe light. TSO certified, STC for installation pending.
TAILBEACON	978 UAT OUT ONLY	N/A	$1999	Tail mount version. Pending TSO and TSO certification.

Jet Shades: Efficient, See-Through

We think the Jet Shades tinted window panels are good for reducing cabin heat and sun glare and for maximizing air conditioning efficiency.

by Larry Anglisano

CHECKLIST

- The shades are well-constructed and see-through clarity is good.
- We found them effective for stabilizing inflight cabin temperature and taming sun-splash.
- For some models, getting the right fit the first time might be a challenge.

The Jet Shades product is the direct result of a pilot trying to solve a nagging problem: extreme heat in the cabin of his Eclipse Jet. "I'd take off single pilot in that airplane and the cabin heat was just killing me," said company founder Kevin Duggan.

But it's not just about reducing heat. Skin cancer should be a real concern in sun-splashed cabins, as should the long-term health of the aircraft's avionics and interior plastics.

Tired of sticking random things around the cockpit windows to shield the sun—and trying products sourced at auto parts stores and even car dealerships (without much success)—he developed the Jet Shades for use in the cockpit (and passenger cabin), which can be left in during flight. We tried a set and were pleased with their performance, impressed by their construction and frustrated by fitting them, proving that interiors aren't all the same among some models.

CONSTRUCTION, COATING

The shades are designed to be easily removable and they use no Velcro to stay in place. Who needs that mess when the adhesive melts in the sun? Instead, you install them by pushing their outer trim in place and remove them by grabbing on to pull tabs.

The shades are made of optical-quality polycarbonate—material that's virtually unbreakable and it will not shatter. An important point is that the Jet Shades are not acrylic, which can shatter.

We bent a shade over pretty hard and it didn't lose its shape or create any ripples in the coating. The panels are designed to be flexible, because that's what it takes to get them in place. More on that in a minute.

Rhode Island-based Jet Shades told us that although the regulatory specs on aircraft windows prohibit tinting them more than 30 percent, this product is easily and completely removable—not requiring an STC.

The Jet Shades specs say they block 72 percent of visible light, 99.9 percent of infrared light and 44 percent of solar energy. The company makes a good point that glare can kill the contrast and visibility of tablet computers and panel displays, so the shades reduce glare by 70 percent. As

This is how the Jet Shades fit in a 2008 Cirrus. It's the same for all aircraft—the flexible tinted shades press-fit into the interior window frame without putting pressure on the glass.

That's a King Air cockpit fitted with Jet Shades in the top photo. The red arrow shows that the windshield panels only cover the upper portion. We had no trouble spotting traffic when we flew with the shades in a Pilatus. That's our test Pilatus, middle, with a full set of mirror-finish shades installed in the passenger cabin. The sun baking the EFIS displays in the already-hot Eclipse cockpit, lower photo, is what early avionics failures are made of.

for harmful UV protection, they're said to block 99.9 percent—sunglasses for the windows, of sorts. Jet Shades has a patent for its coating.

During the early stages of its market testing, Jet Shades made the panels in two different tints, but some pilots complained that the darker tint was problematic for their deteriorating eyesight. The company experimented with a variety of tints and ultimately settled on a custom mix of heat-reflecting, heat-absorbing, light-blocking, heat-blocking and UV-blocking coating. We found them comfortable to look through with and without sunglasses.

We also found the construction of the shades to be quite good, and Jet Shades stresses that the product is made to high standards in a temperature-controlled, clean-room environment. No, these aren't garage-made panels. The patent includes several types of substrates and coatings, as well as CAD-based and robotic CNC cutting processes.

Each shade has crushable trim around the entire perimeter, so as it goes into the window frame there are several bite points and the shade's trim compresses around the trim of the window, keeping it in place.

Duggan made it clear that the shades do not touch the window—something that's important in pressurized aircraft. Since the shade doesn't touch the aircraft window, there's also no passing of heat to the window. Each shade has an approximate 8-inch air pocket for small amounts of airflow from the front and rear corners of the shade.

"In pressurized cabins, we're careful not to seal the window with these shades—that's very important," Duggan told us.

EQUALIZING CABIN TEMP

If you've flown an aircraft with separate pilot and passenger cabins you might have found that it's difficult to equalize the temperature, even with dual-zone climate control. Plus, it's not uncommon to have sizable temperature fluctuations between the pilot's and copilot's side of the cockpit, especially when the sun is dominating one side. The Jet Shades are an effective solution for balancing the temperature, while also making the air conditioning more effective.

Since these are light-limiting tinted shades, you don't want to be flying with the cockpit shades in at night. But in the rear cabin, we don't see any real reason to remove the shades. In our estimation, they can replace foil sunshades that might be removed and reinstalled every time you fly and

CONTACTS

Jet Shades
401-649-0443
www.jetshades.com

SELECT JET SHADES PRICING	
AIRCRAFT	**PRICE**
BEECH BARON 55	$599 cockpit set (three pieces) $899 cockpit and passenger windows (seven pieces)
CESSNA 182	$299 front windshield (two pieces) $299 rear windows (one piece) $499 cockpit doors and passenger windows (four pieces) $999 complete set (seven pieces)
CIRRUS SR22/T/GTS	$599 cockpit set (two pieces) $899 cockpit and passenger windows (four pieces)
PIPER PA32	$499 cockpit set (four pieces) $999 cockpit and passenger windows (four pieces)
KING AIR 200/300/400	$999 cockpit set (four pieces) $1499 cockpit and rear cabin windows (14 pieces)
CESSNA CITATION MUSTANG 510	$1199 cockpit set (four pieces)
PIPER PA46 MIRAGE	$599 cockpit set (four pieces) $1250 cockpit and rear cabin (10 pieces)

park. For some aircraft, that's a time-consuming chore. And like traditional foil shields, the Jet Shades can protect the interior from cracking and discoloration while parked in the sun. Duggan said the Sun Shades are the only aircraft-purposed shades for cockpit use in flight.

There's also a bit of an aesthetic advantage in going with a full set of shades (as the chart above shows, you can order a full set or panels for the cockpit). Since the shades give the aircraft a tinted-window appearance from the outside, we think they boost the aircraft's ramp appeal and also offer privacy when the aircraft is parked.

For safe storage, Jet Shades includes a microfiber storage case with each set it ships.

OUR TRIALS

In our evaluation, we ordered a full set (cockpit and passenger cabin) of Jet Shades for a Pilatus PC12NG. Out of the box, the shades for the rear windows fit like a glove. But the cockpit shades—not such a good fit. We snapped a bunch of photos showing the fit discrepancies and sent them to Duggan, who quickly had another set cut and sent. They were closer, but still not an exact fit. Duggan explained that this is simply the nature of some interiors and in the case of the Pilatus PC12, he's learning that they aren't all identical. Others, like the Cessna Citation, are proving to be an exact fit across the board. We think as more Jet Shades end up in the field, fitting a set of shades will get easier for aircraft that haven't been modified or upgraded. But that won't help aircraft with custom interiors and will result in custom fitting a set.

According to Jet Shades, due to the age of the aircraft, restorations, variation in the installation of the trim and the distortion of the trim due to heat, for some models it now sends out templates that the customer can adjust to fit their specific application. From there it designs and builds a custom set of shades. Duggan told us there will be a design charge for custom shades, but the company is still in the process of figuring that out and will publish the pricing on its website. Speaking of the website, www.jet-shades.com is where you start and the company sells directly to end users. The website has a catalog that's broken down by jets, turboprops and props. Click on the appropriate aircraft and you'll see the various shades appropriate for that model, which includes windshield and cabin window shades.

YouTube See a video of the Jet Shades at http://tinyurl.com/j95ht2a.

Worth mentioning is that the side window shade for the Pilatus blocked the SXM signal of a Garmin portable weather receiver.

NOT CHEAP, BUT FAIR

While pricing is far from cheap, we think it's fair given the quality and effectiveness of the product. A full set of Jet Shades for our Pilatus PC12NG testbed is $1599. That's a total of 14 pieces. For the cockpit only (five pieces) it's $999.

Pricing for a Beechcraft Bonanza is $599 for cockpit shades and $999 for a full set to cover all the windows. We like that the company offers the option of buying a partial set for most aircraft models. For example, you can buy a set for the windshield of a Cessna 182 for $299, for the cockpit doors and passenger windows for $499 or a full set (seven pieces for $999). Duggan said that shades for jets cost a bit more because many have larger windows, plus they're made a bit differently than the ones made for some piston models.

We're planning a sun shield market scan article for an upcoming issue of *Aviation Consumer*.

VFR Refresher Courses: Sporty's Rusty Pilot Tops

Among a handful of interactive pilot refresher courses, we favor the Sporty's Rusty Pilot Online program especially for honing comm radio skills.

by Kate O'Connor

When time flies and you don't, the scheduling or financial issues that kept you grounded might result in an expired medical and the need for a flight review. By that time, your piloting skills are likely in desperate need of some polish. Fortunately, there are good home-study courses available to help those of us faced with this very situation.

FLIGHT TRAINING

But picking the best course for either getting back into flying or getting ready for a flight review is a lot about knowing your learning style. For this article we took a look at five popular interactive online courses for rusty pilots getting back in the air, or to supplement real-world VFR refresher training. Here's what we found.

GLEIM PILOT REFRESHER

Gleim's online Pilot Refresher Course is designed for pilots preparing for a flight review. While it doesn't specifically cover issues related to returning to the air after significant time off, the material presents a thorough, clear and well-organized review of private pilot basics. The course is also eligible for FAA WINGS credit, which can help meet future currency requirements.

Course content is broken into nine sections, each of which begins with an audiovisual presentation. The presentations—slides with a voice-over—provide an overview of the section topic and generally run between 5 and 15 minutes. There is a note-taking function available during the presentations. Each presentation is followed by a 10-question true/false study quiz, which serves as a pretty good indicator of how much studying you need to be doing on the topic. Answers are reviewed after completion with explanations presented below the questions. Section reviews emphasize terminology, which might be quite useful for a pilot who has been away from the industry for a while, but less so for someone still comfortable with pilot lingo.

Following the true/false quiz, each section has a unit outline that breaks the topic into relevant points. The outlines are a no-frills read-and-study tool. While the outlines occasionally include links to outside resources, they don't incorporate the kinds of video, audio and graphic study aids seen in some of the other courses. Once the outline has been reviewed, each section has a ten-question multiple-choice quiz that must be passed before you move on to the next section. The course also includes an oral exam study guide that covers questions for private, sport and commercial pilots.

Perhaps the strangest quirk with this course is that you can't go back to any of the quizzes once they've been passed. They can't be reviewed or taken again once completed. On the upside, the course information is good and the format makes it easy to quickly review areas that are familiar and focus on topics that need more work. It is also the only course reviewed that requires the use of real-world performance and POH data specific to the aircraft you intend to fly.

Still, at $29.95, the Gleim Pilot Refresher Course is the least expensive of the group and we think it offers a lot of material for the money, which pays for 24 months of access to the program. Course completion time will vary depending on the amount of time spent reading for each section. Gleim provides flight review ground school and insurance recurrent training certificates at the end of the course.

The screenshot of the Sporty's $99 Rusty Pilot program in the lead photo is one example of the course's high-quality animation. It's available online and via Sporty's mobile app.

CHECKLIST

- Interactive self-study programs can save money and time that's otherwise spent at a flight school.
- Some courses award ground school completion and insurance certificates.
- Not all courses are specific to passing a flight review. Before starting one, consult with an instructor.

It's about as exciting as watching paint dry, but refresher training wouldn't be complete without brushing up on FAA regulations. Rod Machado's eLearning bundle, screen shot at the top, covers it. AOPA's Rusty Pilots Online course dives deep into airspace and weather review, bottom.

ROD MACHADO'S RUSTY PILOT COLLECTION

Rod Machado's Rusty Pilot Collection is an extensive array of products that includes books, audiobooks, eLearning courses and videos. On the advice of the man himself, we selected the Flight Review Preparation eLearning Course Bundle, and two e-Books—*How to Fly an Airplane Handbook* and Rod Machado's *Private Pilot Handbook*—as a good, basic get-back-in-the-air package.

The eLearning bundle includes two courses—one that focuses on regulations and one on airspace—with a little over seven hours of content in all. Each course is divided up into several parts and each part is broken down by topic. The courses themselves are animated video presentations with an often comedic twist. The interactive mini-quizzes at the end of each section can be retaken and the menus that appear at the side of videos make it easy to find specific topics or return to a section for review. There are also glossary and additional notes sections available for each course. Courses can be streamed online or downloaded to a mobile device. A flight review ground school completion certificate is available at the end of the course bundle. Total cost for the courses is $59.90.

The biggest issues with the eLearning courses is that you need either a good internet connection or to download them (mobile only) before watching. On a slow connection, the videos don't just pause like most media being streamed on a bad connection. Instead, the video freezes, but the course jumps to the next section once the video runtime is up whether the video has actually finished or not.

We think the books are decent resources for a pilot's library, plus they're fun to read. The inclusion of *How to Fly an Airplane* made this the only course we reviewed that really addressed the stick-and-rudder aspect of getting back to flying. Together, the *How to Fly an Airplane* ($44.95) and *Rod Machado's Private Pilot Handbook* ($49.95) e-Books have more than 1100 pages of content, including stories, explanations and illustrations on everything from aircraft systems to stalls—along with information on topics like weather, airspace, communications and regulations more commonly covered in review courses.

There is a lot of mixing and matching that can be done with the Rusty Pilot Collection to get a good package for an individual pilot's specific needs. If updates for the books come out after purchase, you can update your copies on the website. The courses and books are an entertaining and informative mix of humor, knowledge and real-world experience, as long as you have a good internet connection.

KING SCHOOLS RETURN TO VFR FLYING KIT

The Return to VFR Flying Kit from King Schools is a collection of 13 separate King video courses. Courses can be accessed online or through the King Schools Companion app, which is available for iOS. Most of the individual courses are eligible for WINGS credit.

Course structure varies, with some topics—such as cross-country flying—being taught using real-world flight scenarios. Others, like weather, take a more lecture-based approach. Information is presented in clear, accessible ways with relevant illustrations. The courses are broken up into video labs, with each lab covering a subsection

PRIVATE PILOT REFRESHER COURSES COMPARED		
COURSE/PLATFORM	**PRICE**	**COMMENTS**
AOPA RUSTY PILOT (Mac, PC)	Free, with AOPA membership	Focuses on returning to flying rather than passing the flight review and is scenario based. Eligible for WINGS and AOPA's Accident Forgiveness program.
GLEIM PILOT REFRESHER COURSE (Mac, PC)	$29.95 for 24-month access	Focuses on preparing for flight review. We wish you could review the quizzes after passing them.
KING SCHOOLS RETURN TO VFR FLYING (Mac, PC, iOS app)	$299 for lifetime access	Large collection of aviation knowledge in one place, but that's potentially overwhelming.
ROD MACHADO'S RUSTY PILOT COLLECTION (Mac, PC)	$59.90 eLearning only	Machado's humor makes otherwise dry material interesting. Plus the course places worthy focus on stick-and-rudder skills.
SPORTY'S RUSTY PILOT KIT (Mac, PC, iOS/Android)	$99.00	One-hour VFR communications course is a standout. Personal email links allow you to share your progress with your flight instructor.

of the overall course topic. Course lengths vary from fifteen minutes to about two hours. Courses do not include interactive components or knowledge review tools.

While the courses are a comprehensive collection of aviation knowledge, the possible downside is that the sheer amount of information available in this kit might be a bit overwhelming for someone returning to flying. Collective runtime for all of the kit videos is a little under 17 hours, which also allows for more time to cover topics not as thoroughly addressed in other refreshers, including courses dedicated to emergencies, practical risk management and night flying. Course topics are clearly labeled and arranged in a logical progression for someone getting back into the cockpit.

The $299 cost covers lifetime course access and updates. The price also includes access to the King Schools online library, which we think is a good resource.

SPORTY'S RUSTY PILOT KIT

The Rusty Pilot Kit from Sporty's is perhaps the best organized and most effective of the refresher courses we tried. The kit includes two online video courses—a flight review course and a VFR communications course—the FAA Pilot's Handbook of Aeronautical Knowledge, current FAR/AIM and a kneeboard. The video courses are available online and through the Sporty's mobile app. Both of the online courses are eligible for FAA WINGS credit.

The Flight Review course is broken down into seven lessons and takes about two hours to complete. Each lesson topic is divided into subsections that include a series of short videos. The videos are clean, clear and concise and the animations are very good illustrations of the points being made. There are quizzes at the end of each lesson. To complete the course, a final review quiz becomes available once every video has been watched. A passing grade of 80 percent or better will earn you a flight review ground training endorsement. Lesson quizzes can be retaken and there is a good collection of optional resources available to read.

The real standout with this kit was the one-hour VFR Communications course. Especially given that talking on the radio is often cited as one of the more daunting areas for returning pilots, the course does a great job describing best practices for communication in the air. The example communications—including incidental communications used throughout the videos—are clear and meticulously accurate. Like the Flight Review course, there are good supplemental materials available. The only real issue with the course is that it could have paid more attention to lost communications procedures.

To complete the course, two review quizzes must be passed with scores of 80 percent or better. The quizzes are another thing that Sporty's does right. The questions are generated from a question bank. Since you're effectively getting a new quiz each time you take one, it's a much better study tool than a repeat of an already-passed test.

Finally, the courses allow you to share your progress with selected individuals—such as your flight instructor—via email. You type in an email and the course provides that person with a link to your course progress page so they can see what you've completed and your quiz grades. You can also easily revoke access whenever you choose.

The price for the entire Rusty Pilot Kit is $99. The individual video courses are available for $34.99 each. Courses are accessible for 365 days after purchase.

AOPA RUSTY PILOTS ONLINE COURSE

AOPA's Rusty Pilots Online course is the only option we reviewed that is primarily focused on helping pilots return to flying rather than preparing for a flight review. The scenario-based course is based on the in-person Rusty Pilots seminars that AOPA has been running since 2014. The course is eligible for WINGS credit and AOPA's Accident Forgiveness program.

Format-wise, the two-hour interactive course takes you through a cross-country flight, using examples along the way to introduce topics including regulations, decision making and weather. It's presented in nine chap-

CONTACTS

AOPA
800-872-2672
www.aopa.org

Gleim Aviation
800-874-5346
www.gleimaviation.com

King Schools
800-854-1001
www.kingschools.com

Rod Machado
800-437-7080
www.rodmachado.com

Sporty's
513-735-9000
www.sportys.com

QUALIFYING A FLIGHT SCHOOL

Although I didn't plan on it, I stopped flying regularly roughly nine years ago when I no longer had access to my college's fleet of airplanes—and its affordable rental rates. Gone was the school financing to support my flying habit. Like plenty of other pilots, the longer I was away from the cockpit, the harder it got to even imagine finding the time and the money to start training for the flight review. Armed with enough interactive knowledge refresher material, my next step was to find an airplane and instructor. While the online courses made for a solid knowledge review, I remained concerned about finding the right place to train—a frustrating hurdle that makes it easy to see why some never get back in the cockpit.

While grounded, I remained immersed in aviation through my work so I knew the right questions to ask when qualifying a flight school. Others might follow my approach, and think practically. Particularly if you've moved to a new area, start with an internet search of schools, while setting limits on how far you'll realistically travel to the airplanes. In my case, I limited the travel distance to 30 miles. Look for customer reviews during your internet search to get a feel for the school's customer service and the general tone of its customer base. At that point I started calling and during each discussion I explained exactly what I was looking for: a skills assessment after letting them rust for nine years, plus the necessary and focused instruction to complete the flight review.

The airplane models the schools were using or the type of airport they were based at wasn't that important to me, but the maintenance was. One of the schools disqualified itself by sounding completely confused when I said I didn't want to join its standard private pilot course. What I really wanted was an instructor who understood my situation and was comfortable helping me knock the rust off. Another school's pricing was way out of my budget and a third school never called me back.

I ended up at Meriden Aviation Center in Connecticut, which operates a couple of Piper Warriors. The one equipped with a Garmin GNS430W GPS is priced at $159 per hour and instruction is billed at $59 per hour. My experience there seemed the right fit from the start. They asked good questions about my flying experience, talked through a plan, offered me an intro flight and ultimately got me back in the air four days later.

Last, expect a sizable price increase for higher-end rentals. As one example, Performance Flight in White Plains, New York, has a fleet of Cirrus models, including SR20s and SR22s. It also has a Cirrus-approved flight simulator, priced at $235 per hour. The Garmin Perspective SR22GT rents for $435 per hour and the instructor is $125 per hour. Bring your own renter's insurance policy.

—Kate O'Connor

ters, each of which deals with a phase of the proposed flight. Not counting the introduction and conclusion, each chapter has a short quiz that must be passed to move on.

AOPA's Rusty Pilots is the most interactive of the courses listed here. Most pages have icons to click for further information, videos to watch or links to useful websites and related courses/guides. The final chapter of the course provides a guide for good ways to continue knocking the rust off including tools to find flight schools, aviation medical examiners and groups of aviators to join up with. There is also a 40-page resource guide that goes along with the course.

The quizzes hit relevant points and the entire course can be retaken as often as you like. It does a good job creating a scenario that is approachable and exciting while being informative and practical. As a minor complaint, although not strictly incorrect, the radio communications in the videos aren't as clean as they could be.

Overall, Rusty Pilots Online comes across as the most accessible gateway for returning pilots. Although it is only available to AOPA members, the course is free—as well as highly beneficial—which makes it a great place to start.

ONE PIECE OF THE PUZZLE

An interactive ground school refresher course is just one part of the process when it comes to getting back in the air. If we had to pick one, the easy choice would be the Sporty's Rusty Pilot Kit. We think the $99 price is fair, it's accessible in app and desktop form and the radio communications review is a good resource that a lot of pilots can use, based on what we hear on the radio.

Still, while all of the courses we reviewed will contribute to your overall knowledge and readiness to fly, acceptance of an outside flight review ground training certificate or endorsement is at the discretion of the flight instructor who will be signing off on your flight review. We think it's worth checking in with your instructor before investing in a course if you plan to use it for that purpose.

Contributor Kate O'Connor is a staff news writer at sister publication AVweb, with not a speck of rust remaining on her flying knowledge and skills.

iPreflight Genesis: Smart Runway Analysis

The new iPreflight Genesis iPad app from Aircraft Performance Group puts a sharp focus on aircraft performance and blends useful flight planning.

by Larry Anglisano

CHECKLIST

- ⊕ It's a powerful performance app with a shallow menu structure and fast processing speed.
- ⊕ The weight and balance and loading utility is the best we've seen in any aviation app.
- ~ The app could be better if it included turboprop singles and high-performance piston twins.

Step into the world of owner-flown jet ops and you'll be crunching runway performance calculations in far greater detail than you did in a piston single. The same goes for figuring maximum takeoff and landing weights and cabin loading.

Colorado-based Aircraft Performance Group has been catering to flight crews and dispatchers with its iPreflight app for iOS for a while, but the app lacked the full-function flight planning capability that pilots expect in every aviation app. The new iPreflight Genesis app does just that and intuitively blends preflight planning with its in-depth runway analysis, weight and balance and custom engine-out procedures utilities. Here's a look at the app's capabilities and feature set.

WHO ARE THESE GUYS?

If you've recently stepped up to the jet world you probably haven't heard of the iPreflight app or even APG, but there's a deep company history that dates back to 1981. APG's founders operated Aircraft Performance Unlimited, an engineering firm that catered to the airline dispatch industry and ultimately grew to support over 65 airlines around the world with an integrated dispatch system. That company was purchased in 1995 by Jeppesen, which integrated the APU dispatch program into its own service menu.

As a follow-on to its work in the airline industry, APU's founders started Aircraft Performance Group (APG) to serve the corporate aviation market. Its app and other aircraft performance services are now used on more than 5000 corporate aircraft around the world. The company's Genesis app is the next-generation follow-on app to the widely used iPreflight app.

AN APP WITH SIMPLE MENUS

APG keeps the iPreflight Genesis menu structure refreshingly shallow,

The iPreflight Genesis app caters to the turbine market because of its intensive runway performance analysis utility. Part of that includes the app's highly automated weight and balance/loading computations, shown in the screen grab, right.

and it's contained to four major tabs to include the Summary page, the Flight Planning page, the Runway Analysis page and the Weight and Balance page.

You get the preflight planning calculations rolling from selecting the Trip tab on the app's main menu because the number crunching is all based on a trip metaphor.

Start by creating a new trip, which includes selecting an aircraft that will be flown. The app's database has over 350 available aircraft, from King Air turboprops to narrow- and wide-body business jets. Select the aircraft model from the drop-down menu (the app also presents frequently used aircraft), select the departure airport, the destination airport and the time of departure.

Worth mentioning is the app stores 9000 airfields, 26,000 runways and 2400 engine-out procedures, or EOPs. Moreover, APG says that the software for its integrated EOP, runway analysis and weight and balance calculations was developed around the aircraft manufacturer's AFM (airplane flight manual) data.

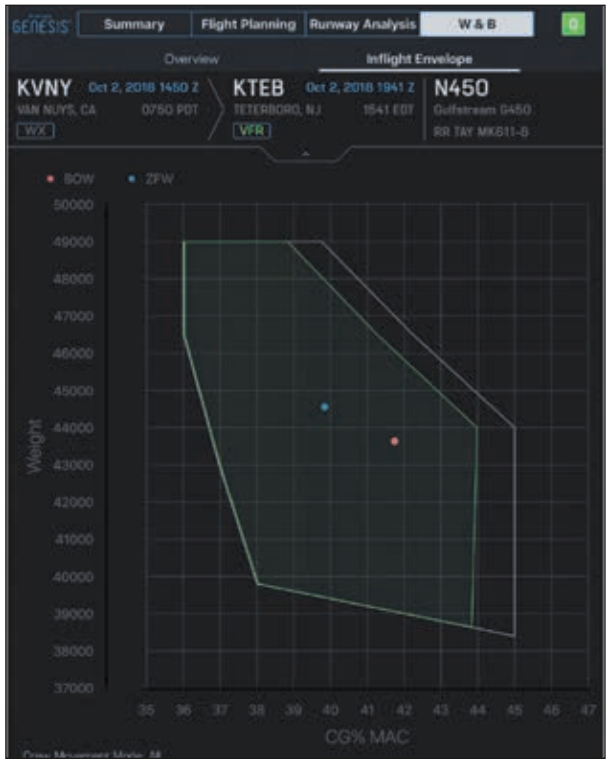
The last step includes adding the number of passengers on the flight, plus any cargo. Once you hit the Create tab, the app runs numerous potential flight plan routes, in addition to calculating the runway analysis data including the performance calculations for the departure and arrival airport. It also makes all of the weight and balance calculations based on seat loading and weight.

Once the app finishes making the computations (most of the number-crunching is finished in roughly 30 seconds, based on our use), it lands on the Summary page. This shows the departure and arrival airports, the flight plan summary (including the route of flight), cruise altitude, required fuel and so forth.

Of note is the Runway Analysis section, which gives a complete overview of the selected runway for takeoff and landing, the required wing flap setting, takeoff and landing limit weights, as well as the planned takeoff and landing weight, runway condition, aircraft bleed status and any inoperative components for the takeoff and landing, including engine-out performance.

The bottom of the Summary page has the weight and balance section, which is an overview of the aircraft's loading as well as the calculated CG, backstopped to determine whether it's within limits or not. Last, to the right of the weight and balance data is a high-level fuel summary for the planned flight based on the relevant aircraft configuration, routing criteria and loading. All supporting documents for these calculations are stored in the app's Trip Folder, which includes the runway analysis, flight plan and log, departure, enroute and arrival weather and NOTAMs. If this sounds like a virtual dispatcher, it's pretty close.

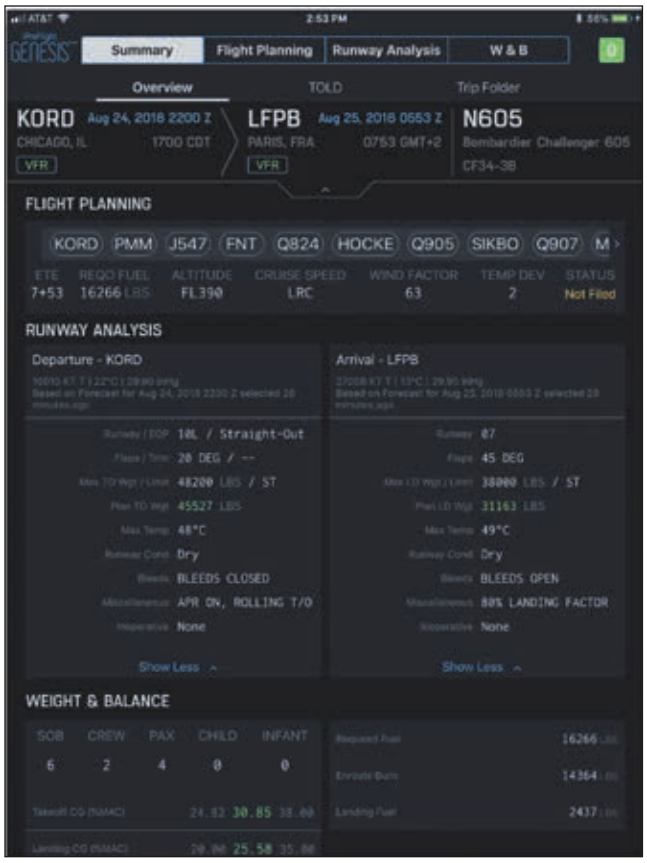
That's the app's new flight planning page in the top image. If you want to avoid the storms along the route of flight, the Manual Avoid function allows you to touch and draw a polygon around the area. The route then automatically avoids the defined area and updates all of the flight planning calculations. The screen grab at the bottom is the graphical CG page, which automatically accounts for loading variations and inflight cabin movement.



The app does rely on an internet connection (many jets have satcomm connectivity) for many of its features, but it works without a connection, too. This includes the MPE, or Maximum Payload Estimator utility, which determines the maximum payloads given a combination of specific temperatures from the departure and arrival airports.

FLIGHT PLANNING

The Flight Planning page provides more detailed and specific information about the flight, including an overview of the departure and ar-



Clockwise from upper left: A major function of the app's Summary page is the Runway Analysis section for both the departure and arrival airport. There's no guessing the aircraft's actual takeoff and landing weight limits. The cabin loading graphic allows you to change the passenger seating configuration on the fly and the app confirms the aircraft stays with CG limits by highlighting the seat in green. The runway analysis computations are highly customizable and account for the aircraft's equipment and a given configuration, bottom.

rival airport. This page also restates the route of flight to be flown, plus in the center of the page shows the climb, cruise and descent profile. For instance, based on the current loading and conditions you'll see the climb speed, expected cruise speed and also the rate of descent in feet per minute. A separate data box shows the required fuel, total trip fuel and the expected fuel remaining on landing.

The map section of the Summary page plots the route to be flown, while enabling the overlay of weather data layers including composite and forecast radar, satellite and forecast satellite imagery, turbulence, winds aloft, PIREPs and lightning strikes. There's also the option of looping the images. There's also AIRMET and SIGMET avoid areas.

Another important aspect of the app's flight planning capability is the ability to change the profile that was originally used to plan the flight, including the speed and altitude parameters. For instance, on the Profile page you can access multiple cruise mode options by selecting different cruising altitudes. In doing so the app automatically recalculates ETE and fuel burn tradeoffs. As an example, if the original flight planning was figured at maximum cruise speed, the time enroute and fuel burn is highlighted for the given cruising altitude. But if you're contemplating changing the cruising altitude, the app offers an immediate snapshot of what the time and fuel implications will be for a given altitude. It's quite logical and presented in a straightforward at-a-glance manner—the way it should be. The app also has a variety of routing options including direct, recently cleared, preferred Eurocontrol routes (for international ops, obviously), custom routing and APG's own SelectRoute feature, which is a proprietary, optimized routing function that's generated by the app's planning software. Route summaries showing ETE, distance, cruising altitude, fuel burn and shear value are displayed for each route to offer no-nonsense comparisons. There's also filing.

Perhaps what we like the most about the iPreflight Genesis is the straightforward but comprehensive weight and balance/loading function. It allows you to key in the exact amount of fuel onboard to be included in the computations and also to specify the exact location of cabin occupants.

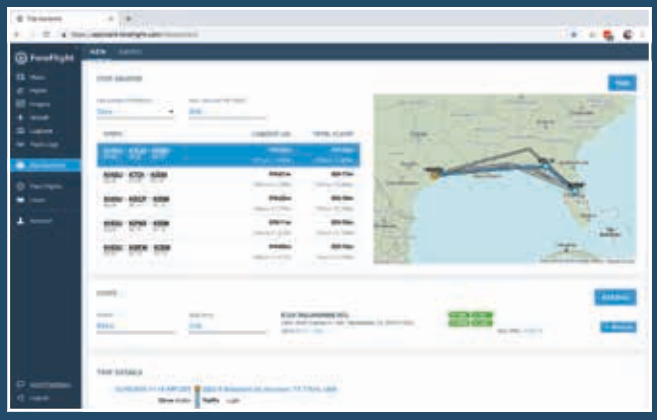
There's a dedicated tab for the utility, simply called Weight and Balance. The function's overview page offers the ability to add, delete and change occupied passenger seating positions within the aircraft's cabin. This is automatically customized when you select the aircraft from the app's list of models, and the app automatically updates the CG cal-

YouTube **See a video demo of the APG app at http://tinyurl.com/j95ht2a.**

FOREFLIGHT'S TRIP ASSISTANT UTILITY

Flight and performance planning is only half the battle. If you fly your airplane for work trips, especially with colleagues in tow, you know that a lot of the preflighting effort—and stress—is coordinating the timing of the arrival and trying to factor the ground transportation time to wherever passengers need to go once they climb off the aircraft. ForeFlight's new Trip Assistant utility has this chore in mind, putting a focus on fuel stops, suitable airports and ground travel times.

ForeFlight's Trip Assistant is accessed on www.foreflight.com by clicking the Trip Assistant tab. The utility uses a basic form to plan each trip, and you start by selecting the aircraft and cruise profile (either max cruise thrust or max range thrust) from a drop-down, the number of people onboard and the weight of the cargo. When you enter the departure and destination address (or business name), the program generates a list of nearby airports. The listed airports that are nearest to where you have to go are tagged with the distance from the address or business entered, the average driving time and maximum runway length. It also lists the available instrument approaches.



Trip Assistant takes the planning one step further by also showing the lowest available fuel price. If you have your JetFuelX account linked to ForeFlight, your discounted fuel prices (instead of retail) are shown. There's also an editable data field for stay time, which is the amount of time it will take to get out of the airplane and on the road to the destination. There are also "depart by" and "arrive by" fields, which can be used in conjunction with the specified meeting time. In other words, if the meeting is at noon, the program will compute the necessary departure and arrival times to make the meeting.

Once all of this is entered, clicking the Calculate tab generates a complete itinerary with the time and place details for the trip. It tells you the total flight time, the refined drive times based on the day and time of arrival and the total trip time.

The previously entered data can always be modified if you want to try different scenarios, including using other airports. The Save tab automatically stores the itinerary should you go to the same place again. This eliminates having to re-enter all of the data a second time, but you can still modify any of the parameters. There's even a Share command so other users can view and modify the trip.

The Trip Assistant utility is available with ForeFlight Performance Plus subscriptions, which are $299 per year, and with the $300 per year Business Performance subscriptions for flight departments. Visit www.foreflight.com.

culations based on where the passengers are seated. You can also specify whether the passenger is a male, female or child and use standard weights or specify their actual weights.

The left side of the Weight and Balance page displays a graphic of the actual cabin seating configuration, how it's currently loaded and the weights of each passenger in a given seat. When the seating position highlights in green, you'll know the loading configuration is within limits. If a passenger were to change seats during flight, simply change their seat on the graphic and the app automatically recalculates a new CG report.

Last is the graphical view of the aircraft's CG envelope, with a fuel vector line of the inflight fuel burn off. You can also see all of the relevant weights including the basic operating weight (BOW), zero fuel weight (ZFW), takeoff and landing weight. And, the app's weight and balance computations work in concert with the runway analysis utility.

DIFFERENT THAN THE REST

At press time, the iPreflight Genesis app has an introductory price of $195 per month, per tail number. It only works with iOS devices and it's downloadable on Apple's App Store.

"The biggest difference between our app and the ForeFlights and Garmins of the world is that we have the required runway analysis utility entirely self-contained within the app," APG's CEO Mike Caflisch explained during our hands-on demo. This is a required computation per the FAA regulations when you get into the world of Part 121 and Part 135 jet aircraft operations.

With the new Genesis app, operators won't have to use multiple apps to get both the performance calculations and flight planning capability—something they had to do with the old version of the app.

We're impressed by the iPreflight Genesis app's simplicity and shallow menu structure, and more impressed with its powerful feature set and its processing speed.

Although we understand the highly regulated nature of Part 25 aircraft, we think the app could be even better if it interfaced with panel avionics through a Bluetooth or Wi-Fi connection, something APG said isn't out of the question, moving forward. That will take sizable effort to coordinate software compatibility, obviously.

We also wish the app had more turboprops and even high-performance piston twins in its database, but the King Air is the bottom end of its capability.

Visit www.flyapg.com.

Flight Gear Power Bank: Quick Charge, Slim Size

If you need a versatile and portable power bank for charging a variety of devices on the fly, the Flight Gear backup battery from Sporty's gets the job done.

by Larry Anglisano

Bring enough portable gadgets on a trip and inevitably you'll be looking for power to recharge them. Sporty's now offers what it thinks is the ultimate solution with its $79.95 Flight Gear backup battery pack. I've been using it to charge my stuff and quickly learned to like its performance and utility.

At first blush, the battery seems big, measuring 7.75 by 3.75 by 0.5 inches, but its saving grace is the thin profile. That makes it easy to slide into a map pocket, flight bag and the front pocket of a backpack. I stashed it in all of the above, but it was a touch too large to comfortably fit in a jacket or pants pocket. The casing is anti-slip, which keeps it from coming out of the hand, but I wish it were even grippier. The drawback to the thin footprint is that it can easily slide between a seat. When the airplane is put away, the battery could work on a motorcycle or bicycle, if there's the right on-bike storage.

The bottom of the case is stamped with an airport traffic light signal guide, the cruising altitudes for VFR and IFR flying, emergency transponder codes and a basic emergency checklist for a carbureted engine failure.

The battery has its USB output ports well positioned on the front edge of case. There are three standard USB-A output charging ports and one USB-C output/input port. A power switch, LED status lamps and Micro-USB port are on the side of the case.

I have a drawer full of gadget interface cables but can never seem to find the one I need at the time, but the battery pack eliminates that nuisance because it can be charged with a Micro-USB, Type-C or Apple Lightning cable. The convenience there is you'll only need one cable to charge both the battery back and whatever device you need to top off, thanks to a variety of ports.

PERFORMANCE

Perhaps what I like best about the Flight Gear battery pack is the ability to charge multiple devices at once. My typical outing in the airplane has me running my iPhone, an iPad and a variety of action cameras and stabilizers. With 20,000 mAh of capacity (three times the power of the typical iPad), the battery has more than enough juice to charge them all at the same time. The battery comes with a 6-inch Micro-USB charging cable for replenishing the pack and simple four-light status annunciators show how much juice is remaining. Total charging time of the battery (from a flat condition) is around seven hours with a Micro-USB cable and around 12 hours with a USB-C cable. The device has a microprocessor that monitors the battery health and will shut down before there's an overvoltage, overcharge or a short circuit.

It's also smart enough to detect the optimal charging current for the connected device and passes along the right amount of power. The USB-C port is dual purpose, either accepting charging voltage in or outputting voltage, based on the device that's connected. This product is a winner.

Visit www.sportys.com.

The Flight Gear backup battery, main image below, has four USB charging ports, including one USB-C port. The image above shows its size compared to a new 9.7-inch Apple iPad.

2018 EDITORIAL INDEX

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Cessna 195 Businessliner

The classic radial Cessna offers a healthy blend of utility and nostalgia. It burns a lot of fuel and handles like a luxury car.

The venerable Cessna 190 series was not the first business aircraft by a long shot, although it was a first for Cessna. These days, for owners wanting to own a piece of aviation history, it is probably the most practical of classics because it's a decent people hauler. Even better, it's not overly expensive to maintain, compared to other classics, that is. There's no fabric, and parts are generally available unlike other classic machines including the Beech Staggerwing, Spartan Executive and Stinson Reliant.

For the skilled tailwheel pilot, a Cessna 190/195 isn't tough to handle. Think of it as the link between the poorly harmonized, high adverse yaw radial-engine classics of the 1930s with the feet-on-the floor machines of today, carrying on only the adverse yaw.

Many vintage aircraft are indeed works of art, but the 195 is actually a practical classic. One owner refers to his 195 as "a Cessna 206 that gets preferred parking at the fly-in breakfasts."

A direct descendant of the 1934 C-34 Airmaster, the C-190 series represents a lot of Cessna heritage—it was the first all-metal Cessna, and the last Cessna to be built with a radial engine.

Here's a fresh look at the current 190/195 market and what to expect when shopping for one.

NOW AND ZEN

As expected, our latest market scan showed that restored and remanufactured models get top dollar, but they're far from untouchable. We spotted a 4000-hour 1948 195 for sale in Indiana priced at $87,500 by a "proud owner," as an example. Its radial engine has 1115 since a major overhaul, and the plane has new carpeting, mandate-compliant ADS-B and a claimed quality repair to exacting standards after an inevitable groundloop. Here's some history of the model line to help sort out the buying decision.

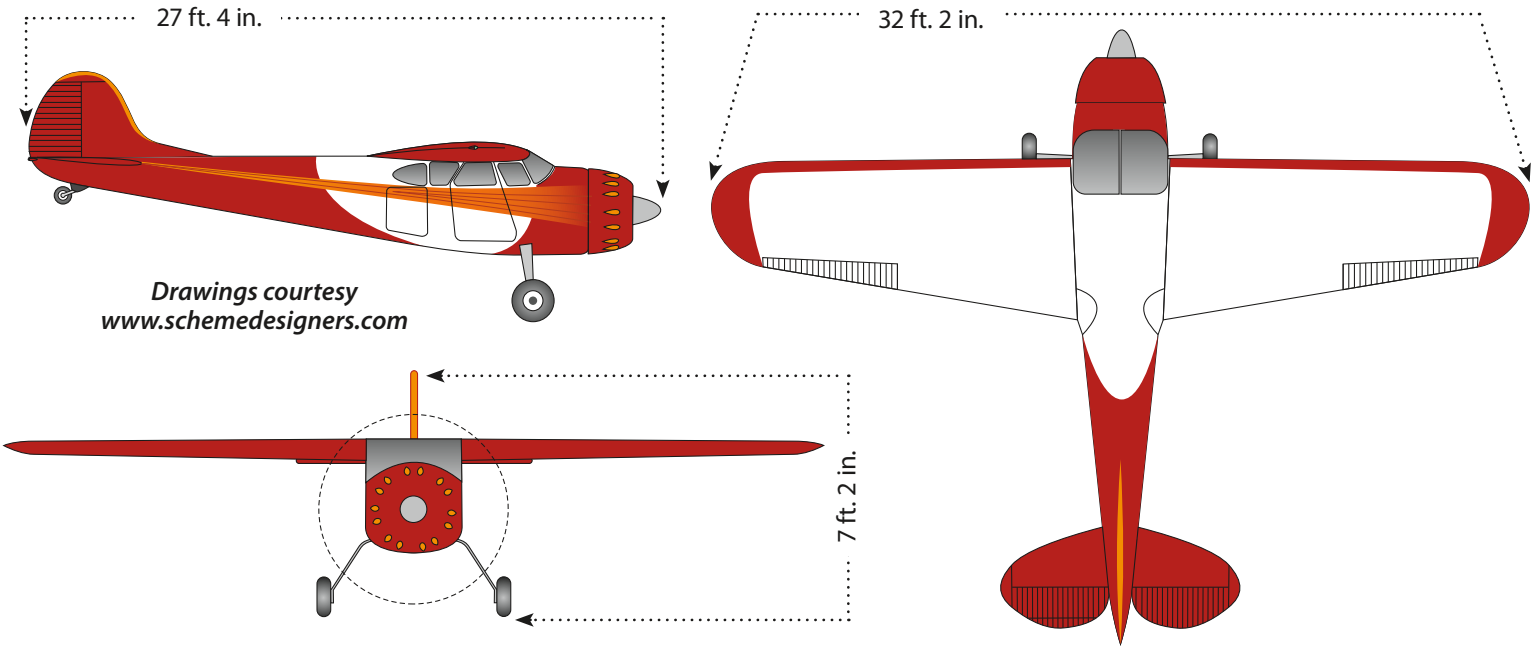
> ***A pilot has to put the effort into transitioning to a 190/195 because the ground handling requires finesse.***

The 195 came in as Beech quit building the Model 17 Staggerwing and took its place as a cabin-class bizplane, at a significantly lower cost. The Bonanza came out about the same time, but had such anemic power it couldn't carry nearly the load and would run out of aft CG quite easily. The Cessna Citation of its day, the 190/195 wasn't a huge seller, but there are plenty of examples flying. Cessna cranked out 1099 variants of the 190 series—190s, 195s and military LC-126s—from 1947 through 1954. Nearly 80 percent were 195s. The FAA registry lists nearly 700 registered 190-series aircraft, but nobody's sure how many are actually airworthy. The main distinction among the models is the engine.

The 190 had a Continental W-670 radial pounding out 240 HP and was alleged to be

That's a "late-model" 1953 Cessna 195B and an earlier variant, a 1948 Cessna 190, flying formation in the lead photo. The 195B is powered by a 275-HP Jacobs radial and the 190 has a 240-HP Continental radial.

CESSNA 195 BUSINESSLINER

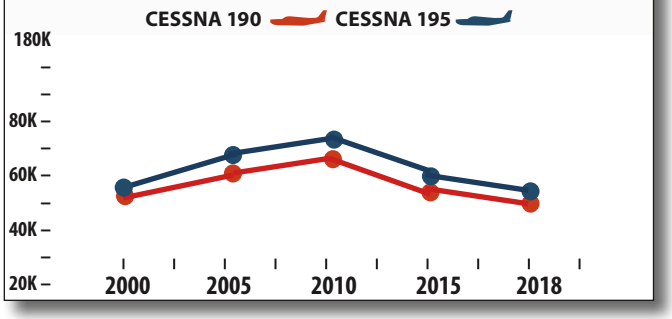


Drawings courtesy www.schemedesigners.com

CESSNA 195 BUSINESSLINER MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1947-53 CESSNA 190	CONT 240-HP W-670-23	1000	$25,000	80	1250 LBS	135 KTS	+$55,000
1947-53 CESSNA 195A	JACOBS 245-HP R-755-9	1200	$25,000	80	1200 LBS	135 KTS	+$60,000
1947-53 CESSNA 195	JACOBS 300-HP R-755-A2	1200	$25,000	80	1200 LBS	140 KTS	+$70,000
1952-54 CESSNA 195B	JACOBS 275-HP R-755-B2	1200	$25,000	80	1200 LBS	138 KTS	+$80,000

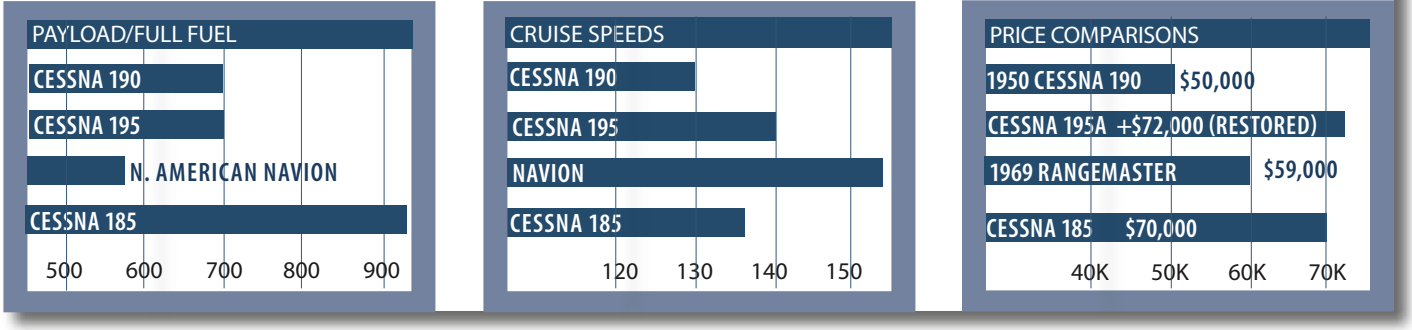
AIRCRAFT BLUEBOOK RESALE VALUES



SELECT RECENT ADs

AD 04-21-08	MAGNESIUM AILERON HINGES
AD 84-10-01	BLADDER FUEL CELLS
AD 79-08-03	CIGAR LIGHTER MODS
AD 87-20-03 R2	SEAT TRACK INSPECTION
AD-63-20-02	WING SPAR CARRY THROUGH

SELECT MODEL COMPARISONS



William Solaga's reworked 195 panel has a pair of Aspen flight displays, an ADS-B transponder and a big-screen engine display for minding the radial engine, top. The 195 panel in the middle is more old school. The throttle and prop controls are placed in the subpanel, bottom.

Cessna president Dwane Wallace's personal favorite. The others had Jacobs R-755 engines of either 300 HP, 275 HP or owner-furnished 245 HP. Most of the 195s were originally equipped with the 300-HP engines, but many have been retrofitted with 275s or 245s. There are still quite a few of the smoother-running Continental-powered airplanes flying, but about half have since been converted to 195s with the Jacobs engines, since the support for the Jake is better.

Owners report that the performance is comparable between the 190 and the "little" 245-HP 195, while the 275-HP and 300-HP 195s are, of course, peppier. The C-195B's 275-HP R755-B2 engine is generally considered to be the most reliable of the group, even though all three of the Jacobs engines have the same displacement. The 300 got a deeper intake manifold to get its extra 25 horses, which seem to make it more susceptible to case cracking.

The other significant changes in the airframes over the years were slightly larger flaps along with a modified horizontal tail at serial number 16084. And in 1953, the Goodyear crosswind gear was offered as standard, along with a lighter, springier set of main gear struts. The crosswind gear casters so the airplane tracks down the centerline in a crab but the wheels remain parallel—more or less—to the runway centerline. It looks odd, but works well on those few airplanes that have it.

PERFORMANCE, HANDLING

Above 8000 feet the airplane is an honest 140-knot machine, but down low it is thirsty and slow.

Expect 12.5-14 GPH for a normal cruise of 140 knots above 8000 feet; you can burn more, but it won't go much faster. Fuel burn is something in the high 20s during takeoff. With 76 gallons of usable fuel on board, you can usually plan on a range of 520 to 780 miles. With the 275-HP Jacobs, count on a cruise of a bit over 130 knots, burning about 13.5 to 14 GPH, at a comfortable and rumbling 1900 to 2000 RPM. Plan on oil consumption of between 0.5 pint to about 1 quart per hour—depending on engine condition. The ship holds five gallons of oil when it's at full capacity.

A pilot has to be willing to put the effort into transitioning into the airplane. The ground handling requires some finesse and the sight picture is unusual. The pilot has to learn how to look straight ahead. Not only does it sit high —which makes for a lot of hard landings as newbies flare too low—the pilot's seat is angled slightly right and the copilot's seat is angled left. That means there is a tendency to look across the cowling on landing instead of straight ahead (like a C-46 Commando), which causes problems in the checkout. In addition, if the gear is not properly aligned, the airplane goes from being manageable to turning the pilot into a test pilot. Stalls are Cessna-like, which is to say gentlemanly.

Control harmony is superb, although the airplane has adverse aileron yaw, but pitch, roll and yaw control is beautifully harmonized, and responsive without being

twitchy. It feels like a luxury car from the 1950s. Still, the airplane will not stay where you put it. Most have some degree of long-term phugoid, plus they will simply wander after a half-dozen seconds no matter how well trimmed. It's a fingertip correction, but you have to fly the airplane all the time. Any slop or worn bearings in the control and trim system makes the wandering worse. Nevertheless, it does not wallow in turbulence.

The visibility from the flight deck is really nothing to brag about, since the big engine blocks the view forward and especially to the pilot's right. Turns during taxiing are a good idea. In flight, the wing's leading edge is just about at the pilot's eye level, forcing him to lean forward to see around it. As a minor compensation, the windshield's top projects well aft of the pilot's head, as in a Cessna 177 Cardinal, so visibility into a turn is quite good.

The original Goodyear brakes are satisfactory if—and it's a big if—they are maintained. The Cleveland brake conversion comes from a Cessna 310, a heavier, nosewheel airplane, and are more brakes than the airplane needs. As a result, the pilot has to learn how to modulate them or it's possible to flip the airplane.

A pilot should be able to both three-point and wheel-land the airplane. Neither is better. However, the power needs to be completely at idle prior to touchdown. One way pilots get into trouble is carrying power through touchdown and then closing the throttle and losing the airflow over the rudder. It three-points beautifully. Once down, the yoke must be pinned fully aft or the airplane will start bouncing. If it starts, full aft yoke stops it quickly. Remember that this is a relatively heavy taildragger with the CG well behind the main gear. If it gets squirrelly on rollout, brakes may not handle it; power and air over the tail and perhaps a go-around are more likely to be successful. Allow a swerve of more than 10 or 15 degrees to develop and there isn't enough brake to stop it. A groundloop in this airplane will usually cause major damage to the gearbox, fuselage and wings, perhaps even resulting in a total loss.

Potential buyers should have a mechanic familiar with the model check the airplane they have in mind for groundloop damage. If it's been repaired correctly, no problem, but if not you could be in for expensive remedial work. On an important side note, a prebuy by someone who knows 195s is essential, and a lot of owners have taken serious financial hits by not doing so.

Two types of spring steel gear legs were installed. The later "light" type on the 1953 and 1954 models was thinner and weighed about 20 pounds less. The earlier gear is much stiffer. Aside from the weight savings, the more flexible light gear may be a little easier on the airframe, especially if a groundloop occurs. Among the 195 cognoscenti, debate rages on the use of the crosswind wheels. Some experienced pilots say that only fools fly without them.

Cessna's idea of luxury was a giant bench seat in the back, comfortable for three, with plenty of legroom. The seaplane door, shown here, is a welcome feature on hot days.

Others maintain that with a little care and experience, a pilot will have no problems with the "straight" gear. The Goodyear castering gear was installed as standard equipment in 1953, but due to poor parts availability, not many of today's aircraft have them. The extra clearance demanded by the swiveling wheels precludes installation of wheel fairings.

Later models have larger air brakes (some people call them flaps) with a lower deployment speed. It was not an improvement as the airplane is so clean that it's hard to slow down to the white arc.

PAYLOAD, COMFORT, RANGE

Remember, this is a cabin-class airplane, so there's room to move around in flight. Gross weight of the series is 3350 pounds. A nicely equipped 195 with full IFR avionics and an autopilot will weigh in at 2100 to 2200 pounds, allowing a payload of over a half ton. Roominess is the aircraft's strong suit, with space for four comfortably, or five cozily. This allows full fuel with Mom, Dad, the kids and a week's worth of baggage. Reminds you of Grandpa's old Packard.

In cold weather, the 195 offers instant cabin heat, thanks to a Southwind gas heater located under the rear seat, as in modern twins.

Along with the old-world glamour of the big radial engine comes a healthy dose of fussing, even before you can start the old bird. A lot of the fussing has to do with oil—lots of oil. Since oil collects in the bottom cylinders if the aircraft has been sitting more than a few hours, the pilot must pull the prop through five to 12 blades. This will check for

Want to work on the Jake's accessory case? In the days when engineers thought about maintenance, Cessna built in a swing-out mount that makes it easy, top. If you simply can't slum around on 275 HP, there's always the 450-HP Pratt R-985 conversion, middle. It's called the 196. That's Ashley Atkinson with her pristine classic pride and joy, bottom.

hydraulic lock and allow the start to generate less of a smokeshow.

The pilot is not home free during taxiing, either, because many of the old radials' oil temps begin to heat up with prolonged ground operation. This is one reason Cessna 195 pilots like to avoid big, busy airports with long rides to and from the runway and chances of takeoff delays. Some owners choose to double the cooling capacity by installing a second oil cooler to cope with the problem. Before shutting the engine down, it's good to pull the prop control to low RPM and allow the engine to idle for a couple of minutes. This gives the engine a chance to scavenge most of the oil that remains inside the crankcase, making a clean start next time at least a possibility. About halfway through this phase, the lineman holding your chocks will develop a glazed-over look of boredom or show his impatience while awaiting your shutdown and fuel order.

When the day's flying is complete, it's time to clean up the airplane before tucking it away. That means wipe off the oil, son. While your flying buddies are already tied down and halfway home, you'll still be wiping oil from the belly of your 195. Radials are notorious for leaking—some say that they just have Alpha personalities and are merely marking their territory—and coupled with the old-fashioned wet vacuum pump, there's a fair amount of oil that gets deposited everywhere. It's a labor of love, though, and merely gives you an opportunity to justify a little extra time at the hangar admiring the airplane's beautiful lines.

Although the engines were designed for 80-octane avgas, quite a few owners report they have used autogas with success and STCs are available to make this a legal alternative. Those who use 100LL commonly use a fuel additive such as TCP or Marvel Mystery Oil to reduce lead deposit buildups in these low-compression engines.

VALUE, INSURANCE

Inflation and a growing image as a classic have brought the resale value of the 195s to multiples of their prices when new. As with other vintage airplanes, the year of manufacture has little bearing on the selling price. By now, many have been restored, so the quality of the machine and equipment extras are the primary determinants of worth.

We perused *Trade-A-Plane* and www.controller.com and saw asking prices starting at $85,000. Buyers seem to fit in either of two general mindsets: purists who want nothing less than a show-plane restoration just as it shipped from the factory, and those who like the lines and nostalgia, but want a practical flier.

The combination of a tailwheel and an aging airframe has an impact on insurance costs. We learned that there are fewer underwriters who are enthusiastic about writing policies for 195s than, say, for 180s or 182s. Those who are interested had what seemed to us reasonable PIC and time-in-type requirements.

A private pilot with no instrument rating, 200 hours PIC and 25 hours of tailwheel experience and an extensive checkout would likely see premiums of about $2000 to $3000 per year, assuming a $85,000 hull and $1 million liability. That's about the same as a tailwheel Cessna 180 or roughly one-third more than a

Getting the landing right every time is a must-have skill for moving into a Cessna 195. Runway loss of control wrecks lead the wreck reports. Photo courtesy of Mark Brown.

182. Experience and ratings lower insurance premiums, of course.

MAINTENANCE

As one expert put it, "There are three rules for long-term happiness with a 190/195. Gear alignment is crucial, the brakes must be well maintained and the tailwheel strut and steering must be well maintained."

It's no secret that there is a serious problem with ignorant maintenance of these airplanes because there was only a rudimentary military maintenance manual published. As a result, not many people know how to properly maintain the airplane. The new owner will invest a little more effort into keeping the plane flying because Businessliners are rare, and fewer mechanics are familiar with the old radial engines and their archaic accessories. Access to the engine accessories is made easier by an engine mount design that allows the powerplant to be swung out from one side, as on a hinge. The first time an onlooker raises his eyebrows at the unusual sight of the engine being canted about 15 degrees to the left, he's usually mockingly told that "Oh yeah, this 195 has the crosswind engine."

As for annual inspections, only the price of the inspection itself is comparable to other singles. The number of repairs on the aging airplane usually bumps the price up to a notably higher number.

One common problem with the 195s is a leaking oleo tail strut. Generally, a good overhaul with proper seals will correct this, but some believe servicing it with Granville Strut Seal might be the answer.

Tailwheel strut maintenance is a big deal, perhaps fraught with denial and ignorance. It's not hard to do, it just has to be done right by someone who knows how. If the chrome inner strut is pitted, it won't hold pressure; it must be smooth. Never put a spring in the strut—it turns the tailwheel into a pogo stick. Never fly the airplane with the tailwheel strut flat—it will damage the tail.

Insofar as ADs go, there aren't many, considering the 60-plus-year age of the airplane. Only four require recurrent inspections. There are no ADs on the engine or propeller, something that strikes us as a record of sorts. All the Jacobs and the Continental engines go about 1000 to 1200 hours to TBO.

PARTS, SUPPORT

Despite the fact that these days Cessna provides little more than moral support, owners report that the parts situation isn't too bad.

In addition to some parts being available from Cessna (albeit pricey), The 195 Factory (www.the195factory.com) can provide most airframe

CESSNA 195 CRUNCHES: RUNWAY LOC

When it comes to care and feeding of the Cessna 195 series, the most common comment we have received from owners over the years is that correct landing gear maintenance is critical to one's ongoing happiness with the machine. Owners express strong opinions regarding the need to carefully align the landing gear and ensure that the brakes, tailwheel strut and tailwheel steering are correctly maintained—otherwise ground handling may be severely compromised.

Our review of the 100 most recent Cessna 195 accidents utterly confirmed the owner comments. A staggering 70 accidents were connected with landing or takeoff—the highest of any aircraft we've ever reviewed. Fifty-four were loss of control (LOC) on landing or takeoff—yes, takeoff, we counted five LOC takeoff accidents, all of them involving either a crosswind or downwind departure attempt.

On top of the 54 common, garden variety LOC accidents were another nine in which a malfunctioning brake was demonstrably involved—lockups or failures.

What also got our attention was the number of gear collapse events, seven, on landing. Most of those turned out to be due to fatigue from pre-existing damage—potentially from a previous groundloop. We saw only two in which the post-accident analysis showed overload as the cause.

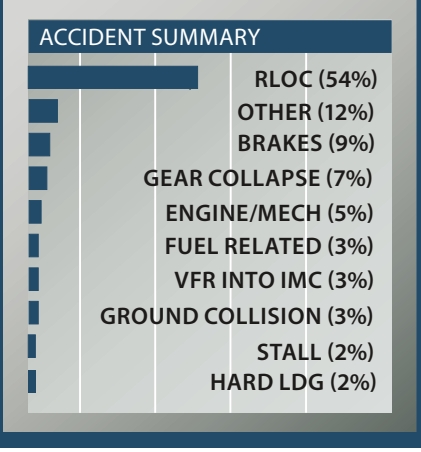
Even though the 195 has a long arm from the main gear to the tailwheel, improper brake use, especially when trying to fend off an LOC event, can flip the airplane. Where the accident data reported on the final position of the airplane, 12 of the 70 RLOC accidents ended up with the airplane on its back.

That's the bad news. Once the landing and takeoff accidents are out of the way—and few of them involved more than minor injuries—the 195 has a surprisingly low rate of accidents that one would associate with an airplane that was designed as a traveling machine. For example, we saw only three fuel-related mishaps. One was fuel exhaustion from a misinstalled cap that was leaking fuel and the pilot refused to believe the fuel gauges even though the passenger repeatedly asked him to land and get fuel.

We have heard reports in the past that because of the geometry of the 195 in three-point attitude that it's difficult to drain water out of the tanks. The accident reports did not support such a claim. There was one forced landing due to water in the fuel and one in which the post-engine stoppage investigation revealed particles of rust suspended in water in the carburetor—an indicator of ongoing failure to maintain the airplane properly.

There were only three VFR into IMC events and it appears that one involved an incapacitated pilot. Two of those resulted in inflight breakups of the airframe, an indication that the airframe is clean and a diving spiral loss of control event can be fatal.

One pilot managed to raise the tail so high on takeoff that he hit the prop on the runway repeatedly before losing control. There were two ground collisions due to the poor three-point visibility ahead and to the pilot's right. A third 195 pilot was minding his own business during runup when another tailwheel airplane, a Waco, taxied into his airplane from behind.



parts from new manufacture.

Heritage Aero (www.heritageaero.com) has many spares for the straight and crosswind Goodyear wheels and brakes, in addition to instrumentation and providing maintenance. Barron Aviation (www.barronaviation.com) manufactures an approved and improved inboard aileron hinge, which can eliminate a recurring AD check.

You might not be well served by taking your Businessliner to the local Cessna boutique for service—you could find yourself paying for the learning time of the technicians. Recently the International Cessna 195 Club (www.cessna195.org) has begun hosting owners' maintenance forums at strategic locations across the U.S. to improve the awareness of the airplane's special needs. The program offers an opportunity to spend time with "195 professionals" who provide hands-on insight by accompanying the owner and his mechanic in inspecting the few areas that are unique to the type.

Several 195 specialty shops have arisen to cater specifically to the marque. In the northeastern U.S., The 195 Factory provides inspections and repairs. In the Midwest, there is a popular shop recommended by owners—Barron Aviation. Visit them at www.barronaviation.com.

In the West, Sonoma Aero and Heritage Aero have been given accolades. Radial Engines Ltd. (www.radialengines.com) overhauls Jacobs and Continental radials. Air Repair Inc. (www.airrepairinc.com) is the type certificate holder for the Jacobs engines and provides repairs and parts for them and the Continentals, too. Air Repair has modernized the Jacobs engines in many areas, mostly aimed at improving the oil burn and oil leakiness of the engines.

Recently overhauled Jakes are alleged to rival flat engines in their oil use. Some parts for the Continentals are scarce, although rebuilders can make do with used, serviceable parts. The R-755 Jacobs are well supported with many new and modernized parts available. The R-915 330-HP Jake is not an orphan, but not nearly as well supported as its smaller sibling.

MODIFICATIONS, CLUBS

For safety, retrofitting retractable

The 195 has a fairly narrow windshield, but visibility isn't too bad because it's relatively wide. That's some formation flying at a Cessna 195 gathering in the photo to the right.

shoulder harnesses (B.A.S. and others) improves survivability in the event of an accident. And the lap belt's attachment point is relocated from the seat frame to the floor where it can actually do some good. There's a popular locking tailwheel (The 195 Factory LLC) which many feel tames the beast's ground handling.

Hartwig Fuel Systems (formerly Monarch) makes a replacement fuel filler cap that's designed to repel water and also has individual venting. It's STC'd for most Cessnas, but not specifically for the 195, so a field approval will be needed.

Although the Lear L2 was the factory-optional autopilot, we note that Brittain has an STC for its B2C system and Genesys for its S-TEC series 30 and 55 systems. (Lots of luck getting repairs on the Lear, by the way.)

Any of these do an adequate job, but we were not able to identify any maker who has certified a yaw damper. This would be a welcome addition due to the aircraft's considerable adverse yaw characteristics.

Judging from the comments of owners, one of the most useful conversions is from the troublesome Goodyear brakes to Cleveland brakes, which are many times more effective. For increased convenience, the addition of tail push handles (B.A.S. Inc.) helps move the airplane on the ramp.

Avionics upgrades for the 195 can be a challenge. The huge oil tank lives behind the instrument panel, thus requiring radios of short depth, and the engine's noisy ignition system was designed in 1934 when radios weren't even on the engineers' scratch pads. A significant tab can result from the avionics shop's chasing of the elusive electrical noise source.

Radial Engines Ltd. has been issued an STC for a fuel-injection mod for the Jacobs 275- and 300-HP engines that reduces fuel consumption and evens out fuel mixtures to the cylinders for smoother operation and greater power. The engine originally had only an oil screen. Many have been retrofitted with oil filters from ADC, Air Wolf or other field STC sources. Airwolf's site is at www.airwolf.com.

In addition to the Jacobs and Continental engines that Cessna installed on the planes at the factory, the years have witnessed STCs for a few other engines. Perhaps the most common is the Jacobs R-755's big brother, the L-6. It provides 330 HP for takeoff.

In the 1960s, Page Aircraft Engines adapted a turbocharger, resulting in the R-755S; it's rated at 350 HP for takeoff/300 HP continuous. Western owners praise the performance improvements for mountain flying. The King Kong of all Cessna 195s resulted from Parks Aviation installing a Pratt & Whitney R-985 with a whopping 450 HP to improve the climb and high-altitude characteristics for aerial photography.

There were only a handful of the latter planes built by Parks—they carry the model designation of "196" after the mod. Most have tip tanks to accommodate the higher fuel flow, but at least one has higher capacity tanks installed in the wings to provide 100 gallons of useable fuel.

The original 10.00 SC smooth-contour tailwheel tire and tube is available, albeit expensive. Some owners have converted to a tailwheel that uses the same tires as a Cessna 180, a much cheaper alternative. They're available from R-R-R-Russ Aircraft Supply. (See www.russaircraft.com.)

The aforementioned International 195 Club has a broad membership and hosts annual fly-ins at various locations in the U.S. Its website has a hangar talk bulletin board where information is shared and the club publishes a quarterly bulletin for members. It has many technical materials and support information.

OWNER FEEDBACK

As an owner of a Cessna 180, I became infatuated with what I think is the finest classic airplane made, the Cessna 195. I was concerned about the radial engine and parts for a 60-year-old aircraft. I found an LC-126 in Texas, had a quick prebuy done by a trusted A&P and bought the aircraft for $98,000. The first yellow flag was that it had not been flown regularly for several years. There were just under 2500 hours on the airframe since it was put in civilian service, and just 25 hours on the engine over the last five years, but a total of 600 hours since overhaul. The interior was an eight out of 10 and the exterior was a seven.

Having read extensively on the International Cessna 195 Club website, I had ignored the admonitions on prebuy inspections and instruction. My son, who had the least experience, groundlooped the aircraft while being checked out by an experienced instructor.

The Aviation Consumer

Cessna 195

(continued from page 31)

It was time to test the support for these wonderful aircraft with John Barron in Missouri, a guy I talked with before I bought the aircraft. Upon discussion with him, we decided to make some additional repairs and replacement of some skins that had not been properly repaired previously.

Upon stripping the skin from the wing, he found that the outer spar was not connected to the main spar. When the skin came off the fuselage, he found that repair of a prior groundloop was not properly skinned, so that skin had to be changed, too. Then we found a cracked doorpost on the left side, a common problem that might be caught on a prebuy inspection. This rejuvenation project cost roughly $42,000.

I got the aircraft back and blissfully began flying it. I had a propeller overspeed problem and had the prop governor rebuilt, but the problem still existed. We took the hub apart and found that the lubricant had dried out in the kidney bearings. We sent it to Byram Propeller Repair in Fort Worth, Texas, for overhaul. This was $3500, plus installation.

By now, I had replaced four tires while learning to land it and needed to replace the tail wheel tire, which was a Polish tire that was an odd size. A call to Bill Milton at The 195 Factory resulted in the replacement of the tail wheel assembly and a normal size tire. Plus, Milton has the parts that are required for normal maintenance, in addition to many other replacement parts.

As for engine parts and overhauls, Radial Engines and Air Repair provide updated parts. I purchased the Spitfire ignition from Radial Engines. The company is developing new mods for the Jacobs, including fuel injection. It turns out that my fear of parts scarcity was unfounded.

Operating costs at 15 GPH, engine reserves of $21 and $5 per hour for the prop is approximately $116 per hour. An annual runs roughly $3500, while insurance is $2500 per year—down from $3500 when I first purchased the aircraft.

A few years ago I had a prop strike on a grass strip in Michigan at the 195 club convention. I called Phil Pedron who acquired new blades, did a field replacement at the strip and flew the aircraft back to Texas. My worry of the radial engine dissipated.

We pulled the engine and sent it to Air Repair for teardown. I purchased a remanufactured engine with steel valve seats, valve rotators and modern gaskets. Now the airplane apparently no longer feels it necessary to mark its territory with oil. The price was $30,000, plus prop blades and installation.

I've had two really good (but expensive) annuals by a knowledgeable mechanic who rigged the aircraft. So now I have a wonderful rejuvenated LC126/195. I also replaced the old radio with a Garmin GTN650 GPS, making it an IFR-capable classic cross-country aircraft.

Leading the Cessna 195 community are the members of the International Cessna 195 Club. Started in 1967 by Dwight Ewing and being carried on by Coyle Schwab, Larry Nelson and Aubie Pearman, these presidents and their boards of directors hold maintenance clinics, annual conventions and caravans. They carry on the tradition of fellowship, education and support of a great community. Its website epitomizes social networking.

The four years I have owned the LC-126 have been fun, instructive and adventurous, if not inexpensive. I look forward to many more hours of pleasurable flying in it.

Robert Donnelly
via email

FEEDBACK WANTED

BEECH BARON 55

We're preparing a fresh report on the Beech 55 Baron market in an upcoming Used Aircraft Guide in *Aviation Consumer*. We want to know what it's like to own these twins, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs (**full-size, high-resolution please**) you'd like to share to the email below. We welcome information on mods, operating expenses or any other comments that can be helpful for buyers considering one. Send correspondence by January 10, 2019, to:

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Email at:
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