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The Aviation Consumer

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MONITORING ADS-B COMPLIANCE

My recent month-long correspondence with a reader dealing with a botched ADS-B installation got me thinking about the logistic nightmare that's already unfolding as the 2020 ADS-B mandate gets closer. More on how you might troubleshoot your installation, or at least figure out if it's working or not, in a minute. First, some updated ADS-B stats.


U.S. Department of Transportation
Federal Aviation Administration
ADS-B Compliance Monitor

ADS-B Aircraft Operation Compliance Report

Non-Compliance Issues Identified

The majority of the fleet that will fly in controlled airspace—nearly 160,000 aircraft—is expected to line up at shops for ADS-B upgrades before December 31, 2019. The equippage effort is falling short because only a fraction of the fleet has been upgraded. The AEA (Aircraft Electronics Association) estimates there are roughly 900 FAA repair stations in the U.S. that should be qualified to perform ADS-B installations. That means more than 120 installations will need to be performed each working day, or 30,000 annually. This assumes that shops will do nothing else but install ADS-B.

Unless the FAA postpones the compliance date, there's going to be a sizable installation demand and perhaps some grounded aircraft, but there could also be FAA enforcement targeting faulty installations. It's already watching with its compliance monitoring system, part of which generates a detailed analysis of an ADS-B transmission. Essentially, the FAA is looking at the transmitted data elements that should be first tested by the installing shop before it releases the aircraft for flight in ADS-B airspace. Ultimately, it was this captured field data that helped Garmin troubleshoot one installation after a shop signed off the interface with incorrect software, incorrect wiring and a misprogrammed configuration.

These installation learning curves could further delay compliance, but should the FAA fund installers to acquire the test equipment needed for the installation? It's a sizable investment that some small shops can't afford. It's also a cost that could ultimately inflate installation prices. Still, you should pick an installer that has experience with your interface. If the system needs field approval, the repair station should also possess good regulatory skills.

I've talked with a lot of pilots that wonder if their ADS-B Out system is actually working, and some are not. Besides querying a controller about the status of your ADS-B transmissions, there is the official FAA ADS-B Aircraft Operational Compliance Report you can request.

This FAA analysis details the status, integrity and any missing elements in the ADS-B broadcast at a given time and location, whether it's airborne or surface 1090ES or UAT transmissions. The report will list any FAR 91.227 noncompliance issues that have been identified and warns that "Prior to January 1, 2020, the owner/operator must take action to correct identified system performance deficiencies as soon as practical. After January 1, 2020, performance issues must be corrected prior to operation of the aircraft in the airspace specified in FAR 91.225." This is enforcement language, if you didn't notice.

If you have the ForeFlight Mobile tablet app and the Appareo Stratus 2 portable ADS-B combo, there's a simple function that offers details about the aircraft ADS-B Out setup. It's found by following Devices, Stratus and then Ownship tab. You can request a compliance report from the FAA by emailing them (9-AWA-AFS-300-ADSB-AvionicsCheck@FAA.gov) and include aircraft N-number, ADS-B transmitter make and model, plus the interfaced GPS make and model. It's a highly technical report, but valuable.—*Larry Anglisano*

BONANZA 35 NITS

I just read with much interest your review of the Beech 35 series in the November 2014 issue of *Aviation Consumer*. My family and I owned an A35 for 10 years (that's it in the lower photo), having sold it for upgrade to an A36. I tend to agree with most of your points, with a few exceptions and critical points you left out.

I'm not sure where everyone gets the idea the 35 Bonanza has an aft CG issue. In the time we had ours, I never had a loading problem, even with the fuselage-contained 20-gallon auxiliary fuel tank.

Regarding your reporting of the Bonanza's tail-wagging tendencies, this must be one of those it-will-never-be-resolved issues. Again, we never had a problem. In fact, from my experience it is no worse than any other aircraft, Beech or not.

On the tail cuff front, I should point out only the "big" tails (C-models and later) got the cuff; the small tails didn't need them, though the tail AD is still pretty extensive.

Corrosion is most definitely a big deal, especially in the older airframes. I'm not sure when Beech started to prime the parts, but our A35 had no zinc chromate or other primer applied to the structure, although there is alclad aluminum. We paid dearly for that lack of protection. In the first 18 months we owned ours, it sat outside in the benign Florida climate. We replaced the entire belly (short of the spars) from the rudder pedals to the aft cabin bulkhead due to corrosion.

Last, buyers should be cautious of modified panels. In the ones with piano-key panels, the outer panel is structural and supports the control quadrant. Panel mods are pricey if maintaining the original Art Deco look is important. Keep up your great work.

Chris Nichols
via email

Experienced Bonanza owners we spoke with all seem to agree that all of the 35-series Bonanzas were easy to load to an aft CG, especially early models. It's also true for the older straight-tail models, including the Debonair.

One owner noted that the CG moves back as fuel is burned. If you start with two passengers in the back, plus a bag or two in the baggage compartment, and fly for a couple of hours, you will likely land with an aft CG.

EARLOBE OXIMETERS

In Larry Anglisano's November 2014 First Word commentary, he wished for a tiny and untethered arterial sensor for keeping constant track of his oxygen saturation during flight.

For those not wedded to over-the-ear headphones (and perhaps even for some that are), an earlobe sensor could fulfill the need, although I have no idea whether such a thing exists. But don't thank me. Thank science fiction author Robert Heinlein for the idea in *Have Spacesuit—Will Travel.*

Don Wilke
via email

They do exist, or at least they used to, Don. We stumbled upon earlobe sensors when conducting the research and learned that sampling oxygen saturation levels at the earlobe isn't even a practice used in clinical settings anymore. Ear sensors have been replaced almost entirely with more modern fingertip devices.

RUBE GOLDBERG ADS-B

Why are manufacturers going off in different directions with different ways to execute ADS-B? If you use Garmin ADS-B equipment, it's going to be expensive. In fact, almost everyone is trying to make it extremely expensive. Why can't manufacturers just have a GPS built into an altitude encoder and let that be the end of it? All you would have to do is add one more antenna and trade out your altitude encoder. ADS-B Out should not be difficult.

The Rube Goldberg approach the industry is taking toward ADS-B equipage is why you're looking at a mass exodus from general aviation. Please take a sensible look at this.

Jerry Gunter
via email

Actually, we think Garmin deserves credit for offering a wide variety of ADS-B solutions at various price points, depending on capability. It recently presented a minimally intrusive approach to mandate-approved ADS-B Out with the $3995 dual-band GDL84. It works with the company's Flight Stream Bluetooth wireless cockpit interface and enables ADS-B traffic and weather display on a tablet device. The benefit is that it doesn't require panel modification, a dedicated display or a control head. But, it doesn't solve the dilemma you point out, since it doesn't have a mandate-approved integral WAAS GPS. We'll evaluate the system in an upcoming issue.

At AirVenture 2014, Appareo—the company that make the Stratus portable ADS-B receiver—showed a prototype ADS-B Out transponder that has an integral WAAS GPS, plus it can interface directly with the company's portable ADS-B unit. Its price is unknown.

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Cirrus SR20: Training, Traveling

The entry-level SR20 has been overshadowed by the flagship SR22, but recent upgrades step the 2014 model up to a higher level and price point.

by Larry Anglisano

AIRCRAFT FLIGHT EVALUATION

According to GAMA sales numbers, the Cirrus SR22 outsold every other piston single in 2013, including the entry-level SR20.

What's interesting is that the SR20 arguably has a broader mission profile than the SR22. Cirrus even markets the SR20 as a dual-role aircraft that can function as a trainer and distance traveler. Perhaps that is why SR20s are more likely to end up on flight school ramps than in personal hangars.

With a starting price of $369,000, the 2014 SR20 shares many of the advanced creature comforts, basic systems and design characteristics of the SR22, save for speed, load-hauling capability and icing protection. But for the new pilot looking to someday step up to the SR22, we think the SR20 has a lot to offer for a substantial price delta. Still, it's easy to see why it's outsold because when tricked out with avionics and styling options, a base-level SR22 has more appeal.

TOO TOUGH TO HANDLE

That could be true for inexperienced pilots that move right into the SR22. Cirrus sales directors aren't afraid to mention that the typical new Cirrus buyer can afford a flagship SR22T—that's the turbocharged model that can easily bring an eye-widening invoice that tops $800,000 when loaded with extras. While a new pilot with these resources may be tempted to put one in his or her hangar, the SR20 could be the better decision, without having to sacrifice styling, avionics capability and safety-enhancing systems.

Remember that the SR20 defined Cirrus' mission to build an airplane that was safe, efficient, fast and comfortable. Delivering a product that has speed, efficiency and comfort is easy, but delivering an impressive safety record—something the competing Diamond DA40 has done better (in fairness, the DA40 fleet is smaller)—is a different matter.

Cirrus learned a lot from a time when the SR-series safety record was disappointing, at best. As a result, it has overhauled its approach to initial and recurrent training. See the sidebar on page 7 for more on this training approach.

As with every airplane Cirrus has ever built, the 2014 composite-constructed SR20 comes with a CAPS (Cirrus Airframe Parachute System) and part of the training effort is encouraging pilots to use it sooner than later, if they get into trouble. This is reinforced every time you start the airplane, via a splash screen on the multifunction display that simply says, "Equipped with a parachute. Live with it." It's there to remind you and passengers of the parachute handle that's in the overhead, should you need to pull it above 600 feet AGL. While the CAPS may be the last resort when things go bad, there are plenty of other standard safety

CHECKLIST

- ⊕ The SR20 can function as a trainer and efficient traveling machine—ideal for flight school leaseback.
- ⊕ Systems and flying characteristics make for an easy SR22 transition.
- ⊖ Avionics and desirable appearance options drive the price over $500,000.

Every SR20 comes standard with the 10.4-inch-screen Garmin Perspective integrated avionics suite, but 12.4-inch displays, upper right photo, are optional. All incandescent exterior lighting has been replaced by LEDs, lower right.

systems that might avoid a pull in the first place, including Garmin's GFC700 autopilot with electronic stability control that provides stall protection, hypoxia check and automated descent mode.

The cockpit is enclosed in a carbon fiber roll cage, the instrument panel is designed with crashworthiness in mind and the two front seats come standard with airbag seatbelts. Even the fuel system and landing gear is smartly designed. Fuel (58.5 gallons total and 56 gallons usable) is stored between the wing spars and well outboard of the passenger cabin. The fixed landing gear is designed to absorb energy and flex into the wing inboard of the fuel cells, helping to keep the cells intact during crashes and hard landings. Speaking of hard landings, newer SR20s have an Oleo strut on the nose wheel to help cushion the impact should you arrive less than gracefully. We can attest that the Oleo strut on the demo airplane worked well.

ENGINE, ACCESSORIES

While Cirrus has made numerous refinements and upgrades to the SR20 over the years, it has retained the 200-HP six-cylinder Continental IO-360-ES, an engine that we found incredibly smooth. It's mated with the standard three-blade Hartzell aluminum propeller (gone is the two-blade prop found on earlier models). Engine operation couldn't be simpler because throttle and RPM control are done with a single lever that moves both cables. Full throttle yields 2700 RPM and power reductions automatically decrease the prop to 2500 RPM until the manifold pressure gets too low to maintain it. There's little to do with the mixture control until cruise flight.

That's because the engine-driven fuel pump is altitude-compensating and equipped with an aneroid to automatically lean the engine during climb. Simply leave the mixture full rich for every takeoff and climb—no matter if you're in Miami or Denver—because the aneroid restricts the fuel flow appropriately for any altitude. You still manually lean the engine during cruise flight in a traditional manner.

The IO-360-ES has a 2000-hour TBO, with an average overhaul cost of $30,000.

New for 2014 is the Beringer performance braking system, a single-caliper system with tubeless tires and redesigned wheel fairings that allows easier access to the brake and tire valve stem during preflight checks. Beringer Aero has roots in the Formula One and motorcycle racing world and its brakes are used on the Pilatus PC12NG turboprop. Cirrus said it made the switch because Beringer's fluid technology is designed to withstand higher temperatures. The result is less fade and sponginess under hard braking. We got aggressive with the Beringers on a high-speed turnoff and immediately sensed more confident stopping power than the older braking system. The Beringer

With 200 HP, the Continental IO-360-ES engine, right, doesn't launch the SR20 from the pavement like the 310-HP IO-550-N in the SR22, but it's remarkably smooth and simple to operate, in our view.

system can be retrofitted to Generation 3 and newer aircraft, starting at $15,300. In 2012, Cirrus switched from incandescent to LED exterior running lights. This includes strobes, navigation, landing and taxi lights.

Airbag seatbelts, top, are standard for the front seats, but air conditioning and a multi-stage blower fan, middle, is optional. All Cirrus models get the Beringer Performance-series brake and hub package, bottom, plus tubeless tires.

PERFORMANCE, SYSTEMS

The base SR20 has a 924-pound useful load and a 675-pound cabin payload with three hours of trip fuel, plus 45 minutes of reserve. Compare that to the SR22's 1340-pound useful load and 974-pound cabin payload with three hours of fuel in the tanks.

Initial max gross weight for earlier SR20 models was 2900 pounds, but it's now 3050 pounds. The POH says you can load 130 pounds in the baggage area, which can be accessed by folding down the 60/40 split rear seat. The back seat can physically accommodate three people, and the rear cabin is equipped with three headset audio stations.

At 3050 pounds, the SR20 is heavier than many models powered by a 200-HP engine. Takeoff and climb performance is adequate, but not nearly as energetic as the 310-HP SR22, although takeoff in the SR20 is procedurally the same as the SR22. With the flaps deployed at 50 percent, apply slight back pressure early in the takeoff roll to take the weight off the nosewheel and the airplane will fly itself off.

With two light adults and full fuel, we saw 800 FPM in a full-power, sea-level climb. Sea-level, non-obstacle takeoff distance is published at 1478 feet at ISA and gross weight conditions. However, owners that operate in high-density altitude situations report less-than-comfortable takeoff performance, particularly when loaded at or close to gross weight.

Once level at 4500 feet, we consistently saw 150 knots true airspeed at 80 percent power, which is 2500 RPM and roughly 25 inches MP on a standard day. Fuel burn was 11.6 GPH, rich of peak. Cirrus advertises a high-speed cruise of 155 knots at 8000 feet.

Lean of peak, expect 135 knots on a miserly 8.5 GPH. Still-air range is roughly 675 miles, when counting on 45 minutes of fuel reserve.

Although the CG tends forward rather than aft, the aircraft is easy to trim accurately for level flight when it's properly loaded. The flight controls are a combination of push rods, cables and bell cranks. The elevator and ailerons are made of aluminum, essentially the only major structures on the airframe that aren't made of composite.

The SR20 uses pitch and roll trim compression spring cartridges to adjust the aileron and elevator to the trimmed angle of attack. The benefits are recognized in turbulence when the autopilot isn't flying because the aircraft has a natural tendency to return to level flight. But the springs (they are big ones) can be the enemy to the pilot that doesn't trim the airplane properly on a landing approach. If you try and fight them, they will win.

Another battle you'll likely lose is spin recovery. The aircraft is not approved for spins, and the POH advises that since it has not been tested or certified for spin recovery, the only approved and demonstrated method of spin recovery is activation of the CAPS. On a side note, Cirrus told us there have been 47 successful CAPS pulls throughout the entire Cirrus fleet, not necessarily related to spin conditions.

Every SR20 is an all-electric airplane and comes standard with the two-screen Garmin Perspective integrated avionics with 10.4-inch displays, GFC700 autopilot, 1090ES ADS-B transponder, dual AHRS, a flight management system keyboard, engine indicating system, dual alternators, dual electrical bus and dual lead-acid batteries. The primary 75-amp alternator is belt-driven and the secondary

40-amp alternator is gear-driven. It's permissible to take off with the optional all-electric air conditioning system on, since the system is connected to the primary alternator. The air conditioner adds approximately 50 pounds.

Major avionics options include synthetic vision, 12.4-inch PFD and MFD, the Max Viz enhanced vision infrared camera system, active traffic alerting system, *e*TAWS terrain avoidance, SiriusXM satellite weather and entertainment system, lightning detection system and the Perspective Global Connect Iridium satellite phone and text messaging system.

BIG OPTIONS, BIGGER PRICE

That's the best way to describe the SR20 pricing structure, which starts at $349,000. From there, buyers have the option of adding three packages, including the $39,900 Perspective Plus avionics upgrade. This is the 12-inch display upgrade, a backup air data computer and the EVS camera system. The Perspective Alerts and Awareness package is $28,900 for synthetic vision and Jeppesen electronic charting—silly expensive, in our view.

After avionics, there's the $24,900 Premium Appearance package, which includes a polished propeller spinner, two-tone paint, leather seating, tinted rear windows and recognition lights. The Carbon and Platinum Appearance upgrades ($18,900 for either one) adds more styling.

You could buy the flagship GTS model, which combines all the options above, plus traffic and terrain systems, with the choice of Carbon or Platinum appearance. Add air conditioning and the price jumps to $506,800—that's more than the $489,900 base SR22 (which is fairly stripped.) A Diamond DA40-XLT is around $498,000 and Cessna's flagship Jet-A-burning 182 Skylane JT-A is around $515,000.

The aircraft flown for this report was a fully loaded GTS Platinum edition that was leased back to Nassau Flyers flight school in Farmingdale, New York. That's the typical mission for the SR20 and perhaps a good arrangement for high-end buyers that aren't ready for the more demanding SR22.

Contact www.cirrusaircraft.com.

CIRRUS SAFETY: FATALS DOWN

If it's true that the SR20 flies like an SR22, it's also true that it crashes like one. That's why the Cirrus training approach for both aircraft are nearly identical. When we looked at 50 random SR20 crashes in the NTSB reports, it came as no surprise that runway loss of control events topped the chart.

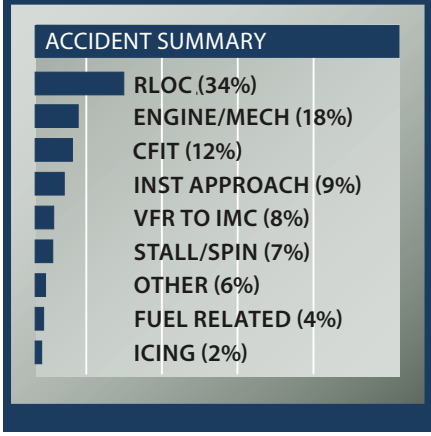
But when it comes to fatal accidents, the trend is down—way down. Cirrus' Travis Klumb said that as recently as 2004, the Cirrus fatal accident rate was about twice the industry average, at 2.6 per 100,000 hours. In 2013, the rate had dropped to 1.01 per 100,000, below the industry average of 1.2. The statistics for 2014 are shaping up to be even better. Klumb credits the substantial drop with the major revisions in the Cirrus training curriculum, which puts sizable emphasis on using the CAPS. He also noted that an early dismal accident record was partly related to the new design, complex avionics and field training that didn't match the aircraft or its complex mission.

On the day we flew the SR20 for this report, we also flew a SR22T for comparison. Strap into an SR20 and you're hard-pressed to tell any difference between it and the SR22. The control layout and sight picture is identical. While cruise-flight handling is essentially the same, taking off and going around is a different matter. Things happen more slowly in the SR20—roughly 5 knots slower—from the traffic pattern all the way to landing, and about 15 knots slower in cruise. Further, it doesn't demand the same rudder input on the takeoff roll and in initial climb.

Klumb doesn't think enough emphasis is placed on practicing go-arounds. "The real situation where Cirrus pilots get into trouble is when they execute a go-around late in the game. When you've screwed up the approach and you're in the flare or on the runway (maybe bouncing), the go-around is very different than it is at 200 feet when the aircraft still has enough flying airspeed," he notes, but that's true in any airplane, really.

But since the SR20 and SR22 fly so much alike, save for some power and weight, the real question on our minds is whether the SR20 makes for a better trainer, since it's an equally slippery airframe. Klumb says it does. "There's a big difference between the 200 horsepower in the SR20 than the 310 horsepower in the SR22 when it comes to left-turning tendency and the amount of right rudder input that's required on a go-around. In that sense, the SR20 can be much more forgiving," he said.

While most of the Cirrus runway prangs aren't fatal, Cirrus is seeing some pilots get into serious trouble when they try to force the go-around when it's simply too late to get the airplane flying again. In these cases, close the throttle, ride it out and let the insurance company handle the rest.



Much like it did with its icing standardization training, Cirrus is reintroducing its landing standardization course for distribution to its training centers and Cirrus standardized flight instructors. Klumb said that transitioning from the SR20 to the SR22 can generally be accomplished in a one-day differences course.

Portable Datacomm: DeLorme inReach Tops

Cabin WiFi hotspots provide smartphone-integrated text, voice and data capability, but slow speeds and high data costs are major deterrents.

by Douglas P. Fields, Jr.

In today's always-connected environment, the light airplane cabin is almost uniquely cut off from the world. For some, the sneaky workaround has been to simply use a smartphone for texting and talking at lower altitudes, but that violates an FCC ban.

There are several new portable products that aim to reduce this airborne isolation and bring the Internet to the cabin. Some of these devices serve double duty for personal flight tracking and SOS broadcast.

We went hands-on with the DeLorme InReach Explorer, the Iridium Go! and the Globalstar Sat-Fi to see if the products are a viable solution for acceptable Internet on the fly.

HOW THEY WORK

The systems operate via constellations of satellites that provide coverage well beyond that available with terrestrial cellular networks, but require a clear view of the sky

All of these devices have extremely wide coverage areas. Both the InReach Explorer and the Go use Iridium's satellite network, while the Sat-Fi uses Globalstar's constellation, which greatly differs from Iridium.

Iridium's satellites orbit the planet in six polar orbits at 485 miles, hopping satellite to satellite before reaching a ground station for worldwide coverage. Globalstar uses about half as many satellites orbiting at 875 miles, angled about 52 degrees from the equator, leaving coverage gaps at the Poles and in a few other places such as southern Africa and southeast Asia as ground stations populate. In the U.S., both providers offer full coverage.

We tried the devices on the ground and in the air while paired with various iOS devices running versions 7 and 8.

IRIDIUM GO

The Iridium Go is Iridium's mobile voice, text and data hotspot. Contained in a 4.5 by 3.25 by 1.25-inch box, it has a flip-up antenna that also powers the unit on. The device is simple—just a power button, two function keys and a small monochrome screen. There's an SOS button on the side for emergency use, a USB port for charging and an external antenna port. Unlike the Explorer product, the battery is user-accessible and replaceable. The Go has a rugged feel and is splashproof. It comes with AC and vehicle chargers, as well as a cover that shields the device from direct sunlight. We wish it had more mounting options other than the $40 RAM window suction mount.

Prior to use, an account must be established with Iridium and various options configured, particularly the Emergency SOS function. Custom emergency contacts can be configured, and the worldwide GEOS network is also available (but must be configured in advance).

All functionality offered by the Go must be accessed using apps connected via WiFi. Iridium itself provides two apps, Iridium Go and Iridium Mail, compatible with iOS and Android. An API allows third-party apps to interact with the Go, but the only aviation app currently available is the FlyCast mobile weather app.

The Go app allows voice calls, SMS messaging, sending tweets and tracking information, plus activating the SOS feature. All contacts require the country code, but texting to and from e-mail addresses is supported. A phone number in Iridium's virtual country code (8816) is permanently

CHECKLIST

- Portability eliminates installation costs and regulatory oversight.
- Satellite transceivers offer internet flight tracking and SOS capability.
- You probably won't like the data speed and costs.

From left to right in main photo, the Iridium Go, DeLorme Explorer and Globalstar Sat-Fi are all wireless and portable, but vastly different in form.

assigned, so calls or text messages to the Go may cost extra, if it can be called at all. During evaluation, one Verizon Wireless customer was not able to call the Go without adding an international plan to the account. The Iridium website can also be used to send messages to the Go.

With the Go on the airplane's glareshield, sending and receiving text messages was quite reliable in straight-and-level and maneuvering flight. Messages can be extremely long; we successfully sent single messages of 999 characters to SMS numbers and 980 characters to e-mail. E-mail recipients get a message from an address like 8816xxxxxxxx@msg.iridium.com, and can reply normally. Sending an SMS from the Go takes about 10 seconds, but receiving one seems to take closer to a minute. A tweet is posted in around 30 seconds.

We tried airborne voice calls using the app and a Bluetooth connection to a Bose headset. Voice quality was comprehensible, but tended to drop off during turns. The call connection was reasonably reliable and dropped only once. Voice calls were unable to be placed or maintained during aggressive maneuvering. There is about a second of latency when using voice calls, so we found ourselves occasionally talking over the other party. While on a voice call, other apps can be used without dropping the call. The Go app advises of an incoming call with a standard iOS alert.

A tracking button in the app sends the recipient a link to an online mapping application showing the user's location. The Go app sends tweets via SMS. The second app, Iridium Mail, provides weather, Facebook, Twitter, mail, web and photos. For e-mail, Iridium provides an address at @myiridium.net. The app must be explicitly told to send any queued mail and receive any waiting mail. Received mail that is too large will not be downloaded unless specifically requested. As the Go operates at only 2400 bps, sending or receiving large mail can be extremely slow. An e-mailed picture (36k size), took almost 10 minutes to send successfully, after four failed attempts. Failures don't restart, so the Go had to do the entire send again. That said, for sending and receiving ordinary text e-mail of modest length (up to a few kilobytes), the Mail app worked quite well. It would be best to use Mail only in straight and level flight, though. You can send pictures from your camera roll, but they will be resized, perhaps too small for your liking.

Globalstar's Sat-Fi, right, has fast data speeds, but didn't work well in flight. DeLorme's inReach Explorer, bottom, has the most utility if you can live without voice communication.

Finally, the Mail app offers web browsing, subject to a large number of caveats. First, all background apps and e-mail should be disabled. Then, the Opera Mini web browser must be downloaded and configured. Iridium provides a list of mobile-optimized sites that should work. Finally, enable the Go's web browsing and, in theory, browse the web, albeit slowly due to that 2400 bps link. We couldn't get it to work.

The battery life seems to be better than the iPad Air's endurance, although not remotely as long as the DeLorme Explorer. Up to five devices can use to the Go simultaneously.

The Go has a number of quirks to it and its apps and website did not have the polish of the Explorer. For example, the initial Iridium account password had an ampersand in it. After several frustrating hours of failed tests, the password was changed to have just letters and things started working. Sometimes SMS messages would be received late or out of order, and sometimes the Go app would crash when attempting to use GPS tracking. Some of these issues may be related to the recent release of iOS 8, and Iridium posted an extensive advisory in mid-September 2014 to expect a new version of the software in mid-October (which, as of press time in late October 2014, hasn't been released).

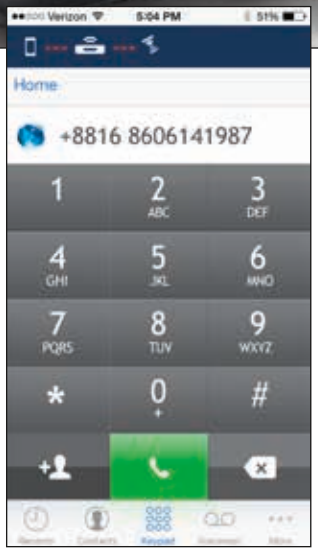
The unit is $815, plus a $50 activation fee. Service plans are offered by resellers (including Sporty's) and are based upon included data minutes, starting at $50 per month for five minutes of data and up to $120 per month for unlimited data. Text messaging starts at 50 cents and is free in the higher plans, while voice calls start at $1.49 per minute and decrease to $1.10 per minute.

DELORME EXPLORER

The DeLorme InReach Explorer is an all-in-one satellite tracking and text messaging device that easily fits in a shirt pocket. It's around the size of an Apple iPhone 5. Three buttons and a four-way rocker control the small color screen built into a ruggedized and waterproof case. The Explorer is entirely self-contained and all of its features are usable from the device itself.

During our evaluation, the battery never dropped below 25 percent and didn't quit when we forgot to power it down overnight after a four-hour flight, with two-minute tracking intervals. DeLorme claims an endurance of 100 hours at 10-minute tracking intervals.

It is necessary to set up an account to activate the Explorer. At this time you can also set up emergency contacts, regular contacts and add



The Iridium Go hardware, left, can benefit from more mounting options. Smartphone interface, bottom, is intuitive and simple.

Facebook and Twitter accounts. Three predefined messages can be configured, which can be sent for free. We think the website is easy to use, and changes made on the website are synched to the device by USB cable.

The Explorer can send and receive short text messages to any cellular phone or e-mail address. It's necessary to include the country code by adding "1" for a U.S. number. Four basic types of messages are available: an ad-hoc message, a pre-defined message, a location message and an online tracking message. SMS messages appear to come from a domestic phone number and email comes from "DeLorme inReach."

Emails include a link to a mobile-optimized site which displays the location where the message was sent as well as for sending a reply. SMS messages also include a link for replying, but if someone replies directly instead of using the link, it appears to come from "unknown." This is quite confusing if you're corresponding with more than one person.

Although messaging from the Explorer itself is possible, and made faster by predictive typing, using an iOS device running the Earthmate app improves the experience. The app connects via Bluetooth, so the iOS device can remain connected to WiFi, such as when using an ADS-B receiver like the Appareo Stratus.

The Earthmate app allows easy sending and receiving of text messages similarly to the built-in Messages app. Received messages cause an alert sound and banner. Online GPS tracking is toggled with a tap, and recipients get a link to tracking by e-mail or SMS. All previous sent and received messages and tracks can be reviewed broken down by date.

A large SOS slider activates the Explorer's emergency functions. There is also a built-in map for reviewing the current position and old tracks. NOAA and DeLorme charts can be downloaded and stored in the iOS device for offline use. Finally, the app's data can be synched with a DeLorme account.

The Explorer itself has a few additional options not exposed in the Earthmate app. Direct postings to Twitter and Facebook are possible. In addition to GPS, the Explorer has an integral altimeter and compass.

The user interface is responsive and, except for typing messages, the input buttons make quick work of all functions. The LCD has several brightness settings and is usable in sunlight. It is easy to turn on and off location tracking, and it's easy to send a message to preconfigured recipients about your location.

In the air, the Explorer works perfectly. The device was placed on the side of the glareshield with the antenna pointing mostly upward. There were no problems with signal strength observed in any of the evaluation flights, and GPS tracking and messaging were always available. The device even worked on a commercial flight to Europe (with careful antenna aiming), and functioned normally on the ground in Iceland and in England.

The unit itself retails for $379 and requires a service plan. Two types of plans are available: annual and month-by-month. There is a $25 per-year fee for the monthly plans, or a one-time $20 fee for the annual plans. The annual plans range from $12 to $80 per month with additional messages and tracking points included, with the top plan including unlimited messages and two-minute tracking. Monthly plans cost $3 to $20 more.

GLOBALSTAR SAT-FI

The GlobalStar Sat-Fi is not battery-powered. Instead, it connects to the aircraft's power receptacle using an included cable. It has an external mag-mount antenna with extension cable, allowing the main unit to be placed remotely. For aviation use, it's a simple matter to remove the magnet and place the antenna on the glareshield. The unit is about four times the size of the Iridium Go.

Up to eight devices can connect to the Sat-Fi simultaneously. Unlike the Go, the Sat-Fi uses a domestic phone number for calls and texting. When a call comes in, all connected devices will ring. Calls have priority over data, so if a call comes in or starts, any data session in progress will drop.

Like the Go, the Sat-Fi must be used with compatible apps for iOS and Android. There's Sat-Fi Voice and Sat-Fi, plus desktop apps for Windows and soon for Mac.

To make calls or send and receive text messages, the Sat-Fi Voice app is used. After configuration, it is extremely simple, like the iOS Phone app. We think the application is the

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SMARTPHONES: SATCOMM KILLER?

Why bother with complicated satellite connectivity when you likely have a smartphone in the pocket? For one thing, the FCC has banned the use of cell phones aboard aircraft per 47 CFR 22.925 I. Originally, it likely had to do with the way the cellular system works.

As the name implies, geographic areas are divided into different cells which use different frequencies, and no two adjacent cells use the same frequency, but two separated cells can safely share them. A phone in a plane has a much longer reach than a phone on the ground, so it could tie up a single frequency across multiple cells. Furthermore, the phone may not be able to receive a signal at all with multiple cells using the same frequencies.

On top of this, cellular network providers use antennas that aim their signal toward their users. As there are no users above ground, the antennas are tuned to radiate most of their power horizontally rather than upward. Additionally, the floor of the aircraft could have a few sheets of aluminum between the phone and the cellular towers, which will further attenuate any signal.

This means cellphones in aircraft are not likely to work well in many situations. The lower the aircraft, the more likely the phone will be able to send and receive an intelligible signal. In less densely settled areas, where there are fewer, larger cells, a cell phone is likely to work better. For some flights it should be possible to maintain a full 3G or LTE connection, while others probably can't even get a basic connection.

What about safety? Cell phones emit radio waves in a variety of frequencies from about 450MHz to over 2.1 GHz at several hundred milliwatts. A general aviation pilot flying with family has likely had cell phones left on during flight and, to our knowledge, there are no recorded accidents attributed to cell phone interference. We know of at least one, ahem, instance in which a pilot's phone was inadvertently left on. The worst interference ever noted was during a flight for this article when a passenger left a cellular phone on and placed it on the glareshield just over the audio panel during a check of the Iridium Go. A distinctive series of clicks was heard over the intercom, which was almost certainly a GSM handshake.

In late 2013, the FCC chairman suggested modifying the rules on in-flight cellular use. So far, nothing has come of it. However, if the FCC lifts its ban then the use of cell phones in general aviation planes would then be at the discretion of the operator under FAA rule 91.21. It could also squash sales of satellite transceivers.

nicest of the three and has an elegant user interface. Unlike the Iridium Go, text messages can only be sent via SMS and not to email addresses.

The second app, Sat-Fi, allows access to email, Facebook, Twitter, photos, weather and the web. This app is suspiciously similar to the Iridium Mail app, right down to the icons used for mail folders, ports used for proxy servers and the options available in settings, so we suspect they designed by the same developer. As the functionality is nearly identical, refer to the Iridium Mail details explained earlier.

The Sat-Fi provides an @globalstarmail.com address and transfers at a data rate is 9600 bps, much faster than the Go. We sent a 26.5k photo message in about 30 seconds, which felt blindingly fast after the Go's 10-minute marathon.

Unique among these three units is the Sat-Fi's ability to be used as a WiFi hotspot with full Internet access. The Sat-Fi app can be set to allow all Internet traffic—not just email and web traffic—to flow through the Sat-Fi, making it a true WiFi hotspot. To best take advantage of this, however, the connected devices should be configured to minimize data use so as not to clog up the connection.

While GlobalStar has done limited airborne testing, we couldn't get the unit to work after starting the engines in a light twin. In a small helicopter, we could send some text messages, but the connection was unreliable. Globalstar sent a replacement with no improvement.

The Sat-Fi is $1000 with a $50 activation fee, minus a $250 rebate for the rest of 2014. Service plans are simple and available on a monthly or annual basis. Annual subscriptions allow the included minutes to be spread across the year. Except for the unlimited plan, the main difference is in the minutes included, with all plans having extra minutes priced at $1. Monthly plans are $40 for 40 minutes, $65 for 100 minutes, $100 for 200 minutes and $150 for unlimited. Annual plans are 12 times as costly for 12 times the minutes.

CONCLUSIONS

Unless there is an overriding need for voice connectivity, we think the DeLorme InReach Explorer makes the most sense for pilots. Its tracking capability is a sizable benefit, plus it's the least expensive to buy and to operate with an unlimited usage plan. It's well-suited for emergency use due to its long battery life and pocket size. Its main drawback is that some incoming messages won't identify the sender.

We think the Iridium Go is elegant, but hobbled by pricey plans. Callers bear the cost of International dialing. Its slow data means only the smallest emails are practical and Web browsing could be intolerable.

Disappointing is the Globalstar's airborne performance, despite its well-done apps, relatively fast speed and decent user interface. Based on our evaluation, we can't recommend it for airborne use.

FAA's Delayed New Regs: Bureaucratic Paralysis

Congress directed the FAA to revise the dated Part 23 certification standard by late 2015, but the FAA says it will fall short. We asked industry leaders why.

Staff Report

For the better part of the last decade, the aviation industry has been talking about a revised version of FAR 23 that would streamline and simplify aircraft certification, theoretically slowing the sharp rise in the cost of new aircraft. Yet two years after the Congress passed legislation requiring the FAA to complete the Part 23 revision by 2015, the FAA says it won't meet the deadline. Even the Europeans are baffled by this delay; industry sources say Europe is far ahead of the U.S. in implementing these changes.

The stakes are enormous. The U.S. is already in danger of losing its traditional lead in aircraft manufacturing and at least two foreign manufacturers plan to certify aircraft in Europe, then gain FAA approval through bilateral, giving them a huge cost advantage over U.S.-based companies.

It's not just new certifications that are threatened. STCs and changes to existing Type Certificates seem to take forever. The magnitude of the problem is recognized, and the FAA has detailed marching orders for putting its house in order—yet it's thumbed its nose at Congress on the deadline.

As the FAA's foot-dragging stifles an industry looking for lower prices on both the OEM level and in the aftermarket, we asked lobbying groups, manufacturers and the FAA what the ultimate revised regulation could mean to the consumer's safety and costs.

BACKGROUND

Part 23 (accurately, 14 CFR Part 23) is the section of the Federal Aviation Regulations (FARs) that sets out the requirements that must be met for an aircraft to be built and sold to the general public. It also covers the requirements for obtaining Supplemental Type Certificates (STCs), which are major modifications to production aircraft. The FAA and Part 23 were, for decades, the gold standard internationally for aircraft certification. It was the model the European Union's European Aviation Safety Agency (EASA) initially followed when it created its own rules for aircraft certification, even using the same number—CS23.

Unfortunately, over the last 30 years a combination of Part 23 being made increasingly and unrealistically complex and the internal culture of the FAA have slowed new aircraft certification and STC issuance to a crawl. Next, a force-fed upgrade.

Aircraft owners are required to comply with the FAA's ADS-B equipment mandate by the end of 2019 if they want to operate in controlled airspace, but installation of this so-called safety equipment has been lagging while owners sit on the proverbial fence, taking a watch-and-wait approach. One reason is the private fund that will supply low-interest loans to owners for the installation. The FAA has to approve the loan guarantees for the program, but it hasn't despite being directed to do so by Congress in 2012.

Bureaucratic red tape and old-school regulation have been barriers in approving some safety-enhancing products and modifications. When we interviewed Pete Bunce, the president of the General Aviation Manufacturer's Association (GAMA), he spoke of the frustration of U.S. manufacturers and the lost sales they have experienced because of the "snail's pace" of FAA certification.

"FAA policy and procedure hinders the industry's ability to efficiently develop and deploy new aviation products and technologies," said Bunce.

Moreover, at FAA Administrator Michael Huerta's press conference at AirVenture 2014, we outlined the problem with departments within the agency ignoring deadlines imposed on them by law and regulation and asked what is being done within the agency to correct the problem. His nonresponsive reply segued through the importance of getting the right answer on issues to a shout-out to FAA department managers in the room for the good work they are doing. STC applicants we spoke with beg to differ with him, citing situations where an inspector could have approved a mod, but required Designated Engineering

Representatives (DER) involvement to do unnecessary testing, and then ignored the DER's findings.

Under pressure from Congress, the FAA established the 14 CFR Part 23 Reorganization Aviation Rulemaking Committee (ARC) made up of FAA employees as well as members of the international aviation industry. We've seen the list of committee members and were impressed by the names we recognized. The committee met with the U.S. aviation community and reviewed international aircraft certification standards before issuing its detailed report (http://tinyurl.com/mav4vvf) recommending a package of changes that the FAA should undertake to streamline certification to make it more sensible, responsive to changes in technology and safety improvements as well as substantially less expensive and faster to update regs moving forward.

OUTSIDE OF THE BOX

The ARC drafted and submitted a nearly 400-page report to the FAA on how to streamline small airplane certification in ways that improve safety while also cutting costs. Part of that plan will rely on ASTM International consensus standards for certifying products, material and other services, in addition to some bold out-of-the-box thinking. Reading through the report, it's easy to spot a common-sense approach.

Early in the report, the ARC states in part: "The ARC looked at how outdated design requirements and certification regulations affect both initial certification and alteration processes. The prescriptive and outdated rules are the major barriers to installing safety-enhancing modifications in the existing fleet and to fielding newer, safer airplanes because they inhibit innovation." Interestingly, the ARC went as far as recommending a new category of airworthiness that would "align maintenance and alteration requirements of older aircraft, not operated for hire, to a level more appropriate for a privately owned vehicle." It also said the certification requirements should match the complexity of the aircraft.

The Flight Design C4, right, is a poster child for a new Part 23. It's in the process of being certified with Garmin's G3X Touch experimental avionics, bottom photo.

We know what you're thinking and we thought the same thing. Finally, new regulation that would allow the installation of low-cost experimental avionics in existing Part 23 aircraft operating under Part 91, right? Not exactly.

We asked Ric Peri, vice president of government and industry affairs at the Aircraft Electronics Association (AEA) what the proposed changes to Part 23 mean to buyers of retrofit avionics. He was only half kidding when he told us "nothing."

Peri said the proposed changes to Part 23 have little if anything to do with avionics retrofits and more about new type certifications. AEA addressed the avionics retrofit topic with the FAA, but that won't even be included in the final report because avionics retrofit guidance isn't in Part 23. Instead, it is Part 21 that governs whether or not non-certified equipment can be installed in the aircraft. There is cautious optimism, however, that parallel rule changes, including enhancements to Part 21, could be the break consumers have been waiting for. We have already seen progress.

Peri, who chairs the ASTM committee, is credited for a streamlined angle of attack installation procedure that sidesteps FAA field approval as long as the system meets ASTM standards. This opened the floodgates for widespread and fully certified AoA installations. These were once mainly available to the experimental market. Peri does believe a new Part 23 will streamline the certification standards of some after-market upgrades and he referenced aircraft seats as one example.

Since seat regulation is prescriptive and heavily governed, certified seats are built to both an acceptable means of compliance standard and to a separate safety standard. Peri believes you'll see the safety standard cut down significantly for this kind of accessory, but more modern guidance materials put in place through a ASTM compliance method. This could change the way a manufacturer proves product safety, greatly reducing OEM and retrofit costs.

The project to watch is the Flight Design C4—a four-place piston single that's currently being certified around a new Part 23 standard. It will be IFR-capable, have a certified Continental engine, non-TSO'd experimental Garmin avionics and a price that's projected to be under $300,000. The C4 will first be certified in Europe under ELA (European Light Aircraft Category) by EASA. FAA certification is anticipated under reciprocity between these two leading regulatory agencies.

Flight Design has participated in the creation of the ELA category and is involved with the current Part 23 ARC review with contributions to the technical and regulatory committees. There's also the Pipistrel Panthera, the four-place Slovenia-designed and-built retractable that's being cer-

Some methods by which manufacturers demonstrate product safety, left photo, could be streamlined under new Part 23 regulations. That could lower the costs of safety-enhancing cabin accessories like airbag seatbelts, both for OEM and the aftermarket.

tified under the CS23 revision with a $500,000 target price, but could more realistically cost $600,000—hardly the affordability consumers are looking for.

LESSONS FROM EUROPE

There is a lot to learn by the progress made in overhauling the European regulations. The European Aviation Safety Agency is, among other things, tasked with drafting aviation safety legislation and providing technical advice to the European Commission and to the Member States. It has been in existence for roughly 10 years and recognizes that rules previously written for the transport sector aren't well purposed for general aviation—a sector that's struggling to thrive for a variety of economic and logistic reasons. It's doing what the U.S. should have done years ago, which is adopting new practices for installing the new breed of equipment that didn't exist when the old regulation was written.

Greg Bowles, GAMA's director of European affairs (Bowles also chaired the ARC to Part 23 and the standards group that's writing the standards for new methods of compliance) told us there are many good programs underway in Europe that address pilot licensing, operational requirements, maintenance and certification standards.

"There is a European proposal in the works which would allow the kinds of upgrades and modifications U.S. operators want to make to Part 23 aircraft, but without needing STC approval to do it," he noted. He's referring to SC-STAN, for Standard Changes, and the rule is expected to be finalized within six months to a year. The policy creates a framework for adding new technologies (GPS systems, MFDs and AoA systems, to name a few) that are predefined in an extensive appendix that can be grown over time and as technology grows. "It's an incredibly forward-looking approach," Bowles admitted. "The new policy eliminates the costly paperwork-intensive part of the installation process that requires engineering a change to an existing type design," said Bowles.

Depending on the criticality of the equipment being installed, the process can vary, but in a predefined way. For example, primary flight displays that indicate primary flight instruments will still have to be E-TSO'd, but non-critical equipment won't need to have a design or production pedigree. "It's an intelligent way to set a bar on the onset for equipment that will be used for IFR flying," he told us.

DESIGN ASSURANCE

Exactly what the new standard will do to reliability and safety is anyone's guess. Reliability rides partly on what is known as the Design Assurance Level (DAL) of the operating software that's found in most new avionics, including primary flight displays. DAL addresses potential failures of the software and the outcome it might have on the flight, from no effect to catastrophic.

Bill Stone, a veteran engineering leader at Garmin, made a direct correlation between DAL and the potential retrofitting of non-certified avionics in Part 23 aircraft.

"There is a strong desire by many stakeholders, including the Small Aircraft Directorate, to further abate the certification requirements for smaller general aviation aircraft and systems. Some are promoting actions to increase design assurance levels of software so there can be new technologies installed at affordable prices. That may result in a situation where experimental systems like the G3X Touch can end up in existing Part 23 aircraft, but it's too early to tell if that will happen," Stone said.

Reading between the lines, we suspect Stone is hinting at an ultimate compromise for an across-the-board regulatory approval to install non-certified avionics in Joe Pilot's old Bonanza. That compromise might require a higher degree of software testing, much like the regulations require now for larger transport category aircraft. The higher level of DAL certification, however, might substitute for a TSO, even though the current DO-178B software certification guidance and DAL level is governed by a TSO.

On the other hand, the design assurance process for certified avionics is considered to be an end-to-end process—from the immediate requirements of basic functionality—to the performance of the final software when running on the target hardware. What design assurance does not and cannot do is ensure there are good requirements and input to the DAL system. Stone strongly suggested this requires good, solid judgment by engineers that know what they are doing.

His point is this: You can have a seemingly failure-proof Level A certified system that still malfunctions. The key for consumers and OEMs in a less regulated Part 23 world might be to select a manufacturer with a proven track record of building reliable systems. We certainly can't argue that Garmin would be a top choice, based on its track record for exceptional quality control and overall product reliability.

That track record and, frankly, Garmin's market influence is precisely the benefit Flight Design has as it attempts to certify the G3X Touch as part of the C4's type certificate.

Worth mentioning is that an

aircraft manufacturer who demonstrates a track record of being able to design and test aircraft in compliance with the FARs can receive Organization Delegation Authorization (ODA), which allows it to test and report on compliance with FARs to the FAA. With appropriate quality control procedures to periodically confirm the manufacturer is doing what it says, the FAA is supposed to accept the certification.

When ODA presents data and reports, the FAA appoints a committee to review it. We were told that whether the committee accepts the data from the ODA depended entirely on who got selected for the committee. Some FAA employees followed policy and accepted data and results; others invariably either required more testing or stopped everything and had FAA personnel redo the tests.

STOP SAYING NO

Regardless of how Part 23 shakes out, we think there needs to be a culture change at the FAA, and that means decision-makers need to lose the fear of making even the simplest decisions. FAA employees cannot be held personally liable for decisions they make on aircraft certification. However, approving a design that proves faulty is perceived as a career-stunting event.

FAA employees and STC applicants we spoke with described an agency that has become unreasonably risk-averse. It's safer for an FAA employee to say no than yes, and if they say yes, that employee generally makes sure the file is covered with other thumbprints to protect themselves should something go wrong. As one airworthiness inspector told us, "It's all good until an aircraft hits the dirt. I don't want to be the one the lawyers come looking for once the crash become litigious."

The employees we spoke with did so only on background; we were not given permission to use their names. Of the employees of manufacturers and STC applicants we spoke with, most refused permission to use their names for fear of retribution from the FAA on ongoing projects.

To be fair, the FAA also faces a serious problem it can't control—Congress continues to refuse to provide the FAA with predictable funding.

Industry leaders and manufacturers we spoke with aren't surprised the Administration won't meet the rewrite deadline because things simply happen slowly there. The AEA's Peri pointed out that it takes the FAA five years to make an amendment to advisory materials, policy changes generally take one year and changes to regulation drag on a minimum of five years. The FAA said it's going to take at least two years longer to get its job done, handing another advantage to foreign aircraft manufacturers like Pipistrel and Flight Design, although GAMA's Bowles said we might see the new Part 23 regulation a bit sooner than 2017.

Congress spoke with rare unanimity in directing the FAA to act and it needs to continue applying pressure. Safety and the preservation of America's lead in general aviation is at risk.

FIELD CERTS NEED FIXING, TOO

Since many aftermarket products are certified under AML STC (that's blanket approval for a large number of aircraft models), the demand for FAA field approvals has lessened over recent years, but the process is complex. Field approvals require sizable amounts of paperwork and coordination on the part of the installer, while the aircraft owner absorbs the cost and downtime. Shops we talked with are frustrated with the process.

The FAA Flight Standards division declined our request for an interview, but agreed to respond to a written query about what the FAA is doing to ease the process of obtaining field certification, why some approval requests on the FSDO level are being passed off to ACOs and what it's doing to ensure across-the-board standardization.

We've noticed that an increasing number of approval requests can't be accomplished at the FSDO level. The FAA developed the Major Repairs and Alterations Job Aid to help walk inspectors through these issues. Interestingly, "Some systems have new and novel features that will need additional analysis until the policy and guidance has been developed to allow broader installation approvals," we were told. Presumably, that policy and guidance will be in the new Part 23 and parallel regs. It's not uncommon for a FSDO or ACO to request engineering data (through a DER), system integration analysis and operational impact analysis. That's fair enough, but these requirements can vary between districts and even among inspectors in the same office. The FAA said it's addressing this by developing specialized focus teams to help provide technical support and guidance for installations.

With the FAA chomping at the bit to get the fleet ADS-B-compliant by 2020, Peter Ring at ADS-B manufacturer FreeFlight Systems told us field approvals for its systems that don't yet have AML approval are generally being FSDO-approved without difficulty. Perhaps the new approach is working. The FAA established an ADS-B focus team that provides a dedicated point of contact that has detailed technical and policy knowledge which field inspectors can use to ease the evaluation and approval.

Shops and owners can help streamline any approval by commencing the approval process early, perhaps before the aircraft even hits the maintenance floor; this way it doesn't become a hangar queen while the shop waits for approval. The installer should submit as much manufacturer's data as possible, plus examples of other approvals and TSO or PMA data appropriate and applicable to the installation.

When the field approval requires the services of a DER for engineering analysis, get ready to pay. Approved engineering data for installing something as simple as an antenna could cost nearly $3000. Since many shops don't have a DER on staff, ask about additional certification costs and the potential for delays before committing to a project. Better yet, select equipment that's approved by an AML. That keeps the sign-off simple.

Choosing a Floatplane: What's a Good One?

A lot of airplanes have been put on floats—with varying results. Here are criteria for selecting a good one and our choices for the best.

by Rick Durden

This article started with an email from a reader asking whether a Cessna 150 would be a good floatplane. It morphed from conversations with experienced floatplane pilots about the 150 on floats—okay, but not great—into what makes a good floatplane, what to look for when buying one and what's involved in putting floats on your airplane.

To keep the subject within limits, we'll limit the discussion to floatplanes weighing 4000 pounds or less and omit flying boats—after all, we covered the most popular, the Lake Amphibian, in detail in our Used Aircraft Guide back in the January 2014 issue.

Given all that, what are the criteria for a good floatplane and the variables to be considered when finding the right one for you?

POWER-TO-WEIGHT RATIO

The first thing Alaska floatplane pilot and flight instructor Terry Dickinson pointed to when discussing his criteria for a good seaplane is its power-to-weight ratio. It has to haul around the weight and drag of two boat hulls that can withstand the pounding involved with going fast on the water and the attaching hardware. That takes power.

Adding to the challenge, on takeoff a seaplane has to transition from plowing through the water, with the floats mostly submerged, onto the "step" where they plane on the surface. To do so, the pilot initially holds the yoke or stick full aft to force the aircraft's nose up and the engine manhandles the floats onto the step. The pilot then lowers the nose to just above level attitude so that the drag of the water is minimized and the airplane can accelerate to flying speed.

The better the power-to-weight ratio, the faster the airplane gets onto the step and into the air—and the less skill and finesse that is required of the pilot.

The power end of the ratio is expensive—so while a great floatplane has a high power-to-weight ratio, a good one for you should have: Enough power to get on the step without requiring superhuman finesse; a takeoff length for safety in the available area and a climb rate that will easily clear obstructions where you are planning to operate.

The other end of the ratio is too often overlooked. Controlling weight in floatplanes matters because it greatly affects takeoff distance and rate of climb. A heavy, high-end interior is not a plus in a floatplane—Spartan is better.

FLOAT SIZE

Floats are identified by numbers that indicate the maximum amount of weight, in pounds, of fresh water they displace when fully submerged. A "2000" means the float will displace 2000 pounds. FAA certification requires that the total displacement of the floats must be at least 1.8 times the gross weight of the floatplane. So a floatplane on a set of 2000 floats can have a max gross weight of just over 2222 pounds.

There's a tradeoff in float selection—the more weight the set of floats can support, the bigger, draggier and heavier they are. On first blush, that means using the smallest allowable floats for the airplane. However, that means more of the float is underwater, which adversely affects maneuverability and ability to handle rough water and stronger wind; it also means that it's more difficult to get the floats onto the step, lengthening the takeoff run.

CHECKLIST

- ⊕ In general, the greater the power-to-weight ratio, the better.
- ⊕ Precise water handling and good maneuverability are major pluses.
- ~ Float size is a tradeoff between weight and maneuverability.

A Cessna 206 on Wipline amphibious floats lifting off of glassy water, one float at a time. The dorsal fin is required on this installation.

Derek DeRuiter, owner of Northwoods Aviation, a seaplane operation in Cadillac, Michigan, told us of bad experiences in a Cessna 172 with the minimum allowable floats, a set of 2000s. When making taxi turns on windy days, it was not uncommon for the downwind float to completely submerge, making maneuvering difficult and risking capsizing.

Often an airplane will have at least two different size floats approved—doing some homework with those knowledgeable about the aircraft and floats is necessary before making a purchase decision.

HANDLING

Because of the side area of the floats forward of the aircraft c.g., they destabilize the airplane in yaw. Tom Wallis has done flight testing for numerous singles and twins on floats and told us that flight testing may demonstrate the need for the addition of more side area on the aft portion of the airframe to provide adequate stability and control. This is usually involves installing a dorsal fin on the empennage or finlets on the horizontal stabilizer.

Maneuverability on the water is important at slow speed in crowded areas and at high speed during takeoff and landing. Even though floatplanes have water rudders to improve steering at low speeds (they are raised out of the water for takeoff and landing), some airplane and float combos are better than others.

Smaller lakes, odd-shaped bays or operations on rivers mean that normal takeoffs and landings may involve turns while the airplane is on the step on takeoff or landing. For example, Seaplane Adventures is based at a location in Sausalito, California, where each takeoff involves a sharp 90-degree left turn. We made flights with company owner Aaron Singer as he graphically demonstrated the importance of selecting a floatplane that is capable of handling the conditions where an owner is going to base it.

USEFUL LOAD

Most STCs for float installation include an increased gross weight for the airplane. That sounds great until you look at the numbers—the weight of the floats is greater than the gross weight increase, so useful load will go down. A useful rule of thumb is that, with floats, many two-place airplanes become single-place if more than an hour of so of fuel is aboard and four-place airplanes become two- to three-place.

When considering any floatplane, look closely at the useful load to assure that the airplane will work for your needs.

American Champion Scout equipped with finlets, planing on the step, top. Steve Gruenberg's Cessna 185 with an IO-550 engine mod being maneuvered with canoe paddles around underwater obstructions, middle. Northwoods Aviation's Piper Super Cub on straight floats starting to get on the step, bottom.

STALL SPEED

Seaplanes generally come off the water near their stall speed and land four or five knots above it. Accordingly, the lower the stall speed, the less pounding the airframe receives at high speed on the waves.

STOL kits may be worth their weight, but we feel that each has to be evaluated based on how much useful load is lost versus stall speed decrease. We think VGs are worth the price as they reduce stall speed measurably and don't add more than a pound or two to the airframe.

A number of pilots we spoke with highly recommended the wingtip extensions available for the Cessna 180, 185 and 206 in terms of substantially reducing takeoff run.

DOORS

We've seen things go wrong fast when taxiing a seaplane. We, and the operators and pilots we spoke with, prefer doors on both sides of the aircraft so the pilot can get out quickly. That's a shortcoming with most of the two-place tandem seaplanes and is one reason that the copilot's door mod for the Cessna 206 is popular.

If you are considering a floatplane with a single door, plan on consciously making all your turns when taxiing so that the door is into the wind. If a gust upsets the floatplane, you want the door side to be up.

VISIBILITY

Being able to see what's going on around the aircraft when taxiing, taking off and landing is important—especially when hitting objects or debris in the water can have serious consequences.

In general, two-place tandem floatplanes give the pilot better all-around visibility than side-by-side seating. Some floatplanes are blind forward during the process of getting on the step; minimizing that time via more power improves the level of safety, in our opinion.

BUYER BEWARE

You've found what looks to be the right floatplane for you—what sort of showstoppers should you watch for when inspecting it? First of all, we recommend that you never buy any airplane, but especially a seaplane, without a pre-buy examination by a

YOU WANT FLOATS WITH THAT?

You've owned a Cessna 182 for several years and you've got it set up just the way you want—except you want it on floats. Can it be done for a reasonable cost or is it better to sell and buy a seaplane you like?

The answer is—it depends. Cessnas destined for floats came out of the factory with a floatplane kit installed. It included a number of structural beef ups as well as extensive corrosion proofing. If your airplane doesn't have the kit installed, you'll have to have that installed before adding floats—and that can be difficult and expensive.

Derek DeRuiter's Northwoods Aviation, does first-time float installations. He told us that putting a Cessna 180 or 185 on floats will cost a bare minimum of $10,000 just for installation of the floatplane kit—if all of the parts can be found. They are no longer available from Cessna. A Cub-series airplane is easier and less expensive and a Husky is pretty simple, as they come from the factory with many of the needed hard points in place.

DeRuiter told us that for Cessnas other than the 182—which is the easiest to put on floats and for which there is a good source of aftermarket parts—unless you have an incredible attachment to your airplane, it makes economic and time sense to sell your landplane and buy a seaplane set up as close to what you want as possible. For the two-place tandem airplanes, it's an airplane-by-airplane call as float installation may not be that difficult.

What if you have an airplane with a float kit and want floats installed—how long and how much? First, have it done by a shop that regularly installs floats, you don't want to pay for someone's learning curve. The airplane will be rolled into the hangar and hoisted by its lifting eyes (rings) atop the fuselage (they're part of the float kit). The main gear and tailwheel will be removed. The landing gear attach brackets and float hardware will be inserted on the airframe and the fuselage pulleys and cable guides for the water rudder cables will be installed. On many airplanes, rudder return springs have to be added as the friction of the water rudder system degrades rudder centering.

If the airplane has cowl flaps, they will be adjusted to open further. The floats are then attached to the brackets and the water rudders adjusted.

On some airplanes a ventral fin on the fuselage or finlets on the horizontal stabilizer must be installed for yaw stability to counteract the aerodynamic effect of the floats. Plan on 15 hours of labor over two days and a cost of about $2000 for a first-time installation.

For amphibious floats the process is a little more complex—there are hydraulics and electrics to connect. Plan on 40 hours and $8500 for labor and parts for the first-time installation.

If you live where the seaplane season is limited by ice on the water, you'll either have to store your airplane for the winter or swap the floats for wheels. Putting the gear back on will take about a day and run you $600, unless it's a Husky, which is a little more complex and takes just under two days and costs about $900.

What does a set of floats cost? The good news is that there are a several reputable float manufacturers that have been around for a long time. The bad news is that floats aren't cheap. For an airplane in the Cessna 180/182 size range, a new set of straight floats will set you back at least $38,000; used ones, in good shape, can be found for under $20,000. A new set of amphibs cost upward of $76,000; for used, plan on $50,000.

mechanic who knows the type and who has not been involved with the aircraft previously.

Keep in mind that the cost of fixing up a floatplane that has been neglected or abused can combine every bit of the cost of fixing up an airplane and a boat—cubed. Start with the normal things you would inspect in a land plane, but be especially wary of corrosion.

Because there are no shock absorbers on seaplanes, the pounding of the waves of every takeoff and landing is transmitted directly to the airframe. Look carefully for cracked or broken structures.

Examine the floats carefully. If possible, make a test flight that includes two or three landings and then see how much water accumulates in the compartments.

Floatplane engines work hard and may run hot; that means a little extra care when looking one over.

CONCLUSION

So, with the criteria applied, what do we consider to be good floatplanes? With appropriate caveats of what's right for you and that there are a lot of mods and float options, here's what we like.

At the top end, the Cessna 185 with the 300-HP IO-550 engine mod, the American Champion Scout, Aviat Husky, Piper Super Cub with either 150 or 180 HP and 260-HP Maule M7.

For a lot of fun with smaller engines, in the four-place world (think of them as two- or three-place floatplanes), the Cessna 180 (stock or with bigger engines), Cessna 172 with at least 180 HP, Maules and the Aeronca Sedan (with a higher power engine mod).

In the maximum fun-for-the-money end of the spectrum—these cross into the "good" category with a more powerful than stock engines, although they still require finesse to get performance: Taylorcrafts, Aeronca Champs and Chiefs, Cessna 120, 140, 150, 170 and the American Champion Citabrias with flaps.

Diesel Conversion: What's Involved?

Fuel economy is a given, otherwise all it takes is money. Africair will convert any model Skyhawk, all the way up to a factory-new 2015 model.

by Paul Bertorellli

CHECKLIST

- There are enough Continental diesels in the field to prove economy.
- The engine works economically only where there's a price spread between Jet A and avgas .
- At $90,000, the conversion cost remains high for limited gain where avgas is affordable.

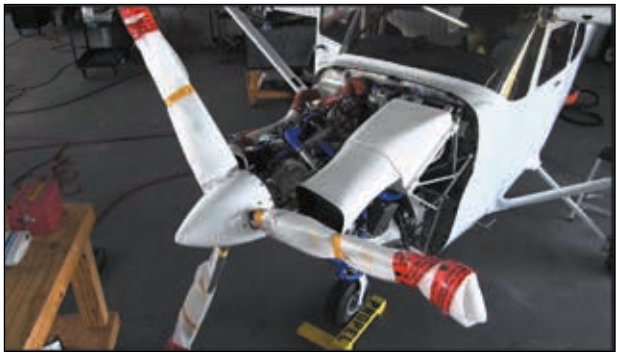
Last fall in a press release that few noticed, Continental Motors announced that a big flight school in Spain was converting 16 Skyhawks from Lycoming O-320s to Continental's CD-135 diesel engines. It escaped much notice because diesel conversions are thought to be a European thing unlikely to gain much traction in the U.S.

A Miami-based company called Africair wants to challenge that assumption by buying up recent-model Cessna 172s and transplanting them with Continental CD-135 or -155 diesel engines. With new Skyhawk prices escalating and the fleet aging, Africair now sees a potential market in North America, not just for training but for personal airplanes, too.

Although projects like Redbird's Redhawk and Premier Aircraft's Skyhawk diesel conversion have gotten most of the ink, Africair's conversions actually predate both of those by many years. When we visited Africair's Miami shops in October, the company was working on three conversions and at least a half dozen more were in the pipeline. So what's involved? Is it practical for an owner to do this or do the economics tilt just toward flight schools?

Africa might not come to mind as a hotbed of aviation, but there's more flight activity there than you might think. Africair, based at Kendall-Tamiami Airport near Miami, has been plying that trade for more that 40 years. It owns the distributorship for the entire Cessna line for Africa and also sells widely in the Caribbean. While the personal airplane isn't an unknown concept on the African continent—especially in South Africa—airlines rely heavily on Cessna singles for *ab initio* training. According to Africair's Travis Tinsey, who has extensive experience in Africa, the market has been lively and is getting livelier. While Diamond Aircraft gets the credit for being the modern champion of aerodiesels, Africair was close behind. As early as 2005, the company saw that avgas was becoming scarce and expensive in its principal market region, just as the then-Thielert Aircraft Engines was gearing up to produce engines for Diamond's DA42 and DA40 single. Even as Thielert was courting Diamond, the engine company was developing conversion STCs for the Cessna 172 and Piper Cherokee. Thielert's original Centurion 1.7 was STC'd for installation in the Skyhawk K through S models in 2004 and the 2.0 version of the engine was available by 2007.

Africair began its first conversions in 2005 and has kept up a consistent, albeit small, volume conversion business since. As of late 2014 when we visited the company's Kendall-Tamiami shops, it was working on three more Skyhawks, all on spec and all likely to sell quickly, according to Africair. Virtually all of these airplanes have been shipped to Africa or the Ca-



Original conversion STCs apply to the restart Cessnas, lower photo, as well as earlier models. These engines swing an MT three-blade composite prop.

Africair is focusing on recent model 172s, like the S-model at left. It has circa-2000 avionics with some upgrades. All the Continental diesels have single-lever power controls, lower photo.

ribbean, according to Africair's Jimmy Lockhart.

The Centurion 1.7 was phased out before Thielert declared bankruptcy in 2008 and following the company's purchase by Continental Motors in 2013, the engine line was re-designated the CD-135, for the 135-HP version and the CD-155 for the 155-HP variant. Both engines are still available for conversion and although Cessna is using the CD-155 in its Skyhawk JT-A, Africair is thus far the only U.S. shop offering that engine in the Skyhawk under an STC still owned by Continental. However, as of press time, it's an EASA-only STC. U.S. approvals aren't expected until next year, but Africair is counting on them to expand its efforts into the North American market.Just as we were recovering from price shock of Cessna's $430,000 new JT-A Skyhawk announced at AirVenture in July, we discovered that the half-million dollar 172 already exists and Africair sells it.

Even before Cessna certifies its JT-A Skyhawk, Africair has been delivering its version to African airline training institutions. They've been buying factory-new G1000 Lycoming Skyhawks and transplanting the engine with the CD-155 diesel. The $500,000-plus price includes container shipping to Africa and maintenance training.

Now, Africair wants to compete with two other companies—Redbird and Premier Aircraft—in offering diesel conversions for Skyhawks for flight training or personal use. What's involved in such conversions? Are they practical and what will they cost?

DIFFICULT ECONOMICS

Nearly everyone we talk to thinks diesel conversions would be an easy sell if the cost were the same as Lycomings or perhaps a bit more. But they aren't. The CD-135 conversion costs about $90,000 complete, or more than three times the price of a premium overhaul on a Lycoming O-320 or IO-360. This high cost of entry continues to limit the market in North America. But in Europe, Africa, Asia and India, prospects are brighter.

"It does really well in markets where the spread between Jet A and avgas is really big. In Ethiopia, you can't get avgas, so this airplane does very well," says Africair's Travis Tinsey. A spread of $2 or more between avgas and Jet A makes the diesel compelling, but the 60-cent spread common in the U.S. is far less so.

The appeal of the diesel, in addition to smoothness and ease of operation, is that it burns fully 35 percent less fuel than the Lycoming avgas engine it replaces. Unfortunately, it gives much of that back in a shorter time between replacement (TBR) than the Lycoming's 2000-hour TBO and the replacement engine costs more than twice as much (about $51,840, depending on exchange rate) as a Lycoming overhaul.

Still, over the life of the engine, it burns so much less fuel that it ekes back some of those dollars. In the U.S., if capital costs aren't included, the CD-135 operating costs is $4 higher than the Lycoming. In Europe, with a $4 spread, the diesel's cost advantage is more than $20.

CONVERTING ONE

Although its business practices might have been questionable, the original Thielert Aircraft Engines did two things well: It invested capital in high-quality factory equipment and it thought out how to build kits to make field conversions practical. Even as it was certifying its first engines, Thielert realized it would have to rely on both conversions of legacy airplanes and OEM sales to survive. It developed kits for the Skyhawk and Piper's PA-28.

What the customer gets—the shop, really—is a complete, palletized engine kit already on the mount. The kits include all the wiring harnesses, the engine ECUs, the cooling ducting

ENGINE	TBO/TBR	PRICE	FUEL PRICE	COST/HR TO TBO/TBR
LYCOMING IO-360	2000 HRS	$25,000	$5.90	$63.40
CONT. CD-135	1500 HRS	$51,840*	$5.28	$65.60
CONT. CD-155	1200 HRS	$54,270	$5.28	$76.26

*** Prices are TBR exchange engines at Euro exchange rates in November 2014. Prices include gear box replacements required 600-hour intervals, but not labor. Oil changes are included**

and radiators, plus specialized engine instrumentation required as a condition of certification. (The engine can be interfaced to the G1000, but not in the aftermarket conversions.)

Africair has been specializing in converting restart post-1997 Cessnas because these include airframe improvements, relatively new avionics and are available at reasonable prices. For instance, a 2000 Skyhawk S of the sort we flew during our visit retails for about $100,000 on the used market and there are plenty to pick from.

Add the conversion cost and perhaps new paint and upholstery and the converted airplane sells for about $270,000. Africair's Tinsey said customers who want upgraded avionics or custom paint can spec that at additional cost. He said buyers have been willing to pay $300,000 for a 10-year-old Skyhawk because the airplanes are durable and easy to service.

The engine conversion takes about four to five weeks. The Lycoming is removed and the airplane's interior is stripped. Any components that need repair or replacement are tended to, including repainting, if necessary. The engine mounting is straightforward, but requires a weight-and-balance adjustment by moving the battery aft of the cabin.

Inside the aircraft, the push-pull mixture and throttle are replaced by a quadrant with a single lever and the panel gets a switch module for the engine's ECU controls. Two 3-inch round instruments display engine condition, power output and fuel flow. Because the engine returns fuel to one tank, there's also a kit to replumb the fuel tank valve at the base of the cockpit pedestal. The two ECUs are mounted low on the firewall and the original cowling is retained, although it's modified for induction and cooling air. Africair's conversion uses a constant-speed three-blade composite MT prop that's automatically controlled by the engine ECUs.

PERFORMANCE

Payload wise, the diesel conversion definitely exacts a penalty. The Africair 172 we flew had a useful load of 775 pounds. With full fuel—it's limited to 44.6 gallons due to wing structural considerations—payload is 298 pounds or two people. Down fueling can make the airplane a three-person ride, but four isn't practical.

We've flown enough diesel-converted Skyhawks to know that their performance is predictable, albeit not consistent. That's because at 135 HP, the conversion doesn't deliver surplus power and we think variations in airframes noticeably impacts cruise speed. So might the prop choice.

The same week we flew the Africair conversion, we also flew one of Redbird's latest Redhawk conversions equipped with a three-blade Hartzell prop, rather than the MT. While the MT version is an anemic climber, delivering about 500 FPM initially, but sagging to 350 to 400 at mid-altitudes, the Hartzell version does much better, delivering nearly 700 FPM initially and easily maintaining 500 FPM through higher altitudes. We found that the MT-equipped Skyhawk wouldn't reach a 1000-foot pattern altitude by mid-downwind, but the Hartzell makes this altitude at the crosswind-to-downwind turn point.

However, the MT prop seems to deliver better cruise speeds. In the Africair conversion, we recorded 118 knots true at 8000 feet, compared to about 109 knots in Redbird's Hartzell-equipped version, in similar conditions. In our initial flight in Redbird's MT-equipped Redhawk, we recorded cruise speeds above 120 knots.

The diesel conversions are consistent on one performance point: fuel burn. In full-power climb, they typically burn about 6.8 GPH and in cruise at 75 percent power, about 5.3 GPH. With two people aboard and full fuel, the converted Skyhawk has prodigious endurance (8 hours, plus) and range.

Is any of this practical for a private owner? It might be for a few who really love Skyhawks and resonate with the idea of fuel economy. And they'd better not be in a hurry. The converted Hawk steams along at 115 knots at almost 22 MPG, compared to 119 knots and 12.6 MPG for the Lycoming version. That's a big economy Delta but one that takes a huge investment to realize.

We suspect owners won't bite in even moderate numbers until (and unless) avgas isn't available or costs a couple of bucks more than it does now. A one-dollar spread against Jet A isn't enough. The prospects might be better for flight schools, but only those flying enough hours to justify the investment in a conversion.

Contact Africair at www.africair.com or 305-255-6973.

BUY A DIESEL? YOU GO FIRST FIRST

For small flight schools, even those with a dozen airplanes, the cost of airframes is a big economic driver. But for the mega schools like Embry Riddle and the University of North Dakota, price isn't a deal breaker. Maintenance cost and dispatch reliability loom large because the schools fly thousands of hours.

Given that aerodiesels burn three gallons an hour less than Lycomings, the potential savings alone ought to make diesels an easy sell, right? Not necessarily. Both schools told us they've examined the potential of diesel-powered aircraft, but thus far haven't been impressed enough to convert their existing fleet or order new J-TA Skyhawks from Cessna.

Why not? "Purchase price is not a big driver for us," says Embry Riddle's Pat Anderson. "Maintenance costs are a much bigger factor," he told us. He declined to say what the maintenance-to-flight-hour ratio is on 172s, but we suspect it's similar to UND's 0 .24 per flight hour. In other words, eight hours of flight—which many school airplanes do every day—will eventually require two hours of maintenance. Diesel airplanes may do better than that, but bad experiences with problem airplanes live forever. The school network has vivid institutional recall of early problems Diamond had with the Thielert-powered DA42. UND's Dan Kasowski also recalls issues the school had with a fleet of DA20s 20 years ago then debuting with Continental's new IO-240.

"They had a ton of growing pains and we were in the middle of it. We'll never do that again. I want a proven product. I don't want to buy anything lower than serial number 100," he said.

And while Redbird reports good dispatch reliability with its small fleet of converted 172s and lower maintenance incidence than with the Lycoming-powered versions, the big fleet buyers may take more convincing.

FlyQ EFB 1.4 for iPad: Alive and Improved

AOPA dropped it, but Seattle Avionics advances the app with a major upgrade that brings more utility and help for aging eyes.

by Larry Anglisano

Although there was some pushback when AOPA offered its fee-based tablet navigation app, FlyQ EFB, there was enough to like, including an intuitive and shallow feature set and large onscreen characters. While Seattle Avionics owned all of the rights to the FlyQ EFB, AOPA was criticized for competing in the crowded app market.

Moreover, compared to popular competing apps like ForeFlight and WingX Pro 7, early versions of FlyQ EFB had a limited ADS-B interface and lacked some features that deterred existing ForeFlight and Wing X users from making the switch.

Seattle Avionics has taken over full control of the FlyQ EFB's marketing and distribution and we're told the three-year contract with AOPA lapsed and wasn't renewed. Countering rumors that the app was dead, Seattle Avionics has been in the app business for 12 years and points out that FlyQ EFB earned a 4.5 out of a 5.0-star rating in Apple's app store. Seattle told us it is committed to advancing the app to higher levels.

The FlyQ EFB version 1.4 is Seattle's first upgrade since the disassociation with AOPA and is specifically made for Apple iOS 7 and iOS 8, although it will work with the older iOS 6, too.

FEW TAPS, MORE NAV

The latest version of FlyQ EFB retains the basic menu structure and simple design philosophy that we liked in the initial release. This consists of five major menu tabs at the bottom of the screen and a navigation bar at the top of the screen for controlling appearance, including split-screen view, screen brightness and the airport search utility.

Seattle Avionics' Steve Podradchik believes it shouldn't take any more than one or two taps to get key information while you're flying. That's why key navigational functions, like frequency searches, are accessed with limited screen taps.

On the other hand, he knows that it's easy to unintentionally tap a function while flying in turbulence with an unlocked screen, so some map-related functions require double taps and many functions are accessed by swiping the screen, rather than tapping it. He also realizes that aging pilots struggle with onscreen font that are too small to read at a glance. As a result, the FlyQ EFB user has the option of quickly configuring the app with larger font sizes.

If you've been away from FlyQ EFB, you've missed a lot. Version 1.3 (introduced last January) was a major upgrade that included the addition of an enhanced ADS-B traffic function that's intended for easy recognition of immediate threats. For example, traffic tags are color-coded based on threat level and the tags have extension lines that depict direction.

The new extended runway feature is accessed by tapping the airport on the map. It extends the runway lines, while nonstandard traffic patterns are identified with directional arrows (standard traffic patterns are not displayed to reduce clutter.) For enroute planning, there's a new graphical altitude optimizer. It has at-a-glance wind speed and direction.

A major new feature in FlyQ EFB version 1.4 is a bearing/distance measuring tool with the Terrain X-Ray function. Placing two fingers between points on the map creates a popup that shows distance, bearing and fuel burn, plus the straight-line terrain profile between the points. The terrain function uses common

FlyQ EFB version 1.4 adds the Terrain X-Ray feature, plus an altitude optimizer, left.

Color-coded ADS-B traffic symbology on the IFR map, right, is intended for quick recognition. Plates on map overlay, plus weather, traffic and fuel prices share the display with 3D synthetic vision in split-screen view, far right.

green, yellow and red colors and displays the maximum height of the terrain along the way. A one-finger swipe moves the measuring graphic around the screen as the function instantly recalculates distance, bearing and fuel burn so you can compare other routes for diversions, as an example. Fuel and time data is calculated based upon the reported winds aloft.

The rings and extended courseline feature enables the ability to see the distance and time between your current position and another object on the map. By turning on a set of measuring rings around the ownship, you can determine the distance and time between airspace corridors, for example. The courseline extends in front of the ownship and looks like a barber pole. The line can be configured based on time or distance and each segment in the line represents one unit. For example, if you configure it to look ahead 10 minutes, each alternations between segments on the line represents one minute of travel. Used with the ring function, the extended courseline lets you know precisely when the aircraft will hit the boundary of airspace.

When it comes to identifying the aircraft on the map, there's an interesting Aircraft Marker function that can be configured to display 12 different onscreen aircraft icons. First, the standard ownship icon was made 50 percent larger and can be configured in green and white, blue and white, red and white. There also the option of selecting fixed-wing or helicopter. The idea here is to create an easier identification of the ownship on the map, a treat for aging eyes.

Missing in previous versions, but added in version 1.4, is the FAA airport facility directory (AF/D) that's accessed in a dedicated tab inside the Airport tab. For off-airport operations (floatplane flying, for example) or for finding non-charted locations, users requested the new geographical latitude/longitude find feature. This is accessed via a dedicated latitude/longitude data field in the upper left corner of the screen to enter the coordinates.

Once the coordinates are entered, a dialog window appears and displays the distance and bearing to the point, plus an option for navigating directly to the coordinate or adding it to the flight plan. Tap on the coordinates in the dialog box and the map automatically jumps to that point.

Fly Q EFB is compatible with third-party interfaces including the Aspen Avionics Connected Panel wireless suite. A "Send to Aspen" command pushes the current FlyQ EFB flight plan to the Aspen EFD-series MFD where it's then loaded into the Garmin GNS430/530.

NEW TAKERS

Seattle Avionics is hoping that these improvements will entice users of ForeFlight and Wing X Pro 7, to name a couple, to make the switch to FlyQ EFB. Now that AOPA isn't involved in the app, it's anyone's guess if more or fewer buyers will make the switch. But the addition of the plates-on-map function, plus the enhancements that make the app easier to use for the eyesight-challenged could be enticing, in our view. The configurable font size was an attention-getter when we saw a crowded demo in Seattle's booth at AirVenture.

One nit we have is the app's incompatibility with Android devices, but Seattle told us that would be too difficult to change. As we've been reporting, Android hardware is gaining sizable momentum for cockpit use.

A major deterrent for buyers switching apps (or selecting one in the first place) is the incompatibility with choice portable ADS-B receivers. FlyQ EFB now supports multiple portable ADS-B receivers for FIS-B radar, TAFs, METARs and winds aloft. These include the Sagetech Clarity, all of the iLevil devices, the Dual XGPS170 and the SkyRadar DX. FlyQ EFB won't work with the Appareo Stratus. That alone could keep ForeFlight users from switching.

You can download a 30-day trial of FlyQ EFB at the Apple app store. VFR Subscriptions start at $69.99 and include VFR sectionals, Seattle Avionics airport and navaid ChartData, fuel prices and airport diagrams. Yearly IFR subscriptions, which include everything in the VFR package, in addition to geo-referenced approach plates and low and high altitude charts, are $119.99.

Cessna 310

Cessna's first post-World War II twin has speed, payload and comfort, but can be complicated and pricey to maintain.

Few general aviation aircraft are as iconic as Cessna's 310. Whether because of its aggressive ramp presence, its supporting role in an old television adventure series or its suitability for a wide range of missions, the 310 is what many non-pilots recall when piston twins come up in conversation. It's arguably the first "modern" light twin and certainly a classic.

While the 310 is all of those things, it's also a complicated machine, production of which ended almost 30 years ago. The tall landing gear might be thought of as delicate and its systems demanding, both to maintain and operate. But it still offers substantial transportation value, and the many different variants that were built as the model evolved means it shouldn't be hard to find the right one for your mission.

HISTORY

Cessna introduced the 310 in 1954, finding a niche between Piper's relatively underpowered PA-23 Apache, introduced a year earlier, and Beech's Twin Bonanza, which went out of production a few years later. It competed most directly against the Aero Commander 520, but that model was discontinued the same year. The 310 was Cessna's first all-metal, modern twin—replacing the pre-war T-50/AT-17 "Bamboo Bomber"—and was clearly focused on business transportation. It foreshadowed the company's subsequent products and helped usher in its future growth.

A Cessna 310 is not difficult to fly, but like any twin, it requires a commitment to initial and recurrent training.

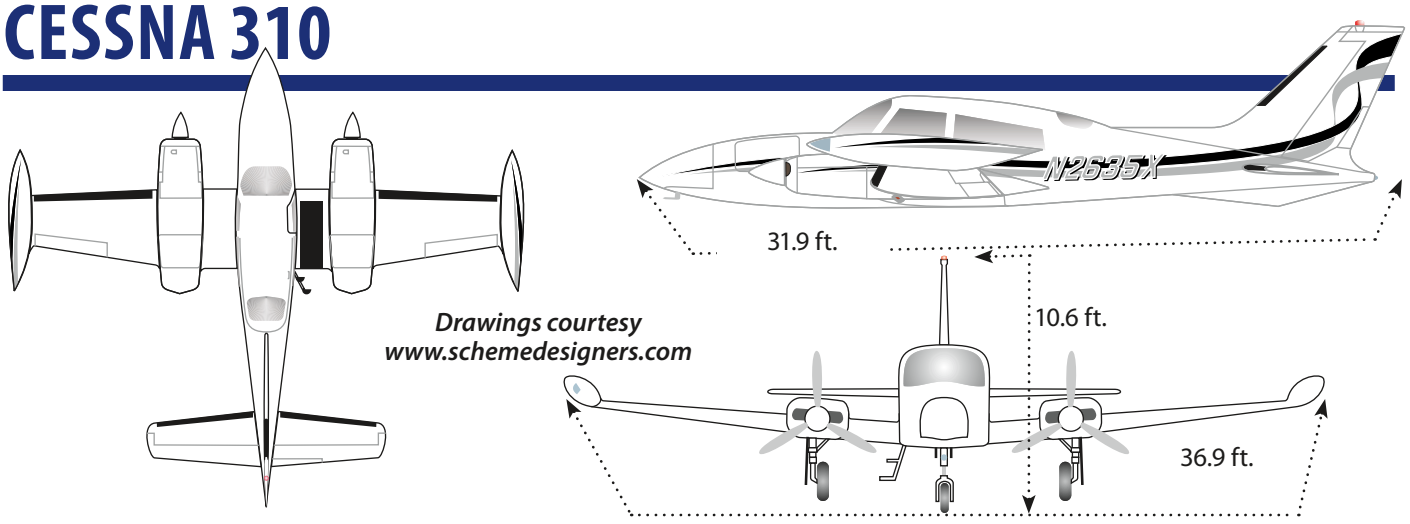
And its featured presence in the 1960s television drama, "Sky King," didn't hurt anything. Its namesake hero, played by Kirby Grant, upgraded to a 310B shortly after that model became available. Named "Songbird," the airplane (several were actually used during the show's production) was as much a star of the series as its actors, perhaps becoming the main reason for the show's popularity on Saturday mornings throughout the 1960s, and even today on DVD.

Cessna's aggressive pursuit of the business market manifested itself in not only the 310's looks, but also its refinement: Many production years saw a new model designation. Cessna brought out the 310B in 1958, the 310C in 1959 and the 310D in 1960, eventually getting to the 310R in 1975 (with a few gaps) before ending production in 1981.

The first 310s came with 240-HP Continental O-470-B engines. From the beginning, a sleek, powerful appearance was a design goal, with tight cowlings and streamlining at the nose and tip tanks (at least by the

That's Guy Maher's 1956 model 310, top. Powered by Continental O-470-B engines, it was the first of the 310 series that ended with the model 310R in 1981.

CESSNA 310

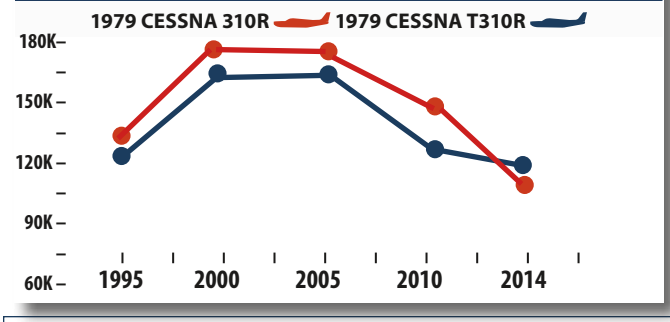


Drawings courtesy
www.schemedesigners.com

CESSNA 310 MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1955-1958 CESSNA 310, A,B	CONT O-470-B,M 240 HP	1500	$25,000	100	1750 LBS	178 KTS	±$28,000
1959-1961 CESSNA 310 C-F	CONT O-470-D 260 HP	1500	$30,000	100/132	1751 LBS	191 KTS	±$35,000
1962-1963 CESSNA 310 G,H	CONT O-470-D 260 HP	1500	$30,000	100/132	2037 LBS	191 KTS	±$41,000
1964-1965 CESSNA 310 I,J	CONT O-470-U 260 HP	1500	$30,000	100/132	2037 LBS	194 KTS	±$46,000
1966-1967 CESSNA 310 K,L	CONT O-470-V 260 HP	1500	$30,000	100/142	1975 LBS	193 KTS	±$53,000
1968 CESSNA 310 N	CONT O-470-V 260 HP	1500	$30,000	100/182	2075 LBS	193 KTS	±$56,000
1969 CESSNA 310 P	CONT O-470-VO 260 HP	1500	$30,000	100/182	2030 LBS	193 KTS	±$61,000
1969 CESSNA T-310 P	CONT TSIO-520-B 285 HP	1400	$35,000	102/184	2108 LBS	225 KTS	±$73,000
1970-1974 CESSNA 310 Q	CONT O-470-VO 260 HP	1500	$30,000	100/203	2086 LBS	192 KTS	±$76,000
1970-1974 CESSNA T-310 Q	CONT TSIO-520-B 285 HP	1400	$35,000	100/184	2108 LBS	225 KTS	±$87,000
1975-1981 CESSNA 310 R	CONT IO-520M 285 HP	1700	$30,000	102/207	2047 LBS	194 KTS	±$108,000
1975-1981 CESSNA T-310 R	CONT TSIO-520-B 285 HP	1400	$35,000	102/207	1777 LBS	223 KTS	±$118,000

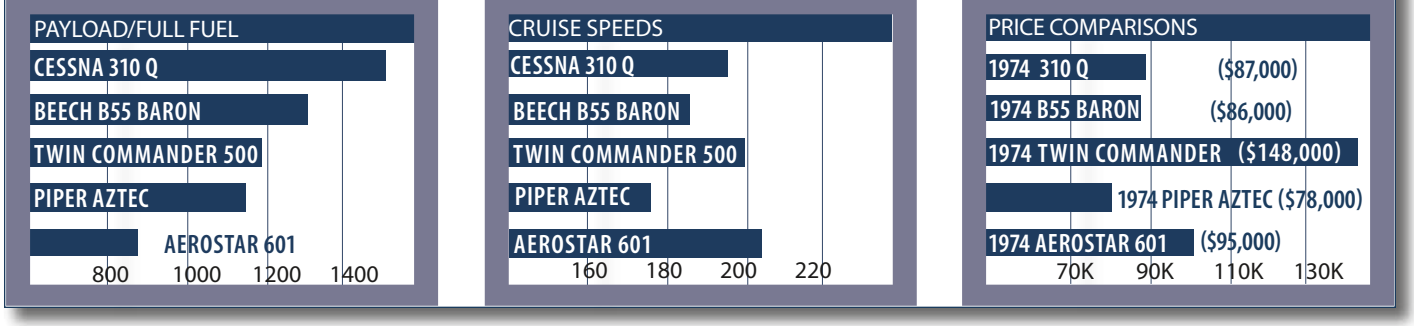
RESALE VALUES



SELECT ADs

AD 90-02-13	MAIN GEAR STRUT BEARINGS
AD 76-08-02	TIP TANK/STROBE LIGHT
AD 73-07-07	FUEL LINE, WIRING CHAFING
AD 72-03-07	LANDING GEAR UPPER STRUTS
AD 69-15-09	MINIMUM FUEL PLACARD

SELECT MODEL COMPARISONS



Cessna 310s generally get avionics upgrades to match their go-places mission. That's a Garmin G500 PFD, top photo. Tip tanks, which are the mains, can induce Dutch rolling in cruise flight and confusion during refueling, bottom photo.

standards of the day). Split wing flaps eliminating the need for external brackets or tracks and their drag. Distinguishing features of the early models are multiple aft side windows, a straight tail and noncanted "tuna tanks," named for their shape.

When the 310B came out in 1958, it brought with it a 100-pound boost in gross weight. For the next year's 310C, an engine change and gross weight bump occurred with the fuel-injected, 260-HP Continental IO-470D. The TBO was 1500 hours, same as with the earlier powerplants. For the 1960 310D, Cessna swept the tail, as it was doing across its fleet.

The next significant change was in 1962, with the 310G. Cessna introduced canted "Stabila-Tip" tanks, said to be more aerodynamically efficient than the old design. The original noncanted and bladder-equipped tip tanks also had a fuel-pickup problem; an airworthiness directive mandated a hefty increase in unusable fuel. With bladderless all-metal canted tanks, swept fin and short nose, it's arguably one of the most attractive light twins ever built.

Cessna didn't stop there. Cabin size was increased, along with gross weight. What started as a five-place twin became a six-placer with 1963's 310H. By next year's 310I, wing lockers and auxiliary tanks became options, as did three-blade props. One significant difference was the switch from the corrosion-prone overwing exhaust design to an improved underwing arrangement on the 310I. An engine change accompanied the modifications, to the IO-470-U, still of 260 HP and still with a 1500-hour TBO. Another engine change, to the IO-470-V, occurred in 1966 (310K), along with extended, one-piece aft windows on each fuselage side.

In 1969, Cessna consolidated its model line, offering a turbocharged variant of the 310 alongside the normally aspirated 310P and dropping the 320. The T310P came with 285-HP Continental TSIO-520-B engines (1400-hour TBO), three-blade props and a 5400-pound gross weight, compared to the normally aspirated 310P's 260-HP IO-470V Continentals, optional three-blade props and 5200-pound gross.

From 1970-1974, Cessna stuck with the 310Q and T310Q, despite bumping gross weight on the 1972 T310Q to 5500 pounds (5300 for the nonturbo version) and changing to wraparound "Omnivision" windows by adding a pair of small panes at the top of the aft cabin.

In1975, the 310R II and T310R II sported one of the biggest changes since the type's tail was swept: an extended nose. The probiscis grew 32 inches, housing a sizable baggage compartment. The normally aspirated version also got 285-HP Continental IO-520-M engines (1700-hour TBO) and another 200 pounds were added to the gross weight—bringing it to 5500 for both the turbo and nonturbo versions—along with improved landing gear.

The 310R marked the airplane's final configuration, which continued until the line was closed down in 1981. Some 5700 copies of the 310 were manufactured, not including its various military versions. The 310Rs are the most numerous, followed closely by the 310Q, a result of sticking with one model for several years.

The 310R rear cabin, right, is spacious, with generous headroom and legroom. Removing the sixth seat leaves more room for stowage.

PERFORMANCE, HANDLING

An old saying about piston twins—they have two engines because they need two engines—refers to what's necessary to obtain their performance and their handling when one engine fails. Both are strong points of the 310, especially the turbocharged versions. Early models feature high-speed cruise in the neighborhood of 175 knots while later ones will top out at around 190. The turbo models can present 225 knots at all-out max cruise, but the fuel burn will be breathtaking. Reduced power settings get 175 knots on later, non-turbocharged models.

Engine-out performance is better than average, with normally aspirated 310s achieving a single-engine service ceiling of just under 7000 feet to 7500 feet, depending on model. Turbos see SE service ceilings of 17,000-18,000 feet climb rates from around 330 to 440 FPM, depending on model and turbocharging.

Figure cruise fuel between 20 GPH for an early, nonturbocharged 310 at economy settings up to 35 or more when flogging a big-bore turbo. Join the Church of the Lean-of-Peak and shave that down to around 28 GPH. Airspeed suffers, of course. Double those numbers, at least at the low end, for takeoff and initial climb.

Speaking of climb, the non-turbocharged models do OK in the low teens and turbo models in the high teens, although their service ceilings can be as high as 28,200 feet (T310Q). They're happiest in the mid to high teens: One owner told us, "At FL250 [the T310R] performs like a very expensive Skylane."

Book short-field performance is surprisingly good, especially for the airplane's weight: Landing over a 50-foot obstacle in a 310R will consume 1790 feet, compared to a Model 58 Baron's 2498. Taking off over that same obstacle will require 1700 feet in the 310, while a Baron needs 2100 feet. Perhaps unsurprisingly, pilots and owners treat the book numbers with a grain of salt, reporting poorer real-world numbers.

Once airborne, however, 310s provide an extremely stable platform. The only fly in the ointment is the type's tendency to Dutch roll, especially in turbulence and in an inexperienced pilot's hands, caused in part by the high rotational inertia of fuel in the tip tanks. Experienced owners tell us Dutch rolls are easily damped with proper technique.

As clean and powerful as the 310 appears, it can get draggy on approach. Relatively large props blank out much of the wing and split flaps produce much more drag than lift. This can be a good thing, since the clean airframe can be difficult to slow down until the first notch of flaps is deployed.

Early models came with an approach-flap extension speed of 140 knots, with full deployment available at 120. The 310K bumped the approach-flap speed to 155 knots or so. Subsequent models through early 310Rs are placarded for 160 knots approach-flap extension and 140 knots for full flaps. Drop two knots from those numbers for late 310Rs.

LOADING, FUEL SYSTEM

For the early models, up through the 310G, interior space is about average for baggage, which means having to stow some items under and between seats, or at passengers' knees. Beginning with the stretched cabin of the 1963 310H, more baggage space was opened up. Wing lockers, whether installed at the factory beginning with the 310I or in the field, can help, as does the 310R's nose baggage compartment. Removing the aft row from the six-seat airplanes—quick-disconnect seats were optional on later models—can help, too.

Weight and balance must be watched closely. The first nose extension—a small one—occurred with the 310K. But by the 310I, cubic feet available began to exceed the airplane's weight-lifting capability. No longer could a pilot "cube-out" a 310 before overgrossing it and it could be loaded out of forward c.g. Adding lots of avionics and other options to the typical model only compounds the problem by upping the empty weight. One solution is STC'd vortex generators that can boost max gross by 100 pounds or more. That said, you can find late-model 310s with close to 2000 pounds of useful load.

The 310's full-fuel payload varies depending upon the model, equipment and fuel tank arrangement. Total usable fuel capacity can be 100, 132, 142, 183 or 203 gallons—from 600 to 1218 pounds of fuel. Full-fuel payload in a lightly equipped 310C with auxiliary tanks might exceed 700 pounds, while it could be as low as 400 pounds in a 310R. Other loading and operating considerations, like maximum landing weight and zero fuel weight, were introduced with later models.

While we're talking about payload is a good time to point out the 310's fuel system on airplanes with all the optional tanks is more complicated than others. It also has a number of idiosyncrasies.

The complications start with nomenclature. Ask a line person where the main tanks are on a given

Hangaring later 310 models may be challenging. They have an extended nose that houses a baggage compartment, top photo.

airplane, and they'll likely point to the wing. With the 310, they'd be wrong. Early models only came with the 50-gallon-per-side tip tanks. As there were no tanks in the wings at all, those were main tanks. As time went on, horsepower increased and so did demands for fuel. First came 20-gallon wing-mounted bladders, followed by an additional 11.5-gallon bladder, for 31.5 gallons in each wing. Then came 20-gallon tanks in the wing lockers. In a 310R, as much as 203 gallons can be available.

If the pilot has the mains topped and takes off without checking the fuel actually went into the right spot, you can guess what might come next.

That's not the only tricky thing about the 310's fuel system. A fully equipped 310 with wing locker tanks can have up to 10 fuel drain points and eight fuel pumps. Connecting all this is a relatively complex (when compared to other piston twins) plumbing system. There's no separate gauge for each tank, though the gauge does switch automatically to read the tank being used (but not the wing locker tanks, which have no fuel level senders). The pilot can read the tanks not in use by toggling a switch. Confused yet? There's more.

Fuel feeds to the engines from either the mains or the aux tanks (but not from the wing locker tanks, if installed). Presuming the mains were full at takeoff, at least an hour's fuel has to be burned off if the airplane has 20-gallon aux tanks (90 minutes for 30-gallon aux tanks) because excess fuel is pumped back to the mains. If there isn't room for it in the mains, it goes overboard.

The mains also are the receptacle for the contents of the wing locker tanks and there has to be room for transferred fuel. The pilot should wait until there are 180 pounds or less in the mains before pumping from the locker tanks.

The aux tanks feed directly to their respective engine, and the only pump serving them is engine-driven. In the event that pump or engine fails, the aux tank on that side could hold 30 gallons of dead weight; there's no crossfeed from the aux tanks to the opposite engine.

Hopefully you'll never discover this factoid the hard way, but those big tip tanks were originally designed as a safety feature, to get fuel as far from the cabin as possible. Early on, a prototype landed gear-up and the tip tanks separated just as they were designed to do, with no post-crash fire.

The good news? The 310 is not unduly prone to fuel mismanagement accidents, so despite the system's apparent complexity, pilots seem to have little trouble dealing with it. All those tanks can carry a great deal of fuel making six- or seven-hour endurance possible in later models. Early models go for four to five.

LANDING GEAR, MAINTENANCE

Lots of attention on the landing gear. It's relatively tall and, as a result, often thought to be more delicate than with other airplanes. Also, all that fuel hanging out on the wingtips tends to create high side loads.

As with so many other general aviation landing-gear systems, one of the keys is finding a technician familiar with and knowledgeable about it. The 310's gear system includes a number of components requiring proper rigging during regular inspections. Done properly, trouble can be avoided, but failure to treat the gear with respect increases the odds of failure dramatically.

People with keen familiarity with the 310 tell us of three weak points in the gear system. The nosegear idler bellcrank, located under the pilot's feet, is probably the worst since its failure—always at retraction, and always loudly—means two prop and two engine teardowns.

The main-gear torque tubes and inner landing-gear door actuator bellcrank are the other two. If the torque tube fails, it does so during the retraction sequence, leaving the associated main gear down and locked. Extend the rest of the gear and land. If the inner landing gear door actuator bellcrank fails, the inner gear door hangs in the breeze.

According to the late Larry Ball, nearly half of all twin Cessna accidents and incidents were directly related to the gear, and a quarter of them to failure of the nose gear idler bellcrank under the pilot's feet. Later model 310s have heavier main gear torque tubes and side brace support brackets. Cessna has a kit available to retrofit earlier airplanes.

Another gear issue that deserves mention is the brakes. Early models had problematic Goodyears. Many were retrofitted with the later, and better, Clevelands. Still, the 310 is large and heavy enough that brake performance can be marginal.

A scan of FAA Service Difficulty Reports going back a few years dredged up numerous entries, underscoring the 310 fleet's age. Items garnering our attention included a cracked rear mount bulkhead in a right main (tip) fuel tank, sheared horizontal stabilizer attach bolts and a brake disc cracked where its manufacturer's name was stamped. But the single system receiving the most entries was, by far, the landing gear.

For example, a Canadian operator reported finding cracks in a right main landing gear extension/retraction torque tube at two places, while another airplane maintained by an Australian facility determined the left and right main landing gear downlocks were in an unsafe condition. Meanwhile, a U.S. operator reported a nose gear extension failure and found a broken bellcrank was the culprit.

For us, these events highlight the need for a 310 expert to conduct

any pre-purchase inspection and for a shop with intimate familiarity to do your ongoing maintenance. That said, most retractable-gear airplanes originally designed in the 1950s likely will require similar attention and expertise.

As far as Airworthiness Directives are concerned, a standout type-specific one is AD 2000-01-16, targeting turbocharged T310P/Q/R models (as well as other turbo'd twin Cessnas) for detailed, repetitive inspections of the exhaust system. The AD, which replaces AD 75-23-05 R5, is designed to detect and correct cracks and corrosion in the exhaust system, which could lead to an uncontrollable in-flight fire, and was the subject of extensive negotiation among operators and the FAA during the late 1990s. Since it became effective, there have been no further exhaust-related accidents in these airplanes, according to those involved with its development.

Another one is AD 90-02-13, which covers the main landing gear barrel inner bearings. It applies to the 310, 340 and all piston-powered 400 series Cessnas except those with trailing link main gear and requires inspections for cracks, including magnetic particle inspection, every 1000 hours or the replacement of the bearings with an improved part.

The props are subject to a couple of ADs: these include the infamous McCauley prop inspection AD (95-24-05) and 94-17-3, repetitive inspection of the prop hub grease fittings.

Other notable ADs include: 98-1-8, replacement of two-piece carb venturis with one-piece units; 97-26-17, ultrasonic inspection of the crankshafts with possible replacement; 96-12-22, repetitive inspections of the engine oil filter adapters; and 96-20-7, repetitive inspection of the combustion tubes on the Janitrol cabin heater.

TYPE CLUBS, MARKET

When considering an airplane in production for almost 30 years, and with so many variants, it shouldn't come as a surprise 310 prices vary widely. An early "straight" 310 averages only $26,000 or so in today's market, rising to $133,000 for a turbocharged T310R, per the *Aircraft Bluebook Price Digest*. Between those extremes, there's no real "spike." Instead, each successive model sees a modest increment in price. The gap is closing between the 310Q and 310R—the 1974 310Q averages around $87,000 while the 1975 310R goes for $93,000. The gap for the turbo models is similar.

Modifications for the various 310 models run the gamut, from the usual avionics upgrades to improved cabin heaters, auxiliary fuel tanks in the nacelles and cabin, and electrically de-iced props. Other mods include vortex generators (VGs), something we highly recommend for all twins when available. They often come with gross-weight increases, as they can reduce critical speeds. Check Micro Aerodynamics (www.microaero.com, 800-677-2370). PowerPac Spoilers (www.powerpac-spoilers.com, 800-544-0169), as their name implies, offers a spoiler kit for the 310R; it requires the Micro Aerodynamics VG kit.

Engine and prop upgrades are available from Colemill Enterprises (www.colemill.com, 615-226-4256) for the 310F through R, and may come with gross-weight increases. A choice of IO-520s or IO-550s is offered; prices and performance gains depend on aircraft model and options selected. Also, RAM Aircraft (www.ramaircraft.com, 254-752-8381) offers engine upgrades for the 310R, but mainly focuses on upgrading powerplants for the turbocharged 310 models.

One of the popular mods, at least for early 310s, was developed by Riley Aircraft Corp., which re-engined 470-powered 310s with a pair of Lycoming IO-540s. The Riley Rocket conversion used normally aspirated engines, with the Riley Turbostream adding a pair of Rajay blowers with manual wastegates. The conversions turned early 310s into rocket ships, but the company has long since gone out of business. Keep that in mind if considering a Riley 310.

All piston-powered twin Cessnas have their own support organization in the form of The Twin Cessna Flyer (www.twincessna.org, 704-910-1790), headed by Bob Thomason. Originally named 310 Owners of America, membership gets you a newsletter and the right to attend worthwhile seminars on operations and maintenance. Overall, however, the Cessna type club of choice would be the Cessna Pilots Association

310 PRANGS: GEAR COLLAPSE, OTHER

In our review of the 100 most recent Cessna 310 NTSB accident reports, landing gear problems led the list. There were 25 reported gear-related events, 20 of which were collapses. There were probably more because gear-up landings aren't always reported—they almost never cause enough damage to meet the NTSB definition of a reportable accident.

If the Cessna 310 has an identifiable shortcoming that causes scraped-up airplanes, it's the gear. The electromechanical landing gear system is as reliable as dirt. However, it absolutely requires that maintenance be done correctly and that worn components be replaced.

In our experience, rigging the gear takes two people who know what they're doing about eight hours—and it has to be done by the book. Further, all parts have to be within tolerances or it's an invitation to a gear collapse.

The reports show that if the nose gear strut of a 310 is flat, it's a no-go item. The nose gear will jam in the well and isn't going to extend.

Finally, if the airplane has to be landed with one or more of the gear legs up, the NTSB reports showed that it's no big deal. As with other aircraft, we've found no gear-up landings in which anyone was even injured *unless* the pilot shut down the engines "trying to save the engines and props." The one pilot who tried that idiocy on a 310 crashed short of the runway.

Other than gear collapses, we saw nothing about the design of the 310 that stuck out when it came to accident causes. We expect to see at least 20 percent of the accidents of a nosewheel airplane to be due to runway loss of control (RLOC). On the 310, there were only five, one of which was on an ice-covered runway. It handles well on the ground.

The fuel system can be complicated—with as many as six tanks—yet there were only eight fuel-related crashes. Of them, just one was due to mismanagement of the fuel system. Six pilots simply used up all of the fuel onboard. One was the victim of a pilot-rated passenger who repositioned a fuel selector and didn't tell the pilot.

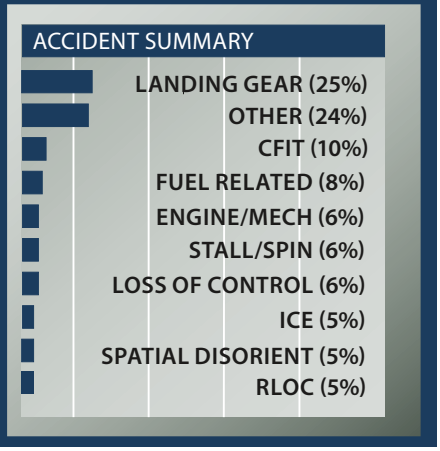
Six accidents were due to engine problems. We suspect there were more engine failures, however, because the 310 has decent single-engine behavior, pilots probably just feathered the dead engine and made a safe landing.

There were six loss of control accidents; only two were Vmc rolls after an engine quit.

Several pilots crashed in IMC under conditions that reflected poorly on their judgment. Some tried to scud run; others shot approaches knowing the weather was well below minimums and flew into terrain or lost it on the missed approach. One hit trees 100 feet below the elevation of the mountaintop airport.

Working 310s were flown into serious icing conditions a number of times with results that varied from hard landings to death.

The "other" category included a number of pilot judgment issues. One pilot and a buddy worked for several hours on a well-out-of-annual 310 with known problems on one engine. They then decided to make an after-dark, gear-down (the gear was questionable) ferry flight to an unlighted airport. The bad engine quit several minutes into the flight, so they decided to return to the departure airport without feathering the prop. They didn't make it.



(www.cessna.org, 805-922-2580), which serves all piston-powered Cessna owners with a monthly magazine and detailed, model-specific support.

OWNER COMMENTS

I've operated a 1967 310N with a Colemill Executive 600 conversion (300 HP IO-520-E engines) for the past four years and 700 hours. My primary use of it is rather unusual as I am the president of Cloud Nine Rescue Flights (www.cloudninerescueflights.org.) Our normal mission is loading the plane with dog cages and flying on trips of over 1400 nautical miles, which we are able to do in under eight hours with a fuel stop.

I find it to be a fabulous plane that is undervalued in the marketplace. Despite acquiring the plane with engines at TBO and having some avionics failures that required costly upgrades, total all-in cost has been approximately $350 per hour. This includes overhauling both engines and accomplishing a number of other maintenance items at the same time. If I prorate the overhaul cost, it ends up being closer to $300 per hour. All this for a plane with two engines, six seats, a comfortable cabin and noncertified anti-icing. Plus, at 6000 feet it can fly at 190-195 knots true airspeed on 27 GPH combined, or 177 knots on 23 GPH, lean of peak.

While I operate my 310 out of a 2800-foot runway, I feel the 310 is best suited to runways of 4000 feet or longer for a comfortable margin. Still, I have taken the plane into runways as short as 1900 feet.

Although a 310 is a six-seater, it is best used for four or fewer adults. The rear two seats are best served for small people, ideally children. As a four-person plane, it provides generous baggage space, especially with the wing lockers. The 140-gallon standard fuel on the earlier models provides over five hours endurance. This is more than sufficient for most flights. A 310R with all the possible extra fuel can have over 200 gallons, but this robs wing locker space.

Ownership is relatively simple and the plane is reliable. I have not had an airframe-specific item ground me.

continued on page 32

2014 EDITORIAL INDEX

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The Aviation Consumer

Cessna 310

(continued from page 30)

The only failures that have caused delays for me are engine related, but that can happen on any plane. Concerns with landing gear are exaggerated so long as it's properly cared for. Parts availability has been good and costs are reasonable if you don't mind buying used ones, in some cases. There are items (most notably the nose gear trunion) that do have high costs. The only maintenance oddity I've had has been needing to replace a decent number of rivets, primarily on the wings. I don't know how much of this has to do with the Colemill engine conversion (and the resulting increased speed), however the cost for these rivets to be replaced is minimal and at no point does it create a structural concern. Despite having over 8000 hours on the airframe, this plane is doing well.

The market tends to favor 310R models, being the newest in the fleet and also having the larger aft cabin, nose baggage, plus the only 310 with FIKI. Their extra length can make hangaring more challenging. The resale value of R models has been going up recently, a testament to the capability and value of the 310.

Last, a 310 is not difficult to fly, but potential owners must make a commitment to both initial and recurrent training.

Ted DuPuis
Cloud Nine Rescue Flights

Since 1981, I've owned four 310s, two of them being the R model owned in the 1980s, one of them being a 57 model owned in the 1990s, and the 1956 model I own now, N5267A, and pictured. I also helped manage and flew a 310R from 2000 to 2009 for two non-pilot business partners.

I admit I am partial to the straight tail classics. Why the 310? With the R model, my wife and I, along with our two 200-pound sons, and 200 pounds of luggage and SCUBA gear flew nonstop to a dive location over 500 miles away in just over three hours and still had 1.5 hours of fuel left for full cruise power.

My 1956 model can easily handle four full-sized adults, each with a typical airline-legal carryon suitcase, and go 400-plus NM with IFR reserves. With just me and my wife, we can take all the gear we want, plus fill the auxiliary tanks and easily add another 200 NM to that nonstop range.

My R models typically trued out in the 180- to 190-knot range, with chock to chock fuel burn rates of around 25 GPH. My 1956 model regularly trues out at 170 to 173 knots while showing a block fuel consumption of 21 GPH. Any 310 is a rock-solid flying machine, great on instruments and a nice short field performer, especially with VGs.

The biggest mistake first-time legacy twin buyers make is thinking that just because these planes can be bought for nearly a song, that they will be equally cheap to operate. Parts and labor will be as much, if not occasionally more, as a $1.3 million new Baron. You must also build your support network of mechanics who truly know the airframe. And as with most other legacy GA aircraft in today's market, what you invest in it now won't be what you realize on resale. But when you consider that for under $100,000, you can have a showpiece 310 that will run with new birds costing seven to ten times as much to buy, that resale depreciation point is moot.

If you go into 310 ownership with the mindset that you are spending this money on the airframe and upgrades because it's what you want now, rather than worrying about the next owner and resale, then you will be rewarded with many years and flying hours of what I think is one of the best and most plentiful twins general aviation ever offered.

Guy R. Maher
Cleveland, North Carolina

FEEDBACK WANTED

CESSNA P210

For the March 2015 issue of *Aviation Consumer,* our Used Aircraft Guide will be on the Cessna P210, the pressurized six-seat piston single. We want to know what it's like to own these planes, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs (full-size, high-resolution) you'd like to share to the email below. We welcome information on mods, support organizations or any other comments. Please send correspondence on the Cessna P210 by January 1, 2015, to:

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