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The Aviation Consumer®

Windscreen Cleaners:

We put leading cleaners to task...page 11

How To Rent a Jet Page 21

LoPresti Boom Beam versus LED… page 4

Custom paintless graphics… page 18

Aspen's angle of attack software… page 23

The Aviation Consumer

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LSA STILL A TOUGH SELL FOR COLLEGIATE TRAINING

That was proven at this year's National Training Aircraft Symposium held at Embry-Riddle Aeronautical University in Daytona Beach, Florida. The annual event gathered alphabet group leaders, aircraft and avionics manufacturers, and educators from many major aviation colleges and universities. The major focus at this year's NTAS event was addressing the challenges of equipping the training fleet for the 2020 ADS-B mandate. But it was also an opportunity for a sales pitch.

Reps from Textron (with its combined Cessna and Beechcraft line), Cirrus, Diamond and Piper all presented their lineup of piston single- and twin-engine trainers—all of which come standard with ADS-B Out solutions. But also present was Van's Aircraft, with the RV-12 factory-built S-LSA, plus Tecnam Aircraft, which offers several LSA models. But despite a well-presented and convincing overview from Van's Aircraft's Wally Anderson and Tecnam's Shannon Yeager, it was obvious that training fleet operators had little interest in acquiring LSA models no matter the cost, build quality, avionics and utility.

Anderson noted that the RV-12 has an integrated Garmin VIRB action camera, which can be a useful tool as primary students try to master landings. Moreover, he made the point that inflight footage could be an effective means for promoting the university and flight program, given the students' use of social media.

According to Anderson, Rotax-powered trainers are simple to operate since they don't have a mixture control. He also noted that Van's has an above-average safety record in the experimental aircraft market, is on par with the safety record of certified models and that priority support effort will be given to flight training organizations when it comes to parts supply and maintenance.

When compared to a Cessna 152, the modern glass cockpit-equipped RV-12 looks better on paper. For the student looking for a modern design, the RV-12 might have more ramp appeal. It can cruise at 132 MPH, compared to 123 MPH for the 152. It climbs at 900 FPM, compared to 715 FPM, and has a 560-pound useful load, compared to 489 pounds in the Cessna trainer. But the body language in the room was telling—no matter how good the RV-12 is, it's still an LSA—with a perceived fragile design that has mostly defined the LSA market. In the hands of ham-fisted students, earlier LSA models haven't fared well. That's a reputation that will be hard to outgrow, even though the RV-12 has been successful in training environments and has benign handling characteristics.

When Tecnam's Shannon Yeager bluntly asked educators if they would consider adding Tecnam or Van's models to its training fleet, he heard crickets. There's more to it than a cost savings, although the additional costs of more expensive trainers is easily passed along to the student to maintain commonality across the fleet. While that does little to reduce student debt, for training fleet operators, it's as much about durability, serviceability and familiarity as it is image.

"For us, availability and maintainability is huge. We beat the hell out of our training airplanes. When we bring them in for service, there generally isn't anything we can't fix. If I bring in a separate LSA fleet for specific and limited training conditions (i.e., day VMC), it complicates how we dispatch the overall fleet. We see it as a risk," said one operator of a 100-plus aircraft fleet.

That risk is partly due to the unknown of how a particular model will hold up in a rigorous collegiate training environment, although there are examples that some LSAs might successfully handle the role as a primary trainer. Tecnam's Yeager pointed out that some Tecnam models suitable for primary training have a 17-knot crosswind component, something that can't be said for other trainers.

I later asked several university department heads what it might take to increase their confidence in a modern LSA training fleet. Most needed proof that the aircraft would match the reliability, serviceability and durability of their existing fleet, but just aren't willing to make the investment to find out.—*Larry Anglisano*

REAL-WORLD CUB SAFETY

I read Stephen Phoenix's letter in the April 2015 issue of *Aviation Consumer,* where he effectively states that the Piper J-3 Cub's fuel tank location is not an issue, and that your article is irresponsible because you said it is unsafe. His assertion is wholly unfounded.

I was flying my fully restored and meticulously maintained 1937 J-3 Cub at Danbury Airport in Connecticut. While departing a short runway, the engine sputtered. I started a right turn to a long runway and as the nose lowered, the engine sprang back to life. Wishing not to make a forced landing, I made the mistake of turning back to the original heading. The engine quit. Facing a forest and a swamp, I committed the forbidden sin and did a 180-degree turn.

The airport is surrounded by hills, so there was no visible horizon and the airplane had no pitch instruments. The Cub stalled, spun, impacted the ground and burned.

I was pulled from the wreckage and 30 percent of my body had full thickness burns. I was given a 50 percent chance of survival, but after three months in the hospital and four months in rehab, here I am, 17 years later. I was saved by Dr. Roger Yurt at New York Presbyterian Hospital.

Had the fuel tank not been in front of me, I think it is likely that I would not have been burned. On a side note, I have over 7000 hours of multi-engine time, and I am rated in helicopters and the Citation 550, the L-39, Ford Trimotor and many others. I know how to fly, but mistakes happen.

John Rolls
Armonk, New York

ADS-B CHEERS AND JEERS

The marginal cost of ADS-B compliance can be fairly reasonable. About two years ago, I upgraded my Garmin GNC250XL VFR GPScomm to a GNS430W for about $8500, plus installation. As an added benefit, it provides position information to an ACK 406 MHz ELT. A year later I replaced my elderly Narco transponder with a Trig TT31 1090ES unit for roughly $2600, plus installation. Interfaced with the GNS430W, it provides full ADS-B Out compliance.

ADS-B In capability is provided with a Garmin GDL39-3D ($850), which receives the 1090 MHz and 978 MHz bands, and has AHRS.

A Samsung Android tablet is mounted on each yoke of my Cessna 185, each running Garmin Pilot software. Both tablets have Bluetooth connections that work with the GDL39-3D so that traffic and weather can be overlaid on excellent moving map displays.

Traffic is identified by tail number or airline flight number, with altitudes, speeds and trends displayed. A 10-inch tablet, mounted vertically, can display approach plates at full size, with a moving aircraft icon. I like this setup.

Charles Curtis
Via email

Based on our calculations, you're into an ADS-B retrofit for around $14,000, assuming the GNS430W install labor was a modest $2,000. Understanding that this offers you far more utility than simple ADS-B Out compliance, that's an awful lot of money for lesser missions and simple aircraft.

On the other hand, you are smartly taking advantage of the benefits that make the force-fed mandate a bit easier to swallow.

Conspicuous by its absence in your ADS-B buyer's guide chart in the April 2015 issue of *Aviation Consumer* was any product that had a complete display interface with the Garmin G1000. As you note in the article, Garmin has ruled out any product other than Garmin for ADS-B input. However, the airplane companies (Cessna, as an example) who have to STC whatever Garmin offers have been virtually silent on this issue with respect to the G1000. Many G1000-equipped 172 ,182 and 206 owners—of both normally aspirated and turbocharged models—will want the capability that displays on the G1000 MFD and works with other installed capabilities, just like TAS or XM.

In some cases, 978 MHz UAT will be acceptable, but for high-flying turbo models, 1090ES will be required. I have gotten some information from avionics suppliers and airplane dealers, but it has been incomplete on the G1000. They also seem to be somewhat in the dark. Can *Aviation Consumer* shed any light on this particular question?

Paul Hollowell
via email

Garmin's Jessica Koss replies: "Many aircraft manufacturers are pursuing transponder-based solutions such as the GTX33ES, which are becoming available as an ADS-B Out compliant option for aircraft with a WAAS-enabled Integrated Flight Deck. Garmin continues to work on solutions for Integrated Flight Decks such as the G1000. They will be made available by aircraft manufacturers to prepare its customers for ADS-B well before January 1, 2020."

continued on page 32

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HID vs. LED: Brightness Costs Bucks

HIDs turn night into day and although not as bright, LEDs offer better contrast and almost limitless bulb life over incandescents. For the price, they ought to.

by Paul Bertorelli

Anyone perusing the lighting aisle at the local Home Depot will have noticed that the lowly incandescent bulb is an endangered species, having been displaced by LEDs and CFLs. The burgeoning LED market has spilled over into aviation in the form of landing, taxi and recognition lights. (Thankfully, we've been spared the CFLs.)

Add to this the availability of another light technology, HIDs, and owners have more choice than ever in upgrading over the ancient GE tractor bulb that's illuminated runways for decades. Never mind that this new technology costs 10 to 100 times more than an off-the-shelf GE 4509, how does it perform?

CHECKLIST

- HIDs are the brightest lighting solution, but also the most expensive.
- LEDs aren't as bright, but are available in more variety, including pulsing and wig-wag options.
- For $15, the lowly incandescent bulb does the job, but contrast is limited and they often fry prematurely.

We'll get to that in this article, but first note that the lighting market has expanded since we last examined the topic six years ago. There are more choices in HID and LED and more approved systems. In some cases, prices appear to have decreased, a welcome exception to everything else in aviation.

HID VS. LEDS

There's nothing special about the common, incandescent aircraft landing light, other than it doesn't last very long, is that it is likely to burn out on the darkest of nights, when you need it most. The gold-standard bulb, the GE 4509, has been around for years and is found on thousands of aircraft. There are even competitive providers of this lamp.

Here a word about nomenclature: Reflector-type bulbs are described with a PAR number—meaning parabolic aluminized reflector—describing the diameter in eighths of an inch. Landing and taxi lights are commonly either PAR 36 or PAR 46—4.5 inches and 5.75 inches in diameter, respectively. Upgraded lamps are generally available in both sizes, but PAR 36 is the most common.

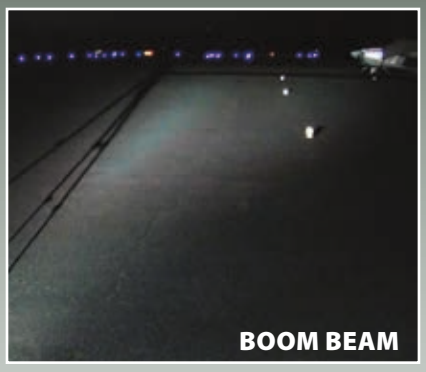
HID—for high intensity discharge—predates practical LED technology by decades. The first HIDs appeared as street lamps more than a century ago and these evolved into the mercury and sodium-vapor lights that are common today. Those large systems were eventually miniaturized for vehicle use and these first appeared about 25 years ago. Aircraft applications were a natural fit and although LoPresti was the first to market HID with its Boom Beam, other competitors have joined the fray.

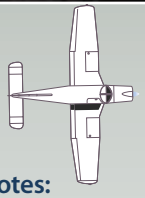
All work on the same principle, but vary in detail. The system consists of two components, a ballast and a lamp assembly, or burner. The ballast (actually a starter circuit) provides a high voltage to the xenon-filled lamp which strikes an arc inside the tube, vaporizing metal salts and creating a hot, bright plasma cloud. With a slightly lower voltage, the ballast sustains the plasma. This staged process is visible when the lamp first fires up; it takes a few seconds to reach full brightness.

David LoPresti told us that in the nearly 20 years the company has been selling HIDs, the lights have gotten smaller, lighter and brighter, with improved reflectors. Their initial product had a 35-watt ballast, but current offerings have an 85-watt unit. "The lumens per watt is higher than ever; our curve is almost straight up," LoPresti says.

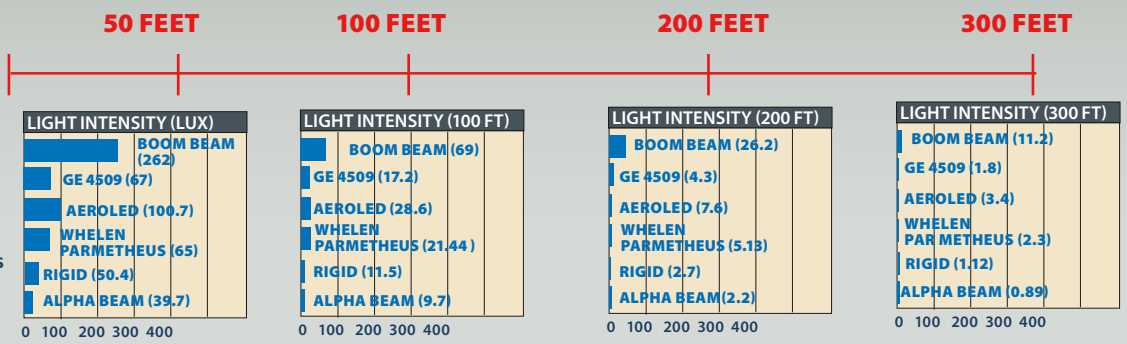
BETTER LEDS, TOO

As HID has improved, so has LED; the diodes themselves have become





Test Notes:
Lamps were arranged on a measured course with reflective targets. Several brightness measurements were made with a lux meter and results were averaged.



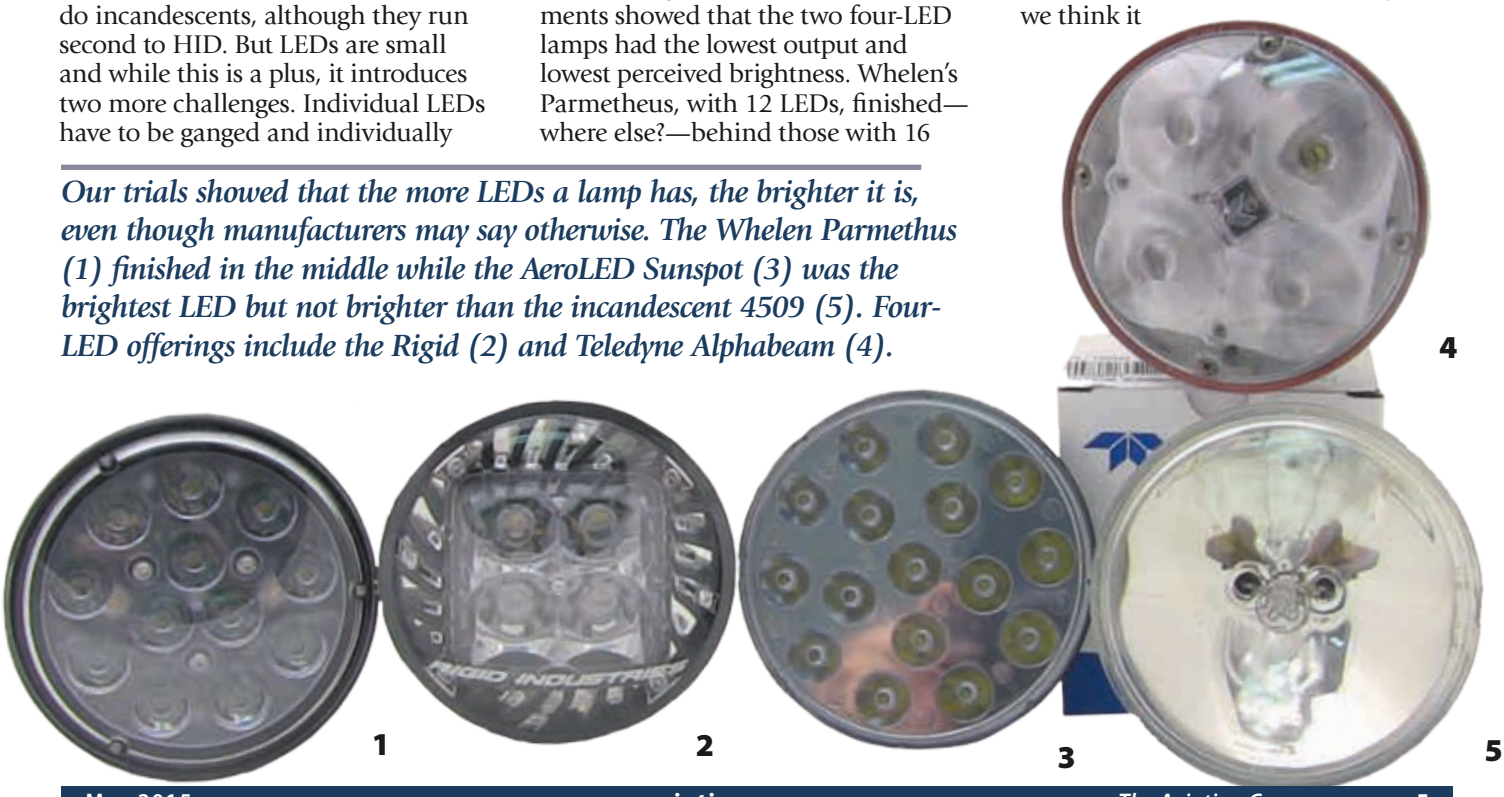
more efficient and brighter. LEDs are more related to transistors than traditional bulbs or HID. They have p-n or positive-negative junctions that emit light when power is introduced across the junction. This has plusses and minuses for aircraft—or any—light applications.

On the plus side, LEDs are efficient. They produce more measurable light per power unit with less heat than do incandescents, although they run second to HID. But LEDs are small and while this is a plus, it introduces two more challenges. Individual LEDs have to be ganged and individually focused with their own reflectors and they can absorb only so much power without frying themselves.

The various manufacturers have addressed this with different design approaches. For example, the AeroLED, the brightest of the bunch we tested, has 16 LEDs while the Alphabeam and the Rigid have but four. While Teledyne uses a sort of Fresnel lens to focus the light output, our measurements showed that the two four-LED lamps had the lowest output and lowest perceived brightness. Whelen's Parmetheus, with 12 LEDs, finished—where else?—behind those with 16 LEDs and ahead of those with four.

To gain a sense of how the lamps perform, we set up a test range with reflective markers at 100, 200 and 300 feet. The lamps were mounted in a rack positioned on a golf cart and aimed carefully by eye. To measure brightness, we used an Extech lux meter with its sensor mounted on a tripod for consistency. Although we don't claim this to be a laboratory test, we think it

Our trials showed that the more LEDs a lamp has, the brighter it is, even though manufacturers may say otherwise. The Whelen Parmethus (1) finished in the middle while the AeroLED Sunspot (3) was the brightest LED but not brighter than the incandescent 4509 (5). Four-LED offerings include the Rigid (2) and Teledyne Alphabeam (4).



PRODUCT	AMPS	PRICE	APPLICATIONS
INCANDESCENT			
GE 4509	7.6	$13	Standard PAR 36 landing/taxi lamp.
GE 4551	8.9	$19.65	Larger PAR 46 lamps for landing and taxi light applications.
LED			
TELEDYNE ALPHABEAM	3.75	$275	Approved PAR 36 drop-in replacement for common lamps.
AEROLED	3	$325 to $364	PAR 36 drop-in replacement; 50,000-hour guarantee
RIGID/PRECISE FLIGHT	2.7	$230	PAR 36 replacement currently available only for experimental aircraft.
WHELEN PARMETHEUS	1.2	$228.95	Approved PAR 36 lamps for landing and taxi applications.
HID			
LOPRESTI BOOM BEAM	3	$1799 to$2999	Product line tilts toward jets and turbines, but many singles and small twins are approved. At least four hours of installation required.
KNOTS 2 U		$655 to $1270	Prices vary with model application. Wingtip recognition lights (and LEDs) are also available.
XEVISION	3.2 to 6.4	$499 to $775	Wide application list for singles and twins. PAR 36,46 and 64 available, as well as pulsing options.

This list doesn't include all lamp options available in any type, but gives an overview of price and application comparisons. Check with vendor for specific prices on the model aircraft you're interested in. All but the Rigid LED were supplied to Aircraft Spruce and Specialty.

gives a good idea of relative brightness. We took several readings for each lamp and averaged these.

There weren't any real surprises in our trials, which generally followed the same results we had the last time we tested these systems for the March 2009 *Aviation Consumer*. As a baseline, we first tried the GE 4509, which proved brighter than all the LEDs except the AeroLED. But it wasn't necessarily a better performer.

Why? Color temperature and beam spread, mainly. Although it measures brighter than most, the 4509 doesn't *look* brighter than the best LED, the AeroLED Sunspot. Its beam is narrow and it doesn't produce much contrast, so although you can see objects it illuminates, it can be harder to resolve the detail.

By contrast—literally and figuratively—the LEDs tend to have a wider, softer beams and a cooler color temperature. It's more bluish. In our estimation, this made small details like cracks in the pavement or tiedown rings more visible. All of the lamps are sensitive to aiming so getting accurate brightness data is difficult. As the chart shows, the AeroLED was the brightest LED by a measurable margin, a distinction it easily held out to 300 feet. Also, its beam spread and color made it perceptively our top choice in this category of lights. It's the one to beat.

And you can only beat it with raw brightness. If that's your thing and you've got the money to pay for it, the HID blows everything away. The Boom Beam LoPresti sent us shot far into the gloom and illuminated the most distant target in sharp relief. Its color temperature is closer to daylight than the LEDs.

We used the default beam tuning, which is quite narrow, but in the well-appointed installation kit LoPresti provides are small tuning plates that allow the beam to be widened. We would recommend this; the Boom Beam has throw distance to spare and spreading some of those candelas out to the side of the aircraft would be helpful.

Speaking of installation, the LEDs are just drop-ins, but the Boom Beam will require four to six hours of shop time. That means installing one will probably total north of $2000 and for some models, way north. LoPresti provides an excellent kit and install manual, but there's more to it than just replacing a lamp.

Like all HIDs, the Boom Beam, below, has a starter/ballast and a separate lamp assembly.

WHAT TO BUY

There's no question that these lamps are a step up from the GE 4509. Just in longevity, the LEDs are supposed to be good for up to 50,000 hours and the HID for 2000. That means it's both practical and recommended to leave them on all the time as recognition lights. Some LED models can also be configured as pulsing lights or, in pairs, as wig-wags. If you want to be seen, that's one way of doing it.

For owners who fly frequently at night or go into dark airports where the runway and taxiway lighting isn't the best, the Boom Beam or HIDs like it may be worth the money if the budget allows. The amount of light they throw really improves the ability to see and resolve runway details.

As for LEDs, at under $400, they've become a reasonably priced aircraft upgrade. Any of the lamps we tested will do, but our first choice, hands down, is the AeroLED Sunspot. Its bright, wide beam is just the right combination of illumination and width. We recommend buying the version with a protective lens, which retails for $364 from Aircraft Spruce.

CONTACT

Aircraft Spruce and Specialty
877-477-7823
www.aircraftspruce.com

FAA FIELD APPROVAL FOR A LIGHT BULB?

Are you flippin' kidding me? That's the family-safe version of my response when a shop wouldn't install a Whelen PAR36 Parmetheus drop-in LED in a reader's airplane without first lobbying FAA field approval. The aircraft, a first-gen Cirrus SR22, has a traditional incandescent landing/taxi lamp mounted in the nose bowl. Replacing it with the Whelen drop-in is a matter of accessing the lamp, unscrewing it from the mount, pulling off the connector and installing the new LED lamp in reverse order. Even a caveman could do that.

The tough part comes when it's time to endorse the installation in the logbooks. The snag: While Whelen has a sizable AML/STC (approved model list supplemental type certificate) for its drop-in PAR36/PAR46-sized assemblies, there isn't an across-the-board installation approval in place. In other words, if the aircraft isn't on Whelen's AML (and the Cirrus isn't), the installation will likely require a field approval.

I contacted Whelen to get the skinny. According to Whelen's Aviation project manager Greg Ginnetti, an IA might determine that the Whelen LED can be installed on an aircraft that's not on the AML by using the basis of Whelen's lengthy PMA. But without a specific aircraft type approval, Ginnetti finds it difficult to envision an IA signing it off without formal FAA interaction.

Ginnetti envisioned correctly. I spoke with several IAs and FAA repair stations around the country and every one of them told me that without an STC, it would have to lobby field approval before installing the lamp. In fact, one actually tried to gain approval for installing a Whelen LED landing light on a light twin, but was unsuccessful because the inspector didn't have enough previously approved data to determine the installation would be airworthy.

What is considered previously approved data? It depends on the inspector that is signing it off. One supporting document could be an FAA form 337 that has been signed by another inspector or ACO, as long as the installation was accomplished in the same make and model aircraft.

The key is to select a lamp based on the availability of approval data. It could save some legwork during the preparation stages of a field approval, while ultimately saving you money. That's because you'll pay for the time it takes a shop to gain approval.

For instance, AeroLEDs offers useful regulatory guidance right on its website, including previously approved 337 forms that shops and technicians can use when preparing a field approval package. AeroLed says that its Sunspot 36LX landing and taxi lights can be installed with just a logbook entry if you can install the light in an existing mount and use the existing wires, switches and circuit breakers. But this is for basic functionality.

The company's Sunspot 36HX landing and taxi lights (these have pulse or so-called wig-wag functionality) can be installed with the pulse function enabled only in a Cessna 185 under its STC, or in other aircraft models by submitting a 337 form that uses the Cessna 185 STC as a basis for approval. This is where it gets tricky. Most inspectors will argue that the Sunspot's approval in a Cessna 185 has little if anything in common with its approval in a Piper Seneca, for example.

One inspector told me that it might be easier to approve a simple installation that includes a TSO'd lamp, but stressed that if there are any structural modifications made to the mounting assembly, changes to wiring and changes to the control switch, the field approval process must be used.

What is that process, exactly? It begins by following AC 43-210, which describes the standardized procedures for requesting field approvals for certificated products. It describes the field approval process, the particular data that supports making an alteration or repair, while outlining the purpose and uses of the Aircraft Flight Manual Supplements (AFMS) and Instructions for Continued Airworthiness (ICA).

Think of a field approval as a one-time STC. The advisory circular also gives instructions for completing the field approval checklist and shows a sample compliance checklist format that shops and technicians should use during the process.

The typical field approval is essentially a three-step process, whether it's the installation of a landing light or a major avionics system. There is research, the submission of the field approval data package and then performing the alteration. Sadly, many inexperienced shops make the mistake of following the process in reverse order; first installing the device and then requesting field approval. This is by far the easiest way to turn an otherwise airworthy aircraft into a hangar queen while the shop waits for FAA approval. I've seen aircraft sit for months while the shop waits for a decision.

It pays to do your homework before making the purchase. In the case of drop-in LED landing lights, FAA approval could end up costing more than the lamp itself.

—Larry Anglisano

Windshield Care: Clean and Repel Rain

A number of products promise to clean your windshield and repel rain. A few actually deliver. Plexi-Clear, All Kleer and 210 top the list.

by Rick Durden

I never made a landing in rain until after I had my private pilot ticket—I'd never even thought about what it would be like flying final at 60 knots while peering through a fuzzy windshield, trying to sort out lining up with the runway and the flare. My first landing in rain (light) wasn't fun. Not having a windshield wiper didn't make sense. As I gained experience, I sort of figured out how to deal with rain on the windshield when landing, but the results often weren't pretty.

Some years later, a buddy picked me up at Detroit Metro Airport in his Alfa Romeo. We drove westbound on I-94 through a driving rainstorm and he didn't turn on the windshield wipers—yet the rain magically swept itself off the windshield. I was astonished; visibility was better than it would have been in my car, with the wipers operating. That's how I found out about and became a convert to rain repellents, in that case Rain-X.

Rain-X seemed like the perfect answer to the problem of rain on aircraft windshields. I found that a lot of pilots used it. The only problem was, it contained acetone, a chemical that damages Plexiglas. As an aircraft owner who would like to delay replacing the windshield as long as possible, that ruled out Rain-X.

That led to a search for a product that was safe to use on Plexiglas and would cause water to bead up and roll away as does Rain-X on glass. The search uncovered a surprising number of such products—including the fairly new Rain-X Plastic.

Unfortunately, when I read the instructions, I found that the windshield had to be clean and dry before applying Rain-X Plastic. That meant a two-step process—clean the windshield and then apply the rain repellent. Of course, that led to the question as to whether there were rain repellent products suitable for Plexiglas that could also be used to clean the windshield—and this article. Being a good, tightwad pilot, I didn't want to have to buy two products, one for cleaning and one for rain repellent.

The products examined, from left: Rain Away, LP Acrylic, All Kleer, Plexi-Clear, Pilot's View and 210 Plastic Cleaner.

CLEAN AND REPEL

A search of the Aircraft Spruce website uncovered six Plexiglas rain repellent products that were also advertised as windshield cleaners. I ordered all six and set out to test each one. The products I examined were 210 Plastic Cleaner and Polish, Plexiclear, All Kleer Cleaner and Polish, Rain Away Glass Treatment, LP Acrylic Polish and Sealant, and Pilot's View Polish.

The test protocol was first to see how well each product worked to clean Plexiglas windshields on older airplanes—I wanted to see how the products worked on windshields that had been around the block a few times—and had bug splat that had been dried on for a matter of weeks. I used the products to clean sections of the windshields of an Aeronca Chief, Piper J-3 and Cessna 195. To

CHECKLIST

- Plexi-Clear, All Kleer and 210 were the best combination products.
- Despite their advertising, Rain Away and LP are not windshield cleaners.
- Pilot's View contains ammonia, which damages Plexiglas.

SELECT WINDSHIELD CLEANER AND RAIN REPELLENT PRODUCTS

PRODUCT	PRICE	CONTAINER	PRICE PER OUNCE	COMMENTS
210 PLASTIC CLEANER AND POLISH	$8.70	7 OUNCES AEROSOL CAN	$1.24	Spray and wipe—although letting it sit on the windshield for a while helped with cleaning bug remains. Satisfactory rain repellent.
PLEXI-CLEAR ANTI-STATIC AIRCRAFT PLEXIGLAS CLEANER, PROTECTANT AND POLISH	$13.60	19 OUNCES AEROSOL CAN	$0.72	Spray and wipe, easy to use and effective on dried-on bug splat. Satisfactory rain repellent. For the price, the best of the products we tested.
ALL KLEER	$5.85	8 OUNCES SQUEEZE BOTTLE	$0.73	Took some rubbing to get rid of bug debris but was one of the best rain repellents.
RAIN AWAY	$5.95	4 OUNCES SQUEEZE BOTTLE	$1.49	Despite being advertised as a cleaner, it's not and did not work well as one. Good rain repellent. Not recommended.
LP ACRYLIC POLISH AND SEALANT	$17.85	36 OUNCES SQUEEZE BOTTLE	$0.49	Also, despite advertising, not a cleaner—directions call for washing the windshield before use. Very good rain repellent.
PILOT'S VIEW	$11.90	27 OUNCES PUMP SPRAY	$0.45	Marginally effective as a cleaner. Satisfactory rain repellent. Not recommended—contains ammonia.

check on rain repellent qualities, I used the products to clean and polish sections of the windshield of a Cessna 210 and flew it in rain.

When I went to use the products, I discovered that two, LP Acrylic Polish and Sealant and Rain Away Glass Treatment, were not cleaners—their instructions called for cleaning the windshield prior to applying the product. While effectively cleaning a Plexiglas windshield can be done with water and a clean, dry cotton or microfiber cloth, I was looking for a one-step process. I did observe that one cleaning and polishing product, All Kleer, had a note calling for removing "excess dirt or grit on the windshield to prevent scratching." I thought that made good sense for any of the products and did not disqualify it as a cleaner.

As rain repellents, all of the products did an adequate job of causing rain water to bead up and run off, greatly improving visibility over an untreated windshield.

210 Plastic Cleaner. For $8.70 you get a seven-ounce aerosol can of 210 Plastic Cleaner and Polish that promises to clean, polish and leave a protective coating. It's a spray-and-wipe cleaner and polish. The only description of its working components provided is that it "contains petroleum distillates."

EASY TO USE

I found it to be one of the easiest of the products to use, although it would run off vertical portions of windshields quickly. For dried-on bug splat, simply spraying and waiting 30 seconds or so soaked the mess and allowed the great majority of it to be wiped off cleanly.

After using it, my note was "fast and effective." It was a satisfactory rain repellent.

Plexi-Clear. With an imposing title, Plexi-Clear Anti Static Aircraft Plexiglas Cleaner Protectant and Polish contains a "propane/butane/isobutane blend and ethanol," and promises to leave a microscopic, high-luster soil retarding and water-repellent finish. At $13.60 for a 19-ounce spray aerosol can, it lived up to its billing. It's a spray-and-wipe product, with clear instructions to

Spray and wipe procedure was effective for the 210 Plastic Cleaner and Polish, here being applied to a section of the windshield of a Cessna 195.

PRESERVING THE PLEXI

The Plexiglas windshields in our general aviation airplanes are pretty remarkable—made of acrylic, they are lightweight with little distortion, and it should be at least 30 years before you need a new windshield (inset), if treated right. That's according to John Zofko, Jr., founder of Great Lakes Aero Products, one of the major glass manufacturers. Even on a tie-down, you can figure on 10-15 years, per Scott Utz, head of maintenance at Arapahoe Aero on Denver's Centennial Airport.

It's the "if treated right" that is the kicker. Plexiglas is soft and easy to scratch—plus a number of the chemicals that are used for cleaning regular glass can attack the acrylic Plexiglas, notably acetone and ammonia.

While preparing this article, I spoke with *Aviation Consumer* editor Larry Anglisano and he related an ugly story to me from the time when he was working as an avionics tech. It seems that a customer arrived to pick up his airplane after some work and found the windshield filthy. The shop had a new-hire kid scoot out to clean the windshield. The kid grabbed a can of MEK (methyl ethyl ketone) and a rag and did as he was told. Shortly thereafter, the shop bought the aircraft owner a new windshield as the single application of MEK had ruined the existing one.

Proper care and feeding of an aircraft windshield means assuring that any cleaners to be used are appropriate for Plexiglas—when in doubt, stick with cleaning your windshield with lots of water and your hand (the one that doesn't have a ring on it). Aircraft detailer Ed Pataky told us that he's not found anything better than plain old water, and lots of it—to soak the bug splats—for getting a windshield clean. Especially if the airplane has been sitting and a layer of dirt has built up on the Plexiglas, flooding it with water will let the dirt and grit simply run off without causing scratching. He also warned against using paper towels as they can scratch Plexiglas and to absolutely stay away from shop rags as they are notorious for having grit and metal particles in them, despite having been washed. It's best to use a clean, soft cotton or microfiber cloth.

The manufacturers I spoke with recommended mild dish soap mixed with water and rubbing the window with one's bare hand as the best method. If a cloth is used, it should be soft and non-abrasive. 3M cleaning products were spoken of positively.

I recognize that often there's no effective way to get water to the airplane—so that's where a good quality cleaner and polisher is an effective way to clean the Plexi without damaging it.

I haven't seen any data as to whether the thin coating left on the Plexiglas by a rain repellent product also helps protect the acrylic—but I tend to think of it like chicken soup; it can't hurt.

spray on a liberal amount and wait a few minutes to soften up heavy bug accumulations.

GOOD DIRECTIONS

Those directions proved to be accurate—it was effective for bug removal. I liked the fact that it warned against using paper towels and how easy it is to scratch Plexiglas. As a rain repellent, it was satisfactory. Overall, I felt that its combination of price and effectiveness made it the best of the bunch.

All Kleer, "The Plastic Windshield Cleaner that leaves the miracle finish," contains isopropyl alcohol as its working ingredient. It comes in an eight-ounce squeeze bottle for $5.80.

With a consistency somewhere between cream and paste, it took some rubbing to get rid of bug splat. It made up for that minor shortcoming by being slightly better than the others as a rain repellent.

Rain Away Glass Treatment turned out not to be a cleaner, so it's not recommended. At $5.95 for a four-ounce bottle, we were surprised at how much of the bottle we had to use for an application. Its active ingredient is acidified isopropyl alcohol.

As a rain repellent only, Rain Away was satisfactory. The label indicates its effectiveness improves with additional applications and calls for them to be made every four to five weeks. We considered the note redundant—one of the secrets of rain repellents is that they need to be applied regularly and they often get better with subsequent applications.

LP Acrylic. Priced at $17.50 for a 16-ounce squeeze bottle, LP Acrylic Polish and Sealant was another product that turned out not to be a cleaner, disqualifying it. Slightly thicker than water, the polyethylene polymer formula is, however, a very effective rain repellent.

Lloyd's Pilot's View Polish and Cleaner came in a one-ounce pump spray bottle that was the size of the complimentary glasses cleaners one gets from the optician, and cost $4.75. (A more economical size, 27 ounces for $11.90, is available.)

Directions are minimal—spray on and wipe off. The active ingredients are "ammonia, alcohol and solvents" and the label promises a "200% vision improvement." Because ammonia can attack Plexiglas, we do not recommend it.

Pilot's View was marginally effective as a cleaner; taking work to get bugs and water spots off the windshield. As a rain repellent, it was satisfactory.

CONCLUSION

For the combination windshield cleaner and rain repellent my nod goes to Plexi-Clear. Its price gave it the advantage over 210. Its ease of use gave it the nod over All Kleer, although I thought All Kleer was a slightly better rain repellent.

Adventure Pilot 740 GPS: Tablet-Based Navigator

Adventure Pilot's new iFly 740 GPS is proof that the portable GPS isn't dead. A better display and integrated power supply boosts credibility.

by Larry Anglisano

Before full-size tablet computers made their way to the cockpit, the Adventure Pilot iFly 700 GPS navigator earned respect as a capable big-screen chart reader. As a bonus, the iFly tablet could serve double-duty as a portable GPS. But there was one problem: Garmin. It dominated the market by rolling out model after model of portable navigators, including the aera series and eventually, the GPS696, which is still in the lineup today.

Then Apple and Android tablets came along and the market seemingly forgot about traditional portable GPS. Still, Adventure Pilot continued to advance its line of iFly tablet GPS systems. Its latest model is the iFly 740—a 7.25-inch tablet-based GPSMap that brings sizable improvements in screen quality, while finally ditching the awkward remote power supply that hindered portability in previous models.

The 740 tablet runs the Adventure Pilot iFly GPS app, which is compatible with both iOS and Android tablets. We recently covered the app in detail in the March 2015 issue of *Aviation Consumer*, so in this article we'll concentrate on the capabilities of the iFly 740 GPS hardware.

FORM FACTOR

The $899 iFly 740 moving map GPS is identical to the older iFly 720 in form factor, but has a higher performance processor with over double the processing power. It also has a more powerful internal WAAS GPS engine.

The 740 also includes Adventure Pilot's EasyView high-definition charts, plus the $50 iFly Streets app. Like the iOS and Android version of the app, the 740 has VFR charts, taxi diagrams IFR low and high airway charts, plus georeferenced approach plates and ADS-B NEXRAD overlay, when interfaced with a portable ADS-B receiver. The "Enhanced" VFR/IFR subscription, which includes the low enroute IFR charts and approach plates is $109.99 per year, or $69.99 per year without approach plates or enroute charts. A single subscription will work on the dedicated 740 hardware and tablets.

CHECKLIST

- Bright, crisp display rivals that of mainstream tablet computers.
- iFly navigation feature set is intuitive and rich in functionality.
- We like that Adventure Pilot ditched the external power supply, but wish for better battery endurance.

The 7.25-inch iFly 740 GPS, below, works well for straightforward navigation and as a chart viewer.

Samsung's Galaxy Tab S 8.4 is larger than the iFly 740 and its display has more than double the pixel count, but in a cloud-darkened cabin the iFly's 740 display is brighter, top photo. That's an iFly tablet mounted to the panel of a Glasair, bottom.

Weighing 14.5 ounces, the chassis measures 7.25 by 4.50 by 0.82 inches and has a 7-inch display, which is operated entirely by resistive touch. Its size is the closest to mid-size tablets, including the iPad mini and Samsung Galaxy Tab S 8.4.

While many general aviation cockpit displays have capacitive touchscreens, Adventure Pilot points out that resistive touchscreens are the choice of military and industrial applications. Further, resistive technology isn't hypersensitive and might perform better in turbulence. It is also more glove-friendly—enabling pilots to operate the screen with any type of glove, not just tech-friendly ones.

But if you're used to the capacitive display on many tablets and smartphones, the iFly's display will take some getting used to, especially when touching, dragging and zooming the map. There is also rubberband route modification. As you would expect from a tablet, the display can be configured for landscape or portrait view.

The iFly 740 (and smaller iFly 520) aren't Android or iOS devices. Instead, they run on Windows-embedded CE6, a closed-core operating system commonly used by developers. That offers an advantage, says Adventure Pilot, because it doesn't suffer from vulnerabilities like an open platform can. As the graphic on page 13 shows, it also offers flexibility for numerous I/O interfacing—including rich audio/video capabilities. It also provides for future expansion.

Speaking of expansion, the tablet has a digital NMEA output for connecting to compatible autopilots, including models from Dynon and TruTrak. Ask your shop to connect it with your certified autopilot and expect a big negative—it's generally not approved.

There is also a serial data output for feeding GPS position to compatible EFIS displays and fuel computers.

While this is a portable device (it comes with a suction mounting arm which we found to be cheaply made, compared to a RAM mounting arm), many users mount the device on or in the panel. Adventure Pilot offers a $59 RAM yoke-mount kit and a $39 kneeboard for additional mounting options.

The device comes with a remote control—useful for aircraft where you solo from the rear seat, for toggling maps, zooming and for using the touch-of-a-button Plane function. It automatically centers the display to your current location

The tablet has two speakers built into the rear chassis, in addition to a wired audio output for driving an audio panel or headphones. This supports the active alert messaging for terrain, airspace and traffic callouts (when interfaced with portable ADS-B receivers).

The list of ADS-B receivers and transceiver is extensive. It includes the first-gen Stratus, the Clarity and Clarity SV, iLevil SW/AW and iLevil 2 SW/AW, Sky Radar DX, the FreeFlight Explorer and RANGR, the SkyGuard TWX and the NavWorx ADS600-series

GOOD PERFORMER

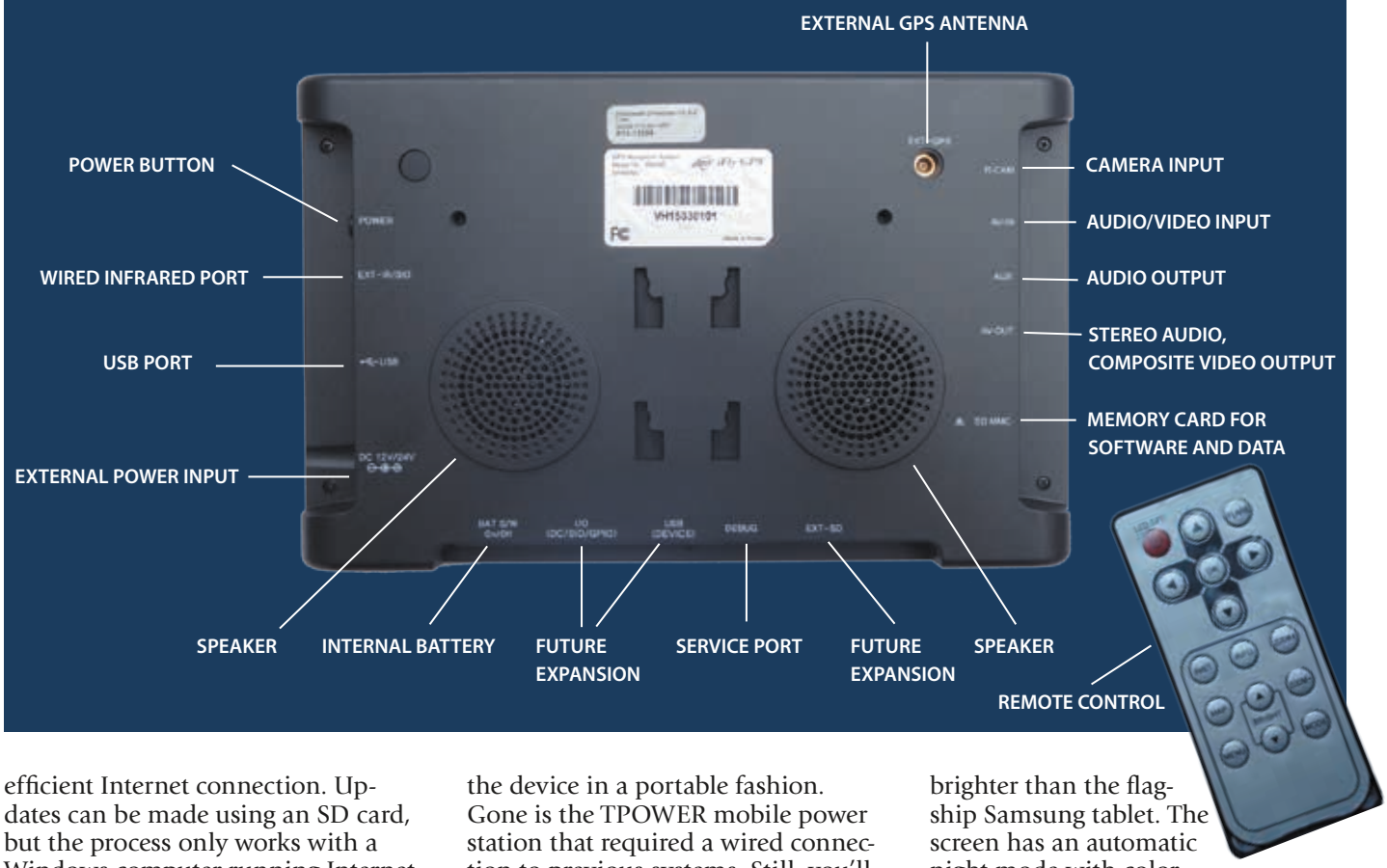
The iFly devices have internal WiFi (it doesn't have Bluetooth) and you connect to a server as you would any other device.

Our evaluator had beta version 9.0 and performed well. We never experienced crashing or freezes, and the processor made for reasonably fast map redraws and screen refreshing, although we found that nav data downloads are slow, even with an

TV iFLY GPS VIDEO

AVweb
www.avweb.com

IFLY 740 GPS I/O INTERFACES



efficient Internet connection. Updates can be made using an SD card, but the process only works with a Windows computer running Internet Explorer.

The system comes standard with an internal WAAS-enabled GPS engine, giving it an advantage over a non-cellular iPad. For reliable navigation from inside the cabin, the iPad could require a remote GPS. We evaluated the iFly 740 in the cabin of a Cirrus while placed on the lap and its receiver performed well without connecting to the optional external antenna.

When the unit is panel-mounted using an AirGizmo panel dock, an external antenna will likely be a required $25 accessory. It simply plugs into the side of the chassis.

Unlike the iFly 720 and earlier predecessors, the new 740 has an internal battery—a welcomed improvement for those that want to operate the device in a portable fashion. Gone is the TPOWER mobile power station that required a wired connection to previous systems. Still, you'll want to plug the device into ship's power. Battery endurance is a measly three hours, which is not uncommon for a high-quality color LCD display, although any iPad and Android tablet will leave it in the dust. The unit has a built-in Li-Po backup battery for roughly 30 minutes of backup.

The tablet has 1300-nit (nit is a unit of visible-light intensity) screen brightness. In real-world sunlight, it passed our test with flying colors, performing well in a bright sun-splashed cabin. We found it easy on the eyes in a darkened cabin, too.

But when it comes to display specs and overall quality, the iFly 740—with an LCD screen resolution of 800x480 pixels—is dominated by the latest mainstream tablet computers of its size. Compared to Apple's iPad mini 3, with a 2048x1536-pixel Retina display, and Samsung's Tab S 8.4 with its 2560x1600-pixel WQVGA screen, the 740 is less endowed. This is only slightly apparent to the eye when placed side by side. But the 740's saving grace is that 1300-nit screen brightness, which is actually brighter than the flagship Samsung tablet. The screen has an automatic night mode with color inversion.

CONTACT

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www.iflygps.com

NICHE MARKET

As impressed as we are with the updated and capable iFly 740—and the iFly GPS app—it's natural to question its stamina in a cockpit tablet market dominated by iPad and Android tablets.

"A growing number of pilots are frustrated with poor sunlight readability and the glare issues associated with consumer tablets. There are also buyers that want reliable hardware that is designed specifically for cockpit use. With all the modern benefits of an app-based navigation tool, plus an extremely sunlight-readable display and robust hardware, the iFly 740 GPS fills this need," said Adventure Pilot's president and owner Walter Boyd.

Adventure Pilot has an iFly 740 upgrade program that allows up to $300 credit for select older iFly devices. The $899 iFly 740 comes complete with AC and DC power cables, remote control, storage case, suction mount and a pre-loaded SD card.

More ADS-B Solutions: Stratus, Sandia, FreeFlight

Both Sandia Aerospace and Appareo Systems introduce new mandate-compliant ADS-B transponders, while FreeFlight offers cheaper UAT.

CHECKLIST

- Appareo transponder has useful integration with the popular Stratus portable ADS-B receiver.
- FreeFlight's under-$2000 (plus installation) RANGR Lite is the cost leader.
- Sandia's STX360/180 UAT transponders are clever, but require a WAAS GPS input.

by Larry Anglisano

Just when we thought we could lay off the ADS-B coverage for a month, along comes no fewer than three new ADS-B product announcements—two in the same day. These product introductions come as the ink still dries on last month's issue of *Aviation Consumer*, which contains an ADS-B buyer's guide. Stay tuned. We'll update the product guide in our June 2015 issue.

Clearly, the ADS-B market is busting at the seams, and the latest product announcements from Appareo, Sandia and FreeFlight offer overwhelmed buyers even more choices. Here's a look at each one.

STRATUS ESG

The $3490 Stratus ESG transponder comes from North Dakota-based Appareo, the maker of the popular Stratus-series portable ADS-B receiver. Appareo also builds flight data monitoring systems for transport aircraft.

While buyers might recognize Appareo for its Stratus-series portable solutions (through its partnership with Sporty's Pilot Shop and app maker ForeFlight), the company has been engineering a mandate-compliant, single-box solution over the course of four years.

The result of that engineering is the Stratus ESG 1090ES ADS-B transponder, which is equipped with an internal mandate-approved WAAS GPS receiver. The ESG doesn't have an internal ADS-B receiver.

Appareo said the 2014 ADS-B equipage trend appeared to favor 1090ES transponder solutions (rather than UAT), based on the latest FAA statistics and input it received from avionics shops.

Appareo isn't focusing on ADS-B solutions for higher-end glass cockpit aircraft, but instead recognizes the price-sensitive, lower end of the retrofit market. These are buyers that might already have a Stratus portable solution—a device the Stratus ESG transponder will complement.

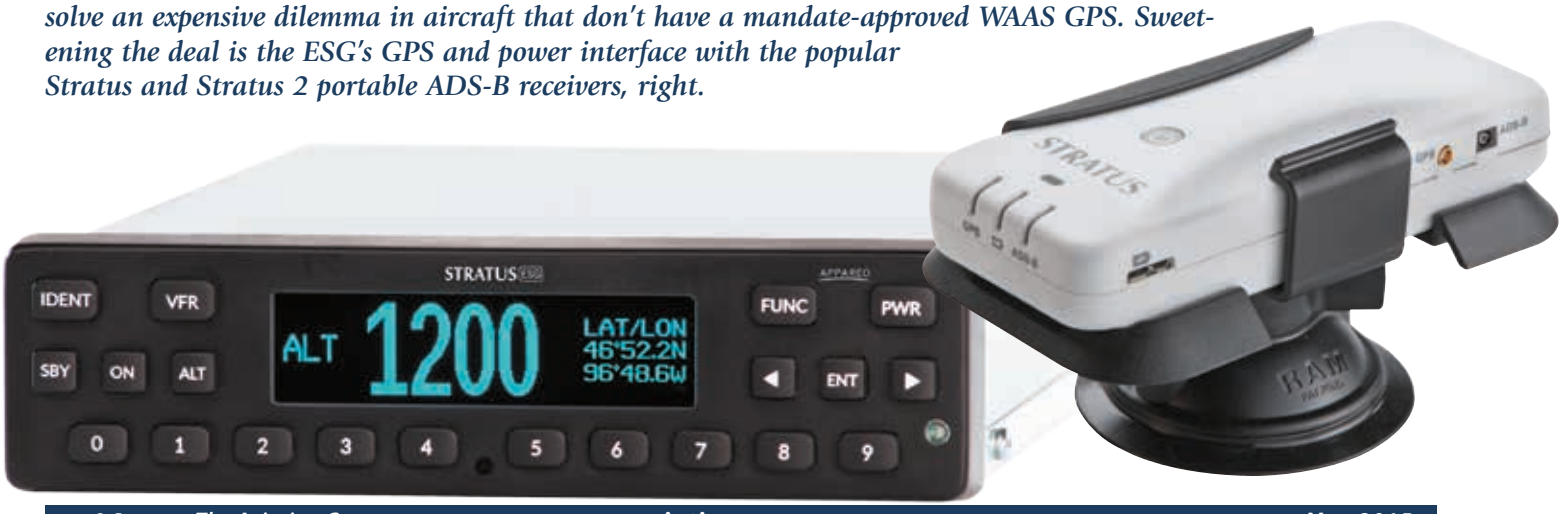
The Stratus ESG is designed to fit in the location occupied by traditional rack-mounted transponders and will comes with an install kit. The transponder will require the installation of a dedicated WAAS GPS antenna, which comes standard with the installation kit. Shops will need to provide an L-Band transponder antenna, or connect to the existing one if it is in good working order.

We hoped the ESG would have an integrated altitude encoder, but it doesn't. Instead, it accepts both Gray code and serialized pressure altitude data from most common encoders.

Appareo's Tony Grindberg told us the focal point for the ESG transponder is a simple, low-cost installation and acknowledged there are cheaper UAT solutions. But as we've been reporting, it is the installation effort that soars the bottom-line pricing well north of $3000.

"Some UAT receivers are available

Once it is certified, the Appareo Stratus ESG digital ADS-B Out transponder, left photo, could solve an expensive dilemma in aircraft that don't have a mandate-approved WAAS GPS. Sweetening the deal is the ESG's GPS and power interface with the popular Stratus and Stratus 2 portable ADS-B receivers, right.



Sandia's STX360 transponder, top photo, has an internal 978 MHz UAT transmitter and receiver. It displays FIS-B METARs and UAT traffic targets. FreeFlight's Equip-It 2020 "Silver Box" solutions come standard with all required accessories, including a WiFi module for tablet app interface, bottom.

at a lower cost than the Stratus ESG solution, but the installation will drive up the total cost of ADS-B compliance," he correctly noted. Appareo doesn't predict installation costs, but did say that for typical single-engine piston aircraft, its Stratus ESG transponder will require approximately half the installation time when compared to a remote UAT system.

As for the interface with the Stratus ADS-B receiver, Appareo said it is still ironing out the technical details of connecting the transponder with the portable receiver. Since the Stratus portable unit and the new ESG transponder require a GPS fix, both devices can share the same external WAAS GPS antenna signal. The Stratus receiver can also connect with the L-Band antenna, through the transponder. Additionally, the portable can be powered off the transponder, eliminating the need to plug it into an auxiliary power port.

This is a wired interface which will require some kind of plug-in harness or panel plug to join the two devices. It can also enable mounting the portable receiver in a glove box or other convenient location, rather than placing it on top of the glareshield.

The ESG has a LED display and has traditional transponder functionality, in addition to an automatic squawk-VFR button.

Worth mentioning is that the Stratus 2 ADS-B receiver is now compatible with the Seattle Avionics FlyQ tablet app for iOS. The Stratus receiver was previously only compatible with the ForeFlight Mobil app.

TV STRATUS VIDEO

AVweb
www.avweb.com

SANDIA STX360

Meanwhile, Sandia Aerospace announced two new ADS-B transponders of its own—the panel mounted STX360 Sentinel and the remote-mounted STX180.

Sandia actually labels the STX360 and STX180 products UAT ADS-B receivers, which happen to have a built-in Mode C transponder. The internal UAT ADS-B receivers enables reception of both 978 MHz traffic targets and FIS-B METAR weather data, which are displayed on the unit's OLED screen.

The STX360 also has a wireless output for interfacing ADS-B data on tablet computers, although Sandia hasn't finalized a list of compatible apps. There is also a remote version, the STX180, for interface on EFIS systems, plus an option for operating the unit with a 2.25-inch control head.

The STX360/180 doesn't have internal WAAS GPS, but Sandia said it is planning on a future GPS option. The transponders are expected to be available in 2016 and priced below $3500.

FREEFLIGHT'S EQUIP-IT 2020

Another announcement comes from FreeFlight Systems, which includes the FDL-978-TXL RANGR Lite, a stripped-down version of its RANGR ADS-B system. With a list price of $1995, the system counters L-3 Aviation's $2521 NGT-1000 entry-level UAT ADS-B system, making the FDL-978-TXL the lowest priced UAT solution on the market.

Incidentally, in an interview with sister publication AVweb.com, FreeFlight's CEO Tim Taylor said it is unlikely that prices will drop much lower than we're seeing now.

"We're already a long way down the curve and have been building and selling ADS-B systems by the thousands, but that curve is flattening out. I don't see economy-of-scale in the future making this any less expensive," he said.

FreeFlight's RANGR Lite is part of its Equip-It 2020 program, and is committed to build 10,000 systems. In addition to the basic UAT Out transmitter, FreeFlight's Equip-It 2020 solution also includes the $3695 FDL-978-XVRL—a version of the Lite that includes ADS-B In.

Both systems come complete with integral WAAS GPS and include the required GPS and ADS-B antennas, installation kit, remote ADS-B control unit (for installations that include legacy, analog transponders).

It's worth noting that L-3 Aviation's low-cost solution doesn't come standard with antennas or the control panel. These hardware costs are absorbed during installation.

FreeFlight said the FDL-978-XVRL also comes with a serial WiFi module for playing ADS-B weather and traffic data on tablet computers. The interface is compatible with the Wing X Pro app for iOS, iFly GPS for iPad, Android and the iFly 720/740

GPS, in addition to FreeFlight's own dedicated tablet app, ADS-B View.

NEED TRANSPONDER?

When venturing on an ADS-B upgrade, it's important to consider the health and vintage of the existing transponder system. That includes the altitude encoder, the wiring and the antenna system. Remember, you'll still need a healthy Mode A/C transponder, plus ADS-B.

This is where you'll need the advice from a trusted shop. They'll know if the existing transponder system is a keeper or a loser. Its condition could be a deciding factor in which ADS-B solution you install.

Look hard at the numbers. If you have to replace an aged transponder and altitude encoder, you'll likely spend $3500 for any of the modern Mode A/C models currently on the market. We'll take a look at that market in a future issue.

For now, the sweet spot for basic ADS-B upgrades is $3500-$4000, after installation. That includes the current price-leader, FreeFlight's $2000 RANGR Lite.

While we're cautious about proclaiming a developmental product a winner, we think Appareo's WAAS-equipped transponder is a smart solution (L3 Aviation's NGT9000 ADS-B solution has transponder functions, ADS-B In and internal GPS, but it's twice the cost).

With an internal GPS, a palatable price (although it isn't a price breakthrough) and its interface with the Stratus receiver, we think the Stratus ESG fills a void. In particular, this is non-glass, aging aircraft in need of a transponder upgrade and ADS-B.

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Champion's New Plugs: Quietly Redesigned

With little fanfare, Champion Aerospace redesigned its massive and fine wire spark plugs, but it's too early to know if it solves insulator and resistance issues.

by Larry Anglisano

Over the last several years, there have been incidents of pre-ignition in large displacement Continental engines. In many cases, it was suspected that cracked or broken ceramic insulators on Champion Aerospace fine wire spark plugs were to blame. The issue led to Cirrus issuing a service bulletin for spark plug applications on its turbocharged models, as did Tornado Alley Turbo, for its aftermarket turbo-normalizing mod.

Subsequently, it turned out the problem wasn't isolated to turbocharged engines—even normally aspirated engines were damaged. It was initially theorized that lean-of-peak engine operation (advocated by some manufacturers) might be the culprit of detonation-induced cracking of the plug's ceramic insulator.

Technically, if done properly, running lean of peak gives the engine a wider detonation margin than rich-of-peak might. Still, Champion kept an open mind and vowed to get to the bottom of the issue.

Without announcement, last year it redesigned both its massive and fine wire aviation spark plugs, while revamping its manufacturing process. While there simply isn't enough real-world data to point to a definitive fix, we set out to determine if Champion specifically redesigned the plugs to be as reliable as plugs from competitor Tempest.

SPARK PLUG 101

It has long been acknowledged that pre-ignition is the most destructive combustion process in a piston engine. How destructive? Consider that pre-ignition generates enough damaging heat in the cylinder that it can actually melt the piston and rings. You don't have to be an engine expert to understand the significance of a compromised spark plug. But you do need to understand how a spark plug functions, and the importance of the insulator.

Insulating the central electrode from the outer portion of the spark plug, the insulator keeps much of the heat from the inside of the spark plug away from the fuel/air mixture.

When that electrode breaks, it can allow combustion of the fuel/air mixture ahead of the plug firing. Once pre-ignition is underway, you might see a substantial increase in CHT on the affected cylinder (and sizable levels of vibration), making a good argument for even a basic graphic engine monitor.

Massive electrode spark plugs use two large grounding electrodes on each side of the center electrode, while fine wire plugs have a single, small-gauge grounding wire in the center—making them more fragile during installation.

Drop any plug to the floor from cowling-high and chances are it will stress or break the electrode. The potential for installation damage was another theory behind the insulator problem with Champion's plugs, as was the theory of thermal shock during large power reductions.

The graphic on page 17 offers an overview of the newly designed massive plug (its cutout looks identical to a fine wire), but Champion's Kevin Gallagher told us the redesign was as much about executing a new manufacturing process as it is a product improvement, producing an aviation

spark plug with internals that closely resemble that of an automotive plug.

He noted that Champion is the only aviation spark plug maker to manufacture its own ceramic insulators and glass seals, while pressing and firing its own cores. Manufacturing is accomplished at Champion's Liberty, South Carolina, facility.

For its new aviation spark plugs, Champion transitioned from the mechanical stack of a silicon carbide resistor, spring and terminal assembly, to the more modern method that Champion has been using on automotive plugs for many years, consisting of a conductive glass core called a fired-in suppressor seal, or FISS.

Gallagher said that while massive-design plugs represent nearly 95 percent of the market, the design change was made to both its fine wire and massive plugs.

FIELD REPORTS

We spoke with a few mechanics to get a feel for their confidence level in the new fine wire plugs, but few were even aware of Champion's redesign.

One tech, an experienced IA at a busy shop and owner of an IO-550-modified Bonanza, isn't convinced that Champion had a design flaw at all. He acknowledged that some pilots are pretty rough on their engines, theorizing that it's tough to pin the blame on Champion's fine wire plugs, even though Tempest's fine wire plugs have a better track record in some applications.

We asked Champion's Gallagher if the redesigned insulator and the new manufacturing process make them less prone to cracking—whether that cracking is caused by thermal shock, water ingestion (in seaplane operations), a lean mixture or the so-called "big pull." That's where the risk of detonation increases when an engine lingers in the slightly rich-of-peak zone for too long of a period.

"Throughout the years, Champion has routinely gone through design improvements, while introducing technological advancements, including platinum, and more recently, iridium electrodes. We re-engineered both the design and the manufacturing method used for the ceramic core in our massive and fine wire aviation spark plugs. Hopefully the awareness that has spread through the flying community regarding the dangers of detonation during transition from rich of peak to lean of peak has decreased the incidents of broken insulators in plugs from all manufacturers," Gallagher told us.

We asked George Braly at Tornado Alley Turbo if Champion's new design instills enough confidence for him to recommend Champion fine wire plugs in turbo-normalized engines. Braly's personal opinion is that the problem was isolated to certain batches of fine wire plugs.

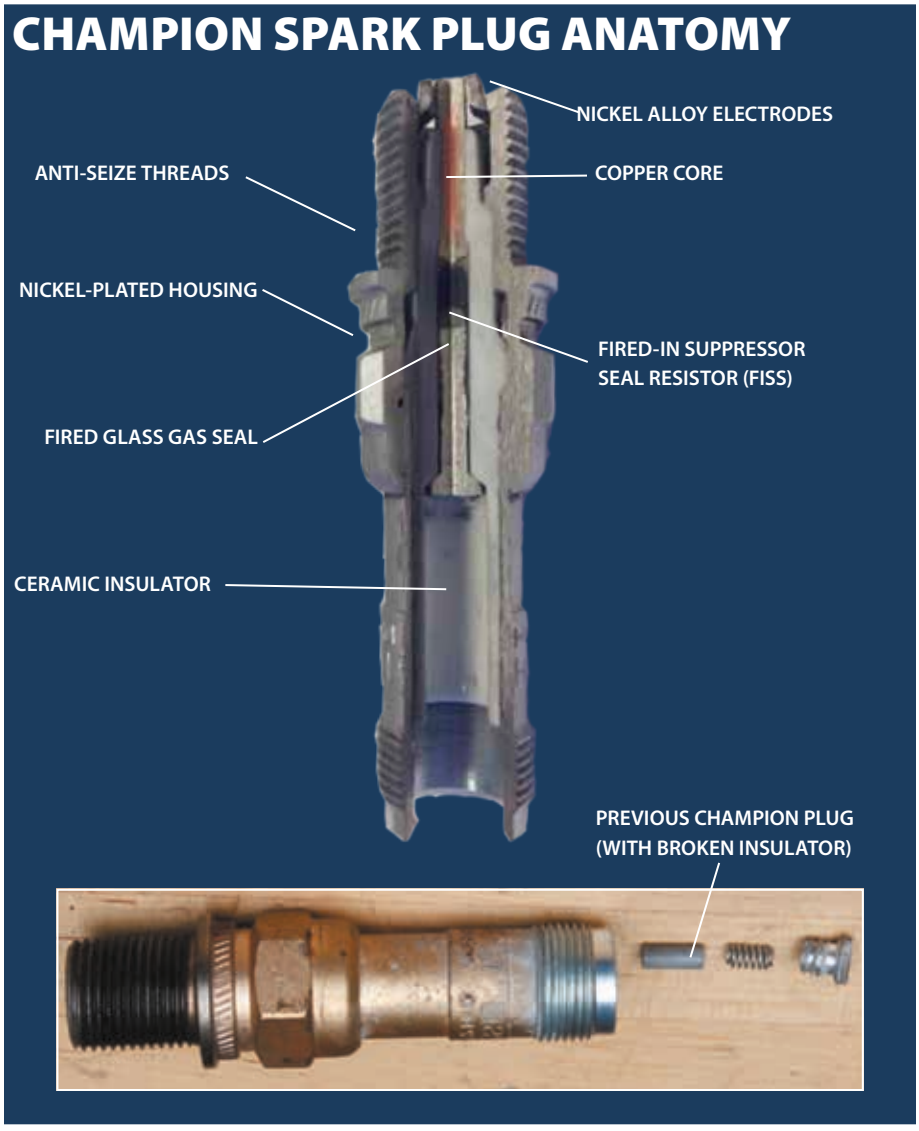
"We saw evidence in our shop that the problem was production-batch related. Until I see evidence otherwise, I'm going to assume Champion solved the problem with this redesign," Braly said.

Braly reinforced the theory that broken ceramics won't always cause pre-ignition. If a ceramic piece separates from the plug and goes out the exhaust valve, it generally won't have the damaging effect as if it lodges in the spark plug, effectively becoming a glow plug as the ceramic gets hot.

Braly and the mechanics we spoke with praised Champion for a company that clearly knows how to build spark plugs, given its long history.

It's important to note that the ceramic in Champion's massive plugs haven't shown evidence of cracking. This shouldn't be confused with Champion's earlier spark plug resistor problem, which might cause engine roughness, stubborn starting and excessive magneto drops.

With an insulator that closely resembles that used in a Tempest plug, plus a redesigned resistor, it's still too early to tell if it's a cure-all for prior problems, but we give Champion credit for being innovative. We'll offer a long-term report as more of the new spark plugs enter service. Contact www.championaerospace.com.



Vinyl Graphics Projects: Better For Composites

Do-it-yourself vinyl graphics are an alternative to custom paint work, but only if the base paint is in top condition. Metal airframes pose a challenge.

by Kenneth Newman

CHECKLIST

- If underlying paint is in good condition, vinyl graphics can modernize aging paint schemes.
- Air Graphics has a proven track record with OEM applications, but there are other cheaper options.
- Applying vinyl graphics to metal airframes is challenging due to surface rivets.

When proposals for a custom paint job on my second-generation Cirrus came in as high as $25,000—with up to 10 weeks of down time—I considered stepping up to a newer model. But my investment in numerous upgrades and my comfort with the aircraft in a variety of missions and weather convinced me to keep my ham and stop looking for rye bread.

Still, logic dictated that it was time to personalize and customize the paint work. Why? Because it didn't need it. N233WZ has always been pampered inside and out and is stored in a heated hangar. However, it was born in a time where Cirrus' ho-hum graphics make it look like every other G2 on the ramp.

I looked at aftermarket graphics, and while I wanted an aggressive design with custom colors, I never found what I was conceptualizing. That is until I saw some cutting-edge graphics and paint work on the Generation 5 Cirrus models. This clearly seemed like a radical change in appearances from the earlier models. Once I got pointed in the right direction, I decided to pull the trigger on an owner-assisted vinyl graphics project. Here is a firsthand account.

DESIGN IT ONCE

The first step in this process was finding a company to design and provide the graphics. The company I chose to work with was Air Graphics from Fitchburg, Wisconsin. Air Graphics works with OEMs, including Cirrus, which was a plus. From my initial email to the delivery of the graphics, I was impressed with the customer service, design work, speed of renderings and the many samples that were sent to me overnight.

Air Graphics will move at the pace you set through the design process. The actual building of the vinyl material requires roughly two weeks. Air Graphics has three jumping-off points for the project: Semi-custom, Custom and the more basic process of reproducing the original design with custom colors.

Although less expensive than a custom paint job, higher-end custom vinyl graphics like the Air Graphics set on this Cirrus won't be cheap. With owner-assisted labor, the total project approached $6000.

Semi-custom designs can be rendered with your registration number in any color. A Semi-custom package means Air Graphics will change the color to your preference; however, the original design does not change. The price range for these predesigned renderings is $2200-$4400. The sizable price spread is due to the specific type of vinyl that is provided. The lower end of the price range is the plain, opaque materials. The cost becomes more expensive through the personal choice use of metallic and ultra-metallic vinyl, while the higher end of the price range is for textured vinyl, print-to-match colors and reflective films. An outline or gradient print added to any vinyl will make the graphic more expensive as well. Ultimately, the final cost is dependent upon the vinyl colors and design selected.

The Custom product requires a design fee of $495, which includes a minimum of three unique designs which are editable until you are satisfied with the final product. I dealt directly with Air Graphics designer Angel Adams. Most of the Custom design products average $3200-$3600, plus the $495 design fee.

Clockwise from upper left: Rendering drawings of the vinyl design are key to planning the project, but the prep work is equally as important—and tedious.

An air-driven rotating Crud Thug finishing wheel is a useful tool for removing the existing graphics, but you must use caution not to trash the base paint below it.

Plan to spend serious amounts of time compounding, cleaning and buffing the surface to remove oxidation that the old graphics might have left in place.

In the end, installing vinyl graphics isn't as difficult as it is time-consuming.

DO IT YOURSELF, MAYBE

Like anything in life, experience is priceless. Jim Markey, my A&P, has it. I did the installation with him at his Certified Cirrus shop, Private Flight, at Sullivan County Airport in New York. The labor cost was about $1500 and the downtime was three days. The FAA does not restrict who can do this project. You do not need a paint shop, there is no required sign-off and you won't need to recalculate the aircraft weight and balance.

It is acceptable to apply the vinyl to control surfaces. However, only a few grams of weight are acceptable to add, plus movement and travel must not be affected. This is where the oversight of an A&P is invaluable.

I was clearly an Indian and not a chief on my project. My advice is to honestly assess your own abilities or the project might not go well. Of note, Air Graphics partners with a shop in Wisconsin that will perform the install at $100 per hour. One interesting point: If you have a Cirrus and want to refresh the exact original scheme, Air Graphics can't do that. Duplicating the original must come directly from Cirrus.

The vinyl application process on my Cirrus took three days, with three people helping, three deliveries of Chinese food, three Crud Thugs (more on that in a minute) and a lot of on-the-fly planning.

First, the layout and inspection of the vinyl components. It is important to compare all of the pieces with master layout sheets that Air Graphics will include. Decide where to begin, based on overlap and how the design flows on the airframe. You'll need a large working space that is both warm and dry.

Next is the most labor-intensive portion of the project—removing the factory graphics. A Crud Thug wheel is attached to a Snap-On Tools accessory mount on an air gun. The device is much like a wire wheel and if used incorrectly, can remove paint from the airframe.

Once the old graphics are removed, you'll need to use a glue solvent to remove any glue residue that remains on the surface.

When the surface is clean of all glue residue, it's time to polish the base paint. It is critical to remove oxidation and any ghosts left from the original decals. We used a 3M product that produced excellent results—the aircraft looked as if it just rolled out of a paint shop.

There is an important caveat here. The base paint on my aircraft was in excellent condition. My A&P had discussed this before I began the design of the graphics. If the paint was in questionable condition, we would not have started the project. This is perhaps the most important aspect of this project and a reason why a vinyl graphics project won't be a fit-all solution.

The last critical step in the prep process is a final cleaning of the base paint. We used ethyl alcohol to remove all wax, oil and dirt from the existing finish.

Application of the new design starts with a dry masking tape application to check for actual fit. The vinyl is applied with a solution of

VINYL VERSUS PAINT: WHICH IS BETTER?

That's what we asked leading paint shops and Craig Barnett at Scheme Designers, a popular aircraft graphics designer that works with both aircraft paint and vinyl designs.

Barnett confirmed our suspicion that vinyl graphics work better on smooth, fiberglass finishes. That makes sense, given the added complexity and challenges that surface rivets and screw heads create during the application process.

"Vinyl graphics designs are handled differently from painted designs. For example, pointed stripes need to have the points into the wind rounded for proper adhesion, and one has to design wraps very carefully to ensure they work properly on the aircraft. I keep vinyl away from excessive heat areas and from oily or sooty areas," Barnett said. He noted that Scheme Designers has done many vinyl graphic designs for riveted aircraft, all with good results, but definitely not as good as painted graphics.

The folks at Hawk Aircraft Painting in Tampa, Florida, concur. Hawk's Joe Dinolfo told us of the problems his shop witnessed with OEM vinyl on later-model Cessna single-engine airplanes. "We ended up removing the decals from more than a couple of these new airplanes because the material just doesn't adhere well around the rivets. Dirt, water and other contaminants get under the material and it can end up peeling off," he said.

Even the best technicians might not be able to get the vinyl to adhere over rivets and screw heads. One tech said he'll often trim a portion of the vinyl away if the tip of a stripe happens to end on a rivet head because inevitably, that portion of the stripe will lift up and peel back.

Sometimes it's about status. Unless it's a model that originally had OEM vinyl graphics, don't be surprised if you take a hit when it comes time to sell the airplane. In the world of high-end refurbished aircraft, aftermarket vinyl accents are considered a shortcut.

"We look at vinyl makeovers as a two-year solution. A real paint job could last 20 years," said Matt Kozub from Ohio-based Aircraft Sales, Inc. He markets the Pristine Airplanes total refurbishment process where every aircraft sold gets custom paintwork. Kozub said that for some models, vinyl can affect resale value.

Last, if you commit to a full-up paintjob, include painted graphics. Scheme Designer's Barnett advises if you are having an aircraft stripped and repainted, it is far more effective to add the design in paint. "A quality paint job will far outlast the vinyl, especially if the aircraft is kept outside. Because of the cost of installing and buying the vinyl design, there is no great savings doing new base paint and finishing it off with vinyl," said Barnett.

—Larry Anglisano

water with 5 percent soap and 5 percent alcohol. This process requires extra hands and good coordination. As long as the vinyl is wet, it's workable, but when it dries it becomes fixed, and there it stays. There is a learning curve here—see one, do one, teach one.

Once the vinyl has set for 24 hours, it's time to make it pretty with microfiber cleaning and waxing. Carnauba wax works, but use caution not to use a cleaner-wax.

It's said that vinyl graphics require little if any maintenance. Most cleaner, soap and wax that is safe for a paint is also safe for the vinyl.

There are widely conflicting opinions on the typical life of the vinyl material (that is, how long it will maintain its resilience before cracking, peeling and generally looking shabby.) Obviously, storage and climate is a huge factor, just as it is with paint. Its location on the airframe is also a factor, as described in the sidebar above.

So far, the vinyl seems to be nonreactive with the deicing fluid that spews from the leading edges.

OTHER OPTIONS

Air Graphics isn't the only source for vinyl graphics, but it does offer one of the most comprehensive design services and is well regarded by many paint shops.

Still, there are other choices, including Aero Graphics in Loveland, Colorado. In addition to offering OEM replacement decals for exterior and interior use, it creates custom registration numbers, logos, military markings and custom striping in a variety of vinyl colors and for its StripeRite paint mask. Its graphics are popular in the Warbird community and are found on a variety of aircraft—from the Quick Silver P51D Mustang—to aircraft on display at popular museums.

Aero Graphics striping is provided in three layers, including a single sheet of wax paper. The top layer is a protective tape which is used during the application process, while the middle layer is the vinyl stripe decal.

Plane Vinyl in Kennesaw, Georgia, specializes in printed vinyl wrap using 3M products to create flying billboards, but can design custom schemes or work with your design.

Plane Vinyl's Bud Newton stressed that the company is careful not to infringe on OEM trademarks and copyrighted designs. Instead, Newton told us his company can make custom changes to these designs for a fraction of the cost of the competition.

continued on page 32

Renting a Jet: Options Increasing

If you sometimes need more capability than your airplane offers, a rental jet may be the solution—but be ready for complicated regs and insurance demands.

by Rick Durden

No airplane is perfect for 100 percent of its owner's missions. It's long been common for, say, a pilot who owns a Cessna 150 to rent an Archer when more capability is needed. We've also seen owners trade up into the class of airplane they've been renting—the rental process having allowed them to get to know the more capable airplane and the experience they'd gained helped in buying insurance.

Nevertheless, it was a little surprising to learn that the more capable airplane some pilots are renting these days is a jet—and that not only are established FBOs and flight schools evolving to meet the trend, but individual jet owners are making their airplanes available.

We interviewed companies that rent jets and pilots that are doing the renting and found that if you've got the financial wherewithal, there are increasing opportunities to rent one. Nevertheless, it's a new field, the FARs and insurance requirements make it more complicated than renting a Cirrus at your local FBO and you may not be able to fly the airplane solo.

We recommend that you have an aviation attorney carefully look over the rental/lease agreement and insurance coverage before you go.

The FARs involving operation require that you be in "operational control" of the jet that you're renting. Simplified, that means the renter, you, have to arrange for whatever flight crew is needed. If the company renting the airplane to you provides the crew as part of the deal, it becomes a charter flight under Part 135 of the regs, and you are a passenger who cannot touch the controls.

FLIGHT TRAINING

Companies such as Angel City Flyers of Long Beach, California, rent jets as part of their focus on flight training. Company president Seosamh Somers told us that it put the first of three Cessna Citation Mustangs on line three years ago. Initially, the jets were to be used for type-rating training, but increasingly, customers desired to rent the airplanes after they had obtained a type rating. The company responded through an arrangement where, initially, a mentor pilot flies with the renter. According to Somers, some of the renter pilots have acquired enough experience that they can meet the internal requirements of the company and its insurer to rent the airplanes solo.

Somers told us that renters usually take the airplanes for a few days, but it's not unusual for them to take trips lasting two weeks or more and going across the country or to Mexico, Canada or Europe. The Mustangs are rented for $1200 per hour, dry. Mentor pilots typically charge about $800 per day.

Texas-based Plane Smart offers a number of aircraft management services including dry leases of a Beech Premier and Cessna Citation II. Director of marketing James Elgin told us that it offers block hour rental arrangements of 25 or 50 hours, paid up front at a dry rate. He said that most customers want to fly the airplane themselves and arrange for the necessary flight crew to meet company and insurance requirements.

In addition to companies formally renting jets, there are owners who want to increase the usage of their airplanes to help offset the fixed costs such as calendar-driven inspections and hangar rental. They will advertise in aircraft sale publications or simply put out the word among pilots in their area.

One pilot told us that he's been

More and more, jets such as the Cessna Citation Mustang are available for rent—but figure on at least $1200 per hour, plus fuel, plus mentor pilot—and you'll need a type rating and a lot of experience before you're turned loose solo.

INSURING YOUR RENTAL BLOWTORCH

As we researched this article, we heard about a turboprop owner who was renting a single-pilot jet. When asked how he was insuring the jet, he said that he paid a lot of money for insurance on his turboprop and it had better cover him in the jet. He then got concerned and called his broker. Fortunately, his particular policy covered him when he was flying other airplanes—but that's not always the case. If you're going to rent a jet, making sure that appropriate insurance coverage is in place is a huge part of the deal.

Jon Doolittle, an aviation insurance broker with Sutton James agency, told us that sorting out the insurance coverage is essential when entering into a jet rental agreement—when things go wrong, they tend to be very expensive things. Doolittle explained that sometimes a jet renter will carry non-owned insurance—also called renter's insurance. That means the renter has one policy and there is another policy held by the aircraft owner. If something goes wrong in the big-money world of jet repair, that almost guarantees a fight between insurance companies and major delays in fixing the jet—not good for anyone.

Doolittle said that it's much simpler if there is only one insurance policy involved—the policy carried by the owner. It usually has higher limits (more coverage) than a renter's policy. The rental pilot should be added to the underlying policy as a named pilot with a written agreement that the insurance company will not subrogate (pursue for payment) against the renter pilot should there be a mishap when he or she is flying.

The insurance company will almost certainly require the renter pilot to have the appropriate ratings to fly the airplane as well as a certain level of experience or fly with a pilot the insurer approves for some period of time before acting as pilot in command. We think that's reasonable—it's consistent with what insurers require for renters who fly even complex piston singles.

Having one insurance company involved with the coverage of the airplane simplifies matters greatly should an inspection uncover foreign object damage to an engine after a renter pilot has flown the jet. The insurance company that insures the airplane simply pays the claim (which may be hundreds of thousands of dollars).

If the jet is normally flown by professional pilots, it's common for the owner to be able to buy as much as $25 million in liability insurance. If the airplane is being flown by a pilot who doesn't fly for a living—such as a renter pilot—as pilot in command, the maximum available liability limit is usually $5 million. The aircraft owner and the renter pilot need to fully understand if this is the case, and agree.

Above all, the renter pilot should have confirmation, in writing, from the insurer of the airplane that he or she is covered under the policy, the conditions that would cause that coverage to lapse and the dollar limits available should there be an accident.

Finally, if the renter pilot is going to be acting as second-in-command, even in a single-pilot jet, it's essential that the insurance company knows about it and agrees in writing.

renting a Cessna Citation II and V from owners who are glad to have a way to help offset fixed costs. He said that he'd gone the route of making a deal with individual owners because he could use the airplane for a week or two at a time, which was difficult to arrange with companies that were in business to make money renting their jets.

He, and others, told us that rental rates for jets with comparable capabilities to the Citation II and V are between $1200 and $1500 per hour, dry. He was renting a Citation because his King Air didn't have the payload or range for some of the trips he needed to make. He also said that the drop in the price of fuel over the last year has made renting a jet much more attractive.

CAUTIONS

To be pilot in command of a jet, you must have a type rating for the type and have completed annual recurrent training. To be the copilot (SIC) in a two-crew airplane, and log SIC time, you'll have to undergo FAR-specific ground and flight training and receive a logbook endorsement. (An SIC-type rating is not required unless you fly outside the U.S.)

We think you should enter into a written agreement that sets out the precise terms of the rental/lease. Market values of older jets have dropped stunningly—a Citation I may only be worth $400,000. While the jet you're renting may be worth less than your Baron, make sure you have your lawyer go through the rental/lease agreement before you sign. You may have a beautiful trip and think you are returning the jet in perfect condition, however, if an engine inspection three months down the road turns up FOD, you could be on the hook for big bucks.

RVSM approval can be a problem. Reduced Vertical Separation Minima rules mean that an aircraft has to undergo approval to fly above Flight Level 280. The approval may be given to the aircraft or the aircraft owner. If to the owner, additional approval may be needed to have it extended to a renter pilot. It's one of those things that might never be an issue until something goes wrong and the FAA starts looking. If it discovers the pilot has been flying in violation of the RVSM approval, a certificate action or civil penalty could follow.

CONCLUSION

If you want to fly an airplane with engines that go whoosh and have the money to do so, the opportunities to rent one are better than they've ever been. Keep in mind that it not only costs a lot of money to operate them, it can cost cubic dollars to fix them. Don't put your sweaty hands on the yoke until you've made sure you and your financial welfare are protected by a suitable rental agreement and appropriate insurance.

Aspen AoA Upgrade: Self-Contained, Simple

Aspen's new software-based angle-of-attack system uses AHRS, air data and GPS input. This eliminates mechanical sensors and a complex installation.

by Larry Anglisano

The way we see it, all PFD (primary flight display) systems should include angle-of-attack sensing and display as a standard function. After all, nearly all of the data that's required for computing a stalled condition can be acquired from the PFD's air data computer and AHRS sensor.

This is partly how Aspen Avionics is adding angle-of-attack functionality to its Evolution PFD and MFD displays. By throwing aircraft-specific programmable software in the mix, the Evolution AoA system is able to compute stall condition for wing flap configurations without referencing an external flap position sensor.

The result is a simple AoA upgrade that doesn't require the costly installation of additional sensors, other than what is already included in an Aspen PFD/MFD setup.

AERODYNAMIC MODELING

Aspen's AoA references the AHRS and air data sensors that are integrated within the Evolution display, in addition to input provided by certified panel GPS receivers. The backup GPS that is contained in the RSM (remote sensor module) can't be used for primary GPS input, but most popular GPS navigators can, including vintage models from BendixKing, for example.

All of this data is combined into an airframe-specific aerodynamic computer model that is configured during installation. The computer model then uses AHRS-provided acceleration data to predict the aircraft angle of attack, which in turn sends the data back to the display.

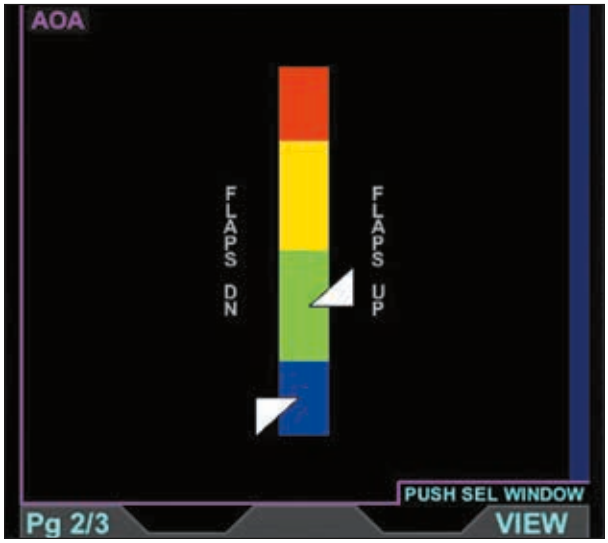
Aspen's AoA provides an indication of where the aircraft is in relation to the angle of attack with flaps up and down, which is simultaneously displayed. Simply focus on the correct indicator (flaps up or down), based on the configuration of the flaps. The benefit of this dual display is you'll always know the predicted angle of attack should you retract or extend the flaps.

An installation procedure calibrates the AoA sensor through manual data entry of airframe-specific stall speeds and approach speeds—with and without flaps.

Additionally, an inflight speed calibration process (which considers aircraft gross weight) further customizes the AoA model for that specific aircraft.

The AoA functionality will be compatible with all 1000-series Evolution displays, including the Pro, VFR, Pilot and MFD through a field-installed software update. As we go to press, Aspen hasn't determined final pricing for the upgrade or how the feature will change the price of existing systems in the Aspen product line. Aspen expects certification sometime this summer.

For more information, visit www.aspenavionics.com.



AoA indications are logically displayed to the right of the airspeed tape on the Evolution PFD, left photo, and on a dedicated page within the Evolution MFD, right photo.

Cessna 195 Businessliner

Once pitched as a business traveler, the Cessna 195 offers load-hauling utility and plenty of nostalgic charm.

There are few personal airplanes that can deliver both mission utility and attention-getting nostalgia. The venerable Cessna 195 Businessliner is one of them. Cessna named it the Businessliner because it was, well, a business aircraft.

But it was not the first business aircraft by a long shot. It is probably the most practical of classics because it is a good traveling airplane that will not cripple you to keep it maintained. It is all-metal and has good parts availability, unlike such machines as the Beech Staggerwing, Spartan Executive and Stinson Reliant. It is the link between the poorly harmonized, high adverse yaw radial-engine classics of the 1930s with the feet-on-the floor machines of today, carrying on only the adverse yaw.

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

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

When you arrive on the ramp in a 195, heads turn. Best of all, 195s are relatively affordable to buy and support. For the pilot who is on the ball, they can be relatively easy to fly.

The 195 owner could treat the airplane like a car—put in people, bags and fuel and not worry about overloading it.

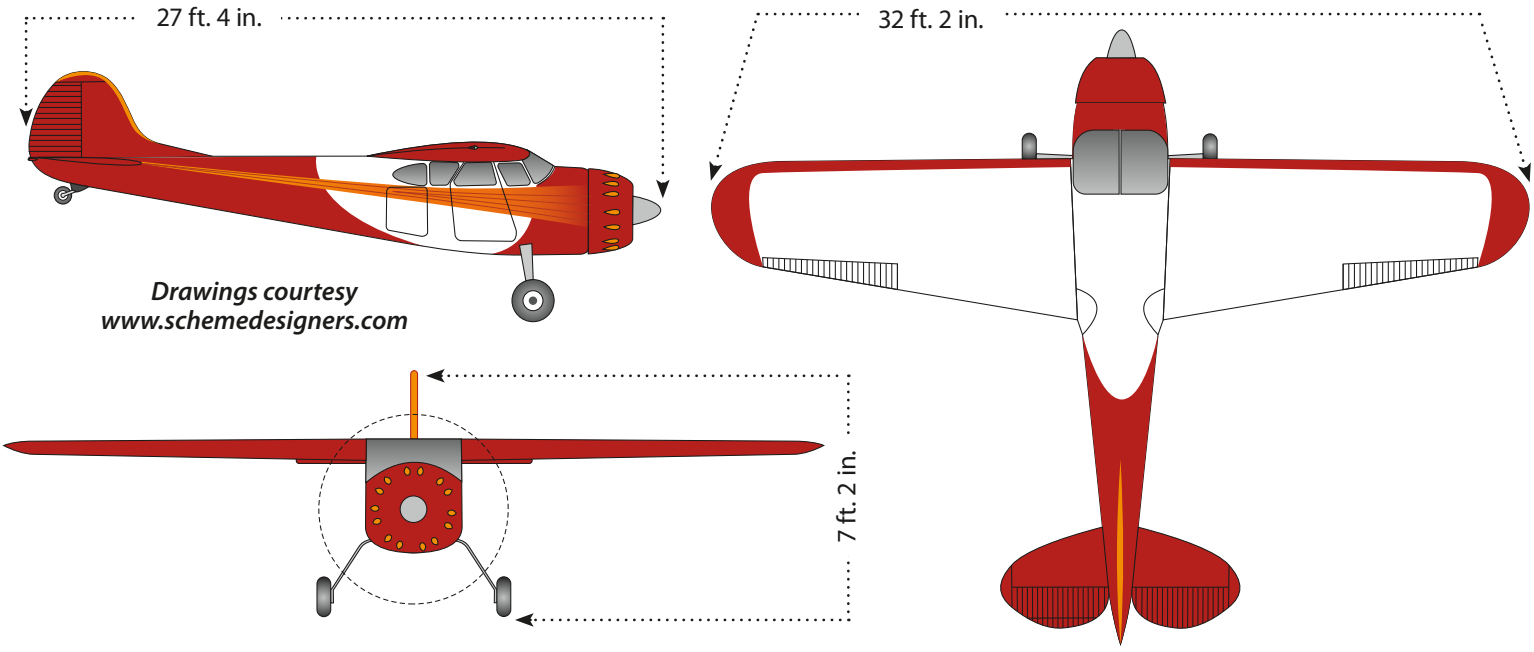
EARLY DAYS

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

The 190 had a Continental W-670 radial pounding out 240 HP and was alleged to be Cessna president Dwane Wallace's personal favorite. The others had Jacobs R-755 engines of either 300 HP, 275 HP or owner-furnished 245 HP. Most of the 195s were originally equipped with the 300-HP engines, but many have been retrofitted with 275s or 245s. There are still quite a few of the smoother-running Continental-powered airplanes flying, but about half have since been converted to 195s with the Jacobs engines, since the support for the Jake is better.

Owners report that the performance is comparable between the

CESSNA 195 BUSINESSLINER

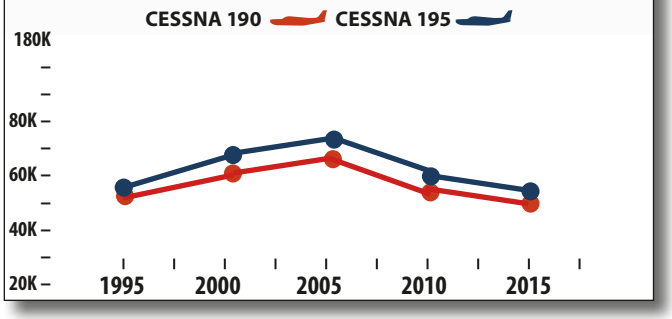


Drawings courtesy www.schemedesigners.com

CESSNA 195 BUSINESSLINER MODEL HISTORY

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

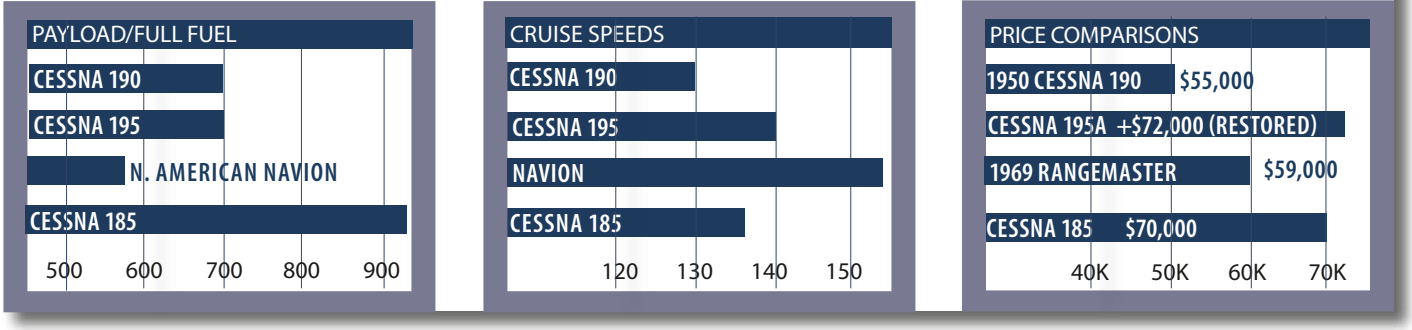
RESALE VALUES



SELECT RECENT ADs

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

SELECT MODEL COMPARISONS



The Cessna 190/195's panel is pure 1950s retro, with old-style metal yokes, piano key switches and no wimpy starter key, but a proper push button.

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

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

PERFORMANCE, HANDLING

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

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

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

Control harmony is superb, although the airplane has adverse aileron yaw, but pitch, roll and yaw control is beautifully harmonized, and responsive without being twitchy. It feels like a luxury car from the 1950s. Still, the airplane will not stay where you put it. Most have some degree of long-term phugoid, plus they will simply wander after a half dozen seconds no matter how well trimmed. It's a fingertip correction, but you have to fly the airplane all the time. Any slop or worn bearings in the control and trim system makes the wandering worse. Nevertheless, it does not wallow in turbulence.

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

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

A pilot should be able to both three-point and wheel-land the airplane. Neither is better. However, the power needs to be completely at idle prior to touchdown. One way pilots get into trouble is carrying power through touchdown and then closing

the throttle and losing the airflow over the rudder. It three-points beautifully. Once down, the yoke must be pinned fully aft or the airplane will start bounding. If it starts, full aft yoke stops it quickly. Remember that this is a relatively heavy tail dragger with the C.G. well behind the main gear. If it gets squirrelly on rollout, brakes may not handle it; power and air over the tail and perhaps a go-around are more likely to be successful. Allow a swerve of more than 10 or 15 degrees to develop and there isn't enough brake to stop it. A ground loop in this airplane will usually cause major damage to the gearbox, fuselage and wings, perhaps even resulting in a total loss.

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

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

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

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

PAYLOAD, COMFORT, RANGE

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

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

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

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

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

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

Want to work on the Jake's accessory case? In the days when engineers thought about maintenance, Cessna built in a swing-out mount that makes it easy, top. If you simply can't slum around on 275 HP, there's always the 450-HP Pratt R-985 conversion, middle. It's called the 196. That's Robert Donnelly's LC-126, bottom.

little extra time at the hangar admiring the airplane's beautiful lines.

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

VALUE, INSURANCE

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

We perused *Trade-A-Plane* and www.Controller.com and saw asking prices starting at $80,000. Buyers seem to fit in either of two general mindsets, purists who want nothing less than a show-plane restoration just as it shipped from the factory, and those who like the lines and nostalgia, but want a practical flier.

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

A private pilot with no instrument rating, 200 hours PIC and 25 hours of tailwheel experience and an extensive checkout would likely see premiums of about $2000 to $3000 per year, assuming a $85,000 hull and $1 million liability. That's about the same as a tailwheel Cessna 180 or roughly one-third more than a 182. Experience and ratings lower insurance premiums, of course.

MAINTENANCE

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

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

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

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

Tailwheel strut maintenance is a

The 195's unique crosswind gear, above, casters to allow the airplane to point off the flight track.

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

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

PARTS, SUPPORT

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

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

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

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

Several 195 specialty shops have arisen to cater specifically to the marque. In the northeastern U.S., The 195 Factory provides inspections and repairs. In the Midwest, there are two shops recommended by owners: Barron Aviation and Butterfly Aviation (www.butterfly.com).

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

Recently overhauled Jakes are alleged to rival flat engines in their oil use. Some parts for the Continen-

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190/195 MISHAPS: GROUNDLOOPS

With their large, comfortable cabins, the Cessna 190/195 series airplanes are delightful cross-country machines—and amazingly safe in that role. Our survey of the 100 most recent 190/195 accidents revealed an almost astonishingly low number of accidents one would expect to see in airplanes used for traveling such as engine failures, VFR into IMC crashes and fuel-related events. They totaled only 15 percent of the accidents—for flat-engine airplanes, we'd expect to see at least that many accidents from engine stoppages alone. We only saw seven engine stoppages in the 190 and 195.

Of those 15 accidents, there were two in-flight breakups, one due to pilot incapacitation and one after the owner flew his airplane into a line of thunderstorms. Only one pilot ran his airplane out of fuel, but that was because he didn't get a fuel cap on correctly, siphoned the tank dry and didn't believe his sagging fuel gauges. Two pilots didn't drain the "rusty water" out of their tanks before departing and things got quiet up front.

Where things get ugly are when pilots try to land 190s and 195s—they lose control at a rate higher than any other airplane we've looked at in our Used Aircraft Guide accident surveys. We found that 63 percent of the accidents were runway loss of control excursions that were bad enough to tear up the airplane. We don't know how many groundloops occurred that merely embarrassed the pilot.

Tied in with those 63 wild rides were at least 15 assertions by the pilots that one or both brakes either failed or locked up. That brings the simple pilot mishandling accident rate more in line with other tailwheel airplanes, but also indicates that brake maintenance is a matter to be taken seriously in a 190 or 195.

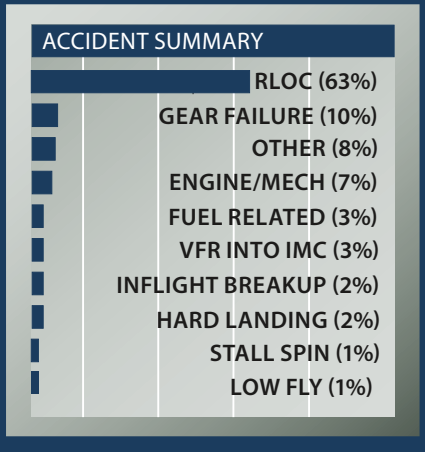
In addition, the airplanes have a lot of mass, so when they start to swerve, a pilot has to take corrective action immediately. The good thing is that the rudder is on a long arm, so there is a lot of control authority—the bad news is that mechanics knowledgable about 190/195 innards tell us that they often see misrigged landing gear which can turn a good-handling tailwheel machine into a pilot's nightmare.

Because of the rate of landing accidents, we were surprised to see only one accident involving a blown go-around. Either 190/195 pilots are so bull-headed they won't go around when a landing starts to go south or making a go-around has a very high rate of success.

We had to wonder about the thought process of the pilot who went around before touchdown in a stiff, direct crosswind. He flew the pattern and came down final 15 MPH faster the next time. Apparently, he didn't remember that he was going to have to slow down during rollout and that his risk wasn't in putting the airplane on the runway—it was keeping it there. Almost predictably, he lost it as he slowed down from a wheel landing and tore up the airplane.

There were 10 fatigue failures of gear legs or axles—a high rate, in our opinion.

We noted that one pilot flipped his airplane on rollout because, he told investigators, he had diabetic neuropathy and couldn't tell how much force he applied to the brakes. He hadn't had an FAA medical in years.



tals are scarce, although rebuilders can make do with used, serviceable parts. The R-755 Jacobs are well supported with many new and modernized parts available. The R-915 330-HP Jake is not an orphan, but not nearly as well supported as its smaller sibling.

MODIFICATIONS, CLUBS

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

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

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

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

Judging from the comments of owners, one of the most useful conversions is from the troublesome Goodyear brakes to Cleveland brakes, which are many times more effective.

For increased convenience, the addition of tail push handles (B.A.S, Inc.) help move the airplane on the ramp.

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

Radial Engines, Ltd. has been issued a STC for a fuel-injection mod

for the Jacobs 275- and 300-HP engines that reduces fuel consumption and evens out fuel mixtures to the cylinders for smoother operation and greater power. The engine originally had only an oil screen. Many have been retrofitted with oil filters from ADC, Air Wolf or other field STC sources. (Airwolf's site is at www.airwolf.com while ADC can be accessed through www.aviationdevelopment.com.)

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

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

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

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

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

OWNER FEEDBACK

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

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

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

Upon stripping the skin from the wing, he found that the outer spar was not connected to the main spar. When the skin came off the fuselage, he found that repair of a prior ground loop was not properly skinned, so that skin had to be changed, too.

Then we found a cracked doorpost on the left side, a common problem which might be caught on a prebuy inspection. This rejuvenation project cost roughly $42,000.

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

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

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

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

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

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

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

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

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

Robert Donnelly
via email

The Aviation Consumer

Vinyl Graphics

(continued from page 20)

Newton also stressed the importance of applying vinyl graphics in a manner that doesn't interfere with airworthiness. While he notes there aren't official FAA regulations that address vinyl graphics (other than registration numbers), he always suggests that control surfaces are rebalanced (should any vinyl cover them) and the aircraft is weighed—no matter how minimum the job is.

"We follow the same regulatory guidelines that apply to aircraft painting, whether the aircraft is experimental or certified. While we know the vinyl is lightweight, it could change the characteristics of a control surface," Newton said.

It's worth noting that Plane Vinyl specializes and works with aircraft only. While it may contract with graphic installers around the country to do the work, it ensures that there is an experienced aviation technician overseeing the project. The key to a vinyl graphics is to know who is doing the application. While there may be installers skilled with working on motorcycles, trailers and boats, working with aircraft is another matter.

WRAP IT UP

My results with Air Graphics were impressive and I think the cost was modest in the world of aircraft refinishing. The takeaway is that it offered a cost-effective alternative to a custom paint job, with less . Combined paint and graphics projects can create limitless results, but require a large budget and downtime.

Contributor Kenneth Newman, MD is a commercial pilot and owns a Cirrus SR22 based in Western New York.

Letters

(continued from page 3)

OIL COOLER CLEANING

In the oil cleaner article in the April 2015 issue of *Aviation Consumer*, Ronald Newburg from Niagara Air Parts asserted that no matter how extensive the cleaning process is, you can't wash all of the contaminants from its nooks and crannies. This is false.

At Pacific Oil Cooler Service, our FAA-approved oil cooler overhaul process follows that of many oil cooler manufacturers and is proven successful in removing 100 percent of the contaminants from the cooler.

Overhauling an oil cooler is a money-saving option versus the expense of a new replacement. In some cases, the cost differential is substantial. We simply present aircraft operators and maintenance folks with all available options.

Wayne Thomas, Sr. Technical Advisor
Pacific Oil Cooler Service, Inc.

AVIDYNE TWEAKS

In the article you noted that a dedicated keyboard could enhance the interface and that the IFD540 has inactive Bluetooth. This will be addressed with an optional Bluetooth keyboard as part of release 10.1.

Customers that register their product on www.myavidyne.com will receive a free keyboard. The software upgrade also addresses your complaint of the way crossing altitudes are handled, plus activating approach-related commands when in Map mode.

As for Avidyne's extended warranty, we want to stress that participation in AeroPlan is not a requirement in order to use our products. To reiterate our position that this program is a choice, we are adding an opt-out clause to the terms and conditions. It allows any customer who has signed up for AeroPlan a 30-day grace period in which they can change their mind and cancel the agreement by submitting a written cancellation request via email at warranty@avidyne.com. This also applies to IFD540 customers that haven't yet used AeroPlan's benefits.

Tom Harper
Avidyne Corporation

In that IFD540 article, we incorrectly stated that Garmin's GTN750 doesn't have automatic waypoint entry completion. Garmin's FastFind does just that.

FEEDBACK WANTED

COLUMBIA 300/350

For the August 2015 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Lancair/Columbia 300/350. 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. Send correspondence on the Columbia by June 1, 2015, to:

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e-mail at:
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