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The Aviation Consumer

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Unleaded Fuel—Why Not an Incentive?

We've been watching and reporting on the progress toward a functional unleaded replacement for 100LL avgas for nearly 30 years. Boiled down, that replacement will have to do three things: 1) meet detonation margins, 2) meet material compatibility requirements—not attack any of the components of existing aircraft fuel systems and the fuel transport and storage, and 3) meet economic realities. That is, sell for a price near that of 100LL.

The FAA and private industry have been working the replacement fuel issue for about three decades, spending millions on studies in an attempt to find a fuel that would work.

Although the economics are unproven, there are now at least two potential replacement fuels in the U.S. SwiftFuel 100SF has undergone ground testing and has done some flight testing, although not yet on an FAA-approved flight testing program.

General Aviation Modification Inc.'s G100UL is well into the FAA-approved flight test program for Cirrus aircraft as well as materials compatibility testing.

In early 2011, the FAA created a committee called the Unleaded Avgas Transition Aviation Rulemaking Committee (UAT ARC). It was assigned to not so much study the issue of replacing 100LL, but to devise a framework for approving fuels developed by industry. The FAA asked Congress for $60 million to fund the fuel approval framework, a process it imagines will be done within 11 years. In reality, most the work will likely be done within the next four years, at least to judge by proposed budget projection. But that's no guarantee approved fuels will emerge before 2017, when the EPA's new lower airborne lead standards will kick in.

A few weeks ago, Canada's National Research Council piled on—it announced it will help the FAA with the unleaded fuel problem with research on a non-petroleum, unleaded solution.

It's fair to wonder if the FAA really wants the distraction. Meanwhile, however plodding as it is, some of the principals in the fuel industry see the FAA's ARC-inspired bureaucracy, AIR-20, as enough progress to at least tamp down market hysteria and for fuel developers to have a risk framework. So far, so good.

But there's a big downside to this, too. The cost of developing and testing new fuels is staggering. The smart people at the companies doing it have to have funding for their R & D. To get it, they have to show potential investors that they are on the right track and can get the job done in a time that will allow return on the investment.

But the UAT-ARC's worst-case timeline extends to 11 years. Even if the bulk of the work is done in half that, that's a long time for investors to wait for a return in an uncertain market. So the UAT-ARC's proposal is, in a sense, counter competitive because it strongly discourages small companies like Swift and GAMI from continuing to invest. It favors the status quo of large refiners and oil companies.

Isn't there a better way? Maybe, but it's radical. What if the FAA went to Congress, not with a budget request, but with an incentive solution? What if it asked Congress to declare a three-year moratorium on all taxes on new unleaded avgas to begin once the first unleaded replacement fuel is approved and has been delivered into an airplane wing from an FBO in the field? That would serve as an economic pump starter. Then all the FAA will have to do is look at test results, approve the certification and, not long after that, tell Congress that it's time to start the tax moratorium and watch 100LL become a mention in the history books.
—Rick Durden

Bargain ANR Headsets

Thank you for the informative article in the December 2012 issue on mid-priced ANR headsets. My Lightspeed 3G has developed a mechanical problem. Your article was well-timed as I need to repair or replace my headset.

Unfortunately, Lightspeed does not offer an upgrade path from the 3G headset I have to the Sierra, but rather only to the higher priced Zulu 2 model. How much better is the Zulu 2 than the Sierra? I must either repair the headset I have, purchase a Sierra as a replacement or trade in my 3G on the pricier Zulu 2.

Steve Atkinson
Via e-mail

Based on the testing we carried out, we feel the Sierra represents a solid value. The Zulu 2 is flagship, with a higher price, so we would qualify your buying decision based on the amount of flying you expect to do. For long trips made on a regular basis and if Bluetooth music is your plan, the Zulu 2 may be worth it. For casual flying and training, the Sierra should serve you well. With the money you save, you might fix the 3G as a backseat or spare set.

I bought my first headset based on my CFI's recommendation. It was a middle-of-the-road, passive model and it got me through my private certificate, but it wasn't very comfortable. A year or so later I bought another one after seeing it at Oshkosh. Again, it did the job, but as I flew more and more I realized I needed something better.

I looked again at Oshkosh, trying every headset at the show. I wanted ANR but worried about the price. I wanted comfort but didn't want to spend more than my annuals cost.

I settled on the Lightspeed Sierra. I found that I couldn't sense any difference in noise level between it and the top of the line sets and it was the most comfortable. And while $600 isn't small change, it was affordable.

I've now used it for about 35 hours and have flown for as long as three hours on one trip and am as happy as the day I got it. It's nice to see that someone is thinking about what the average flyer needs and can afford instead of just reviewing the top of the line, "latest and greatest."

Mike Hatz
Via e-mail

I was happy to see that you included the passive Clarity Aloft in-ear headset in your review of budget ANR headsets. I wasn't surprised to learn that it was a star. I've put several hundred hours on Quiet Technology's in-ear passive, the Halo, and just love it. I prefer the Halo to the Clarity Aloft, mostly because of the lower price, but would be happy to fly with either.

You couldn't pay me to go back to the old head clamps, Bose or otherwise. For those who are comfortable wearing foam inserts, I think the passive, in-ear headset is simply a better mousetrap.

Douglas Garrou
Richmond, Virginia

My Bose headset is collecting dust because of the Clarity in-ear headsets. The Clarity seems just as quiet, is not hot to wear and glasses are easier to wear and comfortable. No over-the-top headband gives more headroom under a tight canopy.

I have no complaints with the Bose headset, but with both available, I've been choosing the Clarity for the last couple of years.

Jim Looloian
Via e-mail

How Much Automation?

I have to take issue with the January 2013 editorial about automation in the cockpit. Having a great, big "HELP" button to fix a situation would be handy at times, however, there are times when the autopilot needs to be in the "off" position.

I had the autopilot roll my Cessna 310 inverted at night. Hanging from my belt, I disengaged the autopilot and rolled the airplane upright. Having had quite a bit of aerobatic experienced helped. I had the autopilot fixed, but I never turned it on again.

Another issue with automation is that pilots who use it seem to lose their "edge." I worry about pilots relying on all the new gadgets and getting into places they can't get out of without good and current skills. It's kind of like having full-time four-wheel drive—it's nice until you get stuck, and then you're really stuck.

Bob Hays
Via e-mail

Renting Expectations

I agree 100 percent with the December editorial on renting. After years of renting airplanes in various locations when I had time while traveling, I have stopped doing so. Too many FBOs have gone from a reasonable checkout to confirm you are safe in the airplane to a very expensive, several hour process of a written test and a full-blown flight review.

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COCKPIT ACCESSORIES

Five Top Apps: WingX is a Standout

But ForeFlight is our top pick for IFR. You won't go wrong with any of these, but the top three are more polished and feature rich than new contenders.

by Paul Bertorelli

Aviation tablet apps, of which there are dozens, have become like the proverbial streetcar. If you don't see one you like, hang around; another will be along shortly. Or at least the one you're considering will morph into something unrecognizable if you wait long enough. Pity the would-be buyer trying to sort through the clutter and claims.

In this review, we'll attempt to do just that with what we consider to be the five top apps for flight planning, navigation and chart handling: Bendix/King's myWingman, AOPA's FlyQ EFB, ForeFlight, Garmin's Pilot and WingX. Yes, there are others, including Anywhere Map's Freedom and Jeppesen's Mobile FD, to name two. We'll get to these in a future issue, but to keep the topic contained, we'll examine only the apps we deem most popular based on sales and expressed reader interests.

For our evaluation, we ran the apps on an iPad mini and although we've tried accessories such as Bluetooth ADS-B boxes, the only peripheral we used for this evaluation was Garmin's GLO remote GPS receiver. Two of the apps are available for the Android OS, but we'll save a review of those for a future report, too. If apps started out as simple flight planners and weather getters, they have evolved into do-it-all navigators and flight libraries, some even including impressive EFIS displays. Except for communications, the most sophisticated apps rival the capability of panel-mount avionics, but at a fraction of the cost. For many buyers, they have displaced the dedicated portable GPS.

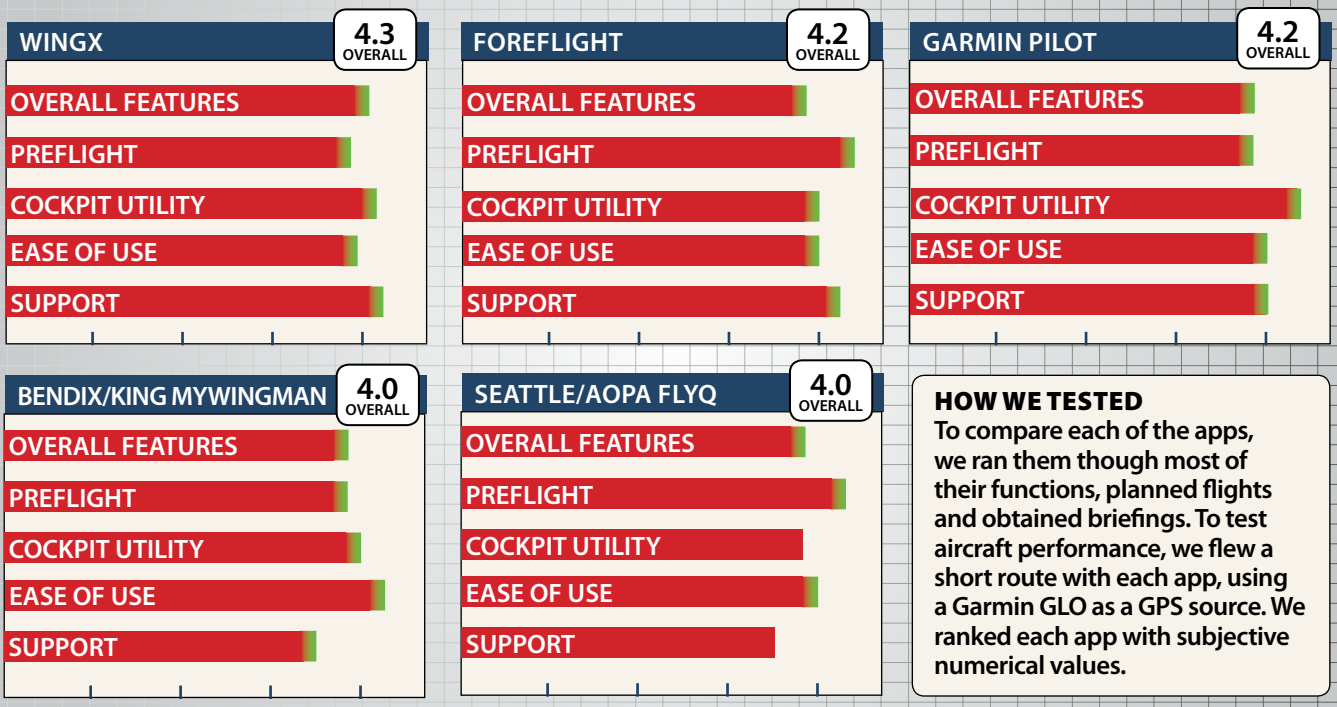
Although the apps we're reviewing here are closely matched in fundamental capabilities such as flight planning and filing, weather briefing, basic navigation and inflight weather display, they vary considerably in sophisticated higher-level features such as terrain display, mapping detail and customization. There are differences in cost, too, but in our view, these are less of a purchase driver than overall features and ease of operation.

For that reason, we're comfortable saying you won't go wrong with any of these apps. As our rating chart here shows, they're close in capability and performance, but it's in our charter to make picks and recommendations, so herewith are our findings.

PRICE COMPARISON

A word about pricing, which is hardly consistent from app to app. WingX,

APPS: HOW WE RANK THEM



HOW WE TESTED

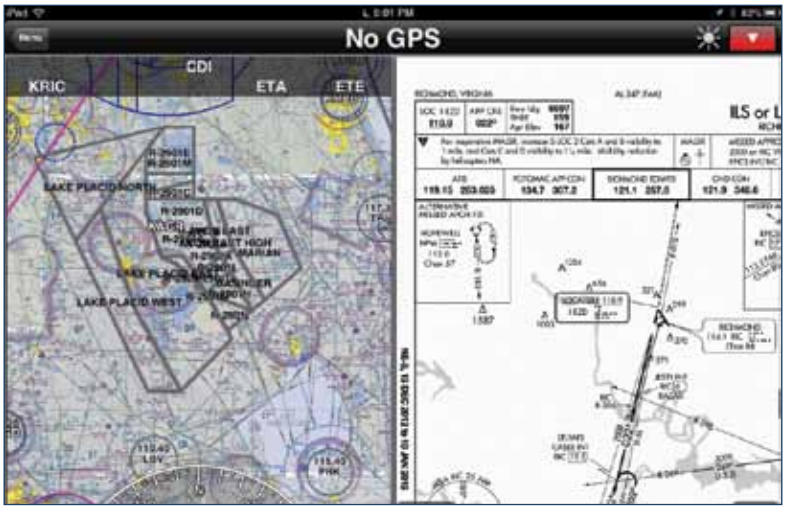
To compare each of the apps, we ran them though most of their functions, planned flights and obtained briefings. To test aircraft performance, we flew a short route with each app, using a Garmin GLO as a GPS source. We ranked each app with subjective numerical values.

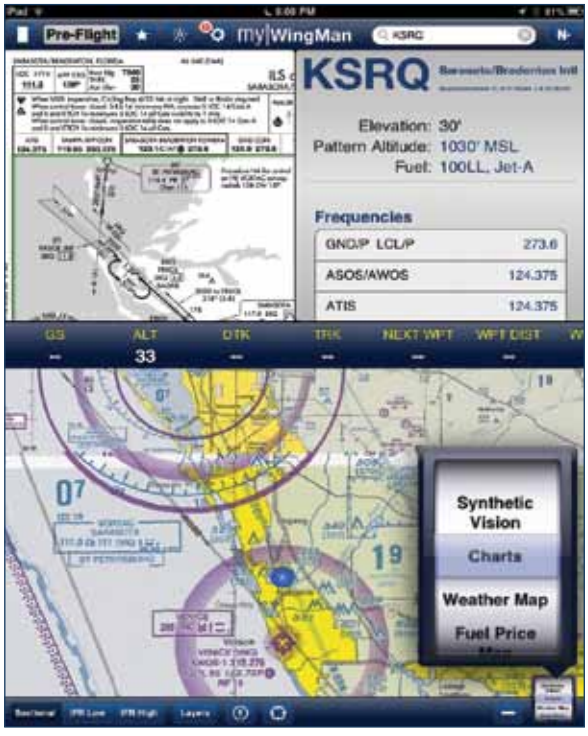
for instance, is the high-priced spread, as shown in our comparison chart. It has the most features of any of the apps, but pricing is à la carte, so you pay for add-ons like synthetic vision and fuel price data.

ForeFlight, on the other hand, throws in the fuel data for its standard price of $74.99 a year and so do Garmin and Bendix/King. Garmin, on the other hand, charges extra for its SafeTaxi data feature, while ForeFlight includes a similar feature as standard with its $149.99 geo-referenced package. Yet when you add everything up, Garmin's price is cheaper. Other apps, say Bendix/King's myWingman, may charge more, but don't have the same or equivalent features. If you're price shopping on apps, click off the features you want, then total it up before buying.

One last point: The apps business is subscription based, which means the providers make their money by selling you data subscriptions. When the sub expires, so does the app's functionality, but with two exceptions in this group of apps: WingX and Garmin Pilot continue to function with an expired subscription and they'll note where and when charts are expired, but still

All of the apps except ForeFlight have dual screens. WingX, below, has the most capable moving map. myWingman, right, uses a unique thumbwheel to switch display functions.





APP SPECS COMPARED

	AOPA FLYQ EFB	BENDIX/KING MYWINGMAN	GARMIN PILOT	FOREFLIGHT	WINGX
COST STRUCTURE	APP: FREE VFR: $69.99[1] VFR/IFR: $119.99 30-DAY FREE TRIAL	APP: FREE VFR: $99 IFR (GEO-REF): $149	APP: FREE BASE : $49.99/YR BASE: $9.99/MON GEO REF: $49.99/YR SAFE TAXI: $29.99/YR 30-DAY TRIAL	APP: FREE THREE MONTHS: $24.99 BASIC: $74.99 PRO (GEO REF): $149.99 CANADA: $150 CANADA/US: $225	APP: $0.99 BASIC: $99.99[2] GEO REF: $74.99 SYN VISION: $99.99 FUEL: $29.99
SUPPORTED PLATFORMS	IPAD2 OR LATER IOS 5.0 OR LATER	IPAD IOS 5.0 OR LATER	IPHONE IPAD IOS 5.0 OR LATER ANDROID	IPHONE IPAD IOS 5.1 OR LATER	IPHONE IPAD IOS 4.3 OR LATER ANDROID
APP SIZE	47.4MB	51.5MB	40.9MB	21.6MB	3.5MB
DATA REQUIREMENT	23GB MAX[3]	23GB MAX	8GB MAX	9GB MAX	3.5GB MAX
ADS-B WX INTEGRATION TRAFFIC	PLANNED	PLANNED	GDL 88 ADS-B WEATHER, TRAFFIC	STRATUS/WEATHER BARON MOBILE LINK WEATHER	SKYRADAR, SAGETECH, DUAL, FREEFLIGHT, LEVIL AHRS, ZAON TRAFFIC
SYNTHETIC VISION	YES	YES	NO	NO	YES
DIES ON SUBSCRIPTION EXPIRATION?	YES	YES	NO	YES	NO
SPLIT SCREEN	YES, TWO	YES, UP TO THREE	YES, TWO	NO	YES, TWO
FUEL PRICE DATA	NO	YES	YES	YES	YES, UPCHARGE
GEO-REFERENCE CHARTS	YES	YES	YES	YES	YES

[1]PRICES GIVEN ARE FOR AOPA MEMBERS; NON-MEMBERS PAY A HIGHER PRICE.
[2]WINGX HAS OTHER PRICING PLANS AS WELL.
[3]DATA PACKAGES THAT OFFER SYNTHETIC VISION AND TERRAIN ARE LARGER.

allow you to use them. WingX loses some of its high-level functions, but the basics remain.

WINGX

As the principle product of Hilton Software LLC, WingX qualifies as one of the original apps, having first appeared in 2004 in Windows Mobile. We're picking it as the top app in this group because it has the widest and most sophisticated featureset, it's relatively easy to learn and it's customer centric, running on an expired subscription.

Like all of the apps, WingX covers the basics, including flight planning and filing, weather retrieval and imagery and inflight navigation. In our view, WingX has two exceptional strengths. It works with the broadest array of remote devices such ADS-B weather and traffic and even as the Levil Technology AHRS if you want EFIS and synthetic vision on an iPad. (We don't particularly because of the gadget hassle factor, but if you do, WingX has it.)

Second, WingX's moving map functions are the most complete and flexible of all the apps. It uses a two-screen format—which can be combined to one or swapped—to display a range of choices from sectionals, to approach plates, to low-altitude IFR enroute charts and a detailed terrain map. Customizing the maps is handled through a series of labeled keys at the bottom of the screen, one of which offers the choice of the basic map, the other the ability to customize such details as obstacles, graphic METARS, runway finders and so forth on each map. But you don't have to move the maps to set the overlays, as with myWingman.

Like Garmin's Pilot, the basic structure is a menu-driven home page from which the principle functions can be selected. Or not. In flight, just about everything can be done from one of the map pages. On the mini, the largish, bright buttons are a help.

What does it need? Not much, really. The app is fast and well supported and although it lacks a detailed operating manual, it has good help screens. WingX's Web site has instructional videos that will bring any user up to speed quickly.

FOREFLIGHT

Along with WingX, ForeFlight is one of the earliest apps and among the best known. It runs only on the Apple IOS and there are no plans to offer an Android version. ForeFlight runs well on the iPhone, a plus because most of us will always have the phone, but the iPad may be elsewhere and not necessarily cellular equipped. Planning and filing on an iPhone is practical and easy.

ForeFlight's strength is in flight planning, especially for the IFR pilot who's dialed into routing decisions. ForeFlight offers the choice of known preferred routing or actual recently cleared routes, saving you the tedium of inserting fixes you're unlikely to fly. It also seamlessly inserts SIDs and STARs where appropriate and has an easy-to-use altitude optimizer.

The interface is efficient and no-nonsense. Just type in the departure

and destination and ForeFlight instantaneously displays a flight log and fuel required. Touch the brief-and-file icon and it grabs the weather and organizes it in order of importance in textual format. For approach plate handling, you put the plates you want into electronic binders and call them up with a touch of the plate button. As with other apps, the plates are easily scalable and can georeference aircraft position for an upcharge. ForeFlight can plot fuel price data on its map and it doesn't upcharge for this, while WingX does.

ForeFlight offers two inflight weather options: Appareo's Stratus ADS-B box and Baron's XMWX Mobile Link. Both offer a range of weather products, including NEXRAD, but Baron's is more complete.

ForeFlight's moving map, while adequate, is not to the level of WingX's, in our view, at least in terms of details such as terrain display and warnings, runway extensions, synthetic vision and so on. On the other hand, ForeFlight is among the most stable of all the apps. ForeFlight and Garmin's Pilot were the only two that didn't freeze up at some point during our trials.

ForeFlight's support is second to none, in our opinion. The app has a full onboard manual (plus powerful document capability) and the Web site has terrific bite-size training videos. ForeFlight claims "fanatical" support and to test this, we e-mailed the support group early on a Sunday morning and got a response from a real human within four minutes.

What does it need? Possibly split screen. We say "possibly" because the other apps have this and while it is handy for map performance, ForeFlight's core function doesn't suffer much without it. And ForeFlight's loyal users may not miss it.

GARMIN PILOT

Anyone who starts diddling with Garmin's Pilot app may have the vague notion that they've seen it before, which is quite intentional. Pilot is modeled on the basic interface of Garmin's most recent dedicated portable GPS navigators, the aera series. Like WingX, it's menu driven from a home page. That means when you get stumped, pushing the home key gets you back to mental bedrock.

Pilot's strength is its moving map and combination navigation display. Like WingX, it has a split screen which can be displayed as a single map with VFR sectionals, IFR enroutes or WACs. These can be overlayed with weather displays, including radar and satellite among 10 choices.

Pilot also offers a version of Garmin's traditional flight panel, which includes an HSI, an airspeed indicator, an altimeter and a VSI. This display has four customization options. It also sports a G1000-like sidebar with a flight data summary. In our view, no one does this sort of thing better than Garmin.

As with ForeFlight, approach charts go into binders automatically sorted into departure and destination, a nice touch. You also automatically get all of the approach plates, with each thumbnail clearly labeled to be touched and expanded. As with other apps, geo-referencing is an upcharge. For weather and traffic, Pilot plays with the GDL 38 portable ADS-B receiver. (See Aviation Consumer September 2012 for a review.)

What it needs: To meet the ForeFlight standard of support, we would like to see easily accessible training videos for Pilot. It does have a complete manual that's well indexed.

Garmin, top, carries the flight panel page from its portable GPS into the Pilot app. ForeFlight, lower, has an excellent flight and nav log.

MYWINGMAN

Bendix/King last summer introduced its own app developed with Seattle Avionics, myWingman. Bendix/King's aim is to gain marketshare generally by introducing avionics that are less expensive and easier to operate than the competition and myWingman is designed accordingly.

Rather than step-through menus or buttons, the app is what Bendix/King calls "flat." The app's main control point is a function wheel which appears as a thumbnail in the lower right of the screen. Touching it expands it to reveal an app-style thumbwheel to scroll through nine primary functions. This is not so much easier, in our view, as it is different. But it's easy to master.

myWingman can have up to three split screens, easily selected from a touch icon in the upper left of the display. However, the function wheel only applies to the bottom screen, so to reset what you want to see, you use two fingers to drag the panel into the lower display, effecting the swap. A novel solution but, again, no better than WingX's quick-acting swap button. Still, there may be instances where having the third panel, say to look for fuel prices or glance at airport info, would be handy.

Speaking of airport info, both myWingman and FlyQ excel at this.

continued on page 32

Rotax 912 iS Flight: Economy, Premium Price

Flight Design hits the market with Rotax's new electronic engine. Preliminary data shows improved fuel economy and easier starting.

If avionics move forward at the speed of light—well, sound anyway—aircraft engine progress is rather more glacial, but it is progressing as we reported last spring with Rotax's rollout of the new 912 iS. Although a few months late, the new engine is finally delivering in volume and we flew one in a Flight Design CTLSi, a new version from the leader in LSA sales.

To speed the uptake, Rotax intended the 912 iS to be a bolt-up option for manufacturers and it basically is that, although some minor airframe mod requirements mean it's not exactly an afternoon swap-out project.

Just as Rotax predicted, the engine delivers better fuel economy over the 912 ULS used in many LSAs and its operation is somewhat simplified. (Not that the ULS exactly required a flight engineer.) But you'll pay for the privilege of knocking the fuel burn down by a half a gallon. The asking price of the CTLSi is nearly $13,000 higher than the standard model with the 912 ULS Rotax. Presumably, there will be some payback in lower maintenance costs, but that'll be for the future to prove.

The 912 iS, left, is the same physical size as previous Rotax models, but its installation is about 12 pounds heavier.

CHECKLIST

- **As promised, the 912 iS is an incremental improvement over the ULS.**
- **Fuel flow appears to be about 0.5 GPH less for equivalent speed.**
- **We need side-by-side operational data before drawing conclusions.**

BACKGROUND

As we reported in the May 2012 issue of Aviation Consumer, the 912 iS ups Rotax's game considerably, although it's hardly what we would call a radical leap forward. It does directly address one major complaint Rotax owners have voiced: repetitive carburetor maintenance.

The 921 iS doesn't have that problem because it doesn't have carburetors. In place of the two altitude-compensating Bing carbs the older engines had, the 912 iS sports electronic fuel injection. It's port type rather than direct injection, but we're happy to take what we can get to lose the Bings.

Direct injection might have tweaked a bit more economy out of the engine, but when we visited the company's Gunkirchen, Austria, plant last spring for the rollout, we were told that the 912's combustion chambers and cylinders would have required redesign to accommodate direct injection and the company decided the juice wasn't worth the squeezing. We would surmise they'll be proven right.

The cylinders themselves have improved cooling flow and the crankcase has also been modified to improve oil flow and scavenging. Overall principal dimensions and piston/crank geometry remain the same.

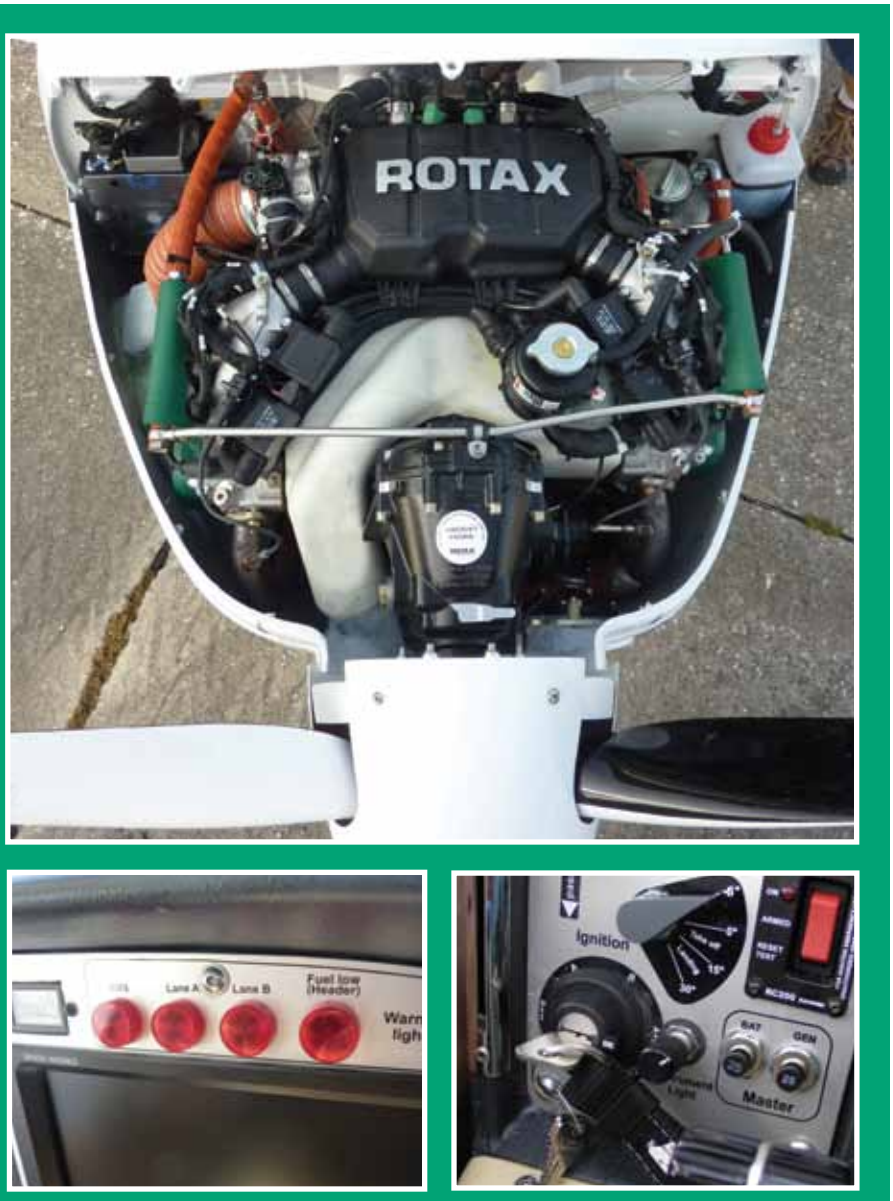
At a glance, the 912 iS looks like a modern automotive engine, as well it should since the fuel injection and ignition is set up like a modern car. It even uses automotive spark plugs. A large plastic induction box dominates the top of the engine, with induction tubes running out to each cylinder.

The airbox is sensor rich, with MAP and temperature probes and EGT sensors for each cylinder. Interestingly, the engine can also be equipped with automotive-type

acoustic knock sensors. They aren't currently programmed into the ECU architecture but may be in the future. The 912 iS can operate on 100LL or automotive fuel containing up to 10 percent ethanol. (Flight Design also approves use of E10; some manufacturers do not.)

The 912 iS is, not too surprisingly, considerably more electrified than is the 912 ULS, which presents challenges for the companies installing it. Critical to the set-up are a pair of high-pressure fuel pumps (43 PSI) to charge the fuel injection system. The pumps are small and contained in a single metal housing. Manufacturers are left to their devices on where to put the pumps, and Flight Design put them in the baggage compartment, along with a small fuel header tank.

The 912 iS has a dual permanent-magnet alternator setup that provides power to operate the engine without ship's voltage. The PMA's magnets are on the rotating flywheel and the coils are fixed, bathed in oil for cooling. Either alternator can run the engine, but they aren't of the same capacity. Alternator A is 16 amps and normally runs the pumps and ECU, with an amp to spare. Alternator B has 30 amps of capacity and comes online automatically when the engine reaches 3000 RPM. Load management is handled by a Rotax-supplied fusebox or load center. This box also supplies DC output for ship's electrics and battery charging. Rotax provides provisions for a third, external alternator for additional backup and capacity, which Flight Design will offer as an option.



The 912 iS, top, looks more like a modern automotive engine than any aircraft motor. Large black object is the engine's induction airbox. Four warning lamps, lower left, indicate health status of the ECU's two channels. A runup ignition check is called for, lower right, but the ECU does its own self diagnosis.

CTLSI

Flight Design considers the CTLSi simply an extended variant of the CTLS, not a new model. Although it's close to a bolt-up, there are some minor changes to the airframe. The aforementioned fuel pumps are in a floorboard enclosure in the baggage compartment, where the fuel header tank—a hard, translucent plastic design—also lives.

The CTLS fuel system has two tanks totaling 34 gallons with a single on-off valve on the center console. The CTLSi keeps the two tanks, but the fuel line is routed through a left/right/off valve from the tanks to the header and the two pumps. The pumps deliver pressurized fuel to the injection system. The system requires a return line to the header tank and header venting through the main tanks. This design strategy continues something we're seeing more of in LSAs: fuel introduced inside the cabin of the airplane. However, in the CTLSi, there's a hard bulkhead between the baggage compartment and the occupant compartment, so this mitigates the risk. Still, in our view, fuel kept outside of the fuselage is a better design strategy.

The 912 iS adds a bit of weight to the basic airplane—about 12 pounds. This is due to additional hardware such as the pumps, the header tank and the fusebox/load center. Empty weight of the CTLSi we flew was 841 pounds. That leaves 479 pounds of useful load or, with full fuel, 275 pounds; basically a one-person airplane with generous baggage. (Allowable weight in each rear compartment is 55 pounds.)

Flight Design's Tom Peghiny told us that the installation of pumps and header tank moves the CG aft, but doesn't reduce loading flexibility. "If anything, I thought it makes the airplane a little easier to land, with the more rearward CG," he said. We didn't have both variants available for trial, so we can't confirm that observation. Rotax said that flying the 912 iS should be transparent to the pilot and

On our CTLSi flight, left, the Dynon Skyview indicated between 112 and 115 knots TAS on 4.3 GPH. The most noticeable difference in the 912 iS-equipped airplane are the cowl blisters, lower photo, to accomodate the fuel rails.

it is that. In fact, it's a little easier because the choke is no longer required. Start-up is car like, as Rotax intended, whether hot or cold. No engine preheat is required in cold weather nor priming in hot weather.

Rotax engines are peculiar for requiring a specific warm-up period and so does the iS version. The engine is supposed to slow idle until the oil temperature reaches 120 degrees F, at which point the throttle can advance to 3000 RPM and the second alternator, which remains dormant until that point, comes on line and begins charging the ship's battery. Otherwise, the engine runs on the smaller PMA and the airplane systems draw on the battery.

While we're on the subject of the battery, the CTLSi has a lightweight and small lithium-ion cell that occupies a mounting box on the lower firewall on the right side of the aircraft. It's a German-made product made by Super-B. Although it's a huge weight saver, as we reported in the August 2012 *Aviation Consumer*, we're not entirely convinced lithium-ion is ready for mainstreaming in aircraft due to fire concerns. However, Super-B assures us, they've had no fires or explosions and the battery is equipped with cell-balancing charging protection circuitry.

The CTLSi's ignition switch is what looks like a standard four position key switch, but closer examination reveals that rather than the traditional right and left mag labels, it has "Lane A" and "Lane B." This reflects Rotax's two-channel design architecture for the 912 iS's ECU. Rotax had the ECU's maker, Rockwell Collins, set Lane A as the default with Lane B running in parallel hot standby. Either channel will operate all of the cylinders.

On startup, the system flashes lane-labeled lamps on the right instrument panel, which signals passing self diagnosis and fault detection. If the lights go out, the ECU is happy with itself.

Theoretically, no run up is required, although the POH calls for one anyway, which we found puzzling. So did our demo pilot, Brian Boucher and Flight Design's Peghiny. Both surmised that this step may be eliminated in future checklists.

Takeoff and flight are unremarkable. The engine has the same 100 HP as the ULS version, so it's no surprise that its climb and cruise performance are similar—with one exception. The fuel burn is lower, although we can't say how much lower it is without a side-by-side comparison with a 914 ULS CTLS. The CTLS POH is a bit sketchy on fuel consumption vs. speed comparisons, but Boucher told us the ULS version cruises at about 115 knots on a little over 5 GPH. Other LSAs in this class typically burn between 5 and 5.5 GPH in cruise.

On our trial flight, we trimmed the airplane up at 4000 feet and saw 115 knots on 4.5 GPH, which concurs with Boucher's observation that it was burning about a half-gallon less than the 912 ULS for equivalent speed. Rotax said when it introduced the engine that it might have 20 percent better fuel economy. Well, it might, but we can't swear to it yet. When we fly it head to head against a ULS engine, we'll have better data. For now, we're comfortable saying it's more economical—we're just not sure how much.

CONCLUSION

The sales pitch for the 912 iS for all of the LSA makers who will offer it—and we suspect that's going to be all of them that now have Rotax engines—is likely to be a combination of slightly better economy, better flyability and lower maintenance. And this may be a good thing, because its payback on fuel savings for an owner flying 100 hours a year will be slow in coming, unless an owner is willing to use mogas, which Peghiny says the company will begin to promote.

Flight Design's base price on the 912 iS version of the airplane is $152,500 versus $139,800 for a comparably equipped 912 ULS CTLS. (Both will remain available for now.) That's a $12,700 price premium or about 9 percent. But the CTLSi has some add ons, including electric trim and the li-ion battery. At those prices, both versions get a BRS parachute system, which we think is a good idea in an LSA. Also, Flight Design is discounting early purchases by $8000, making the price difference only about $4000.

For now, we think the claim of better fuel economy is conditionally evident in the 912 iS, but we need better data to say if it's meaningful, plus some experience with other model aircraft. The real payoff is likely to be reduced maintenance intervals, easier starting and smoother running; no more out-of-sync carburetors. On that count alone, CTLSi owners might come out ahead.

Garmin's New GNC255: Intelligent Navcomm

Garmin's new line of feature-rich navcomm radios set a new standard, beating Bendix/King to the punch.

by Larry Anglisano

Over the years, the role of the standalone navcomm radio has changed from a primary system to backup, often playing second fiddle to all-in-one integrated mapcomm systems. But we've wondered if the traditional navcomm radio might make a comeback if it had more advanced features—perhaps a built-in database for searching frequencies and better yet, an interface that can connect with a panel-mounted GPS for sharing data.

Garmin has done just that—replacing their current line of SL-series navcomms with a completely redesigned line, to include the GNC255 navcomm and comm-only GTR225. These radios are engineered using technology which comes from high-end panel-mounted avionics in the Garmin line.

The new navcomms have plenty of smart features, can interface with portable and panel GPS units, and are compatible with a healthy variety of nav displays. We think the GNC/GTR products are the evolutionary radios the industry has been waiting for.

FAMILY TIES

The localizer and glideslope equipped GNC255-series and comm-only GTR225 replace the SL30 and SL40 line of navcomm equipment, although they aren't plug—or size-compatible. These slim-line radios were designed by UPS-AT and Garmin acquired the product line when they bought the company. While the SL-series was a decent seller, many buyers recognized that the units in the SL line weren't a true Garmin design, especially when racked together with a GNS and current GTN navigator.

That's not the case with the new GNC and GTR radios, which borrow sizeable amounts of styling and features from several products in the current Garmin line—including the GTX300-series transponder. Moreover, the digital nav and comm boards inside the new units come from the current GTN navigators. Even the control knobs and buttons will be familiar to those accustomed to pawing popular Garmin products like the G1000, for example.

The GNC255 and comm-only GTR225 will be familiar to those who've used other Garmin panel-mounted units. It borrows excellent ergonomics from the GTX300-series transponder and GNS navigators.

SIZING IT UP

While not as compact as the Slim Line series they replace, the new navcomm units stand 1.65 inches high with an LCD display area that measures 3.46 inches wide and 0.84 inches high. That's similar to the display on a GTX327 or GTX330 transponder, but these new units have much improved backlighting—which can be adjusted by the user or auto-dimmed with an on-board photocell. The display has a wide 45-degree viewing angle, which isn't bad for LCD technology of that small size. The trade-off for a larger display is a larger chassis and bezel, so the new radios aren't as space-efficient as the older SL-series.

The navcomms use traditional buttons and control knobs, and Garmin resisted the temptation to make these new units touchscreen. We found the basic controls simple to use right away because they're designed exactly the way pilots would expect on a traditional navcomm. In fact,

CHECKLIST

- ⊕ Generous interfacing, including portable GPS connectivity.
- ⊕ Compatible with a variety of nav displays, including the Bendix/King KI209.
- ~ Not plug-compatible with the discontinued SL-series navcomms.

On the install floor, the units impress with rugged connectors plus integrated cooling fan, top photo. On the bench, the new GNC/GTR radios are everything a tech might ask for, including a built-in USB port for loading software and updating the airport/VOR database, center photo. Compatibility with Bendix/King nav indicators should reduce the cost of upgrading tired King navcomms, bottom photo.

the volume controls, squelch control and navigation radio IDENT control layout and functionality is borrowed from the Garmin GNS430 and 530 navigators. Plus, frequency tuning is the same as it ever was— simply dial the frequency on the standby window on the right and transfer it to the active window on the left, using the familiar flip-flop transfer button. Compared to the older SL-series, the controls on these new navcomms are kicked up several notches—with a durable and solid feel that is similar to that of a GNS530 or G1000. We've heard from users over the years who felt the older SL series felt cheap. That crowd will be pleased with the new line, in our estimation.

CONNECTIVITY

The GNC/GTR may seem like traditional navcomm radios on the outside, but digging into the interface potential reveals the most advanced radios we've put on our bench. First, the digital nav and comm boards come from Garmin's current GTN700 and 600 series navigators. Standard is a 10-watt comm transmitter, with an option for 16-watt transmitter, which better suits the needs for high-altitude and jet ops. There's also 8.33 kHz spacing to accommodate the proposed European requirements and future airspace growth.

As most technicians would welcome, Garmin built a USB port on the upper right corner of the front bezel, which is used to update software and an internal database. No need to wire a remote USB port in the harness. To keep the unit cool, there's a cooling fan integrated into the chassis to draw forced-air cooling through the unit, plus inlets along the right side of the GTR/GNC chassis that allow air to flow through the unit. We powered the unit for long periods of time and the unit remained efficiently cool, while the cooling fan kicked on when appropriate.

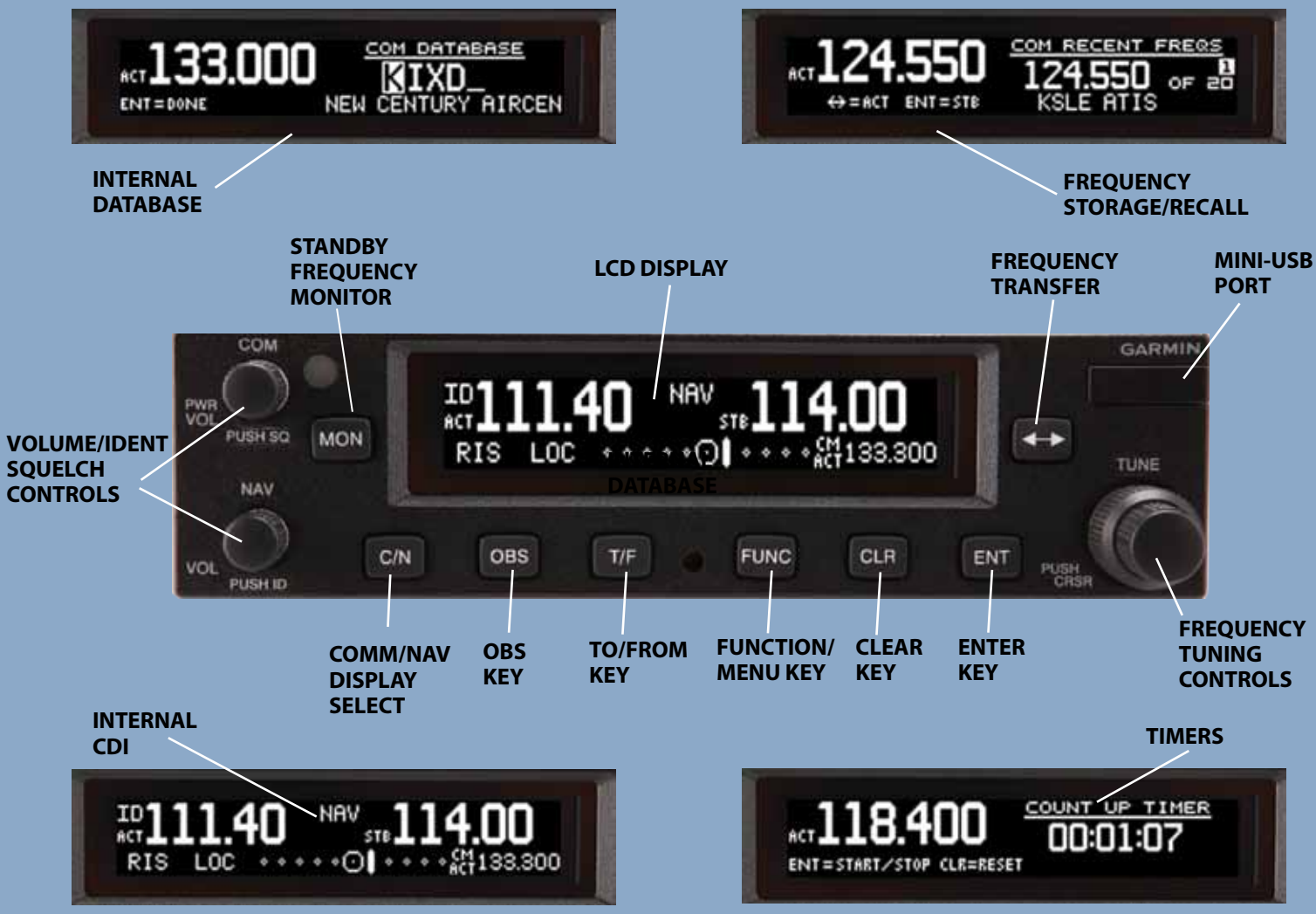
The GNC255, which has built-in glideslope, can interface with a wide variety of navigational displays, including the Garmin GI106A CDI, Garmin G500/600 PFD and the G3X, plus it has compatibility with some Bendix/King CDI units—including the popular KI209, when wired for analog composite output. This Bendix/King indicator compatibility will make existing KX155 and older KX170 radio upgrades cheaper. The GNC is also compatible with the Bendix/King KN62 and 64 series for displaying on-screen DME data, while pressing the OBS key displays the current OBS setting and a graphic CDI. While there's no mention of compatibility with Aspen displays, the composite output format might work. There's also an ARINC 429 databus output.

Speaking of Aspen, we think these navcomms might be more versatile if they could interface with Aspen's Connected Panel wireless gateway.

SMART TALKER

The interface doesn't stop at the navigation receiver. It's the comm radio interfacing that makes the GNC/GTR units more advanced than any radio available for retrofit. It starts with an internal frequency database of airports and VOR stations. This data is provided for download on the Garmin web site and loaded to the unit with a thumb drive. Pressing the Function key enables the menu structure where you can select the database feature to look up the airport name or station ID, much like you would in a GPS. There's also a reverse lookup feature, which fetches the facility name associated with the frequency that the user manually tunes, using the database and a valid GPS position input. Further, when the radio has received data from an external GPS receiver or DME, it displays distance, speed and time to station.

Once the frequencies are tuned, the monitor function allows for listening to the standby frequency without leaving the active frequency. For example, while approaching the airport, with the ATIS tuned into the standby, simply press the monitor button to copy the information. When the Active frequency



receives a signal, the unit will switch automatically to the Active frequency.

Pilots seem to like frequency storage and the GNC/GTR radios deliver—15 frequencies can be programmed, while the radio automatically stores the 20 most recently used frequencies.

The radios have liberal amounts of databus interface, which opens the door for playing with panel and portable GPS units. Garmin told us the unit accepts the industry-standard Aviation In RS232 serial label, which makes it a player with most panel GPS systems, while the NMEA interface makes it compatible with later-model portable GPS units, including the aera796/795 and GPS696/695, for pushing frequencies.

Other features include Morse code station identifier decoding for VOR and localizer stations, an integral two-place intercom, on-screen timers and auxilliary input for music, making the units worthy for standing alone in the stack.

FILLING THE VOID

At $4495 for the GNC255A navcomm ($5495 for the 16-watt GNC255B) and $1995 for the entry-level, comm-only, 25 kHz GTR225, we think these radios fill a void in a market which still has a need for standalone navcomm equipment. That's because traditional navcomms are popular for backing up GPS mapcomms. The discontinued GNC250 and GNC300 line of GPS/comm radios filled that void and were brisk sellers. We expect the new GNC and GTR to take over that role.

There are plenty of owners that don't have the budget for an integrated navigator like the entry-level Garmin GTN650 or even a used GNS430. Further, we think the GNC255 could be an excellent fit for lesser aircraft, including new and legacy LSAs. The ability to connect with a portable GPS enhances the interface and sweetens the deal.

Then there's a calling navcomm replacement market. As the iconic Bendix/King KX155 is aging, many owners are looking for a fresh upgrade that won't result in major and expensive teardown. Although the reliable KX155-series is still offered, we expected Bendix/King to tackle that market—perhaps with a modern, drop-in replacement for the KX155. They could very well have such a radio on their engineering bench. But for now, Garmin targets the navcomm market, with modern radios that won't bust the budget.

CONTACT

Garmin International
www.garmin.com
800-800-1020

Connected Panel: Aspen's WiFi Gateway

The FAA gives the nod to Aspen's CG100 Connected Panel interface, advancing the concept of wireless avionics integration.

by Larry Anglisano

The thought of a wireless tablet computer interfacing with IFR-certified, panel-mounted avionics is enough to make an FAA inspector squirm in his polyester. Aspen Avionics—who has a knack for obtaining product certifications in short order—recently slid this concept and its CG100 WiFi hardware through FAA certification channels and earned STC approval.

Connected Panel is an interface that's sparking interest from a growing list of avionics manufacturers and app designers who are committed to joining Aspen's open architecture. Could this be the start of WiFi-driven avionics? We think the system has serious growth potential and is worth considering when installing a multiscreen Aspen suite.

WIRELESS GATEWAY

The $2499 Connected Panel is essentially a communications network for flowing data from mobile devices—mainly Apple, for now, into compatible panel-mounted avionics. This data can include flight plans and comm radio frequencies, for loading into a GPS navigator, mainly Garmin's GNS400W/500W and the future Aspen KSN770. Thanks to the wireless gateway, data can flow both ways—to or from the mobile device. For example, if you've ever wanted to send engine and fuel data into your iPad, Connected Panel could be the avenue for doing so, as long as there's a compatible app designed for the task. More on that shortly. But no matter the data, the important aspect of the interface—and likely a convincing basis for FAA certification, is that the data first flows into Aspen's certified multi-function display, using Aspen's now-certified CG100 wireless connected gateway. Aspen refers to the MFD as a firewall because this is where the transfer of uncertified and certified data takes place.

The CG100 gateway is a compact, remote WLAN transceiver which weighs one pound and operates on 14 or 28 volts. It connects to the Aspen 500 and 1000 MFD by way of an Ethernet databus and then connects to compatible panel-mounted avionics through a serial RS-232 databus.

For connecting with the mobile device, the CG100 has a WiFi antenna which is generally mounted inside the cabin. For convenience, the antenna can be separated from the transceiver using a run of coaxial cable and mounted in a sidewall, headliner or in a bulkhead.

CONNECTED PILOT

Connected Pilot is the first in a series of planned Connected Panel products. The package includes the CG100 hardware and interfacing software that connects Apple iOS devices to the Aspen MFD. At this point, the system won't work with a standalone Aspen PFD—you'll need a second-screen MFD display.

The CG100 can receive and store data from almost any panel-mounted GPS navigator. Additionally, Connected Pilot can enter and synchronize flight plans between Garmin GNS400W and GNS500W series navigators and forthcoming Connected Panel-enabled flight planning apps. This uploaded, uncertified data can't flow directly into the certified panel-mounted system. It first has to

Aspen's $2499 Connected Pilot suite includes the hardware and interface software for Apple iOS mobile devices, top photo, for commanding the FAA certified CG100 wireless gateway, lower photo. It talks with panel avionics on a serial RS-232 databus.

go into the Aspen MFD. From there, it's up to the pilot to acknowledge the presence of this data and then manually send it off to the intended panel-mounted system. For now, the interface doesn't allow the loading of instrument procedures.

The big concern with a wireless interface is the potential for losing control of the data flow. As automated as Connected Panel is, Aspen makes it clear that the data stream is a managed interface, with pilot-verified interaction.

CONNECTED PARTNERS

The growing list of participating avionics and aviation app manufacturers is proof that Connected Panel is a concept with legs. The short list of committed partners includes Jeppesen, Bendix/King, AvConnect, JP Instruments, Hilton Software, ForeFlight, PS Engineering, Seattle Avionics and Sporty's, to name a few.

Jeppesen offers synchronized upload and download route planning capabilities for Connected Panel. For example, route planning data created with Jeppesen Mobile FliteDeck on iPad can be transmitted for overlay on the Aspen MFD. GPS-based ownship position data can also be transferred through the Aspen gateway to Mobile FliteDeck. This interface will show position on Jeppesen airport diagrams and enroute charts. The on-screen rubber-banding feature in the app will amend route plans on the iPad and then transmit the revised data through the Connected Panel gateway.

AvConnect, a developer of online and mobile products for pilot record-keeping—including flight logs, maintenance tracking, engine diagnostics and performance trending information, has the Aircraft Manager app, which downloads flight data stored in the CG100 gateway. According to AvConnect founder and CEO Erik Murrey, the app and the WiFi interface with Connected Panel answers a call for ridding the tedious paper chase that's required of maintenance recording and management.

The Aircraft Manager app automatically fills in an electronic aircraft and pilot logbook with a custom flight strip. This updates the aircraft's times in the AvConnect maintenance tracking archives. From there, the data can be accessed on a cloud and through email and analyzed for predictive maintenance or diagnostics.

Airframe flight data, including AHARS-derived pitch, bank, roll and ground speed, plus other flight data, including GPS waypoints recorded from Garmin's GNS navigators, are logged to the CG100 during flight. The data, according to Murrey, is valuable to fleet operators and training establishments looking to increase efficiency.

SOFTWARE LOCKOUT

The downside to this evolving technology has already been proven with Garmin's new software 5.0 update to the GNS400W and 500W navigators. The optional software has rendered Connected Panel useless for GNS flight planning functions. Further, Aspen says it is unable to obtain integration specifications that enable ADS-B compatibility with Garmin's GDL88 system.

Aspen issued a statement to customers and the dealer network, saying they'll continue to foster an open integration philosophy within the avionics industry. Further, Aspen urges all manufacturers to follow such an approach for the common good of general aviation. While we don't consider this snag to be a deal-breaker, you'll need to accept potential software incompatibilities in a changing and competitive market. Contact Aspen Avionics, www.aspenavionics.com, 800-322-8346.

CHECKLIST

- ✚ A wireless gateway is an efficient way to move data in the cockpit.
- ✚ Major manufacturers are busy designing compatible Connected products.
- ⛔ Not Garmin—new GNS software hinders some compatibility.

Connected Panel requires at least one Aspen MFD, serving as a firewall between other panel systems and mobile devices. AvConnect's Aircraft Manager app, middle, uses the gateway to keep track of upcoming maintenance events and pilot currency. Jeppesen's Mobile FliteDeck 2.0, bottom, provides interactive upload and download of flight plans.

Speed: Buying 180 Knots for $180,000

There's a good selection of reasonably priced, fast piston singles out there. Just make sure maintenance is up to snuff before you buy.

by Rick Durden

Speed matters. Ask any pilot. Frustratingly, speed costs money and lots of speed, as the warbird set says, costs cubic money. In the single-engine piston world, we'd each love to blast across the sky over 230 knots in a Cessna TTX, yet for most, the exchequer doesn't quite stretch to the nearly three-quarters of a million dollars needed to buy one.

In this day and aviation market age, a $180,000 purchase price isn't out of line, especially if it's split a few ways. Moving through the air at 180 knots is cooking along nicely, so in keeping with our general fascination with symmetrical numbers, we decided to create the 180 for 180 club and then find out what airplanes are qualified to join—those that have a real-life cruise speed of at least 180 knots and a Bluebook value of $180,000 or less.

It turns out that a nice selection of airplanes qualify for the club. Naturally, our research lead to a number of caveats—few of the airplanes in the speed and price range were built in this century, and every single one of them is of sophisticated design with complex systems, so a careful pre-buy carried out by a maintenance technician who knows the type of aircraft is essential if you are going to avoid purchasing yourself a financial nightmare.

Always keep in mind that if these airplanes were being manufactured today they would cost three-quarters-of-a-million bucks, so you are not maintaining a $180,000 airplane—you are maintaining a three-quarters-of-a-million dollar airplane.

We found that after-market mods turbocharging and turbonormalizing, boosted cruise speeds past the magic 180-knot mark for many airplanes, but often added enough market value to the airplane to push it past our limiting number.

One mod is simply too new to evaluate—putting a Continental TSIO-550 into a normally aspirated Cessna 210 easily raises its cruise speed above 180 knots, but the mod has not been around long enough to generate data on the change to the market value of the airplane.

Finally, we found that the consistent rule of thumb to determine how many people, with modest baggage, you could carry with full fuel, most of the speedsters was to take the number of seats installed and subtract two.

With a 310-HP turbocharged engine up front, the Rocket conversion of the Mooney M20K will cruise at 220 knots, above left. Turbocharging or turbonormalizing allows the V35 Bonanza to cruise at 200 knots, left.

MOONEY

For decades Mooney had an unimpeachable rep for speed with modest horsepower—the airplanes went like crazy while sipping gas. Yet it wasn't until the company decided that hanging big engines was okay that their airplanes crossed the 180-knot cruise threshold. The M20K 231 brought back turbocharging to the line after the company's brief fling with it in the M22 Mustang—stay away, although that 1960s pressurized airplane can be bought for $57-$63,000 and cruises at 200 knots, maintenance issues and parts availability make it a nonstarter for an owner that doesn't want a full-time project airplane.

The 231's real-life cruise speed is about 170-175 knots, so it doesn't make the cut here; however, in 1986 Mooney installed a slightly different, more efficient, intercooled engine of the same 210 HP, the TSIO-360-MB1, made a few more airframe tweaks and changed from a fixed wastegate to a density controlled, variable wastegate.

The payoff was a 10-knot cruise speed increase. Owners report 200 knots at FL210 while burning 11.5

Turboed Bellanca Super Viking, right, offers sports car handling and maintenance challenges. Cessna P210, below right, is the only pressurized airplane to make the 180 for 180 club.

GPH. With 75 gallons usable fuel aboard, range, with VFR reserves, can approach 1000 nm when cruising in the flight levels. Real life payload with full fuel is as low as 360 pounds and rarely more than 450 pounds.

The 1986-1990 252 series fell within our price range, Bluebook values run from a low of $125,000 to $165,000.

After the 252 went out of production, Mooney brought it back briefly as the Encore, bumping the horsepower to 220 and increasing the useful load by 200 pounds. Bluebook for the 1997 M20K Encore is $170,000, for the 1998, $180,000.

Two discontinued conversions by Rocket Engineering used the short-body Mooney airframe and turned a merely fast airplane into a screamer. The Mooney Missile is an M20J with a 300-HP IO-550-A up front. Cruise speed jumps to as high as 190 knots. The Mooney Rocket is an M20K with a 305 HP TSIO-520-NB engine and full-feathering prop. Cruise speed is as high as 220 knots in the high teens. While the Bluebook does not price these mods, we saw Rockets on the market recently with asking prices of $170,000.

One long-body Mooney met our parameters. The M20M TLS, with its turbocharged 270-HP engine cruises at 190-210 knots. Bluebook values range from $128,000 for a 1989 model through $168,000 for one built in 1995.

As with all Mooneys, watch for corrosion, particularly in the cabin frame tubes and for fuel leaks.

BEECHCRAFT

Even with but 185 HP, the original Bonanza demonstrated that it was speedy. In 1966, when Beech created the 285-HP V35TC, it put a 200-knot single into the sky. While Beech never, in our opinion, quite got the turbocharging right on any of its Bonanzas, the V35TC served notice that the 285-HP short-body Bonanzas, 33 and 35 series, especially the lighter weight ones, would really boogie at altitude if turbocharged. The production run for the turbocharged V35s was but four years and Bluebook prices values from $69,000 for a 1966 model to $85,000 for one from the 1970 model year.

For the long-body Bonanza, the 36 series, the turbocharged A36TC and B36TC cruise faster than 180 knots at altitude, and many fall within our price parameter. While cooling and fuel burn has been a chronic issue with these airplanes, making us cautious to recommend them, the 1979 A36TC at a Bluebook value of $130,000 through the 1984 B36TC at $175,000 will give you the ability to carry four plus baggage with full tanks at over 180 knots by climbing to the upper teens.

Because the Bonanza line has been the beneficiary of what might be considered a mother lode of modifications, a buyer with a need for speed and a budget should, in our opinion, look for a Bonanza that has the Tornado Alley Turbo turbonormalizing mod. This conversion is available for all IO-520- and IO-550-powered Bonanzas and provides sea-level horsepower up to 20,000 feet.

The mod currently costs just over $50,000, depending on additional work performed but, according to brokers we've spoken with, unlike $50,000 worth of glass panel installation, holds its value well on the used market. It is always cheaper to buy an airplane with the mods you want rather than paying to have them done, however, we heard numbers as high as $40,000 in market value bump for normally aspirated Bonanzas and Cirrus SR22s that had the turbonormalized mod.

A 1974 V35B Bonanza has a Bluebook value of $87,000. Turbonormalized, with a tip tank mod that boosts its gross weight from 3400 to 3600 pounds, it will carry 600 pounds in the cabin with 100 gallons of fuel aboard and fly 1000 nm at 200 knots with VFR reserves. Allowing the most optimistic market bump for the turbo mod and something for the tip tanks, the airplane still comes in under $180,000.

The long-body 36 line started in 1968 and is still in production. Bluebook value for a 1968 36 is $57,000. Turbonormalized, it will cruise at 185-190 knots. Assuming a $40,000 bump for turbonormalizing, and putting a $140,000 ceiling on Bluebook prices for the normally aspirated 36 series, everything up through the 1982 A36 at a value of $140,000 falls within our 180 for 180 envelope.

CESSNA

Cessna pioneered general aviation turbocharging in 1962 with the model 320 Skyknight. In 1966, it hung a 285-HP TSIO-520-C on the 210, creating the T210F, an airplane that had no published maximum operating altitude and would cruise at over 180 knots in the flight levels. Refinements, including going to a cantilevered wing

THE 180-KNOT-FOR-$180,000 CLUB

MANUFACTURER	MODEL YEARS	ENGINE	CRUISE	PAYLOAD WITH FULL FUEL	BLUEBOOK VALUE
MOONEY	M20K 252 1986-1990	210 HP TCM TSIO-360-MB1	180-200 KNOTS	360-450 POUNDS	$125,000-$165,000
MOONEY	M20K ENCORE 1997-1998	220 HP TCM TSIO-360-MB1	180-200 KNOTS	560-650 POUNDS	$170,000 - $180,000
MOONEY	M20M TLS 1989-1995	270 HP LYCOMING TIO-540-AF1A	190-210 KNOTS	400-450 POUNDS	$128,000-$168,000
MOONEY/ROCKET ENGINEERING	MOONEY 300 MISSILE 1977-1988	300 HP TCM IO-550-A	180-190 KNOTS	700 POUNDS	NONE GIVEN
MOONEY/ROCKET ENGINEERING	MOONEY 350 ROCKET 1979-1990	305 HP TCM TSIO-520-NB	190-220 KNOTS	650 POUNDS	NONE GIVEN, SOME RECENTLY ADVERTISED FOR $170,000
BEECHCRAFT	V35TC 1966-1970	285 HP TCM TSIO-520-D	180-200 KNOTS	450 POUNDS	$69,000-$85,000
BEECHCRAFT	A36TC-B36TC 1979-1984	300 HP TCM TSIO-520-UB	180-190 KNOTS	620-900 POUNDS	$130,000-$175,000
BEECHCRAFT/ TORNADO ALLEY TURBO	SHORT BODY WITH IO-520 ENGINE 1964-1984	285 HP TURBONORMAL-IZED TCM TSIO-520	180-200 KNOTS	400-600 POUNDS	NONE GIVEN, ASSUMING $40,000 VALUE INCREASE OVER BLUE-BOOK- $97,000-$180,000
BEECHCRAFT/ TORNADO ALLEY TURBO	36 SERIES 1968-1982	285 OR 300 HP TURBONORMALIZED TCM TSIO OR IO-520	180-195 KNOTS	600-900 POUNDS	NONE GIVEN, ASSUMING $40,000 VALUE INCREASE OVER BLUE-BOOK - $130,000-$180,000
CESSNA	T210 1966-1984	285 OR 310 HP TCM TSIO-520 SERIES	180-195 KNOTS	800-1050 POUNDS	$50,000-$172,000
CESSNA	P210 1978-1982	310 HP TCM TSIO-520-P OR -AF	180-195 KNOTS	800-950 POUNDS	$137,000-$177,000
CIRRUS/ TORNADO ALLEY TURBO	SR22 2001-2002	310 HP TCM IO-550-N	180-195 KNOTS	600-700 POUNDS	$165,000-$175,000
PIPER	PA-24-400 COMANCHE 1964-1965	400 HP LYCOMING IO-720-A1A	185-195 KNOTS	600-700 POUNDS	$112,000-$116,000
BELLANCA	17-31ATC SUPER VIKING 1972-1978	300 HP LYCOMING IO-540-K1E5	180-190 KNOTS	500-550 POUNDS	$49,000-$66,000

the next year made the airplane faster. A 310-HP pressurized version was added to the line in 1978, the T210 having been bumped to that horsepower the previous year.

T210s are amazing load haulers, with the full 90 gallons on board, some could fill the six seats with 170-pounders and carry about 10 pounds of baggage. Realistically, the T210s will generally carry four or five adults and baggage with full fuel, the heavier P210s a little less. The 210 series has the longest CG range of any six-place single, so loading it out the aft end is not the issue frequently wrestled with Bonanzas and Piper Lance/Saratogas.

Solid instrument platforms, you can figure on crossing into the 180-knot cruise threshold at 18,000 feet and about 195 knots at FL250. Cessna 210 broker and guru Dan Howard, says he figures on 180 knots on 18 GPH at 18,000 feet in a T210 and adds one GPH for the P210 to keep up with the demands of the pressurization.

Howard recommends looking for an airplane that has had an intercooler added as it helps high and hot performance, engine longevity and adds about $3000 to the resale value.

The 32.5-gallon Flint tip tanks turn the T and P210 into a 1000-nm range airplane and, per owner comments, increase performance at altitude.

Although a $50,000 Bluebook value for a 1966 T210 looks attractive, making sure it's in good shape before plunking down the purchase price is imperative. While the R model T and P210s have held their value so well that all were above our $180,000 max number, all of the other model T210s fell within the box, with the 1984 T210N coming in at $172,000.

The P210 is the only pressurized single that made our 180 for 180 cut—with a 1978 model valued at $137,000 and a 1982 at $177,000.

CIRRUS

The market reacted to the 2001 introduction of the 310-HP, ballistic

parachute-equipped Cirrus SR22 by buying them in quantity. Cruise speed pushed 180 knots rich of peak, but it wasn't quite fast enough to meet our 180-knot minimum.

Since then Tornado Alley Turbo developed a turbo-normalizing kit for the SR22 that proved so effective the factory eventually installed it, with the turbo-normalized airplanes outselling the normally aspirated versions about two-to-one, which matched Cessna's experience with the T210 and 210.

Cirrus eventually developed its own turbocharging system, with the SR22T. Both versions of the blown-engine SR22 easily cruise faster than 180 knots, some making 210 knots at FL230.

With 84 gallons aboard and a useful load of 1100 pounds, the SR22 carries a decent load—600 pounds in the cabin with full fuel isn't bad in a four-place airplane.

The problem we ran into was pricing. For 2010 and more recent airplanes, the Bluebook recommends adding $85,000 to the value for turbocharging. It does not give an add on for prior years. At some $45,000 installed for the turbonormalizing mod, we can't believe the resale value exceeds the cost of the conversion. Our conversations with brokers gave us resale values as high as $40,000 for turbonormalizing, although we think that is still too high for older SR22s.

Nevertheless, even allowing the full cost for the turbonormalizing mod, a potential owner could buy a 2001 or 2002 SR22, have the modification performed and still walk away with $5000 to $15,000 change from $180,000. There are some 950 turbonormalized SR22s in the field and while we didn't see any listed for sale, we have to believe that some can be purchased below our $180,000 number.

The caveat is that those older airplanes are due for the ballistic parachute repack, a $10,000 bit of maintenance, watch the sale price accordingly.

PIPER

Piper's speedsters, the Malibu and Mirage, easily blow past our 180-knot admission ante, however, we couldn't find any for $180,000. At the other side of the stadium, most of the Lance/Saratoga series, even the turbocharged versions, can be purchased for $180,000 or less, however, none of them have a real world cruise speed of 180 knots.

There is one Piper that is a member of the 180 for 180 club—the muscular PA-24-400 Comanche 400. Built in 1964 and 1965 because William Piper's son, Pug, was convinced that turbocharging would never be viable for general aviation and the only way to get a lot of power at altitude was to start with a huge amount at sea level, Piper dropped a 400 HP Lycoming IO-720-A1A into a Comanche. Initially, the airplane had headaches galore, but determination and a dedicated owners group worked them out over the years.

If you want to whistle along at 185-195 knots while burning 20-22 GPH ROP, have some tolerance for taking care of a slightly offbeat airplane and desire attention when you taxi up to the ramp, Bluebook value ranges from $112,000 to $116,000 but notes that the "value of upgraded or restored models may be significantly higher."

BELLANCA

You want quirky and cool? Look at a turbocharged Bellanca Super Viking. Known as exceptionally tough, with a funky turbonormalizing system on a 300-HP Lycoming IO-540-K1ES, this sports car-handling machine will do 190 knots at FL200. With a tube and fabric structure, cramped interior and a 1000-pound useful load, it tends to be an airplane for aficionados and true believers in the marque.

Now orphaned, as its parent company changed hands and went broke a few times, a potential buyer has to go into a deal with eyes wide open for the airplanes are reputed to be a challenge to keep in good working order, engine cooling is not what it should be and the fabric covering means the airplane must be hangared.

Bluebook values range from $49,000 for a 1972 model to $66,000 for one from 1978. While superficially attractive, we can't help but recall a friend's comment when we looked at buying a late 1960s Alpha Romeo, "You're getting all of the maintenance costs and headaches of a Ferrari without the initial price of admission."

CONCLUSION

Once we got into the research, we were pleased to find that the 180 for 180 club was not nearly as exclusive as we'd imagined. Split three ways, for example, it's a way to buy great speed for a reasonable price and have money left over to refurbish the interior and update some avionics.

If it were we, for a four-place airplane—recognizing that it's a two-placer in real life—we'd first look for a turbonormalized, early model Cirrus SR22, or even consider buying one that had not been converted and having the mod done. A very close second would be a turbonormalized 35-series Bonanza with tip tanks, as it would be like being fitted with seven-league boots—we could easily make 1000 nm trips at 200 knots or better.

For a six-place airplane, we like the Cessna T or P210 series with aftermarket intercooling. While a turbonormalized Bonanza has a little better handling, the long CG and payload of the Cessna tips the scales. If our maintenance budget would allow it, the P210 would be at the top of the list as pressurization keeps the family much happier than nose bags and it has one of the quietest interiors of any single.

We'd stay away from the Comanche 400 or Bellanca Super Viking unless we held an A & P rating or truly liked to tinker and had a friendly mechanic to watch over us.

Alternator Repairs: Plane Power Tops

If your charging system quits, troubleshooting will save bucks. If it's the alternator, overhaul is usually best, but there are good new ones on the market.

Staff Report

When pilots talk about problems with their airplanes, alternators tend not to be a subject of the conversations. That's because alternators are pretty reliable, which is a good thing because most of our airplanes have just one and they are run to failure items. However, when an alternator does fail, an owner is suddenly thrust into a confusing world of original equipment replacements, upgrades, overhauls, new manufacturer replacements, core credits, repairs and prices that can vary by 400 percent.

We'll explain what an alternator does, why it's important to troubleshoot electrical system glitches before buying replacement parts and what your options are if your alternator truly has slipped its mortal coil.

THE BASICS

The electrical systems in our airplanes rely on a battery to start the engine. Once running an alternator or generator provides the power for the electrical system and to keep the battery charged.

Alternators can produce their rated amperage output at low engine RPM—important for night ground operations, and a big advantage over generators. However, unlike a generator, an alternator must have electrical power in the system to operate—if you prop start an airplane with a flat battery, the alternator is not going to work.

The alternator takes the electrical power, at least one to four amps, that comes into it through the field terminal and increases it via wires rotating in a magnetic field to the rated amperage, which is available at the output terminal.

A voltage regulator (VR) senses the voltage in the electrical system and varies the excitement to the magnetic field in the alternator, which adjusts the output of the alternator.

The alternator output voltage is higher than the battery rating so that the battery stays charged. Silicon diodes in a rectifier bridge convert the AC power output from the alternator to the DC power the electrical system needs.

Alternators and electrical systems are sensitive to voltage spikes, so an overvoltage relay (OVR) is in the circuit to take the alternator off line if the voltage goes above about 16 in a 12-volt system and 32 in a 24-

A Kelly Aerospace—now Hartzell Engine Technologies—gear-driven alternator in place. Good cooling is a must for alternator longevity.

CHECKLIST

- Overhaul prices are reasonable, with a good selection of shops.
- Plane Power gets raves for its alternators and its customer support.
- Not troubleshooting charging system failures can cost big money.

volt system. VRs that have an OVR built in are referred to as alternator control units (ACU).

Transient voltage spikes will cause a VR or ACU to take the alternator off line. Turning the alternator switch (or master) off for a few moments and then back on will bring the alternator back on line if the problem was transient.

If the alternator doesn't come on line, it's time to reduce the electrical load on the battery (or rely on the standby alternator system) and land as soon as practical to have the system problem fixed.

WHAT'S BROKEN?

We had a number of owners and maintenance technicians emphasize the importance of proper troubleshooting before spending money to replace electrical system components.

Mike Busch, principal of Savvy Aircraft Maintenance Management observed that he has often run into the assumption that if there is a problem with the charging system then the alternator is to blame.

Curtis Hughes, outside sales manager of Quality Aircraft Accessories, an alternator repair and overhaul facility, said that an owner may expect to replace one and maybe two alternators between engine overhauls. If it gets to be three or more, there's probably something else wrong with the charging system causing the problem.

Alternators live in a difficult environment of heat, long times between use and demand for a high percentage of rated power during operation. We had mechanics tell us that in some installations where cooling was an issue because of bad baffling or simply poor design, they would see alternator life drop to as low as 300 hours, whereas alternators in airplanes that were flown regularly had good cooling and were not operating at a high demand, were making as much as 2000 hours before failure.

STANDBY ALTERNATORS: INSURANCE

What happens when your single alternator fails, leaving your fancy glass panel darker than night? In some situations, this is an emergency. If you're lucky, it's a trip-cancelling inconvenience. That's why you might consider a standby alternator. Standbys are becoming a popular option for those who have ditched the vacuum system from the aircraft, perhaps after installing retrofit glass, which legally, have to include appropriate instrument backup.

One popular and approved option comes from B&C Specialty. They offer the $2200 BC410-series— a 20-amp standby alternator that bolts onto to the now-vacant engine accessory pad where the old vacuum pump labored. The B&C product—and others from different vendors—will automatically feed the electrical bus if the voltage drops below a set threshold.

If the primary alternator has completely failed and the draw on the secondary exceeds 20 amps, the annunciator will flash, warning that you have five minutes to shed the extra load. There are various STCs for a wide variety of airframes and there are applications for both 14- and 28-volt electrical systems. But don't plan on getting away on the cheap—a back-up alternator system could flirt with $5000, after installation.

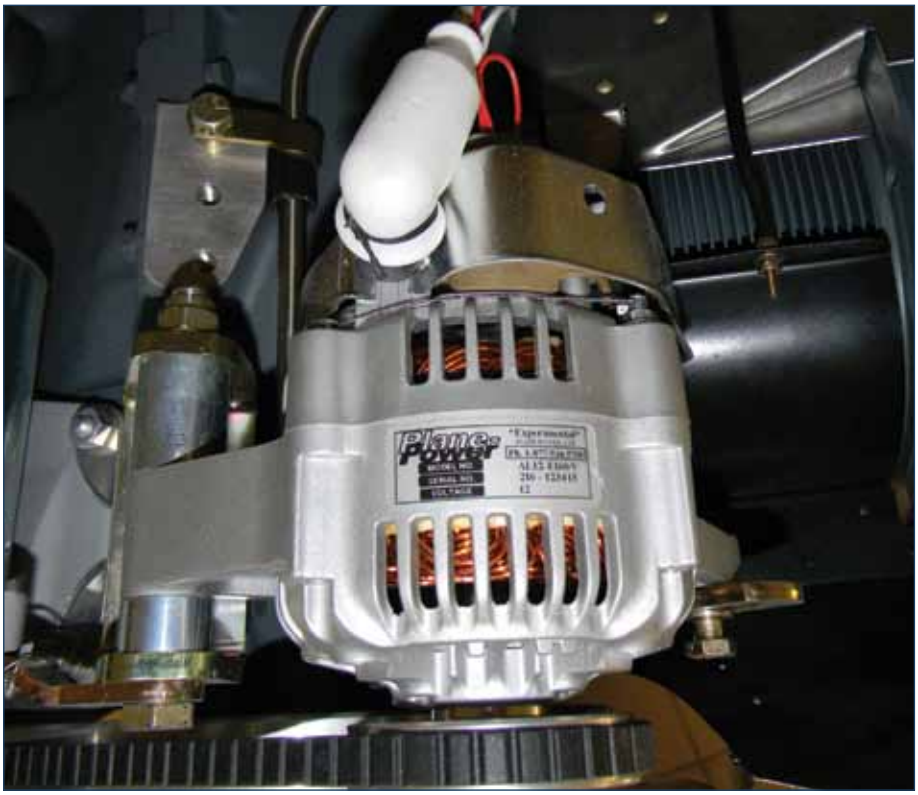
IT'S BROKEN - GENERATOR

For the owner of a generator-equipped airplane that was dealing with a generator which had expired, the unanimous recommendation was to upgrade to an alternator kit.

Derek DeRuiter, proprietor of Northwoods Aviation in Cadillac, Michigan, said that he has been very satisfied with the kits manufactured by Plane Power of Granbury, Texas. The STC instructions are clear and easy to follow, and Plane Power's website includes feedback from owners who have included pictures showing the process of kit installation.

We agree that anyone with a generator-equipped airplane and who does any night flying, should seriously consider spending the $500-$800 for an alternator conversion kit as opposed to the $300-$500 for a rebuilt or overhauled generator. It will improve low engine power

Loadmeter on a dual-alternator Mooney, top. Rocker switches for dual alternator installation, center. Voltage anomaly annunciated, bottom.



A belt-driven Plane Power alternator, installed.

electrical system operation, reliability and get a weight savings of a few pounds.

IT'S BROKEN - ALTERNATOR

For the owner of an alternator-equipped airplane, the number of options available upon death of the alternator are daunting. We learned that most owners tend to simply stick with the original equipment alternator and arrange for an overhauled, exchange alternator to be installed.

Prices vary with the size of the alternator and whether they are belt- or gear-driven, with gear being slightly more expensive. Overhauled alternators are available through numerous sources, from overhaul shops, outlets such as Aircraft Spruce and the various alternator manufacturers. We saw prices ranging from $350 up to $900.

Curtis Hughes of Quality Aircraft Accessories said that he observed that owners usually stick with what was in the airplane, although there are those times that a model simply isn't available. He felt that was the most common reason to cause an owner to buy something different.

If time is of the essence for a replacement, we found that maintenance technicians tend to recommend either going with an overhauled unit from a shop or manufacturer they trust, while returning the dead alternator for a core credit. In most cases, the overhauled alternator can be in the shop the next day.

Where time is not of the essence, we liked the approach taken by Mark Weigand, a maintenance technician in the Detroit area. If the alternator has worked well, he recommends sending it to a good specialist shop with instruction to bench test or tear down and advise. Often the alternator is in good shape and replacement of a $50 or $100 part will put it right for several hundred more hours. If the problem is worse, and the owner has been happy with the alternator, it can be overhauled and back in a week.

We did get consistently negative comments on the longevity of Kelly Aerospace (which has been bought out by Hartzell Engine Technologies) alternators due to perceived poor quality control. A number of the people we interviewed recommended not overhauling those units.

However, we were also told that Hartzell has gone through the Kelly equipment and replaced or upgraded much of it, as well to bring it into compliance with the rest of the Hartzell line and is upgrading QC procedures. This is encouraging, in our opinion.

When we asked maintenance technicians and overhaul shops what companies they'd go to for new alternators the first name we heard was Plane Power. Its dual-cooling fan design and the company's "exceptional" customer service and warranty support were widely praised. Its new, 150-amp, alternator was mentioned by a number of people who noted that because there aren't any airplane systems that demand more than 100 amps, so the Plane Power alternator "must be hell for stout with a rectifier assembly and brushes that are robust," per one commentator.

Others spoke highly of Tempest, which one person referred to as "over-engineered, and I mean that in a good way." He said the price point was higher, but he felt the quality made it worthwhile.

InterAv was felt to be a good unit, but we were told by users that there is sometimes difficulty in the supply chain.

We got recommendations on good overhaul shops, and while we are sure there are more, these got only positive comments from the people we interviewed: T & W Electrical Services, Michigan; Quality Aircraft Accessories, Oklahoma; Modified Aircraft Accessories, Kentucky; Aircraft Systems, Inc., Illinois; George's Electrical Service, California, and Aircraft Electrical Components, California.

CONCLUSION

When the charging system goes offline, make sure that careful troubleshooting is performed before replacing any parts. If it's a generator system, upgrading via an alternator system kit is worth the money, in our opinion. If the alternator is bad, and there is time and it's not a Kelly unit, we suggest having it inspected and repaired or overhauled. If time is of the essence, buy an overhauled unit from a reputable facility or, if you go with a new alternator, we like Plane Power.

Plug-In Power: Extend Battery Life

Power-hungry avionics need external voltage. The Enhanced Flight GPU flows impressive amperage and has a battery tender.

by Larry Anglisano

We've killed enough healthy batteries to know that external ground power is essential. Whether for use during preflighting, toying with newly installed avionics or updating data and flight plans, aircraft batteries can't sustain a charge for long. That's why a portable GPU and a battery charger should be in every maintenance hangar. Enhanced Flight's next-generation plug-in power supplies do both, while also conditioning a battery for increased life. We put the latest generation model 2870A to the test and it earned its keep in just one work day.

BRING ON THE AMPS

Enhanced Flight is branded by Audio Authority, a company with roots in the mobile electronics industry. They originally designed high-end power supply technology and later brought it to the aircraft GPU market. The improved 2870A portable GPU flows an impressive 70 amps of continuous current—that's enough to easily power the on-board systems in piston singles up to light jets. It also boasts 89 percent efficiency, with an extremely stable and noise-free DC power stream intended to replicate in-flight electrical environments.

The physical unit is built inside of a durable, portable housing, weighs 33 pounds and is easily carried in one hand. We found the unit convenient to store and easy to set up, with removal storage caddies that house the rugged interface cabling. It also has a strategically placed digital output meter, which we found easy to read at a glance—even in bright sun. The lesser model 2835A outputs 35-amps—still enough current to easily power smaller piston airframes, like a Cirrus or Malibu, for example.

These GPUs are only compatible with 28-volt electrical busses and are not made for cart-starting turbines. We wondered why the company doesn't offer a 14-volt flavor, but Audio Authority CEO Jonathan Sisk told us that demand for 14-volt GPU systems is low, especially since most newer aircraft are equipped with 28-volt electrics. Further, power-hungry electrical busses are usually found in more substantial aircraft, including larger pistons and turbines. These are the aircraft that heavily rely on critical battery power for preflighting, running on-board environmental systems and for starting.

BATTERY CONDITIONING

The 2870A GPU is more than ground power. It's also an integral battery conditioner, housing the BatteryMinder, a product made by VDC Electronics. Like so-called battery tenders, the BatteryMinder is designed to gently charge the battery as completely as possible and then continuously maintain it. It also modulates high-frequency pulses to break up and dissolve the naturally forming lead sulfate that builds on the battery plates. Unlike chargers, the BatteryMinder won't cook a battery—automatically adjusting its output in response to an ambient temperature sensor built into the interface cable. The system is also useful for quick battery top-offs.

An optional airframe interface kit with polarized mating plug allows hardwiring the BatteryMinder for easy plug-in. It's FAA-approved and is a minor alteration. The 2870A, which has the integral BatteryMinder, is $1445 plus the $59 hardwire kit. The smaller model 2835A is priced at $1045—a good value, in our view.

70 amps is plenty of juice for powering systems in small jets. The VDC BatteryMinder, top, is integrated with the GPU but can be purchased separately and hardwired for easy plug-in.

CONTACT

Enhanced Flight Group
www.audioauthority.com/GPU
800-322-8346

Piper Tri-Pacer

Piper's first trike offers economical operation, more speed than older 172s and excellent handling.

There was a time when almost all light airplanes had tailwheels. They were cheaper and lighter to build than nosewheel airplanes and, besides, "we've always done it this way," has always been very powerful in guiding design decisions. In the little airplane world, save for a few non-conformists such as the Ercoupe, Navion and Bonanza, tailwheels ruled.

By the late 1940s, the all-metal Luscombe had been around for 10 years, Beech and Cessna were going all-metal and the Piper Aircraft Corporation was seen to be lagging the field because it was still making its wide range of airplanes of mostly fabric stretched over a wood or metal frame.

Piper had seen the popularity and safety of the few nosewheel airplanes that had been introduced and, needing to find a way to stay in the swim after the great post-war boom went bust, looked at what it could do with what it had. While the company apparently didn't have the financial horsepower to develop an all-metal airplane quickly, it could convert its four-seat, conventional-gear Pacer to the tricycle-gear configuration, beating out the competing four-place designs from Cessna and Aeronca.

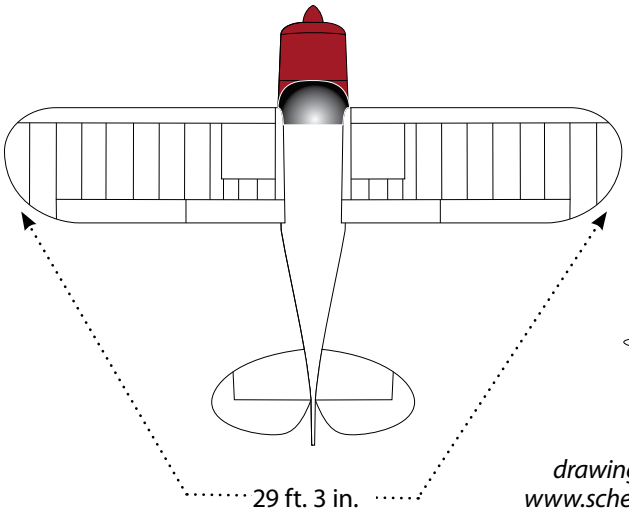
The result, which the company unimaginatively dubbed the Tri-Pacer, was not what one would call an avant-garde looking airplane, even for the early 1950s. Short-coupled, with stubby, strut-braced, high-mounted wings and thick-looking tricycle landing gear, the tube-and-fabric four-seater seems more than a bit dowdy today. The unflattering nicknames bestowed upon it—like Flying Milk Stool, Slow-Pacer and Flying Brick—reflected its silhouette, not how it behaved. Those looks gave way to owners' delight at the airplane's pleasing mix of reasonable performance and load-carrying capability combined with low purchase prices and rock-bottom operating costs.

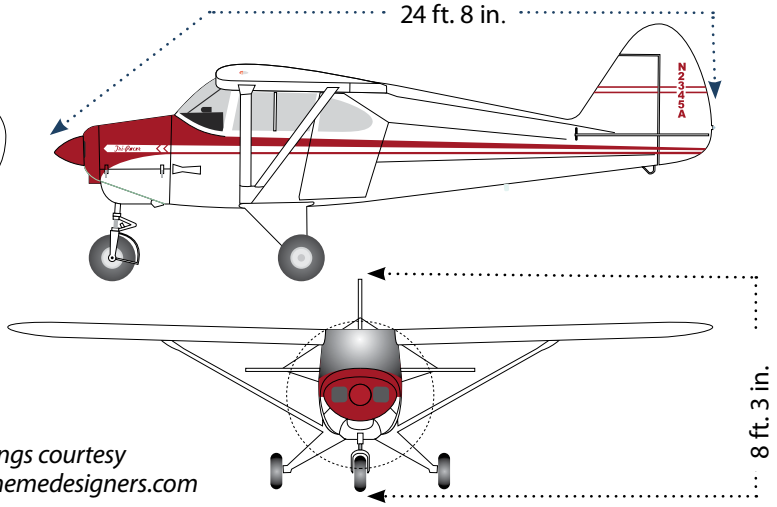
And they've got a point. The Tri-Pacer can cruise faster than a vintage Cessna 172 on only seven to nine GPH. It has good short-field performance, a wide CG range and good parts availability to boot. The price for this ranges from about $15,500 up to around $20,000 or so, though a "fixer-upper" can be had for less. That's a pretty good value, if the prospect of being snickered at while your bank balance stays in the black doesn't bother you.

HISTORY

In a way, the Tri-Pacer defined a whole new market niche, one eventually dominated by Cessna's Skyhawk. Introduced for the 1951 model year, Piper's PA-22-125 Tri-Pacer was based on the PA-20 Pacer, itself only a year old and an upgrade of the earlier Clipper. Because of those roots, it's possible and popular to convert a Tri-Pacer back to tailwheel configuration with an STC should you wish to increase your chances of tearing it up in a runway loss of control accident. While the tricycle gear PA22 has a lower risk of being rolled into a ball in a crosswind, the PA-20 is, to our eye, more

PIPER TRI-PACER



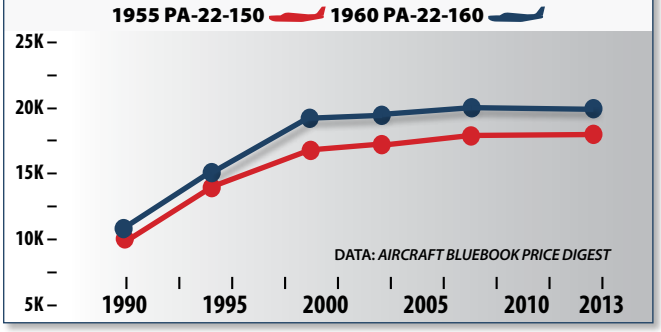


drawings courtesy
www.schemedesigners.com

PIPER TRI-PACER SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1951 PA-22-125 TRI-PACER	125 HP LYCOMING O-290-D	2000	$17,000	36	795 LBS	103 KTS	±$15,500
1952 PA-22-135 TRI-PACER	135 HP LYCOMING O-290-D2	1500	$17,000	36	930 LBS	107 KTS	±$16,000
1955 PA-22-150 TRI-PACER	150 HP LYCOMING O-320-A1A	2000	$21,000	36	890 LBS	113 KTS	±$18,000
1957 PA-22-150 TRI-PACER	150 HP LYCOMING O-360-A1A	2000	$21,000	36	890 LBS	113 KTS	±$18,750
1958 PA-22-150 CARIRBEAN	150 HP LYCOMING O-320-A1A	2000	$21,000	36	890 LBS	113 KTS	±$19,000
1958 PA-22-160 TRI-PACER	160 HP LYCOMING O-320-B2A	2000	$21,000	36	890 LBS	117 KTS	± $20,000
1960 PA-22-160 TRI-PACER	160 HP LYCOMING O-320-B2A	2000	$21,000	36	890 LBS	117 KTS	± $20,000
1961 PA-22-108 COLT	108 HP LYCOMING O-235-C1B	2400	$21,000	36	710 LBS	94 KTS	±$15,000
1963 PA-22-108 COLT	108 HP LYCOMING O-235-C1B	2400	$21,000	36	710 LBS	94 KTS	±$15,500

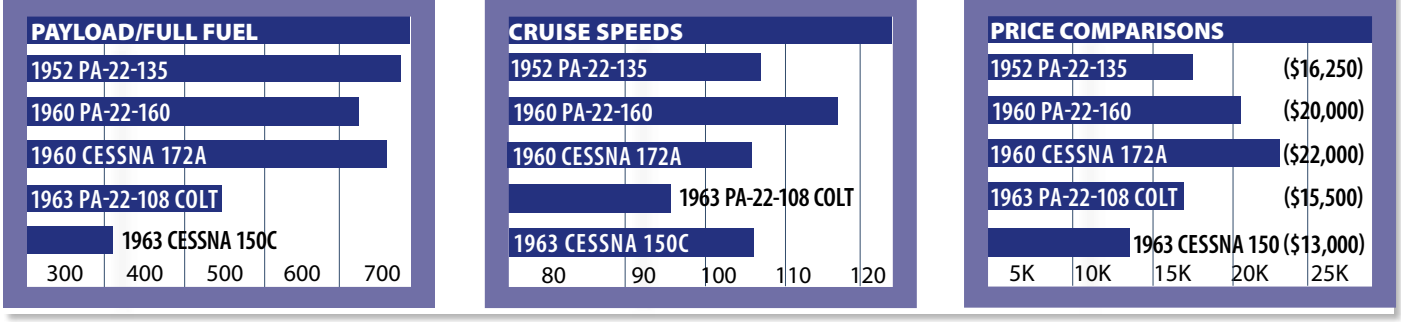
RESALE VALUES



SELECT RECENT ADs

AD 99-01-05	INSPECT WING LIFT STRUTS FOR CORROSION OR DAMAGE
AD 98-02-08	INSPECT LYCOMING CRANKSHAFTS FOR CORROSION/PITTING
AD 98-01-06	INSPECT/REPLACE PRECISION AIRMOTIVE CORP. CARBURETORS
AD 85-06-04	REWORK FUEL TANK SUMPS/ INSTALL PREFLIGHT PLACARD
AD 60-01-07	INSPECT TAIL BRACE WIRES FOR DAMAGE OR REPLACE WITH ROUND

SELECT MODEL COMPARISONS



aesthetically pleasing. Amazing what that nose gear can do.

The Tri-Pacer was a great success back in the heady 1950s. During the airplane's nine-year production run, more than 7600 were built. But in 1956, Cessna decided not to build what was going to be the 170C, put a nosewheel on the prototype and introduced the world-beating 172, which outsold the Tri-Pacer so badly that PA22 production was stopped in 1960.

The first Tri-Pacers had 125-HP Lycoming O-290-D engines, which were changed halfway through the second year of production to 135-HP -D2 models (PA-22-135). In 1955, that engine was swapped out for a 150-HP Lycoming O-320-A1A (PA-22-150). In 1958, the 160-HP O-320-B2A was offered as an option, giving a boost in useful load and changing the model designation to PA-22-160. The latter engine can be retrofitted with an STC; a worthwhile mod at overhaul. From 1958 through 1960, the PA-22-150 Caribbean—a less well-equipped Tri-Pacer—also was offered. Aside from this, there were no significant changes during the Tri-Pacer's production run. Floats were offered as an option for the PA-22S seaplane version, as were 44-gallon tanks after 1955.

Despite ending Tri-Pacer production in 1960, Piper kept the marque alive with the Colt, which, oversimplified, was a two-place Tri-Pacer built to compete against Cessna's 150. Powered by a 108 HP Lycoming O-235-C1B, the Colt only saw three years of production, which ended in 1963. Some 1800 PA-22-108 Colts were produced.

ACCOMMODATIONS

Despite two doors (one on the right front for the front seats, one on the left rear for the back seats), the Tri-Pacer is tough to climb into—perhaps a bit of its tailwheel-conversion heritage showing through. The gear is relatively tall, making for a long climb up, and the doors are small due to the need to clear some of the fuselage tubes.

Panels tend to be pretty basic and can found with most anything installed. Bracing struts are part of the structure.

Once inside, some passengers find the Tri-Pacer cramped and dark. Two wide people sitting side-by-side should be very good friends, at least. As one owner put it several years back, "The Tri-Pacer is built for people who are either small, or who are willing to become good friends, yet we have reports from pilots as tall as 6'5" flying them happily."

BUILT TO LAST

Tri-Pacer construction is fairly sturdy. Steel tubing covered with fabric was the factory standard, and in terms of strength and lightness it does well. But all-metal airplanes soon became the state of the art. As a result, "metalizing" became a popular mod for fabric-covered airplanes like the Tri-Pacer. However, it seems most owners have been able to resist the urge to get their airplanes converted to spam-cans. Most Tri-Pacers are still fabric covered.

The fabric holds up well according to most owners, especially the Ceconite and Razorback coverings. Some might say they last too long, allowing corrosion to progress undetected for a long time. Although Razorback can last more than 20 years, the structure underneath may rot away in only 10. Some owners, opting for safety, get their bird recovered every 10 years, whether it needs it or not.

Even with regular inspections and recovering, the steel-tube structure of the Tri-Pacer is somewhat susceptible to corrosion. One trouble area is the tubing around and under the doors. Another seems to be the tail surfaces, especially the stabilizer. Several owners report finding rust in the lower longerons and tail-section tubing.

The lift struts are another nettlesome component. Internal corrosion is a well-known problem, as is cracking of the strut forks (we'll discuss these further, shortly). Otherwise, owners report maintenance offers no special problems, and upkeep costs are quite low.

A scan of a six-year printout of FAA Service Difficulty Reports

The fabric over metal and wood construction, right, can hide a number of sins—check especially for corrosion. Other than large cooling intakes, the cowling is surprisingly clean and easily opens wide for engine access on preflight, lower right.

(SDRs) revealed only one report, a loose mixture control end fitting that prevented shutting the engine down with the. A search in 2008 found only one trend, problems with starter cables. Slow cranking, and eventually, burned wires were cited in 10 reports, ranging through all models. Replacement at the first signs of reduced cranking power seems to be the order of the day.

Despite its rather dated looks, the Tri-Pacer is a surprising performer, and earns high marks from owners in this regard. Except for the lower-powered models, most Tri-Pacers can lift three adults, a smidgen of baggage and full fuel—and still manage a decent climb rate. And while stubbiness usually translates into a small loading envelope, owners report that it's almost impossible to get the CG too far forward or aft. (But it's quite possible to overload.)

It's got good short- and soft-field performance, provided the field isn't too high or hot. But even then, the Tri-Pacer can hack it if the load is kept light, particularly with the higher-horsepower models. One owner told us he uses his Tri-Pacer to routinely fly over 9000-foot mountains in the west, another has his on floats and flies in and out of lakes at elevations to 5000 feet.

Owners report cruise speeds in the 120- to 130-MPH range at middling altitudes (6000 to 7000 feet). This is comparable to a Piper Cherokee or even a Warrior. Maximum altitude is also very good, with climb performance petering out at about 13,000 feet as engine power bleeds away.

The low-power models are another story, though. Don't expect to carry four people and more than an hour of fuel, because the airplane may not make it off the ground. The low-power models can make fine Sunday fliers, but don't consider them as cross-country, load-toting machines.

Landing can be a challenging, although easier than its tailwheel predecessors, judging by the aircraft's accident history. The Tri-Pacer's stubby wings mean getting slow on final can produce prodigious sink rates (as high as 2000 FPM, according to one owner). This may be why the Tri-Pacer has a reputation for gliding like the proverbial brick. To those who aren't familiar with the airplane, the insidious onset of a high sink rate on final can be unnerving (and lead to undershooting the runway). A key is to nail the speed (68-70 MPH) and carry power. As one owner notes, "You pull the power back, and she lands."

Once the airplane is on the runway, the short fuselage and narrow landing gear can make for somewhat nervous manners. Swerves that are mild in other airplanes may not be in a Tri-Pacer. Hand-operated brakes don't help here, either. This leads to one of the Tri-Pacer's few problems—ground handling.

Strong winds can be a real hazard for this airplane. Its stance on the ground and its high wing are almost an invitation to get blown over. Fast turns can spell embarrassment, as can turns from a headwind into a crosswind. Make a sharp, snappy turn off the runway with a strong wind, and remaining upright can be a real challenge.

Proper aileron deflection when taxiing in wind is a must. But once it's off the ground, the Tri-Pacer can be a delight to fly. Controls are well harmonized, and an aileron-rudder interconnect gives the pilot the choice of making turns with feet off the rudder or hands off the yoke. Pilots report the interconnect is easy to overpower for slips.

While it's close-coupled, the Tri-Pacer is surprisingly stable, perhaps because of the stubby wings resulting in a relatively higher wing loading when compared to other types. Although it will bounce around in turbulence, it doesn't wander or hunt up and down. It won't fly hands-off, but it won't try to swap ends, either.

Another surprise is stall behavior. Many pilots report that the Tri-Pacer won't stall in the classic sense. Haul back on the yoke and the nose comes up, the airspeed goes down and the airplane soon starts to sink. But it never breaks or pitches over—it just sinks. However, "correctly" mishandled, the Tri-Pacer can raise

ACCIDENTS: ENGINES AND R-LOC

We're accustomed to a high percentage of runway loss of control, or RLOC, in our NTSB accident report studies. But we were surprised to find a whopping 63 RLOCs in the 100 random Tri-Pacer wrecks we studied over a 10-year period. Seven of those wrecks involved fatalities.

Based on our findings, Tri-Pacers can be especially tricky—and for some pilots, problematic, on or close to the ground. Perhaps the problem lies in the PA-22 wheelbase and narrow main landing gear design. There's also the stubby wings, which can induce a wicked sink rate when pilots allow the airspeed to drop too low on short final and over the runway.

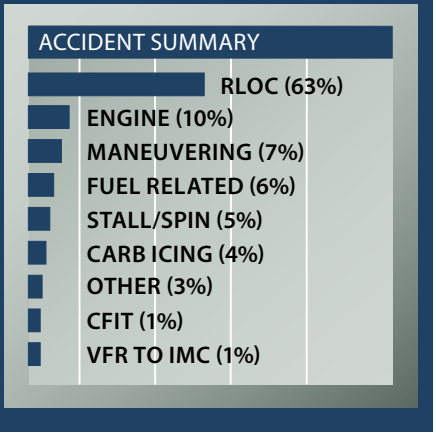
Moreover, some Tri-Pacers are converted to tail-draggers, which can increase the risk of losing control, especially for pilots not accustomed to using their feet when attempting to land and take off in high winds and crosswinds.

We uncovered all kinds of RLOC wrecks. There were lots of bounced landings, which resulted in collapsed landing gear, several balked landings in which the go-around was either improperly executed or not executed in time, and more than one unexpected trip into the weeds because Tri-Pacer pilots misjudged the wind. Speaking of misjudging, we found a handful of takeoff wrecks—including departure stalls into the trees because the aircraft was over gross weight. There were also a few unsuccessful takeoffs due to unsuitable runway surface conditions, particularly for Tri-Pacers operated in Alaska.

Engine-related issues came in second, at 10 percent, and included a failed exhaust system which resulted in engine and airframe fire. The FAA blamed the owner for that one, since he continued to fly the aircraft after several instances of smoke in the cabin.

The failure of one Tri-Pacer's left wing's lift strut and separation of the left wing might have been avoided if an annual inspection and the Airworthiness Directive on the lift strut had been complied with.

There were a handful of carburetor icing events, fuel mismanagement—where pilots fumbled the fuel selector valve, and one wreck where the pilot ran out of fuel on short final after running from IMC conditions. He made the runway but botched the landing—and earned a losing checkmark in the category-winning RLOC column.



the adrenaline of even hardened pilots. It definitely will stall and spin if not flown properly.

The brief production run of the two-place Colt means it is not well known despite its impressive performance. Using most of the Tri-Pacer airframe, the flapless Colt, on 108 HP, has an endurance of nearly six hours, a gigantic baggage area and can carry 494 pounds in the cabin with full fuel. Handling is otherwise the same as the Tri-Pacer, but owners report it to be even easier to make consistent, roll-it-on landings. While a Cessna 150 is five or so knots faster, nothing in the two-place market comes close to the payload and endurance capabilities of the Colt.

AD SCENE

Considering its age, the Tri-Pacer has fared very well in terms of ADs. Most were of the one-time sort and should have been complied with long ago. There have not been any that apply to the airframe issued since 1999.

There is a significant AD on the wing struts, AD 99-01-05, which supersedes AD 93-10-06 (which itself once was two ADs, 77-03-08 and 81-25-05).

Part of the AD calls for inspecting the struts for corrosion and dents every 24 months, as well as treating them with a corrosion inhibitor. The other part of the AD addresses the lift-strut forks. According to the AD, the original machined-thread forks were prone to fatigue cracking.

The fatigue apparently originated at the bottom of the thread grooves, which were sharp. The problem was exacerbated by people using the struts as steps when ingressing and egressing.

The AD calls for immediate inspection of the forks using "magnetic particle procedures" to detect cracks every 500 hours. If no cracks were found, then the forks could be returned to service if they had less than 2000 hours on them (1000 hours for floatplanes or any plane that had been on floats at any time in its life).

But at 2000 hours (or 1000), the forks have to be replaced with rolled-thread types using parts available from Piper or other vendors and installed under an STC. Applying an STC for installation of aftermarket struts and/or fork terminates that portion of the AD. Also, a "no-step" placard must be installed. Buyers shopping for a Tri-Pacer and finding one advertised as low time should make sure the AD has been complied with or the forks replaced.

RESALE VALUE

These days, along with the rest of the fleet, prices are relatively flat, with $15-20,000 being the high/low range for the various Tri-Pacer models, same as it was several years ago. Nevertheless, the plane is still a relative bargain, given its capabilities. At those prices, it's about the cheapest four-seat around.

For example, a 1958 PA-22-150 was selling for $6750 back in 1978. Today, that same airplane is worth about $19,000. On the face of it, the airplane has more than doubled in value. But when inflation is taken

into account, it's about $3000 short of keeping up. That's still not bad in the current aviation market.

BUYER POINTS

Besides all the usual items buyers should look for, the Tri-Pacer has some peculiarities to be aware of. However, any mechanic worth his or her hourly rate (and familiar with the airplane) should catch most of them.

Of course, the airplane's AD compliance history should be carefully examined. While few of the airplane's ADs have been really serious, there are at least three that are genuine safety-of-flight items. Besides the aforementioned strut ADs, the third important one calls for reinforcement of the fabric over the windscreen.

In several accidents, the fabric became loose and lifted up. The ballooning fabric acts like a big air scoop and spoiler, creating incredible drag and destroying airflow over the tail surfaces. This can make control just about impossible, and level flight out of the question.

The age and overall condition of the fabric is another consideration. A fresh covering job may indicate an attempt to cover up expensive structural problems (like rusted tubing). On the other hand, fabric that's more than 10 years old could be doing the same.

The Tri-Pacer is no stranger to brake failures, so a careful check of the condition and history of the brakes is in order. Considering that the brakes are operated by a single hand lever (pressurizing two separate master cylinders), failure can make for some dramatic moments during landing.

Grease-job landings in a Tri-Pacer come with a little practice—staying on the runway requires a bit more skill.

Look for recent (i.e., within the last 10 years) replacement of the diaphragms and drum turning to ensure long-lasting, reliable brakes. Another item to look for is half-inch exhaust valves in the O-320 engines. With the valves, TBO is a healthy 2000 hours. Without, it's only 1200. The Colt's 108-HP engine comes with a whopping 2400-hour TBO.

MODS, ORGANIZATIONS

There are mods a-plenty for the Tri-Pacer. Owners can get everything from the mundane to the radical for their airplane. One worth looking into gets rid of the old drum-type brakes and installs disk brakes. Another adds toe brakes. If a prospective purchase still has drum brakes, a buyer might want to look into Univair's brake STC.

Some owners are turning their Tri-Pacers back into Pacers by removing the nose gear and moving the mains forward. It improves the airplane's looks considerably, but brings with it tailwheel ground handling foibles. Univair also holds an STC for this.

Perhaps the best mod is a simple engine swap, from the increasingly rare O-290 to the quite-common Lycoming O-320, or even a 180-HP O-360.

Available Tri-Pacer STCs also include operation on automobile gasoline, replacing the fabric covering with metal skins, wing-tip extensions, skis, shoulder harnesses and tundra tires, along with the

Owners report that the larger-engined Tri-Pacers make successful, fun float planes, left. In-flight handling is without a vice, lower left.

usual avionics and instrumentation upgrades.

Owners we've heard from almost universally noted Univair as their main source of parts. In addition to holding several STCs (including one to replace the wing ribs with stamped aluminum ones), Univair stocks many hard-to-get parts. Availability has not proven to be a problem.

That's a key consideration in an airplane this old. Membership in the Short Wing Piper Club (www.shortwing.org) is a must for Tri-Pacer (and other early Piper) owners. As a source of current news, maintenance tips and owner information, the club can't be beat.

OWNER COMMENTS

Embarrassingly easy to fly and afford, the Tri-Pacer is quite possibly the best bang for the buck. I say that not just because I own and fly one, but the numbers speak for themselves. More importantly, I am not a rich man. For a 150 HP Tri-Pacer such as mine, at gross weight and standard temperature cruise is 113 knots, it stalls with full flaps at 43 knots, has a takeoff ground roll of 1120 feet and rate of climb of 750 FPM. Mine has the optional eight gallon aux tank, giving 44 total gallons of fuel. It burns 8.5 to 9 GPH.

Insurance runs me $550 per year. I budget $550 per month, which covers absolutely everything, from hangar through fuel, insurance and maintenance.

As for mods, if you plan to fly at night, consider converting from a generator to an alternator. There are many STCs for the changeover to disk brakes. Sealed lift struts eliminate an expensive inspection AD. Bogart battery cables made of heavier gauge copper wire than the original help with starting. I've also gotten the Mogas STC and installed LED landing and taxi lights.

Most importantly, if you are going to own one get a thorough prebuy by a knowledgeable A & P, check for corrosion in the tubing and keep it in a hangar. I can't emphasize hangaring a Tri-Pacer too much.

They are about as honest to fly as an altar boy on Sunday. You have to remember a few things: Power off and flaps down they sink like a brick, attached to a piano, chained to an anvil. So you must carry a fair amount of energy into the flare or you will be unable to arrest the descent.

That issue has bent more than one Pacer and Tri-Pacer. Use the left tank for takeoff, landing and aggressive maneuvering. It has to do with how the fuel line is routed. There are numerous STCs that fix that issue. One is to reroute the fuel line, the other is swapping out the tank selector to one that has left-right-both positions. Trimmer Aviation has the STCs for that and many more for Tri-Pacers.

John Garrison
Via Email

My father and I completed a complete restoration of a Tri-Pacer that won a Bronze Lindy at Oshkosh two years ago. It was featured in the May 2011 issue of *Sport Aviation*. I think the biggest attractions of the Tri-Pac-

er are its low selling price, exceptionally low cost maintenance and simplicity. That's not to mention that it takes up less hangar space than many other aircraft. From a maintenance standpoint, sealed lift struts and founded tail brace wires get rid of two repetitive ADs. Most of the other repetitive ADs can be eliminated by changing a few components.

Most Tri-Pacers are a great two-person airplane, meaning you can take all the baggage you can fit—which is a lot of stuff—or a decent three-person airplane. It can fit four fairly small people and no baggage. The fuel economy and cruise speed make it a great all-around airplane, whether you want to putt around for an evening flight or you want to fly cross country.

I did all of my flight training in our Tri-Pacer and can attest that it is a very good trainer and very simple to fly. I think the way to learn to fly nowadays is to buy a Tri-Pacer with a partner or two, and take your lessons in it. It holds its value, making it cheaper than renting.

Zac Weidner
Via Email

My Tri-Pacer had been previously owned by Carroll Shelby of racing fame. It had been converted to a tailwheel before he bought it. I bought it to put on floats. Prior to doing so I found it a great cross-country plan as I am 6'5" tall. I had plenty of leg room. It was a little busy as a tailwheel airplane. I would probably prefer to keep it as a tricycle gear if it weren't on floats.

Once on floats, I put on a McCauley climb prop per a Svenn's Aviation STC. The lower cruise speed with that prop and the floats ran oil temps up, so I installed an aft-mounted oil cooler with bigger capacity per Dan Stewart's STC. It saved a few pounds and streamlined the nose bowl. Aircraft Innovations LLC wing tip extensions and Micro Aerodynamics Vortex Generators made climb performance more like a Super Cub.

Trimmer Aviation in Alaska has some great STC door mods as well as a fuel selector replacement that eliminates the 100-hour requirement to rebuild the fuel selector.

I do seaplane training in the Sierra Nevadas out of San Andreas, California, and routinely fly into lakes at elevations as high as 5000 feet. I fly it off of a 2000-foot long pond on 105-degree days with two people and 20 gallons of fuel with no problem.

Before floats, it burned 6 GPH at 2300 RPM and cruised at 120 MPH; now it burns 7 GPH at 2400 RPM and cruises at 80 MPH, still a good deal.

I looked at three airplanes before I found one in the condition I wanted. I recommend a careful prepurchase inspection with particular attention to fabric condition and mods installed. It's cheaper to buy one with the mods than to put them on later. I would highly recommend that someone with a limited budget, wanting a rock-solid, easy-to-fly aircraft with low maintenance, buy a Tri-Pacer.

Jim McCloud
Foothill Aviation

I always wanted my own plane from the time I was a kid. Finally I could afford one. I always liked the Tri-Pacer but had never been in one; I just liked the looks! I bought one in June 2007, a 1959 150 with about 2500 hours on the airframe, 500 SMOH on the engine and the original drum brakes.

She's a sweetheart, handling better than the 172s I'm used to. The Tri-Pacer is faster and will carry more weight than a comparable 172. The only point that rang true from the stories was landing.

You have to fly a Tri-Pacer on, then plant the nose gear. If you try to flare like 172, those short wings just give up and you'd better have the hook down and hope you get the three wire, because that thing is coming down right now. I did some pretty good carrier landings getting used to its habits. The Tri-Pacer will bounce real good on grass as well as pavement!

I lost my first PA-22 in a too-long, too-fast approach in a gusty crosswind on my 1700-foot, downhill airport and put her on her back in a plowed corn field. She has been replaced by a 1957 PA-22-150.

Bill Cameron
West Houston, Texas

The Aviation Consumer

Apps Reviewed

(continued from page 7)

The airport page has high-resolution satellite photos of the runways and surroundings. Map management on myWingman is similar to ForeFlight, but not as sophisticated as WingX. No terrain warnings, runway extensions or on-screen position reports.

Using ForeFlight as the support standard, Bendix/King gets a so-so. We had an issue with setting up a DUAT account and our e-mailed query required a four-day response, compared to four minutes for ForeFlight. Other features include rudimentary synthetic vision and a G-meter, which is mostly a novelty.

What it needs: Maturity, mainly, and more features such as inflight weather. (It's planned.) This app has been available for only six months and apps constantly improve with each revision. This one bears watching as Bendix/King hears from its users and improves the app on the fly.

AOPA/SEATTLE FLYQ

The newest app on the block is FlyQ EFB, a joint effort by AOPA and Seattle Avionics, a well-known provider of flight planning software and chart data. FlyQ is an evolution of AOPA's original FlyQ planner for desktops and smartphones. FlyQ has minor details in common with myWingman, but does most of its functions differently from the other apps.

It features split-screen display and both of those can be configured independently to show sectionals, high- or low-altitude enroute charts or approach plates. But unlike WingX, getting the plate to show in the split requires more of a step through than just a single button. Once configured, viewing a plate in one window and a chart with the active route in the other is easier, but it's not intuitive getting there, in our view.

This is further frustrated by the lack of the help screens and manuals that the other apps have. It's not that any of these apps are difficult to figure out, but training support helps reveal the hidden tricks and shortcuts that all of them have, without frustrating trial and error. Also, there aren't any training videos for FlyQ yet. We would like to see them.

FlyQ offers such high-level features as an onboard EFIS using the Levil Technology box with terrain display. It will also function with just the onboard GPS. As of press time, it has no ADS-B support, but that's planned. One thing FlyQ excels at is weather presentation. Its dedicated weather page shows thumbnails of local and regional radar, below which are panels with plain language weather color-coded by flight rules, plus winds aloft and a DUAT summary. What it needs: As with Bendix/King, more maturity and definitely better supporting tools that are easy to find. With ForeFlight setting the standard, support can't be left to chance, even if it's not needed by everyone.

RECOMMENDATIONS

For the pilot who wants all the features, whether they'll be used or not, WingX is the one to beat, in our view. It has good map features, plenty of connectivity with ADS-B and its unique data compression makes it both lightning fast and the stingiest of all for storage requirements.

We think it's the ideal choice for someone who wants an app to function as a portable GPS with weather-getting capability. But it's not the cheapest app by any mean means. Second choice in this category is Garmin's Pilot, which is a good option for the same requirements.

For the serious IFR pilot, we think ForeFlight is the hands-down best choice because of how it handles routing and its no-nonsense fast operation bereft of any cuteness. For the technically competent pilot who has a complete panel, ForeFlight is a supporting utility that's hard to beat. We suspect it will improve more in the coming year as the competition heats up.

As for myWingman and FlyQ, these are both competent apps, but we'll look at them a year from now to see if we think either of them is worth switching to from another app. For now, we don't.

FEEDBACK WANTED

GLOBE SWIFT

For the May 2013 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Globe/TEMCO Swift series, the much modified, two-place, low-wing, tailwheel airplane with retractable gear. 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 you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the Globe/TEMCO Swift series by March 1, 2013, to:

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