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*The consumer resource for pilots and aircraft owners*

# The Aviation Consumer®



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The Aviation Consumer

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## AFFORDABLE AIRCRAFT: A DEMOGRAPHICS PROBLEM

Affordable aircraft is the name of a developing niche market that made its debut at this year's U.S. Sport Aviation Expo in Sebring, Florida. The annual LSA show was even rebranded the Affordable Aircraft Expo, and includes older Part 23 certified airplanes fully or partially rebuilt to like-new standards. If it sounds like competition for the LSA market, it is. Sacrificing high-end avionics in favor of basic steam-gauge instruments and minimal radio stacks can drop the price of a basic refurbed model below the critical $100,000 price point—a target that many advanced LSA models miss.

One example is Aviat's Cessna 152 refurb, branded the AOPA 152 Reimagined. AOPA's Jamie Beckett told me the airplane's $64-per-hour operating cost is a selling point for flying clubs and individuals who have all but given up on ways to fly more affordably. It's also a return to simplicity; no high-end avionics with intimidating feature sets. Based on the comments I heard around the airplane, such simplicity is welcomed.

"Imagine a pilot that stopped flying 20 years ago and has been reading about PFDs, MFDs and other sophisticated systems. That pilot might be out of their element, but this round-gauge-equipped 152 is what older pilots will remember," Beckett said. There was no mistaking the presence of an older pilot demographic at the show. Nearing 50 years old, I was one of the younger pilots in the crowd. That's the rub with the developing affordable aircraft market and it has everything to do with FAA Third Class medical requirements.

Compared to LSA models, affordable refurbs won't help pilots facing FAA medical certification issues—a situation that brought many pilots I spoke with to the show. I ran into my friend Mike Evans, who was eyeballing LSA models as a fallback in case he runs into medical issues. Mike owns a Cessna 182S that he uses for distance traveling, and he used to fly biz jets for work. I could tell he was underwhelmed by the limited mission of the typical LSA.

I spoke with other pilots with similar sentiments, but who were disenchanted after dealing with the tiring process of obtaining special medical issuance. To them, an LSA is better than nothing if medical renewal isn't an option. There are no signs that Third Class medical certification is going away, so no matter how appealing and affordable a competing refurbed Part 23 airplane is, it misses the older demographic that can't get a medical certificate. That's good for the LSA market, but not for buyers who can't or won't absorb the high buy-in cost of an LSA. These pilots will buy nothing.

## TEXT MESSAGE FINDS EXCEPTIONAL SERVICE

I obey the FCC rules and limit my cockpit iPhone use to streaming Bluetooth music. I even mostly resist the urge to snap selfies. But a rough-running left engine on the trip home from the Expo in Sebring had me reaching for the phone to text Senior Editor Rick Durden, hoping he could find a maintenance shop in close proximity that could handle us late in the day.

With limited cell coverage at 9000 feet somewhere south of Savannah, the text message failed to send as I expected. I tossed the phone on the glareshield as we worked on a diversion. Some 20 minutes later, its screen came alive with a return message from Durden. Based on our progress seen on Flight-aware.com, he hooked us up with the folks at Aircraft Maintenance Services at Hamilton-L.B. Owens airport in Columbia, South Carolina. Exceptional service is worth mentioning and the crew at AMS has it going on. They quickly diagnosed the problem to a faulty GAMI fuel injector and even spotted and fixed a corroded connection on a temperature probe. In a couple of hours they had us back in the air for the trip home to Connecticut and the review of Avidyne's IFD540, found on page 8 of this issue. I knew that overpriced phone was worth more than a cheesy inflight selfie.—*Larry Anglisano*

## SURVIVAL KITS

I always enjoy reading *Aviation Consumer*, and it was nice to see the article on survival kits in your February 2015 issue.

I won't pick the article apart and go into what should have been included, but it would be nice to see future articles on survival kits for different geographical regions, such as the tropics, the desert and so forth because each area has its own challenges.

You left out one essential item in the article, and that is a two-way radio. In the military, a radio was always an essential item and portable models found in various catalogs can work. I always carry a radio with me, as it can be used to communicate to a control tower, rescue aircraft or a high-flying airliner.

Vernon Childers
via email

*A portable transceiver certainly can't hurt, Vern, but without an external antenna system, its transmitting range will be limited, especially in mountaneous terrain.*

*Depending on the mission, the ultimate radio for survival could be a satellite communicator, which can also be used in flight and for flight tracking. Some can even interact with Lockheed Martin Flight Services for automatic search and rescue. We covered them in the December 2014 issue of* Aviation Consumer.

## WHICH ADS-B RECEIVER?

I am currently equipping my Cessna 172 for ADS-B Out. I currently have an iPad Air tablet and would like to use it to display charts, in addition to receiving ADS-B weather and traffic data. I have seen advertisements for the Appareo Stratus 2 ADS-B portable reciever and the ForeFlight app combination that will do that. But, also on the market is Garmin's GDL-39, which only works with the Garmin Pilot app. There may be other combinations on the market that I am not aware of. Would you please tell me the advantages and disadvantages of each system? If one is clearly much better than the other, that information would be nice to know.

Evert Uldrich
via email

*That is a tough one to answer, Evert, because the combination you choose could depend on which tablet app suits you and your flying mission the best.*

*There are plenty of available combinations, and we are planning a portable ADS-B comparison article in an upcoming issue. Stay tuned.*

## FLIGHT BAGS

Terrific article on pilot flight bags in the February 2015 issue of *Aviation Consumer.* I used to lug around my leather chart case left over from my airline days, but it's too much to deal with in the small cabin of my Cherokee.

I ended up with Sporty's Navigator and it's a good compromise because if it's not completely stuffed, you can fold it to wedge behind a seat where it's in easy reach.

Tim Reynolds
via email

I read with interest Frank Bowlin's sidebar on the Brightline bags. I also purchased this flight bag and I love it. I stuck a piece of tape on each pocket and labeled what was in them. Now, I never have to ask a passenger to get what I need from the bag without them having to open every zipper looking for it. Perhaps Brightline might consider velcro lettering.

John Zazulka
via email

I thought I would weigh in on flight bags. I was sold on the high quality of Sporty's original flight bag I bought well over 15 years ago when I was a student pilot. It has held up extremely well, and like many pilots, I jam pack it with more stuff than I really need to carry and it keeps soldiering on.

Alan Hues
via email

## AIRCRAFT CLEANERS

In a previous article on aircraft bug removers, you missed a really good cleaner that I thought readers would like to know about. It is called Carbon-X, made by Arrow-Magnolia, and it's available through Sporty's.

Carbon-X comes in a one-gallon plastic bottle and may be diluted to a 20:1 mixture with water. I found that a 1:1 mixture works best for tough bugs, exhaust and oil stains. Just spray it on, wait 30 seconds and then wipe it off—the bugs come off with it.

Tony Crawford
Port Orange, Florida

*Thanks for the report, Tony. We have gotten a number of recent questions about aircraft cleaners, including a few requests for a windshield cleaner review. We are currently gathering a variety of windshield cleaners to evaluate and will report on our findings in a future issue.*

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*The IFD540 has plenty of onscreen data and a crisp display. Its processor and GeoFill FMS comes from the R9 multiscreen flight deck.*

# IFD540 Flight Trial: Data-Rich, Configurable

*Avidyne's IFD540 navigator offers sizable utility and an easy installation. It's powerful for complex IFR missions, but questionable for basic ones.*

*by Douglas P. Fields, Jr.*

After long certification delays, Avidyne is now shipping its IFD540 navigator, a unit billed as a while-you-wait slide-in replacement for Garmin's GNS530W. Since Garmin has not offered a slide-in version of its flagship GTN750 navigator, the 540 is appealing to buyers looking for better flight planning capability, improved graphics and a hybrid touchscreen display, all without having to deal with a time-consuming and pricey installation.

With a list price just shy of $17,000, the 540 is a sizable investment that has many readers asking if the unit offers enough real-world functionality to ditch a functional and reliable GNS530W. Further, how tough is the learning curve, especially for those not intimately familiar with a GNS530?

In this article, I'll attempt to answer this, based on months of flying with the IFD540 during a variety of IFR and VFR missions. We covered the IFD540 feature set in previous articles, so I'll jump right into advanced system operation here.

## FLIGHT PLANNING

After flying with the unit in Northeast airspace, in addition to flights up and down the East Coast, I think the sizable gains in IFR flight planning capability is the best thing about the upgrade.

Much of that is the result of Avidyne's GeoFill function, plus the onscreen touch keyboard that trickles down from Avidyne's R9 integrated avionics suite. I think an option for a dedicated keyboard controller could kick the interface up a notch, as it does on a real R9, but that would require more effort.

GeoFill finishes the data entry automatically, filling the flight plan with fixes near the previous one. No longer is it necessary to consult a chart or tablet to enter all waypoints on an airway, as the Avidyne allows picking an airway and exit point from a list. For long airways like V1 on the East Coast, this can be an enormous time saver.

Viewing the route on the map during entry is convenient, and it can be displayed in a compact form on the right side of the display, while the map occupies the middle. It's even possible to drag the route line to add waypoints by rubberbanding, which will pop up a display of nearby fixes to add to the route.

Flight plans can be saved with descriptive names, reversed and activated. This feature is handy for saving a route component that is frequently used, such as a common departure sequence or as we expected when coming into the busy New York City area and expected routing around Washington, DC, and Philadelphia. Unfortunately, previously entered crossing altitudes are not saved with the routes.

Arrival and departure procedures can be added to the flight plan, including published crossing altitudes, although vector departures aren't included in the database. Entering altitude restrictions elsewhere in the route is simple. Better, the Avidyne will display a vertical speed require-

**CHECKLIST**

- ✚ Hybrid feature set caters to a wide range of user preferences.
- ✚ Slide-in installations really are as easy as Avidyne promised.
- ⛔ If you only use a fraction of your GNS530's features, skip the IFD540.

ment to meet the restriction and a top-of-descent marker on the map.

Adding an approach is essentially identical to the GNS530W, by first using a hard PROC button, and then selecting the approach and transition. The Avidyne helpfully displays the type of GPS approach available (LPV or LNAV, for example), and a second touch of the PROC button displays available arrivals.

When selecting an approach and a transition, the map displays an onscreen preview, making it easy to choose correctly. Unlike the Garmin, however, the procedure is not immediately integrated into the flight plan. It must be manually activated by tapping an approach waypoint, then direct or activating that leg by softkey. One alternative is to edit the flight plan to remove the gap inserted before the transition waypoint.

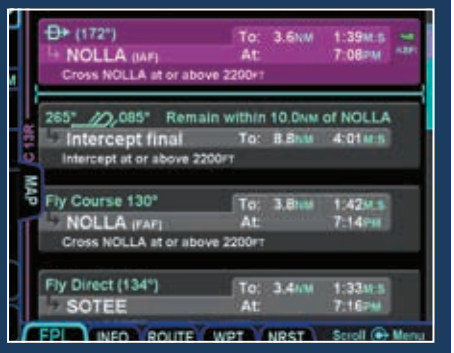
When flying the approach, having upcoming waypoints, FAF, MAP and crossing altitudes on the right side of the screen (and the map in the middle) is fantastic for situational awareness. The next crossing altitude is displayed on the map, and Avidyne says all crossing altitudes will be displayed on the map in a future software release.

Approaches with holds are simpler to fly than with the Garmin; if cleared for a straight-in approach, a hold can be removed by softkey, and an on-screen alert and the softkey label clearly informs whether the IFD540 will sequence past a hold or continue it. The softkeys are labeled opposite from what the navigator will do. "Continue Hold" is displayed as a softkey choice when the navigator will exit a hold, as pressing the button will cause the navigator to, yes, continue the hold. This can also be discerned as the next flight plan leg appears in striped purple and white labeling on the map.

Prior to entering a hold, an alert displays the type of entry the navigator has selected. Inside the FAF, the Avidyne has simplified the pilot's workload. After passing the clearly labeled FAF, a softkey becomes "Enabled Missed." This can be pressed at any point to sequence the navigator to the missed approach.

After the MAP, the button becomes "Activate Missed." Flying the missed, the appropriate altitudes are displayed directly in the plan, but is otherwise similar to the GNS530. One quibble is you must remember to use FMS mode during the approach, as the approach-related softkeys will not appear in MAP mode.

## UTILITY AT A GLANCE



**Clockwise from upper left: Notice the pop-up at the lower right corner of the screen, advising that you are exiting the holding pattern at the GITKE fix. With this prompting, you'll always know how the navigator is treating a hold in lieu of a procedure turn. Detailed onscreen approach information means there is less glancing down at charts. This includes crossing altitudes and intercept altitudes. The IFD540 has plenty of highly configurable data blocks along the sides and upper portion of the display. Notice the ATC facility name in the comm frequency window, in case you forget who you're talking with.**

## ENROUTE

Altogether, learning the enhanced flight planning was straightforward as it is similar, but improved from the GNS530W. I think FMS programming is easier with touchscreen, rather than twisting dials, but the IFD540 does both.

In even modest turbulence, I prefer dials. Only a few features are accessible with touchscreen only, such as pan and zoom. For some things, like tuning frequencies, dials might be the better option.

The 540 has inactive Bluetooth and Wi-Fi that's being saved for future connections. Could a keyboard be one of them?

While Avidyne just revealed its MLB100 ADS-B receiver, it vows to maintain an open architecture for liberal cross-brand ADS-B compatibility, in addition to cockpit app functionality.

Using the IFD540 in flight can be similar to using the GNS530W. Many ingrained habits are identical, easing the transition. The familiar Direct, Enter, Enter key pattern still works

*The IFD540 won't crossfill data with existing GNS430/530s.*

## IFD540 HITS AND MISSES

**There is a lot to like about the IFD540, including clever mode/rocker bezel switches, plus softkeys that Avidyne calls Hybrid Touch, for the ability to also touch onscreen labels. The configurable moving map data fields put a huge amount of information in the pilot's glance and comm frequency decoding is useful. The ability to see the graphical route—as well as the flight plan simultaneously—is a huge improvement and having altitudes displayed on an approach could conceivably prevent a tragedy one day. But I also uncovered some warts that left me scratching my head.**

**The biggest disappointment is that the moving map iconography could be much improved; the lines are thick, the fonts large and some basic information like airspace altitudes are missing. Avidyne's older EX600 MFD displays more map information, more clearly on an identical resolution, physically smaller display and even a smaller Aspen MFD displays more information about airspace and altitudes. Data feeds, such as from the Avidyne MLB700 broadcast weather receiver, may omit basic information that cannot be displayed, such as the altitudes of AIRMETs, making their horizontal extent less useful or even misleading. Finally, the oppressive yellow terrain overlay and oversized obstacle icons on the map render it much less useful at low altitudes.**

**Before an approach is activated, its internal waypoints are not visible, nor are waypoints in a missed approach prior to activation. There are some errors in the displayed decoded comm data, such as 127.85 for Newark Tower, but displayed as LaGuardia Approach. There are also some warts with the current software, including a known issue where the GPS receiver can lose lock after the first 10 minutes, go into coast mode and reconnect a short time later.**

**Some navigational waypoints present in the GNS530W and in the ForeFlight app are inexplicably missing from the IFD540 (I found several in New York airspace alone). I also found that it's extremely easy to accidentally clear a waypoint from a flight plan by tapping the CLR key inadvertently, especially in turbulence. Zooming the IFD540 via the bezel dial is oddly opposite from zooming the EX600 map, which is downright maddening when the Avidyne units are adjacent to each other.**

**On occasion, AIRMET boundaries would not appear on the map, except at certain zoom levels. Finally, there is a large discontinuity in the backlight—going from medium to dim with no linear control.**

**Avidyne said it will be releasing version 10.1 software in the spring, which will contain various fixes and enhancements, although it didn't say exactly what it will include. The no-charge USB firmware update must be done by an authorized dealer.**

as expected, and adding a procedure is the same, although activating it is a little different by pressing a dedicated softkey.

A welcome addition is the ability to add enroute holds with full detail about the direction of turns, leg time/length and course, which will be flown by the autopilot if equipped with GPS steering. Each waypoint in the route will show an ETE, ETA, distance and course, plus the amount of fuel remaining at that point—a feature we particularly liked when flying a long route at maximum fuel range during our evaluation flight from Florida to New England.

Handling reroutes is especially simple, as the route can often be entered directly from the clearance. One real-world challenge I experienced was dealing with a reroute that included a leg to fly a certain heading to intercept a specified radial, and proceed inbound to a VOR. Fortunately, just entering the specified VOR directly into the flight plan produced a course only one degree off the clearance, but I could not determine how to enter a route component to intercept a radial into the flight plan if it didn't happen to work out conveniently like this did.

When flying from South Carolina to Connecticut after a diversion, we were rerouted south of Atlantic City out over the ocean to the Eastern end of Long Island before turning north. That route had well over a dozen waypoints, but entering it using Victor airways was trivial.

Determining a descent point into an airport is especially easy, as entering a crossing altitude on an airport waypoint pre-fills it with five nm out and 1000 feet above airport elevation cues. The descent point will then be displayed on the map and a doorbell-like chime will sound when it's time to descend. The navigator doesn't take into account speed changes during a descent, so I configured it to use a lower descent rate than what would actually be flown and it worked out well.

Detailed information about the destination (or any waypoint) is available on a FMS tab, including runway diagrams, weather, procedures with graphical previews and even sector radials for multiple frequencies. Charts are easily accessed by touching an icon on the waypoint in the flight plan.

One advantage the IFD540 has over the GNS530W is the quality of its moving map, although as noted in the above sidebar, I don't think its graphics design makes efficient use of the available screen real estate.

There are two separate declutter modes for the base map and navigational map. A large number of weather overlays can be individually selected, including satellite radar,

wind, METARs, METs and lightning (both datalink and sferics). Tapping on an airport will bring up a box with field information and decoded weather. It would be nice if tapping the DIRECT button while an information box was displayed would pre-populate that as the destination location, but it doesn't. Tapping on airspace boundaries will show name and altitude restrictions. The map display does not show altitude information, so tapping is required to discern avoidance when flying.

Zooming and panning by pinching and swiping should be intuitive for tablet users. Zoom out far enough and range rings will be displayed, showing current 45-minute reserve flight range and absolute range, but these rings don't compensate for changes in wind or course.

## DATA BLOCKS, TERRAIN

A huge amount of information is displayed around the map borders and is entirely configurable. Between the left and right sides and the top of the screen, there are over a dozen places for displaying user-chosen data blocks from a list of dozens of options. Especially comforting is having the minimum safe altitude, fuel time remaining and, for passengers, destination ETA that is constantly visible on screen.

The configuration process is a little clunky, in my view, but after playing with it for several hours it is satisfying to have the navigator set perfectly to taste. The downside is the amount of data that must be absorbed. If you are easily overwhelmed with screen clutter, you'll likely leave these data blocks off, which really isn't using the IFD540 to its potential.

Another enhancement is a dedicated FREQ button for finding frequencies. The destination airport is on one tab and nearby enroute frequencies on another. All previously tuned frequencies are on a third tab, making it easy to fix a botched frequency entry. Even better, the IFD540 decodes entered comm frequencies and displays the assigned agency in the frequency box, so forgetting which approach frequency you are using is over.



## AVIDYNE, GARMIN COMPARED

| MAJOR CONSIDERATIONS | Avidyne IFD540 | Garmin GNS530W | Garmin GTN750 |
|---|---|---|---|
| Suggested list price without installation | $16,995 | +/- $8000 used | $16,548 |
| Vertical panel space required | 4.6 inches | 4.6 inches | 6.0 inches |
| Display size | 5.7-inch | 5.0-inch | 6.9-inch |
| Display resolution | 640x480 | 320-234 | 600x708 |
| Display color count | 65,535 | 8 | 65,535 |
| Victor airways flight planning | yes | no | yes |
| Per-flightplan waypoint capacity | 128 | 31 | 100 |
| Automatic waypoint entry completion | yes (GeoFill) | no | no |
| User interface | hybrid | keys | touch |

The Avidyne provides forward-looking terrain advisories. These visual aural alerts will provide two levels of warnings if the unit predicts an intersection with terrain or obstacles within the next minute. The moving map displays yellow and red overlays where the terrain is under 1000 or 100 feet beneath respectively, and will enlarge any nearby obstacle threat icons.

This can be useful in unfamiliar areas or with rough terrain, but in congested areas, especially in the crowded New York's Hudson River corridor, it was distracting. Worse, the large obstacle icons rendered the map hopelessly cluttered. Additionally, I experienced a disconcerting terrain alert while at a correct altitude on a non-precision GPS approach in mountainous Vermont.

## LEARNING, SUBSCRIPTION

This, and nav data costs, are the most concerning to buyers. Updating the internal nav data is by USB flash drive and with the same Jeppesen software as the GNS530W. Insert the drive in the unit before startup, updates are selected and the navigator copies the data. This takes around seven minutes for the Eastern U.S., twice that for the full U.S. and can take over 20 minutes for worldwide data. It can only be updated on the ground and the navigator becomes unusable.

This makes programming a chore compared to the GNS530W, which can be programmed by swapping a new card for the old one. The IFD540 can also download log data back to the flash drive. The USB port can be used to charge devices, providing a full 2.1 amps of current.

Avidyne said it negotiated a package price with Jeppesen for the IFD540 data to includes full U.S. nav data, Jeppesen charts and airport diagrams/obstacles for $994 per year. This also includes nav data and Jeppesen charts for any other Avidyne displays in the aircraft.

As for transitioning to the IFD540, we can say with certainty that the IFD540 is a different beast than the GNS530W. Although it does everything the Garmin does, and retains a few ingrained flows, it changes and, we believe, refines the operations to simplify things and reduce pilot workload. That said, there is a lot to learn to get the most out of it.

Avidyne provides a free iPad app (and a Windows program), which simulates the IFD540 functions. I think the user's guide is well written and the app is a good way to become familiar with the operating logic.

For users coming from the Garmin GNS530W (that's a huge chunk of the buyer base), I think the IFD540 can be overwhelming to those that haven't mastered the Garmin—and based on our discussions with some users—there are plenty that still struggle with it. Still, except for navigating between pages, a user could enter an identical flight plan as with the GNS530W and the IFD540 would fly it the same. "Direct to" is identical, and procedures are loaded via PROC button in the same way.

The Garmin's FPL button is analo-

*continued on page 32*

# Multi-Engine Trainers: A Strong Field

*The Piper Seminole is still the trainer of choice, but we think the Tecnam P2006T may be a lower cost replacement if it's robust enough for training.*

*by Rick Durden*

Acquiring a multi-engine rating is a rite of passage for any pilot who dreams of flying for a living. There's no denying the feeling of power you get on first grabbing a fistful of throttles and shoving them up to the stop. There's also no denying that, unless you pay for a type rating yourself, it's the most costly rating you'll get on a per-hour basis.

With the market offering three production twins being regularly used as trainers, we were curious as to how they stacked up. We flew each one, spoke to several instructors at flight schools that did a significant amount of multi-engine instruction and used an out-of-production twin that's still used for training for comparison.

After all the Vmc demos and engine-out simulations, we came away of the opinion that all of the airplanes have some weaknesses, but none that are crippling—although someone who learns in a Twin Star will need significant additional training to fly anything other than a jet—and that the Tecnam P2006T has the potential to take over the multi-engine training market.

## PIPER SEMINOLE

In production since 1979 (with a 1983–1989 hiatus), Piper's 180-HP-per-side light-light twin has been a popular multi-engine trainer almost from the start. Offering lower operating costs than its larger-engine competition, the Seminole overcame initial comments about being too easy to fly because it had counter-rotating props (which had been made about the Piper Seneca and Beech Duchess as trainers), and outsold the competing Duchess handily. It was a significant factor in causing the multi-engine training world to move away from the Piper Twin Comanche, Seneca, Aztec, Cessna 310 and Beech Baron.

The Seminole can be thought of a twin-engine Arrow, although about 10 knots faster on 160 more horsepower. Handling is similar, not particularly responsive—especially in roll—but always honest and predictable except for the quirkiness in pitch on takeoff and landing due to Piper not quite getting the T-tail right.

The inconveniences of the T-tail aside, the Seminole proved to be the hands-down favorite trainer among multi-engine instructors and operators we surveyed. Vmc is 56 knots, the same as the flaps-up stall speed. That means that students will almost never experience a violent roll off if the airplane is slowed below Vmc.

Gross weight is 3800 pounds. With 108 gallons of usable fuel, endurance exceeds five hours. Newer


***The most popular multi-engine trainer, Piper's Seminole, top, is powered by a pair of 180-HP Lycomings. The Tecnam P2006T, left, boasts a surprisingly large cabin and performance close to that of the Seminole on 98 HP per side.***

### CHECKLIST

- Good design is allowing strong performance on smaller-engined twins.
- Costs of keeping older twins running is driving up training prices.
- Tecnam's lightweight twin has the potential for cutting training costs.

*Diamond's Twin Star, right, is powered by 135-HP turbo diesels that are subject to restart altitude and time limits that can adversely affect multi-engine training. Long out of production, the Beech Duchess, below right, is still a popular trainer.*



Seminoles tend to be heavier than old, so allowable cabin load with full fuel has been diminishing. Figure on 550 pounds in newer machines and up to 750 pounds in older ones. Single-engine service ceiling (50 FPM rate of climb) is 3200 feet. Single-engine rate of climb at sea level is 212 FPM, pretty anemic when one converts that to feet upward per mile at the 84 knot Vyse—yet it's consistent with other piston twins. Max demonstrated crosswind is 17 knots.

Prices for new Seminoles start at $700,000 and go up for glass—something training operators want for *ab initio* students who tend to be completely at sea when presented with round-dial panels. The *Aircraft BlueBook* shows prices for pre-hiatus Seminoles below $100,000. Figure that most have been beaten hard as trainers and almost invariably have a damage history.

Schools report that maintenance on older Seminoles can be eye-watering as the airplanes are light and don't withstand the pounding well, but parts are available. As with any twin, there are a lot of parts that can break, so aggressive maintenance is necessary to maintain availability.

Our survey showed Seminole rental rates, wet, ranged from a low of $234 to $400 per hour.

## DIAMOND DA-42 TWIN STAR

Diamond's diesel-powered Twin Star elicited sharply divergent opinions from flight instructors. Most said it was a lousy multi-engine trainer because it was too easy to operate. In the event of engine failure the pilot pushes the two power levers forward (FADEC and single-power lever operation mean there are no prop or mixture controls), identifies the dead engine and flips its off/on switch to off. The prop feathers automatically. That's it.

We agree that the Twin Star is a poor trainer for someone who is going to have to make a living and build time flying a piston or turboprop twin where engine shutdown is more complicated—significant additional training will be required.

However, we also agree with the instructors who said the Twin Star is the perfect trainer for someone who is going directly into a jet, especially a G1000-equipped jet. Power management is jet-like, even to indicators reading out in percent power (the word "load" is actually used), and the need to carry significant power on final when the gear and flaps are down is similar to jet operations. In addition, the long wings make control response in yaw and roll ponderous when slow, much like larger airplanes.

Finally, the seven-buss electrical system is comparable to what pilots will experience when they move into turbine aircraft.

Instructors complained about the design of the seats, using the term "Diamond back" to describe the back pain they developed after sitting in the airplane for any length of time. At the same time, everyone praised the cockpit visibility as well as the astonishingly low noise level and smoothness of the engines and props.

We flew a Twin Star with Rhett Kamm, chief instructor at Independence Aviation at Denver's Centennial Airport. He mentioned that with the stick and the responsiveness of the T-tail, performing steep turns within the tolerances of the Practical Test Standards was difficult. Our experience with them confirmed his observation—and he told us that examiners were aware of the situation.

Rudder forces at Vmc were the highest of the light twins we flew, something that, in our opinion, is good for preparing pilots for the real world of multi-engine flying. Vmc is above stall speed and because the diesels are turbocharged, and do not counter rotate, there is a critical engine that must be respected as well as a sharp roll off at Vmc.

The Twin Star engines have max pressure altitude limitations for starting. It was 8500 feet on the airplane we flew, —which makes single-engine work in the Denver area difficult. Kamm said they flew east some 80 miles to do engine shutdowns over an airport that was at a low enough elevation to provide an acceptable altitude safety margin. In-flight shutdowns are limited to two minutes—after that the engine may not be restarted in flight. According to Kamm, the engine limitations lead to the local FSDO dropping the requirement for engine shutdowns and restarts on checkrides in the Twin Star.

## WHAT ABOUT THE APACHE?

Affectionately known as the world's largest flying sweet potato or "Da Pop," because all Apache N-numbers originally ended in Papa, the Apache and Geronimo conversions of it, are still seen on training school flight lines.

Starting life as a 150-HP-per-side executive transport in 1954, it rapidly proved to be a good trainer. Power was eventually increased to 160 HP, although a weight increase meant single-engine ROC, never particularly good, dropped from 200 FPM to 180 FPM, figures we consider optimistic.

Figure on a no more than a 135-knot cruise unless the airplane has been through the 180-HP Geronimo conversion and then the speed may go as high as 155 knots. The conversion radically improves single-engine performance.

Handling is ponderous, with big pitch changes during flap extension and retraction. Vmc is a no-kidding affair, with abrupt roll off. Because of this and because so many pilots took their multi-engine training in Apaches, it has long been held up as the standard for handling for twin trainers.

An Apache may or may not hold altitude on one engine at a 4000-foot density altitude. It is a good vehicle for teaching pilots that it's impossible to get performance out of an airplane that was never built in. Part of the lack of performance is because the airplane is draggy and heavy—with a 3800-pound gross weight. It can carry over 1100 pounds in the cabin with full fuel.

The systems are antiquated and expensive to keep operating. If maintenance is too long deferred, the cost of repairs may exceed the value of the airplane. Most have one generator and one pump running the complex hydraulic system. Lose the associated engine and it's either reduce current load and hope the battery holds out or plan on using the hand pump to extend the gear and flaps.

Visibility is merely adequate; the engines and wings block much of the world. The cabin is large and comfortable—something appreciated by generations of pilots who pulled the power way back to burn 12 GPH (it can burn mogas), pointed the nose at the far horizon and motored slowly across the country to build multi-engine time.

With Apache prices as low as $30,000 for a decent one, it's not unusual for a pilot who is willing and able to do supervised maintenance to buy one, use it to get a multi-engine rating, build twin time and then sell it for the same price.

On only 135 HP a side and with a 3935-pound gross weight, all-engine rate of climb exceeds 1100 FPM, however, the published single-engine rate of climb is atrocious—150 FPM at sea level. The single-engine service ceiling is 4000 feet. Realistic cruise speed is 145 knots on 12 to 14 GPH (newer ones are faster). With the main tanks full, endurance is about five hours and 690 pounds can be carried in the cabin.

Despite miserly fuel consumption, the life limit on the gearboxes of the diesels and the engines themselves, as well as the need for specialized training for technicians to work on the Twin Star, the DA-42 has proven painfully expensive for many owners. Kamm told us that the average annual inspection ran $12,000, before any squawks were addressed. Operational costs plus amortization of the purchase price (starting at over $700,000) of a new twin means that rental rates for the Twin Star that we saw hovered around the $340-per-hour mark.

### TECNAM P2006T

Tecnam has got to come up with a catchy name for its compact, fuel-sipping twin, P2006T just doesn't cut it, especially as we think it has the potential to break out as the multi-engine trainer. With over 3000 airplanes produced, Tecnam is no rookie in the aviation world. It used its experience making LSAs to come up with a twin that has a gross weight of only 2712 pounds using a pair of the proven 98-HP Rotax 912 S3 engines.

Performance is surprising and impressed us: the all-engine rate of climb is over 1100 FPM, with cruise of 145 knots on a total of 10 GPH. Single-engine performance is as good or better than the other twins we compared: single-engine ROC at sea level is 230 FPM and single-engine service ceiling is 7000 feet.

Fifty gallons of usable fuel gives an endurance of about 4:30, although we'd like to have had a fuel flow gauge on the Garmin G950 glass panel in the Tecnam so that we'd be a little more comfortable that we had the power set correctly. With the tanks full, it will carry 648 pounds in the cabin.

The Rotax engines prefer mogas (oil change intervals decrease with avgas), plus more and more shops have experience with Rotax engines, so we think Tecnam's lightweight approach could be the way to go for reasonably priced multi-engine training.

Priced at just over $600,000 equipped, the P2006T is at least $100,000 cheaper than the Twin Star and Seminole. Even allowing for amortization of the purchase price, we saw rental rates under $250 per hour.

Because the engines only develop 98 HP, they can't drive big alternators—each one only puts out 40 amps. That means load shedding if an engine fails in flight, something that we think will help pilots in training to fly other piston twins.

We liked the handling of the P2006T, it was precise in all axes and responded more as one would expect in a heavier twin. The engines are

*Tecnam's front office is roomy, with excellent visibility.*

not counter rotating. Engine power was down enough at 8500 feet that we did not experience Vmc roll off before getting an indication of approaching stall.

Visibility is the best of the bunch; the pilots sit ahead of the engines. For what appears to be a small airplane, the cabin is roomy and comfortable with plenty of leg- and headroom. Because of the proximity of the props, the ability to open a window is limited. Although there is a good ventilation system, the cabin can be uncomfortable on warm days. On the other hand, cabin heat, as with the Twin Star, comes from the engines instead of a Janitrol heater in the nose-burning avgas as is the case in most piston twins. After far too many flights in frigid cabins because combustion heater systems failed, we're all for heat from the engines.

The gear takes 18 seconds for its cycle, an eternity if trying to clean up the airplane following an engine failure shortly after takeoff.

We did not like the POH for the P2006T or the Twin Star—they are a poor result of European and U.S. certification with a mix of units of measure, terms and user-unfriendly presentation. Often it was necessary to go through a series of appendices to find out whether a limitation from early certification had been removed or changed.

We've certainly seen a lot of beat-up Seminoles and Duchesses, so we're going to be watching to see how the P2006T handles the rigors of training. The stall warning vane is directly in front of the fuel filler cap. Despite a protective cover for the stall vane, someone had bumped the vane on the airplane we flew, so the stall warning was sounding anytime we were below 85 knots.

## BEECHCRAFT DUCHESS

Despite being out of production for over 30 years, we've included the Beech Duchess in this comparison because we regularly see them used as multi-engine trainers, just as we do Seminoles of comparable vintage.

Instructors and operators all spoke well of the Duchess, emphasizing its handling (almost too good) and lack of quirks during takeoff and landing—Beech did its T-tail right. Where we heard frustration was over the availability of parts.

Performance, on 180 HP a side, is on a par with the other twins in this article—figure on a 140-knot cruise, 900-FPM all-engine rate of climb, 250-FPM single-engine rate of climb and able to carry 631 pounds in the cabin with a full load of fuel (100 gallons).

Handling is standard Beechcraft, stable and predictable, with pleasantly fast ailerons. Steep turns and slow flight are without vice. The counter-rotating engines mean stall speed is reached well before Vmc—all of which make this an almost too-easy trainer, much in the Seminole model.

We like having two cabin doors; we think it adds to convenience and safety. The cabin is almost too big, an invitation to overloading, a potentially fatal error when dealing with the anemic single-engine rate of climb endemic to piston twins. We like the tabs in the filler neck of each fuel tank—it's easy to carry a precise amount of fuel when you don't want to fill the tanks.

The Duchess will be on flight lines for some years to come because one can be purchased for well under $100,000 and the hourly operating costs aren't bad—we saw rental rates from $195 to $285 per hour. However, we think demand will drop as students want glass panels and *ab initio* programs grow. As a trainer, we frankly prefer an airplane that is more demanding of the pilot than the Duchess. And, as they get longer in the tooth, the cost of maintaining them will eventually become unacceptable as things continue to break—on our last flight in a Duchess, something failed in the combustion heater system and we spent most of it shivering.

## CONCLUSION

We don't see a boom in the demand for multi-engine trainers, just a slow, steady need for new, glass-cockpit versions as pilots who came up with glass demand them. We like the Tecnam P2006T for its more demanding handling than the Seminole—we think it's a better training tool for turning out pilots who are prepared for other twins that are vicious if the pilot is careless with speed control. If it holds up in a training environment and Tecnam establishes a satisfactory service network, then its significantly lower initial and operating costs will make it a no-brainer for schools. Otherwise, the Seminole should soldier on as the number one choice for training programs.

# Legacy Light Sport: Cub vs. Champ

*For a little less money (sometimes), the Aeronca is a better flier, roomier, faster and easier to land. But it will always lack the Cub's cachet.*

*by Paul Bertorelli*

While pilots grow old waiting for the FAA to reform the Third Class medical, light sport flying remains the last refuge to stay in the air. And vintage airplanes like Piper's venerable J-3 Cub or the Aeronca Champion actually promise affordability, if not comfort and technological panache.

## AIRCRAFT COMPARISON

Taildraggers both, these two aircraft have always enjoyed a following and now they're getting a closer look as potential LSA choices. There are plenty out there and the prices are right when compared to a new or even recent-model light sport costing four times as much.

### CHECKLIST

- ⊕ For $25,000 to $35,000, a Cub or Champ beats the price of a new LSA.
- ⊕ Thanks to Univair, Wag-Aero and the Champion factory, both are supportable.
- ~ They aren't modern airplanes and don't fly like them, either. Got feet? You'll need 'em.

While buying a Cub or Champ is a practical way to own an inexpensive light sport airplane, there are some caveats. They don't fly like or as well as modern certified airplanes, they're not always snap-of-the-fingers easy to maintain and if you can't afford or gain access to a good hangar, forget it. For as tough as these old birds are in the air, they're tender when exposed to even the mildest elements. But if you find a good one, care for its minimal needs and fly it regularly, there's no cheaper way to own and fly an airplane. In this report, we'll look at both aircraft, warts and all.

## THE LEGACY LIST

The list of LSA-compliant legacy airplanes is quite extensive, encompassing at least seven manufacturers and about 130 models of both land and seaplanes. Populations of these aircraft vary, but the J-3 and versions of the Champ are among the most numerous, if not the cheapest.

*Barnstormers* features ads for Taylorcraft BC-12Ds selling for half the price of a moderately restored J-3 and LSA-compliant Ercoupes or Luscombes are likely to be cheaper, too. Just remember that not all variants of these airplanes meet the 1320-pound LSA limit.

Drilling down into the Piper Cub list, there are 27 listed models certified under 1320 pounds, including some exotics you're never likely to clap eyes on, such as the E-2, J-2 or even the J3C-40. "There were three primary models of the J-3," says Steve Krog, who operates the fount of all things Cub, the Wisconsin-based Cub Club. "There was the J-3C, the J-3L and the J-3F. Those stood for Continental, Lycoming or Franklin." Krog says you can count on one hand the number of Lycoming-powered Cubs and maybe two hands for Franklins. "So all the rest are Continental powered," he says, noting that many have been converted, some more than once.

Piper's production started in late 1938, with a few airframes, and picked up during World War II with the L-4. It took off again for the civil market in 1945. J-3 production ended in May of 1947 with a total of about 19,700 manufactured for every variant built. Today, Krog estimates there are 4700 J-3s on the U.S. registry flying or being restored. That means if you want one, they're out there and the most likely candidate will be a post-war J-3C65. It's common to find these with C-85 or C-90 engines, which substan-

*While not exactly apples to apples, we paired Vern Hiett's nicely restored Aeronca 7DC, top, against an upgraded pre-war C-65 J-3.*

tially improve performance. While the Cub remained a Piper product and the company held together for years, the Aeronca Champ enjoyed no such stability. Its antecedents date to the 1920s, but the "modern" Champ as we know it today was a post-war creation. It was actually designed in 1944 at the same time that its side-by-side seating stablemate, the Chief, was under development.

Although the original Aeronca predates the Cub, the Aeronca line is really a product of the post-war years, when it enjoyed brisk sales among military pilots returning home after the war.

While Piper moved beyond the Cub in 1947, Aeronca kept at it until 1951, producing 7AC Champs and 11-series Chiefs. The company was sold to businessman Bob Brown in 1954 who formed Champion Aircraft, which was itself sold to Bellanca in 1970 and carted to Minnesota, where the airplane served as the basis for the Citabria and Decathlon lines. American Champion acquired the company in 1989 and has continued to both develop new models and support the original aircraft. In 2007, it introduced the LSA-compliant 7ECA Champ powered by a Continental O-200-D, the lightweight version of the original O-200.

Aeronca built 11,181 post-war aircraft at its Middletown, Ohio, factory and many are still active on the registry. The list of LSA-compliant models is long—51, to be exact—but many of these are museum pieces that aren't practical to own, if they even exist. The core of the Champ market is the 7 series—the AC, BCM,CCM and the DC. The 11-series Chief also meets LSA requirements.

Aeronca expert Bill Pancake, who we consulted for this article, says about 7200 of the 7AC models were built. The airplane we flew for our head-to-head comparison is a 7DC beautifully restored by Vern Hiett and Dan Gulandri. Only 168 were built. Although it's virtually identical to the 7AC, the DC emerged from the factory with a Continental C-85. It had a large dorsal fin and, in addition to the standard forward fuselage tank, it also had a 13-gallon wing tank.

## CONSTRUCTION

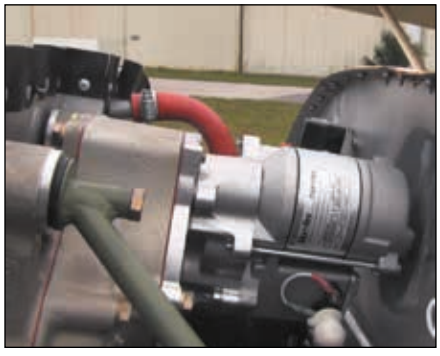
Both airplanes are products of another era of aircraft construction that has more to do with the 1930s than GA's manufacturing heyday in the late 1970s. The Cub, owing its genesis to 1930s design sensibilities, is the more rudimentary of the two. Both are constructed of steel tubular fuselages with gas-welded joins. Aluminum is used for parts like firewalls, cowlings and fairings, but where Piper or Aeronca could use fabric, they did. Fabric was—and remains—light and practical. But if it was cheap after World War II, it's not now. A full recover can cost more than the airplane is worth.

Control surfaces in both airplanes are cable controlled, fabric-covered surfaces. While on the subject of wings, when these aircraft were built, wood was the material of choice for spars, either fir or Sitka spruce. Although there's no reliable count on this, many examples of both airplanes still have the original wooden spars, even though they can be replaced with metal. Not a good thing, that wood, right?

"Not necessarily," says Bill Pancake. "Have someone who's competent and knowledgeable about wood do an inspection. I have no problems with wooden spars if they're maintained," he says.

For trim, the Cub has an automotive-style window crank that runs a cord to a jackscrew, adjusting the horizontal stab's angle of attack. This actually sort of works, just not very well. The Champ has a better system; a ceiling-mounted knob that moves a real trim tab on the elevator.

By modern standards, both the Cub and Champ have an appallingly unsafe fuel tank location. (Remember, it was the 1940s.) It's inside the cabin, behind the firewall and immediately in front of the front seat occupant. The Cub typically has a 12-gallon tank, the Champ a gallon more. Some models of the Champion have the forward fuselage tank, plus a 13-gallon wing tank. It's also possible to convert Champs to Citabria-type wings, with two 13-gallon tanks, giving the airplane a solid five hours of endurance. The J-3 can also have an aux wing tank and one mod allows two wing tanks with the removal of the fuselage tank.



*The pre-war Cub, top, was converted to a C-65 from a Franklin and later upgraded to 75 HP. The Champ, middle photo, has a C-85 with electric start, a real plus for those who don't like propping.*

## ELECTRICS, BRAKES, ERGOS

Both the Champ and Cub were

*The Champ solos from the front, top; no S-turns needed. The Cub's rear solo puts the pilot in a dark hole, second from top. Champ baggage area, bottom, is almost twice the size of the Cub's.*

designed without electrical systems, but many have been converted to have either electric start or both electric start and a generator to charge an onboard battery. Cub Club's Steve Krog told us that to avoid the legal entanglements of a complete electrical system, some owners install a battery and starter, but no generator. This offers a safer alternative to propping, but the airplane will remain grandfathered as having no electrical system. He says a battery charge is good for dozens of starts.

Other choices for both airplanes include wind-turbine generators, which produce sufficient power for a radio or transponder. But increasingly, with high-quality lightweight starters and alternators available, many owners are converting both of these aircraft to C-85-12 engines that can accommodate both on accessory pads. Both aircraft are approved for these engines. The Aeronca 7DC we used for this comparison has a modified C-85 that's essentially the equivalent of an O-200. Whether the electrical upgrade is worth the investment depends on how comfortable—or uncomfortable—you are with hand propping. There's no question propping entails significant risk.

Brakes in these vintage aircraft are adequate, but hardly impressive. You don't need effective brakes in a taildragger except to hold the airplane during the run-up and maybe catch a developing groundloop. Original Cubs had hydraulic heel brakes with rubber expander tubes bearing against friction pads inside the drums. One upgrade that considerably improves performance is the Grove disc brake conversion described on page 22 of this issue.

Early Champs had two types of brakes, both mechanically actuated via cable. The Goodyear system used discs while the Cleveland, which many prefer, has shoes and drums. Either way, the cables have enough slack to require a little anticipatory footwork before braking is needed. Later Champs had conventional hydraulic brakes and those conversions are available for older models.

Cabin comfort isn't a concept that applies to the J-3. While the famous clamshell door is a delight when open in flight on a warm summer evening, it's a drafty, noisy nuisance during the winter. The heater is so-so. J-3 ingress and egress is awkward at best, but helped along with good upper body strength to use the ceiling tubes as support when getting in and out. The seats aren't adjustable and while soloing from the rear offers plenty of legroom, the same can't be said for the front seat. It's cramped and difficult to get into.

The Champ is better, but not great. The cabin is four inches wider than the Cub's and the seat space fore to aft is six inches longer. That translates to more legroom and even space to place something on the floor without losing it. The Champ has a latching door similar to an automobile and although it can't be opened in flight, the tradeoff is a quieter, less drafty cabin, It's also warmer during the winter.

While the J-3's so-called baggage space is literally breadbox sized, the Champ's is large enough to actually carry things like small bags or tools. But it's not as easy to get to as the Cub's is, due to the cabin door configuration.

## FLY OFF

If the two airplanes, as vintage taildraggers, look somewhat alike, they don't fly that way. The J-3 is definitely more kite like, with slightly lower wing loading. On takeoff, the tail comes up almost immediately and the Cub announces when it's ready to fly, requiring just a tug to nudge it into a leisurely 300-FPM climb. Visibility from the rear seat is fairly terrible and S-turns or leaning out the open door is a must during taxi.

If you needed an adverse yaw demonstra-

tor, the Cub would be your first pick; rudder use is a must and pilots with dead feet will soon wake them up. Stalls are gentle with little tendency to fall through or snap into a spin and the Cub's stall indicator is the lower door, which floats up if open in flight. The airplane is a little less benign if stalled in a steep turn and many fatal stall/spin accidents have occurred in just this scenario.

The J-3 isn't hard to land, but it's a challenge to land well. Many pilots don't bother with the airspeed indicator, which is likely to be inconsistent, but rather fly the wing by sight picture and feel. For a three-pointer, touchdown just as the energy dissipates and you'll be rewarded with a satisfying greaser. Land too fast or force it on and those two gear bungees will give you what for. The same will happen on a wheelie if you don't time the stick-on just right.

Contrast that to the Champ, which is quite easy to three point and tends to be less fussy about the speed. The Champ's oleos suck up more energy than the Cub's bungees do. Further, soloing from the front, visibility is far better during both taxi and touchdown. There's no guessing about runway alignment. We think it's an easy taildragger to learn; perhaps the easiest.

Takeoffs, however, require more attention than the Cub does. The tail is slow to rise, perhaps because the fuselage is a foot shorter and the center of mass is somewhat higher. Where the Cub requires a light touch to lift the tail, the Champ needs a more forceful push all the while minding the rudder. Although we can't support it with data, our impression is that the Cub, thanks to its longer fuselage and wider gear track, may be less susceptible to ground looping than the Champ. When the Champ heads for the ditch, you have to be on the rudder right now. The Cub seems to give a little more warning.

Neither of these airplanes will get you anywhere in a hurry, including back to the airport. A J-3 loafs along at about 70 to 75 MPH, the Champ 80 to 85 MPH. Plan for 4.5 to 5 GPH with no leaning capability to eke out efficiency. The C-85 Champ we flew for our comparison also has a better climb rate than the C-65 Cub, even though the Cub has been converted to 75 HP by dint of a different prop that allows for higher RPM. When doing circuits in the Cub, it's common to settle for 500 feet in the downwind, rather than struggling to reach 1000 feet. With two heavy people aboard, 300 feet is more like it.

## HOW ABOUT MAINTENANCE?

**Simple as they are, vintage taildraggers are equally simple to maintain. And even though the original Cubs are 77 years old, parts and support of various kinds are widely available.**

**"It's probably the only airplane you can build today from the combination of three catalogs: Univair, Wag-Aero and an engine shop. You can buy everything to build one," says Cub Club's Steve Krog. And that includes major parts, such as control surfaces, wing parts, gear components and so forth.**

**One caveat, however. The parts may not always be readily in stock. Our pre-war Cub needed a gear strut recently and although Wag-Aero sells it, it took four months of waiting for the part to be made. But many other items are on the shelf. Hard-to-find parts include tailwheels and the original brake expander tubes.**

**"If you're trying to keep a Cub in original configuration, expander tubes are tough. They haven't been made new since 1947 or 1948," Krog says.**

**Engine overhauls aren't much of a problem, although not all shops do the C-65. Our go-to shop is Don's Dream Machines, which has a sterling reputation in the Cub and Champ community. We reviewed the shop in the April 2014 issue of *Aviation Consumer*.**

**Both Univair and Wag-Aero also support Aeroncas, with a full line of replacement parts. Again, not everything will be available all the time, but that's just the nature of owning a vintage airplane. Find Univair at www.univair.com and Wag-Aero at www.wag-aero.com.**

**The American Champion Aircraft factory (www.americanchampionaircraft.com) can also supply some parts, including complete wings with metal spars and repairs on fuselages. It also stocks some fuselage parts, but no parts for the oleo gears. But between Univair, Wag-Aero and ACA, no Champ owner should go wanting for parts.**

**Finding someone who still knows how to do fabric work might be a challenge. On some fields, the skill will be lost entirely. Yet on fields where there are a lot of rag wings, A&Ps may be fully versed. Fortuately, fabric work is a good DIY skill. EAA sponsors fabric training programs and so does Cub doctor Clyde Smith. See www.cubdoctor.com for more. For owner groups, we recommend Steve Krog's Cub Club at www.cubclub.org and the Bellanca-Champion Club at www.bellanca-champion-club.com.**

## CONCLUSION

Either of these airplanes is a worthy choice for a legacy LSA. However, the Champ is clearly the better flier of the two and has more in common with what most of us know as modern airplanes than does the Cub.

Furthermore, because the Cub enjoys a unique cachet, prices are likely to be a third or more higher than a comparable Aeronca. But Bill Pancake told us Champ prices are on the rise, perhaps because more pilots are eyeing them as LSA candidates. So don't count on a Champ always being cheaper. Cub prices in the $40,000 range aren't uncommon, but the high 20s may be the average. Steve Krog told us there are always a few restored or project airplanes on the market.

Bottom line, in the Cub, you're paying more for the prestige and the sublime pleasure of having someone approach you on the ramp and say, "Hey, nice Cub. Can I look inside?" In the Champ, you might pay a little less for a better-flying airplane with better performance, but a lower-profile pedigree. If buying an airplane is about choices, we would say Cub vs. Champ offers exactly that.

# Starter Replacement: Consider Weight, Hot Starts

*When it's time to replace a starter, good choices abound. New starters have unprecedented reliability—so long as the pilot doesn't crank too long.*

*by Rick Durden*

Master switch—on. Mixture—rich. Fuel pump—on until pressure registers, then off. Ignition key—start.

Silence.

Fortunately that result is rare. Almost invariably, when we turn the ignition key to start or hit a starter button on a piston-engine airplane, the starter engages and the prop swings with vigor. Over the past 20 years, new technology has made aircraft starters remarkably reliable—the newer ones should last beyond the engine's TBO, if not abused. So, when there's a big silence on hitting the start switch, the chances are that the problem is not with the starter itself. Nevertheless, the time does come when the starter slips its mortal coil and must either be replaced, rebuilt or overhauled.

We'll talk about how to make your starter last, a little about trouble-shooting problems and what options are available when it gives up the ghost.

## DUTY CYCLE

The one thing a pilot absolutely needs to do to maximize starter life is to keep from overheating it—that means rigidly following the duty cycle limits.

The process of spinning a small, electric motor to turn over a larger piston engine means that heat is going to build up in the motor quickly. Each starter has a published duty cycle limit—the starter may be operated for a maximum number of seconds and then must cool for a minimum period of time. Tim Gauntt, Director of Product Support for Hartzell Engine Technologies, told us that the one way to almost certainly assure that you damage a starter is to operate it beyond the published duty cycle limits.

Hartzell and Sky-Tec duty cycle limitations call for no more than 10 seconds of turning the starter per attempt before letting it cool/rest. That's it, 10 seconds. B & C Specialty allows 30 seconds, but then the starter must cool for two minutes.

For all Sky-Tec starters, the rest time after a 10-second start attempt is 20 seconds. The start/rest cycle can be repeated a maximum of six times.

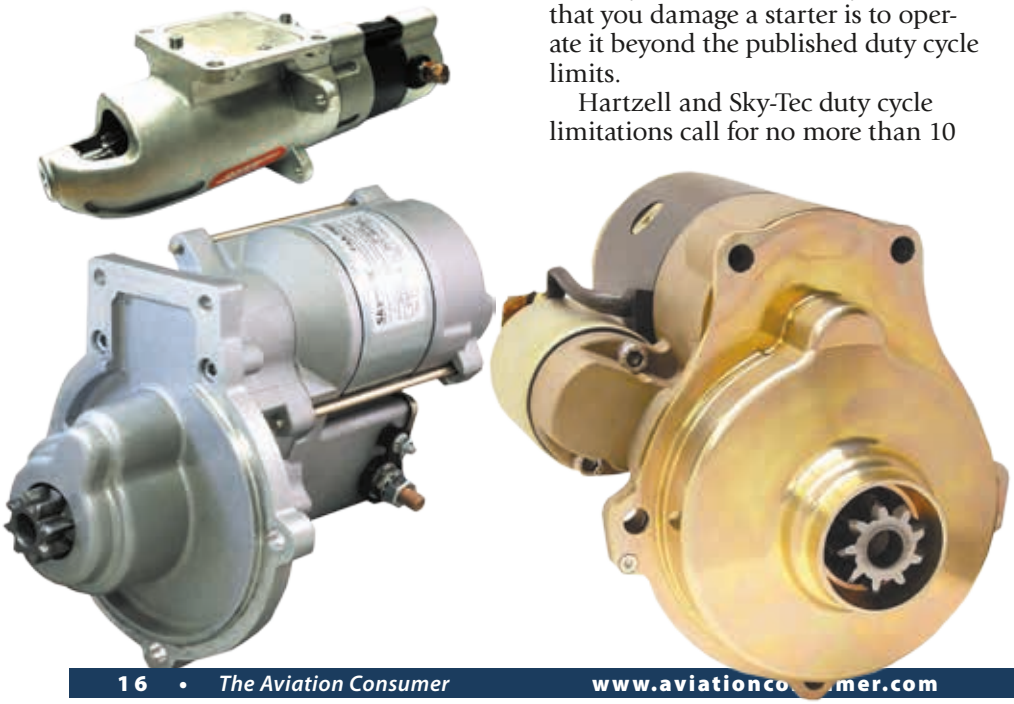
For Hartzell Engineering Technology heavyweight and lightweight Magnaflite (formerly Kelly) starters, the rest time after each 10-second attempt must be 60 seconds. The cycle can occur three times before a 15-minute cooldown is required.

For Hartzell's lightweight E-, X- and M-Drive (formerly Kelly) units, the cooldown/rest time is 20 seconds and the start/rest cycle may be repeated 20 times before a 10-minute cooldown is required.

We think those duty cycles are perfectly reasonable. If the engine doesn't start within those times, something is wrong with the engine that needs to be rectified.

## TROUBLESHOOTING

If you turn the key or press the button and the prop doesn't start turning or only goes to the next compression stroke and stops, don't assume the starter is the problem. Most likely it's an electrical system problem. Rich Chaffee of Sky-Tec told us unequivocally that the first step of trouble-shooting a starter problem is to pick up a voltmeter. That was echoed by



*Hartzell Engine Systems E-Drive starter for Lycoming engines, top left; Sky-Tec and B and C Specialty starters for Continental engines, far left and left, respectively.*

### CHECKLIST

- New technology has increased starter reliability significantly.
- A new starter should last more than the life of the engine.
- Cranking a starter longer than its published duty time will damage it.

Tim Gauntt of Hartzell. The websites for Hartzell and Sky-Tec have clear guidelines for troubleshooting starter issues—just follow them. Our compliments to both companies for websites that provide a great deal of information in a user-friendly manner. We, unfortunately, can't say the same about B & C's website due to its lack of info.

## KICKBACK

Aircraft starters were not designed to be forced backward. If the engine kicks back during a start, there's a good chance the starter will be damaged.

Kickback is caused by mistiming of the engine's starting system or a problem with the mags that allows a mag that shouldn't be firing to do so during the start. If a cylinder fires before TDC it will develop from 20 to 50 HP backward against the 2-HP starter motor. The starter loses. Kickback can even break teeth on the ring gear of a Lycoming engine.

There is nothing in a pilot's starting technique that can cause kickback except for cranking the engine with the mags on BOTH when the POH calls for cranking on one mag—such as on many American Champion aircraft.

Newer starters are designed to break internal components so that no teeth are broken on the ring gear—it's cheaper to replace a starter. Hartzell and Sky-Tec offer models of their starters that are protected against kickback.

Starter warranties generally do not cover damage due to kickback. The only one we did find that did so was on Hartzell's E-Drive series.

## LIFE EXPECTANCY

In the real world of hot starts, renters grinding the starters of 172s until the battery goes flat and less-than-perfect ignition systems, we got all sorts of responses to the question of starter life. Scott Ward of T & W Electrical Service, a company that has been overhauling starters for decades, told us that they routinely get heavyweight starters that have lasted 800-1000 hours, "depending on how hard the airplane starts."

Derek DeRuiter of Northwoods Aviation in Cadillac, Michigan, told us he typically gets from 1000-1500 hours out of a starter, and referred to a nearby Part 135 operator that primarily makes 15-minute flights from the mainland to an island in Lake Michigan as one who sees near the low end in starter life. However, we also got word that the newer lightweight and heavyweight starters will last more than 2000 hours.

## OVERHAUL OR BUY NEW?

Nevertheless, when your starter wears out, what's the better approach, overhaul or buy new?

From a dollars and cents perspective, overhauling (or rebuilding—the process is nearly the same, overhauls can be done in the field and rebuilds are performed by the manufacturer) is less expensive than buying new—figure half to two-thirds the price of a new starter of the same type. John Evans, head of Aerotech of Louisville put it pretty simply, "If your starter has been working for the type of flying you do, you can save money by staying with what you have."

Almost all heavyweight starters

## KEEPING THE STARTER ENGAGED

**The good news is that newer design starters don't need any preventive maintenance. If the starter has permanent magnets, as do all lightweight starters, there's no requirement or even recommendation for preventive maintenance. Rich Chaffee, general manager of Sky-Tec, put it bluntly, "Just use it."**

**Bill Bainbridge, owner of B & C Specialties, the company that made the first lightweight aircraft starters, told us that his starters do not have permanent magnets, but do not need preventive maintenance.**

**If you have a heavyweight starter, it has brushes that wear and can break due to vibration. John Evans, who runs Aerotech of Louisville, a company that specializes in overhaul and repair of starters, told us that he recommends pulling a heavyweight starter every other annual and going through it to check on the condition of the components. He also recommends having the prop balanced on aircraft with heavyweight starters. He's observed that doing so reduces vibration and improves their life.**

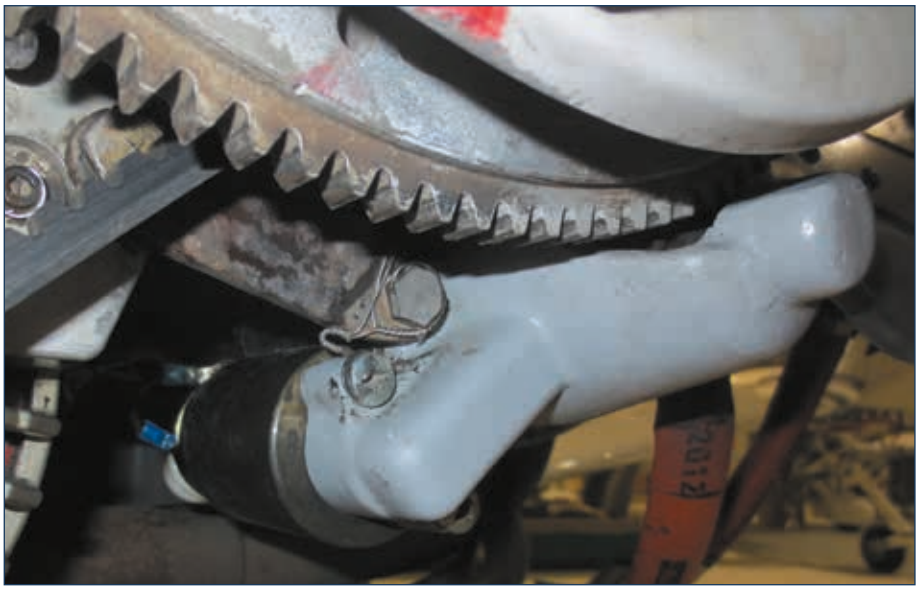
**Lycoming starters that use a Bendix drive to engage the engine flywheel have a frustrating tendency for the Bendix drive to not actually engage the flywheel, unless preventive maintenance is performed. The starter simply whirs while the prop remains stationary and the pilot steams. It's most common on airplanes that don't fly regularly—allowing corrosion to develop on the steel shaft on which the Bendix drive moves, causing the drive to hang up. Those Bendix drives should be sprayed with dry silicon lubricant every 25 hours. It is also recommended that on those with brushes instead of permanent magnets, that the brushes be inspected every 100 hours.**

**When out in the boonies and a Bendix drive refuses to engage, shutting everything off, taking the key out of the ignition, getting out of the airplane and using something solid to tap on the cup around the drive has been known to free it.**

**Experienced pilots operating starters that sometimes have the Bendix drive hang up use a bush technique that takes advantage of the design of the drive to assure it will engage on the next start.**

**The Bendix drive is designed so that once it engages the engine flywheel, it will not disengage until the engine starts. Pilots who are concerned about the next start take an extra step after a normal post-flight shutdown: With the mixture at idle cutoff, they briefly—very briefly—hit the starter. The drive is normally nice and warm and will move freely because of the vibration of the just-concluded flight.**

**The Bendix will usually do its thing and engage the engine flywheel. Because the pilot only briefly activated the starter, the prop will barely move and the engine will not start. The starter is, however, now engaged to the engine flywheel and ready to turn the engine over when it's time for the next flight.**



*Starters on Lycoming engines such as the Cherokee 140, above, and Grumman Traveler, below, engage teeth on the engine fly wheel.*

can be overhauled at specialized shops. Many owners opt for exchanging their worn-out starter for another that has been overhauled or buying an overhauled starter from an overhaul shop or a supplier such as Aircraft Spruce. Depending on the type of starter, we were quoted prices from $200 to $500.

To the extent lightweight starters can be rebuilt—most can—it is through the manufacturer. Prices we saw were in the same range as heavyweight starter overhauls.

Warranties on overhauled/rebuilt starters vary—Hartzell offers six months or 250 hours, Aerotech warranties its overhauled starters for one year, Sky-Tec offers a two-year warranty on all of its starters, new or rebuilt and B & C provides a two-year or 200-hour warranty. Be aware that in order to get warranty credit, you must follow the terms of the warranty to the letter.

## BUYING NEW

The selection of new starters available is nothing short of impressive. Hartzell Engine Technologies acquired a number of the existing starter lines from such names as Delco, Prestolite and Kelly, has upgraded them and added a full line of lightweight, permanent magnet starters. If you have a piston-engine aircraft, Hartzell Engine Technologies makes a starter for it.

Sky-Tec has steadily expanded its line so that it makes high-torque lightweight starters for nearly every horizontally opposed, non-geared aircraft engine.

B & C Specialty Products makes lightweight starters for smaller piston engines, especially helicopters and is particularly popular with the airshow set using MT props where starting can be challenging due to lack of inertial mass of the flywheel and prop.

Technology has improved aircraft starters substantially in the last 20 years—much of it powered by a healthy competition between Hartzell Engine Technologies and Sky-Tec. Advanced clutches and solenoids for quick, clean engagement (the Bendix drive for Lycoming starters may become a thing of the past) and disengagement (the bane of starter adapters on Continental engines) mean that a new starter is likely to last through the life of the TBO of the engine on your airplane and well into the next one.

If weight is a consideration, heavyweight starters weigh in the 17-pound range. The newest lightweight starters are less than half that and, with high-torque motors, spin the engine much faster, making starting easier—especially hot starts.

Prices for new starters vary with the type of starter, but start as low as $359 and go up to over $700. We saw no TBOs for new starters. Sky-Tec recommends, not requires, rebuild at 2700 hours—according to GM Rich Chaffee, they should go longer.

## CONCLUSION

If you decide to buy a new starter, our recommendation is to look at the websites for Hartzell Engine Technologies, Sky-Tec and B & C Specialty Products and then call them to talk about the airplane you have and the type of flying you do. They are not going to recommend an expensive, heavy-duty starter suitable for a flight school if you only put 100 hours a year on your airplane. They'll also discuss weight and balance on your airplane—as choosing a heavyweight or lightweight starter may fix a c.g. problem.

In the scope of interviews with the manufacturers, we learned that each loves talking starters. Tim Gauntt of Hartzell and Rich Chaffee of Sky-Tec both commented that if they didn't get a call from an owner or a mechanic with starter questions during a day, they felt they were doing something wrong.

## CONTACTS

Sky-Tec
817-573-2250
www.skytecair.com

B & C Specialty Products
316-283-8000
www.bandc.biz

Hartzell Engine Technologies
877-359-5355
www.hartzell.aero

# iFly GPS App: Multi-Device, Intuitive

*Adventure Pilot's iFly GPS navigation app is refreshingly utilitarian and works on iOS and Android. Synthetic terrain mapping is missing.*

*by Larry Anglisano*

The iFly GPS app from Adventure Pilot was born from the iFly 700-series GPS navigator, an intuitive tablet-based EFB that is being redesigned to include a better display and internal power supply.

What got our attention is the iFly app's flexibility to run on both the iPad and Android devices, a rare and welcomed option in the world of aviation apps.

After flying with iFly GPS on both platforms, we like its simple flight planning and data entry process, shallow menu structure and useful graphics.

## CUT-TO-THE-CHASE NAV

At the core of the iFly app is its straightforward mapping capability and intuitive feature set. But even better is that the app has a simple navigation logic. Adventure Pilot boasts that the program doesn't need a pilot's guide and we agree, although we think there should be one in the app's menu structure.

With any navigation app, the key to simple operation is a feature set that has minimum menus, and that is just how iFly GPS is designed.

Menu tabs are located at the bottom of the screen, starting with a Menu tab that is pleasantly shallow. Also appreciated is a Fly Direct To option, which brings up a editable data box with a sufficiently sized onscreen keyboard for typing either full text or identifiers for where you want to go. iFly provides the option of finding only airports, VORs, intersections, fixes, custom waypoints or any combination thereof, simply by selecting search boxes. The app also keeps track of previous searches and waypoints, saving data entry time.

A dedicated Map tab is for selecting a map mode, and includes sectional charts (iFly uses Vector maps, which have scalable graphics for higher resolution), low altitude enroute charts, terminal area charts and NOAA approach plates, plus surface diagrams.

It's worth mentioning that while the app has detailed waypoint and airport information, including fuel prices, it is a full-time map display. The app has a built-in day and night mode function that adjusts the screen brightness. We ran the app on an iPad mini3 and Samsung Galaxy Tab S 8.4, and both offered good graphics display.

While on the topic of screen quality, we think the onscreen presentation is acceptable and mapping is crisp, but suspect users accustomed to other top apps will ding it for its lower resolution menu nomenclature. If you are familiar with the iFly GPS dedicated hardware, you'll feel at home with the app.

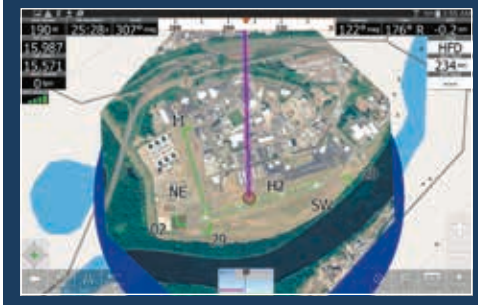
Adventure Pilot's Shane Woodson made it clear that unlike other apps, iFly charts are not scanned. Instead, they are direct from the FAA in digital format and then put through a proprietary process that enhances, improves the contrast, and optimizes them to run faster and take up less space on the devices. He noted that the iFly GPS app takes a smaller amount of space than competitive


*The screen grab at the left is a low altitude enroute chart with flight plan and fuel price overlay. The vertical profile terrain window can be stowed at the bottom of the screen, or expanded.*

### CHECKLIST

- Shallow menus keep the the app quick and easy to navigate.
- iFly provides good situational data, including airport imaging.
- Tape-style flight instruments and synthetic terrain imaging could step the app up a notch.

## IFLY GPS STANDOUT FEATURES



**Clockwise from upper left: A screenshot of the iFly RealView imaging feature displaying a satellite view of Hartford Brainard Airport in Connecticut. The course line shows navigation to the center of field. This utility makes it easy to find an unfamiliar airfield, in our view. Basic round-gauge instruments, including HSI, groundspeed and GPS altitude are highly configurable. Pitch and roll data can be displayed on a round-gauge horizon display with an appropriate AHRS input. The square to the left of the groundspeed indicator is a traffic alert box, for displaying ADS-B traffic data. Chubby fingers will get along well with the onscreen keyboard. It is used for entering flight plan data and for searching waypoints. The iFly GPS app shares the same feature set and graphics as the iFly GPS 720, and the improved iFly 740 dedicated tablet navigators.**

apps, even with the high-definition charts and terrain data loaded. That is a major concern for us and others running many apps.

The Map Mode menu has a selection for overlaying weather data—either Internet weather for preflight planning—or from a variety of ADS-B weather receivers, including the iLevil, SkyRadar and Dual XGPS ADS-B devices.

All map modes include a vertical profile terrain window, which can be expanded into a larger window. You can zoom in and out and control its alert functions. The app has attention-getting terrain audio alerting that is plenty loud enough to hear while wearing a headset.

Map mode also has an option for displaying configurable flight instruments. This can be a full page display, or overlay of individual instruments at the top of the map page, including an HSI for GPS course guidance. Missing is a tape-style flight instrument display, as is synthetic terrain data, but a round-gauge attitude display can depict AHRS-derived pitch and roll data when connected to a compatible ADS-B receiver. Adventure Pilot said it could add synthetic vision in the future, but doesn't think there is sizable user demand.

Flight planning is a snap; simply select the Flight Plan tab, set the departure and destination airport, plus the waypoints along the way, and iFly figures out the rest, including fuel burn that is based on the stored aircraft profile. A More Options tab allows you to reverse the route, set a cruising altitude and check airspace along the way. An online flight plan filing option interacts with Lockheed Martin Flight Services.

### REALVIEW IMAGING

A function that is exclusive to iFly, RealWorld airport imaging includes satellite images of over 12,600 public and private airports. iFly takes the function one step further and provides georeferenced positioning and interfaces it with its AutoTaxi+ function. These RealView images are hard-loaded into the app database.

One way to access the RealView graphic is to simply tap on the airport from a map, and then tap the OPTS tab. Within the Possible Actions menu, you can select the RealView Airport tab. The Possible Actions menu also enables a Fly Direct To here command, for going to the airport. Once navigating directly to it, a course line is drawn from your current position and extends to the center of the airport within the RealView satellite image.

A dedicated NRST tab, for nearest airport search, has a submenu for navigating directly to it, adding it to a flight plan, showing it on the map and viewing approach plates and airport diagrams. Once you select the airport, iFly tells you everything you would want to know about it, including runways, frequencies, fuel prices and hours attended, to name a few.

### CHOOSE YOUR DEVICE

Adventure Pilot says that its app has been beta tested by a team of 400 pilots. We followed an online iFly beta test forum and it's clear that Adventure Pilot makes good use of real-world feedback.

Unlike some other apps that are adding cost options to existing subscriptions, there are few upgrade options with iFly. All of the apps functionality is included for iOS, Android and in the dedicated iFly 720 and soon to be released iFly 740 tablet GPS. VFR subscriptions are $69.99, IFR subscriptions are $109.99, and if you happen to own an Android, iPad and the iFly hardware, you can include all three devices on a single subscription for $19.99 extra.

A free iFly GPS trial can be downloaded from the Google Play store (for Android), the Apple App Store (for iOS) and more information is available at www.iflygps.com. Contact them at 888-200-5129.

# Beringer Brakes: Lightweight, Anti-Skid

*A new line of bolt-on brakes and tubeless wheels from Beringer Aero offers big-airplane performance for smaller models, including LSA.*

**CHECKLIST**

- Beringer offers the lightest brakes and wheels available.
- Simple pressure regulator device offers anti-skid functionality.
- STC approvals for Part 23 retrofits are growing, but limited for now.

*by Larry Anglisano*

Using its experience building patented motorcycle racing brakes, wheels and forks, French manufacturer Beringer Aero brings modern braking technology to small aircraft with a new line of bolt-on brake components and wheels.

Said to be the lightest brakes and wheels available for small aircraft, Beringer's components are now used by several OEMs, including Cirrus, Diamond and Pilatus, in addition to a long list of LSA and experimental kit manufacturers. The product line is unique because it includes an anti-skid feature, plus wheels that accommodate tubeless tire installations.

We took a close look at Beringer's line of brakes and wheels for LSA applications at this year's U.S. Sport Aviation Expo, and also sampled its larger braking system in a new Cirrus. We think the technology represents the next generation of aircraft brakes.

## CNC OPTIMIZED

Brakes and wheels significantly contribute to aircraft weight, and their manufacturing efficiency—and weight—can make the difference between exiting the runway at the first turnoff, or sailing off the end.

Beringer saves weight—while reducing rolling distance by up to 40 percent—by using corrosion-resistant anodized aluminum alloy components that are machined from solid through a CNC process. Claire Beringer said the wheel component R&D and manufacturing process begins by building a 3D model using CAD software. Once the design model is in place, Beringer conducts an optimizing process that moves weight from one part of the wheel to the other, until the perfect strength-to-weight ratio is achieved.

Using a hydraulic press, it then applies a radial and side load on the wheel and mounted tire to check the overall strength and loading of the wheel. It also conducts roll testing, where the wheel is pressed on a rotating drum for over 1000 miles at the absolute highest static load. The idea is to detect fatigue intervals and eventual failure of wheel bearings and other wear-and-tear components.

Beringer offers complete wheel and brake systems to include the wheel, brake caliper, master cylinder, parking brake and its ALIR anti-skid system. More on that in a minute.

All of the components are linked together with braided stainless steel Teflon lines and fittings, and the wheels have sealed bearings and accommodate the mounting of tubeless tires.

The two-piece wheels are equipped with floating brake discs. Floating discs are the best defense against warping and cracking because when the brake rotor is subjected to


*Clockwise from upper left: A Beringer aluminum wheel and brake assembly, ALIR anti-skid regulator and a Diamond DA40 with the Beringer combination wheel-brake-tire Tundra kit.*

## GROVE: BETTER BRAKES FOR CUBS

Piper Cubs are known for a lot of things, but good brakes aren't among them, at least if we're talking OEM equipment. Our pre-war Cub had the original expander tube brakes that, although rebuilt and well maintained, worked sporadically well at best.

Beringer Aero doesn't yet have an STC for the Cub, but a cost-effective solution is the disc brake conversion from Grove Landing Gear Systems, Inc. Yes, the Grove conversion knocks the sheen off that restored-to-the-original gleam, but ask me if I care. You don't really need a lot of brake when flying an old taildragger, but when you need it, you need it badly—for run-ups or countering an impending groundloop that the rudder has given up on.

The $859 Grove conversion kit dispenses with the ancient expander tube and friction pad/drums and replaces them with conventional steel rotors and calipers. The rotors are riveted to the original wheels and the system retains the individual master cylinders in the cabin. The kit includes everything you need except fresh brake fluid. While you're at installing it, it might not be a bad idea to rebuild the master cylinders, which will cost $35 each for diaphragms from Univair. But that's not to suggest this conversion is exactly cheap as J-3 stuff goes. Robbie Grove told us labor is typically six to eight hours, but our shop billed 16 hours for a total labor charge of $1440.

The system fits the airplane's tiny little wheels aesthetically and the performance is almost transformational, not so much for stopping the airplane as holding it on run-up or making a tighter taxi turn, which is sometimes useful.

With the exception of retaining the old automotive-style flare fittings, the Grove conversion uses standard brake parts, including modern composite pads. The rotor is steel, not stainless steel, so it will corrode a bit. But regular use will prevent that from being an issue.

One thing I'm a little wary of is that Grove specifies that the copper brake line from the Cub's stock system loops in front of the wheel assembly, as you can see in the photo. This means that it's exposed to any kind of obstruction on the runway and that an errant rock could damage it. Grove said this hasn't happened in the years he has been selling the conversion, but I see it as a small risk nonetheless. Find out more about the conversion at Grove's web site: www.groveaircraft.com.

*—Paul Bertorelli*

heat, it expands. But when it floats separately from the structure, it is free to expand and shrink without the constraints of the mount.

The Beringer brake calipers are housed in an alloy body to withstand high temperatures, and are fixed on the axle. They're also equipped with stainless steel polished pistons and utilize non-riveted metallic brake pads. The caliper/disc combination affords a chatterless and linear action, even under aggressive braking. We pushed as hard as possible during a high-speed turnoff in a Beringer-equipped Cirrus and experienced no fade or skid.



### ANTI-SKID

The absence of brake locking is a result of Beringer's ALIR anti-skid differential braking regulator. With its adjustable pressure settings (from 290 to 725 psi), the regulator prevents wheel locking by limiting the maximum pressure in the system. The device regulates the pressure between the left and right side, allowing a differential of around 14.5 psi once the maximal pressure is reached. The pressure threshold can be set at the factory (for STC applications) or adjusted by the owner in LSA and experimental models.

The ALIR is standard in most new Beringer kits and the 11-ounce regulator is manufactured from billet, red anodized aluminum. It can be added to existing Beringer kits for $197.

Beringer offers a wide variety of wheel and brake configurations, or standalone wheels without brakes. There is even a four-inch bush tail wheel suitable for LSA models. It sells for around $400.

It also offers four-, five- and six-inch wheel configurations with complete braking systems. The six-inch HE-series wheels and brakes have TSO certification and have a static loading of 2090 pounds. It sells for around $1100 per wheel. Beringer sells individual brake components, including master cylinders, fluid reservoirs and axles at various prices.

The complete wheel and brake kit for retrofitting a Cirrus SR20 or SR22 is $7559. Beringer says it is currently working on retrofit wheel and brake systems for more common applications, including Cessna and Piper models, and hopes to have STC certification later this year.

For more on the product line, visit www.beringer-aero.com, or you can phone its Chicago-based sales office at 708-667-7891.

# Aircraft Weighing: Worth the Price and Effort

*How do you verify the accuracy of superceded weight and balance reports? Put the aircraft on the scales.*

*by Larry Anglisano*

Unless your aircraft has never been modified, there is a good chance there are at least some discrepancies in its weight and balance data.

I learned that firsthand when I worked as an avionics tech, discovering equipment that was installed and removed from some aircraft without being documented. Computing a new report for these aircraft was pointless. After all, you need to start a revision with accurate basic empty weight and reference datum figures. In many cases, the only way to do that is to have the aircraft weighed.

## SPECIALTY SERVICE

While a competent mechanic can handle the task of weighing an aircraft, many shops can't justify the purchase and calibration costs of the scales. The shops I spoke with admitted that it's easier for them to subcontract the work, or send the owner to have it accomplished.

While aircraft weighing is specialty work, the process is easier than you might think if you find the right shop. That includes using a weighing service that has certified and calibrated scales that are designed specifically for weighing aircraft.

Sal Capra at On-Site Weight and Balance in Lakeland, Florida, told me his operation is equipped with a wide variety of scales to accommodate anything from a Piper Champ to a Boeing jetliner.

On-Site will even travel to maintenance shops or private hangars to do the weighing. Capra said the weighing process often reveals errors in CG data, rather than errors in empty weight, although he noted that many aircraft don't weigh what its owner thinks it does. This is usually the result of mathematical errors made during manual revisions to the data. Using the wrong scales won't help.

"No one set of scales is appropriate for all aircraft. It could require an investment of $35,000 for the modern equipment that's needed to weigh a variety of aircraft," Capra said.

The equipment generally consists of multiple scales with wireless transmitters and can include a combination of sensors, including jack stand load cells and platform scales.

On average, expect to pay around $250-$300 for a single-engine piston, $350-$400 for a piston twin and close to $1000 or more to weigh a turboprop or small jet. The process generally takes a couple of hours, including the final paperwork.

Curtiss Cable weighs aircraft at Foothill Aircraft in Upland, California, and warns that retrofits signed off with the statement "negligible change to weight and balance" should be suspect because that's rarely the case. I agree. Some technicians follow the under-one-pound rule; if the removed or installed equipment is less than one pound, they might not compute a new weight and balance report. For that reason, many aircraft gain weight over time.

Whether it's a paint job that didn't include a complete strip of the old paint, or avionics that were installed or removed without factoring the weight of wire and hardware, one pound here and there can add up.

Speaking of adding it up, expect to empty the aircraft of everything that's not on the original type certificate before having it weighed. Some shops might top off the fuel tanks before weighing it and subtract the weight of the fuel from the report. If the airplane is turbine powered, it will have to be defueled because the density of jet fuel changes with temperature.

In the end, the effort and cost of weighing the aircraft will be worth knowing you have accurate data.


***Many maintenance shops can't justify the acquisition and calibration costs for pricey weighing equipment, right.***

# Cessna P210 Centurion

*Cessna's high-flying pressurized single is fast and efficient, but demands pilot proficiency and careful engine operation.*

To gain sizable amounts of speed and efficiency, you'll generally have to fly in the mid to upper teens and higher. And to do that, you'll have to make a choice: stick an oxygen hose (or mask) in your nose or pay for the convenience of pressurization. Due to market demand and high production costs, the choices for single-engine models are limited to Cessna's P210 and the Piper Malibu.

Pressurizing anything, let alone a single, is fraught with difficulty. Part of it comes in the form of mechanical woes—the engines are short-lived, often don't make it to TBO and they cost a lot to overhaul. Pressurization adds another complex system to maintain and operate. Part of it comes in mundane problems: separate, unpressurized baggage compartments and the need to fit everything that goes into the cabin through the pilot's door. Then, of course, there's the extra premium in first place: as of winter 2015, a 1981 P210 costs about $25,000 more than a 1981 T210.

## MODEL HISTORY

Cessna said that the P210 was a daring technological leap when it came out in 1978 and sold nearly 400 in the first two years. Still, the P210 was hardly a fresh, innovative design exercise. Instead, it was a derivative of nearly two decades of C-210 Centurions. The airframe was vintage 1960s and the engine was nothing new. Even the pressurization system had been lifted from the P-Skymaster. No matter. It was still a unique airplane: the pressurized single.

***All of the Cessna 210 Centurions are known for their load hauling and the P210 is no exception.***

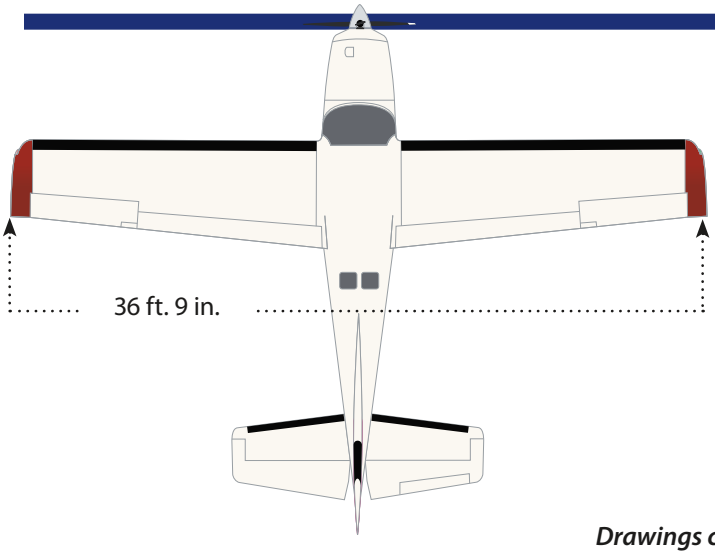
In 1979, Cessna changed the gear. The main gear doors were removed (they'd been troublesome on the 210), which cost some of the original 196-knot cruise speed and a little climb rate. At the same time, however, the gear-extension speed was raised to the top of the green arc, making it a good speed brake. Like other Cessnas, such as the first Cardinals, the early models had design flaws that had to be redressed after the fact.

Problems started cropping up in 1980. A pair of P210s crashed after engine failures caused by detonation. The FAA issued emergency ADs calling for extra-rich mixtures to cool the engines, along with other anti-detonation measures that reduced performance and, of course, boosted fuel burn significantly. The detonation apparently was caused by a poorly matched engine-turbocharger combination. High back pressure on the exhaust system and overly hot induction air temperatures caused the engines to run hot and experience destructive detonation from the excessive heat.

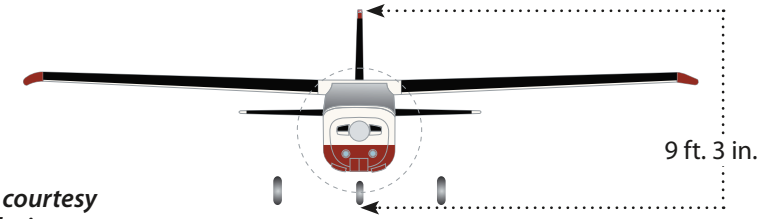
In May 1981, Cessna announced a major program to retrofit all P210s at Cessna's cost with a new turbocharger and a later AD made it mandatory. This was supposed to eliminate the need for ultra-rich mixtures and provide improved range, performance and fuel economy. What the retrofit did, instead, was to lower performance, with P210 pilots finding they couldn't hold manifold pressure or cabin pressure above 16,000 to 18,000 feet. Said one owner: "The

*That is Steve Isaacs's P210N in the lead photo. It was a logical step-up from his Cessna 182.*

# CESSNA P210 CENTURION





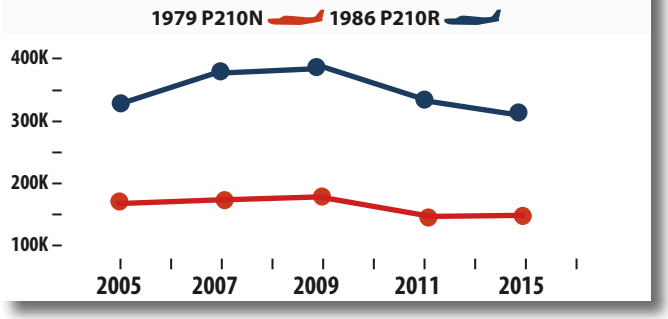



*Drawings courtesy*
*www.schemedesigners.com*

## SELECT MODEL HISTORY

| MODEL YEAR | ENGINE | TBO | OVERHAUL | FUEL | USEFUL LOAD | CRUISE | TYPICAL RETAIL |
|---|---|---|---|---|---|---|---|
| 1978 P210N | CONT. TSIO-520-P | 1400 | $35,000 | 90 | 1600 LBS | 187 KTS | $135,000 |
| 1979 P210N | CONT. TSIO-520-P | 1400 | $35,000 | 90 | 1600 LBS | 187 KTS | $145,000 |
| 1980 P210N | CONT. TSIO-520-P | 1400 | $35,000 | 90 | 1600 LBS | 187 KTS | $155,000 |
| 1981 P210N | CONT. TSIO-520-P | 1400 | $35,000 | 90 | 1600 LBS | 187 KTS | $165,000 |
| 1982 P210N | CONT. TSIO-520-AF | 1400 | $35,000 | 90 | 1600 LBS | 187 KTS | $175,000 |
| 1983 P210N | CONT. TSIO-520-AF | 1400 | $35,000 | 90 | 1600 LBS | 187 KTS | $185,000 |
| 1985 P210R | CONT. TSIO-520-CF | 1600 | $35,000 | 85/115 | 1629 LBS | 212 KTS | $300,000 |
| 1986 P210R | CONT. TSIO-520-CF | 1600 | $35,000 | 85/115 | 1629 LBS | 212 KTS | $310,000 |

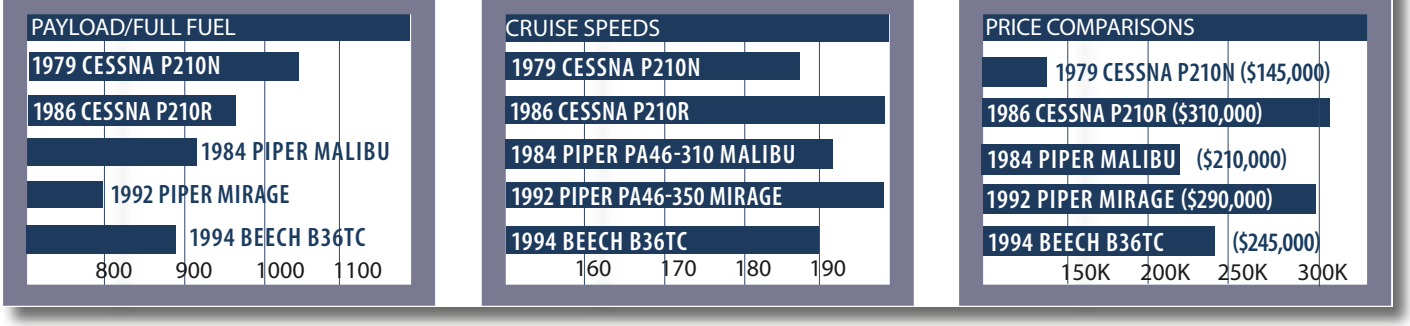
## RESALE VALUES




## SELECT RECENT ADs

| | |
|---|---|
| AD 2007-08-08 | GEAR UPLOCK ROLLER INSPECTION |
| AD-87-02-08 | CABIN DOORLOCK INSPECTION |
| AD-97-04-03 | WING SPAR INSPECTION FOR CRACKS |
| AD 88-22-07 | INSPECT AEROQUIP BRAIDED FLEX HOSES/FIRESLEEVE |
| AD 2002-07-01 | INSPECT HORIZONTAL STABILIZER FOR STRESS CRACKS |

## SELECT MODEL COMPARISONS



*That's a shot of the factory intercooler on a P210R, top, courtesy of Chuck McGill. The Vitatoe turbonormalized IO-550 engine mod, lower photo, generates 310 HP and results in cooler running at high power settings. It also has a welcomed 2000-hour TBO.*

new turbo has turned the airplane into a sick dog at altitude."

Late in 1981, Cessna came up with another solution to the problem: a new air induction system that would be retrofitted free by the company to restore the lost performance. Consisting of a larger intake scoop and redesigned air plenum, it increased manifold pressure by up to seven inches at high altitude.

The 1982 model year brought a number of improvements that make these and later airplanes more desirable than earlier models. Among these were a new "slope" turbo controller that maintains deck pressure at a steady two inches above manifold pressure, in the process eliminating a lot of unnecessary load on the turbo. The old fixed-point controller on 1978 to 1981 P210s was an economy measure that held an upper deck pressure of 35 inches, even when the engine needed only 25 inches. Upper deck pressure is the pressure between the turbo compressor and the throttle butterfly.

This caused the turbo to work a lot harder than it had to, resulting in more exhaust back pressure and hotter induction air. Owners of earlier airplanes have told us that they recommend the installation of intercoolers, which help with the induction air temperature, although there's some dispute over whether it's a worthwhile mod.

Essentially a radiator that cools the induction air, an intercooler can typically raise the actual MP from one to as much as four inches, but only if the engine fuel flow is set up properly. That's because the increase in manifold pressure also requires increases in fuel flow. Push more MP without increasing fuel flow and you'll risk overtemping the engine.

The 1982 models also received a new fuel system with two significant features: proper vapor-return lines and a left-right-both fuel tank selector system that reduces chances of fuel mismanagement. Other upgrades included valve, ring and valve guide improvements and a TBO hiked 200 hours to 1600 hours; dual vacuum pumps and alternators available as options; improved cowl flaps to reduce chances of overcooling on descent; a TIT (turbine inlet temp) gauge, along with a restriction of 1650 degrees TIT to limit leaning and keep exhaust temps down.

## COMPETITION FROM PIPER

The biggest change in the P210 was due to the arrival of competition in the form of the Piper Malibu. Cessna could plainly see that the existing P210 wouldn't be able to compete with it, whereas a revised version would represent a less expensive, highly capable alternative.

The result was the P210R. There was a more powerful 325-HP engine with an intercooler as standard, offering better performance and increased longevity; the original engine was rated at 285 HP continuous, with 310 available for takeoff. Along with engine compartment improvements came significant airframe upgrades such as longer wings and a three-foot-wider horizontal stabilizer.

The extra wing span (more than two feet longer with some 10 feet of new wing area) allowed an extra 30 gallons of fuel in the wings and helped climb performance. Fuel capacity rose to a generous 120 gallons (useable), eliminating the complaint by many P210 pilots that earlier models were a bit short-legged on range. Since the fuel is fed by gravity into the mains, there's no pumping or switching required, so from the pilot's standpoint the aircraft seems to have one big tank.

The new tail allowed elimination of the downsprings and bobweights required in the control systems to achieve proper stability in the old

*Pressurization, air conditioning and anti-ice systems in P-model Centurions contribute to a heavier ramp weight than its siblings, top. There is plenty of panel space for new avionics like the Garmin suite in Greg Dew's P210N, lower photo.*

210s. This made pitch forces lighter, so takeoff rotation, steep turns and the landing flare could be managed with one hand.

On top of all that, the new P210R flies much faster than older P210s. Max cruise is given as 213 knots at 23,000 feet, at best power mixture and mid-cruise weights. That's more than 20 knots faster than the earlier model. Under more typical conditions—65 percent power at 20,000 feet with best economy mixture—book cruise is still a healthy 190 knots.

## MARKET COMPARISON

The preferred airplane is the P210R model, although it commands a hefty price commensurate with its value, and it's rare (only 40 built). And here we're talking about $300,000 or so retail for an average-equipped 1985 model, according to the *Aircraft Bluebook*. Next in rank is the Mark II model built in 1982 and 1983 (none were delivered in 1984). The 1982 model was going for about $175,000 at last glance of the *Bluebook*. And finally, the last choice would be the Mark I models built between 1978 and 1981. The former lists at around $175,000.

The prices quoted are for average airplanes with older avionics—likely to include the finicky 400-series autopilot. Many P210s have mods and upgraded avionics, however, making it tricky to find an "average" airplane.

The cheapest Malibu costs the same as the most expensive P210 and there just aren't any other viable pressurized singles. The pressurized Skymaster can be had for about the same price as the P210, but it adds its own set of problems along with the extra maintenance of an additional engine.

Pressurization, however, is rarely the only consideration. Buyers are more likely to compare the P210 to a high-performance turbocharged single, such as the Beech B36TC. The price of this airplane is within shouting range of the P210 for pre-1985 models. For the P210R, *Aircraft Bluebook* shows it is as much as $125,000 more expensive than a $175,000 turbo Bonanza, although Centurion experts note that rare P210 R-models can easily sell for $400,000 or more when equipped with new avionics, interior, paint and engine. For comparison purposes, the 1983 Piper Turbo Saratoga SP retails for $140,000, some $45,000 less than a same-year P210N.

## HANDLING, PERFORMANCE

Big singles like the 210 have heavy control forces as a rule, but the P210 is heavier still due to the routing of control cables through tight-fitting air seals where they pass through the pressure vessel. As with most Centurions, aileron forces are lighter than pitch forces by a large degree, although elevator response is improved in the P210R model thanks to the new elevator.

Of course, heavy forces also mean the airplane likes to stay where it's put, and that means a solid IFR platform. Since this is the design mission for the P210, that's a desirable trait. But good use of the trim system is necessary and electric trim is a must-have item. Part of the reason for the heavy pitch forces is the huge loading envelope permitted by the aircraft. Load more in the rear or you'll need hefty tug to flare the


*Only the pilot's door gains access to the cabin of a P210, top photo, but there is an emergency exit on the right. Many owners remove a seat from the middle row. Cabin pressurization controls, bottom, are simple to operate.*

airplane without a nose-first arrival.

On a side note, the P210 doesn't exactly jump off the runway, and the extra weight of the pressurization components, air conditioning, deice and weather radar systems make for slower climb rates than you might experience in a T-model Centurion. That means you'll need to be on your game—and obey weight and balance figures—when it comes to short-field takeoffs and terrain clearance.

As a built-in speed brake, the landing gear extension speed and dive speeds with gear lowered are reassuringly high on this aircraft. On the 1978 P210, gear-lowering speed is 140 knots indicated, but with the 1979 models, it was raised to 165 knots, thanks to elimination of the gear doors.

With both aircraft, however, the pilot can dive right to redline Vne speed of 200 knots/230 MPH with the gear already extended. Needless to say, this might come in handy on a speedy descent if pressurization were lost. It's also nice to have the capability to slow down without shock-cooling the engine, if you subscribe to that theory.

Flight checks in the P210R showed a moderate pitch-up when 20 or 30 degrees of flap were suddenly extended and a pitch down with flap retraction after takeoff. The stall was preceded by a good horn warning and light buffet, with excellent aileron control through stall recovery.

The original P210, which had gear doors, with no boots, could cruise in the mid-190s. Add boots, lots of antennas and even radar pods and the cruise drops quite a bit. Compared to a T210, the performance is generally inferior, since the pressurization system steals bleed air from the induction, thus robbing some power.

Real-world cruise speeds for the P210N reported in our latest survey range from 165 to 185 knots, depending on power setting and altitude. The P210R, with its more potent engine, can break 200 knots quite easily. Fuel burns are substantial, however: 15 to 20 GPH for early models and up to 23 GPH at 75 percent on the P210R. Because of time-to-climb limitations and cabin pressurization levels, most P210 pilots told us they prefer cruising below 20,000 feet—at 14,000 to 19,000 feet on average. All reported occasionally moving up to as high as FL 230 to get over weather, however.

Most who responded to our earlier surveys had installed extended-range tip tanks, reporting good endurance with them (as much as six hours). As is often the case, however, pilots prefer to break long trips into three-hour legs, since the endurance of the human bladder is typically less than that of the fuel system.

P210s with standard (90-gallon) fuel systems are limited in terms of range, however. The P210R had an 85-gallon system as standard, with 115 gallons as optional; we don't know how many of the few P210Rs that exist have the smaller tanks.

Speaking of the fuel system, our sister publication, *Aviation Safety*, found some years ago that under certain circumstances, the full fuel load could not be put on board, especially if the airplane is not perfectly level during fueling. This also applies if the nose strut is not properly inflated. This corroborates past pilot comments we've received from owners. One pilot complained that he found it impossible to actually load a "full" 89 gallons in his 1979 P210N. "I now flight plan to use no more than 70 gallons," he warned.

## LOADING, CABIN

All the Centurions are renowned for their load-hauling and the P210 is no exception. Owners typically report payloads after full fuel of 900 to 1000 pounds. The earlier models carry more and payload varies considerably depending on equipment. Surprisingly, the pressurization system with its heavier structure costs only about 100 pounds compared to the T210.

On top of that, the loading envelope is so broad and forgiving that it's extremely difficult to louse up CG calculations. In fact, the P210 flier is more likely to find himself loaded out the front end of the center-of-gravity envelope rather than the rear, particularly on well-equipped airplanes.

The P210 has only one door, so whatever goes in has to go through it. Airplanes like the Beech B36TC win hands-down in this regard. Also,

the baggage compartment is separate from the cabin, so some loading flexibility is lost and passengers have to remember not to put certain items in their luggage.

The P210, on the whole, is quite comfortable. As noted above, the combination of heavier structure, thicker windows, sealing of the pressure vessel and muffling effect of the turbocharger add up to less noise. In winter, the extra heat kicked out by the pressurization system further enhances snugness. But in summer, the airplane can be an oven if it's not equipped with air conditioning. "Even though Cessna has designed a fairly efficient bleed air intercooler for the cabin air," one owner told us, "the air still enters the cabin piping hot."

But the most important comfort factor by far is the pressurization. No masks or cannulas, no popping ears. However, this is about as rudimentary as pressurization gets. The pressure differential is a rather anemic 3.35 PSI, the lowest of any current pressurized airplane. On top of that, the system has no rate controller. It simply starts to pressurize at the altitude selected by the pilot, maintains that cabin altitude as long as it can and then maintains max differential.

## MAINTENANCE

All owners who responded to our survey told us of the need for continuous and careful maintenance. As a result, all noted that their costs were high, but none complained that they were out of hand. It seems that those who buy P210s take a deep breath and prepare for the bills before buying the airplane. (Interestingly, just about everyone said that "my costs are probably above average, since I'm so particular about maintenance," indicating that the owners as a group are a careful bunch.)

Naturally, the 1400-hour TBO on the earlier engines is nothing to boast about. But even that figure's not etched in stone. "The 1400-hour engines will make TBO," said one owner, "but usually with one top overhaul." Judging from Service Difficulty Reports, cylinder cracking is a matter to be reckoned with. Another owner said, "Suffice to say that most operators will have changed a couple of jugs by 800 to 1000 hours, so you might as well plan for it."

Also, buyers should check to see if aircraft have Inconel exhaust systems. Without them, the P210 system is regarded as quite troublesome and carries a 50-hour AD inspection for cracks. Owners report that the two big trouble areas are alternators and vacuum pumps. Dual vacuum systems can be retrofitted to all P210s and are mandated by AD for any equipped with known icing.

By the same token, dual 60-amp alternators were available on 1982 P210s and some 1980 and 1981 models were retrofitted at the factory. Some earlier P210s have a small emergency standby generator, which is not as good, but certainly better than nothing. One owner went so far as to build his own emergency avionics bus that can run for an hour on battery power alone in the event of total electrical failure. We think this is an excellent idea.

In summary, buyers should be prepared to assume significant maintenance costs commensurate with operating a complicated aircraft. "A purchaser needs to consider the P210 as a large airplane in keeping with the traditions of 400-series Cessnas, etc.," advised one owner.

## MODS, CLUBS

Intercoolers can be provided by several organizations. Among them are Riley Superskyrocket and Turboplus. Riley also can turn a P210 into a Riley Rocket by installing a new engine and intercoolers. Riley also offers doors seals and magneto kits. Contact Riley at www.rocketengineering.com or 509-535-4401. A more interesting engine swap is offered by O&N Aircraft Modifications, who will put an Allison turboprop on the airplane. This company also can provide baggage compartment fuel tanks. Rudder, elevator and ailerons can be stiffened and mass balanced to improve the flutter margin by O&N as well. Contact www.onaircraft.com or 570-945-3769.

Speedbrake kits are available from Precise Flight. (See www.preciseflight.com or 800-547-2558.) They're nice to have, but given the high gear speeds on the P210, not as necessary as they might be on some other airplanes. Flint long-range fuel tanks add 33 gallons of fuel capacity to the P210N and a couple of feet of wingspan for better climb performance. It's available from Flint Aero at www.flintaero.com or 619-448-1551. The R/STOL Hi-Lift Systems kit is offered by Sierra Industries. This firm also can eliminate gear doors on early P210s. Contact Sierra at www.sijet.com or 888-835-9377. As for clubs, there is the Cessna Pilots Association (805-922-2580, www.cessna.org) which supports the P210 and all other Cessnas. They publish a monthly color magazine and offer good support and advice.

On a side note, we offer our thanks to Chuck McGill for his guidance while preparing this report. We think his book, *Flying the Cessna 210: The Secrets Unlocked*, is a valuable resource for flying any Cessna Centurion model. McGill also offers initial and recurrent type training for the 210. Visit www.safeflightintl.com.

## OWNER FEEDBACK

I owned and flew a P210 for eight years and 1500 hours. The allure of the P210 is to attain high-altitude, pressurized flight profiles and climb above weather for smooth, sunny flights—spending time in the clouds or precipitation only on climbout and descent. I did this many times and while the ability to climb an additional 20,000 feet would be better, the P210 is the minimum ante aircraft to cross the divide into this type of flying. I discount inflight oxygen as unpleasant for pilots, unacceptable for passengers and a nuisance overall.

Unfortunately, the P210 engine and systems are not up to the task. Even with a Riley intercooler, the engine needs constant attention to avoid overheating. The one time I went to FL230, I had the mixture full rich, the cowl flaps open, cabin heat on full and I still had to reduce the power. I endured multiple exhaust cracks, alternator failures, starter failures (including a starter failing to disengage after the start) landing gear problems, spalled lifters occasioning a major overhaul at 1200 engine hours, a broken door mechanism and multiple vacuum pump failures. The latter is a double blow because losing the primary vacuum pump also takes out the deice boots.

Whenever I activated the boots to remove ice, I wondered if the result would be either wings clear of ice or a blown vacuum pump. My conclu-

## P210 PRANGS: ENGINES AND FUEL

When we broke down the 100 most recent P210 accidents, 24 engine/mechanical events topped the list—a rate consistent with other big-bore singles. Of the engine failures, a third were due to improper maintenance, including everything from the wrong bolt torque to use of non-aviation hoses for the turbocharger oil supply and return lines. In that case, the hoses developed numerous leaks, spraying oil throughout the engine room, leading to an inflight fire.

Twenty-one pilots experienced the big silence up front after mismanaging fuel in some fashion. Ten pilots of P210Ns (left/right fuel system) ran one tank dry and either didn't bother to try to switch tanks to get a restart or were too low to have time before reaching the ground. That's consistent with accident data that shows the fewest fuel-related accidents are in aircraft with an on/off system or one that can feed both tanks at once.

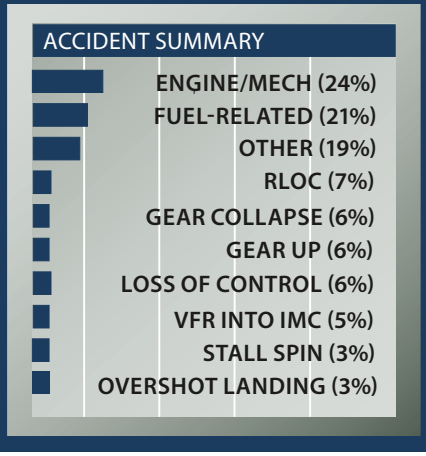
All save one other pilot simply ran out of fuel for various reasons. A P210R pilot decided that having a "both" position on his airplane's fuel selector was too simple. On leveling off at cruise in the high teens, he switched to the right tank and left the selector there until the tank ran dry. During the 15-minute glide to an off-airport landing, the pilot did not ever return the fuel selector to both or try any of the steps in the engine failure checklist in the POH.

Experienced 210 pilots know that combination of long fuel tanks and low wing dihedral means that the wings must be level when the airplane is fueled to assure filling both tanks. In addition, the P210R, with its larger capacity tanks, requires some time to let the fuel reach all the nooks and crannies when fueling. There's an AD requiring a placard calling for allowing two minutes after filling the tanks and then visually checking to assure they are indeed full. It is possible that some of the fuel exhaustion accidents were due to the pilot inadvertently departing with tanks that weren't full.

One pilot planned a six-hour night flight, leaving virtually no reserve at his destination. Four hours into the VMC conditions trip, the alternator failed. He shut off the master switch—did we mention this was at night?—and pressed on. As he flew over numerous lighted airports, the pilot occasionally turned on the master to check the fuel remaining according to the electrically powered engine monitor. The owner, in the right seat, tried to tell the pilot that the fuel remaining indication wouldn't be accurate because the engine monitor had been off while the engine was running. The pilot refused to believe the owner. Fuel exhaustion led to a forced landing and wrecked airplane a few miles short of the destination.

Where we expect to see over 20 runway loss of control (RLOC) accidents for nosewheel airplanes in our accident sweeps, the P210 only had seven. We consider that a reflection of good ground manners.

With its clean lines, a P210 will accelerate smartly with the nose down. That was shown in three of the six loss-of-control accidents where the airplanes broke up in flight. In one, the pilot departed with one of two vacuum pumps inoperative. The second failed while in IMC. Even with a standby attitude indicator, the pilot lost control.




sion is that the objective flight profile is simply too much to ask of an IO-520 and associated systems of the size and weight that will fit into the 210.

I have recently stepped up to a Piper Meridian, and this it seems up to the task. If I were to go back to the piston world, I would take a normally aspirated G-36 Bonanza or if that is too much money, an A36 with a glass panel. These are honest aircraft that do not pretend to be something that they are not. I have much hope for a diesel revolution, however. Maybe a diesel engine-equipped aircraft could move in the direction of turbine durability and reliability, all the while burning Jet A at $3.20 per gallon, a price I recently paid. My 1999 Mercedes turbocharged diesel seems to run as well after 250,000 miles and 16 years as it did when I bought it.

John Godfrey
Beverly, Massachusetts

I have owned a 1982 P210 since 2000. Before that I owned a 1980 model for three years. Overall I have around 3500 hours in the P210. These airplanes have proven to be fine traveling machines, particularly when the trip legs are long. The pressurization has made it easy to carry passengers who would not wear an oxygen mask, plus I arrive at the destination less tired. Cruising in the upper teens or low flight levels often means more direct routings and flying above the weather.

My P210 has known ice, weather radar and the O&N auxiliary tank. Being based in New England, the known ice capability enables flights that would not be legal without it. The pitot, prop and windshield heat all work great, but the boots shed ice and leave a fragmented residue. The aux tank makes the airplane a useful long-range machine and I recommend it for range, more realistic alternate airport choices and the ability to tanker fuel from less expensive FBOs.

Until about three years ago, every high-altitude flight was as much about managing the heat in the engine as flying the airplane. My engine at that time was past TBO (I top-overhauled somewhat beyond mid-time), so I elected to replace it

with the Vitatoe TN550 turbonormaized IO-550 conversion. Heat management is now only a minor issue on hot summer days. The airplane normally is 200 knots plus in the flight levels and in cruise flight it burns about 16 GPH, LOP—at least three GPH less than the TSIO-520 that I had to run ROP. As an example, on a recent winter flight at FL210, the airplane had a TAS of 207 knots at 16 GPH, with the cowl flaps fully closed. So I am getting at least 15 knots more on 3 GPH less burn and much less engine management. It also climbs better.

I have nearly 500 hours on the new engine and have had no problems. Larry Vitatoe has been very supportive before, during and after the conversion. He is a pleasure to do business with.

But the P210 is expensive. My direct operating costs including maintenance—but not an engine reserve—is about $150 per hour. Annuals have been around $7000, and insurance for $225,000 hull, plus $1,000,000 smooth has been around $4500 annually.

But for this I have a most-weather, 200-knot traveling machine that makes 600-NM or longer trips easy.

Donald Fraser
Boston, Massachusetts

The 1979 P210N I owned for three years and 450 hours of flying was the third of five airplanes I've owned over the last 30 years. I'd flown turbocharged and pressurized piston aircraft prior to owning the P210, but had never owned and operated one.

Like many pilots, once spoiled by the pressurization, I found it tough to go back. Since owning the P210 I've owned a BE-58 Baron (normally aspirated and I missed the pressurization), a Piper Malibu and now a Cessna 421.

The P210 is an economical avenue to a pressurized airplane, but there are some significant compromises, mostly driven by the design. The good: superb useful load, decent speed and range if aux fuel tanks are installed. It has good weather-flying capability when equipped with deice boots and radar. The bad: anemic climb performance (this is a heavy airplane), rapid performance degradation with ice on the wing and a hot-running engine.

Max pressurization differential is only 3.35 PSI, but this proved to be adequate, given the airplane's limited climb performance. The service ceiling may be FL230, but a realistic maximum altitude is FL190, or even lower if temperatures are significantly above ISA. I operated the engine at 65-70 percent power and planned on as little as 155 KIAS down low, and as much as 190 KIAS at FL 190.

My airplane had boots, Flint tip tanks and a radar pod, so it was likely a bit slower than most. Block-to-block fuel burns were 18 GPH on longer trips when the climb fuel could be amortized and 19.5 GPH on longer trips.

The engine is tightly cowled and tough for mechanics to work on. Even with properly maintained baffling, it is not a well-cooled engine. Warmer weather required high airspeed climbs (and accompanying poor climb rates) to keep the CHTs reasonable. My engine was not intercooled. I owned this airplane before the LOP craze and never experimented with LOP operation, which may have resulted in higher EGT values.

My overall maintenance experience was positive. The engine did not require unusual care despite its poor cooling. Vacuum pump life was poor, which I think was due to poor cooling and the fact that these are small pumps that are being asked to also run the deice boots. The pressurization system itself was trouble-free after an initial overhaul of the outflow valves accomplished shortly after I purchased the airplane.

For pilots considering a Piper Malibu over the Cessna P210, I'll offer my experience that the Malibu is a much better design, has a 5.5 PSI max differential cabin and performs better on almost all counts, in addition to having a much more comfortable cabin. It is also demands more from the pilot: it's more expensive to maintain (fuel cost would be very similar) and of course to purchase and insure.

If the cabin size is not an issue for you, the P210 can provide very similar utility with a bit less performance and for significantly less money.

Kevin Malone
Traverse City, Michigan

The Aviation Consumer

# Avidyne IFD540

*(continued from page 7)*

gous to the Avidyne's FMS "FPL" tab functionality. It is really helpful that these basic features are so similar.

There are fewer hidden functions and items that have to be learned by rote with the IFD540 as well. Hard buttons such as Garmin's OBS, which perform different functions in different contexts, have no equivalent with the Avidyne. The softkeys clearly show their function at all times and do change with context, which also provides information about what the navigator is "thinking" at any given moment. There is no equivalent to the MENU button, which does something different in every screen. Function tabs are always shown on screen and are easily accessed by touch and hard button. In our view, this offers a sizable advantage over Garmin's GTN navigators. They have limited hard keys and major functions are mostly commanded by touch.

## CONCLUSION

I spent roughly two hours with the Avidyne on the ground before flying, then about an hour flying with it in VFR. In all, five or six hours of familiarization was needed before being ready to fly the unit in actual IFR. On the other hand, I'm a technophile computer geek, a best-case scenario. Someone who isn't comfortable with modern technology might require far more.

However, if the pilot is proficient with the advanced operations of the GNS530W, learning the IFD540 should not present a problem—and indeed may come as a welcome relief—since many tedious functions are streamlined. I think the IFD540 is a major improvement over the GNS530W in essentially every respect.

The GNS530 has been a staple for over a decade, but hasn't changed significantly since the WAAS upgrade. Still, the IFD540s tactical value depends heavily on the mission. The approximate $10,000 investment, after a GNS530W resale, is not insignificant in the cost/benefit analysis. If cost is no factor, I think this is an obvious upgrade, but not without exploring other possible upgrades, including a Garmin GTN750. Compared to a GTN750 upgrade, though, installing the IFD540 is fast. Shops told us the GTN750 requires 20 to 30 hours of labor, plus additional time to mod the panel so it fits. On average, IFD540 upgrades are taking a few hours, and might require minor, billable components.

***The IFD540 is a slide-in to a certain extent. It took roughly four hours to replace a GNS530W in a twin Cessna, left.***

If you fly a reasonable amount of IFR, we think the IFD540 can be a huge time saver and makes it much easier to fly approaches, and into and out of busy airports. For local VFR ops, the upgrade arguably has limited value.

I don't sense Avidyne's intention of addressing my nits on the navigators inefficient map symbology, although feedback from other users could make a receptive Avidyne tweak the interface. In its current iteration, I think its features eclipse the aged GNS530. That, and its well-purposed IFR utility, makes the IFD540 a worthy investment.

*Doug Fields is a regular* Aviation Consumer *contributor. He flies a Cessna 310R based in the New York City area.*

**FEEDBACK WANTED**

## TAYLORCRAFT

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

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