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FIRST WORD

UPGRADES, OUTMODES AND OPEN-SOURCE FLYING

Owners of older Garmin GPS devices who live near our nation's capital got a bit of a surprise recently: The ADIZ boundaries disappeared from their moving maps. While that's not exactly an aerial emergency (the D.C. ADIZ doesn't move around) it would come as a bit of a shock to someone who just launched on a VFR flight expecting to use the map to stay out of the F-16 zone.

What's more disturbing, though, is the "why" behind the disappearance. It seems the FAA, and subsequently Jeppesen, changed the way the ADIZ was coded in their master database. Many popular portables and all non-WAAS Garmin GNS 400/500-series navigators don't understand the new coding. Of course, a WAAS upgrade will fix the problem. (Will that be check or charge card?) The situation conjures an eerie feeling that our cockpit avionics are moving the way of our personal computers. You don't have to upgrade your hardware or software every couple years, unless you want to remain compatible with the rest of the world. Call it a forced choice.

Be it hardware or software, this stuff isn't cheap. We get regular complaints about the monopoly on data held by either Jeppesen or Garmin for this or that cockpit device. It's usually a shock to owners upgrading to a glass cockpit that he must add a fat column to his cost spreadsheet titled "subscriptions."

Into this fray we now have a handful of tiny companies all vying for a fraction of that subscription budget by offering cockpit information on an open platform: the iPad. We have to hand it to these folks. Given their resources—these are two- and three-person companies—they are off to a great start. The biggest hurdles are that the iPad was never meant to be a cockpit GPS with moving map, and that they don't have a fraction of the R&D money that a multinational company has in making a cockpit device. These folks are dedicated and highly responsive to their customers, however, and sell their data and updates at the lowest price they can afford. They have to be all that because it's so easy to shop around.

At Oshkosh this summer, Seattle Avionics made an announcement that tossed some more fuel on this fire. They supply data for Aspen PFD/MFDs, Bendix-King portables and several of the iPad companies. Seattle Avionics bundled the data subscriptions so that if you have it for the Aspen, it's half-price for the portable. Buy the data for one iPad aviation app that uses their data and you just bought it for all the apps that use their data.

I dream that this is the beginning of open-source data for the cockpit, a concept that's only about 10 years overdue. Now couple this with the (finally) widening availability of free FIS-B weather. How long before there's an add-in for the Aspen system that puts the free weather on the MFD? I don't know, but I'll wager it's already in the works. I know people are working on this for the iPad. Unless Garmin has some contractual restriction with XM, I'll bet they're working on a GPS with a built-in FIS-B receiver. (And if there is contractual barrier, they're scheming to get out of it.)

There's no hope this will work backwards to that 430 in your panel. Existing sole-source monopolies on data aren't going away. But backlash on subscription costs is growing and small vendors wielding iPads are not only offering some relief, they might be modeling a new way of making this system work.

At least, we can dream that's what might happen. —Jeff Van West

Electrical vs. Mechanical

Two articles, plus several letters, in the August issue might be summarized as “electrical vs. mechanical.” The description of the Lycoming IE² system again raises the question of why most of us are still flying behind antiquated mixture, ignition and engine control systems, when even the most economical compact car sports electronic ignition, fuel injection and variable spark advance.

Clearly, the aviation industry, at least at the level of GA, has been left behind. Could an appreciation of this fact be one of the reasons that it's so difficult to convince a young student pilot to step into an airplane little different from what his father, and probably grandfather, would have found familiar?

I have had the good fortune to spend the past four years flying the Continental FADEC system, an IOF-240B. After over 500 hours behind a modern injected engine, with variable ignition timing, individually adjusted mixture for each cylinder and even a second spark plug, I would never fly much less purchase, a carbureted, magneto-equipped aircraft.

Similarly, it is absurd to maintain that if we restrict ourselves to paper charts, thick approach-plate books and NDBs, we'll be better pilots. Progress in aviation is measured in technological leaps and the move to electronic flight bags and universal GPS would benefit the entire industry.

My iPad has a superb built-in GPS, for backup use to complement the installed Garmin. Coupled to ForeFlight and with charts and approach plates updated monthly, I carry in my lap far more data that's far more readily accessed than ever before. (Just don't let the iPad sit in the direct sun on a hot day, lest it overheat and shut down temporarily!)

FADEC and the iPad demonstrate that electrical can indeed trump mechanical. I am hopeful that the same will hold true for powerplants and that ultimately we fly behind battery power.

Daniel Spitzer
Via iPad

Avgas

Nice article in the August edition on 100LL. I think you bought out some of the lesser-known problems with 94UL.

Remember way back when we all had hair, and it was dark colors instead of a thin grey? The two-seat T-Bird and the Lee Iacocca Mustang a bit later? Back in those days, Amoco sold unleaded 100-octane car gas.

I worked at an Amoco refinery when I was in college and I remember that the base stock for the 100 unleaded was “Ultraformate,” which was, of course, made in an ultraformer. I was a mechanical engineer and fixed pumps and valves, so I don't know what was blended with what to make the 100 unleaded.

Now I realize that there are octane ratings and there are octane ratings, but Amoco used to blend 100-octane unleaded gas for cars. It sold as premium gas in the station, but was available and not dramatically more expensive than regular, which had lead at the time. They didn't use corn or switchgrass, either. So it seems that blending 100-octane fuel without lead should not be rocket science. (Besides, the rocket guys just use kerosene.) Any info on the old Amoco unleaded 100 octane?

Per several blogs and notes (yours included from Oshkosh), none of this is going to go anywhere unless there is a real threat to remove lead. It looks like this latest threat is going to peter out, which is what will happen to the current effort.

Lastly, can we lock Lycoming and Continental in a dark closet and have

them come out with the same policy? To think that many folks are going to pay big bucks to have their engines downrated in order to use 94UL is just idiotic.

Vince Massimini
Kentmorr Airpark, Maryland

Lock and Key Retort

This letter is intended to voice my concern and/or rebut a recent comment posted in the August 2010 issue of *The Aviation Consumer*. The article on the Lock and Key Navajo was a fantastic article that gave great insight on my program and was very well written.

The comment I am concerned with is on page 22, located in the checklist portion of the page. In the third bullet of the checklist you state, “Investment required is high and some owners may want to shop turbines before committing.”

I do not disagree that the investment is high, but I do disagree that owners should shop turbines before committing. My reasoning is this: Our current target market is towards the newer model Barons and Senecas. If you want to make a comparison to a turbine (early model King Airs) then you are dealing with apples and oranges when you take into consideration our renovation process.

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GPSMap 696 vs. aera: No Slam Dunk Winner

That's because the choice depends on how you use portable GPS. The 696 is for the serious IFR pilot; the aera is an all-purpose Swiss Army knife navigator.

by Paul Bertorelli

Although there's plenty of portable GPS out there, the market isn't as competitive as it once was, with Garmin dominating...well, the world. Two of the hottest products are both from Garmin, the GPSMap 696 and the aera series, Garmin's first aviation touchscreen.

These represent a conundrum for buyers in that they have nearly the same capability, but at different price points. And "nearly" isn't the same as "exactly." The 696 has some features the aera doesn't and vice versa. One outlier in this equation is whether Apple's large-screen

HEAD-TO-HEAD REVIEW

iPad can step in for either one of the Garmins. We've been asked this, so we're examining it in this article. The quick answer is the iPad isn't a replacement for the 696, but, as with the aera, it does some things—a lot of things—that expensive GPS can't.

SIZE IS THE THING

With an intro price of \$3295 (now discounted to below \$3000 at the major outlets), the 696 was (and is) Garmin's most expensive portable. If it had in mind an EFB-wannabe, the 696 has evolved into that niche, even though it doesn't do third-party computing, as some EFBs do.

All of Garmin's recent portables have included named approach fixes, but the 696 was the first to include an actual chart library, using the FAA's AeroNav plates. The 696 also displays jet and low-altitude airways. If that's beginning to sound like the 696 is optimized

for IFR, that's exactly what it is. We've heard from a number of pilots and commercial operators with 696s semi-permanently mounted as navigators and/or flight libraries. Other GPS products have this feature, too, including Bendix/King's AV8OR and Anywhere Map's ATC. At the expense of larger size and weight, the 696 allows full view of the chart and, more recently, geo-referencing of the aircraft position on the plate.

We just said the size and weight were a disadvantage, but is that fair? In a large cockpit, where the 696 is permanently mounted, the weight won't matter and the size will be a plus. In a tight cockpit like a Diamond DA20 or an older Mooney, the 696's 5.7 by 7.7 inch overall size is yoke mountable, but some will find it a push to do that. At 2.2 pounds, it's a heavy lump on controls you want to be able to move without restriction.

The payoff is a large, bright screen that's 6.1 by 3.75 inches and 480 by 800 pixels. The screen is a backlit LCD and about as sharp as any portables, although the iPad bests it. It runs warm and can be a power hog, thus the 696 is best run on ship's power. At reduced brightness, it will operate for up to eight hours on the internal battery, so there's no worry about the 696 coming up short as a backup. With the XM receiver plugged in, battery life is under three hours. (The GPSMap 695—sold without XM—retails for \$2895 or \$2395 discounted. It's a good choice if you already have a weather source.)

aera

Since it owns the GPS portable market, Garmin surprised us by



following the 696 with a new line of products—the aera. There are four models in the line ranging from the \$875 500 to the \$1649 550. (See the chart for discounted prices.) This complicates both the basic choice and the comparison against the 696 because the price variation is more than \$2000 from lowest to highest.

Just to keep things simple, all the aera models have the same hardware, same basemaps and same navigation database. The two lower models don't have the detailed high res terrain, AOPA's airport directory or the SafeTaxi ground tracking feature. None have Garmin's FliteCharts, a significant disadvantage for some pilots. Two aeras—the 510 and 560—have XM weather capability, the other two don't. All of the aeras are shipped with ground nav capability for the U.S. and Canada, but only the two top models are FM ground-traffic capable. The 696, by the way, doesn't come with the road maps and it won't do FM traffic.

Next to price, the next major point of departure is size. Overall, the aeras are 5.3 by 3.3 by .9 inches—about 60 percent smaller than the 696. The display measures 3.8 by 2.2 at 480 by 272 pixels. Plan on smudging that crisp display with your greasy fingers because the aeras are touchscreen controlled, compared to the 696's keys, rockers and a joystick.

FUNCTION TO FUNCTION

In our view, the right way to look at this analysis is to compare function first, then price. You can decide what's important, then dicker with yourself on how much you're willing to pay. (You can dicker on ebay, too, as these products occasionally show up used.)

Both have essentially the same WAAS-capable GPS engine to deliver nav data to a functional display. Beyond that, the similarities are less intertwined. The 696 has a larger and more flexible moving map, although it's not necessarily more detailed.

It can be highly customized to show just the map or the map combined with Garmin's flight panel page that shows aircraft attitude and performance through GPS-derived data or various combinations. Data fields can also be customized. The 696's joystick/cursor knob scrolls through the map, waypoint, terrain

FUNCTION	GPSMAP 696	AERA 500	AERA 510	AERA 550	AERA 560
STREET PRICE	\$2999	\$799	\$1299	\$1499	\$1999
SIZE OVERALL/ DISPLAY SIZE	5.7 x 7.7 x 2.0 3.6 x 6.0	5.3 x 3.3x.9 3.8 x 2.25	5.3 x 3.3x.9 3.8 x 2.25	5.3 x 3.3x.9 3.8 x 2.25	5.3 x 3.3x.9 3.8 x 2.25
WEIGHT	2.18 LBS	9.5 OZ	9.5 OZ	9.5 OZ	9.5 OZ
VOLTAGE RANGE	11-40 VOLTS	11-35 VOLTS	11-35 VOLTS	11-35 VOLTS	11-35 VOLTS
BATTERY TYPE	REMOVABLE METAL HYDRIDE	REMOVABLE LITHIUM ION	REMOVABLE LITHIUM ION	REMOVABLE LITHIUM ION	REMOVABLE LITHIUM ION
CLAIMED BATTERY LIFE	8 HOURS MAX	5 HOURS MAX	5 HOURS MAX	5 HOURS MAX	5 HOURS MAX
STUFF IN BOX	Yoke mount, XM antenna, power cable, cover, AC power adapter, one free data update.	Yoke mount, vehicle friction mount, power cable, one free data update.	Yoke mount, XM antenna, power cable, AC power adapter, one free data update.	Yoke mount, power cable, AC power adapter, carry case, one year free data update.	Yoke mount, XM antenna, power cable, AC power adapter, carry case, one year free data update.
XM WEATHER	+	-	+	-	+
TRAFFIC PLUG-IN	+	+	+	+	+
APPROACH PLATES	+	-	-	-	-
APPROACH FIXES	+	+	+	+	+
AIRWAY DEPICTION	+	+	+	+	+
GROUND NAVIGATION	-	+	+	+	+
VOICE PROMPTS (GROUND)	-	+	+	+	+
YOKE MOUNTABLE	~	+	+	+	+
OPERATING LOGIC EASE	+	++	+++	+++	+++
TERRAIN DATABASE	+	+	+	+	+
HI-RES TERRAIN	-	-	-	+	+
TERRAIN ALERTING	+	+	+	+	+
SAFETAXI	+	+	-	-	+
HSI/PANEL PAGE	+	+	+	+	+
SUNLIGHT READABILITY	++	+	+	+	+

THE SAME, BUT DIFFERENT



1

2

4



1

2

3



The 696 and aera do similar functions, but you get at them differently. Step through the choices with aera's home key (1) to make selections on the home page (2). On the 696, use the joystick (3) to scroll the choices (4) listed on the bottom of the page.

and XM choices. Scale selection is via a range rocker. By comparison, the aera has similar maps, but to step through them requires an excursion through the home key. The choices are map, terrain and the HSI panel. As with the 696, you can customize data fields and detail level, but you can't split the screen, with the panel page on top, say, and the map on the bottom. It's just not large enough. Two in/out virtual keys do the scaling.

CONTROL INPUT/LOGIC

The aeras aren't just the previous navigators with touchscreens instead of knobs. They work differently, having more in common with computers and smartphones than panel or even previous portables.

The aera map page has only four virtual keys: the two scale keys, a menu key and the home key. The menu key is for customization and settings, the home key to step through a dozen options of various kinds. These are logical and easy to master even without the manual.

It's just simpler logic than the 696. The touchscreen itself works well, but can be dodgy at times, requiring two or three stabs to get the command. (The iPad is just the reverse—it accepts unintended commands.) For waypoints and other data input, the aeras have a generous virtual keyboard that makes data input less tedious than with the 696's knob/joystick, but the joystick yields fewer errors, in our experience.

The 696 sports 12 keys, seven dedicated and five soft keys whose functions differ with the display mode selected. We hadn't used the 696 in over a year and were pleasantly surprised at how much quicker it is to navigate some functions than the aeras are. There's no need to double or triple tickle a stubborn key and you don't have to step back through the home key for function changes.

FLIGHTPLANS/APPROACHES

Here, the two have similar capability—to a point. The 696's flightplan logic is like the 430/530 panel

navigator in that you string together a bunch of waypoints in the active plan, then fly it or save it for later. Waypoints can be scrolled in or selected off the map by slewing to them with the joystick. Approaches are complete with all named fixes.

Both the aeras and 696 access the flightplan function through a dedicated key, but the aeras handle waypoint insertion a little differently, requiring a menu step if the navigator already has an active flightplan or waypoint. Waypoints have to be typed in, you can't insert them by scrolling the map. But you can insert a named approach, with the option of entering at an initial approach fix or vectors to final. Both units store flightplans in a bin listing them by name, where they can be edited or reversed.

IFR OPS

On this count, the 696 excels, thanks to its preloaded Garmin FliteCharts,

continued on page 32

CONTENDER OR PRETENDER?

iPAD VS GPSMAP696

For this analysis, we rejiggered our chart to put the iPad on a level field with the GPSmap 696, which is another way of saying we're caving to the whining shrieks of the Mac fanboys.

Having gotten that off our chests, we can honestly say the iPad makes a credible run against the more expensive 696, but because of a couple of key weaknesses, it doesn't match it. Yet. First, the iPad's strengths. It's a killer plate reader. The super sharp screen renders plates in crisp detail and there are several chart vendors for AeroNav products, plus Jeppesen is out with its Mobile TC reader. We'll review these later, but the iPad blows everything away in this category.

For pre-flight planning, several apps are strong players, including ForeFlight and WingX. As we reported in the July 2010 issue, the iPad is competent for text weather getting and so-so for imagery. It can do this from the comfort of your hotel room or the FBO lounge, which the 696 can't do easily. iPad: plus one.

On the other hand, the 696 can suck in near real-time NEXRAD data via XM Radio and the iPad can't. That's a major weakness, in our view. Using its 3G cellular connection, the iPad can pull in weather data on the fly, but we found it hit or miss. Even when it is tracking 3G, the data isn't as good as XM's. It's workable, not exceptional. But when you want inflight weather, you usually want it badly. That's no time for a system that isn't reliable, which XM—despite warts—generally is.

As for an inflight moving map, WingX released its Pro7 app just after our July review and we would call it impres-

**Dogs Playing Poker is meant merely as an analog to show the iPad's vast range of apps and thus its profound cultural influence.*

sively capable. We'll review it in detail later, but it offers a high-res moving map and a display that can be tiled to show the map in one section, an approach plate in another and airport data in another.

It's configured by flight segment so in the takeoff phase, you see the map on one tile, airport and approach freqs on another. In cruise phase, you can devote the entire map to the display. It will store and fly flight plans, but approaches aren't listed by name, as on the 696. Not bad, but not up to 696 standards, either. (At a third the price, you get what you pay for.)

The iPad's GPS function, isn't as robust as the 696's. During our tests last spring, it lost lock several times and on a long trip to Oshkosh in July, its positioning proved too iffy to inspire confidence. Although there are terrain display apps for the iPad—SkyRadar is one—they don't offer the sophisticated warning functions that the Garmin navigators do. These apps may get there, but they aren't there yet. SkyRadar also has a traffic app that relies on a portable ADS-B

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FUNCTION	GPSMAP 696	iPAD
STREET PRICE	\$2999	\$629-\$829
SIZE OVERALL/ DISPLAY SIZE	5.7 x 7.7 x 2.0 3.6 x 6.0	7.25 x 8.25 x.5 5.8 x 7.7
WEIGHT	2.18 LBS	1.5 LBS
VOLTAGE RANGE	11-40 VOLTS	5 VOLTS
BATTERY TYPE	REMOVABLE METAL HYDRIDE	SEALED BATTERY
CLAIMED BATTERY LIFE	8 HOURS MAX	10 HOURS
XM WEATHER	+	-
TRAFFIC PLUG-IN	+	~
APPROACH PLATES	+	++
APPROACH FIXES	+	~
AIRWAY DEPICTION	+	+
GROUND NAVIGATION	-	+
VOICE PROMPTS (GROUND)	-	+
YOKE MOUNTABLE	~	~
OPERATING LOGIC EASE	+	+
TERRAIN DATABASE	+	+
HI-RES TERRAIN	-	-
TERRAIN ALERTING	+	~
SAFETAXI	+	-
HSI/PANEL PAGE	+	~
SUNLIGHT READABILITY	++	+
WX BRIEFING/ FLIGHT PLAN FILING	-	+
MUSIC/VIDEO	-	+
DOGS PLAYING POKER*	-	+

Trainer Bargains: Go For Four-Seaters

While the cheapest deals are the classic two-seat trainers, the best values are in older four-seaters, especially Piper Cherokees and Grumman cats.

by Jeff Van West

Once a upon a time in aviation, trainers were always two-seat aircraft that wedged instructor and student into near-intimate proximity. But things have changed and it's not uncommon for student pilots to pony up over \$300,000 for four-seat cruisers they plan to use for private and instrument training.

That's nice for the well-heeled; those of us who missed the last economic bubble but not the pop that followed need another plan. It can still make sense to purchase an aircraft you plan to train in. We looked at purchase *and* operation with an eye toward owning the machine for a while, or having a good chance at selling it for less than a catastrophic loss.

To that end, we've simplified and eliminated taildraggers and some real rarities like the Ercoupe. Don't start whining. We're all for training in a Champ, but insurance can be expensive and it can't be leveraged

into travel or an instrument rating if you want.

UNDER A BUCK AND A HALF

You can buy decent, two-seat training machine for under \$15,000. The two leading contenders are an older Cessna 150 and a Piper Tomahawk, and the staff here is split on which is a better choice. On paper, it's a no-brainer: The Tomahawk is newer, faster, cheaper and it blows away the Cessna in interior comfort and visibility. Obviously there's a catch: The Piper might kill you.

The Tomahawk has a bad reputation as getting into unrecoverable stalls and spins during training—which is exactly what you're buying the airplane for. The hard numbers on accidents don't completely support this. There were issues, but most seem to have been resolved by changes imposed by AD. Nonetheless, it's not the best stall/spin design ever made and the stigma remains.

Since our staff can't agree, we leave it to you and the instructor you must convince to fly with you which sub-\$15,000 trainer is best.

Interestingly, the Tomahawk is the only contender we turned up where accident history came up as a decisive factor.

FOR FIVE THOUSAND MORE

Push the envelope into the \$15K-\$25K range and there are some excellent deals. Now you can get a late-model Cessna 150 for around \$18,000. Not as flashy or quite as fast as the 152, there are some excellent 150s that have been upgraded with modern avionics and interiors. These obviously cost more than average, but we see a clear price advantage to a late-model 150 versus an early 152.

The Beech Skipper is often confused with the Tomahawk, but the Skipper is a different design and handles well. Not many were made, so they are hard to find and may be hard to sell. The Skipper has some oddities of landing and Beech parts can be pricey, yet it could make for a good buy.

Another sleeper in this class is the American General AA-1B. It's fast, comfortable and carries more weight than the others in this class. It's also the sportiest in handling. With the right instructor, the AA-1B will teach good habits for speed and aircraft control that might be just the ticket for someone whose long-range goals are a high-performance single. It's critical you get a pre-purchase inspection by someone expert in these airframes, however. Prices have been steady of the AA-1B for some time, so its resale value should be good.

While there are inexpensive 172s in this price block, they are the oldest ones, usually sparsely appointed and VFR only.

THE LOW 20S

As the target price crosses \$20,000, older, four-seat aircraft become a possibility. The increased space and versatility that affords may make them a smarter purchase for some buyers. There's no guarantee you'll be able to turn over your airplane



In several price brackets, the Piper Cherokee variants lead the pack in total value for the dollar.

THE MARKET FOR TRAINERS AT MULTIPLE PRICE POINTS

As one pilot's bargain is another pilot's pipe dream, we've broken down our findings by price category. The ★ items are best bets, in our opinion.

We've also included the five-year price trend. This is a bit of a double-edged sword. A big drop could mean a good

deal—so long as it won't keep plummeting. That seems generally to be the case. For example, the price of a 1984 Cessna 172 dropped 39 percent, but that was almost entirely between 2005 and 2008. Some aircraft, such as the AA-1A and the Cheetah have held nearly level despite the downturn.



UNDER \$15,000	CURRENT PRICE	5-YEAR TREND	COMMENTS
1981 PIPER TOMAHAWK	\$13,500	-16%	The Piper is newer, faster, more comfortable and cheaper than the same-priced Cessna, but has a reputation for stall/spin problem. In both cases, watch out for run-out engines as the overhaul could exceed the value of the aircraft.
1969 CESSNA 150	\$14,750	-12%	

\$15,000-\$20,000	CURRENT PRICE	5-YEAR TREND	COMMENTS
★ 1980 BEECH SKIPPER	\$17,000	-26%	A solid Cessna 150 is hard to beat and you can sell it with ease when you trade up. The AA-1B is sporty for a trainer, but that's a plus if your vision is something like a Cirrus SR22. Prices have been good, yet steady, so resale is promising.
★ 1975 CESSNA 150	\$17,250	-8%	
1959 CESSNA 172	\$19,000	-25%	
1976 AMERICAN GEN. AA-1B TRAINER	\$19,500	0%	
1969 BEECH MUSKETEER SPORT	\$19,500	-12%	
1959 PIPER TRI-PACER	\$19,750	+4%	



\$20,000-\$25,000	CURRENT PRICE	5-YEAR TREND	COMMENTS
1980 CESSNA 152 II	\$22,000	-15%	You can't go wrong on a nice, late-model 152. The Cherokee, however, offers more space and better performance for essentially the same price.
1963 CESSNA 172	\$23,000	-18%	
★ 1970 PIPER CHEROKEE 140	\$24,000	-16%	
1968 BEECH MUSKETEER SUPER III	\$25,000	-19%	



\$25,000-\$35,000	CURRENT PRICE	5-YEAR TREND	COMMENTS
★ 1968 CESSNA 172	\$28,000	-16%	All four of these aircraft are really winners, but for different reasons. We think you're likely to get the best deal overall—condition, avionics, times—on Piper in this price range.
1978 PIPER WARRIOR II	\$31,000	-28%	
1996 DIAMOND KATANA A1	\$32,000	-22%	
1977 AMERICAN GEN. AA-5A CHEETAH	\$35,000	-5%	



\$35,000-\$45,000	CURRENT PRICE	5-YEAR TREND	COMMENTS
1987 SOCATA TOBAGO	\$37,000	-43%	With later models, the value delta between Pipers and Cessnas seems to even out, perhaps even favoring the Cessna due to sheer numbers of aircraft available.
★ 1979 CESSNA 172	\$39,000	-30%	
★ 1986 PIPER WARRIOR II	\$39,000	-32%	
★ 1984 CESSNA 172	\$44,000	-39%	



"Bargain" and "glass-cockpit" still don't go together. LSA or certified, prices are north of \$100K and data subscriptions add an additional operating expense.

quickly when you feel the need to move up to four seats or want to toss camping gear in the back.

A late-model Cessna 152 or a mid-60s 172 can be had for the same price and often comparably equipped. That said, a pre-1968 172s have a six-cylinder Continental O-300 that's more to operate or repair than the bulletproof Lycoming in the 152. If we were certain the craft was for just training or one-person travel purposes, we'd favor the 152. It'll also be a much easier resale if you trade up.

The best deal, however, may be the Piper Cherokee 140. It's a bit faster than either Cessna (and obviously more roomy than the 152). Our scan of what's on the market also showed the Cherokee 140s often having better avionics, paint and interiors than 172s of the same price. You're also much more likely to find a low-time Piper 140 than any comparable Cessna. While technically a four-seat aircraft, it's best suited for two people and some cargo. A 140 with a Garmin 430 GPS and autopilot isn't unheard of, although those are priced in the next category up.

BEST DEALS IN THE 30S

The sweet spot of our research seems to be in the \$25,000-\$35,000 range. The only two-seater up here is the Rotax-powered Diamond Katana. It's a bit of an oddball, but worth considering, if you can find one. The chief advantages are excellent fuel economy of 110 knots on 4.5 GPH (automotive gas if you want), terrific

visibility and excellent handling. The Katana A1 has an anemic climb, however. There are some Katana 100s out there, which were upgraded to 100 HP. With so many LSAs using the Rotax, getting maintenance for it is not nearly the task it once was.

We think the best overall values at this price are the Piper Warrior IIs. Dollar for dollar, they tend to be the better equipped, in better shape or a decade newer than same-priced Cessna 172s. The 172s in this range are the Lycoming-powered ones, so the maintenance and operating cost delta is less than in cheaper Piper-Cessna match-ups. Good IFR platforms, some with older GPS, can be found with patience.

Again we see the American General line as a sleeper worth considering. The average price for a AA5A Cheetah falls just inside this category. While you might get more plane for the buck in a Piper, the Cheetah, will be faster and, some might say, just cooler. If your trainer will turn into a traveling machine, don't overlook the Cheetah.

\$35K AND BEYOND

The field starts to get quite wide when you cross \$35,000, and we're beginning to get beyond many people's idea of "budget." The value advantage the Piper Cherokee line dwindles to non-existence at this price. There are also more 172s to choose from. The Socata Tobago is also priced here. It's not fast, but it's solid, comfortable and worth a look if you like being a bit different.

Depending how much past \$35,000 you're planning to go, the American General Tiger becomes an option as well as the Piper Archer. The Archer can be a terrific buy as we've seen several that had top-drawer avionics lavished upon them. Cessna 182s are a possibility, but we're not sure their handling and fuel burn make them a desirable primary trainer. They make a good instrument platform, of course.

There is one two-seater you'll find several of in the high \$50K range. That's the Diamond Katana C1 with the Continental IO-240. It's a terrific performer and trainer with an honest 125-knot cruise speed if you want to travel. The downside is that it's not legal for IMC flight, so practical travel (and IFR training) is limited.

While the LSA movement was supposed to be about budget flying, the dollar signs are still too high for this roundup. The cheapest of the used LSA makes that we have gotten good reports on are used Allegros in the \$50K-\$65K range.

BUY THE BEST YOU CAN

Sound advice in most big-purchase decisions of any kind is to buy the best you can afford with what's a reasonable price range for you. The aircraft market is still molasses slow, so a patient buyer can score an excellent deal given enough time and effort.

Looking across the board, though, we think the Piper Cherokee 140 or less-expensive Warriors are the best trainer deals out there. Hot on their heels are the AA-1A and AA-5A. Given that once you buy the bird, you may have it for a while, the versatility of extra space makes sense.

Here's one last tip: Try to find an aircraft that already has the avionics you want. For older airframes, an interior teardown might be needed for rewiring just to get one new GPS/COM to work right. In choosing between a newer bird with older radios versus a clean, but tired, airframe sporting a new audio panel and late-model GPS, the latter would be the walk-away choice.

LED Landing Lights: Worth the Expense

These products have multiplied and improved since we last examined them. Top picks are AeroLED's SunSpot and Whelan Parmetheus.

by Paul Bertorelli

In case you haven't noticed, the compact fluorescent bulb—once the darling of the green energy set—is dead meat. It's soon to be displaced by cheaper, brighter and more efficient light emitting diode technology. The same has happened in automotive lighting and many new light sport aircraft have LED nav and landing lights. Legacy certified aircraft would probably have more LED technology too, if the FAA hadn't worked so hard to chill the market by raising expensive certification hoops.

Nonetheless, a few hardy companies have created LED products—landing and taxi lights and nav lights—for the aftermarket. The market has actually expanded slightly since we last examined these products a year-and-a-half ago. Moreover, we expect to see more products for the certified market during the next couple of years, mirroring the emerging trend in all segments of the lighting market.

For this report, we tried seven LED products, all but one being pitched as landing or taxi lights. Our impression is that companies have improved the performance of LEDs to the extent that they're no longer just curiosities. However, they remain expensive—as much as

20 times more than an incandescent bulb intended for the same ap-

plication. However, even at those prices, a LED landing light might make sense for some owners.

LED TECH

Recent breakthroughs in LED manufacturing have brought prices down, improved efficiency and output and also increased the range of colors the lamps can output. Unfortunately, the industry standard GE 4509 PAR 36 that the vast majority of airplanes have as landing lights is neither the most reliable nor best bulb going. (PAR refers to parabolic

aluminized reflector and the 36 is actually the lamp diameter expressed in increments of 1/8 inch, thus the PAR 36 is 4.5 inches in diameter.)

Five of the lights we tried were PAR 36 equivalents, more or less. It's more or less because although the diameters are the same as the 4509, the depth may not be, due to the LED heat sink on the back that keeps the diodes from frying. This is a sensitive point that Whelan's Jeff Argersinger says must be explained and it's the reason that brightness measurements alone don't tell the full story about LEDs.

One characteristic of LEDs is that they can be driven harder to produce more light and some designs do exactly that. To keep the LEDs from burning up, a larger, more efficient—that may mean deeper—heat sink is used on the back of the lamp.

That means it may or may not fit the same mount that housed the original 4509. The selection of lamps we tested were all of varying depths and all but two were deeper than a 4509. The exceptions—Whelan's 12 LED Parmetheus product, which is actually 1/2 inch shallower than a 4509 and the AeroLED SunSpot. The Laminar Flow

CHECKLIST



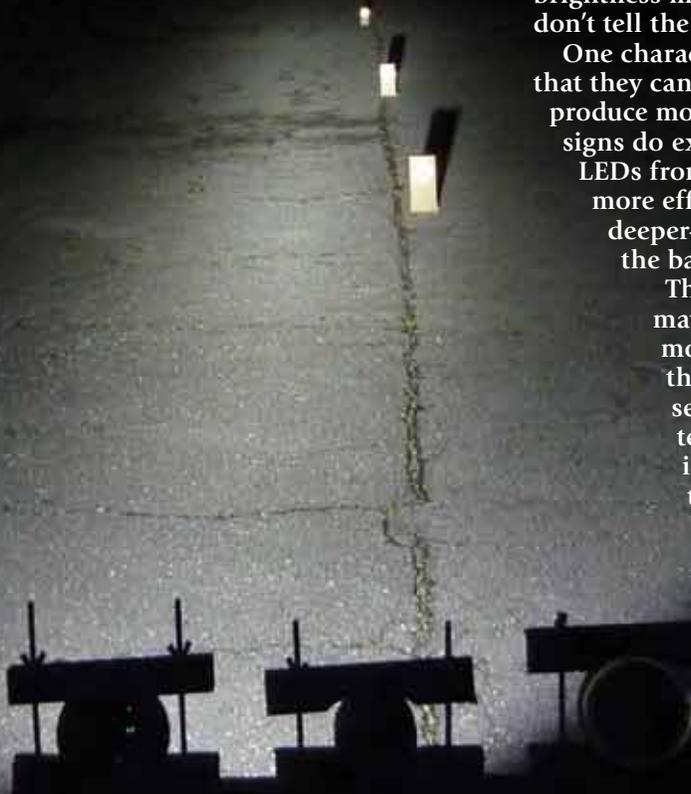
Overall, the lamps have improved noticeably since we tried them last.



It's better to think of them as recognition lights that double as landing light rather than as expensive bulbs.



For owners who don't fly much, we would say skip the expense of LEDs.





product, depending on how it's mounted, might also be shallower than a 4509.

In our estimation, the LED lamps in this group are likely to fit most applications, especially if the space behind the existing conventional lamps is open and unobstructed by the mount hardware.

Before buying any of these products, we would advise asking the manufacturer about what specific

All LEDs have rear-mounted heat sinks to protect the diodes from overheating. The trick is make them shallow enough so that a replacement lamp is no deeper than the 4509 it replaces. Whelan managed this in the Parmetheus, above. All but one of the LEDs are polarized, but Teledyne's Alphabeam, middle photo, is not. AeroLEDs SunSpot, lower, sports five leads, allowing installation as a flasher or wig-wag.

applications have been directly tested and, if there's any doubt that yours is among them, ask about return policies. We doubt if any companies would refuse returns on lamps that don't fit.

APPROVALS

This is a sticky point for LED replacements, although it shouldn't be. The FARs are utterly open-ended about lighting requirements for light aircraft. Here's the entire spiel from FAR 23.1383: Each taxi and landing light must be designed and installed so that: (a) No dangerous glare is visible to the pilots. (b) The pilot is not seriously affected by halation. (c) It provides enough light for night operations. (d) It does not cause a fire hazard in any configuration. (Halation is the undesirable spreading of the light beam.)

Seems simple enough, but all the LED manufacturers told us that various regional FAA Aircraft Certification Offices have nonetheless dreamed up additional testing requirements and at least one has both refused to provide an approval path while also declining to provide suggestions for a test program that would yield such a path.

Moreover, landing light bulbs are not TSO'd—although strobes are—and it's not clear that a PMA of any kind is required to replace a bulb. Whelan is, nonetheless, planning an STC approval process for its Parmetheus bulb.

AeroLED told us some of its products have been installed under Form 337 approval but also noted that some FSDOs have refused to approve this. For its Alphabeam, Teledyne is pursuing a PMA, even though the 4509 it replaces doesn't have one.

Frankly, since there's no clear guidance prohibiting it, we would be inclined to simply install the bulb as though it were a 4509 and let the cards fall where they may. Here's a summary of the products we examined.

TELEDYNE ALPHABEAM

Teledyne's Light and Display Products specializes in advanced LED lighting systems for various industries. It got into the landing light game the same way other companies have launched aviation products—someone on staff was a pilot and saw an opportunity.

Teledyne engineer George Panagotacos is a pilot and operator of an aircraft maintenance shop with his brother and saw a way to leverage the company's expertise in LEDs into the aviation business. The divisions launch product is the Alphabeam, a highly engineered direct, drop-in replacement for the GE 4509.

Panagotacos told us that the Alphabeam's light pattern is almost identical to the 4509 but more symmetrical and slightly broader. We see this as a good thing, because at 6 degrees of width horizontally, the

4509 is considered somewhat over-focused—it's like looking at the dark world through a toilet paper tube. The Alphabeam—and other LEDs—address that, at the slight expense of not having the distance punch.

A principle challenge in designing effective LED landing lights is focusing the light output and balancing beam width against distance focus. The Alphabeam does this through technology called total internal reflection, or TIR. This method surrounds each LED emitter with a sophisticated reflector system that aims emissions from four-LED groups into a cogent whole.

Temperature control is also a critical issue with LEDs and relates directly to light output. The Alphabeam has a robust heat sink, making it ¼ inch deeper than a typical 4509. (4509s actually vary a little, depending on manufacturer.) The device has a peak draw of 45 watts at any voltage between about 10 and 40, but typically runs at about 35 watts.

As its temperature rises, the bulb's thermal protection circuitry folds the power output back to protect the LED junctions, although it's unclear if this makes a visible difference in light output. Teledyne says the projected lifetime of the lamp is a minimum of 5000 hours. (During our tests, the Alphabeam's heat sink got too hot to handle, as did most of the lamps.)

It's non-polarized, so you can't fry it by incorrect polarity. Retail price of the Alphabeam through Aircraft

Spruce is \$325 and it should be available later this year.

WHELAN PARMETHEUS

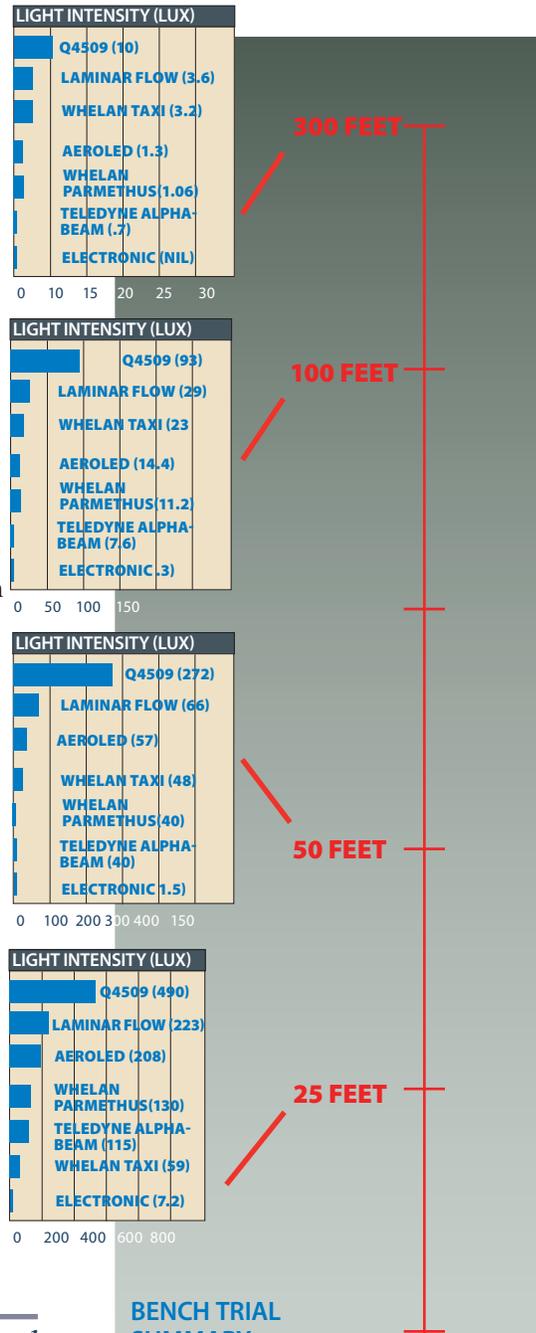
Whelan has been in the aircraft lighting game since 1952 and its rotating beacons are all but the industry standard. Whelan has a rapidly expanding line of LED products and not just in aviation.

It has its own version of TIR in a new product called the Parmetheus which, like the Alphabeam, is intended as a direct 4509 replacement. It's available in both landing light version with a 10-degree beam and a spreader taxi version with a 40-degree beam.

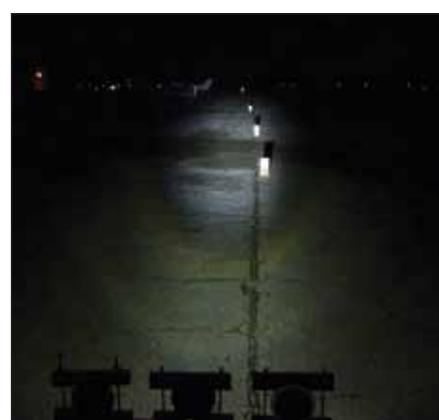
What's most noticeable about this lamp is its size—it's only 1.75 inches deep, so it's more compact than the 4509 it replaces. That means it ought to fit any mount, with no interference. Whelan projects a 10,000-hour operating life for the Parmetheus and it carries a three-year warranty, meaning it's essentially a lifetime bulb. It's available from Spruce in 14- or 28-volt versions for \$239 to \$268.

AEROLEDS

When we last examined LEDs, we complained about an over wide beam width that spread the light too much to make out distant detail. So AeroLEDs sent us a new product, with a

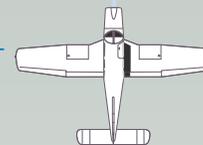


Pictures hardly do justice to the difference between the Q4509, left, and Whelan's taxi light, right. The 4509 is brighter and has longer reach, but its narrow beam misses the fringes. The LED is a cooler blue, with fewer harsh shadows and a wider, more balanced beam.



BENCH TRIAL SUMMARY

To gain a sense of how light output among the LEDs varied, we set up reflective targets at 25, 50, 100 and 300 feet. With the lamps shining downrange, we measured light levels with a lumens meter. The values represent the brightest parts of the beams, which we found by sampling on the observed centerline and five feet either side of it. From these data, we picked the highest values. Although measured output varied substantially, perceived illumination of targets was more even.



CONTACTS

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

AeroLEDs
www.aeroleds.com
208-850-3294

Laminar Flow Systems
www.laminarflowsystems.com
888-327-8140

Malibu Aerospace
www.malibuaerospace.com
877-662-5428

Whelen Engineering Co. Inc.
www.whelen.com
860-526-9501

narrower beam and it reports it will soon introduce new products that are brighter still.

The product we tried—the 16-LED SunSpot—is intended as a combination landing/taxi/recognition light, which qualifies it as the most feature packed of all the products. (At \$469.50 from Spruce, it ought to be.)

Where the other lamps have two or three leads, the SunSpot sports five. It can be configured as a landing light, a single flashing recognition light or, if used with another SunSpot, a wig-wag setup. At 1.25 inches deep, it's the shallowest of the lamps we tried and ought to fit about any mount.

OTHER OPTIONS

AC TV



For a dramatic video comparison of the landing lights tested in this article, log on to our sister publication, www.avweb.com and click the video button in the upper right of the home page. Scroll down to the LED landing light video.

Of the three other products we tried, only one is intended as a 4509 replacement. That's the 12-LED lamp from Laminar Flow Systems. We don't have a price on this yet, but it also includes a flashing function and, uniquely, a cooling fan to force air through the heat sink.

Also from Spruce is a \$529 product called the Electronic Landing Light, a German-made unit intended for the experimental or LSA market. At 3 inches in diameter, it's too small for the 4509 mount but might be useful elsewhere. It has a blinding, attention-getting red flasher that will leave you seeing spots.

Last, we took a look at a new LED wingtip taxi light package from Malibu Aerospace. This is a developmental product intended solely for Piper's PA-46 line. It's priced at about \$1700.

FIELD TRIALS

The graphic on page 13 shows how we set up our test range. While brightness is not the final arbiter of LED effectiveness, it's not irrelevant, either. And bluntly, measured against a Q4509, the LEDs hardly hold a candle, so to speak. But the 4509's brighter beam is also hot yellow and narrowly focused, so it misses illuminating things you'd want to see—perhaps a deer darting across the runway or the protruding tail of an airplane.

LEDs are typically in the 6500 Kelvin range—much bluer—than the 2500 Kelvin of incandescent bulbs. This produces an effect closer to daylight and although objects may not stand out more, they're easier to resolve, in our view. Viewed from the business end, they stand out better in sunlight as a recognition light and especially conspicuous when flashing.

Moreover, the 4509's sharp-edged spotlight misses things outside its illumination cone, making it a terrible taxi light. All the LEDs we tried had a broader beam and illuminated things the 4509 missed at a slight expense of distance illumination.

Ranked in brightness, the Laminar Flow led the group, with the Whelen Products and AeroLEDs in the middle and the Alphabeam and Electronic Landing Light trailing. But perceived brightness, well, that's a different story. You can see a barely noticeable difference between the brightest and dimmest bulbs, but we can't honestly say it's much of a distinction. The

diminutive Electronic Landing Light appears hobbled by its small size and, in any case, it's suitable only for experimental aircraft.

CONCLUSION

We like these products and even though they're expensive, we think they deliver value through their longevity, flexible beam width and favorable color temperature. Because they're so much more expensive than conventional incandescents, we think the right way to look at them is as always-on recognition systems that double as landing lights, not the reverse. Even if you fly only in daylight, these products deliver benefits. If you fly under 50 hours a year, justifying the expense might be a reach.

Our top price-is-no-object pick is the AeroLED SunSpot, since it's bright and includes a flasher. If we're going to have LEDs, we want the flasher option. The Laminar Flow is a good pick, too, but it isn't in production yet. The best value option without a flasher? Hands down, it's Whelen's Parmetheus. It's a good performer at a reasonable price and its small size means it will fit any mount.

Letters

(continued from page 3)

If you renovated an early model King Air, for example, and went through the same renovation processes as I do in our Lock and Key program, then you could compare the investment apples to apples. In this case, the same King Air would be approximately \$2 million dollars vs. our \$795,000 base price.

You would also need to take into consideration the vast differences in operating cost. I truly believe that the comparison to a turbine is inaccurate simply due to the apples to oranges comparison. If you took each aircraft (or any twin-engine turbine for that matter) and put them on the same playing field (avionics, paint, interior, engine times, prop times, systems renovations, gear overhauls) then one could easily discern the differences in investment.

Mike Jones
President/Owner
Mike Jones Aircraft Sales



CHECKLIST

-  More ADS-B solutions points to market competition for price lowering.
-  You can benefit from ADS-B now with available products.
-  Some products won't meet the mandate.
-  Mixing non-certified products with panel-mount gear is a regulatory unknown.

Low-Cost ADS-B: Trig Avionics, NavWorx

New ADS-B products are appearing on the market, showing hope for affordable solutions. But will today's low-cost options meet tomorrow's requirements?

by Larry Anglisano

In all the years we've been covering avionics, no piece of technology has been more confusing, uncertain and changeable as ADS-B. While NextGen may be the epitome of force-fed government technology, you'll eventually need to comply with an ADS-B mandate.

The equipage mandate is still on schedule for the year 2020. That's a long time given the rapidly changing nature of avionics. Buying equipment now is risky, yet the race for affordable ADS-B solutions has begun. Some are even introducing low-cost portable ADS-B products, an idea that's putting consumers at ease.

Which low-cost products will withstand the scrutiny of the FAA and the test of time? We don't know. But here are some contenders.

FREEFLIGHT SYSTEMS

Texas-based FreeFlight shows the most promise for a certified and compliant ADS-B solution, in our

view. The company provide high-end GPS products to numerous markets (including aviation) and has ADS-B products expected to be TSO'd by year's end. The products are UAT-based, which is 978 MHz in and out for weather and traffic.

When we spoke with FreeFlight's Jamie Luster, we sensed a dedication to bring to market products that meet the FAA's stringent specifications while ensuring the consumer buys a product that will

go the uncertain ADS-B distance. FreeFlight openly admitted that low-end and non-certified products spawned from this process will be useful, but temporary solutions. They have a first-hand look at what it takes to meet the ADS-B TSO.

The FreeFlight product line consists of the RANGR 978MHz-series of datalink systems. The RANGR line offers several reasonably low-cost, lightweight solutions for becoming ADS-B compliant and adding datalink traffic and weather to the cockpit. FreeFlight told us their RANGR 978MHz solution will be fully ADS-B compliant, will meet the requirements of the mandate, can be installed easily with an STC provided by FreeFlight Systems and offers both datalink and traffic benefits with the transceiver models. Further, they offer an "E" version of the RANGR product for the experimental market designed for upgrade to a fully-TSO'd

Trig Avionics leads for the moment on low-cost, space-saving solutions that at least comply with ADS-B out—the part required by 2020. Several systems can display on portables or panel-mounts, such as the NavWorx System on the

SkyVision Xtreme, shown above.



MANUFACTURER	PRICE	MODE	COMMENTS
NAVWORX			
ADS600	\$1495	UAT	Receiver only, ARINC interface \$200 extra
ADS600-B	\$2495	UAT	Receiver/Transmitter, ARINC interface \$200 extra
PADS-600	\$1495	UAT	Portable for experimental applications, Bluetooth
FREEFLIGHT SYSTEMS			
RANGR TRANSCEIVER W/GPS	\$6995	UAT	ADS-B in and out, Full up system
RANGR TRANSCEIVER ONLY	\$4995	UAT	ADS-B in and out, Requires GPS
RANGR TRANSMITTER W/GPS	\$6295	UAT	ADS-B out w/integral GPS
RANGR TRANSMITTER ONLY	\$3795	UAT	ADS-B out only
RANGR-E TRANSCEIVER W/GPS	\$3495	UAT	Experimental version in/out, Upgradeable, Integral GPS
RANGR-E TRANSMITTER ONLY	\$1995	UAT	Experimental version ADS-B out only
RANGR-E TRANSMITTER W/GPS	\$2995	UAT	Experimental version ADS-B out only, Integral GPS
RANGR-E TRANSCEIVER	\$2495	UAT	Experimental version ADS-B in and out
TRIG AVIONICS			
TT31	\$3126	1090ES	Flat-pack, rack mount transponder; KT76A replaceable
TT21	\$2095	1090ES	Remote transponder with panel-mount control head
TT22	\$2595	1090ES	High-performance version of TT21
TA62	\$1800	1090ES	A1 ADS-B receiver for VFR applications (dual ant. \$2700)
TA63	\$2400	1090ES	A1 ADS-B receiver for IFR applications (dual ant. \$3600)
TA64	\$6300	1090ES	ADS-B for turbine and higher-end applications

version. While the experimental market has always enjoyed a certain freedom to do what they please with their own aircraft, it's doubtful the FAA will treat them differently when

it comes to operating in the NextGen environment.

The proposed RANGR product is available with or without an integral WAAS GPS and can be saddled up

with remote receivers through ARINC and Serial data. The units are diversity-capable for connecting with top and bottom L-Band antennas.

Prices vary across the line, so reference the chart on page 17. Also note that UAT products are only for aircraft that fly below 18,000 feet—at least for ADS-B out compliance.

TRIG AVIONICS

Scotland-based Trig Avionics (with products sold through an established U.S. dealer network) is focused on low-cost 1090ES transponder solutions as well as ADS-B transceivers. These products are aimed toward LSA, ex-

perimentals and aircraft with limited electrical systems, but are certified to TSO C166B standards.

For ADS-B output transponders, the TA60 family consists of three

DISSECTING THE ADS-B MANDATE AND REALITIES

Let's dismiss any rumors, predictions and hopeful body English about where the ADS-B compliance mandate is headed: After January 1, 2020, aircraft must be equipped with ADS-B out equipment when operating in Class A, B and C airspace; in Class E airspace within the 48 contiguous states and the District of Columbia at and above 10,000 feet MSL, excluding the airspace at and below 2500 feet above the surface; Class E airspace at and above 3000 feet MSL over the Gulf of Mexico from the coastline of the United States out to 12 miles. An 1090ES transponder will do basic compliance. You won't get free weather or traffic, but you'll be in compliance. Piper Cubs, stark biplanes and other aircraft originally certificated without an electrical system, including balloons and gliders, are off the hook for now.

ADS-B gear falls under two TSOs: C-154C for UAT (Universal Access Transceiver) operating on the efficient 978 MHz spectrum and C-166B for 1090ES (Extended Squitter.) Some of the new low-cost products don't meet either TSO. For those that plan to, we've heard from some manufacturers told us product certification is more stringent than they ever anticipated.

On the shop level, there's no AML-STC (Approved Model List, Supplemental Type Certificate) for ADS-B. With an AML-STC, the shop follows the installation manual and signs off

the installation. No AML-STCs point at a hard-nosed FAA tone guarding the tight ADS-B regulatory spec. The specifics of installing ADS-B gear are covered in FAA AC 20-165.

Mandate aside, subscription-free cockpit weather and traffic is appealing. Massachusetts-based WSI is the weather provider to FIS-B (weather) broadcast with an impressive suite of weather products. A catch here is that FIS-B only works with a UAT system and the broadcast isn't widely available yet.

Enhanced traffic surveillance without expensive active traffic systems also appeals, but to reliably see traffic you'll need a full-up ADS-B system with input and output. There are also bound to be dual systems like Garmin's GTS800 series that relies on an 1090ES Extended Squitter for output and its own ADS-B traffic receiver for input, along with an active interrogation system (that pings other aircraft transponders).

Complying with the mandate with a single 1090ES transponder looks like the easiest solution. In today's money, you can get there for around five grand by installing one of these transponders and coupling it to a TSO-C145/C146 WAAS GPS. But, as noted above, to see traffic on your cockpit display, you'll need to add an ADS-B in solution. For weather, you'll need some kind of UAT solution. So a combo of UAT in for all data and 1090ES for ADS-B out might be a popular choice.

Portable solutions work fine for weather, but you won't get reliable traffic data unless you also have an ADS-B out system.

models with liberal traffic duties being the primary focus: the TA62, intended for basic VFR operations; the TA63, which should meet the needs of most GA airplanes; and the TA64, intended for jet operations. The TA60 series can display traffic on a wide range of cockpit displays, including Aspen, Avidyne, Garmin and most other ARINC 735 compatible displays. Traffic can also be displayed on compatible handheld displays (such as Garmin 496 and 696 series). Remember that these units use the ES ADS-B solution that can't offer FIS-B weather.

Trig has a new line of transponders that offer a fresh alternative to the same old boxes we've seen on the market for years. The TT21 and the TT22 are perhaps the smallest mode S transponders on the market with 1090ES ADS-B output. These models use two pieces: a control head that's installed in the panel and a remote transceiver. An altitude encoder is built in to the controller—a bold and welcome move. The controller uses an LCD screen and squawk code, and Flight ID input duties uses a conventional rotary knob. We eyed these transponders and found them built to rugged standards. The controllers are even splash-proof for water ops and open cockpits.

The TT31 is a conventional rack-mounted Mode S transponder that's plug and rack compatible with the popular Bendix/King KT76A. The TT31 is electrically efficient, using as little as half the bus power of most modern Mode S units despite a fully backlit display and transmitting at 240 watts. A software upgrade (expected by the end of the year) and a connection to an appropriate GPS will make the TT31 ADS-B out compliant. Pricing is still being finalized.

NAVWORX, INC.

There are three ADS-B products in the NavWorx Product line, including a portable system. While not TSO-certified, the units offer a low cost option right now.

The \$1495 ADS-600 is a remote UAT that interfaces with panel-



mount displays for displaying TIS-B traffic and FIS-B weather data. An optional ARINC429 interface allows the 600 to play on Garmin 430 and 530 navigators. The ADS-600 is strictly a receiver so you'll need ADS-B output, or step up to the \$2495 ADS-600B which is a Non-TSO transmitter and receiver.

The PADS-600 is the portable unit with integral GPS and it has a Bluetooth interface for communicating with PDAs and tablets. It also has Serial output for talking with a variety of portable GPS navigators from Garmin. The PADS-600 is designed to Velcro on top of the aircraft glareshield and has an antenna that's mounted to the side of the unit.

NavWorx has an impressively liberal display compatibility including interfaces with the G1000, G500/600, GNS430 and 530, GMX200, GPS396/496/596 portables, Aspen PFD/MFD, as well as a variety of experimental-based systems. We think coupling a UAT ADS-B in solution like NavWorx with a transponder-based ADS-B out system will be a popular (and cost-effective) choice in the long haul.

CONCLUSION

If you're anxious to play in the ADS-B environment, any of these low cost solutions can get you there, with limitations from model to model.

As for dealing with the mandate, we're still not budging in our advice to sit tight. A lot can happen both technologically and regulatory in 10 years. What you buy today might not be what you need tomorrow.

For avionics retrofits that need

transponder upgrades now, investing in a 1090ES model could offer a baby step to NextGen. Trig's offerings do just that. Of course, there's also the ADS-B out-enabled Garmin GTX330ES, for \$5995.

We think NavWorx offers the least expensive path to a full-up system that can display on a variety of cockpit screens. Shops will need to proceed with caution when mixing non-certified and portable equipment with fully certified panel-mounted gear.

When it comes to the full-up certified solution, we think FreeFlight is the company to watch as they aggressively push for full certification and TSO compliance. For those who fly in Class A airspace and want FIS-B weather, there's no good single solution yet, but a portable FIS-B and a panel-mount TIS-B solution could be the ticket.

As we see how these options play out in the real world, we'll report back.

CONTACTS

FreeFlight Systems
www.freeflightsystems.com
800-487-4662

NavWorx, Inc.
www.navworx.com
888-628-9679

Trig Avionics
www.trigavionics.com
+44(0)131 449 8810

Inogen O₂ Generator: Unlimited Supply

But it comes at a high price. If you use a lot of oxygen or you'd use it more if running out weren't a worry, this gadget is worth a look.

by Marc Cook

Cost-conscious pilots (is there any other kind?) will tend to use resources with care. These days we don't run around as much at full power, guzzling fuel, and by the same token, those of us who routinely carry an oxygen system for high-altitude flight often reserve its use for the times we feel it's absolutely necessary. After all, getting a bottle refilled on a long trip can be a real (and expensive) pain in the, er, cannula.

Shift the paradigm—say, make the oxygen available to the pilot essentially unlimited—and the usage model changes significantly. Now you don't think twice about putting on the tube for higher-altitude flights and you can finally consider adhering to the recommendation to suck oxygen above 5000 feet MSL at night. The engine of this shift is an unas-

suming 7.5-pound white box called the Inogen Aviator. What, exactly, is this thing? The Inogen Aviator is a device that comes out of the medical industry and is generally known as an oxygen concentrator. That's not to say it's a simple compressor. If you think in terms of a block diagram, the Inogen takes ambient air, increases its pressure and forces it through a zeolite filter. The zeolite separates the pressurized ambient air into oxygen and nitrogen; the nitrogen is ported off and the oxygen is captured.

There is nothing to refill, and in the case of the Inogen, tests have cleared the mechanism to a life of 10,000 hours. (Company spokesmen say that, actually, the life is probably quite a bit longer, but that's where testing stopped.) All the device asks for is 12-volt power—nominally around 5 amps, but up to 15 amps during maximum oxygen flow rate while the internal battery is also charging. Two types of battery pack are available, good for 3 or 6 hours of independent use. Overall size is 10.7 x 3.9 x 9.5 inches, plus a small power-converter brick with a cigarette lighter plug to connect to ship's power.

AH, FEELS GOOD

With an inexhaustible supply of oxygen, the Inogen Aviator can meter O₂ to the pilot in varying levels. Like the best electronic oxygen conserving systems, the Aviator has a sensitive pressure sensor on the machine side of the lightweight cannula. When you inhale, a slight negative pressure is generated in the line. Sensing this pressure drop, the

Aviator kicks out a bolus of oxygen.

The duration and volume of the bolus depend on which of the five flow-rate settings you have selected. Setting five is maximum output, and each lower setting represents a 20 percent reduction in effective flow rate. On the lower three settings, the bolus is hardly noticeable. In fact, you need to look at the little pinwheel flow marker in the cannula line to know it's working. On setting four of five, the bolus can be detected, and it's relatively aggressive on the fifth level—although you gradually become unaware of it after a half hour or so.

On two long trips, including one from California to Oshkosh, I tested one of the first Inogen Aviators released. To measure the efficacy of the system, I used a pulse-oximeter, and bear in mind that this was a test using one human body over the course of a little more than a month. My baseline oxygen saturation (or "sats") at home near sea level is consistently 98 percent according to the oximeter used for the test.

Let's take the stuff to altitude. One set of flights at 13,000 feet MSL, which thanks to summertime temperatures gave a density altitude of 15,800 feet, provided some insight. My sats after an hour at altitude with no oxygen was 85 percent. For this test, I tried each of the five settings and compared them to my current oxygen system, which uses a simple conserving cannula and a needle-valve rate adjustment—the results are in the accompanying table.

CHECKLIST

-  With nothing but 5 to 15 amps of ship's power, you can have unlimited oxygen.
-  The unit is small and light, with five output settings.
-  Passengers should bring their own. It's a one-person system.
-  At \$2999, it's not exactly an impulse buy. Bottle systems are cheaper.



CONDITION	O ₂ SAT @15,800 FT. DA	O ₂ SAT @17,200 FT. DA
NO SUPPLEMENTAL O ₂	85	NOT TESTED
INOGEN SETTING 1	88	86
INOGEN SETTING 2	90	88
INOGEN SETTING 3	93	91
INOGEN SETTING 4	96	95
INOGEN SETTING 5	97	96
STANDARD O ₂ SYSTEM	93	90

What are we shooting for? It's generally accepted that you want to keep your inflight sats at 92 to 93 percent. Clearly, supplemental oxygen was indicated on my first test flight at 13,000 feet. It's also recommended that when you're flying at night or under stressful conditions—say, an IFR flight with an approach to minimums—your sats should be 94 to 95 percent. Studies have shown an increase in procedural errors at reduced sats.

As you can see from the table, the Inogen was able to keep me within a percentage point or two of normal at altitude, and above the high stress threshold at the tested altitudes. And while it's hard to know without more testing—and an airplane capable of flying quickly at altitudes where mine is wheezing—it sure looks like the Aviator could go to 17,500 feet pressure altitude and keep a healthy, average-size pilot in the happy zone. (That's the real happy zone, not that little bit of delirium from hypoxia.)

MORE TO THE STORY

So that's the math, but leaving the story there does the Aviator a disservice. I'm probably like a lot of pilots who carry an oxygen bottle on board in that I tend to think pretty critically about when I'm going to use the stuff, reserving it for those times when I think I must have it. In the back of my mind is the concern about running out during a long trip—and paying an FBO a huge sum to refill the bottle, assuming that it even can.

So you treat oxygen as a nonrenewable resource—at least during a long, away-from-home trip—and use it sparingly. The problem is that you might not use it to feel better or think more sharply on a long trip, or to improve your night vision when flying above 5000 feet. Or worse, you might

run out and have to fly above 12,500 feet to clear terrain or weather and risk, at best, feeling lousy when you land. At worst, you could be impaired for the instrument approach at the end of the flight.

Let's not discount the comfort factor. After both long trips, I landed after as much as 4.5 hours at altitude without a hint of headache. I know from experience this is uncommon, particularly on the first day of a literal cross-country.

Having an essentially inexhaustible supply of O₂ on board changes your thinking. Flying at 10,000 feet, you don't hesitate to use it. Cruising above 5000 feet at night? You won't give O₂ use it a second thought.

Which brings us around to the bottom line. The Inogen Aviator sells direct from the distributor for \$2999, and remember that in the current guise, it's a single-person device; it's not possible to share the output. A standard portable system with a single regulator can be had for as little as \$400, although the high-end units with electronic metering system start at around \$1000. The cost of refilling is another issue.

I have a 22-cubic-foot bottle good for a claimed

Two battery packs are offered, a 12-cell and 24-cell system, upper photo. Control head displays settings and other useful data while the pinwheel confirms oxygen flow.

26 man-hours duration. It costs around \$25 to refill locally, so call it \$1/hour for O₂. (The electronic systems have greater endurance, but you have to buy the equipment first.) So the economic break-even point might be reasonably close or many years of flying down the road.

For pilots who don't need or want to fly high, or who do so infrequently, the Inogen Aviator probably isn't worth the money. But for those who embrace convenience and who understand the literal feel good value of inflight oxygen, the Aviator is a tempting morsel. For more information, call 805-448-5289 or visit www.windblade.com. Find a direct link at www.kitplanes.com.

Marc Cook edits Aviation Consumer's sister publication, KITPLANES.





X-Air LS A No-Frills LSA

If you can forgo sweeping composite curves and accept Cub-like performance, the X-Air LS will reward you with a simple, reliable aircraft. But it's still not cheap.

by Jeff Van West

It's almost a law in aircraft sales that for each level—light sport, piston singles, biz jets—the majority of buyers want the top of that class. LSAs are no different and every manufacturer we talked to over the years has found the same: deluxe models with all the trimmings out-sell the budget offerings.

That's why we see \$150,000 LSAs out there with Italian leather seats and cockpit avionics rivaling new airliners. No problem for a pilot who managed to sell his Bonanza and has the cash, but wasn't the whole point

behind light sport the creation of options for inexpensive flying?

REALLY LIGHT SPORT

X-Air's General Manager, Matt Verdieck, feels that's where his company's LS model comes in. "We've done everything we can to keep the aircraft fun and affordable." Affordable is still a relative term, but a fly-away price of \$59,995 for a new aircraft is about as cheap as one could hope for these days. That price gets you basic VFR instruments, a Dynon D-10 engine monitor, a panel-mount

CHECKLIST	
	A 30-year-old design that's proven easy-to-fly and cheap to operate.
	At \$60,000, it's about as inexpensive as you can get for a new airplane ...
	... but that's still twice as much as a legacy LSA with similar performance.

ICOM radio and a two-seat intercom. Optional brakes on the copilot side and an AirGizmos GPS dock in the panel will cost you \$495 and \$150, respectively. A GTX 327 transponder is another \$2695, but we'd probably look at an ADS-B compliant option instead. That's it for the options list.

X-Air kept the price low by using its proven kit design. The fuselage is aluminum tubing covered with Dacron sailcloth. This makes for some unusual systems. The 15-gallon fuselage fuel tank is behind a zippered flap on the fuselage, and the baggage area is behind a similar zippered flap behind the seats. The cloth also has a tendency to wrinkle in places. This doesn't cause any problems, but it's not the sweeping lines we're used to on most new LSAs. The wings can fold for storage.

AC



To ride along on an X-Air LS demo flight, log on to www.avweb.com and select the video index. Or, go directly to <http://tinyurl.com/xairlsa>. Recorded at Oshkosh 2010, this video shows several details of the aircraft as well as its performance in flight.

The LS (opposite) looks like an closed-cabin ultralight, right down to the wrinkled sailcloth skin.

The interior surprised us with its comfort and ease of ingress and egress. It's 43 inches wide (that's one inch narrower than a Cessna 182) and the seats are quite comfortable. Four-point harnesses are standard. The panel is attractively molded and laid out, rather than utilitarian and the sticks, throttles, trim and flap controls are all finished in wood.

Systems are simple; both flaps and trim are manually actuated via overhead levers. Unlike some high-end LSAs we've flown, there was enough trim authority for hands-off flight at any cruising airspeed. We found the copilot throttle between the seats awkward to use in flight, however.

We think the LS hits it just right on the mix of digital and analog instruments: Simple instruments for airspeed and altitude, a spot for a portable GPS, and engine data and readouts are collected in one neat digital display.

The gross weight is only 1234 pounds, which is unusual in the LSA world where most designs use all 1320 pounds the regs allow. But the empty weight is low enough that a typical useful load is about 550 pounds. Fill the fuel tank and you still have 460 pounds of payload.

FLIGHT TEST

The X-Air LS flies like most LSAs, which is to say it flies more like an airplane than an ultralight. It's responsive to small inputs and is light in pitch, although the controls are heavier overall and with a slower roll rate than in many new-design LSAs. Rudder use is a must.

It's stable in all axes and is utterly forgiving in slow flight and stalls. Visibility is excellent with the doors on, but you can remove them for the wind-in-your-hair experience.

Power comes from the 80-HP Jabiru 2200. While less popular than the ubiquitous Rotax 912, we've been impressed so far with the performance and maintenance costs of the Jabiru engines, and think it's a smart choice for the LS. The result is an aircraft that cruises comfortably at 90 MPH while burning 4 GPH. What it lacks in cruise speed it gives

back in takeoff, climb and landing performance. Sea level ground roll for takeoff and landing is under 300 feet. It's about twice that to clear a 50-foot obstacle. Climb rates are around 800 FPM at sea level on a standard day.

The only flight oddities were that takeoff requires a bit of an over rotation followed by some forward stick to get the right climb pitch. Landings are straightforward but the great forward visibility might mean a few tries to get the sight picture right. We also thought at first that the system had quite a bit of backlash. This turned out to be a loose fitting on the removable stick on the copilot's side.

Ground handling is good. The nosegear is steerable, if a bit stiff in our view. The craft weighs so little that one person can easily move it around the ramp.

Verdieck says the performance is similar to a Piper Cub. That's about right, albeit one with side-by-side seating and tricycle gear.

CAN A BUDGET LSA FLY?

One benefit to manufacturers of the customer preference of buying deluxe is that the margins are usually higher on these models. This may be of particular importance in the light sport market where margins are low to begin with. That begs the question as to whether a budget LSA like the X-Air LS is a viable endeavor over the long haul.

CONTACTS

X-Air LLC
www.x-airllc.com
859-250-5240

While we harbor our doubts that the market for a new, yet budget, LSA is big enough to support a business plan, we think the X-Air LS's simple and tried design makes that a partially moot point. Parts should be readily available or simple enough to get made. The light sport rules can make this simpler than with legacy certified aircraft that meet LSA criteria.

That brings up the issue whether it's worth spending \$60,000 for a new aircraft that gets you the performance of a 1940s design costing half that much. We think there's a legitimate gain in safety and comfort (particularly for larger individuals) in an X-Air versus something like an Aeronca Chief or Luscombe 8. How much of a gain and what that's worth is not a no-brainer. But for the individual who's looking for fun flying in a new aircraft and doesn't mind a few wrinkles in his Dacron, the X-Air could be the ticket.

Inside the cabin, the LS feels rather refined, with four-point belts, comfortable seats, a sculpted panel and wood trim on the controls. The cabin is also 43 inches wide.



Avgas Update: The Approval Grind

GAMI's G100UL and Swift's UL102 are before ASTM International for review. Both face a long haul that may not yield progress until next year.

by Paul Bertorelli



Where to now with avgas? Following a flurry of activity at EAA AirVenture—briefings and meetings, mainly—has the flag inched forward toward a replacement for 100LL? In short, it's hard to tell. If there's substantive progress, it's occurring behind closed doors, although the venue has changed.

By early September, the FAA revealed a generally positive test result on a 150-hour test cell run with Swift's UL102 fuel, a variant of several blends it has developed. Meanwhile, General Aviation Modifications Inc. still has be-



fore the FAA a request to approve its G100UL via STC. From what we're able to surmise, this effort is stalled, but GAMI says it's still pursuing it.

Both Swift and GAMI have applied for ASTM International approval of their fuels, which the FAA insists upon before certifying any fuel for

general use. It's at this point that things gets complicated, muddled by flyspeck technical considerations that may or may not matter and by politics. We're told that three potential test fuels may go before the ASTM fuels committee in December: Swift's blend, GAMI's G100 and a proposed

new fuel called 100ULL (ULL for ultra low lead). The ultra low lead idea percolated up from the GA industry and doesn't have a named sponsor yet. Depending on how the fuel is formulated, it could contain as little as half the tetraethyl lead used in 100LL. The hope is that such a fuel might provide at least an interim step to satisfy proposed EPA rules for reduced emissions, which is what's driving the coming extinction of 100LL. But there are two big unknowns with 100ULL. Will it provide the necessary knock resistance and will EPA go along with an interim lead reduction until it can be eliminated? With no direct sponsor, it's also unclear how 100ULL would be tested.

In late July in a letter to AOPA at the association's request, EPA's Margo Tsirigotis Oge said the EPA currently had no timeline

SPECIFICATION	100LL D910	SWIFT UL102	GAMI G100UL
MOTOR OCTANE	99.6 MIN	102.2	98.5
PERFORMANCE NUMBER	130 MIN	139.6	130
LEAD	0.53 MAX	<0.01	N/A
FREEZING POINT	-58 C MAX	-64.5 C	-58 C
NET HEAT	43.5 MIN	41.9	41.75
VAPOR PRESSURE	38-49 KpA	48.5	49 MAX
DISTILLATION END POINTS			
10%	75 MAX	48.5	80
40%	75 MIN	161.0	75
50%	105 MAX	161.0	132
90%	135 MAX	161.5	165
END POINT	170 MAX	175.0	180

WHAT THE NUMBERS MEAN

Aviation fuels are traditionally measured in motor octane values using a single-cylinder test engine. Performance number refers to octane values above 100. Lead content is given as milliliters per liter maximum. For 100LL, it's about 2 grams per gallon.

Net heat is energy density per unit weight, given in megajoules per kilogram. Both G100 and Swift UL102 depart from the spec (red values), having slightly less energy per weight than 100LL. But they have more energy per unit volume.

Remaining points of departure with D910 are distillation end points, which refer to how much the fuel's various fractions boil off at what temperatures. Both Swift and G100UL are off spec here, but it's unclear if this translates to any operational differences. Thus far, other than slow cold starting for Swift, it appears not to.

for lead regulation and that its advanced notice of proposed rulemaking doesn't propose to ban leaded fuels. Nor, she said, does the EPA have the statutory authority to ban lead in fuels. The next day at AirVenture, FAA Administrator Randy Babbitt said exactly the opposite in carefully parsed words that said that only EPA had the statutory authority to regulate lead emissions. (In this context, fuel is merely the vector for the lead.)

Optimists might read this as EPA backing off from its threat to extinct avgas by lowering lead emission standards, but the agency still has before it two agenda items that suggest otherwise. The Friends of the Earth/Bluewater Network suit to force EPA to ban lead or conduct lead-limit monitoring is still active. Further, the agency's own agenda calls for sharply reduced lead emissions under its National Ambient Air Quality Standard and it has pushed the states into air monitoring programs.

It's unclear if these statements from EPA have stayed the execution or just moved it off. We haven't been able to get a clear answer because we think no one knows for sure, given the uncertainty surrounding what EPA's lead monitoring may reveal.

AVGAS TECH

On the ASTM's plate is how to develop a standard to approve these new fuels. The consistent barrier in rapid fuels develop has been the industry's insistence that any new fuel meet a specification called ASTM D910. This is sometimes viewed as recipe for how to make unleaded avgas, but that's a misnomer. It's really a specification for purchasing agents buying fuel on contract and although it has limits on some components—such as lead, sulfur and dye, it's not a compositional recipe, but rather a description of fuel performance characteristics. If that makes it sound like Shell's avgas could be different from Exxon's formula, that is exactly the case. But the two will perform the same with regard to octane, heat content and aging.

D910 came about not as a blue sky spec for the perfect avgas but as a real-world description of what was known to work. Unfortunately, because of blind adherence to D910, no proposed new fuel—and dozens have been tested—has passed muster.

SWIFT FUEL TEST CELL FINDINGS

The FAA's 150-hour test cell run on Swift's UL102 revealed no particular surprises, which was itself no surprise. The fuel continues to demonstrate excellent knock resistance.

The Lycoming IO-540-K was monitored during the 150-hour run and sparkplugs were removed to check for deposits. The engine was also allowed to cool overnight and was restarted the following morning. It proved to be a bit slow in cold starting, but had no problems when warm. (Cold is relative. The engine was at ambient temperature, not chilled to Minneapolis in February.)

Several concerns have been raised with unleaded fuel and a big one is valve recession and wear,

something that Continental has said is a major worry. Oil dilution is also a potential problem with a high aromatic fuel with different combustion properties than avgas. On the plus side, there are no lead byproducts to foul the oil or build deposits on pistons and valves.

No substantial valve recession was observed in the FAA tests, nor did major components such as valve guides, bearings or piston surfaces exhibit unusual wear. The valves did show light deposit buildup and so did the sparkplugs.

Continental told us its brief testing of Swift fuel revealed similar trends. The fuel pump diaphragm showed some wrinkling, but Lycoming believes it's not a serious issue.

Into this miasma come Swift and GAMI.

The formula constituents in Swift and GAMI vary substantially from avgas. Swift is a so-called binary composed of 85 percent mesitylene (trimethylbenzene) and 15 percent isopentane. G100UL is composed primarily of conventional aviation alkylate gasoline, blended with a proprietary aromatic package.

Swift easily meets D910's minimum 99.6-octane requirement. The FAA's recent tests pegged it at 102.2 MON, which closely matches what typical FBO avgas really is.

Depending on the blend, G100UL is a little over 98 MON. But GAMI's testing has revealed that there are scale-up effects for some fuels, meaning that 98 MON certified in a single-cylinder octane test engine can provide knock resistance equivalent to more than 100 octane in a full-scale engine. Shell has done research indicating the same thing, suggesting that one way to address this issue is to use a different means of specifying octane for aviation fuels. This is one of the issues the ASTM committee will need to address and resolve.

The FAA's technical report found that Swift fuel meets or is close to D910 on all but two points. Its heat content is lower by 3.7 percent and its distillation end points are quite a bit higher. Distillation end points refer to the percentage of material

that evaporates at certain temperatures. Because it's composed of a high-boiling point aromatic (mesitylene), Swift fuel's limited fractions evaporate at higher temperatures than avgas does. G100UL has similar departures, but they're not as great.

The over arching question: Does it matter operationally? Our guess is that it probably doesn't, given the amount of flight testing both Swift and GAMI have done thus far. The FAA's 150-hour test cell run on Swift revealed no issues that relate to distillation points, but then the test wasn't designed to do that.

Beyond these technical issues, the larger issue before ASTM is bureaucratic and political. Even though it's composed of industry representatives used to making rapid-fire business decisions, ASTM has a reputation for moving at a glacial pace. The committees meet only periodically and their members must fit the work into their day jobs. Further, the committee is composed heavily of oil company representatives who may resist the idea of a patented, compositionally specified fuel, which both Swift and G100UL are.

We were told by two sources involved with the committee that it understands the urgency of accelerating the fuels approval process. Still, the next formal meeting isn't until December, so progress may not be visible until 2011, if then.



photo by Thierry Deutsch

Cessna 172 Skyhawk

Cessna's practical entry-level four-placer has earned buyer trust and there are literally thousands to pick from across the price spectrum.

If there's an airplane that still makes even the slightest economic sense to own and fly, it's probably the Cessna 172 Skyhawk.

While it's a dated airframe that won't turn heads on any ramp, the Skyhawk delivers enough for the money to earn its keep. On the used mar-

ket, there are oodles of models from many vintages to pick from.

Even if you bottom feed and end up with a project airplane that begs for mechanical and cosmetic attention, chances are it will take only a modest sum to bring it to airworthy

status. It might not be the fastest, the most aerodynamic or poshest ride around, but one thing is certain: The Skyhawk delivers enormous practical

value for its highly affordable purchase price.

For this reason, you won't need to look far on any ramp or used airplane

ad to find a Skyhawk. During its original 31-year production run, a total of 35,773 Skyhawks were built and well over 20,000 of those are still flying in the U. S. The fact that Cessna could reintroduce and continue to build and sell such a stale

It may not be the fastest pony in the stable, but the Hawk is the most affordable.

design compared to flashy composite speedsters that dominate the market says that buyers resonate with the Skyhawk's many strong points.

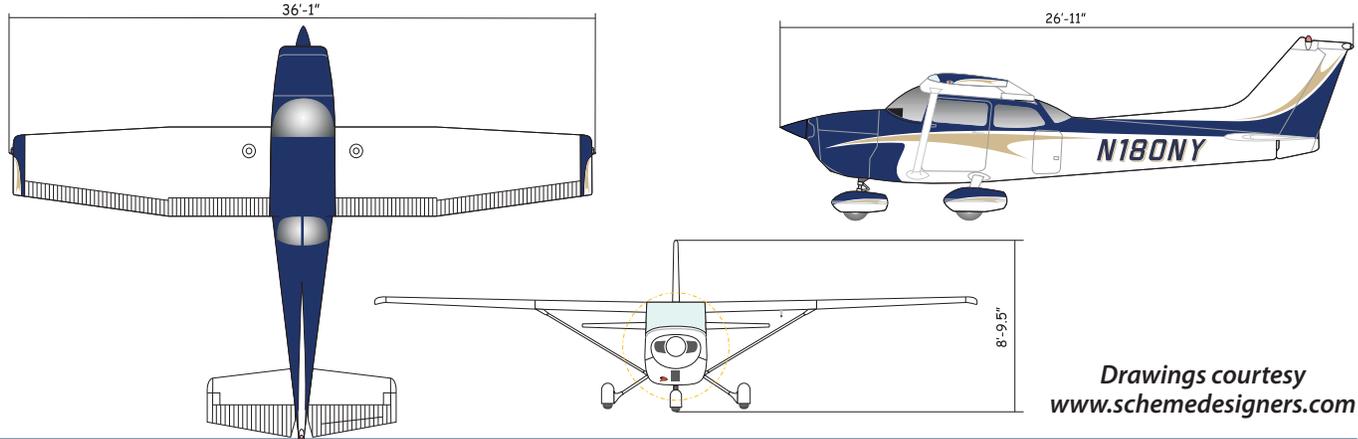
The performance and economics are compelling. The airplane chugs along at an honest 115 knots, burning under 10 gallons per hour while carrying a reasonable load. Just don't be in too much of a hurry to get where you're going in a Skyhawk—it's no speed demon. On the other hand, you'll need to work at getting hurt in a 172—it's an easy airplane to fly by most standards. It has a low fatal accident incidence.

Most owners are enthusiastic about their rides. Nearly all boast of an easy-to-afford set of wings that can easily haul family, friends and gear. Many fly hard IFR and brag of a stable instrument platform. As one owner put it, "It's tempting to step up to something with more speed and creature comforts, but my Hawk is predictable in every aspect of ownership."

MODEL HISTORY

The 172 legacy started in 1956. Ac-

CESSNA 172

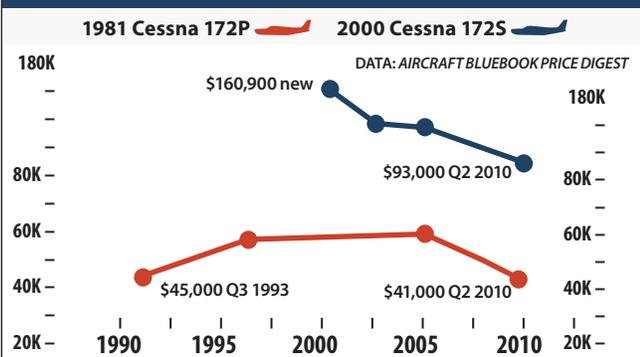


Drawings courtesy www.schemedesigners.com

SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1956-1959 172	CONT. 145-HP O-300-D	1800	\$21,000	40	940 LBS	108 KTS	±\$17,500
1960-1961 172B	CONT. 145-HP O-300-D	1800	\$21,000	40	875 LBS	114 KTS	±\$21,000
1962 172C	CONT. 145-HP O-300-D	1800	\$21,000	40	920 LBS	114 KTS	±\$22,000
1964 172E	CONT. 145-HP O-300-D	1800	\$21,000	40	970 LBS	114 KTS	±\$24,000
1968 172I	LYC. 150-HP O-320-E2D	2000	\$20,000	40	1000 LBS	115 KTS	±\$28,000
1969 172K	LYC. 150-HP O-320-E2D	2000	\$19,000	40 (50)	970 LBS	115 KTS	±\$29,000
1973-1976 172M	LYC. 150-HP O-320-E2D	2000	\$19,000	40 (50)	970 LBS	115 KTS	±\$34,000
1976-1980 172N	LYC. 160-HP O-320-H2AD	2000	\$13,600	40 (50)	850 LBS	120 KTS	±\$39,000
1981-1986 172P	LYC. 160-HP O-320-D2J	2000	\$13,000	40 (64)	950 LBS	120 KTS	±\$44,000
1997+ 172R	LYC. 160-HP IO-360-L2A	2000	\$17,000	50	860 LBS	122 KTS	\$70,000 - \$269,500
1999+ 172S	LYC. 180-HP IO-360-L2A	2000	\$17,000	50	890 LBS	124 KTS	\$72,000 - \$301,500

RESALE VALUES



SELECT RECENT ADS

AD 08-26-10	ALTERNATE STATIC SELECTOR VALVE
AD 08-02-18	PICK-UP COLLAR SUPPORT AND SCREWS
AD 04-19-01	SHOULDER HARNESS ADJUSTERS
AD 99-27-02	FUEL SELECTOR VALVES
AD 97-01-13	FUEL, OIL AND HYDRAULIC HOSES
AD 08-05-09	CREW SEATS (172R/S ONLY)
AD 08-03-02	FUEL RETURN ASSEMBLY (172R/S ONLY)
AD 07-08-03	FLEXIBLE FUEL HOSES (172R/S ONLY)
AD 07-05-10	CREW SEATS STEEL LOCK ROD (172R/S)

SELECT MODEL COMPARISONS

PAYLOAD/FULL FUEL

'81 CESSNA 172P	~550
'81 PIPER WARRIOR	~550
'79 AG CHEETAH	~650
'81 BEECH SUNDOWNER	~650
'00 CESSNA 172S	~650

CRUISE SPEEDS

'81 CESSNA 172P	~110
'81 PIPER WARRIOR	~110
'79 AG CHEETAH	~125
'81 BEECH SUNDOWNER	~125
'00 CESSNA 172S	~125

PRICE COMPARISONS

'81 CESSNA 172P	(\$41,000)
'81 PIPER WARRIOR	(\$34,000)
'79 AG CHEETAH	(\$39,000)
'81 BEECH SUNDOWNER	(\$37,000)
'00 CESSNA 172S	(\$93,000)



Avionics upgrades make an already good IFR airplane even better. Top, Steve Mayotte's M-model Skyhawk sports a GNS530W and new replacement plastic overlays presenting a clean yet original look. Bottom: Newer Hawks won't need much upgrade with G1000 glass.

tually, it was the tail-dragging model 170A that planted the 172 seed back in 1949. The 170A was a fabric-wing machine that suffered from poor roll response since its ailerons were carried over from the smaller Cessna 140.

The 172, of course, is a true tricycle gear airplane, but one that almost didn't come to pass. Met-Co-Aire of Fullerton, California, had already developed a tri-gear modification for the Cessna 170. Piper's Tri-Pacer, the first trike to sell in serious volume, was a hit because it was

so much easier to land and taxi, which is what budding pilots wanted. Then as now, mastering a conventional gear airplane without an excursion into runway edge ditches was a difficult challenge.

The tricycle gear promised to simplify training and it was thought to be the design of the future.

But not everyone saw it that way, least of all the established movers and shakers at Cessna. Nonetheless, some at Cessna saw that there was a place for a tri-gear airplane and they began to develop one, albeit without the official blessing of the company's management. In fact, if the behind-closed-doors tri-design wasn't stashed away for future use, the 172 as we know it today may never have come to market.

The R&D effort that became the 172 was conducted at an isolated farm strip well away from Cessna's main operations in Wichita. The prototype's first flight occurred in June of 1955 and although it was successful, a list of concerns surfaced:

There were worries about controllability versus stability, ground handling concerns plus fear of propeller strikes, yaw or directional stability and the need to ensure enough elevator power to overcome the high thrust line, which tended to press down the nose gear, aggravat-

ing the prop strike problem. Further, the firewall had to carry both the engine's weight and the nosegear attach point, which Cessna engineers knew would take a terrific beating at the hands of ham-fisted pilots. Other questions related to centering the nosewheel in flight and figuring out how to keep the wheel from shimmying like crazy on landing and takeoff. This was uncharted territory for Cessna and non-issues for familiar tail-dragging designs.

MODERN GEAR

The 172 main and nosegear that emerged from these deliberations formed the foundation for what became Cessna's standard fixed-gear design. The gear was made fairly short to lower the center of gravity and minimize porpoising and ground upset. A total of 2318 landings were made during the test program by a number of pilots with widely varied experience.

This resulted in what Cessna marketing mavens called the "Land-O-Matic" gear and Cessna's promotion soon reflected its new devotion to tricycle gear design. The ads touted that you "drive it into the sky and drive it into the ground." Unfortunately, the latter part of that phrase came to have a double meaning. In truth, getting the landing gear right was not quite so simple and it took some effort to improve the 172's crosswind and ground handling habits.

The 172 as introduced in 1956 was powered by a Continental O-300-D six-cylinder engine rated at 145 HP turning a fixed-pitch propeller. Gross weight was 2200 pounds. The original 172s had an upright vertical stabilizer and a straight-backed fuselage which, to the modern eye, looks dated. But that wasn't so in 1956 and Cessna moved 1100 172s that year.

Then began what would become a proliferation of model changes and improvements, including the long hibernation between the mid-1980s and 1997 which brought the 'technically advanced' Skyhawk still in production today. More on that in a bit.

The 172A, with the vertical tail swept, was introduced in 1960. The new empennage was heavier; rudder power was reduced, and directional stability was degraded somewhat all in favor of marketing. The fastback

Arguably a dated design, the 2010 172S sports many improvements and a \$225,000 price tag. With the reintroduction of the line in 1997, Cessna upped its game with vastly improved interiors, lower photo.

fuselage blended with the swept tail looked cool.

The 172B was developed for the 1961 model year. The landing gear was shortened by three inches to improve crosswind and taxi handling, while the motor mounts were raised by the same amount to retain propeller ground clearance.

A baggage door was incorporated for the first time and the "Skyhawk" name was introduced. Most pilots use 172 and Skyhawk interchangeably and in later models the two did become one. But early on, just like in the car market, there was a distinct difference in trim and equipment levels.

In 1963, the "Omni-Vision" rear-window 172D version was introduced. To help overcome the squirrely handling, the span of the horizontal tail was increased by eight inches. The center strip in the windshield was eliminated and along came the one-piece windshield, which improved the view out the front. An optional child's seat for the baggage bay was introduced and gross weight was increased another 50 pounds to 2300 pounds.

Skyhawk models 172 E through H (1964 -1967) featured improvements such as a shorter nose gear stroke lessened by three inches and the F-model came with electrically operated flaps. Many lamented the passing of the manually operated versions because these were more precise, less distracting and easier to maintain. The competition from the other side—the Piper Cherokee—maintained the simplistic manual flaps.

POWERPLANTS

A significant change occurred with the 172I in 1968: The Continental six-cylinder engine was dropped in favor of the Lycoming 150-HP O-320-E2D, one of the most prolific engines ever made. In addition to a new cowling and motor mounts, the new engine package got an oil cooler.



Of course many—including the folks at Cessna—believed that the 172 had seen its day and would soon be displaced by the newly emerging 177 Cardinal. So Cessna ordered 4000 engines from Lycoming for the Cardinal. But the 150-HP Cardinal proved a dog so the Skyhawk inherited the engine. It included the troublesome dual Bendix magneto which still draws the ire of owners and mechanics alike.

The 172K of 1971 dropped the famed—and successful—Wittman spring steel main gear in favor of tapered steel tubes that provided more fore and aft flexing to supposedly improve ground handling on rough surfaces.

The landing light was moved from the leading edge of the left wing to the nose-bowl of the cowl, which improved airflow over the wing at the expense of more complicated cowl removal and sharply reduced bulb life, probably due to engine vibration.

In 1972, the 172L emerged with an extended dorsal fin to improve longitudinal stability, making it more difficult to enter a spin. But closer to the ground, 172 pilots typically approached and landed too fast and the accident record bears out that observation to this day; runway prangs due to off-speed landings are a common accident scenario.

In 1974, cruise performance was improved through an effort to reduce drag and improve airflow through



the cowling. This turned out to be a greater improvement than many of the other changes. At 8000 feet, 75 percent cruise increased from 113 to 120 knots, although owners say the lower number is more realistic and most plan for even less, around 100 to 105 knots. This suggests that if Cessna had paid more attention to aerodynamics than to perceived market movements, the 172 would have performed better than it does, at least with regard to cruise. Environmental awareness soon caught up with GA as the Skyhawk continued to evolve.

With the mandated change to



Older Skyhawks look a little staid when compared to modern plastic airframes but Cessna learned long ago that staid is a perennial seller.

low-lead fuel, engines designed to operate with 80-octane fuel showed various signs of distress. Lead fouling of plugs and valves rose to epidemic proportions. Deposits caused hot spots that led to premature failure of engine components. Fuel system elements deteriorated because of new and incompatible aromatics and other additives.

ENGINE DISASTER

The Cessna and Lycoming solution turned out to be ill-starred at best, a disaster at worst. In 1977, the 172N was fitted with the now-infamous O-320-H2AD. It had 10 additional horsepower which yielded a higher service ceiling and a knot or two of added cruise speed, but these improvements came at horrendous cost. The engine was a maintenance nightmare. Because of poor lubrication in the valve train, cold starts in cold weather caused tremendous damage to cams and tappets. The spalled metal tended to quickly trash bearings, oil pumps and other critical components.

Cessna and Lycoming supported owners to a generous degree, as avia-

tion goes, but it took a long time to understand the nature and cause of the problem and to devise ways to alleviate it. More than 5000 of these engine/airframe combinations were built.

There are three major ADs on the H2AD engine and resale value of the airplane is dependent on compliance. AD 77-20-7 calls for replacement of the tappets, AD 78-12-8 calls for replacement of the oil pump impeller and AD 78-12-9 (the big one) mandates replacement of the crankshaft.

It's critical that these ADs be checked. We think it's unlikely that any 172s are still out there sporting unmodified H2ADs, but the logs ought to be reviewed, nonetheless. In 1981, the troubled H engine was replaced in the 172P with another model, the O-320-D2J engine that yielded relatively good service. This is the last of the original Skyhawks and the line was history in 1986.

THE MODERN SKYHAWK

Cessna Chairman Russ Meyer stood by his promise to restart piston single-engine production if Congress passed liability reform. Turns out he's a man of his word. The Skyhawk was reintroduced in 1997 as the 172R and sold for about \$135,000 with average equipment including the new Silver-Crown Plus line of avionics—a launch product for Bendix/King that

proved to be doggy. While modern for its time, this gear was plagued with problems and it's not uncommon to find an airplane that has a radio stack replaced multiple times.

Although produced under the same type certificate, the airplane has a long list of improvements, including a metal panel, refined seats, better seatbelts, better ventilation and improved anti-corrosion treatment. The mid-2000s model line brought the 172S with Garmin's G1000 integrated avionics suite and eventually the hugely capable GFC700 autopilot. While it had its growing pains, the G1000 was a vast improvement over the Bendix/King gear and brought the 172 into the world of glass.

The biggest change was the fuel-injected Lycoming IO-360-L2A in place of the carbureted variant used in the last production Hawks. This change reduces the likelihood of carb ice, but some owners complain that these engines can be bitchy to start.

Cessna shot itself in the foot on quality control. Owners of these newer aircraft were peppered with ADs and service bulletins totaling no fewer than nine for the 172, ranging from exhaust system problems, firewall problems due to shoddy assembly work, engine oil pressure switches, missing rivets and bad bolts in control yokes. Cessna has stood behind these fixes, but all things considered, owners would prefer better quality in a new airplane.

PERFORMANCE

Folks who buy Cessna 172s tend to be honest about the airplane's attributes and limitations. Most consider the 172 a two- to three-place airplane with room for baggage and with acceptable although not exceptional performance and range. Most owners say 8 GPH is about right for fuel burn, with a little more for the newer 172s, especially the SP. One hundred knots is about right for IFR planning speeds.

Loading a 172 requires some attention from the pilot, but it's relatively generous in CG range and regardless of loading, there are few complaints about the handling qualities. Pitch forces are the highest of the three axes, but good speed



control minimizes this. Properly flown, the 172 can handle stiff crosswinds. Improperly handled, it suffers a high level of landing accidents.

Despite NTSB reports littered with loss of directional control, prop strike, and nose gear failures, the 172 has few vices. It has proven itself as a forgiving airplane that has enabled many people to be pilots who otherwise wouldn't have made the cut.

One of the great strengths of the 172 is its comfort. While its dimensions aren't generous, for all but the longest or widest of pilots and passengers, it's comfortable. For sightseers, the backseat of a Skyhawk is one of the best places to be. Seats in earlier (and unmodified) models are somewhat skimpy and uncomfortable after a couple of hours. In later models, both the comfort and adjustability of the seats are quite good.

Most owners, particularly those who've had their Skyhawks for a few years, report low annual costs. Compared to other brands, Cessna parts are reasonably inexpensive and used parts are normally available in abundance, if needed.

For a design as old and with so many airplanes operating, the number of SDRs and airworthiness directives is surprisingly small, even considering Cessna's problems with late-90s production quality. Skyhawks are notorious leakers of rain, especially around the windshield.

Introduced in 1997, the 172R eliminated the issue of carb-icing with the fuel-injected Lycoming IO-360.

Rigging and condition of control cables, pulleys, fairleads and fittings should also be carefully checked.

Many 172s have been poorly or improperly rigged over the years. Corrosion has been found between cable strands and this isn't always visible. Things like this tend to be disguised by a new paint job rather than fixed. The design is notorious for poor nosegear shimmy damping.

MODS, OWNER SUPPORT

Fifty years ago, the general aviation industry was busy putting the tailwheel in front. Now, there are modifiers to put the nosewheel in the tail. Things have come full circle so you can now undo Cessna's work and turn the 172 into a 170. There are countless other mods, too.

Some owners feel flap and aileron gap seals pay off both in low-speed handling and improved cruise. Others say there isn't any difference. Others swear by 180-HP engine upgrades to up the ante in climb performance.

Some of the more popular mods included STOL kits (www.springaviation.com), (www.hortonstackdoor.com), (www.sijet.com), engine upgrades from Penn Yan Aero (www.pennyanero.com), Air Plains Services (www.airplains.com), and

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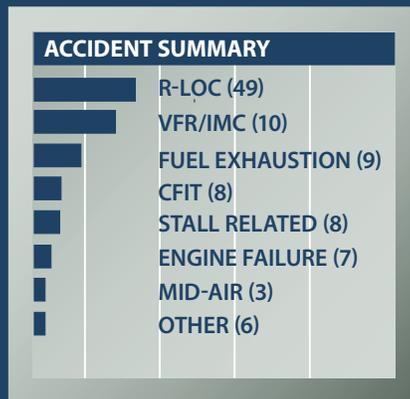
ACCIDENT SCAN: BOTCHED LANDINGS

When we sifted through a sample of 100 Cessna 172 crashes from the year 2000 to 2010, one thing was blatantly clear: Students tend to lose control of these airplanes on takeoff and landing.

The accident reports are littered with cross-wind landings gone bad, prop strikes and bent firewalls, plus a smorgasbord of botched go-arounds. This is all typical fare for all of the Cessna 100 series airplanes.

It's not that the Hawk is hard to land but rather it's exposed to students and neophyte pilots trying to learn how to land, thus its tendency toward runway prangs. On the other hand, master the Skyhawk in a crosswind and you can fly about any other tricycle gear airplane with ease.

Thrown into the accident mix was a healthy dose of spatial disorientations due to continued VFR into IMC by non-instrument rated pilots, fuel exhaustion, more mid-air than we'd like to read about, some of the inevitable engine failures including one



sudden-stoppage after a tired Continental swallowed a valve. We also found a couple of classic augers, the result of glassy-eyed, under-the-influence pilots.

By chance, we ran across a suicide, too—the well-reported teen in Tampa who flew a 172R into the office building. This was no fault of the airplane, but made the model famous on national television. Still, we couldn't find any accident pattern that points to problems with the Cessna 172 as it relates to safety reliability or bad habits. Instead, it's the 172 pilots who hold the smoking guns in the NTSB records.

Isham Aircraft (www.ishams.com). Auxiliary fuel tanks are available from O&N (www.onaircraft.com) and Flint Aero (www.flintaero.com). PowerFlow exhaust modifications are also available (www.powerflowsystems.com).

Cessna Pilot's Association (www.cessna.org) which has an insurance program, monthly magazine and fly-ins is an excellent tool for all kinds of support. The association runs a variety of type-specific maintenance and operational clinics, including sessions on owner-performed maintenance.

WHICH MODEL?

Mods or not, if you're not considering a newer 172, which of the many model variants is best? For basic day VFR flying, we think an earlier 172 is a good buy. The original Skyhawk

with the straight tail and "fastback" fuselage is the best handling, say those who know the breed. The O-300D is unquestionably one of the most successful and comparatively trouble-free engines ever to come from Continental.

Self-proclaimed Cessna experts might say it's easy to pick the worst 172: the notorious O-320-H2AD-engined 172N. However, thanks to mods, overhauls and information about the engine, this model's horrors have receded into the past.

If price isn't the major concern, a used S-model G1000 ride is desirable. For less, the 172P could be the ultimate model to pick, in our view. It has a proven and reliable powerplant and represents good value for the money. But check the logs for an airplane that's been beat up in flight school operations. Understand, too,

that you'll likely need to upgrade the avionics—a big expense that can make an already excellent aircraft even better.

READER FEEDBACK

I have a 47-year-old 1963 Cessna 172D. With respect to the Skyhawk, what's not to like? I think this is the perfect airplane for me. I have put nearly 320 hours on mine since purchasing N2618U in 1997. Mine is powered by the Continental O-300, which is mated to a climb prop. While I don't go forward very fast, I can climb like a bat out of hell (when compared to other Skyhawks). I am a VFR pilot and the Skyhawk is perfect for flying VFR.

I am relatively short and the 1963 172 is well suited to a short pilot. I don't have vortex generators, yet my stall speed is a very sedate 41 MPH, with the airplane very controllable even at the slow speed. When I am at the top of my game, I can come in quite slow and be stopped just past the numbers. Most Skyhawks I have flown climb at 500 to 700 FPM. On a cold day, I can climb out for the first 1000 feet at 1500 FPM. My airplane is stone simple to operate, with a bulletproof engine, Johnson bar flaps and, in some cases, the typical World War II surplus instruments common in Cessnas of this vintage.

I budget \$1500 per year for annuals and rarely go past that amount, though I am quite anal on my maintenance and always replace with brand new when my mechanic recommends replacing parts. Insurance is quite inexpensive at approximately \$760 per year. I hangar my plane in an expensive hangar, but consider that money well spent due to the wear and tear my airplane has not suffered to the elements. Bottom line: Everything in the airplane is simple and reliable.

I like how the older airplanes fly, and I think they fly better than the newer ones. My seats are cloth-covered originals, so on a long cross country, the ergonomics leave a lot to be desired compared to newer Cessnas. My airplane averages 7.1 gallons per hour, so she's a cheap date. I don't fly as often as I want, so the Skyhawk is a wonderful companion that tends to make me look better than I am. I have noticed that a Skyhawk seems to be as big a plane

that people fly just for fun. Ninety five percent of my flying is for fun, with the remaining 5 percent takes me somewhere. My favorite flights have been long cross-country flights that have spanned half the continent. I flight plan for 90 knots, which is quite accurate. I carry 39 gallons of fuel, with 36 useable, giving me a solid 5:30 theoretical, although I usually plan for approximately three-hour legs. Most people consider my airplane too slow to be a good cross-country aircraft, but I disagree and have the experience of several voyages over 1000 miles to back that up.

I like having the extra room in a four-seater, although in 13 years I have only filled the seats once. With a max of two people, I know I can safely carry pretty much anything we need. The Skyhawk won't awe anyone with blistering performance, but it is a great airplane to own. It won't send you to the poor house, has no bad habits and when one hasn't flown much of late, it doesn't bite as you get back in the groove.

Only thing to learn with a generator-equipped plane like mine is that you can't activate all the electronics and lights at the same time and idle the engine. I, like others, have wanted to get into glass, but when push comes to shove, the old airplanes fly just as well or better than the newer ones, without one having to trade the house on an airplane. I can't think of a better all-around airplane to own and fly. Someday, I will probably get glass, but it is very likely to be carried aloft in a Skyhawk. Cessna's 43,000-plus airplanes sold proves that a lot of people agree with me!

Hesham D. Oubari
Suffolk, Virginia

My Cessna 172 is not your usual Skyhawk. I purchased my 1975 172M in 1984, equipped with factory long-range 52-gallon tanks and it had already been modified with a 180-HP AVCON conversion. Cruise is 144 MPH at 10 GPH at 8000 feet. I have flown the airplane a total of 2300 hours, including four trips to Alaska and many trips to the Midwest and East Coast. The airplane will fly anything off the ground you can sensibly, though not necessarily legally, load into it.

Worthwhile modifications I have



added: Horton STOL, Powerflow exhaust system, Paul David STC wheel fairings, gap seals, Mountain High oxygen system, Aero-Trim aileron trim and a Hoskins fuel computer. The engine was field overhauled at 2400 hours, and was the final engine to be done by Sacramento Sky Ranch before they discontinued their machine shop. Assembly and installation was done by IA Dave Hillerman at Turlock, California, and it just could not have turned out any nicer. All propeller work has been excellent, accomplished by Johnson & Sons, now at Shafter Airport in California.

The AVCON conversion makes the airplane what it is, basically a less-roomy 182 at 172 expense. Fully loaded sea-level rate of climb is greater than 1000 FPM and it will still be climbing at 200 FPM at 18,000 feet. The weak point is that the legal gross weight remains at 2300 pounds, since AVCON never increased it as some other 180 HP kits have done...at the loss of 10 degrees of usable flaps. The constant speed prop more than makes up for this with better climb, higher service ceiling and is at least as fast as the fixed-pitch kits. High terrain and density altitudes here in the intermountain west really demand the extra 30 HP.

Maintenance over 2300 hours of use has included one major overhaul, two prop overhauls (because of ADs), one prop governor overhaul, replacing the junk ARC radio and transponder, one repainting, one interior replacement, replacement of all glass with upgraded thicker Plexiglas, replacing one Slick mag that failed in

Passengers won't find biz-jet comfort in a Skyhawk, but even in older Hawks, custom interiors can do wonders. This work was done by Dennis Wolter's Air Mod shop.

flight, replacing the worn-out original Prestolite starter with a lightweight Sky-Tec unit, and twice having the alternator wiring chafe through in flight, plus a new battery about every three years. Not too bad for 26 years of loyal, dependable service. This has been a good all-around work and family airplane. It is at home on pavement or rough dirt strips, has an 860-pound useful load and is fast enough for long cross-country flying.

Handling is typical 172, namely, solid and unchallenging (perfect for less-than-stellar pilots, like me). It is noisy, so good headsets are a must. The long range fuel is necessary for the larger engine, allowing for regular 600-plus-mile trips with generous reserves.

Insurance through AVEMCO runs about \$1200/year, hangar rent runs \$540/year, and owner-assisted annuals help keep expenses down. I change oil (Aeroshell 15W50 plus AvBlend) and a spin-on filter every 30 hours, adding one quart during the interval.

This is the best airplane available and affordable for my needs and is likely the only one I will ever own. Or need.

Stewart Vaughn
Via-email

696 vs aera

(continued from page 6)

which cover the entire FAA AeroNav library for the U.S. At full scale, the 696's screen is too small to show the plates in detail, but they're readable. You can scale up and scroll the plates to see the finest detail. Garmin just added standard geo-referencing of aircraft position on the plate and this is available as an upgrade for older 696s. If you prefer Jepp charts, the 696 will also run ChartView.

No such features are found in the aera, which nicely displays approach fixes, but no approach plates. However, both the 696 and the aeras display low and high-altitude airways and fixes, but neither allows naming airways in a flightplan. That remains the province of panel-mount navigators.

HAZARD AVOIDANCE

All contemporary Garmin products since the GPSmap 396 have excelled at hazard warning and avoidance. The 696 and aera continue this capability. The 696 and aera 510 and 560 accept XM WX Satellite Weather through a remote receiver; the lesser models don't.

Again, there are differences in display. The 696 has a fully dedicated page for the weather, which is handy for looking at detailed NEXRAD imagery; it's just much easier to see the details. Punch the cursor knob and you can scroll through full pages of satellite mosaics, METARs, winds and so forth.

To do the same on the aera, step through the home key to the weather key, then select the same products for a more detailed view. The detail is

there, but not nearly so easy to read as on the 696. Terrain is similarly handled. Both navigators allow setting up terrain alerts based on look-ahead time, desired buffer and alert sensitivity. The 696 and the two upper tier aeras have high terrain resolution while the other models have standard resolution. Either will keep you out of the rocks if you're paying attention.

BOTTOM LINE

What to do here? A clear-cut yay or nay is difficult because the decision is driven by how and what you fly. The 696 occupies plenty of upper tier cockpits where it's valued as an EFB—we're thinking high-dollar singles, twins and turbines whose budgets allow for add-on gimcracks that aren't necessarily primary equipment.

If that doesn't describe you and you've got a good IFR panel mount, the 696 can serve as backup nav, plus a chart library. If you want just the charts, the iPad with ForeFlight or WingX (or any of several chart readers) will be cheaper and easier to keep current.

As you can see from the foregoing, the 696 is optimized as a serious IFR tool. If that's not what you do, it will be overkill, considering the high price. Otherwise, either the aera 510 or 550 get our top recommendation. Both are XM weather capable and have all the basic navigation features—plus the hazard warnings—that anyone could want.

By dint of size and standard on-board map databases, the aeras are also good street navigators, so you can find your hotel in the rental car. At that task, the 696 falls short. In a future issue, we'll compare these products to other market options.

FEEDBACK WANTED

CIRRUS SR22



For the January 2011 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Cirrus SR22, the big success story for the new century. We want to know what it's like to own these singles, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other comments. Please send correspondence on the SR22 by November 1, 2010, to:

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696 vs iPad

(continued from page 7)

receiver. That's a nice idea, but there isn't enough ADS-B out there to make the investment worthwhile, in our view.

Even the 696's TIS input won't show all the traffic, but it will display more than an ADS-B-based system will. SkyRadar will also grab weather through ADS-B and while that holds promise, we can't really judge it until the network is built out. We'll take another look in a few months. (The ADS-B weather is free, by the way.)

Conclusion: The iPad won't yet cut it as a portable GPS navigator that's as reliable or capable as the GPSmap 696. It does lots related to navigation and aviation, but other than plate reading, it doesn't do many of them really well.