

The Aviation Consumer[®]



Legacy LSA Options

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Photo courtesy Cub Air



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FIRST WORD

Avgas? What, Me Worry?

That seems to be the attitude embodied in the findings of the FAA's unleded avgas transition plan, or UAT-ARC. The details are described on page 9 of this issue, such that we have any details. The FAA has steadfastly refused to release the report or comment on it, but the outlines of the agency's intent have leaked out. (Don't they always?)

So what should an owner make of this report, which proposes to ask for \$60 million in taxpayer dollars and another \$13 million from the industry to fund a fuel certification program lasting 11 years? (Why not 10, a rounder number? We don't know.) It also proposed to spawn yet another committee to oversee approvals for whatever fuels may come down the pipeline as would-be replacements for 100LL. If it's approved by the DOT, where the report now resides, the process could deliver approved fuels to the field no later than 2024, if it's adopted in 2013. We presume approvals will actually happen much faster than that.

Does this ARC, after more than a year of meetings, represent real progress? According to the people we talked to who were involved with the process or otherwise should know, the answer is yes. Many have complained for years that the reason nothing substantive happened in the avgas replacement arena is twofold: There was no need for change because the EPA wasn't serious about legislating against lead emissions for aircraft and, in that context, the FAA didn't take the problem seriously either. Although the ARC doesn't exactly represent a bold step forward, it at least gets the various parties talking to each other and thus ends the deadlock that has characterized the 100LL "crisis" for some 30 years.

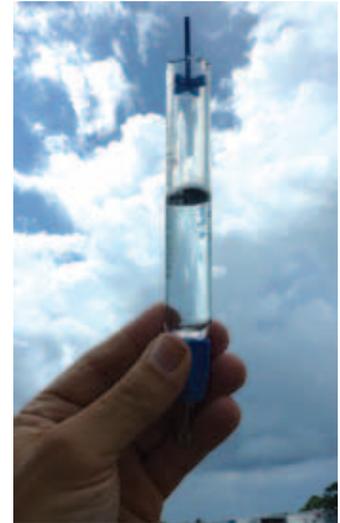
How about this 11-year timeline? It may not be a bad idea. For one thing, the EPA process to declare a finding of endangerment against lead emissions is plodding along at the speed of a garden slug, and the Friends of the Earth's recent lawsuit is probably not going to change that. One worry is that the Center for Environmental Health's lawsuit in California will reach a settlement that bans the sale of 100LL in the state. No one can say if this is possible, much less likely, so that risk seems small. In my view, CEH's lawsuit should be seen for what it is: a cash shakedown through an out-of-court settlement. California law gives plaintiffs in cases like this 25 percent of any settlement and CEH has always settled.

So that gets us back to square one with the FAA's UAT-ARC, whose process may have pluses for everyone if it works reasonably well. The big winners are the refiners making 100LL now. The status quo doesn't change, they continue to make leaded avgas as a niche product and the rest of us worry only about the price and/or whether major oil companies will exit the business near term.

If fast-track developers like Swift and GAMI can jump through the FAA's certification hoops as fast as they are allowed to, they could have certified fuels in under five years. If not, they'll be subject to a slow cash bleed and that's not good for anyone.

One risk is that the FAA's \$60 million funding request will be held up or simply not approved. It seems to me that the FAA should have shifted the testing and certification burden to the industry, which has deep expertise in fuel development rather than asking for \$60 million in multi-year funding that it's unlikely to get in the current budget environment and which is more funding than is needed anyway.

But ultimately, none of this may matter. As Continental CEO Rhett Ross says, the industry may be done worrying about it and has resigned to simply having solutions for any fuel supply contingency, including for legacy owners who need 100-octane gas. If this muddled FAA policy direction is as good as it gets, I guess we'll have to take it. But we don't have to call it good. —Paul Bertorelli



DA42 VI Specs

I think you have a typo in your article on the Diamond DA42 VI in the May 2012 issue in describing the performance of the current DA42 NG. In one part of the article, you said that the NG model at 8.3 gallons per side (about 90 percent power) could only do 167 knots. It was capable of speeds as high as 184 knots at 14,000 feet—the highest altitude 90 percent power was available from the Austros in the NG.

Also, I would like to point out that the DA42 NG familiarization guide (highlighting the differences between the Thielert- and Austro-powered DA42s) shows cruise performance at power settings as high as 92 percent. But in two places in the guide, they show bold red hash marks at 75 percent power, similar to gas engines, a continuous recommended maximum cruise power setting.

I believe that the poor longevity of the original Thielert engines was due to similar operational issues. The original DA42 1.7 Thielert engines had a recommended max cruise power setting in the POH of 70 percent, but most owners regularly flew them at 90 percent because the airplane was so slow.

Gregory Wroclawski
Via e-mail

You're right about the apparent performance disparity, but it's not a typo. Our data comes from an observed flight trial, not the POH claimed speed.

Having said that, we rarely have time to repeat flight trials to get best-case data and/or to follow up when the POH claim doesn't match real-world claims. We'll concede we should do a better job of that and will try to in the future.

Engine Moisture

Back in 2006, you ran an article on engine dehydrators in *Aviation Consumer*. I recall this article quite clearly because from its conclusions,

I purchased a set of ACI Black Max dehydrators for my Cessna 310. I've been using them ever since.

I'm trying to learn if it is best for me to disconnect my dehydrators when I preheat my engines or if I should leave them running. The



answer will come from measuring the humidity and dewpoint in the engines with one configured with the dehydrator running while preheating, and the other without the dehydrator running while preheating. In addition, I'd like to run several other tests to measure the effectiveness of preheating and its implications for humidity inside my engines.

What I'm wondering is how you placed your data loggers down the oil filler tube on your test airplane. What did you use to lower these into the crankcase and how did you retrieve them? Would you please tell me which model data logger you used, how you controlled it down into the crankcase, and how you were able to retrieve it? Also, how did you get the data loggers into the cylinders?

Ken Sutton
Via e-mail

As noted in the article, we used Lascar EL-USB-2 dataloggers, one of which we inserted in the oil filler tube, attached with a strong cord. It's too big to fit all the way down the filler tube, so we constructed a foam gasket to seal out any ambient humidity.

As for the cylinders, we built small chambers of plastic pipe to house the dataloggers, then screwed these into the sparkplug holes. These probably don't yield

exact readings for the cylinders, but it's as close as we could get.

Battery Chargers

I just read your articles on battery chargers in the October 2011 issue of *Aviation Consumer* and came across a charger while I was looking for the one you recommended. I am in no sense a battery geek or an electronic buff, but I cannot find a significant difference in the charging specs of your recommended battery minder and this one.

This is by no means an attempt to find a better aviation charger, but just a find one at a lower price. With technology changing, something will always pop up. Could you please check the specs? This one can charge 12- and 24-volt batteries.

Rudolph Steencamp
Via e-mail

The model in question is a NOCO Genius G7200. See the specs at www.atbatt.com. We're not familiar with this charger, but have asked them to send a sample. It looks good on paper, but has the capability to reach 15.5 to 17 volts in boost mode.

That would definitely damage a 12-volt aviation AGM battery. Furthermore, the VDC BatteryMINDER, which we've picked as our Gear of the Year best battery charger, is approved by both Concorde and Gill, while the NOCO is not.

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Legacy LSAs Choices: Champ Still a Winner

Yes Virginia, there really are \$20,000 airplanes worth buying. The Champ is tops, but both Taylorcrafts and Ercoupes have become more fiscally attractive.

by Jeff Van West

Some of the most popular new LSAs are distinctly old-school in their roots. There are three popular modern takes on the Piper Cub. American Champion reintroduced the venerable Champ that begat the Citabrias and Decathlons. There are even a few modern Luscombes out there from an effort to revive that line.

While these new, old-style machines will cost you north of \$100,000, you can get the originals for a quarter of that. They might lack modern conveniences like, say, an electrical system or a starter motor, and they might not be in perfect con-

dition. But then again, the \$75,000 you save buys a lot of maintenance. And gas.

As with modern LSAs, we recommend you stick with the big brands. A great deal on a 1941 Interstate Cadet might sour quickly as you try to find an obscure part.

PIPER

The Piper J-3 Cub is the iconic legacy LSA in this group, with about 19,000 produced between 1938 and 1947. Most original Cubs had the cylinders of a 65-HP Continental poking out from their cowlings, but many have been upgraded in power and technology since then. Any engines over 85 HP may need special paperwork. We'd recommend against a Cub with an old Lycoming or Franklin engine, if you can even find one.

Cubs are a joy to fly and can get airborne before seeing 45 MPH if lightly loaded. If the engine has been upgraded, they even have climb performance, so small strips are a possibility. Cruise speeds are often

in the 75-MPH range—a bit more with a bigger engine, a bit less if you leave the clamshell door open for the wind-in-your-face experience.

A solo pilot sits in the back, which means forward visibility is poor until you raise the nose, at which point it becomes passable. What few instruments there are sit five feet away, but they're not that accurate and you rarely need them. Passengers often sit up front and block your view of them anyway. Neither seat is roomy, but the front seat is less so with a 12-gallon fuel tank at that person's knees. The fuel gauge is a wire attached to a cork that floats in the tank and sticks up ahead of the windscreen. If the wire drops too low, so does the deadstick Cub.

Some Cubs have auxiliary wing tanks that can refill the main in flight by gravity feed. Some Cubs have also been rejiggered with electrical systems (often just battery-powered), which makes life at towered airports and near Class B and C airspace simpler. We've even seen a few with starter motors. But all this adds weight to an already load-limited aircraft. The extra fuel is a nice perk, but a fully charged handheld and prop starting is a fine way to operate a Cub. Just be careful when you do the prop start, because simultaneously holding the Cub's stick and operating the handheld radio is tough with only one arm.

The Cub wants coordinated flying. Coordinated stalls are mostly a transition from slow flight to slowly mushing flight. Uncoordinated stalls are good spin training—presuming you have at least fundamental spin smarts and some altitude.

Steve Krog of Cub Air (cubair.net), who helps many perspective Cub



Photos by Terry Shepherd



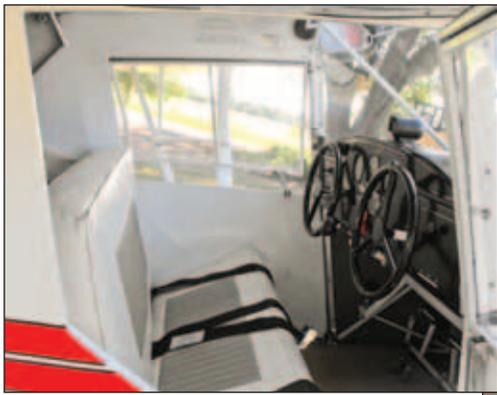
7AC AERONCA CHAMP

1945-1948

2938 FAA REGISTERED

\$20,000 to \$25,000

Our top pick due to good combination of performance, price maintainability, and relative interior space (as you can see here). Rotten spars and corroded gear can be an issue.



buyers with perchance and training told us: "Don't try and save money by getting a project. It's cheaper to get a good clean one." Painstakingly restored examples are likely to be overpriced, in our view. Bluebook gives a median price of \$20,000, but we don't see many that cheap. Expect a clean Cub that's no showpiece to cost at least \$25,000.

Variations on the theme include the L-4, built for the Army during WWII, and the Cub Special (PA-11). The PA-11 has a bit more room in the seats and is really the launching point for the modern Cub derivatives. There's also the side-by-side Piper Vagabond, which gives a new definition to the term "cozy." Parts support for the Piper LSAs is excellent. There are also great owner groups at www.cub-club.com and www.j3-cub.com.

AERONCA

The Aeronautical Corporation of America, a.k.a. Aeronca, built about 8000 Champs over time, primarily the 7AC made between 1945 and 1948. The untrained eye might confuse one with a Cub, but the pilot experience is quite different.

Champs are wider than Cubs and can be soloed from either seat, although the front is usually the position of choice. There's a 13-gallon fuel tank in the forward fuselage, but it's not as intrusive as the Cub, and a Model-A fuel gauge sits atop the in-

strument panel. Some Champs even have heat (well, the control says heat anyway). The Champ's oleo strut landing gear is more forgiving to hard arrivals than the Cub's bungee cord system. Alas, the Champ lacks the clamshell door of the Cub, but it does have a large sliding window on the left side and a bit more room behind the rear seat to toss a picnic lunch.

With the same 65-HP engine, the Champ will squeeze out five to 10 MPH more than the Cub. Engine upgrades are common in Champs as well. The balance for that is a Champ lifts off at about 60 MPH, so it's not quite as good in tight spaces as a Cub. Champs and Cubs are about equal in penalties for the uncoordinated flight and stalls, maybe slightly worse for the Champ. Champ cockpit visibility is better than the Cub in any phase of flight.

There was once a massive price delta between Cubs and Champs, with the Aeronca offering all the fun for a fraction of the cost. That

delta has eroded, but still favors the Champ, especially for fully restored aircraft. Most Champs run \$20,000-\$25,000. Champs were also produced on and off over the years, and some later-year ones are still LSA legal and good deals.

Basically the same aircraft, but with side-by-side seating and yokes instead of sticks is the Aeronca Chief. As with the Vagabond, it's cheaper to buy but you'd better be thin or really friendly with your copilot.

Parts support is excellent here as well. For owners groups, you have the National Aeronca Association (www.aeroncapilots.com) and the Aeronca Aviators (www.aeronca.org).

TAYLORCRAFT

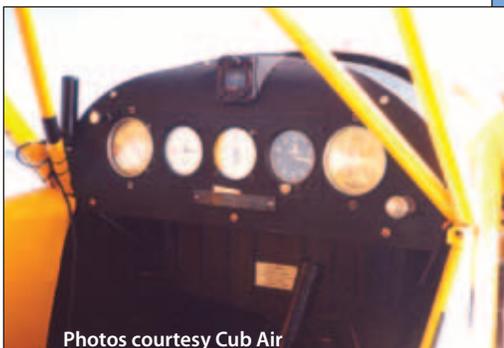
Paired with William Piper to create the original Taylor Cub design, C.G. Taylor left Piper in 1935 to form Taylorcraft. Not as well known or as numerous as the Cubs and Champs, there were about 2800 of the desirable BC12D models made.

Most are equipped with the

Photos by
Terry Bowden

TAYLORCRAFT BC-65 & BC12D	1938-1957	2124 FAA REGISTERED	\$17,000 to \$27,000
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Cowl and yoke designs vary, but they all have a big, retro feel similar to this BC-65. T-craft are relatively fast and efficient for the class. Seating is cozy.



Photos courtesy Cub Air



PIPER J-3 CUB	1938-1947	5348 FAA REGISTERED	\$25,000 to \$55,000
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Highest points for style and flying with the door open, but will cost you more for the same or less performance. Best short-fielder of the group, however.



Photos by Terry Shepherd

LUSCOMBE 8A	1946-1949	1542 FAA REGISTERED	\$18,000 to \$25,000
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A sporty flier with side-by-side seats and a stick. Some have wind-driven electrical systems. Look close and you'll see the fuel gauge behind the pilot's head. Support is a bit more challenging.

Continental 65-HP that's becoming a theme here. Many Lycoming and Franklin T-craft have been converted to Continentals, and often to more powerful versions than the A65. Some 85-HP T-craft rolled off the line as well. There are later Model-19 T-craft, but these are not LSA legal, nor are some of the upgraded models with gross-weight bumps. However, earlier BC-65 models fly almost identically to the BC-12Ds and meet LSA specs.

Seating is side-by-side and snug. Control wheels rather than a stick drive what many consider stiff and somewhat sluggish controls. It has light wing loading and floats off the ground. It will float equally on landing if you carry too much speed.

Some are modified with shorter wings—but be careful as some of these are now experimental aircraft. The original wing has excellent stability, however, even if it requires the same good rudder skills as the Cub and Champ. T-craft can reach 95 MPH in cruise and have decent climb performance. The BC12D models carry 18 gallons of gas. Pencil that out at 4.5 GPH, and that's 21 MPG and a 380-mile full-fuel range.

Taylorcraft prices had begun an upswing after years of super-cheap status until the economic downturn. Now prices of \$16,000-\$18,000 are common for T-crafts. They top out at about \$25,000.

Parts support is decent and your club is the Taylorcraft Owner's Club

and Foundation (www.taylorcraft.org). There is also news from the Taylorcraft 2000 company (www.taylorcraft.com), which took over the brand in 2009 and hopes to be producing parts by the time you read this. They already have inventory for 75 percent of a complete airplane and plan to offer custom-ordered complete Taylorcraft in a year or two.

LUSCOMBE

Often mistaken for a Cessna 120/140 (which are too heavy for LSA status), the Luscombe 8 series offered a modern metal fuselage with cloth-covered wings. Some of these have been recovered with metal. The 8A through 8D are LSA legal, but most have been converted back to 8As with engine changes.

A potential trap with these changes would be a Luscombe 8A with a Continental C-90, metal wings and wing tanks. Steve Krog (who also trains on Luscombes) says this is legal but certainly hurts useful load. Terry Bowden, who does DAR work for several legacy LSA models, tells us this switch technically make it an 8F, which has a 1400-pound gross weight—too high for LSA. Bowden is working with the FAA to clarify this and ensure these planes can keep their original gross weight of 1200 or a reduced weight of 1320.

Cruise speeds of 95-100 MPH make the Luscombe the hot-rod of this group. Short field performance

ERCOUPE 415-C,CD	1946-1947	1072 FAA REGISTERED	\$14,500 to \$15,000
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"Unique" only begins to describe the Ercoupe. Enthusiasts say they're great fun with a WWII retro feel, and are babe magnets. Note the lack of rudder pedals.



Photo by David Abrams



Photo courtesy Syd Cohen

is still good considering that cruise. Visibility over the nose is fine on the ground and terrific in flight. The view out the sides is less so, with smallish windows, and it's non-existent to the rear. In fact, what you'll see if you look behind you is the 14-gallon fuel tank with a gauge built into it that'd be easiest to read with a mirror.

Seating is side-by-side with a control stick, so entrance and egress require the same flexibility it takes to read the gas gauge. Controls are responsive, especially the rudder, which is probably where the Luscombe's semi-undeserved reputation for being difficult to land comes from. The gear is a bit narrower than others, which may be the rest of the picture. The landing gear on the earlier models is a single oleo that's a bit stiffer than the Champ. The heel brakes are hard to reach and only on the pilot side. Passenger-side brakes can be added.

A Luscombe will stall and spin when prompted, but it recovers well. Those familiar with the breed tell us it's a terrific and fun flier. However, if they aren't rigged straight due to a ground loop in the past, then they can get quirky.

Luscombe prices haven't moved much in the past five years, but there aren't that many out there, so it's hard to peg a trend with authority. Parts support is acceptable for keeping a Luscombe airworthy. The Luscombe Association (www.luscombeassoc.org) is a good resource, as is The Luscombe Endowment (luscombe.org).

ERCOUPE

The Ercoupe (or in some cases, Aircoupe) is only nosewheel airplane in this group. And that's just the beginning of the differences. It's also a low-wing, it's all-metal (except for the earliest wings), it has a twin-rudder tail and if you find one with rudder pedals, it was likely a post-production conversion.

How can it have no rudder pedals but have twin rudders? The control wheel coordinates the turn for you, moving both aileron and rudder in concert. The control wheel also steers the nosegear. All legacy LSAs must be driven all the way to the tiedown, but in the Ercoupe you literally drive it. There's a single brake pedal for

stopping. There's no right rudder for climb, but the twin rudders are outside this slipstream, so there's less need.

For crosswinds, you land it in a crab and the trailing-link gear straighten out on their own. (Last time we discussed the 'Coupe, we liked this straightening to a dead cow falling off a truck. We won't make that mistake again.) The idea was to prevent ground loops, but Ercoupes can and will ground loop if set down

too fast with too much crab angle.

Ercoupes also have limited elevator travel to prevent stall-spins. This means limited CG range, so they are side-by-side seats. The 24 gallons of fuel is kept in the wings with a five-gallon header tank in the cabin. Ailerons are full-span, so the roll rate is comparatively snappy. Getting one to stall is nearly impossible, by design. Cruise performance is near the top for this class, with 90-95 MPH. Climb performance is anemic on a

SAVVY BUYER TIPS

Even though these aircraft are bought for the enjoyment of flight rather than serious travel, replacing emotional appeal with an educated opinion of the aircraft's worth is critical for staving off inevitable heartache later.

All of these aircraft qualify for autogas use with the proper paperwork. But this is a double-edged sword. Mechanics and restorers tell us they commonly see fuel systems and engines full of rust and other junk they attribute to the hydrophilic and other properties of alcohol in auto gas.

Speaking of engines, total hours on small Continentals is often less of an issue than recent use. In addition to compression checks, a borescope for cylinder rust is a good idea for any plane that hasn't flown much recently, especially if it's been tied down outside. Some of these engines have been rebuilt so many times they won't maintain oil pressure well. Cub expert Steve Krog recommends a close check of that, both cold and hot.

If it's a cloth aircraft, the health of the fabric is central. Get an expert opinion. Recovering a Champ or Cub is \$6000 in materials alone. The labor starts at \$12,000 on top of that and can double depending on what horrors they find underneath. We can't understate the need for expert eyes here. Krog told us of a Cub buyer who showed up with a sweet deal airplane that, on examination, had its cloth screwed to its wing rather than stitched. Both wings had to be completely replaced.

The Luscombe and the Ercoupe don't get off easy. The issues there are corrosion, corrosion and corrosion. There are only a few ADs for Luscombes, but some are drill holes to drain the carry-through spar, vertical tail and gear. Ensure these have been done. Watch for cracked doorposts, too.

Corrosion on Cubs, Champs and T-craft is common at any low point, such as lower rear longerons and tail. Tapping and probing all these areas for flex or the rattle of loose rust in key. Aeronca lower landing gear legs and both Cub and Taylorcraft aileron horns often corrode due to a steel-aluminum sandwich construction. This usually means a whole new aileron.

Wooden wing spars should be checked for cracks and dry rot. Replacement with metal spars is an option for several of these aircraft. For an Ercoupe, be sure the AD for its rear spar has been complied with.

Almost all of these planes have had landing damage at least once, even Ercoupes. Check the logs for when and what was repaired. The logs may not be complete, but further records can be purchased on CD from the FAA. Also watch for old landing-gear bungees on Cubs and unserviced oleos in the Champ. The latter are very expensive to replace. Ercoupes can have issues with damaged nose gear forks and main gear struts.

This isn't just a matter of cost. None of these aircraft are quite as crash-worthy as a modern machine, especially those with a fuel tank in the cabin. We think it's an acceptable risk given the mission and low speeds. But even if the plane sings to your heart, you've got to purchase with your head.

good day, but it makes up for that by descending like a homesick anvil when the power is pulled. Ercoupes with 100-HP conversions climb better. While we're talking conversions, a nice modification is a split elevator that adds just a bit more authority at low speeds.

Ercoupes were certified with electrical systems, which means they are the only model of these five that isn't exempt from the ADS-B mandate in 2020. You'd only need to equip if you fly near Class B or C airspace (and you fly ADS-B free with prior permission even then), but it is a consideration for some. Even an inexpensive ADS-B Out could cost nearly a quarter the value of the aircraft.

Note that if you must be LSA-legal, only the A, B, C and CD models have low enough gross weight. They all come with electrical systems and starters. They even have lights for flying at night. The canopy opens from the center downward, so you can hang your arm out the side while you have P-38 fantasies inspired by the twin tail.

Ercoupe prices have fallen since we last looked in 2008. If you don't mind the quirks, the airplane could be a great buy. Parts can still be had, primarily through Univair. The Ercoupe Owners' Club is at www.ercoupe.org.

RIGHT FOR YOU

Our top pick of this group is the Champ, hitting a sweet spot of relative roominess, flight characteristics, supportability and affordability. The best deal is probably an Ercoupe, but it's an acquired taste.

Between the Luscombe and the Taylorcraft, we think the Taylorcraft will be easier and cheaper to support long term. The Luscombe is still a fine choice if you find a clean one. A Cub is great if you have the budget for it. It's slower and a bit cramped, but it gets all the looks on the ramp.

With engines that burn 4-5 GPH, this is about as cheap as a gasoline airplane can get. Bring a sweater if it's cold. Bring a noise-cancelling headset even if it isn't plugged into anything. And if you end up parking next to a new LSA on the ramp, know that you might be slower and rough on the edges, but you're flying one of the originals.

Which Garmin Retrofit: G500 or G600?

Two retrofit PFD systems that look the same but aren't created equal. The buy decision depends almost entirely on what class of airplane you fly.

by Larry Anglisano

When Garmin's capable G600 retrofit PFD system came to market somewhere around 2008, it wasn't the brisk seller many shops hoped for. Its sticker price closing in on \$30,000 was part of the problem.

This snag was part of the thinking behind the G500, a lesser-equipped system certified for aircraft with an MTOW under 6000 pounds and with à la carte pricing to add capability as needed.

But there are things the G600 can do standard that the lesser G500 won't do at all, let alone for an extra

fee. Here's a feature-for-feature comparison of these two systems that helps make sense of the unnecessarily complicated buying decision that's stumping ready buyers. We won't cover the user interface. You can read about that in our February 2007 issue of *Aviation Consumer*.

CERTIFICATION MATTERS

Both systems have multiple TSO approvals and carry STC with a healthy Approved Model List (AML-STC). But it's the higher level of software certification that makes the G600 a player in Class III aircraft (typically larger piston and turbine models between 6000 and 12,500 pounds). Class III aircraft require Level C software versus Level B for those of you keeping score at home. If you've got a King Air, you must go with a G600.

With the exception of needing true TAWS-B, we see no reason to install a G600 in a Class I or II aircraft.



It might be possible to get a field approval for a G500, but we wouldn't count on it.

A bugaboo that surfaced when the G500 was introduced related to aircraft originally certified under 6000 pounds, but with aftermarket STCs putting them over the 6000-pound limit. The consensus is that the original certificated weight applies and a G500 should be fair game.

Both systems have nearly identical required installation processes and approved interfaces to other equipment. Whether you install a G500 or G600, a Garmin GNS 400W/500W-series, CNX/GNS-80 or GTN-series navigator must drive it. Either system must be backed up by an independent attitude, airspeed and altimetry source. These are the three steam gauge instruments (or certificated combination glass backup instruments) you'll find in all certificated glass panel aircraft.

The G600 and 500 use the identical GDU620 combination PFD/MFD display, with dual 6.5-inch diagonal color screens housed in a single bezel. You won't tell either system apart by looking at the PFD's flight data or thumbing through the pages in the MFD, as there's no obvious difference in how data is presented or in how the system is operated. Bezel key and control layout is identical. The G600/500 is essentially trickle-down technology from the Garmin G1000, and both use identical Line Replaceable Units (LRUs) that feed the display a host of data.

We get asked what systems interface with the G500 vs. G600, and the truth is they're essentially the same.

CHARTS WITH THAT?

Options are generally easy to add to a G500 using SD enablement cards that, for a price, unlock the features and functionality that may already exist inside the systems software. The G1000 system works the same way. SD cards are also required for terrain, obstacle, Garmin FliteChart, SafeTaxi and Jeppesen ChartView database storage. Since these cards must be inserted into the GDU620 all the time there's no sharing the cards with

GARMIN G500 AND G600 FEATURE FOR FEATURE		G600	G500
BASE PRICE		\$29,995	\$11,996
AML-STC APPROVED		YES	
CLASS 3 AIRCRAFT APPROVED BETWEEN 6000 AND 12500 MTOW		YES	NO
GAD43 AUTOPILOT GYRO EMULATOR / ENABLEMENT CARD		STD	\$4490
GARMIN SVT SYNTHETIC VISION		STD	\$4995
GARMIN GWX68 RADAR COMPAT. (RADAR NOT INCLUDED)		STD	\$995
THIRD-PARTY RADAR ENABLEMENT		\$3995	
JEPPESEN CHARTVIEW ENABLEMENT CARD		\$2395	
GARMIN FLITECHARTS AND SAFETAXI		STD	
GARMIN GDL69 XM DATALINK		OPTION	
TRAFFIC SYSTEM OVERLAY CAPABLE		YES	
VIDEO ENABLEMENT		\$1495	
INTERNAL TAWS-B TERRAIN ALERTING ENABLEMENT		\$7995	N/A
S-TEC 55X ALTITUDE PRESELECT ENABLEMENT		\$2995	
S-TEC DFCS2100/1500 DIGITAL AUTOPILOT INTERFACEABILITY		\$6995	
RADAR ALTIMETER ENABLEMENT		\$2395	

your hangar buddies. (They encode to your specific G500/600 after they have been installed.)

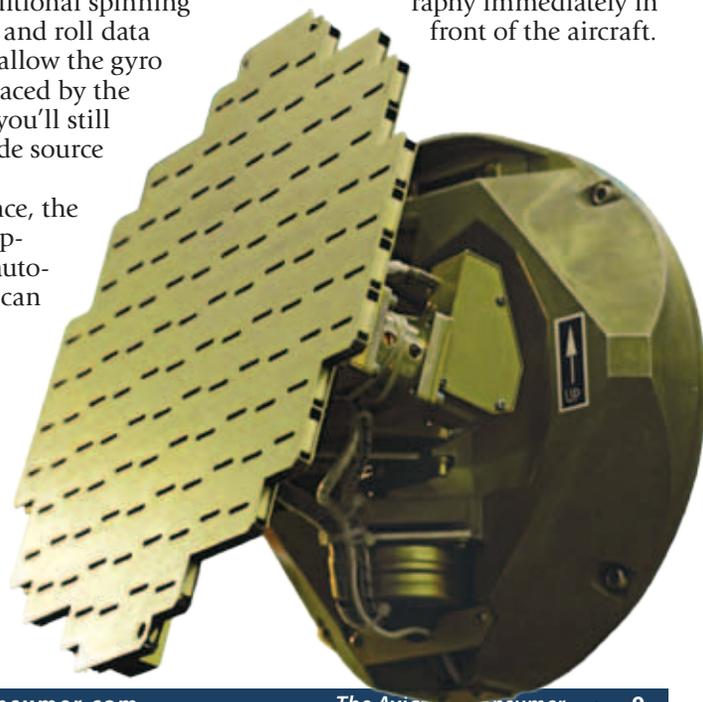
One major component that's standard on the G600 is the GAD43 autopilot gyro emulator. The GAD 43 is a remote box that converts AHRS digital pitch, roll, heading and yaw rate data into analog signals used by attitude-based autopilots to include the popular King KFC200/150 series and some ARC/Sperry autopilots. The analog signals from the GAD 43 emulate those of traditional spinning gyros that feed pitch and roll data to the autopilot and allow the gyro to be tossed and replaced by the AHRS-fed GAD 43 (you'll still need a backup attitude source on the panel).

From our experience, the GAD43 is a terrific upgrade to old analog autopilots. Either system can connect to an S-TEC 55X autopilot, complete with altitude preselect. Compatibility with S-TECs

digital DFCS systems is a \$6995 option on either system. Out of the box, both Garmin systems provide GPSS digital steering standard and will support flight director functions on the PFD.

Standard on the G600 but a \$4995 option for the G500 is Garmin's synthetic vision, known as SVT. In case you've missed the synthetic vision hoopla the past few years, synthetic vision depicts a forward-looking display of the topography immediately in front of the aircraft.

No matter how you choose, the list of compatible radars is small.



LABOR INTENSIVE EITHER WAY

Downscaling to the lesser G500 over a G600 won't yield an easier installation. That's because the pieces, parts and wiring interface processes are nearly identical. There's no way to avoid intensive teardown, data interfacing and modification. The obvious part is modifying or replacing the instrument panel (and copilot's panel for dual systems) to accommodate the GDU620 display and required backup instruments. Keep in mind that these installations require at least one GNS, CNX or GTN navigator, which also needs a home in the new panel.

The hidden cost is the installation of the multiple remote LRUs. For example, shops need to dig deep into the airframe to install the GRS77 AHRS that provides the flight data in the right position. The GDC74 air data computer gets plumbed into the pitot-static system for altimetry, airspeed and other primary flight instrument data. Even the outside air temperature sensor and magnetometer are critical remote placements that might require relocation of other systems, such as strobe light packs or antennas, in order to prevent interference.

Ramp this up if you need the GAD 43 gyro emulator connected to your autopilot. If you've ever laid your eyes on the bundle of wires that snakes its way to and from a King KFC200 autopilot computer, you can imagine what your shop will have to deal with when rewiring a good portion of the input circuitry. There are also sizeable amounts of ground configuration and flight testing before the shop turns the installation loose.

It's impossible to nail a one-size-fits-all price for installation of a G500/600 since there are so many variables. Most projects could be on the shop floor for a solid three weeks and more, meaning labor costs well north of \$10,000. Many budgets may want to scale down to the lower-priced G500 so they can sacrifice a few options in the name of sanity.



The depicted imagery is derived from the aircraft attitude, heading, GPS three-dimensional position and a database of terrain, obstacles and other relevant features.

Standard and pre-installed on both systems is Garmin's FliteCharts

and SafeTaxi surface diagrams. FliteChart functionality is disabled 180 days after the charts expire. Jeppesen's georeferenced ChartView approach plates and airfield surface charts require a \$2395 enablement plus subscription through Jeppesen.

Both systems can play traffic and XM Weather when inputted by appropriate traffic systems to include TIS, TAS and Garmin's new TAS/ADS-B combination traffic system. Weather and satellite entertainment for either system comes from Garmin's remote GDL69A XM receiver that can input without the need for an optional enablement card. The GDL69A has a list price of \$3600. For real-time lightning data, either system accepts input from the proven L-3 WX500 remote Stormscope without enablement.

BIG TOYS: TAWS-B, RADAR

TAWS-B is the certificated terrain-alerting system that's required of turbine-powered aircraft with six or more passenger seats. The G600 can fill that duty when fitted with the \$7995 option. This is done internally and without the need for a remote box.

Uncertified terrain-awareness comes as standard on the G500, but upgrade to certified TAWS-B functionality isn't possible. Either system has a \$2395 option to overlay radar-altimeter data on the PFD from the Bendix/King KRA10A.

We like Garmin's powerhouse GWX68 digital color radar (starting at \$20,995 with a 10-inch array). It plays out of the box on the G600. It can also play on a G500 but requires a \$995 enablement. Interfacing with third-party radar systems costs \$3995 for a G600 or 500, and the choices are limited to the RDR2000/2100 series and RDS81/82-series radar.

IT COMES DOWN TO WEIGHT

If you fly a Class 3 category machine or require full-up TAWS-B, you have no choice—you need a G600. But for most Class 1 and 2 aircraft, we can't see any reason to buy a G600. A G500 purchased with the GAD43 autopilot emulator and SVT synthetic vision (two popular options) is still a \$7519 savings over the equally equipped G600. Popular options such as Jeppesen ChartView and third-party radar enablement don't change the picture because they're options on both systems.

We think adding the G500 was a smart move on Garmin's part, making it a more affordable step into retrofit glass, which is just the way Garmin intended it to be.

Avgas Replacement: FAA Carves Out a Plan

After three decades of waffling, the FAA has set an 11-year timeline for an avgas replacement. But it will probably happen sooner, say industry sources.

by Paul Bertorelli

After months of back-and-forth meetings with industry players, the FAA finally seems to have settled on an unleaded avgas transition plan that foresees an 11-year timeline and a strong central role for the FAA in testing and certifying fuels. The agency is also recommending the formation of another government/industry committee to oversee how an avgas replacement fuel—if one ever emerges—finds its way to the field.

The FAA's Unleaded Avgas Transition rulemaking committee (UAT-ARC) convened in early 2011 in response to concerns from owners and manufacturers about the lack of visible progress in finding a replacement for 100LL, which is potentially threatened by emerging air quality standards that will sharply limit lead emissions. The UAT-ARC committee was expected to issue a progress report last summer at AirVenture but, claiming budget issues, it failed to do so, nor did it follow up with any meaningful information last fall at AOPA's Summit in Hartford, Connecticut.

Although the FAA declined to answer our questions about the ARC's recommendations and wouldn't say when the report will be issued, we were able to piece together the report's highlights from sources familiar with it.

TIMELINE

The ARC committee consisted of representatives from the FAA, the oil companies, owner groups such as AOPA and EAA, EPA and the Clean 100 user group, an owner coalition seeking a 100-octane solution for eereplacing 100LL.

It first met in the spring of 2011 with a six-month term, which was later extended. Its charter was to devise a certification path for an unleaded replacement fuel, not to develop or even identify a replacement. The ARC's work product was to be a report recommending an action plan. That report is now being reviewed by the Department of Transportation.

According to sources we spoke to, the FAA ARC recommends an 11-year timeline that would ultimately lead to the certification of new piston fuels, although the report itself appears not to specify octane requirements. The report incorporates close integration of ASTM International, the industry consensus organization that reviews and approves fuel standards, which the FAA has traditionally required before a new fuel can be fielded.

The report lists 16 steps or Avgas

CHECKLIST



Industry sources say they're happy the FAA has now taken the lead in the avgas transition.



The inclusion of the FAA's Environment and Energy section in fuel deliberations is seen as a plus.



Eleven-year timeline isn't a show stopper, but buyers may have been expecting faster action.

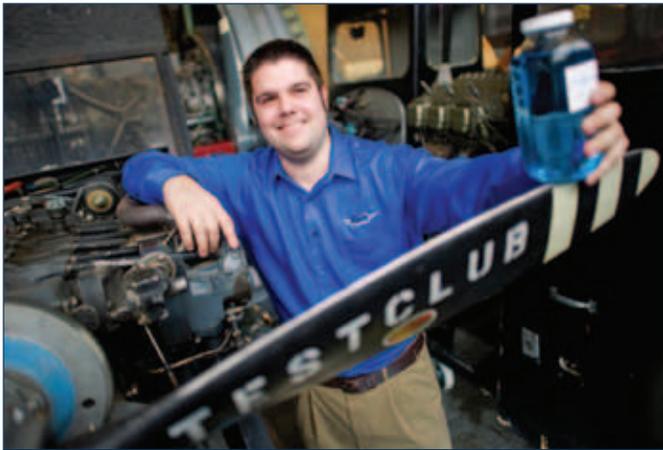


\$60 million budget request may be problematic. Will the process be delayed if the budget isn't approved?

Readiness Levels through which each fuel must pass before being approved. These include such technical issues as octane values, materials compatibility, aging and other traditional fuel specs heretofore required by ASTM. Some of the ARLs—we're not sure how many—relate to actual deployment of the approved fuels. And yes, according to sources we interviewed, there will almost certainly be more than one fuel.

Yeah, we know, we haven't seen prices like that since 2003. The 100LL replacement may or may not be cheaper.





Swift's Jon Ziulkowski, left: "Can we do it in three to five years? I think we have to." Lower photo, GAMI's G100 remains a contender, but the FAA has fought issuing an STC.



include actually picking fuels, but it does recommend yet another committee called the Piston Aviation Fuels Initiative (PAFI) that would essentially act as an overseer to assure that each of the 16 ARLs are met. But it would not function to pick a single winning fuel.

Does this mean that several fuels from different sources could compete in the market? Evidently it does, according to Michael Kraft, CEO of Lycoming, who sat on the ARC committee. In a podcast recorded at Aero in Friedrichshafen, Germany, Kraft said, "It's highly likely that you may see multiple fuels achieving the same unleaded standard. The important thing is that it's going to be transparent to the end user," Kraft told us.

It's unclear if the proposed timeline means that fuel developers will have to stretch their work out over the 11-year period, but sources familiar with the ARC's intent said they believed that's not the case.

We were told that despite the long timeline, approved fuels may emerge much sooner than 11 years. In fact, fuels like Swift's 100SF and GAMI's G100UL, which have been testing extensively for some time, may enter the approvals process with many of the 16 ARL boxes ready to be checked.

If that's true, Swift's or GAMI's fuel could conceivably be competing with 100LL well before any environmental pressure forces led fuel from the market, if it ever does. Swift told us that this is its intent.

The sources we spoke to told us the FAA's \$60

million funding request is a worst-case number, envisioning up to 10 candidate fuels. "I don't think there will be that many. Right now, there are only two, Swift and GAMI," one source said. However, we know of research on at least one more potential candidate being conducted by Aircraft Specialties Lubricants. This fuel hasn't been submitted for approval yet. Nor have the oil companies revealed their potential candidates. Meanwhile, we checked on the progress of other fuel projects.

SWIFT FUEL

Swift has earned a preliminary ASTM spec approval (D7719) to allow it to proceed with further flight testing. Swift's Jon Ziulkowski told us that once the ARC's recommendations are in place, Swift will begin work on meeting a final ASTM standard.

Swift had made a deal with Embry-Riddle to conduct extensive flight testing under an STC arrangement. But that agreement has fallen through, so this summer, Swift will begin flying its fuel in Cessna 172s, also under a limited STC. Ziulkowski said Swift intentionally limited its STC application to apply to testing only and doesn't envision distributing fuel to an STC'd aircraft population.

In May, Swift announced that even as it seeks approvals for its fuels, it's moving forward with production and distribution plans. It formed a new company called Swift Fuel LLC and has engaged Rob Broin of RMB Energy, a veteran in the renewable fuels industry. Ahead of having its fuel approved, Swift will be constructing a production plant this summer near its headquarters in Indiana. That plant will have a capacity in the 10,000-gallon range, said Ziulkowski, and Swift's intention is to use end-state processes as close to actual market-ready fuel production as is practical.

When it first appeared, Swift fuel was pitched as a renewable biofuel and it may or may not turn out that way. For its pilot plant project, Swift plans to use waste acetone from both bio and industrial sources as a feedstock. (Acetone is a waste product from butanol production.) The Swift process converts acetone into mesitylene or tri-methylbenzene, the primary constituent of its fuel, so it

continued on page 32

The ARC envisions ASTM developing at least two "gating" standards, one for traditional hydrocarbon-based fuels and a second for non-hydrocarbon fuels, such as Swift's high-aromatic fuel. We're told that these specs have already been developed but aren't yet in final form.

The 11-year time span envisions development of test and certification standards that the committee recommends be done by the FAA. For this, it's asking for significant funding—some \$60 million over the period, plus another \$13 million from the industry. Presumably, these funds would be used to support the FAA's Atlantic City Hughes Technical Center, where the fuels would be qualified.

Once fuels meet an initial ASTM spec, they would be passed on to the FAA test center for further evaluation. The ARC's charter did not

FUELS PODCAST

AVweb
<http://tinyurl.com/6m2wt5q>

CHECK THE GAS, FILL THE WATER

The only reason leaded avgas still exists is to deliver high octane cheaply and the only reason for octane is to prevent detonation in high-power, high-compression engines. But octane isn't the only way to quench detonation, something engineers have known for years.

Injecting a water-methanol spray into the combustion chamber—so-called anti-detonation injection or ADI—was once a common technique when octane wasn't available or when aircraft designers wanted excess power available in bursts, even when burning high-octane fuel.

If it worked 60 years ago, why not now? That's exactly what Air Plains is proposing in its resurrection of ADI STCs developed by Todd Petersen during the 1980s, when mogas as an alternative fuel was in vogue. But just as mogas fell out of favor, a victim of a shrinking cost difference between it and avgas, so too did Petersen's ADI fade. Only a couple of systems were installed, although like Petersen's hundreds of mogas approvals, the STCs remained alive.

Air Plains, which is a mod and engine conversion house in Wellington, Kansas, is updating Petersen's original work using state-of-the-art electronic controls developed by Electronics International. Air Plains has in mind systems that would allow high-horsepower engines to operate safely on 91 AKI fuel, either 91UL or mogas of the same octane.

The underlying idea behind ADI is to use a water/methanol mix to cool the combustion event and slow the propagation of the flame front, which tends to accelerate when the fuel/air mixture encounters the hot surfaces of cylinder walls, valves and pistons. This leads to instant, explosive ignition that we know as detonation. Even high-octane fuels will detonate if the cylinders get hot enough, but octane serves to yield a more orderly flame front and thus provide detonation margin.

Although water alone is an effective

anti-detonation agent, early research revealed that a methanol/water blend (about 60/40) is more effective and the methanol actually adds a little energy to the combustion process. It also serves as anti-freeze, protecting the ADI reservoir from freezing down to about minus 40 C.

Traditionally, ADI injects the fluid not directly into the cylinders but into the induction manifold downstream of the carburetor or fuel injection throttle valve. This simplifies and lightens the system and it's the approach that Air Plains is following with the revised ADI system it will soon have ready for the market.

"The main goal we're working on now is to have it available for today's technology. By that, I mean some of the electrical equipment used before is a little outdated," says Air Plains' Rafael Soldan.

Petersen's original STCs covered the IO-470 and IO-520 families and four airframes, the Cessna 188 and 210 and Beechcraft 55 and 58 Barons. Although the existing engine STCs approve the engines, Air Plains will need to seek additional airframe approvals to expand the market. So far, only non-turbocharged engines are approved, but Air Plains says it has turbocharged engines on the to-do list.

Although it hasn't flown the revised system yet, Soldan told us the configuration has been settled. The system consists of a baggage-compartment-mounted tank—5.5 gallons for singles and 11 gallons for twins—plus two pumps, a main and backup pump. The injection point is through an add-on plate downstream of the throttle body.

The ADI is controlled by what Air Plains calls a TPCU or temperature and pressure monitoring unit. The system is set up to inject when either of two

parameters are met: 25 inches or more of manifold pressure or CHTs of 400 degrees F or more.

"This system prevents detonation in a way that's super conservative. When it was tested originally, detonation occurred at way higher parameters than what we're using," Soldan said.

Electronics International has been engaged to make the control unit, which is pictured below. The system is essentially automatic, switching on when the ADI parameters are met. It can be switched off or on manually by the pilot. The backup pump is operated from a separate electrical bus. There are also low fluid warning lights.

Fluid flow is either on or off, with no modulation and consumption is one gallon per 10 minutes of operation, or about 6 GPH. However, injection typically wouldn't be used in cruise flight or even high-altitude climb in normally aspirated engines. The fluid blend is 60 percent methanol, 39 percent water and 1 percent soluble oil to keep the system lubricated. Air Plains doesn't have a price yet on pre-mixed fluid, but says methanol bought in 55-gallon lots is about \$2 a gallon.

Weight of the system is estimated to be about 42 pounds for a single-engine airplane, including a full tank of fluid. Air Plains hasn't settled on system prices yet, but as of May 2012, it was estimating between \$8000 and \$11,000. For more, see www.airplains.com or call 800-752-8481.





Pipistrel Panthera

Gear of the Year: Pipistrel Innovation

Slovenia? Who knew? But this company led the way in 2012 with innovative products that set the world abuzz. (Plus 12 other top picks of stuff we liked.)

We're not exactly big on heaping kudos on products that don't exist. On the other hand, we know an exceptional idea when we see one and at least a couple of those are trickling out of tiny little Pipistrel Aircraft in Slo-

The Aviation Consumer

PRODUCT OF THE YEAR:

venia, thus we are picking Pipistrel as our company of the year for its innovation and creativity in aircraft design.

When we visited Europe last March, we put Pipistrel on our itinerary and it was well worth the effort. Having started as

an illicit ultra-light manufacturer in the days when Yugoslavia was under communist rule, Pipistrel has



evolved to become an idea leader in cutting-edge aircraft design. Specifically, the company's just-announced Panthera—a four-seat, 200-knot cruiser—is unique for having placed fuel economy and efficiency at the top of the design brief list. Only one other company, Diamond, comes close to that kind of commitment to resetting the bar on fundamental aircraft design. Pipistrel also won NASA's Green Flight Challenge three times with its efficient designs.

The company is, in short, getting noticed and we predict competitors will soon be getting on the energy-efficiency bandwagon, too. And that's a good thing for pilots and owners beleaguered by high fuel costs and flying less because of it.

In addition to Pipistrel, what follows are our top picks for the best products and services we've seen in the last editorial year.

BEST AIRCRAFT BATTERY: CONCORDE

And by a margin wide enough to

taxi a Piper Mirage through. Year after year, our reviews and surveys of aircraft owners reveal enthusiastic satisfaction with Concorde aircraft batteries. And not just the batteries themselves, but the company, too, which gets kudos for good customer service.

Concorde batteries generally perform better than their stated ratings and we find very little evidence of premature failure. User opinions back up our findings. For more details, see www.concordebattery.com.

BEST NAVCOMM GARMIN SL30

What with the dominance of the GPS mapcomm—the GNS430/530 line from Garmin and the newer GTN line—the lowly navcomm is now just an afterthought, right?

Not quite. While there's not huge demand for simple navcomms, they still have a place when a second or third radio is needed in a panel with-



out much space. In our December 2011 review, we reported that the SL30's sophisticated digital circuitry packs a host of useful and practical features in a small package. It's well designed and easy to use. For more, see www.garmin.com.

BEST BATTERY CHARGER: VDC BATTERYMINDER

If you have an expensive aircraft battery, you need a charger for it from time to time, but it doesn't have to be expensive. Our top pick, and there's really no contest here, is VDC's BatteryMINDER.

This sophisticated charger incorporates the latest in charging technology, including temperature sensing (when needed) and float and maintenance modes. If you

don't fly much, your battery will last longer if it's kept on a charger. And VDC's





are the best. See www.batteryminders.com for more.

BEST FUEL MONITOR/TOTALIZER: TIE: MVP50 AND AURACLE

We'll admit we're starting to sound like a broken record on the MVP50. Last year, we picked it as the top engine monitor and this year, we're picking it again as the best fuel computer and totalizer. But it shares top honors with the Ultra Electronics Auracle.

Both of these instruments are large-screen, multifunction devices that perform a range of engine monitoring duties. So if you're thinking about fuel monitoring, go for the full Monty and get a large-screen engine monitor while you're at it. We see these as worthy investments. See www.biuy-ei.com and www.ultra-fei.com for detailed specs on these products.

BEST LIGHTNING DETECTOR: AVIDYNE TWX670

With the widespread deployment of datalinked weather offering five-minute cycles for NEXRAD, the lowly sferics device has become less of



a must-have for many owners. Still, for the really serious weather pilot, having both NEXRAD and lightning detection brings an undeniable edge.

By tracking strike rate, sferics give instantaneous information on a storm's maturity level and of all the detectors we've tried, Avidyne's TWX670 has the best overall featureset for the price. It can drive up to seven displays and uses a well-designed color-coded depiction system to sort through intensity. Azimuth accuracy is excellent. At \$7995, it's the most expensive system out there, but still a good value. Check out www.avidyne.com for the details.

BEST IPAD WEATHER: ADS-B

Although we're huge fans of datalink weather from XM WX Satellite Weather and WSI, it's an undeniable fact that you have to pay for those services. If you don't fly that much, you spend money for something you're not using very often.

That's why ADS-B for the iPad is a better value. The weather service isn't as complete or as sophisticated as datalink weather is, but it's more than mission adequate. The sharp focus of real-time weather is the dynamic aspect of it and that's NEXRAD. ADS-B gets that into the cockpit without much fuss.

The system to beat for doing that is Sporty's new Stratus portable, which we reviewed in the June 2012 issue. It's a single, wireless box that's about as seamless as these things get. The second option is the SkyRadar portable, which, evidently in response to competition from the Stratus, has lowered its price to as little as \$599 on its newest unit. (Stratus is \$799 from www.sportys.com.) For SkyRadar,



Pipistrel Virus

see www.skyradar.net. Neither work with Droid apps yet, but we suspect someone will come along to serve that demand.

BEST LSA: PIPISTREL VIRUS

As our innovator of the year, Pipistrel is quite active in the LSA segment, with five powered airplanes in the lineup. What caught our eye as this year's best LSA is the Virus. OK, we're not crazy about the name either, but there's no debating that the underlying design is brilliant.

The Virus is superbly constructed in the company's factory in Slovenia, a region with a long history of glass sailplane manufacture. What sets it apart from other LSAs is its performance and economy. With only the 100-HP Rotax 912, the Virus can steam along at 140 knots true on under 5 GPH. With the new 912 iS, the fuel economy will be 15 to 20 percent better than that.

What that means is the Virus is one of a small handful of LSAs fast enough to be serious cross-country airplanes or at least sport airplanes with legs. We're not sure that constitutes a serious market draw, but we would rather have the speed and endurance than not. For more, see www.pipistrel.com.

BEST TIEDOWN HARDWARE: ABE'S AVIATION

Following the great tornado fiasco at Sun 'n Fun in 2011, we set out once again to find the best portable tie-down hardware. It didn't take long to settle on a system made by Abe's Aviation, an Oregon-based company with an interest in back-country flying.

The Abe's system consists of trap-



Abe's tiedowns

ezoidal-shaped steel plates driven into the ground at a perpendicular angle to resist the load. We connected these things to a truck and tried to pull them out of the ground with no success. They're overbuilt from stainless-steel plate and rod, so they ought to last awhile. If you really want your airplane to stay put in a blow, these tiedowns will get the job done. For details, see www.abesaviation.com.

**BEST WINDSHIELD CLEANER:
LP ACRYLIC POLISH/SEALANT**

You could get lost in an aviation supply catalog looking for a decent windshield cleaner. We'll keep you from entering the woods in the first place by simply recommending



the best one we've tested: LP Acrylic Polish and Sealant. LP Aeroplastics is a leading maker of aircraft windshields and they've been at it for years. All of the polishes we tried worked well, but LP's had the best rain-resistant qualities, which is what we

were looking for. It's a respectable cleaner, too, but its real strength is as a polish to resist dirt build up and shed water. Get it from Aircraft Spruce at www.aircraft-spruce.com.

**BEST PORTABLE INTERCOM:
DRE 205E**

Although the world seems to be dominated by high-dollar glass pan-

els and digital audio panels, what about those of us flying 30-year-old Cherokees with coffee-grinder ADFs or even a non-electrical system Cub or Champ? Wouldn't it be nice to have a modern intercom? It would and in the 205e, DRE has the best one we've tried recently. Priced at

around \$300, this intercom has a host of "big audio" features including remote audio inputs for music or traffic, squelch that actually does what it's supposed to, even in a noisy cockpit, and first-class audio quality. Getting the squelch right for high-noise environments isn't easy, but the 205e pulls it off.

Other features include music muting and a stuck-mic indicator. You can power the intercom using batteries or ship's power, so it would be useful even in older LSA-qualified airplanes with no electrical system, a real plus in our view. We've come a long way since that old Cherokee rolled off the line. For specs and details, see www.drecommunications.com.

**BEST LOGBOOK APP:
LOGTEN PRO**

In our estimation, pilots either love filling out logbooks or they hate it. We have no other means to explain why we get more requests to review logbook programs than about any other kind of app or program. So review them we did.

The fruit of that exercise was our conclusion that there's LogTen Pro and there's everything else. This app is highly and easily customizable, covers virtually every imaginable base and is easy to use.

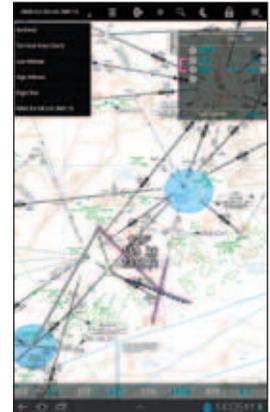
Further, it has good utility for such add-ons as currency, business expense reporting and instruction. Speaking of instruction, it even allows a CFI to enter a signature right on the tablet, so no excuses

for carting a paper logbook to your next instrument proficiency check. For more on the app, see Apple's App Store or www.coradine.com.

**BEST ANDROID APP:
AVIATIONMAPS**

In case you're wondering, it's not all about the iPad. We're seeing more and more apps for the Android operating system, both phones and tablets. The market is hardly one to one, however;

we don't see a Droid version of every iPad app. But there are more choices in Android hardware every month. If you tilt toward the Droid platform, we recommend Avilution's



AviationMaps, which is easy to use and has all the basics, such as the FAA chart of your fancy and layering of graphic weather products on the map display.

Like the iPad apps, it also does on-the-fly flight planning and weather retrieval for an airport or a route. We've found that Android apps in general seem to be a step or two behind iPad apps, but this one is the best evidence that the Droid app writers are catching up. Get all the details from the Android Market or www.avilution.com.



DRE 205e intercom



AIRCRAFT FLIGHT TRIAL

Cessna Grand Caravan: A Top Haul-It-All Option

Lately, most new Caravans are going overseas as commuters, but Cessna would like to revive the 208B's personal transportation appeal.

by Paul Bertorelli

Airplanes, like people, often start out being one thing but as they age, they become something else entirely. And so it is with Cessna's now-venerable Caravan that began life as an unglamorous box hauler that few would ever see on the ramp in daylight. It then became a niche utility airplane for the bush, capable of hauling not just the fisherman, but their camp and a couple of boats, too. Of late, it's finding yet another niche as a short-haul commuter airplane.

Cessna is finding plenty of buyers in that latter role, but it would also like to reinvigorate another niche it enjoyed during the 1990s: the Cara-

van as a semi-luxe personal hauler with a nice interior and virtually no limitation on what the family can haul on vacation or the executive can take along on a regional business trip. The market Cessna lives in bears little

Two must-have options for Caravans include the belly pod and radar, top photo. All versions now have Garmin's G1000 as standard, right.



CHECKLIST



If the Caravan were any simpler to fly, no one would want to.



Load and configuration flexibility have proven the secret to its success.



Although a slight weight penalty, TKS improves the aircraft's weather dispatchability.



The slab-sided shape and modest speed will never cause anyone to call a Caravan a fleet-winged glamour queen.

resemblance to that into which it launched the Caravan in 1985. Even the company that originally caused it to be launched, Federal Express, has changed its name.

Coming up on the end of its third decade in production, Cessna has more competition not just from the Quest Kodiak and Pacific Aerospace's P-750, but from its own used models (some 2500 have been built) and from other cheap, used airframes that clog the market.

Yet the Caravan endures because it does something other airplanes don't do as well. It hauls a lot stuff in a big cabin at acceptable if not exceptional speed and with reasonable direct operating costs. It's also about as easy to fly as any turboprop you're likely to plant your pants in. When Federal Express—now FedEx—convinced



The Caravan's Oasis interior, left, can be configured to suit customer whims.

The commuter setup, middle photo, has an adequate center aisle. All Caravans have a large clamshell cargo door on the left side of the airplane.

There's an airstair door on the right side.



Cessna to develop the first Caravan, a single-engine turboprop with a big fuselage made perfect sense to fly boxes from its spokes out into smaller airports. When that contract reached its end, Cessna saw a market for a similar airplane with a longer fuselage, windows and seats and thus was born the Grand Caravan. It has two fuselage plugs—one each fore and aft of the wing for a total length of 41.6 feet compared to 37.6 for the short Caravan 675.

Neither airplane has changed much since they first appeared on the market. The biggest change, other than the fuselage stretch, was a larger engine for the Grand Caravan in 1994, the Pratt & Whitney PT6A-114A, a 75-HP upgrade over the 600-HP straight 114. The 114A was also fitted to the original 208 and makes it an excellent floatplane, which is a capability the factory doesn't offer for the Grand Caravan. Cessna's busi-

ness leader for the Caravan, Lannie O'Bannion, told us that through the mid-1990s until about 2000, the Grand Caravan enjoyed some success as a heavy-hauling personal airplane or flying bus for business transport. But lately, sales have shifted sharply offshore where the airplane can be configured with up to 14 seats for the commuter role. O'Bannion and Cessna believe there is strong market growth in this segment, especially in China, Russia and India where a lack of developed road infrastructure represents a potentially profitable niche for an airplane that can haul a lot over short distances—say 200 to 300 miles. Of the 100 or so Caravans coming out of Cessna's Wichita, Kansas, plant, three quarters go to foreign markets, a reversal from the airplane's early days. Although Kodiak is a competitor, Cessna may enjoy an edge because of its global marketing experience.

MODERN CARAVAN

The airplane has been improved in increments since its 1985 introduction, but it hasn't seen radical changes during the production run, other than the engine upgrade with the larger Grand Caravan in 1990. O'Bannion says the Caravan was conceived as a payload airplane and it still is that.

Before flying a demonstration model, we went over the numbers with Cessna's Rip Lee, a demo and delivery pilot. Useful load on the airplanes vary by the type of equipment they carry, but there are three basic configurations: the windowless Cargomaster variant, the aforemen-

tioned commuter configuration and an executive, luxury transport version equipped with what Cessna calls the Oasis interior, which is built and installed by Yingling Aviation.

Max takeoff weight for the Grand Caravan is 8750 pounds against a basic empty weight of around 5240 pounds. The useful load is about 3545 pounds, typically, for a pod-equipped 208B. (The cargo versions carry more weight, but less volume.) One thing that gives Caravans flexibility is that they carry a lot of fuel, but don't necessarily need it to complete the typical mission. With 332 gallons capacity (2224 pounds) and a typical burn rate of about 52 GPH (350 pounds), the Caravan is a 5.5-hour airplane, with reserve. Typically, commercial operators trade the fuel for revenue payload, but for those who don't, a Grand Caravan can carry 1300 pounds-plus, with the tanks full. That's six or seven people and all the baggage they want.

Lee took us through some loading problems using the Caravan's iPad app, which shows that the airplane has a generous 25-inch CG range. You can't quite load with abandon, but almost. There's a giant cargo door on the left side of the airplane, but no dedicated baggage compartment. Most of the airplanes come out of the factory with the underbelly baggage pod. Made primarily of Kevlar, it's a \$63,450 option. "There's no performance penalty, so there's really no reason not have it," O'Bannion said. The pod has four bottom-hinged doors, each a loading station and each placarded with a weight limit, typically between 250 and 310 pounds.

The CG tends toward the forward edge of the envelope. With full fuel, two pilots and baggage up front, it's out of the forward limit. But to bust the aft limit, you have to work at it. There's an optional tail stand for max effort loading, but that's only because passengers enter through the rear airstair door, and the more rotund ones could tip the loaded airplane.

SYSTEMS, FEATURES

The most recent major change to the Caravan (in 2008) is the Garmin G1000, customized for the airplane, and the addition of known-ice TKS as an option. The airplane began life with pneumatic boots but Cessna concluded that TKS is just a better performing system. Freight dogs flying

around the Midwest during the winter would probably agree.

There is a weight hit. In this airplane, the TKS carries 20 gallons of fluid and fully charged and ready, the penalty is about 130 pounds. All surfaces are protected, including the struts, and there are prop slingers and a windshield bar. As are most PT6 installations, the engine is equipped with a manually controlled inertial separator that routes any ice-contaminated air around the turbine inlet.

The overworn cliché is that the Caravan is really nothing but an inflated 182 and although that overstates the case a little, it's not far off dead center, either. This is definitely true of the airplane's systems. The fuel is stored in two wing tanks feeding a central header. Two valves in the overhead turn it on or off, and there is a cross-feed feature to balance the load.

Control circuitry is similarly Sky-lane-like, with cables, but in addition to conventional ailerons, the Caravan also has top-wing spoilers which assist roll rate when the ailerons reach 5 degrees of up deflection.

Electrical power is delivered through a dual-bus 28-volt electrical system with a standby alternator that normally runs in hot standby mode. Speaking of standbys, the G1000-equipped Caravan has the usual backup AI and pitot-static instruments mounted dead center under the multi-function display.

Seating options are varied. For the offshore market, the cabin has up to 14 seats, but that's limited to nine in the U.S. The Oasis interior can be configured with club seating, row seating or some combination of the two. For those flying the airplane more than an hour or two, there's a potty seat option in the last row by the door.

Like most new airplanes today, the Caravan has an options list, but it's not extensive. The G1000 is standard, but TKS, air conditioning, radar, an oxygen system, the cargo pod and an HF radio are among the bling you can add to the invoice. Typically equipped price, says Cessna, is about \$2.3 million on a base of \$1.99 million.

FLYING IT

Cessna's Rip Lee told us there's a five-day-long training program to prep a pilot to transition into the Caravan, but we're having trouble understanding what the trainee does for the other

4½ days. Yes, the airplane is that simple and easy to fly. The largest training barrier isn't the airplane itself, but the G1000. If you're G1000 current, the only other challenge for a piston driver would be learning the engine management and that's mostly limited to starting it.

Once you flip on the battery and turn on the starter motor, all you need to do is move the fuel condition lever to normal when the engine Ng value reaches about 14 percent. Once the fire is burning, turn off the starter and you're done. You do have to watch for a hot start, as is true of any turbine.

For such a big airplane, the Caravan taxis precisely and since the pilot's eyes are nine feet above the runway, the visibility and situational awareness are superb. With the G1000's needs attended to, the rest of the pre-takeoff consists of a propeller governor check, setting the flaps and checking the trim. There aren't any real killer items on the checklist.

With three aboard, we were well under gross weight, but even with 675 horsepower, the Caravan doesn't quite push you back in your seat. Acceleration is business-like to a rotation speed of about 70 knots and an initial climb of just under 1000 FPM. At that point, most pilots would turn the airplane over to the Garmin GFC700, but we hand flew it to altitude.

"Altitude" in a turbine usually means the flight levels, but not in a Caravan. It's perfectly happy in the 8000- to 12,000-foot range, and going higher helps neither the speed nor the fuel burn much. Lee told us he climbs into the teens or 20s only for weather or a tailwind. Checking the POH performance tables shows why. At 12,000 feet, the airplane trues at 167 knots on 306 PPH. At 20,000, the true drops to 164 knots of 268 PPH. That's a fuel savings of 5.7 GPH and may hardly be worth it.



Entering the cockpit requires use of stowable boarding ladder, top. The bellypod has four access doors, each placarded with weight limits.

The Caravan's full-flap stall speed is a surprisingly low 48 to 50 knots, variable with weight. Stalls and slow flight are, again, not much different than a 182. It takes a determined tug to get the nose high enough to actually get the burble and a break. The slow stall speed led us to believe you could fly approaches at 65 or 70 knots, but Lee recommend 90 knots, slowing to 80 over the threshold. Pulled back to flight idle, the Caravan will come down and slow down at the same time, so much so that it really wants a gust of power to arrest the descent for the final setup. We suspected that being so high above the runway would complicate judging the flare, but it didn't seem to. We chirped the wheels smoothly on the first try.

While Cessna is enjoying great success selling the Caravan as a short-range commuter, Lannie O'Bannon said the company would like to get back some of the sales it saw 15 years ago as executive and business transportation. "We know who the buyers are," he says. "The challenge for us is to just get the airplane in front of them." In our view, the Grand Caravan certainly has the chops to do the business mission, as long as buyers don't get too hung up on the lust for glamour. If they do, Cessna will happily sell them a Citation.



Compact Folding Bikes: Brompton Our Top Pick

Brompton and Bike Friday offer the easiest, cleanest and most compact folders, but they ain't cheap. Dahon's Mariner may be the best overall value.

by Jeff Van West

As terrific as on-airport cafés and crew cars are, there are plenty of times a few inconvenient miles separate the airport from your real destination. A bicycle small and light enough to carry with you could make all the difference in multiplying your aircraft's utility.

The good news is that the recent surge of interest in biking has brought several more folding bike options onto the market. We'll just look at compact folding bikes—small

wheels and frames to minimize space and weight. There are also full-size folding bikes that we may look at in a later issue.

There are literally dozens of compact folder models out there. So we asked manufacturers to send us their best choices for this mission: Small and lightweight bike to travel three to 10 miles with a light bag. To test, we ran each bike multiple days on our hilly, six-mile daily commute, and brought together a group of pilots to try the bikes on the tarmac and in their airplanes.

THE BROMPTON SOLUTION

Brompton has been in the folding bike business for a long time, and

Dahon's Mariner is light and small enough to heft into the back of a Cessna 152, but the greasy drivechain is on the outside.



it shows. It's the smallest and most secure when folded, while still being the second easiest to fold. The drivetrain folds between two halves of the frame so you're much less likely to touch the greased chain or have it brush against your aircraft interior. The folded bike is the most secure of any we reviewed, so there's no risk of it unraveling as you maneuver it into place.

But what really set the Brompton apart was that provided for the details beyond just folding up the bike. You can leave the handlebars extended while folding up the bike and wheel the compacted bike behind you like a rolling suitcase. A clip on the front of the frame holds any of a wide variety of bags with capacities up to 1890 cubic inches. You can even leave the bag clipped to the frame when folded up. There's also a wheeled bag for the entire bike.

The Brompton isn't flawless. Most compact folders are less stable than full-size bikes, but the Brompton's 16-inch wheels and short wheelbase make it the squirreliest of all the bikes we rode. It's not unsafe by any means, but turns you'd confidently race though on a road bike will give you pause on a Brompton. There's a rubber mount that gives the Brompton a partial rear suspension (think Mooney landing gear rubber pucks). We only rode the firm suspension version. The soft one might be less stable. We also rode the hardest, smallest tires. Wider tires might tame the ride a bit more.

Each Brompton is built to order, with prices starting about \$1300. The biggest choice is probably the drive system, which can be one to six speeds. We enjoyed the six-speed, wide-range we tested, but it's an odd combination of a three-speed rear hub and a two-speed derailleur. The handlebar shifters also have a cheap, plastic feel in stark contrast to most everything else on the bike.

There's also an \$811 option to shave about two pounds off the frame with some titanium parts. Even with all steel parts, the Bromptons weigh under 26 pounds.

YOUR BIKE FRIDAY

Bike Friday custom builds folding bikes, targeting serious bike users. Their models range from the space-saving Tikit we tested, to nearly-full-



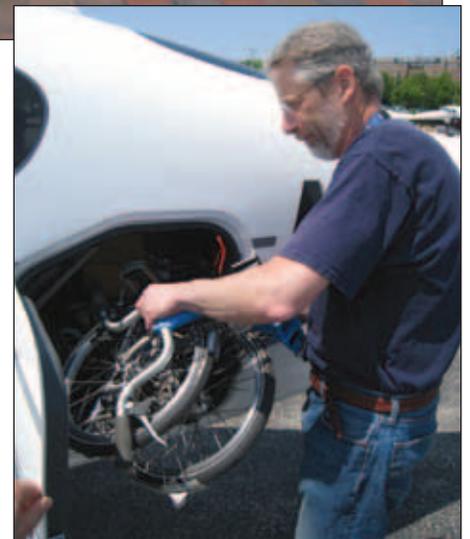
Half a fold becomes a kickstand for the Brompton. The rest of the fold locks tight for easy maneuvering through small cargo doors. Speaking of cargo, the carry bag will tote plenty of gear, and there's an optional rear rack.

size bikes, tandems and recumbents. The Tikit was the fastest and easiest fold once we mastered it. It has 16-inch wheels like the Brompton, but its geometry gives it a more stable feel. Bike Friday says customers have ridden centuries (100-mile races) on Tikits. It wouldn't be our choice, but the model is quite comfortable.

Like the Brompton, the drive-train folds between frame members,

however, the Tikit we tested used a grease-free belt drive anyway. This was the optional high-end Gates belt drive. It worked flawlessly, even under high torque and it was quieter (and lighter) than a chain.

The belt drove an 11-speed internal-geared hub to provide a wide range of gears and smooth operation. The Tikit can be ordered from single speed up to this 11-speed model. Bike Friday customer service is second to none, something we got to test when the 11-speed hub on our Tikit failed. We had our replacement within days.



The Tikit's fast fold makes it a bit long when folded, which made it more challenging in confined cargo spaces. The bike is solidly built, but has a somewhat "homegrown" look that might be a turn off to some.

The Sidekick's (below) shaft drive and internal hub means no mess when loading. The Downtube's (right) suspension smooths the ride, but gear clearance is limited. Both bikes fold similarly to the Dahon on the opposite page.



	WEIGHT AS TESTED (LBS)	FOLDED L x W x H (INCHES)	PRICE AS TESTED	PRICE RANGE	HITS +	MISSES -	CONTACT
BIKE FRIDAY TIKIT	28.5	34 x 16 x 26	\$3500	\$1400-\$3500+	TERRIFIC RIDE, EASY FOLD, DRIVE-TRAIN FOLDS IN	LONG WHEN FOLDED, PRICE	800-777-0258 WWW.BIKEFRIDAY.COM
BREEZER ZIGGY 8	27.6	31 x 13 x 27	\$759	\$759	BUILT-IN PUMP, INTERNAL GEARS	DRIVETRAIN EXPOSED, DF*	215-824-3854 WWW.BREEZERBIKES.COM
BROMPTON	24.1	24 x 11 x 25	\$2500	\$1300-\$2900+	BEST FOLD, LIGHT WEIGHT, MOST PRACTICAL, DRIVE-TRAIN FOLDS IN	LEAST STABLE, PRICE	44 (0)20 8232 8484 WWW.BROMPTON.CO.UK
DAHON FORMULA	23.7	32 x 13 x 25	\$1259	\$1259	LIGHT, GREAT COMPONENTS, GOOD RIDE	DRIVETRAIN EXPOSED, DF, PRICE	626-305-5264 WWW.DAHONBIKES.COM
DAHON MARINER M7	25.5	31 x 13 x 26	\$539	\$539	LIGHT WEIGHT, RACK INCLUDED	DRIVETRAIN EXPOSED, DF	626-305-5264 WWW.DAHONBIKES.COM
DOWNTUBE IX FS	31.4	35 x 21 x 32	\$539	\$499-\$599	TERRIFIC RIDE, FULL SUSPENSION	HEAVY, DF, DRIVE-TRAIN EXPOSED	215-245-4032 WWW.DOWNTUBE.COM
DYNAMIC SIDEKICK	32.5	32 x 15 x 27	\$849	\$799-\$899	GOOD RIDE, CLEAN SHAFT DRIVE, SLIDEPAD BRAKES	HEAVY, DF	800-935-9553 WWW.DYNAMICBICYCLES.COM
SCHWINN HINGE	33.6	30 x 13 x 30	\$200	\$200-\$250	CHEAP	HEAVY, LIMITED ADJUSTMENT, DF	800-626-2811 WWW.SCHWINNBIKES.COM
SWIFT XOOTER	28.2	40 x 14 x 32	\$749	\$749-\$939	TERRIFIC RIDE, EASY FOLD	STILL BIG WHEN FOLDED	800-816-2724 WWW.XOOTR.COM

*DF=DAHON-STYLE FOLD, WHICH WE CONSIDER MORE COMPLEX THAN OTHER SYSTEMS.

For example, our Tikit came in a Samsonite suitcase that converted to a trailer and connected using a repurposed pneumatic tool hose. It

worked great, but looks odd. Another ding is that seat and handlebar adjustment requires a hex wrench.

Tikits start at about \$1400. The model we tested was \$3500—light-duty cyclists need not apply.

DAHON AND BREEZER

There are good folder options well under \$1000. Dahon, probably the most recognized name in folding bikes, sent us two models: The Mariner M7 and the Formula. The Breezer bike company sent us their Ziggy, which is built for them by Dahon, so it's quite similar.

The Mariner, Formula and Ziggy all use the same lightweight aluminum frame and folding system. This is a multi-step process: Drop and twist the seatpost, twist up

You might get three Bromptons in the back of this Comanche (top). Two Dahons or Breezers fit if you remove the seatposts (bottom).

the handlebars, extend the handlebars, drop the handlebars, fold the frame, fold the pedals if necessary. Get all the pieces rotated and extended right, and a magnetic catch will hold everything folded together. The dropped seatpost cleverly becomes a stand for the folded bike. Reverse to unfold.

The three bikes are set apart mostly by components. The Mariner has a seven-speed derailleur, fenders and a rear rack. The Ziggy is much like the Mariner, but with a seven-speed internal hub and a pump built into the seatpost. The Formula sports a high-performance tires, disc brakes and 18-speed Shimano Tiagra parts.

A shortish wheelbase but with 20-inch wheels make these bikes middle of the road in terms of handling. The Formula handles better than the other two due to its tires, but we think the lack of fenders for wet roads and a rear rack make it less suited to most pilots' mission. The Dahon locking mechanisms are simple and solid, but we wonder about the longevity of the plastic safety catches covering them.

The other ding we see on the Dahon-style is that the fold puts



the gears and chain on the outside where it's more likely to mark you and your interior with grease. Putting the bikes in a bag is a good idea. The Ziggy's internal hub and partial chain cover make this much less of an issue.

The Mariner is a good value at \$539. The Ziggy is \$759, and the Formula is \$1259, due to the high-end components.

DYNAMIC AND DOWNTUBE

Dynamic's Sidekick and Downtube's IX are the high-tech entrants. The Sidekick is unique in that it's a shaft drive—no chain or belt. The system is butter-smooth and almost silent. Combined with an eight-speed internal hub this eliminates any potential for chain-grease mess.

Our Sidekick came with the optional Slidepad brakes, where a single brake lever actuates the rear brake and that brake actuates the front one. Dynamic claims the system virtually eliminates the chance of "over-the-handlebars" accidents, and simplifies the cabling of the bike somewhat. We found the system worked as advertised, but probably would frustrate a serious rider used to precise braking control. It's also a single-point failure for your bike brakes, which rubs many pilot types the wrong way.

The Sidekick both folds and rides comparably to the Dahons or Breezer, but the latching mecha-

nisms are a bit more robust on the Sidekick, which we liked. Dynamic includes a strap to hold the Sidekick folded up, which is a bit inconvenient. Changing a tire on the shaft drive is just one extra step over a conventional chain, but it exposes the greased drive gears and could get messy. (We should say that changing a rear tire on any of these bikes usually requires a wrench and some fiddling. You might be better off folding it up and sticking out your thumb for a lift.)

The Downtube IX is a full-suspension folder and a surprisingly good rider. Stability for the Downtube was second best of all the bikes we tested, due in part to a slightly longer wheelbase than most others. It also sports beefy locking mechanisms and lacks anything but a strap to keep it folded up.

We question the value of a full suspension, however. The front and rear shocks definitely suck up road vibration and even sizable potholes. But the full-size rear derailleur on 20-inch wheels makes for little ground clearance. You won't be doing serious single-track on this bike. Not for long, anyway.

On penalty for the gadgets and beefiness of the IX and the Sidekick

is weight. Each bike weighs about 32 pounds—four to eight pounds more than the competition. The Downtube is a fair value starting at \$499 (the company has some other, cheaper models as well). A comparable Sidekick will be about \$250 more.

TV FOLD-UPS



AVweb
<http://snipurl.com/23un87n>

XOOTER

One of the taglines for this bike is, "a great bike that happens to fold." We couldn't agree more. The Xooter was, hands-down, the best riding bike of the lot. It has all the stability of a full-size hybrid (around-town) bike, even on 20-inch wheels. It's quite light

and uses decent, if not top-of-the-line components.

The fold is fast and clever, but not that small. We couldn't get a folded Xooter into several small aircraft without significant disassembly. The Xooter would be a great bike for tucking in the corner of your office or the coffee shop. But unless you fly something big enough to require a type rating, it's probably not your best bet for tucking into an airplane.

WORTH THE BUCKS?

None of these bikes are cheap, and some are more than high-end road bikes. Is it worth the money?

continued on page 31



Bike Friday's Tikit is their most compact machine, but they custom build all bikes to meet the owner's specs. That's really a suitcase turned into a trailer. The disassembled bike and trailer gear also fit inside.



Cessna Skymaster

Twin redundancy without a VMC, but at the expense of some efficiency, speed and quiet.

The idea of the push-pull twin makes such fundamental sense, that it has been applied to aircraft designs in one form or another for nearly 100 years and in literally dozens of models you've never even heard of. As recently as 2005, Adam Aircraft tried the idea again with the A500 push-pull piston twin. Like many before it, the airplane was gutted more by market reality than by a fundamental flaw in the idea.

Then there's the Cessna 337, arguably the most commercially successful push-pull attempt, at least in terms of numbers built. And although the 337 Skymaster isn't the most popular twin ever marketed, it's done all right for itself and has achieved its primary goal: eliminating asymmetric thrust and simplifying the pilot's workload in the event of an engine out.

If the concept was sound, the execution of it by Cessna was a little less so. The Skymaster acquired a reputation as a bit of maintenance hog and although its performance is respectable, other twins do just as well, if not better, on less fuel and

on less dollars spent on wrenching. Like most used twins on the market today, Skymasters are a bargain. When fuel prices started their climb five years ago, market values of twins started downward and today, you can find a reasonably well-equipped Skymaster for well under \$100,000. Airframe values seem to have stabilized since we last examined them three years ago, which is more than we can say for other piston twins.

A SIMPLER WAY

When Cessna began to develop the Skymaster in the mid-1960s, the accident history was horrid for twins. Part of that was due to training. The doctrine in those days was to actually surprise the pilot with a real engine shutdown to simulate losing one. In the hairy-chested thinking of the day, instructors would even do this on takeoff. As a result, loss-of-control accidents due VMC rollovers were, if not common, more prevalent then they are today.

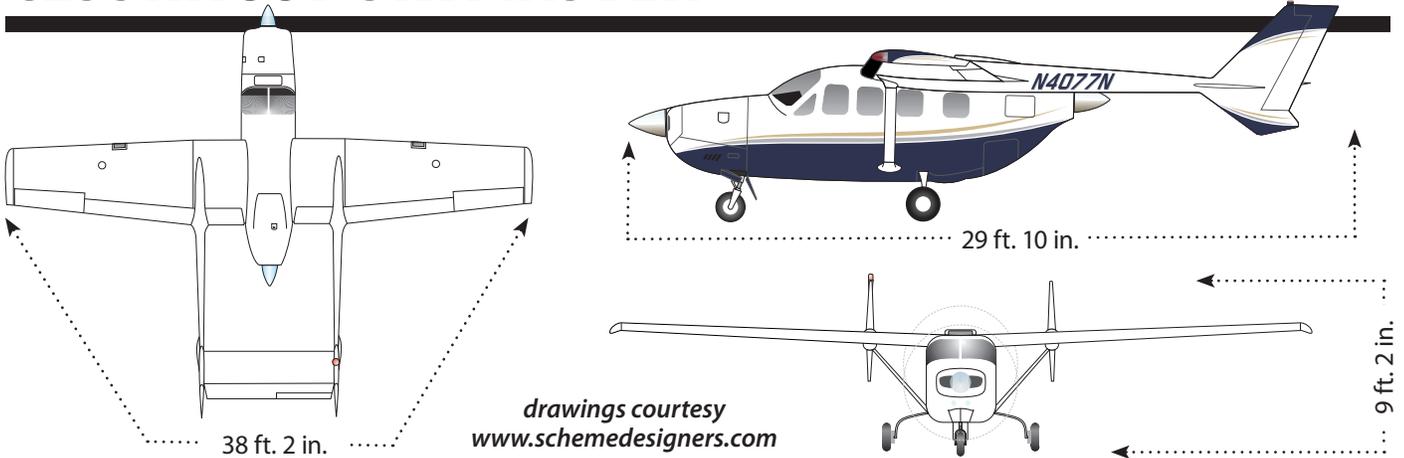
In an engine-out situation, conventional piston twins generally need to be handled with kid gloves

lest the airplane get too slow and roll over on its back. So Cessna approached this problem just as other designers had going back to the Caproni Ca. 1 of 1914: they aligned the two engines with the airframe centerline, offering pilots the safety of a second engine without the penalty of adverse handling. If one quits, identify it, feather it and don't worry about the dead-foot, dead-engine drill. The FAA even granted the 337 its own class rating, limiting pilots to centerline-thrust twins only. It was much easier—and probably safer—to earn a multi-engine rating in a Skymaster than in a conventional twin.

Part of Cessna's plan worked, since there's little question the Skymaster is easier to fly on a single engine than a conventional twin. But, since the VMC rollover accident doesn't happen that often in the real world because training doctrine moved to zero thrust instead of an actual engine shutdown, the airplane's overall accident record isn't that much better than conventional twins.

A pilot looking to improve redundancy by stepping up from a single

CESSNA 337 SKYMASTER

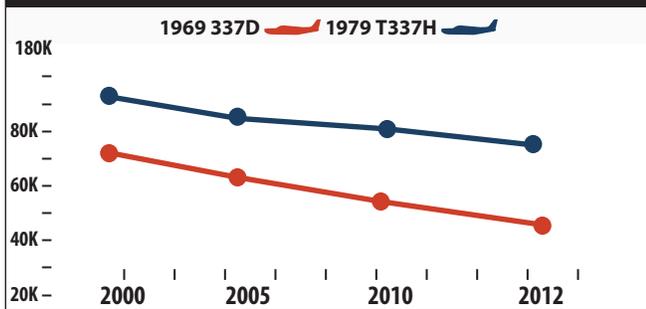


drawings courtesy
www.schemedesigners.com

SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1963-67 337,A,B SKYMASTER	CONTINENTAL IO-360-C/D	1500	\$30,000	93	1585 LBS	167 KTS	±\$35,000
1968 337C SKYMASTER	CONTINENTAL IO-360-C/D	1500	\$30,000	93	1750 LBS	166 KTS	±\$42,000
1968 T-337C TURBO SKYMASTER	CONTINENTAL TSIO-360A/B	1400	\$30,000	93	1705 LBS	195 KTS	±\$49,000
1969-70 337D,E SKYMASTER	CONTINENTAL IO-360-C	1500	\$30,000	93	1780 LBS	166 KTS	±\$47,000
1970 337E-T TURBO SKYMASTER	CONTINENTAL TSIO-360-A	1400	\$30,000	93	1780 LBS	194 KTS	±\$57,000
1971-73 337,F, G SKYMASTER II	CONTINENTAL IO-360-G	1500	\$30,000	90	1705 LBS	169 KTS	±\$56,000
1975 T-337G-P PRESSURIZED SKYMASTER II	CONTINENTAL TSIO-360-C	1400	\$30,000	150	1516 LBS	204 KTS	±\$70,000
1976-77 337 G II SKYMASTER	CONTINENTAL IO-360-G	1500	\$30,000	150	1705 LBS	169 KTS	±\$70,000
1978-1979 337 H II SKYMASTER	CONTINENTAL IO-360-GB	1500	\$30,000	150	1592 LBS	169 KTS	±\$85,000
1978-1979 T-337 H II SKYMASTER	CONTINENTAL TSIO-360-H	1400	\$30,000	150	1596 LBS	200 KTS	±\$82,000
1980 337H SKYMASTER II	CONTINENTAL IO-360-GB	1500	\$30,000	90	1705 LBS	169 KTS	±\$79,000
1980 T-337H TURBO SKYMASTER II	CONTINENTAL TSIO-360-HB	1400	\$30,000	90	1592 LBS	200 KTS	±\$94,000
1980 T-337H-P PRESSURIZED SKYMASTER II	CONTINENTAL TSIO-360-CB	1400	\$30,000	150	1516 LBS	204 KTS	±\$95,000

RESALE VALUES



SELECT RECENT ADS

- AD 2011-15-11 WING DAMAGE INSPECTION
- AD2011-10-09 SEAT RAILS AND ROLLERS
- AD 200704-19 SUPERIOR AIR PARTS CYLINDERS
- AD 2004-21-05 INSPECT COMBUSTION HEATERS
- AD 2004-19-01 SHOULDER HARNESS ADJUSTORS

SELECT MODEL COMPARISONS

PAYLOAD/FULL FUEL

Model	500	700	900	1100
CESSNA 337H	[Bar chart showing payload capacity]			
CESSNA T337H	[Bar chart showing payload capacity]			
PIPER SEMINOLE	[Bar chart showing payload capacity]			
PIPER TWIN COMANCHE	[Bar chart showing payload capacity]			
BEECH DUCHESS	[Bar chart showing payload capacity]			

CRUISE SPEEDS

Model	140	160	180	200
CESSNA 337H	[Bar chart showing cruise speed]			
CESSNA T337H	[Bar chart showing cruise speed]			
PIPER SEMINOLE	[Bar chart showing cruise speed]			
TWIN COMANCHE	[Bar chart showing cruise speed]			
BEECH DUCHESS	[Bar chart showing cruise speed]			

PRICE COMPARISONS

1980 337H	(\$81,000)
1980 T337H	(\$96,000)
1980 SEMINOLE	(\$75,000)
1972 TWIN COMANCHE	(\$94,000)
1980 DUCHESS	(\$73,000)

to a twin certainly will achieve it with a Skymaster. But in the bargain of gaining redundancy, pilots can be forced to accept a platform with more cabin noise, a set of operating peculiarities all its own and tightly packaged systems presenting more of a challenge to maintenance personnel than if each engine resided on its own wing. All of this might argue in favor of a single-engine airplane or even a conventional twin. Then again, if you fly over the Great Lakes at night, maybe not.

MODEL HISTORY

The 337 Skymaster's front/rear engine layout and high wing started out as the fixed-gear Model 336 in 1964, powered by Continental IO-360-A engines of 195 HP apiece. Widely acknowledged as a slug, Cessna sold only 195 336s in one year of production; 77 remain on the FAA's registry today. In 1965, the company folded the gear and upgraded powerplants to a pair of Continental IO-360-Cs pumping out 210 HP, resulting in the 337 Skymaster. Cessna sold 239 copies that year.



(Not really learning from its 336 experience, Cessna flew a cantilever-winged, lower-powered version, the 327, in late 1967, but it proved too slow and the project was dropped the next year.)

To make the original 336 a retractable, Cessna borrowed the complex and occasionally troublesome hydraulic landing gear system from the 210. In 1973, it was upgraded to a simpler and more reliable electrohydraulic system. While less complex and easier to maintain, the system still isn't as robust as, say, a Baron's or Seneca's.

Early models also came with multiple fuel tanks, another system that proved problematic in the field. It, too, was replaced in 1973 by a superior, less complicated system. A turbocharged version—the T-337B, powered by 210-HP TSIO-360-A or -B engines from Continental—appeared in 1967, but was dropped in 1972 with the addition to the Skymaster line of the almost-revolutionary pressurized 337 version, the T-337 G-P, powered by TSIO-360-C engines up-rated to 225 HP.

The turbo reappeared in 1978, with TSIO-360-H powerplants, but Skymaster sales had begun slipping by then.

The Skymaster is military tough even without the extra beefups. Former military versions do turn up on the used market. (Interior photo by Michael Nowicki.)

Cessna pulled the plug following the 1980 model year, after a total production run of 2058, plus 332 pressurized versions. In addition, Cessna built slightly more than 500 Skymasters for the U.S. Air Force. These saw extensive action in Vietnam as the O-2A. This version boasts structural beefups, hard points and extra windows. These airplanes frequently appear on the used market and may well be the least expensive warbirds available. Additionally, some civilian models were converted to an O-2B configuration for the military to use in psychological warfare.

Major tweaks in the airplane's history were few, but there were many designation changes. Beginning in 1970, some inspection panels were added—making maintenance easier—and the airframe was lightened a bit, increasing useful load. The interior arrangement also changed through the years, with various combinations of seat mounting.

As is common with any aircraft, the non-pressurized 337's gross weight crept up during its years in production. Early models started at around 4200 pounds; late ones weighed 4630 pounds, with max landing weight limited to 4400 pounds. Meanwhile, the P-337, with its 30 extra horsepower, had a take-off weight of 4700 pounds and max landing weight of 4465 pounds.

Piston-twin prices are as soft as ever, and the 337 is no exception. On the up side, most of the depreciation has been squeezed out of these airframes. The downside? Cessna 337s can't be counted on to increase much in value. But a Skymaster is a lot of airplane for the money. Besides current fuel prices and future uncertainties, other factors depressing prices are that the 337 has a reputation for being a maintenance hog—one that's not entirely deserved—and they aren't all that fast as like-powered twins go.

Buyers should be aware, however, that buying a cheap twin is not the same as operating a twin cheaply. A hangar queen will eat through a bunch of money if it needs remedial work and, in any case, you'll need to find a shop familiar with the breed to do the pre-buy and maintain the airplane going forward. The Skymaster doesn't perform much better than a Cessna 210, and it has two of



everything to maintain and replace, driving up ownership costs.

PERFORMANCE, HANDLING

Skymasters aren't speed-demons, although the turbocharged models do respectably well for pilots willing to take them into the teens. Owners of normally aspirated models can plan on between 155 and 165 knots true, depending on altitude and how much fuel they want to burn. The turbocharged and pressurized models will push 190 to 200 knots at 20,000 feet, their maximum certified altitude. At middle altitudes, 170 to 180 knots is typical for the turbo models, which ain't bad.

Since Skymasters have relatively small displacement six-cylinder engines, fuel burn tends to be reasonable, ranging from 15 GPH to 22 GPH total, with 19 to 20 GPH typical for a 150- to 160-knot cruise. For comparison, a Twin Comanche will do about the same speed on 100 fewer horsepower and a lot less gas. Efficiency isn't a Skymaster hallmark, except when compared to larger, faster twins.

All-engine rate of climb ranges from a modest 1300 FPM in the old 336 to a lethargic 940 FPM with the last 337H models. We're unaware of any other twin-engine airplane with a book rate of climb below 1000 FPM; even the old 150-HP Apache had a book climb of 1250 FPM with both engines running. On the other hand, lose an engine in a 210 and there's no rate of climb, only a rate of descent. In a 337, you should at least be able to eke out 200-300 FPM.

Like many Cessnas, runway performance is good. Landing-configuration stall speeds range from 55 to 62 knots, depending on the gross weight of the particular model—about 10 knots below conventional twins like the 310.

As a result, a Skymaster will get off the ground in less than 1000 feet at gross weight—a feat very few other twins can manage. Barrier perfor-



A pressurized Skymaster makes performance-enhancing travel in the flight levels practical. Mods for different engines, vortex generators and these winglets all seek to boost the 337 a bit more.

mance is not quite as good, however; the leisurely climb rate brings the Skymaster's 50-foot takeoff figures down to the middle of the light-twin pack.

The single-engine climb rates of all the light twins tend to be very similar—200 to 300 FPM—because engine-out climb rate is a certification point around which the airplane is designed. The FAA requires a certain minimum climb, figured by a formula relating to stall speed, and the manufacturers typically bump up the gross weight to the point at which the airplane just barely meets the FAA minimum. Any excess engine-out climb capability is, in effect, wasted payload. And payload numbers sell airplanes.

What's surprising is the difference between the front and rear engines. Climb on the front engine only is about 50 FPM less than on the rear, but not necessarily for all versions of the Skymaster. Reader Robert Prader told us his research reveals that later models have better front-engine performance. "It is true that front and rear engine single-engine climb rates are significantly different for all pre-1973 Skymaster models; however, the front and rear single-engine climb rates are not significantly different for the pressurized models and the 1978 and later turbo models," he said. "If you consult the POH for any pressurized model, you will find that a single-engine climb rate of 375 FPM is listed for a standard

The 337 is no sports car, but it makes a solid IFR platform. There is plenty of room for gear as Gene Micekt's 337 shows. Visibility on clear days is fantastic because the wing's leading edge is behind you.



SKYMASTER AILMENT PUNCHLIST

The Skymaster's reputation as a shop queen is partly undeserved. However, you'll want a technician familiar with the type on the lookout for chronic Skymaster problems like these:

- **Rear engine oil leaks.** Loose rocker box covers, a chronically leaky quick-drain and a sloppy breather tube seem to be the main culprits.
- **Defective landing gear switches.** Inexpensive switches plagued the Skymaster during the mid-1970s. In fact, the entire landing gear system is a challenge to maintain, one almost demanding proactive maintenance and inspection.
- **Water leaks.** Leaks around the windshield were a chronic problem in early models. Check for possible rain damage and condition of windshield sealant.
- **Hot-running rear engine.** Some familiar with the Skymaster swear the hot rear-engine problem isn't a problem, but is the result instead of defective gauge installations. Regardless, additional louvers are available to help. A digital engine monitor should be installed, however, and careful attention paid to the rear engine's baffling and cowling.
- **Defective paint jobs.** When Cessna switched to DuPont Imron on Pawnee Division models in 1977, it ignored metal preparation and priming recommendations, using a cheap, quick-wash primer instead of Alodine and an epoxy primer. The result was an epidemic of filiform corrosion, particularly in warm, humid coastal areas. By now, most of the surviving airplanes will have been painted at least once. But check the logs and inspect the paint carefully.

day at sea level at gross weight, with no mention of which engine is out. If you consult the POH for the 1980 non-pressurized turbo model, you will find it specifies a climb rate of 335 FPM for the same conditions, again with no mention of which engine is out."

While leaving the gear down produces a climb penalty of a bit over 100 FPM, raising it carries a temporary 240 FPM hit. (Praeder told us this is about average for most twins and probably for single-engine retracts as well.) This is because Cessna's complicated gear door arrangement adds drag while the gear's in transit. In an after-takeoff engine-out situation, it may be better to leave the gear down, just as it is recommended in some singles to leave it down until obstacles are cleared.

In normal flight, the Skymaster has typical Cessna handling: heavy in pitch, reasonably responsive ailerons. (The P-model has especially light ailerons.) Pilots praise its IFR stability.

The noteworthy aspect of the Skymaster's handling—indeed, the whole reason for the airplane's existence—shows up when an engine fails. Instead of the normal yaw-roll-stall-spin scenario too often following engine failure in "conventional" twins, the Skymaster continues to fly straight ahead. An unprepared or rusty pilot can take his time and concentrate on the task of identifying and feathering the prop on the failed engine, without worrying about losing control.

PAYLOAD, RANGE

A Cessna press release from the 1970s describes the Skymaster as "a full six-place airplane with nearly a ton of useful load."

Good luck with that. At best, the two rear seats can accommodate youngsters. And that press release conveniently forgot when the fifth and sixth seats are installed, there's no baggage space, nor is there a baggage door. Consider the Skymaster a roomy four-placer.

Real-world useful loads run around 1500 pounds—not bad at all, and several hundred pounds more than a Twin Comanche. Standard fuel is 93 gallons, which should leave more than 900 pounds available for payload; plenty for four passengers and their bags. Standard fuel is just adequate, however—unless you throttle back—providing a bit more than three hours with IFR reserves at fast cruise.

Pre-1973 airplanes with long-range tanks had a four-tank fuel system; later ones came with a two-tank system. The long-range tanks—150 gallons in 1975 to 1980 models, 131 gallons in earlier models—solve endurance limitations nicely, at the expense of payload, of course. One owner told us that with long-range tanks full, he has seven-plus hours at 150 knots with 650 pounds of payload (three people and bags). Not a bad compromise.

Oddly, the P-337 is allowed only five people; it was certified under different rules requiring an emergency exit in a six-seat airplane. Rather than put in the exit, Cessna simply limited the seating to five. Early P models had a middle seat hinged up and to the side to get at the back row, but these seats didn't slide fore and aft. Access to the rear seats in other Skymasters requires an awkward scramble over the center row.

The Skymaster's visibility is excellent—about as good as it gets in any light airplane, single or twin. The view down is unlimited, of course, and the wing's leading edge is back far enough that it doesn't block upward vision, either, as with most Cessna singles. Good visibility is not only a safety feature; it adds to the feeling of roominess in the cockpit.

The Skymaster is also quite noisy, since the passengers are sandwiched between the engines. Also, sympathetic vibration can be a problem, particularly without prop synchronizers. Conventional twins are quieter by far.

MAINTENANCE

The Skymaster was the most complex aircraft ever engineered and manufactured by Cessna's Pawnee Division, which otherwise built only Cessna singles. Evidence suggests the division simply wasn't up to the task, particularly in the 1975-to-1980 pe-

riod when production was growing rapidly and Cessna was plagued by an epidemic of design, engineering and production problems.

For example, the pressurized Skymaster was initially such a disaster that the first year's production was recalled to the factory for complete remanufacture and modification. Distinct from other twins, Cessna had to pack everything into the fuselage, not having the luxury of sticking systems out in the wings or into the nose. As a result, access is difficult and it is those systems where most maintenance problems will be found.

The basic airframe is stout, with a rugged strut-braced wing. There are remarkably few ADs on the airplane. And remember that the military version of the Skymaster did plenty of rough duty in Vietnam, often flying home with bullet holes or worse.

Still, a potential Skymaster nightmare is runaway maintenance costs, particularly in the turbo and pressurized models, so the prudent purchaser will closely examine logbooks and service records of any aircraft under consideration.

MODS, GROUPS

The Riley Rocket was a popular Skymaster mod and included upgrades to 310-HP TSIO-520 engines, intercoolers, three-blade props and air conditioning. Rockets come on the market now and again, at a premium price over stock models. For more, check out www.skymaster.com. What appears to be a follow-on to that product is available from www.therocket2.com. This company offers full refurb services on the Skymaster line.

Other mods include vortex generators from Micro Aerodynamics (www.microaero.com) and intercoolers from American Aviation (www.americanaviationinc.com). Both Horton (www.hortonstackdoor.com/stolcraft_description.htm) and Sierra Industries (www.sijet.com) apparently still offer STOL kits and other aerodynamic mods. A wing spoiler kit is available from PowerPac Spoilers (www.powerpacspoilers.com).

Aviation Enterprises (www.cessnaskymaster.com) offers a wide range of major modifications for Skymasters, ranging from air conditioning, airstair doors, extended wing-

tips, IO-550 engine conversions—for one or both engines—long-range fuel and MT propellers. The company also can provide various parts, including cargo pods. Similarly, RT Aerospace (www.rtaerospace.com) offers several items of interest to the Skymaster owner, including a convertible rear seat for the baggage area.

Cessnas seem generally blessed with good owner organizations, perhaps because the company abandoned the piston market in 1986 and stayed out of it until 1997. The clubs and groups have proven to be as good as it gets when it comes to support.

Every Cessna owner should join the Cessna Pilots Association (www.cessna.org). The organization offers the usual benefits, including an insurance program, monthly newsletter and fly-ins, and has a wealth of Skymaster-specific information. Two useful if unofficial Skymaster Web sites are the Cessna Skymaster Web Site (www.skymaster.org.uk) and SOAP, Skymaster Owners And Pilots (www.337skymaster.com).

READER COMMENTS

My aircraft is a 1965 Cessna 337. She is based at Linden, New Jersey. I have owned her for about a year and a half. At the time of purchase, the aircraft had no significant upgrades. All instrumentation was original. There were two old navcomms, a DME, a LORAN and an ADF.

Last summer, I pulled out the number 2 navcomm, the ADF, DME and LORAN. I installed an Aspen EFD1000 Pro PFD and a Garmin GTN750. Planned upgrades, in probable order of priority, are a JPI primary engine monitor, an autopilot and maybe a GTN650. ADS-B In is also in the cards.

When I first bought her, I had no experience with twins. My primary training was entirely in Cherokees, Archers and a Diamond DA20. After that came a flying club with Cessna 172s and the Civil Air Patrol (more 172s and some 182s). That was my intro to the high-wing world.

I never thought of buying a twin. I came close to buying a Comanche, but the price was too high. This Skymaster happened to be based at Linden, where my flying club was. The owner's mechanic was on the

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field, too. When the owner decided to sell, his price was right: \$50,000 got me a flyable airplane with a pair of mid-time Continental IO-360s. The airframe was relatively low-time, as the previous two owners flew infrequently, flew VFR only and rarely went cross-country.

For the missions I envisioned, this is an excellent airplane. It has the range and is comfortable enough for trips from my home base to Montreal, Chicago, Nashville and other destinations. It is big, heavy and stable, and it makes a good IFR platform.

Some of the numbers: I cruise at 9 to 10 GPH per engine doing 155 knots.

Fuel capacity is 128 gallons in two mains (92 gallons total) and two aux (36 gallons total) tanks.

My annual (only had one so far) cost about \$1200. Insurance last year cost \$2700 and should be less now that I have about 75 hours in type. Flying the 337 is a real pleasure. At 4200 pounds max gross, she feels

quite stable in most conditions. She does handle more like a truck than a sports car, but that's not a problem for an aircraft having the range and capacity that this one does.

There are some operational considerations to be aware of when flying the 337 as opposed to a conventional twin. Instead of raising the gear at positive rate of climb, you wait until obstacles are cleared. The gear doors are closed when the gear is down and when the gear is open. The doors open while the wheels are in transit. Accordingly, there is far more drag while the gear is in transit than when the gear is down. If you lose hydraulics while raising the gear, you could be low, slow, at a high angle of attack and with far more drag diminishing your rate of climb than if you left the wheels out until you cleared your obstacles.

On the takeoff roll, you must advance the rear engine throttle first, make certain you are developing power and only then advance the

front-engine throttle. In the event of an in-flight engine failure requiring shutdown and feathering of the prop, you must be very careful to identify the correct engine. Given the push-pull configuration, "dead foot/dead engine" does not work.

On the positive side, on short final you can play with the throttles differentially to get an aggressive sink rate if needed, without worrying about asymmetric thrust or adverse yaw.

One of the neat features of the 337 is the great visibility. In a 172 or 182, your visibility upward to the sides is limited because of where the wing is. The left wing is right there next to your head. This limits your ability to see traffic at 9 o'clock or 3 o'clock high, and limits your view as you are making turns in a traffic pattern.

You don't have those problems with the 337 because—as in a jet—the wing is behind you. Given how the weight of the two engines is distributed, the center of gravity and the

ACCIDENT SCAN : SHORT ON COMMON SENSE AS WELL AS FUEL

When "Other" leads the accident hit parade, some explanation is in order. A few of these were gear-up landings and a couple others were downwind takeoffs, both understandable, if unfortunate, pilot gaffes where little more than pride was damaged. Three were in-flight encounters with thunderstorms, with fatal results. One was a truly bizarre case where the O2 system had been filled with compressed air instead of pure oxygen.

But several others left us wondering if the perceived safety of the push-pull was leading beyond complacency into dunderheadville. There were four attempted takeoffs with a known inoperative rear engine. In at least two cases, witnesses relayed that the pilot claimed he had successfully done this before. Not so this time—all four were fatal. Even some of the other categories have some aspect of this. Two spacial disorientation accidents involved IFR with known inoperative flight

instruments. One of the fuel mismanagement wrecks was a departure with known inoperative fuel gauges. One pilot told his wife before the flight he planned to practice instrument approaches with the cabin lights turned up so he couldn't see outside. He struck a mountain.

Where there was a mechanical problem, we saw a wide divergence of outcomes. Several wrecks resulted from a rear engine loss that the pilot didn't react to correctly (or even realize soon enough). While correct procedures resulted in little or no injury, even when the one-engine Skymaster couldn't outclimb terrain and ended up in the trees.

Even the ubiquitous runway loss of control (R-LOC) strayed from the common crosswind botch and favored hard landings. There were also a shockingly high number of fuel exhaustions due to poor fuel planning.

This may indicate that too many Skymaster pilots think of their 337 like it's a big 172—something that's bound to catch up with them eventually.

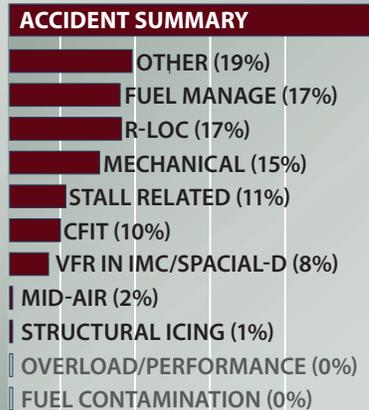


Photo by Felipe Garcia

center of lift are behind the pilot's station. With the wing behind you, your visibility is unrestricted.

Roger Levy
Linden, New Jersey

I am writing to call attention to some statements that I believe were either not accurate, or not fully accurate, in the discussion of climb rate and single engine performance in your previous report on the Skymaster, including the following passage.

"What's surprising is the difference between the front and rear engines. Climb on the front engine only is about 50 FPM less than on the rear." It is true that front and rear engine single-engine climb rates are significantly different for all pre-1973 Skymaster models; however, the front and rear single-engine climb rates are not significantly different for the pressurized models and the 1978 and later turbo models.

If you consult the POH for any pressurized model, you will find that a single-engine climb rate of 375 FPM is listed for a standard day at sea level at gross weight, with no mention of which engine is out. If you consult the POH for the 1980 non-pressurized turbo model, you will find it specifies a climb rate of 335 FPM for the same conditions, again with no mention of which engine is out.

Aerodynamic refinements on 1973 and later models, including switching from 76-inch props front and rear, to a 78-inch prop in front and a 76-inch prop in the rear, reduced the difference between the front and rear-engine climb rates on normally aspirated models, and essentially eliminated them on the pressurized and non-pressurized turbo models. At 10,000 feet ISA and gross, the SERCs are still a respectable 245 and 210 FPM for the pressurized and 1980 turbo models, respectively.

As for the leaving the gear down versus raising it, according to my research, the drag during Skymaster gear retraction is about average for a light or medium twin; however, the drag is much below average when the gear is fully extended.

Very few light- and medium-twin POH's contain data on how many FPM will be lost from single engine climb rates when the landing gear

is extended instead of retracted. Listed below is all of the data on the impact of gear extension on single engine climb rates that I was able to find in the light- or medium-twin pilot's manuals on my bookshelf. The single-engine climb rates quoted are for sea level ISA at gross weight. In each case the gear-down climb penalty information was listed on the SERC performance chart.

Robert Praeder
Via e-mail

- **Aerostar 601P:** SERC 240 FPM. Gear down subtract 300 FPM. Thus SERC clean except for gear down (240 - 300) FPM is a descent rate of 60 FPM.
- **Beech Baron 58:** SERC 382 FPM. Gear down subtract 200 FPM, prop windmilling subtract 200 FPM. Thus SERC clean except for gear down is (382 - 200) FPM or 182 FPM.
- **Cessna 1979 340A:** SERC 315 FPM. Gear down subtract 350 FPM, prop windmilling subtract 400 FPM, flaps down 15 degrees subtract 100 FPM, flaps down 45 degrees subtract 600 FPM. Thus SERC clean except for gear down is (315 - 350) FPM minus 35 FPM—a sink rate of 35 FPM.
- **Cessna 425:** SERC is 357 FPM. Gear down, subtract 350 FPM, flaps 15 degrees, subtract 200 FPM, flaps 45 degrees, subtract 800 FPM. Thus SERC clean except for gear down is (357 - 350) FPM or 7 FPM.
- **Cessna 1965 337:** SERC front is 360 FPM. SERC rear is 450 FPM. Gear down subtract 110 FPM. Gear in transit subtract 240 FPM. Thus, SERC clean except gear down is (360 - 110) FPM = 250 FPM front and (450 - 110) FPM and 340 FPM rear. SERC clean except for gear in transit is (360 - 240) FPM for 120 FPM front and (450 - 240) FPM or 210 FPM rear.

Compact Fold-a-Bikes

(continued from page 23)

Well, Schwinn sent us their \$250 Hinge. It's heavy, rides like a truck, doesn't fit tall riders and has only one speed, so it had better be a level ride to town. We think the \$250 spend on it would be wasted because after a few frustrating trips, the bike would just gather dust in your garage.

This is what made the Brompton such a standout: It was so convenient. So, if you want to invest enough to get a bike you'll enjoy using regularly, we think it's worth it. If you want a good bike value that you don't expect to use all the time, we like the Dahon Mariner. If you're on the other end of the spectrum and want a folder capable of serious, all-day rides, contact Bike Friday and have them custom craft your dream machine. You'll pay handsomely for it, but we doubt you'll be disappointed.

One decision you'll have to make with many of these folders is whether to go with an internal geared hub or conventional gears with a derailleur. All internal hubs mean a weight penalty of an extra pound or two, but they keep greasy gears out of the way and can be shifted while you're standing still.

We weren't overly impressed with the Shimano internal 8- and 11-speed hubs on some of these bikes. They seem finicky with the setting for correct shifting, and multiple folds and unfolds seems to exacerbate the issue. Readjusting the shifting takes only a minute, but it's an annoyance. The 7-speed Shimannos and the Sturmey-Archer ran perfectly (although the Sturmey is rather noisy). Some bikes offer an option for a NuVinci continuously variable hub, which we've ridden and think is the smoothest, quietest internal hub there is.

And as comprehensive as we tried to be, several companies didn't reply or didn't have bikes available. Tern, Citizen, Vela, Origin 8, Giant and others also have compact folders. We hope some of the criteria here will inform your own research if you search further for the perfect portable bicycle. Let us know if you find another winner.

Fuel Update

(continued from page 10)

depends on cheap acetone to make the conversion economic. Assuming it can have its fuel certified long before the 11-year timeline, would Swift propose to market it right away to compete with 100LL?

Ziulkowski told us it would and that he believes Swift fuel can be sold at competitive prices and perhaps cheaper than avgas.

"Can we do it in three to five years? I think we have to," says Ziulkowski. "We've never had as much involvement from the oil companies as we've had in the last six months. I think this is because of the ARC. And we always said we intended Swift to be an alternative fuel, not just a replacement for leaded avgas."

GAMI

General Aviation Modifications Inc. continues its testing work on its G100 unleaded fuel. G100 is a hydrocarbon-based fuel with high aromatic content, either xylenes or mesitylene, as Swift uses as its primary component.

GAMI's George Braly told us the company has settled on a formula suitable for testing and it's pursuing an ASTM approval. However, the centerpiece of its fuel efforts has been obtaining a wide approval under an STC, which the FAA seems to have delayed at every turn.

Assuming it gets through the gating standard, GAMI can begin formal testing through the FAA's Hughes Technical Center, although it has already done much of the testing the fuel is likely to be required to

pass. GAMI is currently expanding its materials compatibility testing, as is Swift, since there are concerns that high aromatic content fuels can adversely affect seals and gaskets.

GAMI is also exploring production options with refineries to produce larger volumes of the fuel for testing and to prove its economics.

ASL

Aviation Specialties and Lubricants also has a fuel project underway, but unlike the others, ASL's product would be a chemical additive blended into a conventional high-octane aviation alkylate. Essentially, it would be a drop-in replacement for tetraethyl lead and would deliver about the same if not more octane, says ASL's Ed Kollin, a veteran petroleum chemist who also developed the CamGuard engine additive.

Kollin told us he is continuing to refine and test potential additives and that octane results look promising. ASL has no stated timeline for submitting a fuel for approval, according to Kollin.

91UL

Although not a replacement for 100LL, the French oil company Total has begun marketing a new aviation fuel in Europe called 91UL. It's essentially 100LL without the lead made under a standard that was a rush job by ASTM in response to the military drone market. Drones continue to be dominated by piston engines, a large number of which are Rotax 912s. Although Rotax engines can burn leaded fuel, they don't need the high octane and running on unleaded fuel reduces the maintenance load.

Total is selling 91UL at about a

FEEDBACK WANTED

PRE-201 MOONEYS



For the October 2012 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the pre-201 Mooney series—the M20C, E and F. We want to know what it's like to own these retractables, 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. Photos should be medium or high resolution. We can't publish low-resolution photos.

We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the Mooneys by August 1, 2012, to:

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e-mail at:
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dozen locations in Europe, but we're not sure if they can or will expand the distribution. It sells for a price between mogas and 100LL and its deployment is widely seen as an effort to push mogas out of the market.

Lycoming cooperated with Total in the rollout and although Lycoming has recently expanded its list of engines approved for low-octane fuel, it has publically stated that mogas isn't what it has in mind, but an aviation-spec'd fuel, which 91UL is.

Kraft says deployment of 91UL in Europe is "a fantastic mechanism" to serve as a template for 100-octane deployment in the U.S. because it's being done with no additional engine or airframe-specific EASA approval, nor does it require STCs.