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The Aviation Consumer®

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The Aviation Consumer

EDITOR
Paul Bertorelli

MANAGING EDITOR
Jeff Van West

CONTRIBUTING EDITORS
Jeb Burnside
Jonathan Doolittle
Rick Durden
Larry Anglisano

SUBSCRIPTION DEPARTMENT
P.O. Box 420235
Palm Coast, FL 34142-0235
800-829-9081
www.aviationconsumer.com/cs

FOR CANADA
Subscription Services
Box 7820 STN Main
London, ON 5W1
Canada

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The High Cost of LSAs

I just got a call from a reader in New Jersey who sold his Baron—lucky guy—and wants to step down into an LSA to finish out his flying career. "When you get these things all tricked out with glass," he said, "they cost $170,000." That happens to be a significantly larger piece of change than he got for his Baron.

Is this right? Or more to the point, do these kinds of prices make for a sustainable LSA industry with dozens of players? The short answer, I think, is no. Let me rephrase that: Prices like that won't sustain the large number of LSA manufacturers now in the market, but my view is that nothing will.

At the U.S. Sport Aviation Expo in Sebring in January, we heard manufacturers report on how they struggled to get through 2009. I'm not seeing the market forces that will change that. Yet. So the current economy will hasten what most in the industry expect: An inevitable shakeout that reduces the number of players in the field. While I hate to see any company fail, I'd much rather see four or five vibrant manufacturers and a little less choice than a dozen struggling ones providing a wider range of models.

While I'm confident the LSA market will continue to expand incrementally, it will never be large enough to support dozens of models. (There are currently more than 70.) One trend in LSA—although not the only trend—is high-end glass with synthetic vision. Dynon's new Skyview product was on display at Sebring in a Flight Design CTLS. Invoice for the package: $159,000. At $13,095 for the glass upgrade alone, it's actually a good value, given that the capability rivals certified glass costing five times as much. But is it right for an LSA? That depends on what you want out of an LSA and what you plan to do with it.

I recently bought a quarter share of Piper J-3 Cub, a pre-1940 version. Its panel is resplendent with an airspeed indicator, an altimeter and an oil pressure gauge. I'm thrilled with that because my idea of a good day is to cruise down the beach at 500 feet with the door open, using what's left of my real vision, not the synthetic kind.

For a cross country, I'll get back to a freshly printed sectional—remember them?—and maybe a portable GPS. On the hand, if you've got no time schedule to keep, it's perfectly practical to fly long trips in LSAs. Just don't get in a hurry. For that, maybe you want glass. Or maybe you don't. In my view, for a long trip, 100 knots at 500 feet looking at the passing scenery is far preferable to 8000 feet looking at someone's electronic rendering of the same reality.

If you're not in the clouds, what's the point of glass? So do enough buyers share my admittedly simplistic view of LSA flight to shape the market? Frankly, we're about to find out.

As Tecnam, American Legend, Flight Design, Remos and others trend toward the higher end of the market, they'll learn what will sell and what won't. They have to sustain their business plans, not me. It's common knowledge that the more expensive an aircraft is, the larger the margin for the seller.

And that leads to this observation: Let's not deny these companies the notion that they should make a profit or entertain the idea that they should operate break even just to carry on the glory and passion of flight. To do that is to invite a universe of barely viable companies that build marginal products supported by people who don't or can't even answer the phone.

So when I see a well-built LSA like a Legend Cub, for example, with a price tag in the mid-120s, reasonably equipped, my reaction is to think that's about right. I'm less interested in the higher end all-glass models because they don't meet my current philosophical tilt of what LSA represents. If some buyers feel differently, good for them. That's why we have markets that offer choices.

—Paul Bertorelli

Econ 101

As a retired professor of economics, I can't resist adding to your article on product support in the March 2010 issue. First, all of us realize that producers are in business to make money. Period. No matter how much we might like to believe their warm and fuzzy marketing pieces, without profits, they leave. The fundamental accounting equations: Total revenue minus total cost equals profit. Repairs and support are costs for any producer.

Second, we live in a changing world. What once was a nicety, is now a necessity. What once took a generation to exhibit change, is now changed regularly. So what we once thought of as a "capital" item is now more like a "consumable" item.

SAVVY OWNERSHIP

Product Support: There's a Limit

Should we be steamed when companies stop supporting our 20-year-old headsets and radios? Yes, but to expect anything different is unrealistic.

by Joseph E. (Jeb) Burnside

The term "product support" means different things to different people. For example, someone in the market to buy a new aircraft may worry about whether the local FBO has personnel trained to maintain it. Meanwhile, a renter pilot buying a new headset wonders what will happen if an earcup cracks five years from now. Both pilots may also be in the market for a handheld GPS. Will database updates for it still be available in a few years?

Perhaps because of the relatively high prices we pay for these and other products, there's often the expectation of manufacturers supporting them forever. And keppesen should continue offering custom database updates long after the memory space required outstrips that available in the hardware. Good luck with both. So, how long can we expect to receive a manufacturer's support for their products? What factors into a manufacturer's decision to discontinue support of a product? Are our expectations unrealistic? If so, why?

OBSOLESCENT MOUSE TRAPS

In the bargain of always pressing for better technology, we also have to accept some obsolescence. Put another way, better mousetraps come along. The problem that many aircraft owners and operators can't get their heads around is that the old stuff still does the job for which it was purchased, so the idea of junking a navcomm because of a failed circuit board—even if that board may be 30 years old—doesn't seem rational when the airplane it's in is 50-something years old. After all, parts for the airplane are still available, why not the radio? Upcoming supports engines they made in the 1960s.

With electronics, however, it's different. A poster-child example is the wildly popular-in-its-day Northstar M3 Approach GPS navigator. First available in 1996, production of the M3 Approach was discontinued long ago. But it was only last year when then-current parent company, CMC Electronics, ended support and the M3 became a doorstop.

CHECKLIST

- Technical advances make new products better with more capabilities, but...
- ...new capabilities mean existing parts become obsolete and too expensive to replace.
- Exceptions abound, but most aviation companies support products well into obsolescence.
- Yes, it sucks that you can't get parts for your 50-year-old Omnigator.

CMC said in a March, 2008, notice that it "evaluated several technical alternatives to extend the life of the product and...determined there were no cost-effective solutions." Solutions to what? Trying to squeeze 10 pounds of aeronautical data into a five-pound sack, that's what.

Another example is Garmin International's well-regarded GPSmap 396. This portable navigator, introduced in 2005, was the first such product to feature a color screen and datalinked weather information, including near-real-time NEXRAD weather radar imagery. Late in 2009—early November, to be exact—the company stopped producing and selling new 396s. Why?

According to Garmin spokesperson Jessica Myers, the company's decision to discontinue any product—portable or panel-mounted—"may include...parts availability, the introduction of new products that supersedes an existing product, and/or a decrease in overall sales volume that no longer supports continued production."

A classic example of a spiral into unsupportable obsolescence is the once-popular Northstar M3. The company never followed up with improved products and the unit died a slow death. Garmin did follow up the GPSmap 195, upper photo, but color maps at affordable prices pushed it off the support desk.

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The world of 2010 is different. We have accelerated the introduction of technology. What has not changed is the way we as humans look at products. We expect that if we can hold it and it doesn't melt, then it must be a capital item. And we assume capital items can be repaired endlessly like the compass.

In the case of electronics, I would suggest that we should not view these items as capital, but rather as consumables. We can then reasonably calculate the amount of time that this will be with us and useful. Divide the price by months of use and you have a better framework for deciding whether to stick it in the panel or on the yoke, or skip it all together.

Interestingly, what causes some problems is that those of us who fly 1940s and 1950s aircraft have our minds set with respect to product evaluation in about the same time frame as the introduction of our airplanes. A 100-channel radio probably was good for 25 years. Then we went to 200 channels, and on to 360 and 720s. I daresay that I don't value any communications products beyond 48 months. And I can't tell you it is my choice, but just the way the world goes.

What has changed is the technology. What has not changed is the way those of us who use it view the technology. So the older I get, the more I realize technology will change the world. And it will happen even without my permission.

Bill Massey
Corning, California

Fuzzy Math

I was drawn to the Commander 112/114 review article in the December 2009 issue as I've been a fan of the model for some time, though I've never flown one. I'd heard the mantra of "too slow and not enough load" many times, but had not investigated the numbers.

I need some help with the "fuzzy math" in the article. The model history chart indicates a 114 has a useful load of 1153 pounds. Minus the fuel of approximately 410 pounds, the payload is a respectable 745 pounds. Clouding the math further, the article mentions on page 27 that the payload of a 114 checks in at 950 pounds.

Considering my Cirrus SR22 carries 81 gallons useable fuel and has a useful load of 1100 pounds, leaving 614 pounds for people and gear, the payload of the 114 is downright envious! What's missing here is the max gross, which is not mentioned on page 27.

Did I forget to carry a one in my calculations, or are the terms "payload" and "useful load" mixed up? Thanks for all the work your staff does to provide pilots valuable aviation information month after month.

Chris F.
McLean, Virginia

One problem in reporting on the Commander line is that there are six different model variations, each with a different empty and gross weight. According to the Aircraft Bluebook Digest, the largest load hauler is the 114A with an empty weight of 2070 pounds against a gross of 3260 pounds for a useful load of 1190 pounds.

Fill it with fuel and you can haul 782 pounds. (The straight 114 has a 1235-pound useful load, according to the Bluebook listing.) Real world numbers vary from the Bluebook, but that's the general range.

A Vote for the Factory

Usually your writers cover most aspects of various options or points in your articles but in the "Top Overhaul Shops" in the March 2010 issue, it's obvious that Jeff Van West does not fly an airplane for business purposes. Your conclusion on page 13 states that the rebuild shop is a better option than a factory engine. Not if your airplane is flown for business around the country.

There are two major points you missed. First, an airplane is down a long time to remove and rebuild an engine. That time out of service can run from weeks to months. Not a smart business practice if flying the airplane produces revenue or is used for business travel. A factory engine (new or rebuilt) can be ordered, re-

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CONTACT US

Editorial Office
941-929-1693
E-mail: avconsumer@comcast.net

Subscription Department
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Palm Coast, FL 32142-0235
800-829-9081

Online Customer Service:
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Flight Design's CTLS series, above, is the LSA market leader, despite having doubled in price in five years, mostly due to a soft dollar.

LSA Price Trends: Just Too High?

Some would-be buyers say as much. But real buyers want tricked out cockpits and big-airplane options, thus the $120,000 LSA is about average.

by Paul Bertorelli

MARKET ANALYSIS

A brief query to the WABAC machine unearthed this gem on light sport aircraft from the *Aviation Consumer* archive: "Some think the combination of lighter, cheaper airframes and simpler pilot certification will yield a boom in private flying."

We think it's reasonable to say that almost everyone thought this, but if you now think the boom sounds more like a faint squeak, you aren't alone. The LSA groundswell has yet to form and judging by comments from our readers and video viewers, the cost of the airplanes has something to do with it. Maybe a lot to do with it.

"Why are LSAs so $%#@*! expensive," wrote one reader, after we reviewed the American Legend Cub on amphib floats (retail: $159,000) for our April 2010 issue. It's a fair question and one that's not too difficult to answer with two observations: One, they aren't that expensive when compared to larger certified aircraft and, two, although the industry never said as much, the notion of the $40,000 LSA somehow became embedded in the consciousness of some buyers and continues to form the cost/value perception for many would-be LSA customers.

To this, we would add a third market reality: The top five LSA sellers—Flight Design, American Legend, Tecnam, Remos and CubCrafters are not down-market offerings. Typical prices are north of $125,000 and some are well above that. This proves what aircraft manufacturers and BMW dealers have known for years: the cheap seats aren't big sellers.

THE STATE OF PLAY

In phoning sources in the industry, we conclude that no one really had a sense of how fast the LSA market would grow, which may be a good thing, given that it hasn't exactly exploded. On the other hand, it hasn't done so badly, either, especially in the context of a terrible economy.

As of March 2010, about 1750 LSAs have been sold in the U.S., basically since about 2005 when

the LSA rule was finalized. During the same period, U.S. manufacturers delivered about 10,700 piston aircraft, so LSA represents about 17 percent of additional market for piston GA. That may not be revolutionary, but it's more than credible, in our view. On the pilot certification side, market penetration is less impressive. About 2000 sport pilot certificates have been issued, according to the FAA, a little over 3 percent of the 580,000 U.S. airman file.

What's not obvious from those numbers is the impact LSA has had on retaining older pilots. Many so-called "full-circle" pilots are selling their standard category airplanes and getting into LSA flying as a hedge against losing their medicals. These pilots tend to be affluent and can afford to buy LSAs priced at $100,000 or more. But the savvy players in the industry realize they represent a bubble, not a sustainable market.

"We see a continuing number of older pilots worrying about their medicals and buying LSAs as a result," says Tecnam North America's Phil Solomon. "But that's not where the explosive growth will be. It will come from getting airplanes back into airports where there aren't any now."

IS PRICE THE THING?

Tecnam's angle on this is somewhat unique, since it's pushing hard to broaden LSA into the training market to build the next new wave of pilots. But to succeed, won't we need a fleet of $40,000 LSAs to make it all affordable?

"There's an answer to that," Solomon adds. "It's called an ultralight." Of course, mainstream training of LSA pilots in ultralights is a non-starter, but true LSAs are gaining traction in the training market, high perceived costs or not. Solomon says potential buyers are doing what they always do: fixating on purchase costs instead of operating costs and margins. He argues that an owner or flight school with a newish Cessna 172 for training can expect the airplane to bill for at least $130 per hour wet, with maybe $16 finally going to the owner after expenses. A new LSA, on the other hand, can bill at $120 an hour and deliver more than double the margin back to the owner. Profit for the owner or flight school, says Solomon, is more fundamental to getting airplanes back into the system (and into moribund airports) than actual purchase price.

CubCrafters' Jim Richmond: "I don't know who told the public that light sport airplanes were going to be cheap, although I know that happened."

But an owner on the market for his own LSA won't buy that. He'll look at the tall price tag and make a snap judgment on price/value. But where does that price signal come from? Are the perceptions just wrong?

WHO SAID CHEAP?

"I don't know who told the public that light sport airplanes were going to be cheap, although I know that happened," says Jim Richmond of CubCrafters. His company unapologetically plies the upper end of the market with designs like the hot-rod Carbon Cub SS typically selling for $180,000 and nearer to $200,000 if tricked out to the max. Despite upper tier pricing, CubCrafters remains in the top five of companies selling LSAs in a hyper competitive market.

Then again, cheap is relative. EAA's Earl Lawrence, who was intimately involved in the early development of LSA rules and the ASTM International standard that governs their manufacture, argues that the industry has delivered on inexpensive airplanes.

"Really, the LSA rule cut costs in half," says Lawrence, noting that a new basic Cessna 172 costs $270,000 and a new Skycatcher—and a number of comparable LSAs—are half that. The point, he argues, is access to the activity of flying on an affordable basis, not how fast the airplane will go or how much it will carry for how many dollars.

We heard this several times: What some legacy buyers don't get is that

Phil Solomon of Tecnam North America: Cheap LSAs? "There's an answer to that," Solomon adds. "It's called an ultralight."

TALE OF TWO CUBS

At least 15 percent of the new LSA market consists of Cub clones, aircraft based loosely—really not *that* loosely—on Piper's Super Cub. American Legend's Cub is thus a good point of departure for a price comparison with what went before. Although based on the Super Cub, the Legend is substantially improved and modernized, while still retaining the Cub aura. The cabin is 3 inches wider and has two doors instead of one and the wing and spar carry-through structure have been substantially strengthened.

How does the cost compare? We think the fairest comparison is to run the Super Cub's original 1950 price through an inflation calculator. According to the Bluebook Price Digest, the 115-HP Super Cub retailed for about $4000 or $35,000 in 2010 money. Looking at the same comparison between Piper's last Super Cub in 1994 with a 150-HP Lycoming (retail $97,756) yields a 2010 price of $139,000—a bit more than the current average Legend prices. The 1994 Super Cub had more power, but the panel was crude by modern standards and Legend's airframe is stronger and better protected against corrosion.

1979 SUPER CUB


AMERICAN LEGEND CUB

We think this analysis reveals several things. First, by the mid-1990s, Piper was already experiencing the phenomenon of aircraft product costs outstripping inflation. Second, the fact that Legend's price hasn't risen much higher suggests that the company has found some production economies—it has—and that perhaps the ASTM approval process doesn't save as much money as it was originally thought it might.

We checked with Legend's Darin Hart for his view on production costs. By his estimates, the original Cub required 1100 hours to build, a number Legend has trimmed to about 800 hours through CNC machining and other tricks. But a rag-and-tube airplane is still labor intensive and Hart estimates that it costs $800 to $1000 an hour just to keep the factory open.

He says there are some economies to be had by mass buying and larger volume. But these are incremental reductions, not major ones. "It takes about $35,000 in labor to build one of these airplanes. There's really no way to get it much cheaper," says Hart.

Nonetheless, as we go to press in early April, Legend is considering introducing a basic Cub-type airplane for about $89,000, although no final decision had been made. Like the other top LSA manufacturers, Legend has done better at the other end of the market, above $100,000.

LSA was and is intended to prop up the market with an affordable buy-in of new products, not blazing performance. It was, and is, more about access, less about practical travel.

And that explains in part why the industry pushed back against expanding the 1320-pound weight limit to include more legacy designs. "We specifically excluded some of the heavier legacy airplanes because we wanted to encourage the development of new airplanes and new products," Lawrence told us. And anyway, he adds, new LSAs will become used aircraft soon enough and will thus become affordable for owners who don't want or can't afford a $100,000-plus LSA.

Yet to be seen is how fast used LSA prices tumble. While older pilots buying into both new and LSA-compliant legacy airframes are an above-ground trend, we're not sure the trend is well-established enough to prop up prices much. Some legacy aircraft such as the Aeronca Champion, the Ercoupe and Taylorcraft remain good buys.

PRICE PRESSURE

So why aren't we seeing the $40,000 or $60,000 LSA? Actually, we are. Long-time kit maker RANS offers the S-6 LSA in this price range. But American Legend has sold five times as many airplanes at twice the price, further reinforcing the notion that buyers respond more to top-tier pricing than they'll admit to.

To understand why most LSAs are above $90,000 and some are a lot above that, you have only to examine Cessna's experience with the Skycatcher. The company's Bob Stangarone told us that when it entered the market, Cessna did what it always does: intense, detailed market research. Whether LSA or certified, we doubt if anyone has as good a grasp of market realities for piston airplanes as Cessna does.

Based on that work, Stangarone said, Cessna's goal for the Skycatcher was $100,000. "Price has always been a key objective for us. We knew the market would be there if the price was right," he says. Cessna didn't quite make the price goal, given that the Skycatcher base price is $112,250, but the typically equipped model will sell for about $120,000.

Cessna's experience tests the notion that the market self-limits above $100,000. As we go to press in early April 2010, Cessna has more than 1000 firm orders for the Skycatcher, which itself represents nearly 40 percent of the current market.

Stangarone is blunt about the price point. "We got into LSA to encourage new pilot starts and to feed Cessna brand loyalty," he says. "But we told our parent, Textron, that the airplane would be profitable." And to fulfill that promise, Cessna took Skycatcher manufacturing to China, the only company in the LSA segment to do so. (Seven of the top 10 LSA sellers in the U.S. are manufactured offshore, some in Eastern Europe and the former Soviet bloc, where there's plenty of manufacturing capacity and downward pressure on costs and wages.)

That turns out to be a mixed blessing, however, as Tom Peghiny of

continued on page 8

ASTM: WORKING, BUT SOME WORRIES

One reason LSAs were supposed to be less expensive is that they would require little ongoing FAA oversight to certify and build. LSAs are built under the so-called industry-consensus guidelines developed with ASTM International.

Five years into the deal, has the plan worked? Generally it has, but not everyone we talked to agrees that ASTM oversight has been the slam-dunk winner everyone thought it would be. There are some concerns about the airplanes actually being ASTM compliant and a recent FAA assessment found issues with the paper trail manufacturers are supposed to maintain. A series of accidents involving Zenith Aircraft sent a brief chill through the industry, but appear to have had no lasting effect.

The notion that ASTM airplanes would be quicker to design and certify is a misnomer, according to CubCrafters' Jim Richmond. "We spend almost as much certifying a Part 23 airplane as we do an LSA. As far as the tests go, we did all the same tests for the Sport Cub, but without the FAA oversight." Cessna did the same with Skycatcher. In fact, its test program for the 162 resembled a full-up FAR 23 program.

"When we flight tested, we wanted every corner of the envelope covered because we assumed the student pilot would get it there," says Cessna's Bob Stangarone. Such testing is expensive in both dollars and potential bad PR. Cessna had two crashes for Skycatchers due to unrecoverable spins that we doubt many—if any—of the other manufacturers have tested at all. Cessna made some design changes, but a few readers have asked if the airplane is spin prone. (We don't think it is and that its recovery characteristics are normal, given Cessna's design changes.)

So where are the savings? Mainly in not having to hire expensive DERs and contractors to check the FAA's boxes. Further, not having to pursue a production type certificate unburdens companies of layers of paperwork and regulation. Most important is that ASTM was intended to be and is seen as a living document.

In that sense, ASTM is "absolutely working as advertised," says Flight Design's Tom Peghiny. When changes in certification rules or standards are needed, the ASTM committee meets, listens to everyone in the industry with a stake and makes a decision—quickly. Everyone we spoke to said if there's a leading reason to like ASTM, responsiveness is it.

But just as many people we spoke to said they had concerns that six accidents involving flutter-induced structural breakups of Zenith Zodiac aircraft—variants of which are available as LSAs—would cause the FAA to reconsider allowing manufacturers to have a mostly free hand in building and certifying their own aircraft. EAA's Earl Lawrence told us there's always a worry that the FAA and/or NTSB would overreact in such a case. Thus far, the FAA hasn't appeared to, but we think the NTSB definitely did. Either way, Zenith stepped up and engineered a fix for the aircraft that includes an extensive kit for beefing up the wing.

As the Zenith problem was being tamped down, the FAA was completing a limited assessment of how well companies are living up to the ASTM-required documentation which works in lieu of a formal production certificate. The results caused a bit of a stir in the industry.

"Some of the companies the FAA looked at had the impression that they were the best ones looked at," says Dan Johnson, a board member of Light Aircraft Manufacturers Association. When the FAA issued its report, however, it found a laundry list of shortcomings mostly related to documentation and procedures. Critically, neither the FAA nor LAMA has done auditing to determine if aircraft meet ASTM guidelines for flight qualities. LAMA offers an in-depth audit for its members for a modest fee, but it doesn't do flight testing. Johnson says the FAA effort interfered with LAMA's audits because companies believed they'd been inspected once and didn't need another. Significantly, the FAA visited U.S. factories, but not offshore companies that export into the U.S.

The FAA's findings included lack of proper documentation, poor record keeping on calibration of instruments and weak quality control systems. Neither Johnson nor EAA's Earl Lawrence appear to be alarmed by the FAA's findings.

"This is only a five-year-old rule. There certainly has been some noncompliance," says Johnson. "It's just that everybody had to figure out some things along the way." Meanwhile, LAMA has done its full audit of 12 of the top 20 companies and has more audits on the calendar. Thus far, there's no widespread indication that industry self-monitoring isn't working and if safety or high accident rates are an issue, we haven't seen any evidence suggesting it.

Flight Design's Tom Peghiny, right: "ASTM is absolutely working as advertised."

Buyers have signaled that they want inexpensive, basic airplanes. But they actually buy fully tricked out, glass panel versions, such as the CTLS, top, and the CarbonCub, lower.

Flight Design USA pointed out. With its German-designed CTLS series, Flight Design has more than 300 airframes flying in the U.S., the single largest market share. But it has been absolutely hammered by currency exchange rates.

When Flight Design first introduced the original CT2K, the no-options price was $65,000 at a time when the Euro was at parity with the dollar. Eight years later, the Euro has been as high as 1.6 to the dollar and now hovers around 1.4. Further, stripped down steam-gauge airplanes are passé—glass is the thing.

As a result, Flight Design prices have more than doubled in six years. At the Sebring U.S. Sport Aviation Expo, Flight Design introduced a new version of the CTLS with Dynon's new synthetic vision Skyview. Price: $159,000. That's nearly two-and-a-half times the original asking price, but it's also a far more sophisticated airplane.

With the exchange rate working in their favor, you'd think that U.S. manufacturers would have a competitive advantage in selling in Europe. That isn't the case, unfortunately. The European Union has yet to approve U.S.-equivalent LSA rules so, for the moment, LSA activity is a one-way street running out of Europe into the U.S., the strong Euro notwithstanding.

Another price pressure point for U.S. manufacturers is competitive labor rates, Despite a slow economy, it costs more to build an airplane in the U.S. than elsewhere and the lower the selling price, the less the margin. Airplanes from CubCrafters and American Legend are still largely hand built, although some automation can be applied.

"The people with those skills can work for Boeing or they can work for CubCrafters. Either way, it's going to cost the same to pay them," says CubCrafters' Jim Richmond.

Like every other company, CubCrafters has tried to sharpen the pencil and build an airplane to sell for under $100,000. American Legend will be trying that again this year. But there are two problems with this: One, the margins on these airplanes are razor thin and, two, they haven't proven to sell any better and may sell a little worse than more expensive airplanes. Richmond told us CubCrafters' sub-$100,000 airplane project was short-lived. "We tried. But it became apparent to me and I told the staff that we were committing suicide at that price," Richmond says.

SUSTAINABILITY

Richmond's comment frames a daunting challenge for those trying to make it in the LSA market and that is getting the price/volume/margin relationship right. This isn't necessarily easy to do on large-volume manufactured products like cars and computers. It's orders of magnitude more difficult in airplane making where regulation, harsh market vagaries and where small volume magnifies unit cost variables.

In manufacturing, it is often assumed that if the price is lowered enough, the market hits an inflection point and both sales and profits increase thanks to the magic of economy of scale. Call it one finger on the invisible hand.

But if this works in the thousands and hundreds of thousands of units, it clearly doesn't help much in the hundreds (or less) of units that apply to the world of LSA.

"We're not seeing that kind of behavior in this market," says Earl Lawrence. "You don't sell any more aircraft at $60,000 than at $120,000. That wouldn't indicate a market break," he says. With more than a thousand airplanes in the order book, Cessna would be the test case for this, obviously.

"We know that some people think LSA prices ought to be $60,000 or $70,000. That's an unrealistic expectation. We never thought we could hold prices that low," says Bob Stangarone. And Cessna has something none of the other LSA makers do: A well-established support network into which the Skycatcher can seamlessly flow. The other manufacturers have to rely on either a thinner dealer support network or factory direct support. Either way, the prices have to have enough margin to pay for that support and, based on our research, current LSA prices barely do that.

Conclusion: We think there will always be a handful of sub-$100,000 new LSAs, but these will be the most basic airframes and anyone making them will either have to have other more profitable products in their line or a trust fund to pay the phone bill and keep the lights on in the parts department.

Adding up the component costs of a well-equipped LSA, it's difficult to see how one can be sold for under about $120,000. We predict that for the short-term, the median price for new LSAs will remain in the mid-$120,000 to $135,000 range for those companies that hope to survive. As much as we wish it were lower, to expect this is simply delusional.

Belly Degreasers: Arrow-Magnolia, Simple Green

All the products we tried get the job done. But we prefer the milder soap-type products over aggressive chemical solvents. Belly grease just isn't that hard to remove.

by Paul Bertorelli

The underside of an airplane is out of sight and thus usually out of mind until the owner peeks downstairs to check something. And there, in all its filthy resplendence, is a flying Super Fund site. How to clean it up?

To find out, we recently tested a crate full of commercial cleaners designed if not specifically for this task, then for general degreasing and clean-up. Lasering right to the findings, all of them work, some are better than others, but the overarching consideration is to have a strategy to get this messy job done just frequently enough to keep the airplane clean without getting obsessive about it.

WHY DO IT?

The reasons for doing this go beyond the cosmetic. Greasy dirt can conceal things you'd like to see, like loose fasteners, degrading paint or cracks. The larger issue is belly-mounted transponder and DME antennas, which don't work well—and sometimes not at all—with a slathering of dirty oil. So, what are we looking for in a degreaser? Something that allows doing the job quickly, easily and without having to slide under the airplane with a creeper much, if at all. Preferably, the product should be just aggressive enough to get the filth off, but not so harsh as to soften the paint. (Some of these degreasers will do that.)

Where possible, we would prefer to avoid having to wear protective equipment for breathing, eyes and skin and, again, some of these cleaners require that. Generally, belly degreasing is going to happen outside, so ventilation isn't an issue. In a hangar, however, it could be.

Cost is not much of a driver here, but ease of application is. If whatever method you use to degrease is more of a hassle than it needs to be, you won't do it as often as you should.

With these criteria in mind, we bought 16 commercial products from Aircraft Spruce, which constitutes most but not all of what's on the market. Conceding there are other products that might be as good or better, feel free to contact us with your own suggestions.

CLEANER CLASSES

There are two ways to sort these cleaners—by chemical makeup or by packaging. In the chart on page 10, we sorted the cleaners into three categories—aerosols, spray bottles and mixed solutions, since these relate directly to one of our primary criteria: ease of use.

First, the aerosols. We bought seven varieties of these ranging in price from $5.80 to $24.95. At the expensive end, are LPS's Super Degreaser and CRC Super Degreaser.

PRODUCT	MATERIAL	PRICE	UNIT PRICE[1]	COMMENTS
AEROSOLS				
AVL NO CHLOR DEGREASER	NAPTHA SOLVENT	$5.80	$.41/OZ	Effective for light build-up, slow-acting. You'll need a lot of rags. Flammable and slight breathing hazard.
CRC SUPER DEGREASER	BROMOPROPANE, BUTANOL	$17.50	$.97/OZ	Powerful chemical solvent, flammable and best to use with breathing protection. Excellent for unpainted parts, less so for belly cleaning. Expensive.
LPS HDX DEGREASER	TRICHLOROETHYLENE	$8.50	$.44/OZ	Same as above, but cheaper. High HAZMAT and not the best for paints . Avoid plastic contact.
LPS PRESOLVE	NAPTHA SOLVENT	$13.85	$.92/OZ	Similar performance to AVL, but twice the price. Nothing special in this field.
LPS SUPER DEGREASER	BROMOPROPANE, PROPANOL	$24.95	$1.24/ OZ	Like CRC Super Degreaser, powerful solvent suitable for non-painted surface and tough degreasing. Expensive.
SIMPLE GREEN FOAMING	POLYETHYLENE GLYCOL, DERIVATIVES	$5.50	$.27/OZ	Non-toxic, but a mild eye irritant. Quite effective on even heavy build-up, but foam is messy. Cheap. Best pick in aerosols. Not specifically an aviation product.
TRI-FLOW CITRUS FOAMING	PROPANOL, BUTOXYETHANOL	$8.25	$.59/OZ	Not as aggressive as CRC. Foam nozzle needs work. Very narrow stream makes it difficult to apply.
SPRAY BOTTLES				
AERO COSMETICS WASH WAX ALL	NON-CAUSTIC SURFACTANTS, LUBRICANTS, WAX	$9.95	$.29/OZ	Relatively benign and works as claimed. Effective on heavy build-up, but you need lots of rags or paper towels.
ALL NATURAL NEVER DULL	SURFACTANTS AND NATURAL ENZYMES	$7.50	$.23/OZ	Same as above. Very green, effective and water soluble, but without the wax component.
PPC BELLY WASH	SURFACTANT, DETERGENTS	$10.85	$.54/OZ	Non-toxic and moderately effective, if somewhat slimy to work with. Nothing exceptional.
GREZ-OFF HEAVY DUTY	SODIUM METASILICATE, SODIUM GLUCONATE	$5.75	$.17/OZ	Cheapest of the lot. Works by combining with grease to form rinseable emulsion. Alkaline base makes it iffy for aluminum. There are better choices.
EXTREME SIMPLE GREEN AIRCRAFT	ETHER DERIVITIVES 2-BUTOOXYETHYNOL (DILUTE)	$10.65	$.33/OZ	Not the same stuff as the aerosol version, but the specialized aircraft formulation. Equally effective, but more expensive.
MIXED CLEANERS				
ARROW-MAGNOLIA CARBON-X	ETHYLENE GLYCOL, MONOBUTYL ETHER, SODIUM HYDROXIDE	$18.99	$.30/OZ[2]	Mixed 20 to 1 with water (or stronger) it's hands down the best value. Effective, benign and easy to use.
ARROW-MAGNOLIA MACH-1	ETHYLENE GLYCOL, MONOBUTYL ETHER, SODIUM HYDROXIDE	$21.70	$.34/OZ	Same mixing as Carbon-X and same performance. Can be used for entire aircraft. Ease of use makes it the top overall pick.
GUNK S-C DEGREASER	ALIPHATIC PETROLEUMS DISILLATES, ETHANOL	$6.75	$.21/OZ	Mixed with kerosene or Stoddard Solvent, this one is probably overkill for the typical belly. Excellent for engines and steel parts. Cheap, even when mixed.
JETSTREAM HYDRASOLVE	GEL-TYPE WATER-SOLUBLE DE-GREASER	$21.95	$.34/OZ	Mixed with water at 5 or 10 to 1, it performs like the Arrow-Magnolia products, making it a good choice. A gallon doesn't go quite as far.

NOTES ON TRIALS:
[1] Unit price is based on tested container volume. Some products are available in larger containers with commensurate price breaks.
[2] These prices are for unmixed solution. A typical wash job might require 10 to 20 ounces of cleaner to 3 to 4 gallons of water. Cleaners were tried on a Cessna 182 with a moderately grungy belly, following the manufacturers' instructions and using cotton shop towels for clean-up.

In addition to being expensive, these aggressive chemical solvents showed signs of going after the paint and, to be fair, they are really not suited for this job. The same is true of LPS's HDX, a trichloroethylene-based solvent. Best to use these sparingly and with both eye and breathing protection. We would spray a bit on a rag and degrease that way, rather than spraying the paint and removing the gunk and degreaser.

Two of the aerosols are naptha-based—AVL No Chlor and LPS Presolve. These aren't as aggressive as the others and also not as effective. You'll need a little elbow grease and lots of rags. Tri-Flow Citrus Foaming was in this group, too, although it's propanol, not naptha. The foam nozzle worked poorly on this product, in our view, so we saw nothing to recommend it.

Another foaming product is Simple Green Foaming. Although we considered this the best pick of the aerosols because it is effective, it's also messy. The foam quickly eats up the grease and plops down your arm like gooey lard. The material is polyethylene glycol and, compared to the others, is non-toxic. It's not specifically intended for aircraft.

Bottom line on the aerosols is that we don't like them much. They tend to be more expensive, the sprays are harder to control and if you don't stay to windward, you'll get a face full. There are better solutions.

SPRAY BOTTLES

We found five of these, all under $11, making them generally better values. The most expensive of these, PPC Belly Wash, is supposedly a dedicated product consisting of surfactant enhanced detergents. It's non-toxic, but somewhat slimy to work with. The spray head didn't work as well as Simple Green's did.

One of these products, Aero Cosmetics Wash Wax All, is designed to work with or without water and indeed it does. Spray it on, wipe it off and you're left with a clean, some-

CONTACTS

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

what slick surface. But it will take quite a few rags to do a full belly and you'll probably want a scrubbing rag and a removal rag.

Of this group, we liked Simple Green and Extreme Simple Green the best. We didn't notice that it was particularly more or less effective than the others, but the packaging was robust—important if you carry cleaners with you—and the bottle neck had a pistol shape, which nicely met our test for ease of application. At $10.65 , it's closer to the top of the price tier than the bottom.

Note that Crystal Simple Green is not intended for aircraft use, but we think it's fine for painted surfaces. If you're picky, get the Extreme Simple Green Precision Aircraft version.

MIXED SOLUTIONS

Which leads us to the mixed solutions meant for fleet wash applications, of which we tried three, plus Gunk SC Degreaser. And here lives the winning entry. Arrow-Magnolia makes a range of solution-type industrial detergents including the two we tried, Carbon X and Mach 1. These are sold in gallon jugs—or 55-gallon drums if you own an airline—and are mixed with water in up to a 20-to-1 ratio.

So the hot set-up here is carwash style. Mix up a bucket of suds and use a brush to scrub away the grime. Carbon X is supposed to be better for exhaust stains, but we thought both products were about equally effective. The key advantage is that with a long-handled brush, you can do most of the degreasing at a distance, without the creeper bath. These products were just effective enough to remove the grease, without being too harsh.

Another product we tried was Jetstream's Hydrasolve, a gel-type water soluble product also meant for mixing with water. It works about like the Arrow-Magnolia products, but can't be cut as much with water.

The Gunk SC is an aliphatic petroleum product intended for mixing with other solvents, such as Stoddards or naptha. It's overkill and a little impractical for belly work, but good for parts and engine cleaning.

BOTTOM LINE

We picked the Arrow-Magnolia washes as the best overall choice because while you're degreasing, you can use the same stuff to wash the rest of the airplane. One job, one day...done.

Foaming-type cleaners like Simple Green Crystal, right, are effective, but messy. Mixed-solution cleaners, lower, are easy to use and cost effective.

But here's the thing: The brush wash will miss stuff, like areas around antennas or around skin laps. So that means you'll need to go back and spot clean the leftover grime. For this, any of the spray bottle cleaners will be fine. Our first pick is Simple Green, but PPC Belly Wash or All Natural Never Dull are good performers, too.

If you're unhealthily obsessive about belly cleaning while traveling, we would go with Wash Wax All and some durable fiber towels that can be discarded after use. It does a good job without water, even if the applicator bottle leaves something to be desired. Finally, a word about composite aircraft.

Diamond and Cirrus both say any cleaning product suitable for metal that doesn't attack the paint is acceptable for composite surfaces. Cirrus cautions against using cleaner containing silicone, which none of the products we tried do.

HOW SIMPLE GREEN GOT AIRCRAFT FRIENDLY

About 13 years ago, just as the World Wide Web was becoming noticeable—yeah, it's been that long—quite a little storm brewed up over Simple Green. It had become popular among owners as a degreaser.

Then it was revealed that Simple Green didn't meet the U.S. military's Mil-Spec requirements and, according to both the Air Force and Army, the stuff was actually corrosive to aluminum and caused hydrogen embrittlement.

At the time, we soaked a sample aluminum coupon in Simple Green and never noticed any effects. (We didn't test for embrittlement.) In any case, on painted surfaces, the stuff never sees bare metal. Sunshine Makers, the manufacturer of Simple Green, reformulated the product and it now meets Boeing and Pratt & Whitney corrosion specs, although it's only partially MIl-Spec compliant.

If you're really worried about cleaner getting into the skin laps and trashing your airplane, stick with the Extreme Simple Green version.

Avidyne EX600: A Great MFD Gets Better

Avidyne reasserts itself with an upgrade to its popular EX500. The big brothers offers a larger, but dimmer, screen and some much-needed features.

by Larry Anglisano

It's interesting to watch brilliantly engineered avionics grow stale. Two years is middle aged for panel gizmos and four years is geriatric. Avidyne's popular and feature-rich EX500 is trickle-down technology from the grander EX5000 Entegra MFD. Pilots now demanded more from an MFD than EX500 can offer.

Avidyne's answer is the EX600. Call it an EX500 on steroids if you want, but we call it a much-needed improvement and a lease on life, perhaps for a year or two. Upgrade pricing from an EX500 is fair, but buying a new EX600 is pricey and installation could be a challenge in tight radio stacks as the bigger EX600 demands more vertical space. Here's a closer look.

PURSUING THE PERFECT MFD

The EX600 is big but not huge. It stands 4.93 inches high and fits the standard 6.24-inch rack-width. Weighing 4.75 pounds and fairly deep at 11 inches, the box feels substantial and sturdy. There's a lot of display area at 5.8 inches diagonal.

Let's get this out of the way: From our evaluation, the new display—that sports 25 percent more viewable area than the smaller EX500—is actually dimmer (or at least appears dimmer) than the EX500. Brightness is controlled with a single brightness button on the bezel. There's also a soft key for putting the display in day or night mode with a single button push. Bezel keys are wired to the aircrafts avionics dimming system.

When we griped to Avidyne engineers about our display findings (the test unit was actually installed in a customer aircraft after upgrading from an EX500 and isn't viewable while he wears his sunglasses). They told us the newly designed transflective display could appear dimmer than some other displays that are collocated in the same area in the panel even though it is designed for better sunlight readability.

Another engineer went on to explain that transflective displays work exceptionally well in both low- and high-lighting conditions but appears dim in certain overcast and cloudy conditions. Still, we noted a substantial difference when we flew the EX600 driven by a Garmin GNS 430W (a display that isn't the brightest either). After focusing on the EX600 for an hour in flight, we jumped in an airplane that had the smaller EX500 and it appeared considerably brighter. Avidyne is dealing with this anomaly head-on and further evaluating our findings in hopes of providing a solution.

We feel the on-screen text for the EX600 is uncomfortably small. It keeps eyes on the display for too long when they should be outside or on the instruments. We wish the EX600s traffic tags, for example, were bigger. The same holds true for textual weather.

Another nit of ours is the Avidyne's requirement for 28 volts. It's easy in electrical buses that are 28 volts from the get-go but tough if 14-volt systems where a voltage con-

CHECKLIST

- ⊕ Easy to use both in operating logic and physical button structure
- ⊕ Connects to a wide range of GPS navigators, peripheral devices and radar systems.
- ~ Bigger display, but small text and brightness may be an issue.

The EX600 adds some sorely needed improvements in the ability to pan and zoom easily on the main map screen.

verter is required. These beefy power supplies are power hungry and we've seen more than one stress a marginal electrical system. A power supply also means there is another remote box to install, with the associated hassle and expense.

SAME EASE OF USE

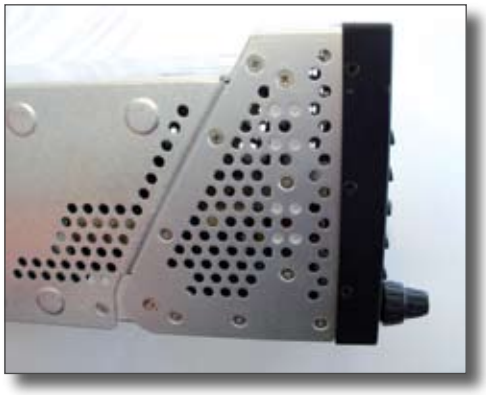
Avidyne sets the standard for ease of use, in our estimation and the EX600 retains the EX500's user-friendly operating logic. On-screen data boxes are straight-forward. Intuitive menus on the lower portion of the screen are accessed by rotating the right rotary knob to scroll through main menu pages. From there, soft keys lead the way. Map decluttering is a snap with a soft key dedicated to customizing topography. When you need to scroll across many miles of that topography to eyeball weather and airspace (which is always), Avidyne finally delivers with a smart map panning feature called QuickPan. Panning is commanded by rugged and nicely lighted rocker-like keys on the bezel.

We found the pan feature a welcome addition but also found that large jumps in panning distance were slow. For instance, we were airborne over Hartford and repeatedly pounded the left pan button westbound—out to the Lakes region—to look at an active NEXRAD picture. Either we were impatient or the box ran slower than we expected. We like the single button press that takes you back to present position. You can quickly toggle between present and pan position with a single button push and you can zoom in when in pan mode to study weather and airspace detail.

Geo-referenced charting is through the familiar Avidyne cMax on its own "Charts"page. This offeres Jeppesen Electronic Airway Manual charts and airport diagrams. Once on the Chart page, it's reasonably easy to pan around the chart, zoom in or out of the chart or view particular areas. We were grabbing the right control knobs to command the charts, resulting in a menu-structure fumble since charts are controlled with the left knob.

There's a day/night soft key on the chart page, too. As one would expect, the departure airport comes up on startup while the list of available approaches at the destination are loaded as part of the flight plan. Along the way, approaches for air-

Widely underestimated is the amount of heat modern displays spew. It's noticeable in warm weather and will kill the unit if the avionics cooling fan fails. We bring this up because Avidyne offers extended warranty coverage and we're all for it given the out-of-warranty repair costs.

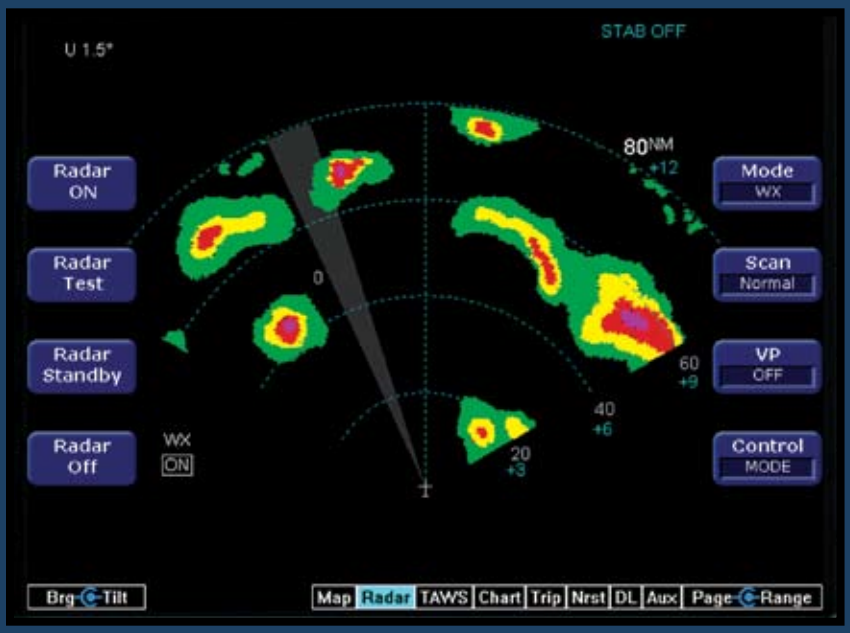


If it looks like Avidyne bolted a bigger screen to the chassis of the smaller EX500, they did. This means the EX600 can slide into the wiring of an existing EX500 install and an EX500s can be easily modded into EX600s with a trip to the factory. Of course, the radio stack will need to be modified to accommodate the larger bezel, 4.925 inches high compared to 4.40 inches.

MAKING OLD RADAR NEW AGAIN

If there's an easy way to jumpstart an older radar it's displaying it on a color MFD and Avidyne perfected this science a long time ago.

Radar-versioned EX600s have two pairs of concentric rotary knobs instead of one. These extra knobs are used to set tilt angle and radar range scaling as well as for commanding bearing and gain control. The EX600 offers a dedicated radar page as you would see on a traditional display. But the real bonus is the ability to overlay the data over the map page along with flight plan and other input data. Radar operation is intuitive, with simple soft keys for basic functions like turning the radar on or off. Some radar units have more functionality than others, such as vertical profile and sector scan, and Avidyne includes all of these functions in the radar software.



Avidyne adds some tricks of their own including BeamView, a function that displays the radar's beam width as a function of radar range. BeamView looks a lot like a sweeping spotlight that's intended to simplify the interpretation of multiple cells at longer distances. We were impressed most by Auto Tilt, which automatically adjusts the radar tilt angle as the aircraft changes altitude. This can be a sizeable workload reducer.

The display must be interfaced with a heading system otherwise known as heading bootstrap or synchronization. This input that originates from the slaved gyro of an HSI or AHARS and ensures that the radar returns are in proper orientation on the map display as the aircraft changes heading. This heading synchro interface can be labor intensive. They can be costly, too, if the aircraft doesn't have a heading source for the bootstrap.

Avidyne's EX600 radar list seems never-ending, sporting 19 models of many vintages including old monochrome units. For comparison, Garmin's GMX200 will only overlay the RDR2000-series, RDS81 and proprietary GWX68 while the ancient Honeywell KMD 850 plays RDR2000 only. A provided radar plug adapts the existing wiring to the new display. For some systems, in-flight calibration can be a tedious but required challenge that owners will pay for. Installing shops will need at least some radar experience when interfacing to the EX600.

In a day and age where satellite weather rules the roost, ship radar is still an integral part of many missions in high-flying, higher-performance aircraft. The EX600 continues to answer the call with sharp graphics and smart functionality to rely on. ***— Larry Anglisano***

ports along the route of flight can be loaded via the EX600 Trip Page and a push of the auto-fill softkey.

This Trip Page is where datalink weather is accessed, providing decoded METARS, graphic METARS, Textual TAFs, Winds and temp aloft. It's easy to have a look-see at METARS at surrounding airports along the flight, both as an icon in the list of airports and in detail when you scroll to any airport. Avidyne has perfected the ability to simply evaluate the weather along the route—something other displays haven't quite perfected, in our view.

On top of color-contoured terrain base map there's a terrain and obstacle database and the ability to input TAWS-B and EGPWS terrain from a generous list of high-end Honeywell Class B systems. There's also a rich interface connecting to multiple brands and models of navigators of all vintages. GPS units that output enhanced ARINC labels for things like holding patterns or procedure turns will make result in curved flight plans on the EX600.

All the bases are covered for playing traffic minders: There's the Avidyne TAS-series traffic as well as L-3 Skywatch and 791 TCAS, Honeywell KTA and TCAS 1 and Garmin GTX330 TIS. With a proposed ADS-B interface through the TAS600 system, the EX600 will no doubt display ADS-B traffic in the near future.

Weather is supplied by the MLB700, a SIRIUS-based satellite receiver with products provided by WSI InFlight. The Avidyne display function has matured offering NOWrad radar mosaic, graphical and textual METARs, TAFs, temp and winds aloft, TFRs, Hail Warnings and Storm Track Vectors, plus lightning data from the WSI Precision Lightning Network. There's also the HeadsUp XMD76-series XM-based datalink system. Both systems offer entertainment through a remote control (not through the EX600).

Lightning comes from Avidyne's own TWX670 Tactical Lightning Detection system. It's a modern and impressive Sferics suite. There's also the L-3 Stormscope that we find stark in comparison.

A modest ship radar interface remains an important requirement for retrofit MFDs and Avidyne wins hands down (see sidebar). Both

DISPLAY	BEZEL HEIGHT	SCREEN	SHIP RADAR?	CHARTS?	BASE PRICE	COMMENTS
EX600	4.93 IN	5.8 IN	RICH INTERFACE	STANDARD	$9940	EASY FEATURE SET, GOOD VALUE
GMX200	5 IN	6.0 IN	LIMITED	OPTIONAL	$8995	SPLIT-SCREEN FUNC, TRAFFIC OPTIONAL
EFD1000MFD	7 IN (3.5 IN WIDE)	6.0 IN	NO	NO	$7995	SECTIONAL MAP, PFD REVERSION
KMD250	3 IN	3.8 IN	NO	NO	$5886	AVAILABLE WITH GPS, PLAYS XM

the Garmin GMX200 I/O and the ancient Honeywell KMD-series are lacking.

Data updates for the EX600 are loaded to the unit through a USB port located on the bezel. Approach plates for the entire country can be uploaded to a single memory stick. The cMax charting capability for Jeppesen approach charts is included in the EX600 base price. Obviously, the charts themselves require a subscription. Updates for the moving map are also through Jeppesen, which is another source of update expense.

CONCLUSION

There's no questioning the abilities of the EX600. It does a lot and it does it with ease compared to the layers-deep architecture of the Garmin GMX200. We think this gives the EX600 an edge. The display brightness concerns us. We're certain this can be fixed, but Avidyne says how soon is unknown. We also would like to see an alternate approach-chart option like Garmin provides with their MFDs. Owners are frustrated with the Jeppesen nav data monopoly and cost.

The EX600 has a base price of $9990. Common radar interfaces bump that price to $13,990 and big-airplane radar interfaces make it $16,990. Existing EX500 owners can upgrade to the EX600 for $5495.

With Aspen Avionics coming on strong with the MFD1000 and Garmin's reasonably priced G500 PFD/MFD combo, competition is building. But if all you need is an MFD—especially if older radar overlay is a requirement—we think Avidyne still owns the market with the feature-rich and now big-screen EX600.

Larry Anglisano is Aviation Consumer's Avionics Editor.

CONTACTS

Avidyne Corporation
800-284-3963
www.avidyne.com

IFR Desktop Simulators: Buy On Top or X-Plane

For round gauges and plug-and-play simplicity, ASA's On Top is still a good value. But X-plane is the budget king, and the only choice for realistic glass panels.

by Jeff Van West

There's no question that logging some time flying pixels on your desktop computer can help keep you sharp flying real instruments through real clouds. How much it helps depends on how sophisticated the simulation is and how you go about using it. So let's be crystal-clear that we're talking about the bottom rung here: What's the best choice for a simulator you can install at home to practice your procedures and scan in the half hour between cleaning up after dinner and the next episode of *House*?

We should also set a few ground rules. You won't be able to log time for approaches flown without an instructor by your side, so we see no point in forking over big bucks for an FAA-approved system. You will want at least the basic flight controls, so expect to spend about $110 for something like CH Products' Flight Sim Yoke. Helicopter controls might cost a bit more. We wouldn't bother with rudder pedals for airplanes. Plan on using your keyboard and mouse to control on-screen switches, knobs and buttons.

ASA'S ON TOP 9.5

ASA's On Top is not a game. Its purpose is IFR training and proficiency, and therein lies one of its strengths: It's simple. Big buttons and super-clear instructions lead you through setup and use. The program also ships with a chart-viewing program provided by FlightPrep. This has two advantages: Charts are easy to display and you have charts that match the navaids and GPS database you're using on the sim. Just like updating your charts in the real plane, flying a simulator with old navaids can be a problem as approaches change. On Top does have an airspace editor that lets you update the database manually.

There's nothing fancy about the graphics. The instruments and avionics are not photo-realistic. The visuals for airports and weather out the forward windscreen are the barest required. But this made On Top the best performer on older computer systems.

Some additional niceties are that double-clicking any instrument will cover it (the program can simulate failures, too). The manual includes performance profiles for the nine aircraft to choose from. Included as well are 10 instrument scenarios based on real accidents. Loading one will put you in the hot seat. If you can resist the temptation to read ahead and find out what the failure will be and just fly it, it can be truly enlightening.

The avionics are generic except for the Garmin GNS 430 and the G1000. The 430 uses a module built by Reality XP that leverages Garmin's own 430 simulator so it's almost a fully-functional 430 and is definitely up to the task of GPS proficiency training. It's the non-WAAS 430 and the database is several years old, however. ASA is planning on releasing a WAAS version but has no timeline yet. We hope they will keep the non-WAAS as

ASA's On Top doesn't bother with photorealistic cockpits, but it's easy to see and manipulate. The Garmin 430 is plenty realistic for practicing GPS use and GPS approaches.

X-Plane (upper right) offers a wide range of aircraft and terrific visual effects, but only basic avionics are well simulated. Add SimAvio (lower right) and you can get a full glass cockpit.

an option but with a newer database for all the pilots who have not upgraded.

The G1000, on the other hand, is a facsimile of the PFD in reversionary mode (with power instruments on the PFD) and there's no MFD. GPS control is actually done through an inset window running the 430 but using G1000-like buttons. While this may be useful for your G1000 instrument scan, we think it's inadequate for real G1000 proficiency. It's also only available in the Cessna 182.

On Top had the least realistic flight model of any of the simulators. That's good for your scan, but can be frustrating when trying to nail an ILS approach. It's not bad, it's just that the other sims we tried were better. Adjusting the control sensitivity is easy to do but the options are limited.

On Top sells for $149.95. ASA also offers IP Trainer, which is a quite thorough training program for IFR wannabes, and Instrument Refresher, which is designed specifically to help pilots brush up for an IPC. Both of those programs include lessons and an On-Top-like simulator, but only for a basic Cessna 172. They sell for $169.95 and $79.95, respectively.

ELITE 8.5

Elite is a major player in the certified flight simulator market along with companies like Frasca and Precision Flight Systems. But they are unique in that they sell the same core software the pro systems use for use on a home machine.

The software is robust and impressive, as you expect for something capable of driving a $200,000 simulation. The visuals are sharp in the areas they need to be, such as poor visibility in mist or airport lighting. It's easy to reposition aircraft or set up instrument failures. Flights can be recorded and played back. The aircraft fly accurately and cockpits are quite realistic. The program runs surprisingly well on older computers.

But for the home user, this capability comes at a serious price. The core system is $199 for just two aircraft models, the Cessna 172 and Piper Archer III. Upgrading to the Premium version with more aircraft and better visuals punches that to $499. But Premium might not give you all you want. Several of the Elite aircraft have an option for a GNS 430W. This is actually a more modern version of the same Reality XP module ASA uses. But there are no on-screen buttons in the Elite version. To use 430 with Elite, you must buy a physical control box—for an additional $549. Approaches outside the U.S. and Canada are an additional charge

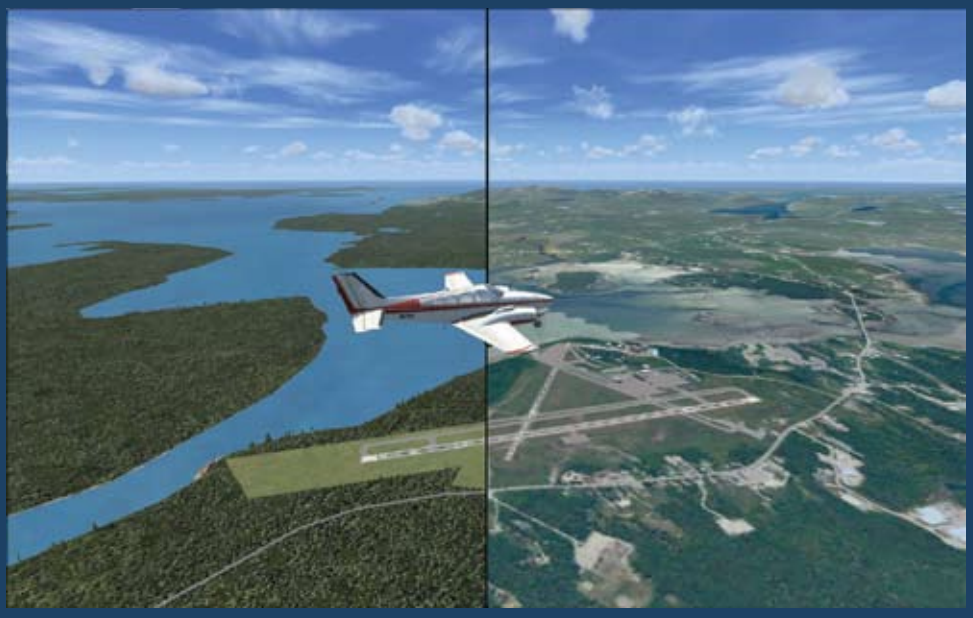
Elite does some neat tricks. For $169 you can get a set of dozens of instrument scenarios you can fly with realistic ATC communications directed to your aircraft and background chatter. For an $89 unlock code from Elite and about $50 worth of cables from Garmin, you can connect a real Garmin handheld GPS and use it as if it were in a real airplane.

As capable as the software may be, we don't see the value being worth the cost to a home user.

X-PLANE

X-Plane's users run the gamut from non-pilot sim enthusiasts to the product development departments of companies like Garmin. What simulates flight connected to real G1000

HOW ABOUT A BOOST FOR YOUR VFR PROFICIENCY?



Ever wished you could get the visual accuracy of Google Earth mapped right into your flight simulator? A small company called Sim Savvy has you covered. Massive Scenery is an add-on for Microsoft FSX that replaces the original computer-generated scenery with satellite images so you are literally flying over the real world.

It's about as easy to install as anything could be: Connect the USB hard drive shipped by the company, tell FSX to use the scenery off that drive and go fly. The product is a great tool to explore an area you've never been as a preview of what to expect when you actually get there. We've heard from one user that remote runways that aren't placed quite right in FSX now appear in the right spot, which isn't surprising since these are real photos from space. The added realism is just more fun, too.

Another big advantage is that it improves performance. Scenery loading off of a hard drive takes less computing power than scenery the computer is generating. We saw frame rates jump an average of 10 frames per second. It may not sound like a lot, but if you're getting 12-15 FPS normally, a 10 FPS jump is huge.

There are a couple of drawbacks. The image is only two-dimensional, so it looks flat when you're close to the ground. The only standard scenery items that still appear are airports (which overlaid on the satellite images of the airports quite well in most cases), airport buildings and some bridges and towers. The scenery is daytime only, and only from the season when the image was taken (usually summer). The company points out you can't really see the ground at night anyway, and it would double the number of files needed.

Massive Scenery costs $200, which includes the USB hard drive. East- and West-Coast scenery is currently available. The Central U.S. will soon be added for no additional cost, and current customers will be upgraded at no charge via a returnable flash drive. You can get information at www.sim-savvy.com or 970-259-2555. *—Adam Cutler*

screens as that product is developed and refined? X-Plane does.

As you'd expect, the flight model is the most realistic of all the simulators—put the flaps to 10 degrees in a single-engine Cessna and the nose will immediately pitch up. The visuals are outstanding. Settings for weather are simple but flexible, with quick buttons for things like marginal VFR or Cat-I minimums. There's also a quick placement on 10-mile final for any runway. The database is worldwide, but you only install what you want. There's even an automated ATC that does a passable job on vectors to an ILS (if a bit overzealous in issuing heading changes).

The program comes with a variety of aircraft, but most are for gaming, not proficiency. You can download almost any aircraft you want if you search online. Many are free, but even the for-pay ones are usually under $40 and often contain several similar types. X-Plane is the only option that will run natively on a Mac (or Linux). It will also do that trick of driving your real, portable GPS.

Using X-Plane for IFR proficiency has some limitations. It's not the most intuitive program to use, although the forums and customer support is excellent. Since it was developed as a game, the instruments and avionics look great, but are smaller and harder to see and control than On Top or Elite.

The avionics also aren't necessarily accurate representations of any given radio. Common conveniences like flip-flop frequencies aren't always available. This may cramp your style if you're trying to practice procedures just as you would in your real aircraft.

It's worse if you're trying to simulate more modern cockpits. We flew a Cirrus SR20/22 model provided by C74 Enterprises (air.c74.net) that flew great (it'll even porpoise on landing if you botch it) but it must use the simulation of the Avidyne system and GNS 430 that's part of X-Plane. X-Plane's Avidyne is quite limited and the 430 isn't capable of much more than direct-to. There's no G1000 simulation within X-Plane.

Add-ons can come to the rescue here. You can drop that same Reality XP 430W, or even a 530W, that ASA and Elite use into an X-Plane cockpit for $49.95. The module only works on a Windows version of X-Plane. They also have a similar plug-in for Microsoft FSX.

You can fly a full G1000 cockpit for several piston singles using SimAvio from FlyThisSim. This isn't a plug-in for X-Plane. It's a separate program that provides just the glass cockpit and runs at the same time as X-Plane. The two work together so you can fly with X-Plane handling the flight controls and visuals and SimAvio doing the cockpit. They can run on the same machine or on two networked computers. FlyThisSim also has an Avidyne Entegra cockpit with GNS 430s that it will offer soon

SimAvio requires a fairly powerful Windows machine to run and we weren't able to test it on our hardware. We saw it operating live through a screen-sharing demo and it looks impressive. We'll try to look at it closer in a future issue. Pricing for the SimAvio is $39.95, and it comes with two round-gauge cockpits. G1000 or Avidyne add-ons are packaged by the manufacturer (so you get all the Cessna singles as a package, for instance) at $98.95. FlyThisSim will also offer just the 430 and 430W at some point in the future. Database updates for any of these systems will be $8 a cycle. And you thought you only had to pay for current data in your real airplane.

MICROSOFT FSX

Many pilots use Microsoft's Flight Simulator X (FSX) for instrument proficiency. The program is the last in a venerable line and has a devoted following even though Microsoft has discontinued it. It's still available for as little as $19 online and does a fine job with basic instruments. The flight model is acceptably good if you adjust all the realism sliders from "easy" to "realistic."

FSX visuals are good, although low visibility isn't always rendered well on slower machines. The cockpits provided are more realistic than the default X-Plane equivalents. There is a reasonably good G1000 cockpit for the Cessna, Mooney and Baron. It's not quite up to par for practicing IFR procedures as you would do them for real, but it has some value for a G1000 scan and actually flying the approach. There is a simulation of something like a Garmin 500 GPS, but it's also different enough from the real thing to make using it for practice of limited usefulness, as we see it.

Compared to X-Plane, FSX is easier to set up and use. There are also at least as many FSX aircraft for download or purchase as there are for X-Plane. FSX is more resource-intensive than X-Plane. On a given machine, X-Plane is usually the better performer. FSX's navigation database is locked in time and getting steadily older. We suspect some third party will step up here, however, and offer updates given how many FSX users are out there.

CONTACTS

ASA
800-272-2359
www.asa2fly.com

Elite Simulation Solutions
800-557-7590
www.flyelite.com

FlyThisSim
info@flythissim.com
www.flythissim.com

RealityXP
www.reality-xp.com

X-Plane
913-269-0976
www.x-plane.com

SQUEEZING THAT IFR DOLLAR

We think a copy of X-Plane and a basic control yoke are the best value for someone looking to keep up home proficiency. Adding the Reality XP module makes practicing with a GNS 430W or 530W a real option. Even the SimAvio plus X-Plane route is a reasonable cost if the company can deliver a real facsimile of a glass cockpit. Pilots of these aircraft need double proficiency—IFR scan and avionics—and there's no other home solution that allows you to do both at once that we know of.

For those wanting simplicity and full functionality right out of the box, we'd steer them to On Top. While more expensive, the inclusion of the Garmin GNS 430, scenarios and U.S. approach plates matching the practice database makes it worthwhile.

SOFTWARE	AIRCRAFT	REGION	GNS 430W?	G1000/AVIDYNE ENTEGRA?	BASE PRICE
On Top 9.5	Eight piston singles, one piston twin, one turboprop	World, but little visual detail	Yes, but only 430 (non-WAAS)	Limited G1000 PFD only	$149.95
Elite 8.5	Nine piston singles, two piston twins, one turboprop	U.S. and Canada. Europe and South America for $199 each	430W with hardware module for $549	Not on home systems	$199 Core, $499 Premium
Microsoft FSX	Hundreds available for free or shareware download	World, varying detail and accuracy	Both GNS 430W and 530W with Reality XP add-on for $49.95*	Limited G1000 for 172, Mooney and Baron	$29**
X-Plane 9	Hundreds available for free or shareware download	World, high resolution	Both GNS 430W and 530W with Reality XP add-on for $49.95*	Limited Avidyne included. Full Avidyne in development from FlyThisSim. Full G1000 for Cessna, Diamond and Beech with FlyThisSim add-on for $138.90	$29

*** Windows only ** Prices vary online**

IFR Chart Choices: Air Charts is Top Value

Despite electronic inroads, paper still rules. We like Air Charts for en route use, while FAA/AeroNav approach plates are easier to keep updated than Jepps.

By Joseph E. (Jeb) Burnside

Despite all the blather about electronic charts and the paperless cockpit, dead-tree charts still rule. If that sounds depressingly old school, the good news is we have choices, even if it's among only two basic publishers.

Another piece of good news is we can put down one publisher's chart and pick up the other's without too much confusion. While there are qualitative differences between the two publishers, a major distinction is how they go about distributing updates.

One publisher offers more of an *à la carte* pricing and publishing scheme while, if you want approach plates from the other, you get everything else in the bargain. And despite a third-party company's simplifying the process, there's still a price to pay when it comes to managing revisions.

EN ROUTE CHARTS

There are two main choices for your instrument chart needs: FAA/AeroNav (FAA) and Jeppesen. Both provide the same basic product: A folded, four-color set of charts presenting navigation data for specific areas of the U.S. If your travels take you outside the U.S., there's a map for that, also, though not from the FAA, which doesn't offer worldwide coverage (although charts for the North Atlantic and North Pacific are available, plus versions for Alaska and the Caribbean/Gulf of Mexico). Meanwhile, Jeppesen offers charting solutions for pretty much anyplace you'd want to fly (and probably a few you don't).

As the excerpts on page 23 depict, symbologies and use of color differ slightly between the two publishers. What you can't see is Jeppesen uses thin, lightweight paper for both its en route and approach charts, which the company's Web site says reduces on-board storage space while keeping weight as low as possible. All told, worldwide Jepp coverage (including terminal procedures) involves some 34,000 sheets of paper, according to the company. In contrast, the FAA/AeroNav en route low-altitude products are printed on the same-weight paper as a VFR sectional chart.

Another area where Jepp and the FAA differ. Complete conterminous U.S. low-altitude en route coverage comprises 27 charts when purchased from Jeppesen; the same thing from the FAA is 36. Both also publish a separate area chart in their full U.S. sets. Jeppesen's take on the area chart includes all locations where Class B airspace exists, plus some other major airports. The FAA version, instead, provides details on facilities at select high-density terminals throughout the country—which may or may not include Class B airspace—mainly for military use.

Yet another difference is what's omitted from the FAA en route charts package: detailed airport data. Jeppesen's en route low-altitude coverage—which the company calls its Airway Manual and which is designed for mounting in an extra-cost, two-inch-thick plastic or leather binder—in-

CHECKLIST

- ⊕ Jeppesen's charting products are the highest quality and include the most information.
- ⊕ Air Chart Systems' IFR Atlas is an inexpensive, high-quality reprint of all FAA/AeroNav charts.
- ⊖ Jeppesen's approach plates are superior to the FAA product, but aren't available separately.
- ⊖ Air Chart Systems' plate revision procedures are quirky and plates don't wear well..

cludes detailed textual information on navaids, ATC communications and various chart legends, among other data. While chart legends are built in to the FAA products, to obtain from the Feds the same basic data Jeppesen provides would require purchasing the Airport/Facility Directory for the area in which you intend to fly, plus an Aeronautical Information Manual, AIM, at a minimum.

Whether all that data is necessary in the cockpit is arguable, but if you need it, Jeppesen provides it. The company also makes this data available in electronic format, as an option.

Aside from the textual data, and along with different cost and pricing structures—see the table on page 22—perhaps the biggest difference between FAA and Jeppesen charts is the update process. Both publishers key their update schedule to ICAO's Aeronautical Information Regulation And Control cycle, or AIRAC, which is every 28 days.

For example and presuming an annual subscription, the FAA will ship you a complete set of fresh en route charts every 56 days, or every other AIRAC cycle. In between, you'll have to record any changes yourself, based on a Notam review. According to the agency, there's an average of 35 changes to an en route chart every 56 days, or every other AIRAC cycle. When subscribing to FAA charts, one simply throws the old ones in the recycling bin and stows the fresh copies in the airplane. Simple.

Jeppesen's revision system, however, is more complicated. For example, Jepp distributes revisions every 14 days. Dave McLean of the company's Aviation Navigation Solutions group told us, "Jeppesen makes every effort to mail revisions by this date, which is in advance of any time-critical changes to aeronautical information." According to McLean, "En route Low Charts are updated as changes occur via Chart Change Notices (CCN) sent with every revision for a given coverage and cycle. The CCNs are revised to a specific tab in the manual and the changes are grouped by categories such as Navaids, Airways, etc. Actual charts are replaced as needed or when a significant number of changes occur, typically about once a year."

Enter Air Chart Systems. Formerly known as SkyPrints and also as Howie Keefe's Air Chart Systems, the company markets a set of chart atlases. Like the road atlas popular before GPS navigators trickled down to cars, the Air Chart product is a spiral-bound book of charts, measuring 11 by 11 inches and not quite ¾-inch thick. Air Charts uses FAA charts—which are public domain—and arranges them so each page is a chart segment slightly overlapping with an adjacent page. Air Chart customers get a complete, spiral-bound set of FAA/AeroNav low-altitude en routes.

Since the company publishes only one updated atlas annually, what about all those changes occurring throughout the year? Good question and one Air Chart Systems handles by sending out a cumulative update sheet every 56 days. When the update is received, it goes into a pocket bound into the atlas. Updated information—like a revised minimum en route altitude along an airway, for example—is organized by geographic area, to be consulted as part of the planning process.

APPROACH PLATES

While keeping up with en route charts is a pain, maintaining a set

Is Paper Dead Yet?

Although much of our everyday information exists only in bits and bytes, paper remains popular for viewing text and images. This very magazine is an example. It's relatively light, doesn't need batteries, is readable in the brightest sunlight and never needs rebooting. But the size and weight of, say, a complete set of en route and terminal charts for the conterminous U.S. argues strongly in favor of an electronic solution.

We've looked at many different hardware/software combinations over the years, most recently in last month's roundup of electronic flight bags. Each solution has its benefits and drawbacks, usability and expense perhaps being foremost among the latter. Many solutions available today come down to two basic choices: a simple, generic hardware platform used to display AeroNav/FAA PDFs but without en route charts, or a more complicated device with every possible bell and whistle, including a GPS-driven moving map, Bluetooth, visual charts and directions to the nearest Starbucks after you land. Vendors either start with a lobotomized product (e-book readers) and develop kludges to make it work or they grab some other off-the-shelf hardware and add features until chart retrieval and display—not to mention response time—become afterthoughts. (Yes, that's an iPad above, displaying a PDF approach plate. No, we haven't had a chance to try it in the cockpit. We'll have a full report soon.

The typical IFR pilot these days already has at least one moving map in the cockpit, probably two—why force us to buy another one if all we want is charts? Since there isn't a cockpit-sized solution out there that doesn't combine the simplicity of VCR programming with the performance of an IBM PCjr, most of us still need to carry some paper. If there was a hardware/software solution offering approach plates and en route charts in a simple, robust, cockpit-friendly format without costing an arm or a leg, we'd bet it soon would be as ubiquitous as 100LL. We're waiting.

LOW-ALTITUDE AND TERMINAL PROCEDURES CHART PRICE COMPARISON

	Air Chart Systems			FAA/AeroNav				Jeppesen			
Full Coverage (48 states, PR, VI)											
	En Route ($)	IAPs ($)	Both ($)	En Route ($)	IAPs ($)	Both ($)	Electronic IAPs	En Route ($)	IAPs[8] ($)	Both ($)	Electronic IAPs[9]
Annual Subscription	109[1]	225	299	418.65	596.67	1015.32	193.70	419	n/a	1198	875
One-Time	109[1,3]	225[3]	299	81.23[5]	121.98[5]	203.21[5]	14.90	150	n/a	388	238[10]
Eastern U.S. (East of Mississippi)											
Annual Subscription	109[2]	160[4]	269[2,4]	329.18	422.76	751.94	193.70[7]	284	n/a	724	368
One-Time	109[1,3]	160[3,4]	269[2,3,4]	49.64	64.20	113.84	14.90[7]	85	n/a	221	174[10]
Western U.S. (West of Mississippi)											
Annual Subscription	109[2]	160[4]	269[2,4]	329.18	457.99	787.17	193.70[7]	303[6]	n/a	856	665
One-Time	109[1,3]	160[3,4]	269[2,3,4]	49.64	69.55	119.19	14.90[7]	96	n/a	241	174[10]

Notes:

1. Price shown is for first Air Chart Atlas; subsequent Atlases (for VFR, etc.) priced at $79 each.
2. Price is for single Atlas with full conterminous U.S. coverage; less-than-full coverage not available.
3. Same as annual subscription; regular 28-day updates through each May are included.
4. Includes IAPs for some additional states on either side of Mississippi River.
5. Does not include Change Notice published every 56 days (mid-cycle).
6. Includes Illinois, Indiana, Michigan and Wisconsin.
7. Regional coverage not available; purchase same product as full U.S. coverage.
8. Jeppesen does not offer IAP charts separately; when purchased, they are part of complete charting coverage for a geographic area.
9. Jeppesen's electronic charting service, JeppView, includes electronic text and IAPs with paper en route charts.
10. Via JeppView Trip Kits, which require an active JeppView subscription.

of approach plates can be up there with getting a root canal. Nationally, according to the FAA, there are some 19,000 procedures, including arrivals, departures and approaches; some are combined (a localizer procedure, for example, printed with an associated ILS), but that's still a lot of paper. The paper the FAA uses for its approach plates is similar to newsprint; Jeppesen uses the same lightweight stock as their en route charts.

CONTACTS

Air Chart Systems
www.airchart.com
800-338-7221

FAA/AeroNav Services
aeronav.faa.gov
800-626-3677

Jeppesen
www.jeppesen.com
800-353-2107

Presently, the FAA publishes 26 bound or loose-leaf volumes to distribute it all, some of which can get close to an inch thick. Jeppesen, meanwhile, requires 10 of its two-inch binders to organize complete U.S. coverage for approach plates, arrivals and departure procedures.

But that doesn't include revisions. The FAA update method occurs every 56 days when complete new terminal procedure volumes are published and shipped. Halfway, a Change Notice is distributed, containing the procedures revised in the preceding 28 days. Once the Change Notice is received, it should be consulted before executing a published procedure. After 28 more days, new volumes are published, replacing the old ones and the Change Notice.

Jeppesen's standard revision process is similar, according to McLean. "Charts are revised based on the AIRAC date and sent in the respective revision cycle (typically 14 days) with an effective date as appropriate." But that's not all. Jeppesen also offers its "Q Service" as well as charting customized for business jet operators who don't care about smaller airports with short runways.

"Q Service is really a modified Standard Service and differs only in how revisions are sent and filed," McLean told us. "Rather than replacing each terminal procedure as it revises, all new procedures for a given cycle are placed in a tab along with the revision letter that shows what has changed. When planning a flight, the pilot would first check the appropriate tabs to see if there are any changes and if not, then they would continue on the main section to find that procedure." Q Service terminal content is completely replaced every 56 days.

Finally, Jepp also offers the Airway Manual Express, which is typically for smaller coverages. It comes in two volumes: one is the text and en route charts, updated when changes occur. The second volume contains only terminal procedures, SIDs and STARs, and is revised every 28 days, with complete replacement every 56 days, similar to the FAA charts.

Air Chart System also is in the approach plate business, supplying FAA

SIDE-BY-SIDE COMPARISONS

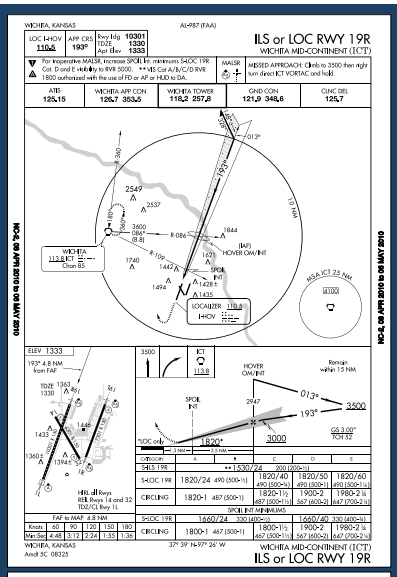
When evaluating which chart or chart system to use, the levels of detail, symbology, use of color and overall "look and feel" of the charts should be one of the criteria you employ. Some of these variables are entirely subjective. Others, especially detail levels, aren't.

At right, we've reproduced the FAA/AeroNav (left column) and Jeppesen (right column) versions of an approach plate and en route chart. (Due to production issues, these excerpts may not be precisely to scale.)

Whether the two chart publishers differ in their approach isn't really open for debate; there are differences. Among them are paper quality/weight and binding methods not readily apparent from these excerpts.

Some may view the Jeppesen charts as too cluttered. On the other hand, some may believe the FAA/AeroNav versions omit critical information, or present that information in a manner which minimizes its importance. Whether they do or they don't is a judgment call, in our view.

At the end of the day, chart choices often come down to which were used in an individual's instrument-rating flight school: Once the rating is earned, we tend to stick with what we know and have become familiar with.



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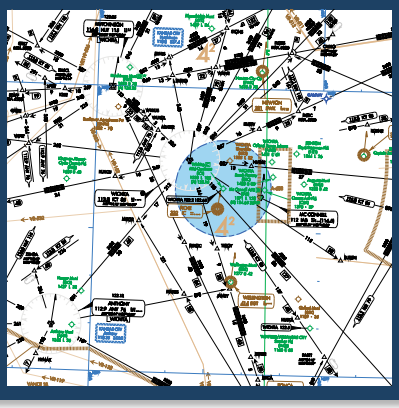


volumes on a nationwide or regional basis. Like its en route atlas, however, Air Charts' approach plates updated annually. Each 28 days an update sheet is distributed, similar to a NOTAM summary. Then, at 56 days, the company provides a cumulative update similar to the one for its atlas. The operator is expected to use the update as a guide to when replacement approach plates are needed and may download them without charge from Air Chart Systems' Web site.

RECOMMENDATIONS

When comparing the differences between FAA/AeroNav products and Jeppesen's, there's no real dispute in our mind: Jepp's charts are better, with greater attention to detail throughout. Amazingly, Jeppesen has kept their pricing for en route charts in line with the FAA/AeroNav product (or is it the other way around?), and its full airway manual service is only $175 a year more than the FAA's. These prices don't include the necessary binders, but then the FAA doesn't offer a catalog case to put all its approach-plate volumes in, either. If money were no object, we'd go with the Jeppesen product every time.

But money is an object. Looking at the best way to back up the moving map in our panel and ensure we have a current en route chart for wherever we want to go, the Air Chart Systems IFR Atlas is our choice. The price is right, the update process is simple, the quality is high and—presuming the atlas made it into the airplane—we'll always have the chart we need when we need it. After all, when was the last time they moved a VOR? So, in our view, the best bang for our IFR charting buck comes from using Air Chart Systems for our en route needs.

Once we're wedded to the Air Chart format for our low-altitude en route charts, we're also locked into using FAA/AeroNav for our approach plates, since Jeppesen doesn't sell its terminal procedures without its en routes. (Which is a shame, since Jepp's is a superior product when compared to the FAA's.) But, the update process Air Charts uses to supply approach plates doesn't impress. Too, after a few months of being in the airplane, FAA approach volumes need help, with torn and missing pages. We can only imagine what they'd look like after a year. So, we conclude we're better off subscribing to the FAA's approach plates and pitching them every 56 days. If we're headed somewhere off the beaten path, many FBOs stock what we need, or we can print them from the agency's Web site.

That's what we'd do, at least until inexpensive, reliable hardware/software solutions exist and we can totally eliminate the dead-tree versions of these charts once and for all.

Jeb Burnside is Editor-In-Chief of sister publication Aviation Safety magazine, www.aviationsafetymagazine.com.

Cessna 310

It's hard to find a more distinctive, macho piston twin. But be especially careful of gear rigging and fuel-system management.

Few general aviation aircraft are as iconic as Cessna's 310. Whether because of its aggressive ramp presence, its supporting role in a television adventure series or its suitability for a wide range of missions, the 310 is what many non-pilots recall when piston twins come up in conversation. Its arguably the first "modern" light twin and certainly a classic.

While the 310 is all of those things, it's also a complicated machine, production of which ended almost 30 years ago. The tall landing gear might be thought of as delicate and its systems demanding, both to maintain and operate. But it still offers substantial transportation value, and the many different variants that were built as the model evolved means it shouldn't be hard to find the right one for your mission.

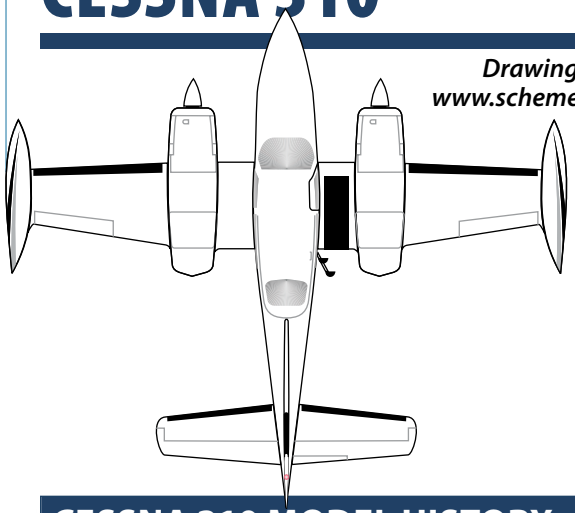
HISTORY

Cessna introduced the 310 in 1954, finding a niche between Piper's original, relatively underpowered PA-23 Apache, introduced a year earlier, and Beech's Twin Bonanza, which went out of production a few years later. It competed most directly against the Aero Commander 520, but that model was discontinued the same year. The 310 was Cessna's first all-metal, modern twin—replacing the prewar T-50/AT-17 "Bamboo Bomber"—and was clearly focused on business transportation. It foreshadowed the company's subsequent products and helped usher in its future growth.

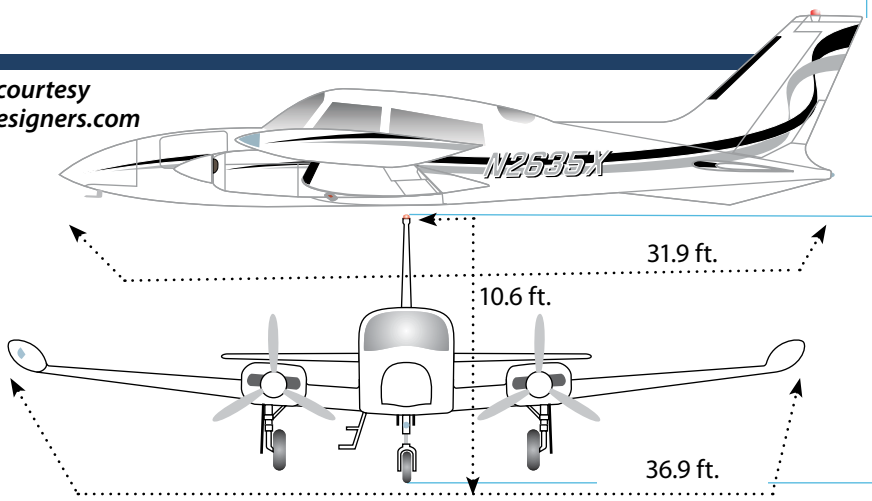
It's at home both at large airports and 2000-foot grass strips.

And its featured presence in the 1950/60s television drama, "Sky King," didn't hurt anything. Its namesake hero, played by Kirby Grant, upgraded to a 310B shortly after that model became available. Named "Songbird," the airplane (several were actually used during the show's production) was as much a

CESSNA 310



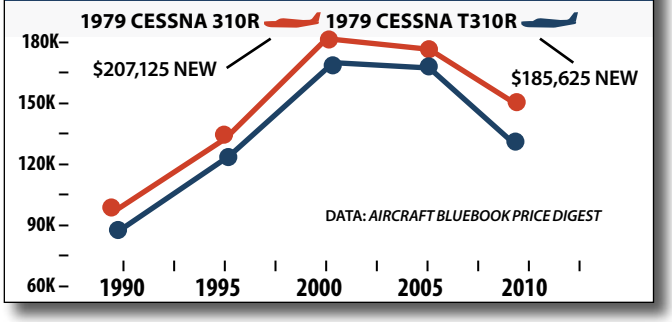
Drawings courtesy www.schemedesigners.com



CESSNA 310 MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1955-1958 CESSNA 310, A,B	CONT O-470-B,M 240 HP	1500	$25,000	100	1750 LBS	178 KTS	±$55,000
1959-1961 CESSNA 310 C-F	CONT O-470-D 260 HP	1500	$30,000	100/132	1751 LBS	191 KTS	±$61,000
1962-1963 CESSNA 310 G,H	CONT O-470-D 260 HP	1500	$30,000	100/132	2037 LBS	191 KTS	±$45,000
1964-1965 CESSNA 310 I,J	CONT O-470-U 260 HP	1500	$30,000	100/132	2037 LBS	194 KTS	±$50,000
1966-1967 CESSNA 310 K,L	CONT O-470-V 260 HP	1500	$30,000	100/142	1975 LBS	193 KTS	±$56,000
1968 CESSNA 310 N	CONT O-470-V 260 HP	1500	$30,000	100/182	2075 LBS	193 KTS	$60,000
1969 CESSNA 310 P	CONT O-470-VO 260 HP	1500	$30,000	100/182	2030 LBS	193 KTS	$65,000
1969 CESSNA T-310 P	CONT TSIO-520-B 285 HP	1400	$35,000	102/184	2108 LBS	225 KTS	$80,000
1970-1974 CESSNA 310 Q	CONT O-470-VO 260 HP	1500	$30,000	100/203	2086 LBS	192 KTS	±$95,000
1970-1974 CESSNA T-310 Q	CONT TSIO-520-B 285 HP	1400	$35,000	100/184	2108 LBS	225 KTS	±$90,000
1975-1981 CESSNA 310 R	CONT IO-520M 285 HP	1700	$30,000	102/207	2047 LBS	194 KTS	±$120,000
1975-1981 CESSNA T-310 R	CONT TSIO-520-B 285 HP	1400	$35,000	102/207	1777 LBS	223 KTS	±$130,000

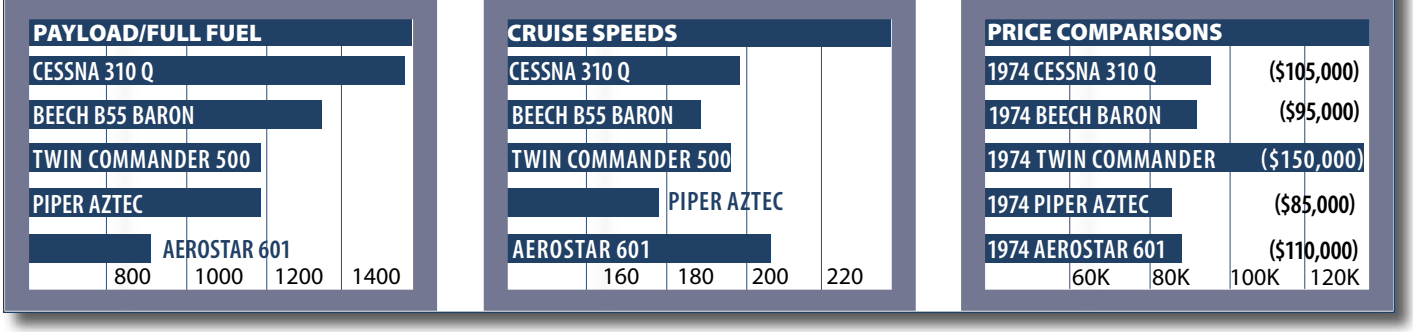
RESALE VALUES



SELECT ADs

AD 90-02-13	MAIN GEAR STRUT BEARINGS
AD 76-08-02	TIP TANK/STROBE LIGHT
AD 73-07-07	FUEL LINE, WIRING CHAFING
AD 72-03-07	LANDING GEAR UPPER STRUTS
AD 69-15-09	MINIMUM FUEL PLACARD

SELECT MODEL COMPARISONS



star of the series as its actors, perhaps becoming the main reason for the show's popularity on Saturday mornings throughout the 1960s, and even today on DVD.

Cessna's aggressive pursuit of the business market manifested itself in not only the 310's looks, but also its refinement: Many production years saw a new model designation. Cessna brought out the 310B in 1958, the 310C in 1959 and the 130D in 1960, eventually getting to the 310R in 1975 (with a few gaps) before ending production in 1981.

The first 310s came with 240 HP Continental O-470-B engines. From the beginning, a sleek, powerful appearance was a design goal, with tight cowlings and streamlining at the nose and tip tanks (at least by the standards of the day). Split wing flaps eliminating the need for external brackets or tracks and their drag. Distinguishing features of the early models are multiple aft side windows, a straight tail and non-canted "tuna tanks," named for their shape.

When the 310B came out in 1958, it brought with it a 100-pound boost in gross weight. For the next year's 310C, an engine change and gross weight bump occurred with the fuel-injected, 260-HP Continental IO-470D. The TBO was 1500 hours, same as with the earlier powerplants. For the 1960 310D, Cessna swept the tail, as it was doing across its fleet.

The next significant change was in 1962, with the 310G. Cessna introduced canted "Stabila-Tip" tanks, said to be more aerodynamically efficient than the old design. The original non-canted and bladder-equipped tip tanks also had a fuel-pickup problem; an airworthiness directive mandated a hefty increase in unusable fuel. This 310, with bladderless all-metal canted tanks, swept fin and short nose, is one of the most attractive light twins ever built.

Cessna didn't stop there. Cabin size was increased, along with gross weight. What started as a five-place twin became a six-placer with 1963's 310H. By next year's 310I, wing lockers and auxiliary tanks became options, as did three-bladed props. One significant difference was the switch from the corrosion-prone overwing exhaust design to an improved underwing arrangement on the 310I.

The middle seats are ample for most adults. Rears are a bit cramped but can come out for great baggage options. The 310's stability makes in an ideal IFR platform and worthy of serious avionics.

An engine change accompanied the modifications, to the IO-470-U, still of 260 HP and still with a 1500-hour TBO. Another engine change, to the IO-470-V, occurred in 1966 (310K), along with extended, one-piece aft windows on each fuselage side.

In 1969, Cessna consolidated its model line, offering a turbocharged variant of the 310 alongside the normally aspirated 310P and droppng the 320. The T310P came with 285 HP Continental TSIO-520-B engines (1400-hour TBO), three-blade props and a 5400-pound gross weight, compared to the normally aspirated 310P's 260-HP IO-470V Continentals, optional three-blade props and 5200-pound gross.

From 1970-74, Cessna stuck with the 310Q and T310Q, despite bumping gross weight on the 1972 T310Q to 5500 pounds (5300 for the non-turbo version) and changing to wrap-around "Omnivision" windows by adding a pair of small panes at the top of the aft cabin.

In1975, the 310R II and T310R II sported one of the biggest changes since the type's tail was swept: an extended nose. The proboscis grew 32 inches, housing a sizable baggage compartment. The normally aspirated version also got 285 HP Continental IO-520-M engines (1700-hour TBO) and another 200 pounds were added to the gross weight—bringing it to 5500 for both the turbo and non-turbo versions—along with improved landing gear.

The 310R marked the airplane's final configuration, which continued until the line was closed down in 1981. All told, some 5700 copies of the 310 were manufactured, not including its various military versions. Unsurprisingly, the 310Rs are the most numerous, followed closely by the 310Q, a result of sticking with one model for several years.

PERFORMANCE, HANDLING

An old saying about piston twins—they have two engines because they need two engines—refers to what's necessary to obtain their performance and their handling when one engine fails. Both are strong points of the 310, especially the turbocharged versions. Early models feature high-speed cruise in the neighborhood of 175 knots while later ones will top out at around 190.

From the early "tuna tanks" to the canted, streamlined tip tanks of later models, those tanks are the mains. Owners must ensure line service put the fuel in the correct tanks.

The turbo'd models can present 225 knots at all-out max cruise, but the fuel burn will be breathtaking. Reduced power settings get 175 knots on later, non-turbocharged models.

Engine-out performance is better than average, with normally aspirated 310s achieving a single-engine service ceiling of just under 7000 feet to 7500 feet, depending on model. Turbos see SE service ceilings of 17,000-18,000 feet climb rates from around 330 to 440 FPM, depending on model and turbocharging.

Figure cruise fuel between 20 GPH for an early, non-turbocharged 310 at economy settings up to 35 or more when flogging a big-bore turbo. Join the Church of the Lean-of-Peak and shave that down to around 28 GPH. Airspeed suffers, of course. Double those numbers, at least at the low end, for takeoff and initial climb.

Speaking of climb, the non-turbocharged models do OK in the low teens and turbo models in the high teens, although their service ceilings can be as high as 28,200 feet (T310Q). They're happiest in the mid-to-high teens: One owner told us, "At FL250 [the T310R] performs like a very expensive Skylane."

Book short-field performance is surprisingly good, especially for the airplane's weight: Landing over a 50-foot obstacle in a 310R will consume 1790 feet, compared to a Model 58 Baron's 2498. Taking off over that same obstacle will require 1700 feet in the 310, while a Baron needs 2100 feet. Perhaps unsurprisingly, pilots and owners treat the book numbers with a grain of salt, reporting poorer real-world numbers.

Once airborne, however, 310s provide an extremely stable platform. The only fly in the ointment is the type's tendency to Dutch roll, especially in turbulence and in an inexperienced pilot's hands, caused in part by the high rotational inertia of fuel in the tip tanks. Experienced owners tell us Dutch rolls are easily dampened with proper technique.

As clean and powerful as the 310 appears, it can get draggy on approach. Relatively large props blank out much of the wing and split flaps produce much more drag than lift. This can be a "good thing," since the clean airframe can be difficult to slow down until the first notch of flaps is deployed.

Early models came with an approach-flap extension speed of 140 knots, with full deployment available at 120. The 310K bumped the approach-flap speed to 155 knots or so. Subsequent models through early 310Rs are placarded for 160 knots approach-flap extension and 140 knots for full flaps. Drop two knots from those numbers for late 310Rs.

LOADING

For the early models, up through the 310G, interior space is about average for baggage, which means having to stow some items under and between seats, or at passengers' knees. Beginning with the stretched cabin of the 1963 310H, more baggage space was opened up. Wing lockers, whether installed at the factory beginning with the 310I or in the field, can help, as does the 310R's nose baggage compartment. Removing the aft row from the six-seat airplanes—quick-disconnect seats were optional on later models—can help, too.

Weight and balance must be watched closely. The first nose extension—a small one—occurred with the 310K. But by the 310I, cubic feet available began to exceed the airplane's weight-lifting capability. No longer could a pilot "cube-out" a 310 before overgrossing it and it could be loaded out of forward CG. Adding lots of avionics and other options to the typical model only compounds the problem by upping the empty weight. One solution is STC'd vortex generators that can boost max gross by 100 pounds or more. That said, you can find late-model 310s with close to 2000 pounds of useful load.

The 310's full-fuel payload varies depending upon the model, equipment and fuel tank arrangement. Total usable fuel capacity can be 100, 132, 142, 183 or 203 gallons—from 600 to 1218 pounds of fuel. Full-fuel payload in a lightly equipped 310C with auxiliary tanks might exceed 700 pounds, while it could be as low as 400 pounds in a 310R. Other loading and operating considerations, like maximum landing

weight and zero fuel weight, were introduced with later models.

FUEL SYSTEM

While we're talking about payload is a good time to point out the 310's fuel system on airplanes with all the optional tanks is more complicated than most. It also has a number of idiosyncrasies.

The complications start with nomenclature. Ask a line person where the main tanks are on a given airplane, and they'll likely point to the wing. With the 310, they'd be wrong. Early models only came with the 50-gallon-per-side tip tanks. As there were no tanks in the wings at all, those were main tanks. As time went on, horsepower increased and so did demands for fuel. First came 20-gallon wing-mounted bladders, followed by an additional 11.5-gallon bladder, for 31.5 gallons in each wing. Then came 20-gallon tanks in the wing lockers. In a 310R, as much as 203 gallons can be available.

If the pilot to have the mains topped and takes off without checking the fuel actually went into the right spot ... you can guess what might come next.

That's not the only tricky thing about the 310's fuel system. A fully-equipped 310 with wing locker tanks can have up to 10 fuel drain points and eight fuel pumps. Connecting all this is a relatively complex (when compared to other piston twins) plumbing system. There's no separate gauge for each tank, though the gauge does switch automatically to read the tank being used (but not the wing locker tanks, which have no fuel level senders). The pilot can read the tanks not in use by toggling a switch. Confused yet?

Fuel feeds to the engines from either the mains or the aux tanks (but not from the wing locker tanks, if installed). Presuming the mains were full at takeoff, at least an hour's fuel has to be burned off if the airplane has 20-gallon aux tanks (90 minutes for 30-gallon aux tanks) because excess fuel is pumped back to the mains. If there isn't room for it in the mains, it goes overboard.

The mains also are the receptacle for the contents of the wing locker tanks and there has to be room for transferred fuel. The pilot should wait until there's 180 pounds or less in the mains before pumping from the locker tanks.

The aux tanks feed directly to their respective engine, and the only pump serving them is engine-driven. In the event that pump or engine fails, the aux tank on that side could hold 30 gallons of deadweight; there's no crossfeed from the aux tanks to the opposite engine.

Hopefully you'll never discover this factoid the hard way, but those big tip tanks were originally designed as a safety feature, to get fuel as far from the cabin as possible. Early on, a prototype landed gear-up and the tip tanks separated just as they were designed to do, with no post-crash fire.

The good news? The 310 is not unduly prone to fuel mismanagement accidents, so despite the system's apparent complexity, pilots seem to have little trouble dealing with it. All those tanks can carry a great deal of fuel making six- or seven-hour endurance possible in later models. Early models go for four to five.

Long gear make the airplane sit higher than new owners are accustomed, increasing the likelihood of an earlier and firmer arrival than expected.

LANDING GEAR

The other 310 system usually getting lots of attention is the landing gear. It's relatively tall and, as a result, often thought to be more delicate than with other airplanes. Also, all that fuel hanging out on the wingtips tends to create high side loads.

As with so many other general-aviation landing-gear systems, one of the keys is finding a technician familiar with and knowledgeable about it. The 310's gear system includes a number of components requiring proper rigging during regular inspections. Done properly, trouble can be avoided, but failure to treat the gear with respect increases the odds of failure dramatically.

People with keen familiarity with the 310 tell us of three weak points in the gear system. The nosegear idler bellcrank, located under the pilot's feet, is probably the worst since its failure—always at retraction, and always loudly—means two prop and two engine teardowns.

The main-gear torque tubes and inner landing-gear door actuator bellcrank are the other two. If the torque tube fails, it does so during the retraction sequence, leaving the associated main gear down and locked. Extend the rest of the gear and land. If the inner landing gear door actuator bellcrank fails, the inner gear door hangs in the breeze.

According to the late Larry Ball, nearly half of all twin Cessna accidents and incidents were directly related to the gear, and a quarter of them to failure of the nose gear idler bellcrank under the pilot's feet. Later model 310s have heavier main gear torque tubes and side brace support brackets. Cessna has a kit available to retrofit earlier airplanes.

Another gear issue that deserves mention is the brakes. Early models had problematic Goodyears. Many were retrofitted with the later, and better, Clevelands. Still, the 310 is large and heavy enough that brake performance can be marginal.

MAINTENANCE, ADS

A scan of FAA Service Difficulty Reports going back five years dredged up numerous entries, underscoring the 310 fleet's age. Items garnering our attention included a cracked rear mount bulkhead in a right main (tip) fuel tank, sheared horizontal stabilizer attach bolts and a brake disc cracked where its manufacturer's name was stamped. But the single system receiving the most entries was, by far, the landing gear.

For example, a Canadian operator reported finding cracks in a right main landing gear extension/retraction torque tube at two places, while another airplane maintained by an Australian facility determined the left and right main landing gear downlocks were in an unsafe condition. Meanwhile, a U.S. operator reported a nose gear extension failure and found a broken bellcrank was the culprit.

For us, these events highlight the need for a 310 expert to conduct any pre-purchase inspection and for a shop with intimate familiarity to do your ongoing maintenance. That said, most retractable-gear airplanes originally designed in the 1950s likely will require similar attention and expertise.

As far as Airworthiness Directives are concerned, the most recent type-specific one is AD 2000-01-16, targeting turbocharged T310P/Q/R models (as well as other turbo'd twin Cessnas) for detailed, repetitive inspections of the exhaust system. The AD, which replaces AD 75-23-05 R5, is designed to detect and correct cracks and corrosion in the exhaust system, which could lead to an uncontrollable in-flight fire, and was the subject of extensive negotiation among operators and the FAA during the late 1990s. Since it became effective, there have no further exhaust-related accidents in these airplanes, according to those involved with its development.

Another one is AD 90-02-13, which covers the main landing gear barrel inner bearings. It applies to the 310, 340 and all piston-powered 400 series Cessnas except those with trailing link main gear and requires inspections for cracks, including magnetic particle inspection, every 1000 hours or the replacement of the bearings with an improved part.

The props are subject to a couple of ADs: these include the infamous McCauley prop inspection AD (95-24-05) and 94-17-3, repetitive inspection of the prop hub grease fittings.

Other notable ADs include: 98-1-8, replacement of two-piece carb venturis with one-piece units; 97-26-17, ultrasonic inspection of the crankshafts with possible replacement; 96-12-22, repetitive inspections of the engine oil filter adapters; and 96-20-7, repetitive inspection of the combustion tubes on the Janitrol cabin heater.

DOLLARS AND SENSE

When considering an airplane in production for almost 30 years, and with so many variants, it shouldn't come as a surprise 310 prices vary widely. An early "straight" 310 averages only $30,000 or so in today's market, rising to $155,000 for a turbocharged T310R, per the Aircraft Bluebook Price Digest. Between those extremes, there's no real "spike." Instead, each successive model sees a modest increment in price. The biggest single gap is between the 310Q and 310R—the 1974 310Q averages around $100,000, while the 1975 310R goes for $115,000. The gap for the turbo models is similar.

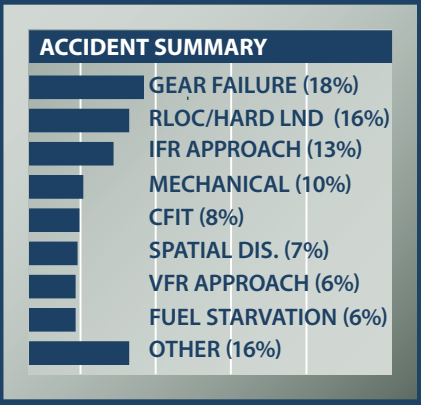
With those prices, there's no question the 310 can be a good bargain, although long-time T310R owner Mike Busch tells us, "It is a violation of the FARs to use the words 'twin' and 'bargain' in the same sentence." It offers twin-engine performance and security, a large cabin and substantial loading flexibility. But those

310 ACCIDENTS: PROBLEMS ON PAVEMENT

It's not that often we have to create a special category for our accident scan, but the number-one accident cause for the 310 often gets lumped into "other" for most retracts: gear failure.

The most common reason for the failure was cited as poor maintenance, but several times a contributing factor was the second-place winner for accidents: runway loss of control and hard landings. Our favorite crossover was this report: "The pilot receiving instruction made a hard landing. The instructor took the controls and initiated a go-around. Suspecting landing gear damage, he kept the landing gear extended ... On the approach, the right main landing gear fell off the aircraft." Yep, that's failed. A theme in the hard landings was falling right off the back of the power curve with descent rates too high to arrest before impact. Related were the six percent we're calling "VFR Approach" where pilots got into high sink rates and didn't even make it to the runway.

Botched approaches, CFIT and spatial disorientation combined for a 28-percent share of the accidents (89-percent fatal). Three mechanicals were engine failures that led to V_{mc} rollovers due to poor single-engine technique. Fuel mismanagement claimed six percent. All indicate that even though the 310 is a good first twin, proficiency is essential.



benefits must be balanced against the increased risk of single-engine operations, especially when low and slow. That debate's been going on forever, and we won't resolve it here. The same cam be said about the extra expense in engine maintenance, fuel bills, and insurance premiums. Also expect higher fees for annual inspections and even hangaring, and transient parking, when compared to a high-performance single.

The market seems to have an answer for all this: Singles retain more of their value year over year, even during the current downturn. Compare a 1981 Beech A36 Bonanza, which carried an average new price of $160,000. It now goes for around $120,000. A 1981 Cessna 310R II, average price new $234,000, now goes for $145,000. Other twins show similar results.

MODS, TYPE CLUBS

Modifications for the various 310 models run the gamut, from the usual avionics upgrades to improved cabin heaters, auxiliary fuel tanks in the nacelles and cabin, and electrically de-iced props. Other mods include vortex generators (VGs), something we highly recommend for all twins when available. They often come with gross-weight increases, as they can reduce critical speeds. Check Micro Aerodynamics (www.microaero.com, 800-677-2370). PowerPac Spoilers (www.powerpacspoilers.com, 800-544-0169), as their name implies, offers a spoiler kit for the 310R; it requires the Micro Aerodynamics VG kit.

Engine and prop upgrades are available from Colemill Enterprises (www.colemill.com, 615-226-4256) for the 310F through R, and may come with gross-weight increases. A choice of IO-520s or IO-550s is offered; prices and performance gains depend on aircraft model and options selected. Also, RAM Aircraft (www.ramaircraft.com, 254-752-8381) offers engine upgrades for the 310R, but mainly focuses on upgrading powerplants for the turbocharged 310 models.

One of the popular mods, at least for early 310s, was developed by Riley Aircraft Corp., which re-engined 470-powered 310s with a pair of Lycoming IO-540s. The Riley Rocket conversion used normally aspirated engines, with the Riley Turbostream adding a pair of Rajay blowers with manual wastegates. The conversions turned early 310s into rocket ships, but the company has long since gone out of business. Keep that in mind if considering a Riley 310.

All piston-powered twin Cessnas have their own support organization in the form of The Twin Cessna Flyer (www.twincessna.org, 704-910-1790), headed by Bob Thomason. Originally named 310 Owners of America, membership gets you a newsletter and the right to attend worthwhile seminars on operations and maintenance. Overall, however, the Cessna type club of choice would be the Cessna Pilot's Association (www.cessna.org, 805-922-2580), which serves all piston-powered Cessna owners with a monthly magazine and detailed, model-specific support.

OWNER COMMENTS

I've owned a 1956 Cessna 310 for almost 40 years, first with some great partners and then for 30 years as sole owner. It has 50-gallon, straight, "tuna" tanks and a three-place bench seat in the back. Our family has used it for some wonderful vacations around the country, as well as to Canada, the Bahamas and the Virgin Islands. With grown children, more of our trips are with two passengers and the plane's expensive "drinking habit" is challenging to rationalize.

The early 310s are easier to fly than many high-performance singles. Fuel management is stone simple: a fuel tank for each engine, avoiding the need for switching tanks, unless cross-feeding. There are no cowl flaps and no RPM ranges to avoid. The flaps and gear are electric. The landing gear design is a marvel of simplicity.

The plane has great climb and cruise performance, with a rated gross weight of 4600 pounds. The weight of the fuel in the tip tanks seems to make the plane more stable in turbulence. It also causes some pilots new to the 310 to overshoot bank corrections on landing approaches, but that is soon solved. The plane has three-axis trim and is very stable in pitch. It does not have

the same stability in roll. Without an autopilot, copying a clearance in IMC can sometimes result in unusual attitude recovery practice!

The only design complaint I have is with maintenance. Because of limited clearance under the cowling, removal of an exhaust stack (as needed to replace a cylinder) requires lifting the engine off its mounts.

Buyers of early 310s should pay particular attention to the augmenter tube area for corrosion. Also, the nose gear and its actuating mechanism are fairly long and sensitive to excessive landing sideloads or manhandling by tow vehicles—I never let my plane be towed.

An owner should have a copy of the Cessna parts manual, a marvel of beautiful drawings and detailed information. There is considerable variation by serial number within a model and the parts manual has that information. Parts availability is still fairly good, with many parts common to multiple models.

Fred Stadler
Arlington, Texas

I currently own a 1975 310R with a Colemill conversion. It is undoubtedly one of the best performers in the light twin class. I have owned quite a few twins, but none have the overall performance of the Colemill 310. At gross weight with the OAT at 25 degrees C, initial climb will be around 1200 FPM at 150 knots. In the winter, it's much better. Single engine performance is also much better with the conversion.

At cruise, normally between 9000 and 10,000 feet, full throttle produces 21 inches MP. With the props at 2300 RPM, the TAS will be between 190 and 195 knots on an average of 30 GPH total.

My flying does not require [the fifth and sixth] seats which leaves a large area for any cargo. Along with the extended nose baggage and the two wing lockers, there has never been a trip that required me to leave anything behind. The 310R is also a few inches wider than the Barons, making longer trips more relaxing for pilots and passengers.

The 310 is an easy plane to fly and is stable for instrument flying. Some have complained the tip tanks are a little hard to get used to but I have not experienced any problems. It does build up some speed on the descent so a little forward planning is needed to get down without cooling the engines. I have VGs on my plane and would highly recommend them to all. A great safety feature.

Annuals run between $3500 and $6500 depending on what needs to be done. The important thing to have someone familiar with 310s do the annual. Be sure that the gear is maintained in accordance with the manual. If not, I can tell you that you may pay for it later.

Craig Johnson
Via e-mail

For the past nine years I have owned a 1955 Cessna 310, the 42nd to come off the production line. I absolutely love it. I consistently get 22 GPH or better, averaging 175 knots. With full fuel (100 gallons) I still have over 900 pounds of useful load. I do not have aux tanks, but don't feel I need them. After 3.5 hours, I'm ready to stop and take a break anyway. And since I only have the tip tanks, I never have to worry about having the selector switched over to the right tanks in fuel-critical situations.

I have repainted her, put in a new leather interior and redone the panel with a GNS 430W, Gemini 1200 engine monitor, ring-lit gauges and other upgrades. I have also reinforced the landing gear structure with the 414 side brace kit.

There are so many misperceptions about these early 310s. For instance, the original over-the-wing augmenter exhaust pipe system was one of the best. The exhaust was blown out these straight pipes cleanly and easily with little chance of the corrosive gases getting hung up anywhere. And, with modern noise-canceling headsets, the roar of these straight pipes (which sounds like bunch of old Harleys) is no longer a problem.

Chuck Jessen
Mill Valley, California

I have been the proud owner of a 1966 Cessna 310K since 1976, and traveled from Oregon to Maine and to the Bahamas and Cayman Islands.

continued on page 32

The Aviation Consumer

Cessna 310

(continued from page 31)

There have been numerous times that certain places were not accessible within a time frame had it not been for this plane.

It is right at home both at large airports and 2000-foot grass strips. I am amazed at the overall utility it provides. Time schedules within a 600-mile radius are simple and much more convenient than any commercial airline. The one fact that I think I like best is that my luggage always arrives at the same time I do and at the same place.

Of course, as time passes, parts are a little more difficult to come by and more expensive. My membership in the Twin Cessna Flyer for the past 25 years has been a lifesaver, both for finding parts and getting a decent price on them.

I can't think of any other business or pleasure tool that means more to me. And besides, it's fun.

Leonard E. Yokum, Jr.
via email

Letters

(continued from page 3)

ceived and then the airplane brought in for a quick engine swap and then back in the air.

The second point is that a local rebuild of your own engine (or even a rebuild by a national shop) provides a limited warranty in which the repair or replacement of the engine parts most often must be only done by the rebuild shop.

For those of us who use airplanes for business and fly all over the country, in most instances, a warranty limited to the rebuilder's shop is worthless. If I have a factory Continental or Lycoming and I have a problem covered by the factory, any factory authorized factory service center can fix it.

If the local overhaul shop is based in Denver and I have a problem in New Hampshire then what?

In 35 years of flying, I am on airplane number eight. Two airplanes I had the local engine local shop overhaul with no complaints. But any warranty problems would only be corrected by returning to the rebuild shop.

Then as my aircraft business travels increased, so did my need for a quick engine swap and a warranty good anywhere in North America. So my next two overhauls were factory replacements. My downtime was days. The slight increase in cost was minimal compared to the flying time lost with having the plane's engine rebuilt, anywhere.

The warranty with a factory engine has been used half a country away from my homebase and my maintenance shop. So while a local engine rebuild may be the cheapest way to go to get the job done. In the long run it can be very expensive in lost money and having a warranty that isn't good away from the overhaul shop.

Bob Worthington
Las Cruces, New Mexico

Actually, a field rebuild is not necessarily the cheapest option. But the top shops provide better unstated warranty performance than the factories do, even at remote locations. If your field shop didn't honor your warranty remotely, you picked the wrong shop.

FEEDBACK WANTED

BELLANCA VIKING

For the August 2010 issue of *Aviation Consumer,* our Used Aircraft Guide will be on the Bellanca Viking, a classic old-school fabric and wood airplane. We want to know what it's like to own these retracts, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the Viking by June 30, 2010, to:

Aviation Consumer
7820 Holiday Drive South
Suite 315
Sarasota, FL 34231
(preferred) e-mail at:
avconsumer@comcast.net

Dante Deo

Reference your February *First Word* remarks, that was one of the best written pieces of journalism I have read in any genre. "Mother of Perpetual Guilt and Suffering" LOL!

Jim Lauerman
President
Avemco Insurance Company

Paul Bertorelli replies: Sister Salisha, rest her mean old bones, would never believe I finally did something to advance the cause of humankind.