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The Aviation Consumer®

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The Aviation Consumer

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Forget Checkouts, Now It's Training

Like Carl Sandburg's fog, progress sneaks up on you on little cat feet and before you know it, you can't see a damn thing. That's the reaction I had when I immersed myself in the G1000 training programs we're reporting on in this issue. What I was not seeing is how expensive it can be to be checked out on these things. Strike that; check out is the wrong word. You have to be *trained*.

I can remember the first time I was shown a Bendix/King KNS80. Whoaa… rho-theta navigation? How cool was that? Not that much, really. It was hardly revolutionary technology, but the important thing was that if it was in an airplane you intended to fly, it took about 15 minutes of instruction to understand it and another 15 minutes of practice to master it. In other words, it didn't have much impact on the cost of checking out in a new airplane.

Those days are long gone, however, perhaps for the better. But not if you want to fly on a budget. The impact of the G1000 on the cost of flying starts immediately at the checkout—I mean *training*—phase. An hour won't do it. Neither will two. In Googling around various flight schools, I find the cheapest rental rates for a Cessna 172 equipped with a G1000 to be around $140 an hour, but $160 isn't unusual. Add in an instructor at $50 to $80 and you're looking at something like $225 an hour.

Never mind how much time it takes to really master the G1000, what do FBOs and flight schools require? It varies between three hours and 10 hours. The school where I flew to test the efficacy of the training programs charges $2295 for a VFR G1000 course that includes four ground lessons, four flights and an oral. At the very minimum, a basic three-hour checkout, which is barely enough unless you're sharp going in, will cost about $700.

I don't begrudge the schools the money, to be honest. But I'd never added it up myself and the totals were somewhat shocking. I'm acutely aware of the care and feeding costs of the G1000 for owners, but I just never examined it in the context of rental and training. Small wonder that the cost of the $24.95 intro flight has ballooned to $200.

The $160 question (plus instruction) is whether this progress is worth it. What do you get for what you have to pay? And keep paying, since G1000 skills are as perishable as any high-level computer or technology knowledge. There's no question that systems like the G1000 do far more than anything that preceded them. They provide better situational awareness and, especially, superb weather awareness. All of this should contribute to flight safety, but probably hasn't, given how persistently pilots make smoking holes whether the airplane has steam gauges or a lavish glass panel. This may change as glass makes more inroads but, I kinda doubt it.

So then what's the payoff for all the money and effort required for G1000 training? Is it a better flight experience? Yes, for IFR. With its in-depth FMS capability, the G1000 is clearly designed to render transparent the abstraction that is IFR flying, even if takes some effort to bring the picture into focus behind layers of screens and menus. Once these are understood—and it's not that hard to do that—operation of the G1000 is slightly more automatic than it is distracting. But if you slight on the training and practice, the equation will go the other way and trust me, you'll find yourself wishing for an old KX-170 with a mechanical tuner.

Any of the programs we've reviewed in this issue will get you to and keep you on that proficient edge. But not without an ongoing expenditure of time and money, and it will require a little more of each than you might imagine. If you're just breaking into this realm, the price tag on progress may be a little surprising. It certainly was for me.—*Paul Bertorelli*

Cheap Plastic Indeed

"Aftermarket Saves Big"? (June 2011 *Aviation Consumer*) Not if you buy from Plane Plastics! Their stuff takes an enormous amount of trimming and fitting. At best, it ends up looking second rate and some cannot be made to fit at all.

I can show you pictures of stuff I ordered by model and serial number of the aircraft. The left instrument panel cover was especially bad. I was terribly disappointed by the whole experience.

An acquaintance on the field ordered a whole suite of plastic for a 172, interior and exterior, from them and had a labor bill of about $4000 for the trimming and installation.

Russ Walker
Brawley, California

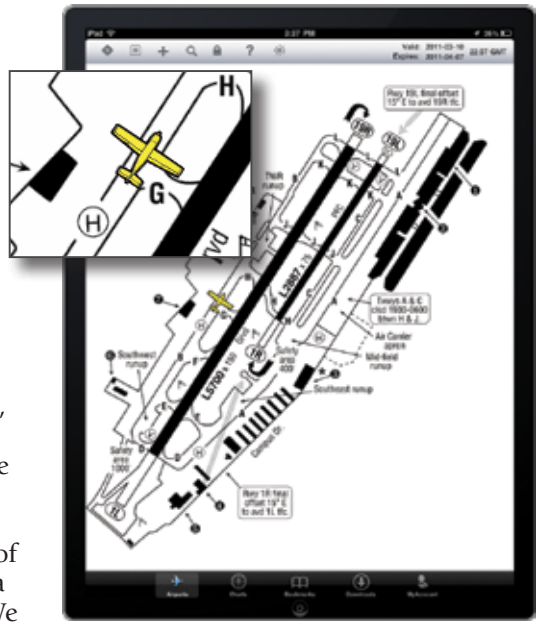
Thanks for letting us know. We had heard some complaints in the past, but none recently. Plane Plastics declined to comment on your photos when we asked.

Airguide Additions

There are a few points we'd like to clarify regarding your article "Flight Guide iEFB 3.0" (July 2011 *Aviation Consumer*).

ForeFlight and other iPad Apps do not have an airport diagram for every airport. They are missing approximately 2000 airports for the USA. Flight Guide iEFB, on the other hand, has nearly 5000 airports coast to coast because we research and draw them ourselves. We also georeference all of our airport diagrams. Other iPad Apps only georeference about 700 FAA airport diagrams.

The FAA only provides taxiway identifiers for larger tower airports. In Flight Guide iEFB, we depict all the taxiway identifiers, as well as non-standard traffic patterns, surface types, runway gradients and pilot-controlled lights. We also point out the location of all the businesses, which comes in handy at an unfamiliar field.



We include panel IFR & VFR charts so pilots can read the pertinent information (Transition Routes, Restricted Airspaces, Legends, etc.) found along the edges. We also take info from the AFD, but then add information we obtain directly from the airport managers. We have a team of researchers making sure our data is the best and most complete. We push these updates to the iPad daily, rather than on the 28-day cycle as everyone else does.

Our geo-referenced airport diagrams and IAPs show an airplane icon depicting your direction, not just a yellow dot as shown in the article.

You knocked our pricing, but we feel such superior airport information is worth more. It's the most comprehensive airport information a VFR pilot can have.

Brenda Garcia
Airguide Publications

Zenith ≠ Zenair

I enjoyed your article on the CH 750 STOL LSA. However, there are a few errors that need to be corrected.

Designer Chris Heintz has developed his designs independently of Zenith Aircraft Company (Zenith). Zenith produces kits for the experimental homebuilt market under license from Chris Heintz. Zenair Ltd. (Chris Heintz' original company in Canada) and Zenith Aircraft Co., are not sister companies as you state, but are independent. Zenith does not supply kits to Eastman or anyone else for ready-to-fly SLSA.

Zenair in Canada is the only authorized company to supply SLSA kits/parts for the CH 750 STOL SLSA and Zodiac 650 SLSA. Other than Zenith and Zenair, no other company is authorized to manufacture parts of Chris Heintz designs.

I also need to point out that Chris' last name is spelled HEINTZ (like the ketchup but with the addition of a "t"). As a matter of fact, Zenith is an anagram of Heintz. Sorry for being upfront about this, but it's important that this is clear to everyone.

Matt Heintz
VP, Zenair

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Aircraft Batteries: Concorde Still Excels

We've put Concorde and Gill batteries, both sealed and flooded, head-to-head for a decade now. Concorde has taken the ribbon every time.

by Kim Santerre

We have tested Concorde and Gill aircraft batteries on multiple occasions looking for the longest battery life and best value. In our view, and in our opinions expressed in our reader polls, Concorde's products are a better bet.

Our gold standard has been the FAA capacity test as the core of that test methodology since it takes each battery's amp-hour rating into consideration during the test, so we are testing apples-to-apples, so to speak.

Per FAR 23.1353(h), we look for 80-percent capacity at the one-hour discharge rate. This simulates the stress of an alternator-out situation where battery power alone keeps the essential electronics bus running for a minimum of 30 minutes.

There is no established standard for the number of cycles a battery must undergo, and we were only checking to see if the battery passed or failed each test.

Results were repeated three times with three sets of different batteries for a total of over 20 batteries.

Obviously, doing this over and over takes a toll and ultimately as the cycles continued, some of the batteries started to fail the capacity test by reaching the cutoff voltage before they were supposed to—in other words, the capacity dropped below the 80-percent level—at which point we stopped testing that battery.

CONCORDE ON EVERY FRONT

In each of the separate tests conducted a few years apart using three different type testers, we consistently found that Concorde and Gill flooded cells were close in their rated performance. However, Concordes generally have higher rated and actual amp-hour capacity out of the box than Gill. The Concorde flooded batteries also lasted several cycles longer than the Gills before they dropped below their official capacity rating. Two reader surveys returned similar opinions.

The Concorde sealed batteries performed better than their ratings, whereas, Gill sealed batteries just made their lower rating. Ultimately, the Concordes showed better performance throughout the test. So, in this limited quantity of batteries we tested on three separate occasions, it appeared the Concordes have greater cycle endurance before failing the capacity test, as well as greater average amp-hour capacity ratings than their Gill counterpart. The Gills met their lower amp hour specs, but most did not last as many cycles in repetitive capacity testing.

In a final abuse test, we gave the sealed batteries a charge and let them sit for six months. We kept this six-month interval up until the batteries failed a capacity test. The Concorde AGMs finally failed the capacity test at 30 months (but we still use them around the shop). The Gills died at 12 and 18 months and could not be charged.

One area in which we were criticized in testing is that only three to four examples of each brand (12- and 24-volt and both flooded and sealed) were tested on

HOW TO MAKE YOUR BATTERY LAST LONGER

Buy a sealed battery. See, wasn't that simple?

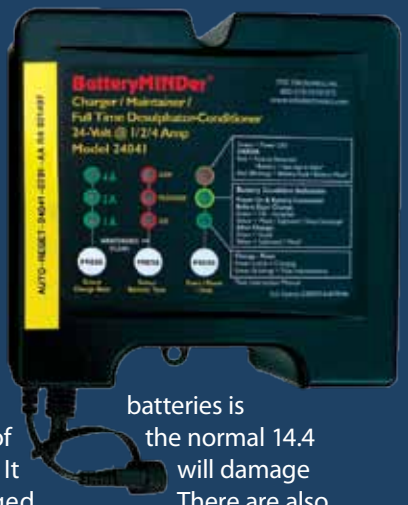
Sealed batteries can sit for much longer periods without discharge, and never need water. If you have a flooded battery, you'll want to keep it charged with a trickle charger if it will be more than a week or two between flights. Don't trickle charge over 13.2/26.4 volts; you'll do more harm than good, unless the charger is on an interval timer. Only use an aviation-rated charger and only use distilled water.

Never, ever leave a battery partially discharged, even overnight. Sulfation starts immediately.

Avoid parasitic losses when possible. These could be from an electric clock, radio memory or anything that draws current when the master switch is off. This includes ground faults. Parasitic draw contributes to the early failure of batteries through sulfation. Concorde also has an advisory out on an easy-to-do parasitic load test for aircraft to find those loads on the battery that drain it while the aircraft is sitting.

Watch your charging system voltage. Match it to the charging profiles in the maker's battery owner manuals, including seasonally adjusted maximum voltages when possible. High air temps need lower voltages. Some voltage regulators automatically change with temperature; others need to be manually adjusted.

Both companies have battery manuals and ICAs on their sites as well, with extensive information on the proper care and feeding of their batteries. An improper initial charge of a flooded battery with an auto charger can ruin it. Concorde says the Deltran Battery Tender brand chargers, popular in the automotive markets, should not be used with Concorde AGM batteries as the charging voltage is set too high.



One caution with sealed batteries is charging voltage in excess of the normal 14.4 to 14.7 (28.8 to 29.4) volts. It will damage a sealed battery if prolonged. There are also seasonal variations in acceptable charge voltage. Dedicated aviation profile multistage chargers from VDC Electronics solve this problem with storage charging (Automotive chargers typically are set too high and shorten the life of aircraft sealed batteries). What hasn't been solved is aircraft charging systems that are set too high or improperly maintained.

For those people who don't want to get their systems properly adjusted, they are better off staying with a flooded battery and doing all the associated battery maintenance such as adding water.

Given current battery prices, an owner would be ahead of the game to get that electrical system fixed and get an aircraft-type multistage charger to try to get at least four good years with a viable capacity test, rather than just buy a new battery every two or three years.

Table 1. Recommended Voltage Regulator Settings

Battery Temperature	Voltage Regulator Setting (Volts DC)	
	12V System	24V System
Below 0°C (32°F)	14.5 – 14.75	29.0 – 29.5
0 to 15°C (32 to 59°F)	14.25 – 14.5	28.5 – 29.0
16 to 30°C (60 to 86°F)	14.0 – 14.25	28.0 – 28.5
31 to 45°C (87 to 113°F)	13.75 – 14.0	27.5 – 28.0
Above 45°C (113°F)	13.5 – 13.75	27.0 – 27.5

each test. We freely admit this is not a large sample. But the results were repeated three times with three sets of different batteries for a total of over 20 batteries over the 10 years. The Concordes consistently won the match, so we feel confident in our opinion that they are the better value.

USER OPINIONS

Our latest survey of user opinions turned up results consistent with our 2007 one. Sealed batteries are now the majority choice at 59 percent, most of which were Concordes.

"Concorde sealed is the way to go," said one reader. "Already because the corrosion repair around the Gill vent cost me $$$. Gill also does not have enough cranking power and does not last." Another told us, "I prefer sealed due to limited maintenance requirements. I have used Gill in the past and have been happier with the reliability of the Concorde. I change the battery every three years." Concorde says their current production is nearly 99 percent of the sealed variety.

The brand usage has reversed from 2007. Then it was 55 percent were Gill and 37 percent for Concorde. Now it's 48 percent for Concorde and 40 percent for Gill. "The Concorde RG-35 batteries are absolutely the best I've ever used. They have performed flawlessly for me with little to no maintenance, especially important here in Fairbanks, Alaska." But Gill still had fans: "My Gill G242 is five years old and still going strong! I fly two times a week and use battery on the ground to program flight plans and listen to music." The Gill proponents were limited to flooded-cell type batteries, and a number said they simply replaced what was already installed.

If you were paying attention above, you'll see there was 12 percent unaccounted for. These were homebuilders who have the option to use the other makes such as the Odyssey battery. "The Odyssey battery is far better than either Concorde or Gill that I have used in the past. The cranking power is at least 1/3 greater and it is very small and lightweight."

CONTACTS

Concorde Battery Corp.
800-757-0303
www.concordebattery.com

Gill Batteries
800-456-0070
www.gillbatteries.com

West Coast Batteries (Odyssey)
888-379-2555
www.odysseybatteries.com

The respondents as a group seem battery savvy (based on many dozens of insightful comments), and a full 69 percent put their own battery into service, saving themselves a good chunk of change. What is surprising, though, is only 37 percent have ever used a battery charger, and of that group only 19 percent use an aviation-type charger. Case in point for using a charger: "With short flights, my battery sulphated badly and needed encouragement to participate. Now with a VDC Battery Minder connected the day before, the system runs well. The battery has de-sulphated."

There is lots of room here to improve battery life with an aviation charger between flights if the plane will sit for more than two weeks at a time. Many respondents seem resigned to changing the battery at three-year intervals, but that really doesn't have to be the case with a proper charger in the picture. Some 37 percent claim their battery is over 36 months old, quite a few claimed five years for Concorde sealed or flooded or Gill flooded, and some respondents spoke of 10 years when the battery was well tended.

"I have never had an aircraft battery that didn't last 10 years or longer. The brand is not as important as the maintenance done on the battery. Checking the water level every month or two, never adding anything to the battery except distilled water, and never letting the battery sit in a partially discharged condition will ensure maximum life. I keep the battery topped off with a solar trickle charger [available from VDC Electronics] in the back window that I clip to the battery when not flying. I've had this experience with batteries in my Cessna 172 and later in my Cessna 182. I'm an electrical engineer, studied lead acid batteries while in college, and have been flying 45 years."

Many respondents indicate they do capacity checks—a good thing. Some wonder if the capacity check shortens the life of the battery. The short answer is, "Yes." But there is currently no better way to test a battery, and the life shortening is relatively low.

In addition, it's probably mandatory. FAR 91.403 says to follow Instructions for Continued Airworthiness (ICAs), and the ICAs from the battery makers don't exempt any aircraft using their battery from capacity testing if it is used as a starting battery as opposed to emergency or backup use.

FAILURE RATES

Battery failure (defined as death in under 24 months) is still an issue, but both makers improved over the 2007 survey. Sealed batteries were reported as nearly twice as reliable. For Concorde the early failure rate was 7.6 percent. For Gill it was 30 percent. That may seem like a lot—and it is compared to car batteries—but it's still a big improvement over 2007 when the failure rate was 22 percent for Concorde and 59 percent for Gill.

We did get a repeat finding, which we still find a bit baffling and will use the same rationale for the result, and that is there is a 400 percent higher failure rate for 12-volt batter-

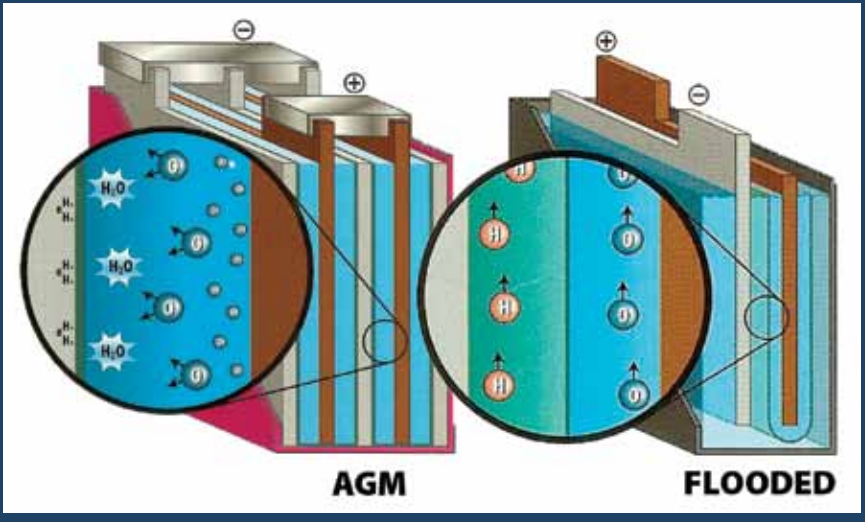
Technical Corner

WHAT'S A SEALED BATTERY?

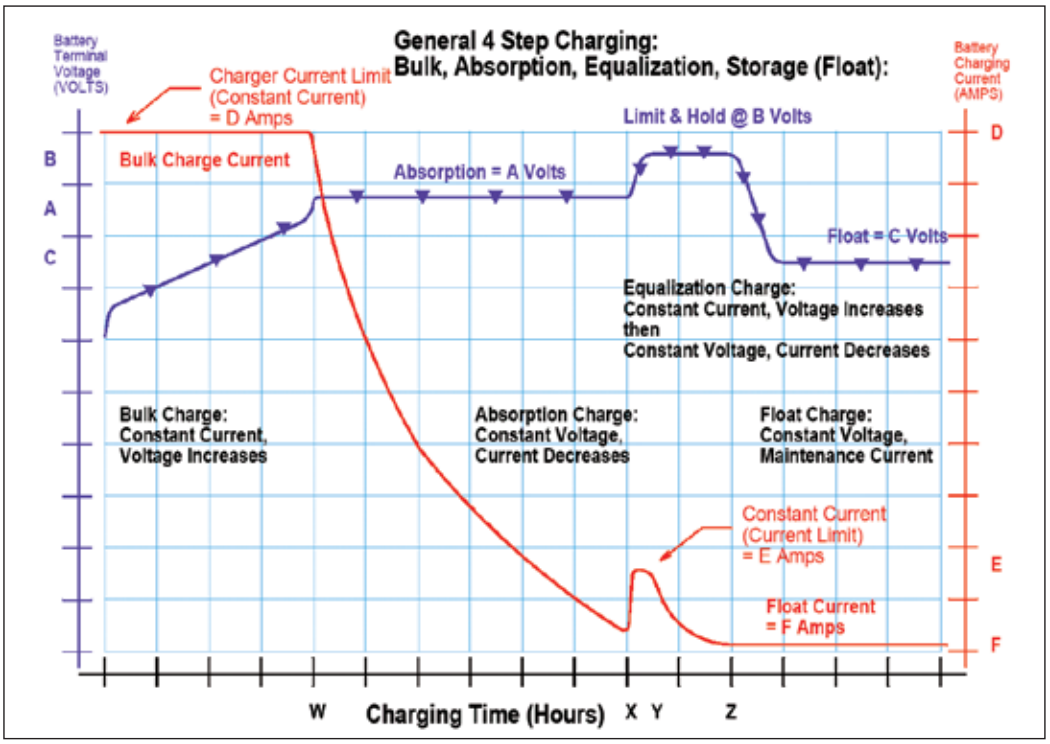
The term AGM (sealed), recombinant gas (RG) or starved electrolyte battery are the same thing. This technology generally offers greater cranking and faster recharge ability for a given model than a flooded battery due primarily to its extremely low internal resistance and different internal design. (You could drive a spike into an AGM battery and pull it out and the battery would not leak.)

To paraphrase Concorde: The cells are sealed with pressure relief valves that keep gasses within the battery. The plates are sandwiched between layers of fiberglass mat with fibers of different length. The mat is over 90 percent saturated—but no more. The remainder is filled with gas to provide channels by which oxygen travels from positive to negative during charging.

The void spaces allow the freshly generated gasses, which are in their atomic state and highly reactive, to recombine rapidly and safely. Because this design allows much lower internal resistance than flooded battery technology, AGMs have greater starting power and resistance to self-discharge. These are not gel cell batteries; that's a different technology.



The VDC charger uses a multistage controller tailored expressly for aviation AGM and flooded cells. You can see how the charging scheme varies with time and existing battery charge.



ies than 24-volt types (failure defined as unserviceable in under 24 months).

Since 24-volt batteries have double the number of cells of a 12 volt, there is an inherently greater risk of a bad cell or failing cell, but we can only conclude the newer aircraft electrical systems (post 1978) take less of a toll on batteries or get more TLC because they are so expensive.

Owner flying hours are holding about the same, but are still low, with 29 percent flying 25-50 hours per year, 38 percent flying 50-100 hours per year and 23 percent over 100 hours per year.

Along those lines, only 12 percent of respondents were satisfied with the warranty service. There were 19 percent unsatisfied and 69 percent were out of warranty or did not pursue it.

As an aside, 29 percent indicated that they will jump a dead battery and press on. This is an inherently dangerous practice unless you plan on staying in the pattern since that dead battery is nearly worthless for two to three hours (assuming it was in decent shape) should your alternator system fail. Much of the alternator output is going to servicing electronics, not charging the battery.

THE MARKET SPEAKS

When you're picking a battery, it's important point here is that to judge value, use a dollar cost per amp hour rather than simply the battery price.

Using Aircraft Spruce prices, a Gill G35S sealed, 23 amp-hour battery is $189. A Concorde 29 amp-hour version is $198. It looks at first glance like the Gill is the better buy, but in reality you get 26 percent more amp-hour capacity in the Concorde for $10 more. That's $8.22 per amp-hour for the Gill and $6.83 per amp-hour for the Concorde. We think this makes the Concorde the better value in cost. The Concorde ICA requires less frequent testing and has a better warranty, as well.

Our data shows Concorde as number one in sales with a 48-percent market share, followed by Gill at 40 percent and the remainder in the homebuilt market made up mostly of Odyssey sealed batteries. That last option isn't available for many certified aircraft. If we were to go out and buy a new battery today, it would be a sealed Concorde.

Kim Santerre is the editor of our sister publication Light Plane Maintenance.

Concorde's copper terminals and hardware aren't subject to the dissimilar metal corrosion of a copper battery cable terminal on Gill's lead post with a steel bolt, washers and a wing nut.

Smart Autopilots: Is There a Downside?

New autopilots poke their nose in even when the system is technically off. Is this lifesaving technology or a sales gimmick with a dark side? Or is it both?

by Jeff Van West

We pilots routinely kill ourselves. Not only is this a bummer for the people intimately involved in the wreck, it's also bad for business. Cirrus Aircraft defined itself as a trend-setter in combatting this with certified aircraft when the first SR20s rolled off the line with whole-airframe parachutes in 1999.

Better than just surviving a catastrophe at the expense of the airplane, however, would be recovering back to controlled flight. Cirrus again led the charge in light GA with "LVL" button as part of the Garmin Perspective avionics suite (a modified G1000) in 2008.

More sophisticated than a simple rip-cord solution, the LVL (blue) button leverages the tumble-proof digital "gyros" to pitch and/or roll the aircraft back to level flight without overstressing anything.

Avidyne came up with a similar feature called "Straight and Level" in its DFC 90/100 autopilots. This makes the feature retrofitable to aircraft formerly equipped with the

REALITY CHECK

STEC 55X. Both Garmin and Avidyne have protection against going too fast or too slow—in some cases even when the autopilot is technically turned off.

This is taking us into uncharted territory: these autopilot systems can actually disobey the pilot for that pilot's own good. All Airbus and "I'm sorry, Dave. I'm afraid I can't do that" pot shots aside, this begs the questions of whether these systems really work, whether they are worth the expenses, and, more philosophically, is this a direction we want to go?

Is this where we want to be going, where part of your preflight is to make sure the aircraft is equipped with a smart autopilot at the ready?

Right now the only contenders in small, certified aircraft is the Cirrus Perspective system and the Avidyne DFC-series, so we'll focus on those.

SMART AUTOPILOT TRICKS

Step one is clarifying what the systems do and don't do. We've tried both the Perspective and the DFC's one-button recovery to level flight. They work as advertised. The systems are even smart enough to unload the wings before attempting to roll level and pull up. Unofficial (but we'll say reliable) sources have told us the DFC has even demonstrated recoveries from inverted dives. We expect the Perspective would do the same.

Both systems also have under- and overspeed protection when the autopilot is engaged. If the pilot commands a climb without adding sufficient power, such as during a botched missed approach, and the aircraft will slow to a specific speed and then pitch down just enough to hold that speed. Meanwhile, beeps, flashing text, and audible callouts will warn "Underspeed Protection Active." Restoring power will restore the climb and disable the mode. Again, we tried it and it works.

The Avidyne system uses a similar tactic of the pilot commands a descent that crosses Vne: It pitches up. The Perspective system is different. It only offers overspeed protection with the Electronic Stability and Protection (ESP) that's part of the $39,900 Perspective 700 Select package. ESP was also retrofit on many Perspective SR22s sold before the function was offered.

ESP runs full-time, even with the autopilot off. If you overspeed the airplane, either by commanding too much descent on autopilot or by manually pitching down, the autopilot servos push back on the stick to slow the plane from 200 knots to 190 knots. Yes, the autopilot could be pitching down because you

told it to descend, and then pitching back up not to overspeed—in an endless loop until the pilot fixes the problem. Good thing it isn't smart enough to need psychotherapy.

It's only 10 pounds of force, so you could easily override it. In fact, when we tried a manual dive in an ESP Cirrus, we found the push subtle given the higher stick forces at 200 knots. The combination of the push and the visual and auditory warnings should get a pilot's attention, however.

ESP also limits pitch and roll. Pitching to 17.7 degrees nose up or 16 degrees nose down will earn you that same 10-pound pushback toward level flight. Rolling past 45 degrees of bank will generate a five- to seven-pound push on the stick back toward about 30 degrees of bank along with only a subtle visual cue (see sidebar, page 9). An ESP aircraft (Garmin has the system running on some other G1000-equipped aircraft) can't get into a steep spiral. It may spiral and descend, but the bank will keep oscillating between 45 and 30 degrees. ESP can be temporarily disabled at any time if the pilot chooses.

The evolving term for this kind of thing is "envelope protection." The autopilot steps in with warnings or actual action when the pilot flies outside of a prescribed performance envelope.

High-flying Cirrus aircraft take this autopilot-as-overseer a leap further with Hypoxia Check. If a pilot cruising at 15,000 feet doesn't push any buttons for 30 minutes (virtually impossible for a Cirrus pilot with a pulse), the system throws up an alert (which, of course, entices the pilot to push a button). If the pilot doesn't respond, the autopilot will descend the airplane, first to 14,000 feet and then to 12,500 feet. The time before a warning tapers from 30 minutes at 15,000 feet down to five minutes by 25,000.

We've come a long way from a Nav-o-matic wing leveler.

HOLES IN THE SAFETY NET

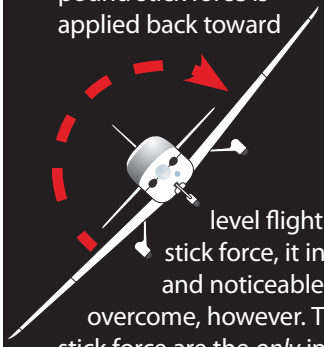
"The parachute gets all the attention, but I'm convinced this system is just as revolutionary," says Bill Cattley, Northeast Division Director for Cirrus, when talking about ESP. The jury is still out on whether that's

WHAT ESP'S COAXING LOOKS LIKE

Garmin's Electronic Stability and Protection (ESP) as implemented in the Cirrus will apply stick forces back toward wings level when you exceed 45 degrees of bank, or pitch level when you exceed 17.7 degrees nose up, or 16 degrees nose down.

The roll protection is annunciated by two thin lines at the 45-degree positions of the roll indicator.

Nothing happens until the pilot banks the airplane (intentionally or accidentally) through 45 degrees. At this point, the two thin lines of the ESP tick mark slide back along the roll indicator to 30 degrees and a five-pound stick force is applied back toward



level flight. If the bank angle continues to increase despite that stick force, it increases to seven pounds. The push is quite sudden and noticeable if you're lightly gripping the stick. It's quite easy to overcome, however. The movement of the tick mark and the pressure of the stick force are the *only* indications ESP is actively righting the aircraft.

As the airplane reaches 30 degrees of bank, stick force has tapered off to reach zero pounds and the tick mark moves

back to the 45 degrees and the system is back in its overseer mode. If the airplane banks again, such as if it were trimmed for a left turn, the system will kick back in at 45 degrees and the cycle will repeat. Remember, the autopilot is *off* during this whole time.

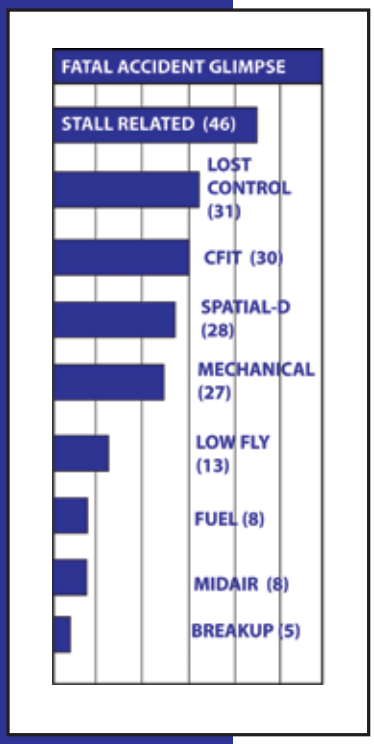
Would the system prevent the dreaded graveyard spiral? Our short test indicates it would—so long as the pilot lets it. If the pilot were simply confused and applying back pressure when they should be rolling out of the turn, the stick force would get things going in the right direction. If the pilot were truly confused and misreading the cues and really thought the correct action was more left bank (we're not sure how that would happen with synthetic vision as well, but just suppose), then they would have no trouble overpowering the system, spiraling right into the ground.

LOSS OF CONTROL A LEGIT KILLER

When we first clapped eyes on the little blue bail-me-out autopilot button in the Cirrus Perspective, we allowed as how it could be safety nannyism run amok. After all, at some point, doesn't the pilot have to step up and actually fly the airplane? And how many loss-of-control incidents can there really be?

Quite a lot, it turns out, depending on your definition of "a lot." As part of our monthly accident reviews, we took a look at all of the fatal crashes for 2008. We examined only general aviation accidents in the U.S. involving certified aircraft; we tossed the amateur-builts, ultralights and LSAs. That added up to 218 accidents involving at least one fatality—a typical year in the past decade.

The results don't exactly paint a picture of steely-eyed aeronautical competence. Twenty-eight of the accidents were described as some form of VFR-into-IMC that led to spatial disorientation. An additional 31 appear to be loss of control of some kind. We say "appear" because some of the NTSB reports lack the detail to make a firm conclusion. Throw in an additional five structural breakups and 46 stalls, and you can make the case that exactly 50 percent of the fatal accidents appear to involve a perfectly sound airplane flown by a pilot who simply lost it and lacked the means to recover.



You can thus see a reasonable rationale for an autopilot with the capability to intervene if the aircraft is flown beyond certain parameters. Even if it nudges the airplane back to a point where the pilot's head reattaches to his brainstem, that might be enough to avoid a fatal loss of control.

Maybe, that is. Our source of doubt relates to an incomplete understanding of what really happens in loss-of-control accidents. Based on the 2008 data, 13 percent of the accidents involved spatial disorientation in which pilots—some of them instrument rated—knowingly flew into IMC. These strike us as basic poor-judgment accidents in which the loss of control may only be incidentally related to the outcome. The real cause may be more fundamental and related to the pilot's inability to assess and act upon risk generally.

Designers of autopilot envelope protection schemes also face the considerable challenge of knowing where to establish the edges of the envelope. Can a pilot be protected against everything? In one accident, a relatively inexperienced (282 hours) pilot was flying an ILS into North Canton, Ohio, in a recent model Piper Turbo Saratoga. Although the accident report doesn't confirm it, the aircraft was almost certainly equipped with an approach coupler. Yet the pilot appeared to have hand-flown the approach in a way, according to the radar track, that wasn't wildly out of control, but that eventually reached sufficient pitch up and bank to cause a stall. At what point could or should a smart autopilot nudge the pilot back into the center lane? Or should more effort be placed in training pilots to use the first line of defense which, in this case, might have been the approach coupler.

As noted in the graphic above, the largest single factor in fatal accidents is stalls of some kind, many involving spins. Such that it's possible to discern what really happened in many of these accidents, it appears at least some pilots got into stalls simply because they didn't realize airspeed was decaying and angle-of-attack was increasing.

Bottom line: Smart autopilots with envelope protection may have rich pickings in preventing fatal accidents. But it's likely to be many years before they penetrate the market enough for any of us to notice. *—Paul Bertorelli*

true, but if it saves even one life, how could anyone say it's a bad thing? We've lost at least a few Cirrus owners to hypoxia alone.

Smart autopilots aren't entirely idiot proof. The Perspective's System originally uncoupled the autopilot when the pilot initiated the missed approach. Now it stays coupled and commands a climb, relying on the underspeed protection to prevent a stall on the missed if the pilot doesn't add power.

We tried this and could see a pilot convinced he had started the missed and confused why the aircraft isn't climbing. A confused mind has a way of misreading, or even ignoring, alerts. The warning says, "underspeed protection active," not "add power, stupid." It's not quite at the sardonic CFI level yet. That means it can only point out the problem, not the corrective action.

The same is true of preventing an accelerated stall in a base-to-final turn. We suspect 10 pounds of push and a visual-only warning on a PFD won't have any effect on a pilot pulling and banking while focused outside the cockpit on the runway he's overshooting.

This gets at some of the user interface issues with smart autopilots, what's the best way for them to intervene? Steve Jackobson of Avidyne puts in this way, "There are really two conditions to worry about. I've gotten myself distracted and need someone to slap me in the face, or I've become a dog watching TV." By dog and TV he means the pilot sees the right information, but just isn't processing it correctly. That's where "Add power, stupid" may be what's really needed.

Avidyne's DFC 100 has envelope protection when the autopilot is in flight director mode that simply alerts the pilot. The DFC 90 retrofit version doesn't have this feature. Avidyne hasn't announced any upgrades to the DFC series for envelope protection when the unit is completely off, but we suspect they will to compete, if nothing else.

The Avidyne DFC 90 and 100 prevent over- or underspeeds while on autopilot and warn, but don't act, on the flight director. New software will also warn of excessive roll. It also offers one-button upset recovery.

That brings up the potential for unexpected complications with this kind of technology. One of the carrots to get owners of STEC 55X autopilots to stomach the $10,000 upgrade to the DFC 90 was that the new indicated airspeed mode could be used for emergencies. We reported on this in our September 2010 review of the DFC 90. If the engine fails, the autopilot can hold the best glide speed of 88 knots while you deal with the emergency.

Except that we know of installs where that doesn't work. With servos that are technically within spec but less than optimal, the airspeed mode can overshoot and then get stuck in underspeed mode at about 80 knots, rather than 88. We've seen this in both the SR22s we fly periodically that were upgraded to the DFC 90.

Avidyne tells us, "It would take one hand to count the number of open issues" with the DFC 90, but considering we saw this issue twice is two airplanes, we expect it's more widely spread. It's possible DFC 90 pilots are out there assuming this feature will work and will only discover it doesn't when they actually try to use it. The AP still won't let the airplane stall. But flying seven to eight knots below best glide with limited heading response isn't what the upgrading owners signed on for.

CFI IN THE MACHINE

While there's something vaguely Orwellian about an airplane taking matters into its own hands, the systems are really logical extensions of terrain-warning alerts and audio callouts, or red chevrons on the attitude display pointing back toward level flight. We've flown them. They aren't obtrusive in practice. Even the most conscientious pilot can become distracted or hypoxic, and there's real room to save lives here (see sidebar, page 10).

But there is the more slippery and politically incorrect issue that smart systems like this lure people into personal flying who wouldn't—or shouldn't—be in that seat. Cirrus is arguably again the poster child here, and not in a flattering way. There are many conscientious, competent and safe Cirrus pilots. But there are also many low-time pilots relying on the technology to make their mission possible. We don't see this as a bad thing per se, but we, and many others, opine it's why the fatal accident rate for something with so much safety gear is not significantly different than aircraft without it.

The new start-up screens in the Cirrus we used for the ESP tests drove this home. They prompt the pilot to choose personal minimums as an "infrequent flier, average pilot or elite aviator." Each category has a symbol over it you've probably seen before: a green circle, a blue square and a black diamond.

The reasoning is to make the decisions simple. But in-flight decisions usually aren't simple. Taking a 200-knot machine cross-country isn't a weekend on the slopes.

While a one-step unusual attitude recovery and overall envelope protection is a fine thing, and arguably worth the expense, we won't get too excited until we see smart systems that aid and augment some higher-level thinking. Where are the smart systems warning us we've lined up with a runway that's too short for the current temps and pressure, or point out our destination just dropped below approach minimums and offers some alternatives?

We still think there's something important about a pilot wanting to actually, you know, fly. Hopefully the future of smart systems will be some artificial intelligence that aimed at helping a pilot do that better—rather than just feeding the dog.

AC TV

To see some of these autopilot functions in practice, log on to www.avweb.com and select the video index. Look for the video on Smart Autopilots.

What's It Worth? Appraisal Realities

Surprisingly, many owners fail to do basic tasks which would add to the appraised value of their airplanes.

by Bicknell Eubanks

CHECKLIST

- With just a little time and not much—if any—money, simply cleaning the airplane will add value.
- Well-organized log books will return far more than the time it takes to prepare them.
- Don't delude yourself into thinking mods and avionics upgrades will return full value.
- If you're the seller, don't ask the appraiser for his verdict. He's working for the buyer.

AIRCRAFT OWNERSHIP

As a professional aircraft appraiser, I was retained to perform an appraisal on a 1978 Grumman AA5B Tiger not too long ago. I met the owner at his hangar and when he rolled open the hangar door, I wasn't prepared for what I saw.

It was one of the saddest airplanes that I have ever seen. It sat in a hangar that had housed it for three years as it collected dust on what had once been a good, fresh paint job. Its partially deflated tires were sitting in an inch of water, possibly from a roof leak. This airplane showed three years of neglect. Fortunately, the sliding canopy was closed so most of the dust had not penetrated the interior.

The airplane was about three years out of annual and it had not been flown or even run in those three years. This airplane was not going to appraise for very much money, even though the owner expected that it would.

What was really sad was that the owner had owned the airplane for several years and had taken good care of it until three years before the appraisal. He had even installed new avionics just before he abandoned the airplane to sit idle in the hangar. If he had performed just two annuals and taken a trip around the patch once a month, it would have been worth several thousand dollars more in its market value.

NEGLECT KILLS VALUE

This owner was not alone in presenting his airplane for appraisal without properly preparing it. It doesn't take much effort to make an airplane more presentable and valuable without investing much or any money. I have appraised airplanes that have not had the interior cleaned since the last long flight. Surprisingly, this occurs quite often in corporate, cabin class and turbine equipment, which you would expect to be better cared for.

One Navajo had a week-old fried chicken dinner that had been left to spoil in the cabin. After one week in a closed cabin sitting in the Texas summer sun, the cabin was pretty rank. This was not an isolated case, either. For some reason, many owners don't clean the cabin even when they know an appraiser will be looking at the airplane.

"Just check with the FBO and they will give you the key and/or open the hangar for you," is about all the effort some owners are willing to exert. When I ask about the logs and records, many owners sound puzzled and even ask if I really need them. Yes, I really need them. They are a core part of assessing the value of an airplane. Make no mistake, the logs and records are 80 percent of what I need for a good appraisal.

Let's go back to our poor abandoned Grumman Tiger. Up until the day he began neglecting it, the owner had kept meticulous records and had maintained the airplane on a regular basis. This was reflected in the logs and records. While nothing could erase three years of neglect, good records helped establish that the airplane had been well cared-for most of its life.

Consequently, the appraised market value was for more than it would have been without the records. Keep this in mind when you're organizing your own records. Well preserved records will return far more than the effort it takes to organize them.

Technically, I guess it shouldn't make a difference in the appraised value. But, let's be honest about it. I

am a human being, as are my fellow appraisers. Even though I try not to let such things affect my appraisal, I am sure that, subconsciously, they do. If an owner doesn't have enough pride of ownership to prepare his airplane for the appraiser, what else has been neglected?

Think of the appraiser as a buyer, which is pretty much what he is, since he is quite often acting as the eyes and ears of a buyer who may live more a thousand miles away. In fact, I have appraised jets for clients in the Bahamas, South America, the U.S. Virgin Islands, Jamaica, Mexico and as far away as South Africa who made their buying decision based, in large part, on my report. So in a sense, I am the buyer.

WHAT'S INVOLVED

What does an appraisal entail? Ideally, I like to be able to look at the airplane from at least 50 feet away initially. How does the sun reflect off of it? How does it sit on its gear? Does it sit kind of wing low? If it does, it may have some problems that I need to check the logs for, perhaps an accident or a hard landing has sprung the landing gear. Then I move to within 20 feet. At this distance, I can see minor corrosion far better than I can close up. It is also a good distance from which to take pictures. Then I move close and examine for scratches, dings and other hangar rash using my eyes and my fingertips to detect chips, orange peel and other defects on the surface.

So what can you do to prepare for the appraiser? First, give the aircraft a bath and a thorough cleaning inside. On the day of the appraisal, park the airplane outside so that the sunlight glistens off of it.

Second, make sure that all logbooks, receipts and required documents are available, preferably in the aircraft, for the appraiser to examine. All doors should be open. I have flown hundreds of airplanes, but I don't remember how the doors work on all of them. This is especially important for pressurized aircraft.

Third, be present during the appraisal to answer questions. The appraiser will have many questions that only you can answer. For instance, many airplanes have been modified in some way. The modification might be anything from a quick oil drain, or a spin-on filter, to a larger engine or maybe a STOL system. The appraiser needs to know how much the modification cost, who did the mod and when it was done. Keep in mind that you won't recover the full cost of the mod when you sell the airplane.

First impressions count for a lot in aircraft appraisal. The L-19, above, was clean and in a well-lighted, presentable hangar. The hapless Tiger, right, hadn't had a bath in three years and presented poorly. The owner was disappointed with its low appraised value, but a half day of cleanup on the airplane would have improved it.

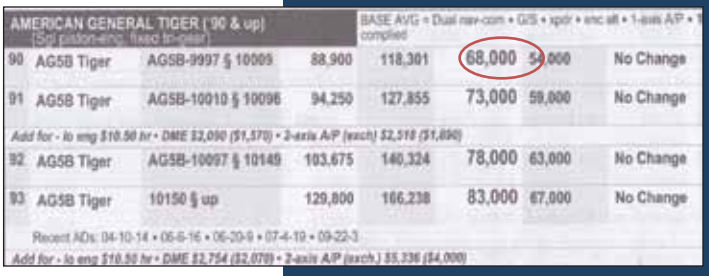
For instance, if your airplane has an upgraded engine, the appraised value of that upgrade will be a fraction of what it cost to install. The original engine can be replaced with a stock engine that sells for $35,000, while the upgrade engine sells for $45,000. Many owners think they can count on the full $45,000 when it comes time to tabulate the market value of the airplane. It just doesn't work that way.

The actual added value is $45,000 minus $35,000, or $10,000 and this figure is then depreciated for age and hours of usage. Usually, the figure is between $5000 and $7000. Also, unless you are paying for the appraisal, the appraiser cannot divulge the appraised value to you. This rule is as inviolable as attorney-client privilege.

So it behooves you to be present while the appraiser is working. Remember, the value added will always be less than the cost of the mod, whether it is an engine mod, cuffed wingtips, or any of thousands of mods that can be applied to an airplane. You may know all about the mods, but if you don't tell the apprais-

er, he has to look for them in the airplane's records. The chances are that he'll miss something. The appraiser is not going to ask to fly the airplane or even run the engine. He assumes that if the airplane is in annual, it will fly. If it is out of annual, then that will be reflected in the appraised market value. And it will be less than it would otherwise be.

The appraiser will take lots of pictures of both the exterior and the interior. (If the owner plans to sell the airplane, he can use the pictures that are taken for his ad, provided he is named on the appraisal as being the client). I also take pictures of the logbook pages so that I can study them on my computer. Before digital cameras, I spent hours in the corner of the hangar perusing the logbooks.



NAAA

Because I am a member of the National Aircraft Appraisers Association (NAAA), I have been speaking about NAAA appraisals, although most appraisers look for the same criteria when building an appraisal. We use different databases, however. I use the extensive NAAA database, while others may use *Bluebook*, *VRef*, or some other database. Whatever database the appraiser uses should be based on the actual selling price rather than the advertised asking price. Remember, the seller never determines the market value of an airplane; the buyer does.

If you need an appraisal for tax purposes or for a donation, the Internal Revenue Service now requires that you obtain an appraisal that meets the Uniform Standards of Professional Appraisal Practices (USPAP). Also, turbine aircraft, because of their complexity, will be appraised according to USPAP standards in the near future. A USPAP certified appraiser has taken a course in standards that meet USPAP criteria. Many NAAA certified appraisers are also USPAP certified, so one good way to find a USPAP appraiser would be to ask NAAA.

A USPAP appraisal is more in-depth than is needed for most purposes, such as financing, insurance and the like. Since it's more expensive, an aircraft owner is better off with a regular NAAA or similar appraisal.

WHO NEEDS ONE?

Finally, why is an appraisal needed? The most obvious reason is so that you, the owner, can set a good selling price. For both buyers and sellers, it gives realistic starting places from which to begin negotiations. Sometimes, without this, buyers and sellers may be too far apart to even talk.

Also, banks are required by the FDIC to have a certified appraisal on record to substantiate collateral value. Perhaps an owner wants an appraisal to verify the aircraft's value in case of loss. There are other reasons, too, such as estate and divorce property settlements. Last, what if something catastrophic happened to your airplane? As I write this, tornadoes are wreaking havoc across the U. S. and I am sure that many airplanes have been destroyed. I only hope, for their owners' sake, that they had a recent appraisal on hand. In most cases, an appraisal costs less than an annual, and I can make the case that it's worth having.

Bicknell Eubanks is a certified NAAA appraiser. Reach him at www.b-and-e-aviation.com.

BLUEBOOK: WHAT'S IN A NUMBER?

In setting a sale price for an airplane, many sellers look in *Trade-A-Plane* or *Controller*, pick a nice high number and slap it on their Web ad. Brokers (and buyers) may then gently remind the seller that those are asking prices that often have little to do with reality.

Closer to reality and the starting place for many appraisals in the long-established *Aircraft Bluebook Digest*. Many brokers use another guide, *Vref Aircraft Value Reference* and some use both guides. The starting place is what Bluebook calls "average retail" and it's the number we've circled in the accompanying graphic.

But what does it mean, really? Everything and nothing, frankly, because it assumes a set of conditions which are unlikely to exist for the airplane in question. But it does provide a value benchmark position by which an individual airframe can be judged. It assumes a mid-time engine, sound paint and interior and usually a minimum avionics suite specified in the lower line of the listing.

From there, valuation becomes as much art as science. For example, for the Grumman Tiger referenced above, you add $10.50 an hour for every hour the engine is below mid-time. You also add for avionics upgrades, new paint and interiors or subtract if the interior and/or paint are shabby.

Avionics can be a sticking point between buyers and sellers, because many sellers assume they'll get full value for, say, a newly installed Garmin GNS530. Although the *Bluebook* has a long section giving new, uninstalled prices for many of these systems, it doesn't give an actual value, but rather a depreciation table. For avionics, it recommends 60 percent of new for the first year, declining to 30 percent in the five- to nine-year range.

How can *Bluebook* possibly calculate this stuff? Through nearly constant research largely biased toward actual sale prices, not just asking prices, says *Bluebook* editor Carl Janssens. Nonetheless, the buyer sets the real price on the day and place of the sale. And that's the only price you can take to the bank.

G1000 Training: Garmin's PC Sim Excels

It's simple, cheap and effective. But if you want to be spoon fed, King Schools and Sporty's have better (albeit more expensive) options.

by Paul Bertorelli

Garmin's G1000 electronic flight display has so dominated the market that it's spun off its own cottage industry of products meant to teach people how to use it. And believe us, given the G1000's complexity, the need is hardly overstated. Indeed, some flight schools charge several thousand dollars just to check out pilots transitioning into the G1000, and that's after they've done computer-based orientation. The idea behind the training products is to give the would-be G1000 pilot the lay of the land before actually getting into the airplane. All of them—there are about a half dozen—do that to varying degrees at varying price points, each driven by a particular training doctrine. Depending on how you learn, there's a product for every purpose.

EXPANDED MARKET

We found seven G1000 training products of various kinds, a modest market expansion since we last examined these products five years ago. All of them are computer based in some way, either with programs you install on your own machine, DVDs or online access. There's also a book on the subject, Max Trescott's *G1000 Glass Cockpit*, which can also have a CD-ROM companion course, which we took a quick look at. Here's a summary of the products we tried.

ASA G1000 COURSE

At $49.95, this course is the least expensive of the structured courses.

PRODUCT	FORMAT/PLATFORM	PRICE	PROS	CONS
ASA COMPLETE G1000 COURSE (WWW.ASA2FLY.COM)	COMPUTER BASED, MAC OR PC	$49.95	INEXPENSIVE, EASY TO USE, GOOD BASIC COURSE, MINIMAL COMPUTER RESOURCES REQUIRED	LACKS SCENARIO-BASED TRAINING, ON-SCREEN KNOBS CAN BE DIFFICULT TO USE
GARMIN G1000 PC TRAINER (WWW.GARMIN.COM)	COMPUTER-BASED, PC ONLY OR MAC EMULATION	$24.95	SLAM-DUNK BEST VALUE; ON-SCREEN SIM IS COMPLETE, EASY TO USE; SIM FUNCTIONS LIKE THE REAL THING	NO SCENARIOS; BUILD YOUR OWN SYLLABUS FOR TRAINING; PFD, MFD NOT VIEWABLE AT SAME TIME
GARMIN TMS eLEARNING G1000	ANY PLATFORM, ONLINE BASED	$99.95 EACH FOR VFR OR IFR	MODERATE PRICE, WELL PACED AND COMPLETE COVERAGE OF SYSTEM	NARRATOR DRONES A BIT; STATIC COMPARED TO SPORTY'S AND KING OFFERINGS
JEPPESEN G1000 TRAINING/CORE VFR (WWW.JEPPESEN.COM)	PC ONLY OR MAC EMULATION	$199 VFR $143.95 IFR $239.95 BOTH	SIMILAR TO ASA COURSE IN CONCEPT AND IDENTICAL TO GARMIN eLEARNING; SIM WORKS BETTER	SAME AS GARMIN eLEARNING
KING SCHOOLS CLEARED FOR FLYING G1000 (WWW.KINGSCHOOLS.COM)	COMPUTER-BASED, PC OR MAC EMULATION	$249	SOUP TO NUTS COVERAGE; HEAVILY SCENARIO BASED; INCLUDES RISK ASSESSMENT; QUIZZES ARE A PLUS	LONG SEGMENTS CAN DRAG A BIT; SIM BEHAVIOR QUIRKY AT TIMES AND FOCUSED ONLY ON TOPIC AT HAND
SPORTY'S G1000 CHECKOUT COURSE (WWW.SPORTYS.COM)	DVD OR ONLINE, PC OR MAC EMULATION	$89.95	FAST PACED, COMPLETE, WITH SOME SCENARIOS; CAN INCLUDE GARMIN PC SIM FOR DOWNLOAD	LACKS HANDS-ON DIDDLING WITH AN ONSCREEN SIMULATION; QUIZZES WOULD BE NICE
MAX TRESCOTT'S PILOT LEARNING (WWW.MAXTRESCOTT.COM)	ALL PLATFORMS, BOOK AVAILABLE SEPARATELY	$34.95 (BOOK) $99.95 (CD-ROM) $59 (ON LINE)	BOOK IS A VALUABLE REFERENCE FOR SERIOUS G1000 USERS; GRAD LEVEL WORK IN THE CD-ROM AND ONLINE VERSIONS	SLIDE-BASED PROGRAM NOT AS GLOSSY AS VIDEO; LIMITED ON-SCREEN SIMULATION

Jeppesen's and Garmin's eLearning, left, offer choice of Demo, Train or Solo mode. Hosted by Rob Reider, lower left, Sporty's course is fast paced and thorough, but lacks the integrated simulator exercises of the King course, lower right.

By "structured," we mean it's composed of learning segments with a specific syllabus defined by the G1000's taxonomy, not types of operations. It will run on a Mac or PC directly off the CD, with no need for PC emulation on the Mac, a plus.

It's a minimalist approach to multi-media training, using a slide show format with the option of listening to a narrator or reading the text directly off the page. The course has 14 sections, which you can navigate in any order and revisit as necessary. As the narration proceeds, a static view of the G1000 is high-

lighted with the topic being discussed, but the images don't animate much. You can search the program to find topics or answer questions. At the end of each section, a short quiz tests your knowledge of the just-covered subject matter, but there's no onscreen simulator to practice with.

GARMIN

Garmin has added a new training product since our last review, the online-based TMS eLearning for the G1000. At $99.95, it leads you through a series of training blocks based on the G1000's operational organization. As the narration proceeds, there are highlights and animations to illustrate the points being made and you can scroll this material in any order and at whatever pace suits you.

It has what we could call a conventional hierarchy, in that it begins with the basics irrespective of operational scenarios and then evolves toward the G1000's more complex capabilities.

At the end of each exercise, the program allows you to punch keys and twirl knobs with an onscreen simulator. This worked well, but with one exception: The G1000's outer FMS knob proved to be difficult to manipulate with a mouse, something that was true of all of the onscreen sims. Nonetheless, if you can stomach the program's bloodless narration, it will get you through the basics. There's a VFR basics version and an more advanced IFR version.

This was less of a problem with Garmin's other G1000 trainer, the $24.95 G1000 PC Trainer. The last time we tried this option, it sold for $3.99, making it the best value by far. Even at six times the price, it still is, in our view, but only for pilots who like to learn in a specific way—by reviewing the POH or documentation and constructing their own syllabus. There are no talking heads, no narration pointers and no inside tricks. On the other hand, the sim works largely as it does in the airplane, although you can view only the PFD or MFD on one screen, but not both. This turns out not to be much of a disadvantage.

JEPPESEN G1000 TRAINING

Jeppesen's approach similar to the Garmin eLearning product. Well,

HOW'S THAT WORKIN' FOR YA', SPARKY ?

First of all, it's ridiculous to assume that by completing any of these courses, that you can just step into a G1000 airplane and motor off. So, of course, I tried exactly that with predictable results. After slogging through portions and/or most of some of the courses, I put myself on the flight schedule in a G1000 DA-40 at Europe-American Aviation in nearby Naples, Florida.

I flew with G1000 expert Bruce Batelaan. I'm neither new to the G1000 nor a glass newbie, but I've never been current or proficient on this system. As a steely-eyed CFII with thousands of hours in the clag, I secretly thought I could ace the thing, but that plan went to hell once the avionics switch flipped on. This instantly revealed the yawning gap between computer training and actually operating something. It's one thing to move a knob or a softkey with a mouse, quite another to use the actual knobs—*if you put your fingers on the actual knobs*.

Is that really a problem? It is, says Batelaan, and I demonstrated it by twirling the intercom knob while meaning to set the baro value for a GPS approach. Happens all the time, he says. Another surprising area of confusion is the comm radio setup and its relationship to the audio panel. Transferring frequencies from the waypoint pages is easy enough, but despite doing this on the sim to what I thought was complete understanding, activating frequencies and splitting the audio tripped me up, another task Batelaan says many have trouble with. And, of course, while that problem is worked, something else is unraveling.

Curiously, building flight plans and setting up approaches proved easy, probably because it's so like the GNS430/530 series, which I have a lot of time with. No problems either with syncing the HSI to the right source and following the navigation prompts and commands.

Although people who like glass sing its praises—so do I—there's no question the basic scan is more work because there's just too much stuff to look at. Some of this adds to situational awareness, some of it is just data noise. Indeed, says Batelaan, to keep primary students from going down the tubes, he limits the MFD to the engine page and strips down the symbology on the PFD to the bare bones.

Conclusion: You can't learn this system well enough from books or computers to fly it solo with confidence. On the other hand, getting into the airplane without that background training would be equally delusional.—*Paul Bertorelli*

AC TV

For a video review of the training programs, scan the tag at right with a mobile app or log onto our sister publication at http://snipurl.com/27xoaa. For breaking aviation news, see www.avweb.com.

make that identical, actually, since Jeppesen did Garmin's TMS program. At $199, it's the second most expensive program and runs on a PC only, or PC emulation on a Mac. There are actually two versions, the Core/VFR version, which we tried, and the IFR Procedures version which sells for $143.95, or get both for $239.95.

Like Garmin, the Jepp product is organized by phase of flight, so it's loosely scenario based. Within each phase—pre-takeoff, takeoff, enroute, emergencies and so forth—are discrete sections describing how the G1000 operates and is used in these scenarios. Although this is done in slideshow rather than dynamic video, you can rapidly scroll around each section with a play control, skipping around as needed. Like the Garmin TMS, the professional narrator is a bit of a drone, but the sections aren't overly long. And by the way, Jeppesen has no online version; Garmin's TMS version does that.

Another aspect of this program that we liked was its self-testing design. There are three tabs labeled Demo, Train and Solo. If you press Train, the program presents you with a task involving manipulating certain controls, then prompts with visual cues to guide you toward the right button presses. Press the Solo tab and it does the same thing, sans the guidance. As with the other programs, you can skip ahead to cover areas you're weak on or review what you've forgotten. The approach is sufficiently basic to take a G1000 neophyte to relative proficiency; just don't get in a hurry.

KING SCHOOLS

Speaking of not being a hurry, that applies in spades to the King Schools approach to teaching the G1000. If there's a mega application here, at $249, this is it. Compared to the others, it's more like a day-long seminar and it's conducted in the Kings' signature green-screen lecture format, backed almost entirely by dynamic video, not static slides, although they do use some static graphics.

King Schools sells an integrated approach to training in that the course is designed not to just train you on the basics of the G1000, but to throw in a heavy dose of real-world scenarios and even some risk assessment, which is ground that the other courses don't till. There's a full section on the basic box operation and a second section on how it fits into IFR operations, including some high-level stuff like WAAS performance and the finer points of IFR approach clearances.

We found the overall organization of segments to be curious in that flight planning, one of the G1000's more complex operations, is placed early in the syllabus. On the other hand, once you've mastered the FP function, everything else falls into place.

The lectures are complete and on the longish side, so brew a pot of coffee and relax. You can scrub through the segments to move things along and at the end of each one, there's a focused, scenario-oriented quiz that allows you to respond to queries via an onscreen simulator. The sim is adequate to the task, but a bit quirky at times, especially when manipulating the outer FMS knob, a key control. Get through the entire course and there won't be much you won't know about the G1000, at least in concept if not detail. You'll have a detailed understanding of the G1000's flight planning functions, which is ultimately the point of the exercise.

SPORTY'S G1000 CHECKOUT

For our last review, we examined Sporty's first foray into the G1000 training realm; since then, they've upped their game with a new program hosted by airshow announcer Rob Reider. It's available on either DVD or online for $89.95, a price that includes the option to download the Garmin PC sim program. The DVD version is PC only.

The Sporty's program is a bit brisker than the King offering in terms of pacing and the tradeoff is that it doesn't cover as much ground, but hits the basics thoroughly with a

continued on page 32

FUTURE FUEL

The Mogas Option: Plenty of Engine Choices

Lycoming recently approved the popular O-360 line for mogas and many airframe approvals are out there. Supply at airports is improving, but remains iffy.

by Paul Bertorelli

While the FAA and the oil industry plod along toward an eventual replacement for 100LL, one alternative persists like a large elephant squatting uncomfortably on the conference room table: mogas. We know more owners, desperate for at least some kind of clarity, are seriously considering it as an option. Moreover, the list of airplanes that can burn mogas is longer than you might imagine and likely to grow.

Last year, Lycoming quietly announced that it had approved its 180-HP parallel-valve O-360 series for use with a specific grade of mogas. Does this mean the company is bullish on mogas as an alternative to a 100-octane equivalent? Not really. The company is just responding to market realities. In other parts of the world—Europe and Asia, mainly—mogas is becoming a fuel of choice because avgas and the infrastructure to dispense it isn't available. And if it is, the cost Delta between avgas and mogas is greater than it is in the U.S.

A MOGAS SWELL?

We know more owners are looking at mogas as an alternative because we're hearing from them. The list of engines and airframes approved for mogas is long and likely to grow modestly.

Even some relatively high-performance aircraft such as some Bonanza models and Cessna 182s are approved for automotive fuel. Yet supply and distribution remain a problem. According to AirNav's monthly surveys, about 109 airports have mogas available, although the number is probably somewhat higher. That represents only 3 percent marketshare, a number too tiny to represent much volume.

But it's also inching upward as FBOs take a second look at putting in the tankage necessary to dispense mogas. U-Fuel, a Wisconsin-based manufacturer of self-dispensing fuel systems, is marketing modular pump products under the SportFuel brand. It's also helping buyers of these systems find high-octane, ethanol-free premium gasoline, which some FBOs who already have mogas pumps worry about finding reliably.

According to the U.S. Energy Information Administration, about 12 percent of U.S.-refined gasoline is non-reformulated fuel and/or not blended with ethanol. Given that large volume, it's not clear why non-ethanol fuel isn't more easily available at distribution terminals, but our checks with FBOs who carry mogas reveal an undercurrent of concern about supply.

U-Fuel helps its customers find sources of supply, but it doesn't intervene as a third party to assure a broad-based supply chain. But one new company is doing just that in California. Clear Gas LLC formed in May and plans to deliver unleaded, ethanol-free fuel to the recreational, marine and aviation markets.

It will essentially act as a third-party clearing house by combining small individual orders from various sources into larger volume buys from terminals that have the fuel available. This addresses the long waiting times some FBOs have experienced in obtaining mogas supplies. Clear Gas says the effort is more about staged delivery and low volume sales and not necessarily high-volume lower pricing. (See www.cleargas.co for more.)

LOTS OF APPROVALS

Both the EAA and Petersen Aviation (www.eaa.org and www.autofuelstc.com) did extensive work on mogas approvals during the 1980s and although those STCs are still available, the perceived lack of ethanol-free fuel has put demand into dormancy. But for anyone interested, the STCs—or airplanes that already have them—are there for the buying.

Current mogas approvals apply to a large and useful range of aircraft, including the O-470-powered Cessna 182P, right. Although it's not bullish on mogas, Lycoming recently approved 93-octane fuel for its O-360 series, lower photo. Airframe approvals from OEMs may follow.

Petersen's STCs, for example, are priced at a reasonable $1.50 to $2 per horsepower, depending on octane requirements. A few models, such as the PA-28-160, 161 Warriors and the Archers are, at $2750, more expensive. Petersen's list of approved airframes is extensive, including such popular models as most of the Cessna 100 series, Beech models including some of the 35 line, Maules, dozens of Piper singles, the Grumman Tiger and a host of low-powered taildraggers. Neither Peterson nor EAA has done much recently with new approvals, but if avgas supply worries force the issue, it's not inconceivable that demand could return.

LYCOMING'S VIEW

Against this slight stir in the market comes Lycoming's surprise approval of its 360 series for mogas. We say "surprise" because the engine and airframe companies have traditionally taken a dim view of mogas for several reasons. Ethanol became the main villain 20 years ago, but there are also concerns about octane requirements, vapor pressure standards, quality assurance in the distribution chain and fuel aging.

Unlike avgas, which has a long-term aging requirement, mogas can degrade relatively quickly, forming gum and varnishes that can clog fuel filters and carburetor jets. The warmer the weather, the faster the degradation. While this might not be a problem for the distribution tanks, which are refreshed with new supplies, it can be for an airplane stored for a year with mogas in the tanks. (Veteran mogas users tells us they fill their tanks with avgas or an avgas/mogas blend if long-term storage is planned.)

In approving the 360 line, has Lycoming relented on these concerns? Not exactly, it turns out. It still thinks avgas is the better choice but accepts

Want high performance on mogas? The Beech G35 Bonanza, below, qualifies. It's powered by a Continental E-225. Unfortunately, mogas approvals don't apply to newer model Bonanzas.

Wisconsin-based U-Fuel claims some traction in attracting airports to install modular Sport Fuel systems, left. In California, the newly formed Clear Gas aims to find and deliver reliable supplies of ethanol-free premium. Lycoming would rather see 93-octane fuel.

that mogas is a reasonable substitute.

"The reason we did these approvals was mainly for international markets," says Lycoming general manager Michael Kraft. "To be blunt about it, the availability of avgas in the U.S. and Canada is quite good, but when you move to Asia-Pacific and the Middle East and other areas, they don't have the avgas distribution. To give you an example, the Nigerian Air Force flies Lycoming piston-engine aircraft and they've run mogas for years. What we're doing here is putting bounds on the mogas you should be using rather than pump gas, where you don't know all the parameters."

And what is that gas? Lycoming specifies this in its most recent version of Service Instruction 1070Q. That bulletin calls for an ASTM 4814-09b automotive fuel with a minimum 93 AKI octane, less than 1 percent ethanol and tightly constrained vapor pressure.

The bulletin says automotive fuels typically have RVPs between 7 and 9.3 PSI in summer, but these vary by region and in some geographic areas, there's no upward limit at all.

Kraft says this raises the risk of fuel starvation due to vapor lock, especially where fuel lines enter the warm firewall area. Although real-world vapor lock with mogas doesn't seem to be a widespread problem, it's hardly unheard of. Our survey of mogas users earlier this year revealed that at least two had suffered inflight engine stoppages which they attributed to vapor lock. Cars are more tolerant of vapor pressure swings because the fuel systems are pressurized from the tank forward and some systems have fuel return lines that tend to cool the gasoline. Moreover, except in mountainous areas, cars don't routinely climb to high altitudes, where lower pressure encourages the boiling that causes vapor lock.

How much of the current mogas delivered to U.S. airports meets this spec is unclear. Finding out about octane values before the fact isn't easy, without calling the airport and perhaps not even then. The Web directory www.pure-gas.org list sources of E0 premium and also provides octane. But not all airports are listed.

Pricewise, Airnav shows about a $1.32 price Delta between mogas and avgas, on average. But at some airports, the price difference is much less and a few even charge more for mogas than for avgas. We think this has to do with local flowage fees and airport overhead, because we doubt if FBOs can make a profit center out of mogas sales.

MORE APPROVALS

Although Lycoming's approvals last year don't represent a wholesale swing to mogas, they do indicate the company wants some downside protection against avgas availability issues. "Our motivation on this is that generally we want to have the engines approved for the widest range of fuels possible. It gives flexibility in the distribution chain. We want to be accurate about what the fuel requirements are with regard to octane and vapor pressure and allowable oxygenates," says Lycoming's Kraft.

As with all of the mogas approvals, both the airframe and engine require a TC or STC. Lycoming's approvals are for the engines only. We asked if any OEMs are considering factory airframe approvals and Kraft says he believes some will, for the same reasons that Lycoming has: In the current market, the more fuel options, the better.

Continental has taken a different tack.Although it's adding to approvals for high-horsepower engines that can burn unleaded aviation fuels of less than 100 octane, mogas isn't on the table, at least in public. It's focusing instead on developing an aircraft diesel to burn Jet A.

CONCLUSION

Does it make sense to consider a mogas STC or buy an airplane that can be approved? We think that depends on the type and amount of flying you do and how nervous you are about future avgas supplies.

If you fly 150 hours a year—that's a lot these days—in something that burns 10 to 12 gallons an hour, burning mogas could save you as much as $2000 a year. That could easily pay for an annual. Owners we've heard from aren't much interested in the bucket-and-can brigade, so you can either invest in a portable dispensing system of your own or rely on airport tankage. If there's an airport pump within reasonable range, the numbers can work, even if it's not a slam dunk. There's just enough mogas available to make long trips possible, bridged by avgas fillups.

On the other hand, for a 50-hour-a-year pilot flying something that doesn't burn much fuel, the savings may not be worth the effort of finding mogas, unless it's easily available on the home field or close by.

The good news may be that mogas availability seems to be modestly on the rise. It's possible that as more light sport aircraft appear and owners tire of waiting for a 100LL solution, the mogas market will reach critical mass. Even tripling the current availability might attract more buyers and make mogas fueling less of a hunt-and-peck affair.

Although the price difference between mogas and avgas is not consistently large, it could become that way if the cost of the 100LL replacement is significantly higher than the current leaded-fuel standard.

iPad Kneeboards: Waiting For Perfection

While no solution was ideal, we liked the simplicity of MyClip. Skyhigh's Genesis and Sporty's iPad Flight Desk also did well. A real mount is still our favorite.

by Jeff Van West

Fly with an iPad lying in your lap for about 15 minutes and you'll wonder if there is a better way. The thing is basically terrific in the cockpit, but it's, how shall we put this, big. Or at least big enough it covers the paper pad you're used to having on your thigh, or big enough in flops off your knees when you want it to stay put.

But big also means you might want it out of your lap, and that's the drawback with most of these iPad kneeboards. Sometimes you want a screen that's ready for the glancing, such as when flying an instrument approach, and other times you just want it out of the way where it won't get its screen scratched.

SIMPLICITY RULES

To that end, any consumer case that won't slip off your lap could be all you need. (We have a $25 Bear Motion case that does the trick just fine.) A bit of Velcro may be handy if you want it to stay just so on top of your current kneeboard.

Another option is the MyClip from Tiet. This is just a leg strap with two padded clips on elastic. The clips grab either side of the iPad—either portrait or landscape—and hold it securely. However, it's not so tight that you can't tilt it quickly to get a non-glare viewing angle. If you don't need the other trappings of a kneeboard (pen and paper, pockets for small items) then this is our recommendation. My Clip was designed for an iPad without a case, but you can make it work with some cases (including that Bear Motion), albeit a bit less securely.

At $40, the MyClip is pricey for such a simple gadget, but it works well. Its leg strap is a bit short, so thick legs might need an extender. We tried taking a case with a loop, like the HandStand, and hacking our own leg strap. It worked … sort of. Worth a shot if your case has such a loop for attachment.

The other plus of a setup like this is you can quickly don it or pull it off as necessary. If you want a real pad on your leg as well, though, you might do better with a real kneeboard.

SPACE VS. FEATURES

Many of our testers liked the Sky-High Genesis iPad Kneeboard with the clipboard attachment. The basic kneeboard is really just a flip-open case (woven nylon, but attractive enough for daily use outside the aircraft) with a removable strap for your leg.

The optional clipboard cleverly adds on so that you can have the iPad on your leg and flip the writing area over the iPad when you need to. This keeps the complete system over one leg (right or left). We also liked how flipping the clipboard over protects the iPad when not in use or when quickly removed for landing.

CHECKLIST

- ⊕ Enough options to meet most people's kneeboard preferences.
- ⊖ Prices range from the annoying to the absurd.
- ⊖ Strapped into a kneeboard may not be the best place for an iPad, anyway.

The SkyHigh Genesis iPad Kneeboard, with the optional clipboard, hits a sweet spot of size, comfort and ergonomics. It lacks pockets and might be tight on thick legs.

The Genesis keeps the iPad controls and charging port accessible.

The add-on design makes the kneeboard a bit thick, which may put it in the way of yoke travel. It's super secure, but that makes it hard to tilt if there's a glare. The strap is a bit short for thick legs. There's a place for your pen, but no pockets, so you'll have to stash your checklist and mints elsewhere. The Genesis case is $35, and the clipboard add-on is an additional $20.

The other tester favorite was Sporty's Flight Desk, but it wasn't without flaws. First the pluses: It offers both iPad and notepad at once, has a few pockets for miscellaneous flat items and is stiff enough with a grippy material that strapping it to your leg is optional. The iPad holder for the Sporty's design is also loose enough that the iPad could fit in without removing a thinner daily-use case or protective skin.

Sporty's also has a system to prop up the iPad at several angles. One tester pooh-poohed this feature until glare hit the screen in flight. He then used it and was sold on the idea. That pilot had a Cirrus, so there was no yoke interference issue, but the same design in a Cessna 172 meant the yoke hit the propped-up iPad for all but the tallest pilot (seat furthest back).

This leads to the biggest drawback of the desk: It's big. We think it's a bit too wide for a Cessna 172 cockpit. It was fine in the 10-inch-wider Cirrus. The flight desk zips closed into a case acceptable for daily use (but you

GET THE PAD OUT OF YOUR LAP

The underlying problem with all of the kneeboard solutions we tried is that we found our laps to be less than ideal places for the iPad no matter what. Maybe it's because the device is a natural distraction magnet, or maybe it's just the nature of something you have to look at as you tap, pinch and scroll, but the iPad in the lap meant more heads-down time than old-fashion paper ever did.

This was one of the nice things about the MyClip—it was easy to just pick the thing up.

But our favorite solution was to put it in a mount. Many people complain that the iPad is too big for mounting on the yoke in front of you and we agree. So don't. We found the best yoke mount solution with a dual-yoke set-up was the opposite yoke with the iPad canted toward the pilot. We also had success with a suction mount in a Cirrus both in the lower corner of the windscreen (it didn't block instruments or much of the forward view) in the corner of the window (just don't forget it's there when you open the door).

We tested three mounts, a RAM suction and yoke mount from Sporty's ($59 and $55 respectively) and PilotMall's Yoke Pad ($75). The suction cup is shockingly strong and held the iPad with ease. Both RAM mounts use a ball-and-socket setup that lets you set almost any viewing angle. The YokePad is well-made, super-light and has several locking sections that let you get the tilt of the iPad just right and adjust it easily in flight (important with glare). However, the YokePad only adjusts in one direction, so it's really only suited if the iPad is directly in front of you. It also requires a screwdriver to attach, so it's not for an airplane where you'll need to install and remove the mount regularly. The YokePad can accommodate an iPad without removing a case if it's a thin one.

If you're not looking for a full kneeboard, the MyClip holds an iPad or iPad2 securely in a portrait or landscape orientation. It's also quick to remove for landing. It suffers from short-strap syndrome for large-diameter legs, however.

Sporty's iPad Flight Desk (top left) has a tilt that's great for finding a non-glare angle, but can interfere with the yoke, especially for shorter pilots. MyGoFlight's Kneeboard C can have the iPad and clipboard on the left or right, or even have the iPad inside with a clipboard on the cover (it's magnetic).

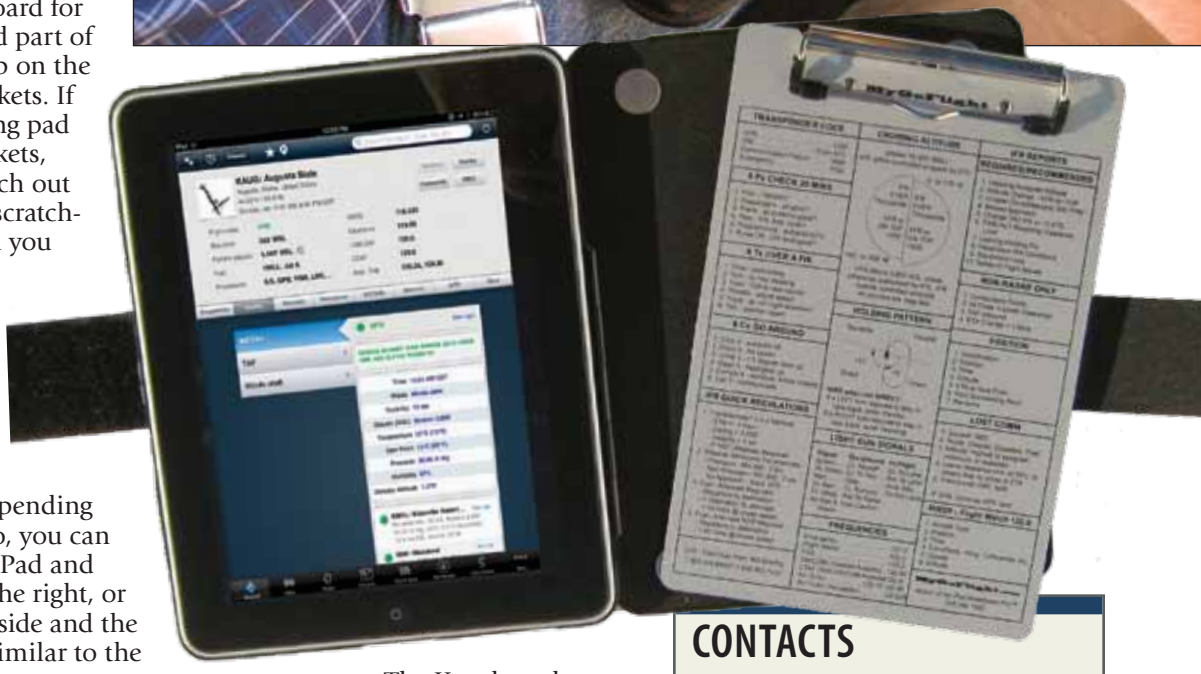
might need a bigger briefcase). The other miss with the Sporty's design is there's no opening to charge the iPad, although you could cut one out.

The Flight Desk is $58. Sporty's also sells an iPad Kneeboard for $40 that has just the iPad part of the Flight Desk and a flap on the right side with a few pockets. If you don't want the writing pad but must have some pockets, this could work. Just watch out for items in the pockets scratching the iPad screen when you close it.

MyGoFlight's Kneeboard C is a truly novel design. It's a thin clamshell with a magnetic clipboard that fits on one side and a magnetic iPad holder that fits on the other. Depending on which leg you strap to, you can set up the case with the iPad and clipboard on the left or the right, or you can have the iPad inside and the clipboard on the cover, similar to the Genesis.

This sounds clunky, but it's actually the lightest kneeboard of all and super secure (really strong magnets). You can also quickly pull out the iPad to see something without glare and then drop it back in the case. Slick. The design also allows for charging while in the case.

The first Kneeboard C we tested had issues, the magnets were stronger than the glue that held them and there were some sharp metal edges. The replacement unit was much better. Both cases, though, suffered from falling into a V shape if you spread your legs at all. We think this was because of the smooth finish on the case. You can toss some flat items under the clipboard in the clamshell of the case, but there's no pocket.



The Kneeboard C might be a top pick, except for the price—$189, or with a custom graphic for an additional $29. We've seen used iPads for that much. It's a cool system, but unless you need something that will stay put through an outside loop, we don't see how it's worth that investment.

KNEEBOARD ON NOT?

As we said, we're not sure a kneeboard is the best way to fly with an iPad (also see sidebar opposite). If you do want it on your knee, a Velcro hack to your current kneeboard, a simple clip, the SkyHigh Genesis with the clipboard, and Sporty's Flight Desk would be our recommendations—in that order.

CONTACTS

MyGoFlight
303-364-7400
mygoflight.com

PilotMall
800-249-5730
www.pilotmall.com

SkyHigh Gear
www.skyhighgear.com
801-390-5507

Sporty's Pilot Shop
800-776-7897
sportys.com/PilotShop

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Beech Model 19/23

Be it a Sport, Sundowner or Musketeer, it won't wow anyone with its performance. It will deliver on overall handling and comfort, however.

Photo by Brent Earwood

The concept of "training" and Beechcraft go together like ketchup and ice cream, which is to say you know about both, but Beech airplanes don't spring to mind when you think of cheap-to-fly entry-level airplanes. Nonetheless, during the heady days of GA in the 1970s, Beech did dip its toe in the trainer market.

The model 19 and 23 series Beechcraft, the Musketeer, Sport and Sundowner, were Beech's answer to Piper's Cherokee line and if not the 150/152, then the 172 from Cessna. Beech didn't exactly set the world on fire with sales, but the two models did acceptably well. They're neither the fastest nor sleekest looking of the GA lot, but they're better built than the competition and there's no question that these airplanes—really, all of the Beech line—are the best handling light GA aircraft.

But handling isn't everything, of course, and the Sundown and Musketeer do have some quirks. Weight and balance issues may be one and so is speed, or lack thereof. But so what? Beech owners just look at the dowdy cruise speeds as an opportunity to spend a little more time flying.

These aircraft represent a shopping paradox for those in the market for a used aircraft. You can buy one for a song—a discount song at that—but when you try to sell it, will it even be worth the opening intro notes? We're not sure this matters much, as long as buyers going into the deal know the score.

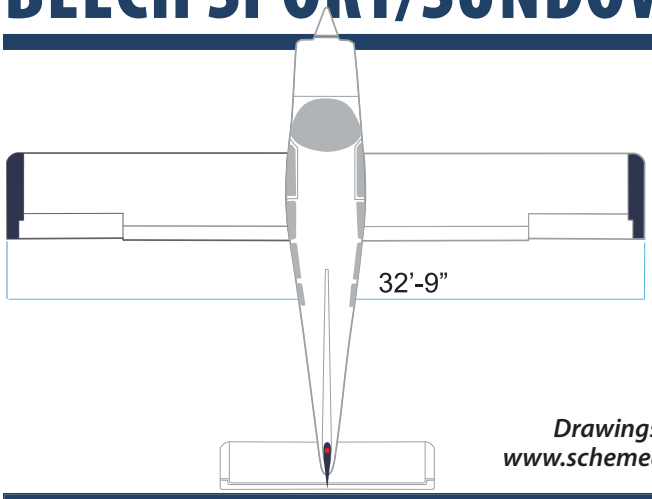
MODEL HISTORY

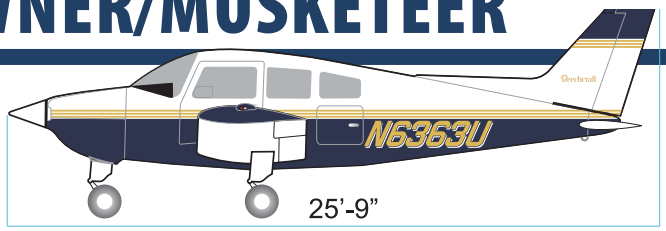
The Sport and Sundowner first appeared in the early 1960s, specifically the Model 23. It had a 160-HP Lycoming O-320, and could carry four people in comfort, as long as they weren't in a hurry to get anywhere. The original Model 19 debuted in 1966. With 150 horses, it's really a two-seater with a backseat for more stuff. Except for the engines, the two aircraft are essentially identical.

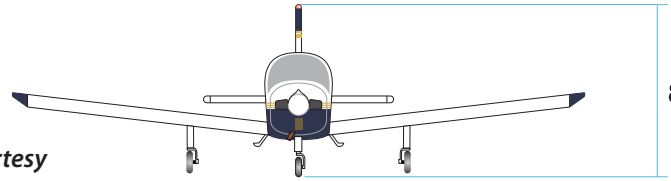
Beech also came out with the same aircraft sporting retractable gear and a 200-HP engine and carrying the Model 24 Sierra designation, an airplane that's the subject of its own UAG report.

The Musketeer evolved over the years. The original 1963 Model 23 had a 160-HP Lycoming, following the lead established by the Piper Cherokee two years before but Beech soon re-engined the airframe with Continental IO-346-A, an oddball engine that was essentially an IO-520

BEECH SPORT/SUNDOWNER/MUSKETEER





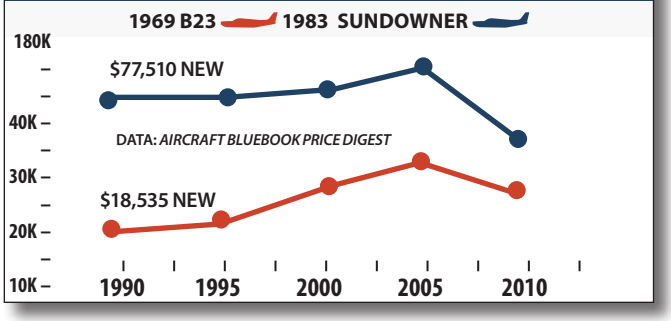


Drawings courtesy
www.schemedesigners.com

SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1963 MUSKETEER 23	LYC. 160-HP O-320-D2B	2000	$21,000	60	900 LBS	110 KTS	$17,250
1964-1966 A23 II	CONT. 165-HP IO-346-A	1500	$21,000	52	700 LBS	114 KTS	±$19,000
1966-67 A 23-19 SPORT	LYC. 150-HP 0320-E2C	2000	$21,000	60	700 LBS	107 KTS	±$17,000
1966-69 A 23-24 SUPER III	LYC. 200-HP IO-360-A2B6	2000	$30,000	60	900 LBS	120 KTS	±$19,000
1966-68 A 23 A III	CONT. 165-HP IO-346-A	1500	$21,000	60	700 LBS	114 KTS	±$22,000
1968-69 SPORT III 19A	LYC. 150-HP 0320-E2C	2000	$21,000	60	700 LBS	107 KTS	±$22,000
1969 M19A	LYC. 150-HP 0320-E2C	2000	$21,000	60	700 LBS	107 KTS	$19,500
1968-71 B, C CUSTOM	LYC. 180-HP O-360-A2G	2000	$21,000	60	900 LBS	107 KTS	±$25,000
1970-74 B 19 SPORT	LYC. 150-HP 0320-E2C	2000	$21,000	52	700 LBS	107 KTS	±$21,000
1972-1976 C23 SUNDOWNER	LYC. 180-HP O-360-A2G, A4G	2000	$21,000	60	900 LBS	114 KTS	±$31,000
1977-1983 C23 SUNDOWNER	LYC. 180-HP O-360-A4K	2000	$21,000	60	900 LBS	114 KITS	±$35,000
1974-79 B 19 SPORT	LYC. 150-HP 0320-E2D	2000	$21,000	58	700 LBS	107 KTS	±$23,000

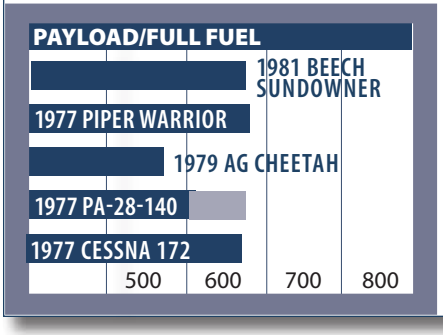
RESALE VALUES

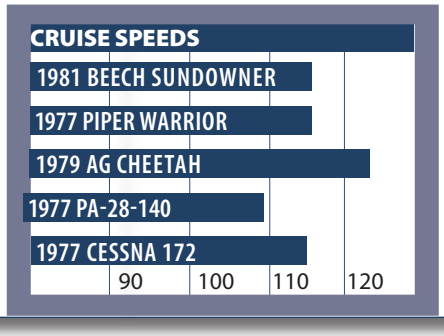


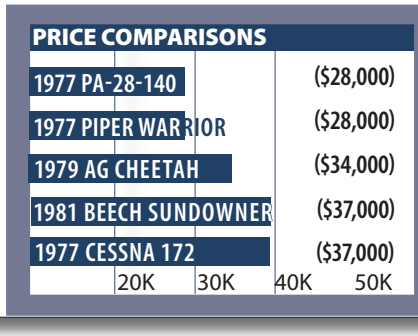
SELECT RECENT ADs

AD 89-24-09	INSPECTION MOD FOR ROD ENDS
AD-87-02-08	STABILATOR HINGE FASTENERS
AD 85-05-02	MODIFY FUEL SELECTOR GUARD
AD 78-04-01	FLAP CONTROL WELD ASSEMBLY
AD 77-03-05	MAIN LANDING GEAR INSPECTION

SELECT MODEL COMPARISONS







Manufactured as the CT-134, the Musketeer served as a trainer for the Canadian Air Force. (Photo by Alain Rioux.)

with two cylinders hacked off. Many owners have since swapped out this orphan engine with a type much easier to service.

By 1968, Beech switched horses again, this time back to Lycoming, with a 180-HP O-360-A-series, the motor that carried the line through the rest of its production life. Meanwhile, Beech wheeled out the 150-HP Sport as a trainer in 1966. By 1970, the two models had become the B19 Sport and the C-23 Sundowner. (If you're confused, you're not alone.)

MEDIOCRE PERFORMER

The 19/23 series was never a hot performer. Indeed, by 1973, the FAA determined that, when flying at its certificated maximum gross weight of 2250 pounds, the B19 couldn't meet the certification climb performance minimums. In response, AD 73-25-04 was issued, limiting the B19's gross weight to 2000 pounds, a heavy performance hit. A Beech kit raised max gross back up to 2150 pounds, but the airplane was no load hauler. After 1973, Sports that rolled out of the factory came with the mods already installed.

The Sport continued in production until 1979, when Beech introduced a clean-sheet design as a replacement—the two-place Skipper, another Beech idea that didn't quite pan out. The Sundowner chugged along for a few more years before being sucked under by the great GA depression and sales downturn of the 1980s.

By 1983, the line was history. Still, some 2400 Sundowners were built and many still fly. The Sport isn't quite so numerous, with only 900 built, some of which occasionally turn up on the training flight line here and there.

Owners fairly gush about how comfortable these airplanes are but tend to frown painfully when describing performance. Cruise speeds in the 100-knot range are about the best you can expect from the 160-HP models. The Sundowner with the big Lycoming will do 117 knots with a light airframe and fresh wax job.

In its original incarnation, the Sport got socked with an AD due to poor climb performance at gross weight. But even after the AD-mandated improvements, it was hardly any better. Owners have reported gross-weight climbs in the 300- to 400-FPM range on hot days. Then again, this may vary by aircraft condition. One owner said climb rates of about 500 FPM through 9500 feet were possible. Loaded to gross, Beech claimed only a 792-FPM climb for the Sundowner at sea level. So don't expect much.

The Sundowner is not a STOL ship in the landing department, either. Although the book says you can stop on less than 1000 feet of pavement at sea level with no wind, we say good luck. Allowing for real world piloting skills, add at least 25 percent to that figure. And if you do manage to shoehorn your way into a 1000-foot strip, you'll probably need a set of wrenches and a truck to get the airplane out.

Listed takeoff performance for the airplane is 1130 feet of pavement just to lift off. You'll need nearly 2000 feet of level ground between brake release and the first 50-foot obstacle if you expect to clear it. If density altitude creeps up, you can find yourself needing jet-length runways. At a 2000-foot high field on a calm, 88-degree day, figure on 1700 feet to get off the ground and almost 3000 feet to clear the obstacle. These airplanes are clearly not suitable for high-elevation airports or even sea-level 'dromes with short runways.

PAYLOAD, RANGE

OK, so these aircraft don't burn up the course speed-wise. But don't look to them for aerial pick-up truck duty, either. Net payload for both the Sport and Sundowner are quite close to other aircraft in their class, which is to say not much.

Range is certainly not outstanding, although quite acceptable for most owners. In all but the early model Sports, standard fuel load is 57 gallons useable. That's enough gas to carry the Sport about 620 miles, while the Sundowner will cover only 530 miles on the same load.

That fuel load may sound impressive, especially when you look at the fuel capacities of the competition. The Piper Cherokee, American General (Gulfstream/ Grumman) Tiger and Cessna Cardinal all carry seven gallons less gas.

Yet, all those airplanes can fly just as far because their higher cruise speeds let them cover the same amount of ground on less fuel. Of course, your mileage may vary, especially if you've got any illusions about carrying people and baggage.

Fill the cabin and you can't fill the tanks, it's that simple. The Sundowners can be expected to haul about 900 pounds of useful load in their average equipped condition. If you need full tanks, that means you can only carry three people and 50 pounds of baggage.

If you're in a Sport, toss out the third person and the baggage, and you still get to sweat those high-weight climb rates. So, the Sport/ Sundowners are cheap to buy, but the payback is lack of performance; there's still no free lunch.

Like most Beech products' the

Sport and Sundowner are routinely described as being delightful to fly. In the air, the controls are light and well harmonized, smooth and responsive. They're stable enough to make good IFR trainers, even if their low cruise speeds turn them into one-airplane traffic jams. There are even aerobatic models. But that doesn't mean handling and flying is wart free. The Sundowner, and especially the Sport, can be downright vicious on landing.

These airplanes have developed a reputation for providing some ego-crushing landings for even experienced pilots. Student pilots who were unfortunate enough to endure training in the Sport all too often wound up with more than their egos crushed.

The reason for all this sturm and prang is the airplane's bad habit of porpoising and crow-hopping on landing, a trait it shares with Mooneys but not with other trainer types in this class.

Some experienced Sport pilots can regale hangar-flying crowds with tales of epic wrestling matches as they worked throttle and yoke desperately trying to stop the porpoise before A) the nose gear collapsed; B) the aircraft groundlooped; C) the runway ended; or D) all of the above.

At least part of the reason for this touchdown behavior is the landing gear design. Beech chose a trailing-beam configuration for the aircraft. Normally, this type of landing gear is quite forgiving of botched landings.

But Beech went for stiff rubber shock mounts instead of oleos, converting what would have been wonderful cushioning into terrible springs, ready to help the aircraft rebound into the air at the drop of a wheel. With its stiff rubber donuts, the Mooney gear has the same shortcoming with the same results for hapless pilots.

Gentle, mains-first touchdowns are the rule to prevent a crow-hopping excursion across the field. All this is not to imply that good landings are impossible in the Musketeers. Precise speed control is the key. If you're the type who likes to tack on a few knots for the insurance company and another couple for the wife and kids, buy a Cherokee or some similar, more forgiving design.

The Sport and Sundowner demand precision handling down final and into the flare. If your landing technique is off, these aircraft will show you exactly where you're going wrong by magnifying the results out of all proportion to anything you've seen before. Great training, if it doesn't scare you to death.

Speed control is also important in the opposite direction for Sport pilots. Coming over the fence a few knots too slow can result in running out of stabilator in the flare. That, in turn, translates into a nose-first touchdown and at least some crow-hopping down the runway.

Pilots report the Sport is a bit nose-heavy, especially with flaps down, and many have found that carrying some power into the flare provides more controllability into the touchdown. Some owners tell us they carry ballast in the baggage compartment to offset this.

Another strategy for coping with the aircraft's landing habits is to install the Beech spin kit. One Beech dealership we spoke with some years back reported that the spin kit, which adds strakes to the nose and stabilator along with a ventral fin to the rear fuselage, seemed to tame the aircraft's landing characteristics.

With all this as background, it should come as no surprise that the Sport and Sundowner have their greatest safety troubles in the landing arena. That's true of other types, too, but it's doubly true of this model.

At least the aircraft are consistent in this regard. Consider that an NTSB study reaching back to the early 1970s identified the Sundowner as the worst aircraft in its class for hard landings. We're talking about a rate of hard landings that was five times worse than the Cessna Skyhawk or the Piper Cherokee.

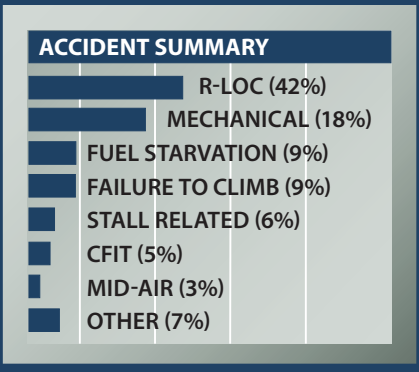
Indeed, every time we've looked at the safety records of the Sport and

They may be slow, but their comfort and stability have earned many respectable IFR panels and relatively plush interiors. (Photo by Brent Earwood.)

ACCIDENT SCAN: CAN'T KEEP THE WHEELS ON

It was no surprise that the walk-away winner on Beech 19/23 accidents was runway loss of control (R-LOC). What does stand out was how often the excursion took the Beech out at the knees. This student pilot's statement is typical: "I touchdown and ballooned up. Then the airplane returned to the runway and ballooned again. About the third bounce I lunged forward as the nosewheel had broken off." It's important to note that at least one wheel loss happened due to gear damage from a previous renter's hard landing. Several excursions may have been related to the pilot inadvertently locking up a brake during the landing, or overcontrolling with brakes during the S-turns trying to recover.

Four post-crash fires from runway excursions also caught our eye. We can't say the Beech 19/23 is that much more susceptible than comparable aircraft, but when the gear shear, the fuel-filled wings are that much more likely to break open. There were several instances of crashes into trees where pilots walked away, so the aircraft doesn't just fold up at the least provocation.



Mechanical failures made about a normal showing. There were a few that sounded suspiciously like the carb-ice events that technically fall under fuel starvation.

Speaking of fuel starvation, four accidents were due to the fuel selector in the off position and a subsequent failure on takeoff. Two of those were fatal and both with pilots not familiar with the aircraft. The geometry of the system seems to be that there's a longish time between fuel off and engine stoppage.

The nine percent of accidents we're calling "Failure to climb" point out the limitations of the little Beech. None were the airplane's fault; they were from pilots attempting to take off overloaded, underpowered due to density altitude, or from too short a runway. Or all three, like the 26,000-hour ATP who tried to depart a 2000-foot turf airstrip on a 90-degree day 210 pounds overgross. There was also the pilot and CFI who, "had been practicing touch-and-gos throughout the day, and repeatedly had difficulty achieving pattern altitude."

Even if you're casual with the POH, you should at least listen to what the aircraft is trying to tell you.

Photo by Sheldon Clouse

Sundowner, the story has been the same—lots of hard landings and lots of overshot landings. And even today we find the pattern intact. One interesting finding of our studies through the years has been the low rate of groundloop accidents.

Both the Sport and Sundowner have nice, wide-stance main landing gear, so once the aircraft are firmly on the ground, they handle and track quite well. It's getting them to that point that's the challenge. We don't mean to overstate the case by any means, but forewarned is forearmed.

Musketeer ground handling is so good, in fact, that it's possible to get the aircraft to pivot around inside its own wingspan, making maneuvering on the ramp or around the gas pumps a breeze.

MAINTENANCE

If there's one thing that really seems to keep Musketeer owners happy, it's that the airplanes are cheap to keep. Maintenance troubles through the years have been mercifully few and far between. Thankfully, Beech seems able to maintain a sense of proportion as to what's important and what's mere window dressing when it comes to issuing "mandatory" service bulletins.

Other maintenance items to be concerned with are fairly obvious. The landing gear, for example, should come in for detailed scrutiny at any pre-purchase inspection, as well as during annual inspections.

Given the previously discussed landing troubles, it's a better-than-even bet that some sort of trouble will be found on pre-purchase. By the same token, make sure the firewall gets a good once-over, since bending and warpage of the firewall is one common consequence of excessive crow-hopping and nose-first arrivals.

Another item to scrutinize closely on annual inspections is the fuel caps. The NTSB called for pressure checks of older caps, but simple visual inspection should be able to detect caps that have become too stiff and crusty to provide a good seal to the wing filler port.

Nevertheless, cap replacement and/or overhaul every 10 years is not a bad idea as a prophylactic measure. And, of course, pay attention when checking the sumps on preflight. En-

On the best of days, the Beech 19 or 23 has a mediocre climb. Add some hot, high or heavy, and it can become non-existent. (Photo by Dubravko Sertovic.)

gine troubles on these aircraft should be few and far between.

One notable exception is valve sticking, which on the O-320 and O-360 should be considered facts of life. Lycoming Service Bulletin 388B calls for checks of valve guide wear every 400 hours, but we'd cut that interval in half if you're experiencing normal 100- to 150-hour-per-year utilization.

Cut it in half again if you're flying less than 100 hours per year. The inspection is simple, once you've got the proper jigs, and it could save you thousands in later cylinder work. In the just-plain-annoying category, there are complaints about leaking windshields and windows. This sort of thing is not really a problem particular to the Musketeers, since most of the smaller GA singles seem to suffer from window leaks to one extent or another.

The cure—the real cure, that is—is to remove the suspect window, clean the tracks and re-install it with new sealant. The route most often taken, though, is to simply slather more RTV around the rim and hope for the best.

On pre-purchase inspection, pay special attention to the sidewall insulation and carpet padding for clues to potential pre-existing leaks. As with Mooneys, which suffer the same problem, this can lead to serious corrosion.

WATCH THE IO-346

Make no mistake about the IO-346—found in the 1964 through 1967 Sundowners—it's an oddball. It was used only in the Musketeer and is found nowhere else. Only 513 examples were built. Despite its origins as a sliced-up IO-520, it's a rare mechanic indeed who's familiar with this engine.

If you insist on buying one of these models, be prepared to finance your mechanic's learning curve. At the same time, be prepared for the prospect of owning a very interesting lawn ornament.

Pistons are no longer available for the IO-346, according to Mattituck. Your only hope come overhaul time is that your current pistons are serviceable and that your cylinders can be chromed back down to size. Otherwise, you're in for a long, hard search to find serviceable pistons.

Compounding the situation is the fact that the engine's listed TBO is only 1500 hours. How about just swapping the Continental oddball out for something a bit easier to deal with?

Don't hold your breath. We could find no STCs available to allow such an enginectomy. So the best bottom-line advice we can offer is just avoid the models with this engine; there should be plenty of others to pick from.

OWNER COMMENTS

I purchased N1918L three years ago after deciding after 34 years on the ground to finally return to flying. I received the majority of my initial training in a Sundowner back in 1974 and wanted to continue my relationship with this great airframe when I took off once again.

The Sundowner has several major attributes that make it ideal for a guy my size. I'm 6 foot 5 inches and weigh 275 pounds. It offers me two doors, so there's no crawling across to the pilot's seat, and it has the most leg, shoulder and headroom of any aircraft I've flown.

While not the fastest bird in the sky, I can count on getting to my destination without being sore and stiff from being crammed into a tight cockpit. The design and build of the Sundowner is much like every other Beechcraft. Everything is sturdy and well engineered. My airplane is as tight and aerodynamically stable as it was on its first flight. I've been told that some parts on the C-23 are not interchangeable airframe to airframe, because each plane was hand finished before leaving the assembly line to insure all parts fit together as snugly as possible.

Overbuilt and extremely sturdy trailing link landing gear make any landing easy on the airframe, and the Madras wingtips on my airplane help to lower the stall speed and re-

Cylinders for the IO-346 are available, but not the pistons. (Photo courtesy Don George Engines and Parts.)

Two doors and a tall cabin makes the Sundowner tops in comfort and feel like a bigger airplane.

sult in much slower, smoother touchdowns. This is especially important as the Sundowner glides like a large rock. Weighing in at a maximum of 2450 pounds, it's definitely not the most agile machine on the ramp—more like an SUV. But that weight and stability really pay off in the sky. I can trim out my airplane and sit back and relax unless the trip gets bumpy, with minimal input required to insure a stable flight.

I've invested in enough upgrades to make the airplane a very attractive IFR-capable traveler. I use an EDM-730 to monitor my extremely dependable Lycoming 180-HP O-360-A4K engine, along with other parameters such as fuel flow and capacity, remaining estimated duration of flight, battery charge, shock cooling, OAT, EGT, CHT and RPM. The 730 is linked to my Garmin GNS430W, allowing fuel flow and duration information to be automatically entered into my flight planning functions.

Comfort features such as a four-place intercom, Rosen visors, leather seating with sheepskin covers for the front seats and a portable Arctic Air air conditioner make any trip more comfortable.

I have recently added a set of Gar Industry front-seat shoulder harnesses to the front seats. These are highly recommended as they are easily removable, well made and no FAA approval is required to utilize them in your aircraft. The added level of safety they provide is well worth the $299 purchase price.

Since my first annual, I've relied on the expertise of Hammerhead Aeronautical in Laurens, S.C. (www.hammerheadaero.com) to keep my airplane in top shape. The late Mike Rellihan, along with current owner Chad Moser and his crew, specialize in "baby Beeches." Their continuous oversight of our aging aircraft assure owners that no detail will be missed, and there will be no head scratching to try and come up with the correct answer for any concern regarding our airplanes.

The premier organization for baby Beech owners is the Beech Aero Club (www.beechaeroclub.org). Members of the club have access to a wealth of feedback and knowledge regarding the smaller Beechcraft airframes. With worldwide membership, BAC is a must for any Sundowner owner.

I'm sure I'm missing a lot of worthwhile details regarding the Sundowner, but maybe this will give you a start.

Brent Earwood
Jackson, Tennessee

We purchased a 1982 Beech Sundowner four years ago as the nucleus of a flying club we own. I had operated Warriors in a commercial operation previously and looked first for them, then 172s. But there were none in any condition to do what we planned. As a last resort, I looked at the Beech line and found the C23 we now own with only 2500 hours on the airframe, 100 on the engine and a decent set of radios to start with.

Since then, we've operated it for approximately 1200 hours. Block-to-block, we average 7.5-8 GPH with a mix of training and cross-country flying. We flight plan 113 knots at 9 to 10 GPH for cross-countries. Handling is straightforward and easy; its roll and pitch response feels more like a Bonanza or a light version of a Baron than the typical fixed-gear four-seater. The ride in turbulence is solid without much side-to-side wiggle. Overall, it feels like a substantial airplane in the air, and that gives a lot of confidence to both pilots and passengers.

It has been quite popular with our pilots for its cabin comfort as well. You sit bolt upright in the cockpit, more like a Bonanza or Baron than other low-wing brands like Warriors. Entry doors on both sides are convenient and safe; just make sure they're closed properly—there is no secondary latch.

I had serious reservations about using the type as a primary trainer because of the reported wheelbarrowing tendency and subsequent nosegear collapses. In fact, ours had a nosegear collapse not long after it was delivered new to its first owner. But we've had no problems with this at all; attention to proper airspeed and flare seems to do it. Instrument students have raved about the panel layout as everything is logically placed and easily viewed.

I wish the engine instruments and fuel gauges in the subpanel were lit, but they're not in ours. It is stable enough in IFR flight for comfortable cross-country travel and training.

One operational gotcha: weight and balance. The loading envelope is remarkably narrow. With two aboard in the front seats, 50 pounds or more is needed in the baggage area to keep the CG in line. There is a small weight that can be added to the airframe well aft that does the same thing, but at a few hundred dollars we've opted for bags of sand.

Maintenance has been mostly routine; we average $25/hour for inspections and repairs based on a 250 to 300 hours year. The only type-specific item was a rebuilding of

the nosegear, including replacement of the oleos, which cost approximately $3000. The airframe is robust and the engine (180-HP O-360) is well matched to it. Parts are mostly easy to come by; sometimes they're breathtakingly expensive, like an entry step for $3700 (we repaired our cracked one instead), so knowing the parts houses and going with good-quality used parts when reasonable to do so saves a lot of money.

In summary, I'm very happy with the airplane and am glad to have stumbled onto it.

Jack Shelton
Blaine, Minnesota

I decided to purchase a 1975 Beech C-23 Sundowner after receiving my private pilot certificate in 1995. Since January 1996, it has been my first and only aircraft. Although I had not planned to keep the aircraft for more than a few years subsequent to my getting an instrument rating, I found myself continuing to enjoy this Beech for nice weekend cross-country trips.

One of the things my passengers and I especially enjoy about the Sundowner is the great visibility. During a check ride, one CFI who was unfamiliar with the type, commented that the visibility was about as good as a helicopter. While I don't think it is quite that good, it is great!

Another strong point is the entry doors configuration. It is enjoyable not having to enter from the port wing and having to slide across the seats. The cabin is also big and roomy, giving the appearance that it is larger and could carry more than it actually can.

The instrument panel is also roomy, easily accommodating avionics upgrades, like my GNS430W and a GTX-330. I still have nearly a third of the panel available for future toys.

The Sundowner, like other Beech products, has a solid feel and the controls are smooth. I typically fly in the 5000- to 10,000-foot range, which gets me into cooler air—important during Alabama summers. At these altitudes, I can expect to cruise at 115 knots, with a fuel burn of about 8.5 GPH with the Lycoming O-360. This gives the aircraft a theoretical endurance of about six-plus hours, which far exceeds my endurance. Speeds on the Beech are a little slower than a similarly-powered C-172 or PA-28, but this slower speed is more than offset by the comfort of the larger cabin. On a typical 300-mile flight, I am in the air another 10 to 15 minutes more than I would be in a Cessna or Piper. I just consider it an opportunity to fly another 10 to 15 minutes.

Maintenance costs are modest. My annuals run about $1200 to $1400. Insurance costs me about $1200 annually. The most difficulty that I have had in ownership is getting genuine Beech parts. I believe that the good people at Raytheon think I am ordering parts for a King Air! Parts also tend to be more difficult to locate on the aftermarket for items such as interior trim, windows and plastic exterior trim pieces such as wingtips.

It is interesting to me that a lot of pilots are not familiar with this particular aircraft or its siblings, despite the fact that 4000 of this family of aircraft were built over the 20-year production cycle. Pilots are always approaching me about the airplane, and telling me how much they like it. The really nice paint job makes it even more appealing.

The flying characteristics of the Sundowner are excellent. There are two areas, however, that I would caution prospective buyers to be aware of—weight/balance and approach/landing speeds. The C-23 tends to be nose-heavy and needs be kept at balance or slightly aft. Many owners, like me, carry extra weight in the baggage area to counter this forward CG characteristic.

The other area of concern is landing. I carry a few extra knots of airspeed on approach and landing, to help maintain better control. The nosewheel needs to be kept off the runway until the mains are firmly on the ground. The Beech's short wheel base, along with the tendency to be nose-heavy if the weight and balance are not correct, can result in porpoising, with potentially bad consequences for both airplane and pilot/passengers.

For the past 15 years, I have enjoyed my Sundowner. It is a solid, reliable airplane that is a thrill to fly.

Bill Moran
Birmingham, Alabama

G1000

(continued from page 18)

few of the high notes thrown in.

It's easy to watch, although not quite as dynamic in presentation as the King program is. Much of the time is spent watching the G1000s PFD or MFD run their paces as the narration proceeds. You can stop the program and scrub back and forth to repeat what you may not have absorbed. What's missing here is the quizzes that the other programs have. Some people learn better if they know they'll get the opportunity to demonstrate their knowledge through a test and we would like to see this in the Sporty's course.

MAX TRESCOTT'S PILOT LEARNING

We obtained access to Max Trescott's training system too near our deadline to evaluate it thoroughly, but what we did see impressed us. We would call this graduate-level training, given the detail that Trescott goes into in each section of his training. Furthermore, he has a dedicated course for the Perspective version of the G1000, although some of that system's major features have migrated to other G1000 variants.

In our last review, we gave high marks to the book/multimedia combination and we repeat that recommendation here. None of the other courses offer the detailed book, which will be a plus for students who prefer to learn from text rather than multimedia.

The online course is slide based, with good narration and use of static graphics. Its granular detail could, in our view, benefit from more use of dynamic graphics or video. At some points in the narration, we wanted to see the button pushed or the knob twirled to lock in the point being made.

The Trescott course has some minimal scenario-based segments and there are short quizzes at the end of each section. Some offer you buttons or knobs to select, but others just describe the sequence of key and knob strokes.

WHICH TO BUY

Although scenario-based training is all the rage these days, not everyone needs or wants it. With that in mind, for the self-motivated pilot, Garmin's $24.95 PC Trainer is the walkaway best value. You can learn all you need from it by trial and error and the G1000's excellent manual. It behaves largely as it does in the airplane and the determined techno-nerd can attach a joystick to the computer for (somewhat) more realistic operation.

But if blundering about on your own doesn't appeal, the King School's program is the best overall choice for completeness and comprehensibility. It leaves hardly any stone unturned and anyone completing it will have no fear of the G1000 in any type of operation.

At less than half the price, Sporty's course is nearly as good, if not as complete. The fact that it includes the Garmin PC sim is a plus and, in fact, we would recommend the Garmin product as a companion to any of these other training courses, as none of them do a particularly good job of letting you just experiment with the keys and buttons, something we consider a vital part of learning a new box. The other programs we tried are competent, if not remarkable. Garmin's eLearning and the Jeppesen product are quite similar, but the Garmin online version is $100 cheaper and even less expensive if you buy both the VFR and IFR version of the Jeppesen course.

At $49.95, the ASA G1000 trainer might be a good choice for a flight school wanting to give students an overview on the cheap, but even so, it's not as strong as the other offerings, in our view.

We have no reservations about recommending Max Trescott's book as a must-have reference and we find the multimedia course excellent, albeit lacking a little in glitzy production values. On the other hand, it goes into details the others gloss over.

FEEDBACK WANTED

PIPER SUPER CUB

For the November 2011 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Piper Super Cub, the world's favorite working airplane. We want to know what it's like to own these utility classics, 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 Super Cub by September 1, 2011, to:

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