The Tecnam line has only one fatality, but it wasn't this Bravo, which wound up in a Texas backyard after an engine failure. Both occupants were uninjured.

AIRCRAFT SAFETY REVIEW

LSA Accident Survey: Low Fatals, High Overall

Seven years worth of data show that landing accidents among LSAs are higher than for GA as a whole, but fatal accidents match the overall average.

by Paul Bertorelli

When the light sport aircraft rule was busy being born a decade ago, it was intended to be a poster child for inspired innovation driven by reduced regulation. While there's no argument that LSA has ignited a bushel of new designs, not much has been said about safety and crashworthiness. Is it reasonable to assume that a 1320-pound airplane will be as safe as one weighing 300 or 500 pounds more?

Can a 1320-pound airplane be as safe as one weighing 300 or 500 pounds more?

In our view, the proof is in the flying and in the accident record. The U.S. LSA fleet now has some seven years of operational history, which we think is sufficient to warrant a first look. For this report, we examined the accident histories of the top 10 selling LSA manufacturers in the U.S. Our initial findings reveal that for this fleet, the fatal accident rate is comparable to GA in general, but the overall accident rate is substantially higher because LSAs suffer many more landing accidents than do larger and heavier aircraft.

And some models are much worse than others. We also confirmed another trend we've heard anecdotally: Some LSAs break a lot. Amidst the accident reports are incidents of broken gear legs, missing wheels and surprise collapses of landing gear components. In some cases, these were the cause of accidents, but the result in others.

SMALL NUMBER SYNDROME

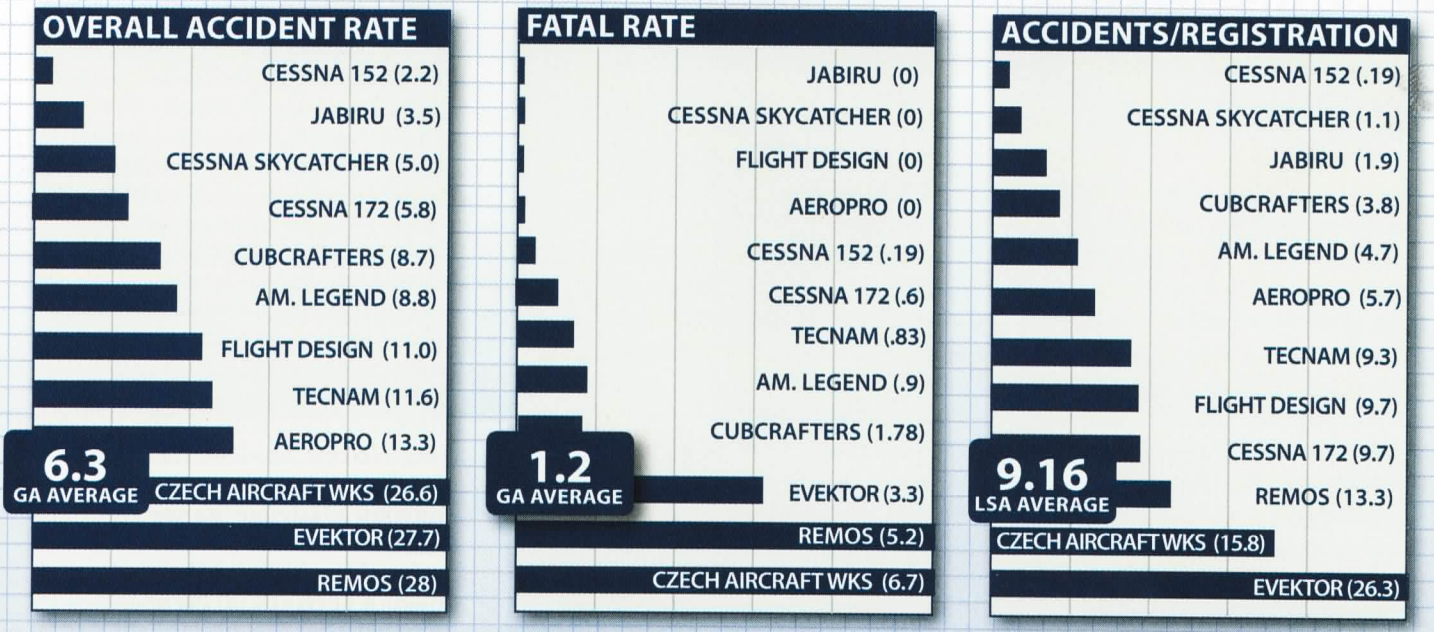
One caveat up front: Even though we looked at 10 manufacturers of LSAs for a seven-year reporting period, by our calculation, this sums to about 1440 aircraft and a calculated total fleet hours of about 960,000. By aviation statistical standards, these are small numbers, thus any calculated rates are susceptible to wide swings based on just a few occurrences. In our view, then, it's too soon to draw blanket conclusions about LSA fleet safety in general. We simply need more flight hours. But it is, nonetheless, fair to report on some early trends that emerge from the accident data.

As we did for our Cirrus accident report in the January 2012 issue of *Aviation Consumer*, we calculated accident rates based on U.S. accidents reported to the NTSB between 2005 and 2012. We calculated fleet hours by stratifying manufacturer registrations by year and assigning each aircraft estimated flight hours for that year. We used estimated flight hours—and our own surveys as

CHECKLIST

- **Although the fleet is still young, fatal accidents aren't out of the GA norm.**
- **Landing accidents are more frequent than with other light aircraft.**
- **The data shows that three models, Remos, Evektor and Czech Sport Cruiser, have measurably higher accident rates.**

FATAL AND OVERALL RATES COMPARED



ANALYSIS METHODOLOGY

Accident data given here is accidents per 100,000 hours of flight. Accidents per registration is accidents per 100 airplanes registered. Data and accidents apply to U.S. fleet only. Fleet hours were calculated for each model by multiplying average annual hours flown given by *Aircraft Bluebook Price Digest* by the number of that model given on the FAA registry. The aircraft populations were stratified by year and each model was given credit for a full year of flying, regardless of what month it went into service. Accident reporting period for most models was 2005 to 2012 and for each LSA manufacturer, all models were combined into a single fleet. The Cessna 172 data includes only S models built since 1997. The Cessna 152 data includes only accidents and flight time during the reported period.

backup—from the *Aircraft Bluebook Price Digest*. These were typically 100 to 150 hours per year, per aircraft. While it's true that many aircraft in the LSA fleet used for trainers fly 300 or more hours per year, it's also true that this offsets those privately owned aircraft that fly 50 hours a year. None of the manufacturers except Cessna provided us with their own fleet-hour estimates, nor could any offer accurate information on how many aircraft are privately owned versus flightschool operated.

Although we've tried to compile all the accidents, we know we've missed some. Some simply aren't reported to the NTSB, while others are reported but are miscoded by the NTSB with the wrong aircraft name or model or a non-standard manufacturer name. Suffice to say we scoured the data and included all the accidents we could find.

LOW FATALS

This group of LSAs had an admirably low rate of fatal accidents. Taken as a composite, our data for this group showed a fatal rate of 1.4/100,000 flight hours. That's a bit higher than the GA average of 1.2, but given our small sample size, the difference is statistically insignificant.

Four manufacturers—Cessna, Jabiru, Flight Design and Aeropro—had no fatal accidents at all in the U.S. For Flight Design, which has the largest LSA fleet and the most hours, we think that's a remarkable record.

It's less rosy for Flight Design when the overall accident rate is considered, but more on that later.

Also less impressive is the fact that 10 of the 14 fatal accidents involved three manufacturers—Remos, Evektor and Czech Aircraft Works, which makes the Sport Cruiser LSA. These are definite outliers in our survey group, but it's not clear why.

The overwhelming majority of LSA accidents are runway loss of control events, which are rarely fatal. There's no discernible pattern to the fatal accidents that we could see. Evektor had a couple of VFR-into-IMC crashes and a stall spin. The Sport Cruiser had four fatals, three of which looked like simple loss of con-

TOP VS. BOTTOM

For U.S. accidents, the Evektor line, left, finishes at the bottom of our LSA accident survey, with 26 accidents per 100 registrations. The Jabiru, right, and Cessna Skycatcher have the top overall and accidents/registration record.

LSA WRECKS: THE GEEZER FACTOR

It's well-established that the light sport industry is buoyed along by so-called full-circle pilots—older pilots who've dropped or don't want to fuss with a medical. These owners are also wealthy enough to buy new LSAs. Unfortunately, they may also be driving the high accident rate. We spoke to a dozen CFIs specializing in light sport instruction, and nearly every one of them told us that older pilots stepping down from heavier certified airplanes struggle with the light control forces in LSAs.

"It's real simple. They have an incorrect attitude...if I can fly a 182, I can fly this little thing," says Jerry Eichenberger, who operates a flight-school in central Ohio with a Tecnam and an old Champ. "But if they've ever flown an airplane as lightly wing loaded as a typical LSA, it was 30 years ago. These airplanes take a significant amount of transition training. They don't fly like a 182," he adds.

He maintains that there aren't really any control issues for landing LSAs as a class. It's a version of taildragger versus tricycle gear. If you learned in the former, you'll have no trouble with it.

Not everyone agrees that's true of all LSAs, however. Jerry Plante told us the flight school where he instructs had a couple of Sport Cruisers, which the instructors called "Sport Bruisers." Plante said no one wanted to fly them twice. "I've had my head slammed against the canopy several times. It's not a fun airplane to fly," he said. One pilot pushed over in pitch hard enough to float a fire extinguisher off the luggage area and drive it through the canopy; it departed the airplane. The school eventually got rid of the LSAs.

What exactly is the problem here?

"What I typically see is that students are flaring high and it's a low inertia airplane; it pancakes in. Call it a carrier landing," says Larry Cazier, who's instructing in a RANS S6 tricycle gear. He's developed a method to simply fly the airplane onto the runway with a little power.

We were surprised to hear from a few instructors teaching in taildragger LSAs and also soloing and renting those airplanes. (Yes, it takes expensive insurance.) What's involved there?

"It comes down to experienced pilots not used to using a rudder," says George Hoover, who teaches in a Cub Crafters Sport Cub in Mesa, Arizona. "They're behind the airplane. It's light. You can feel everything," he adds. Younger pilots generally do better in any airplanes, but also in LSAs.

Earl Kessler, who instructs in Carson City, Nevada, told us he had an exceptional young student who soloed a Cessna 172 in only seven hours. When he put the student into a Zenith LSA, they both got a surprise. "He couldn't control it. I had to grab the stick to stop the PIOs. It just takes a finer touch to fly an LSA," Kessler said.

None of the schools or instructors we talked to suggested that LSAs aren't up the pilot-training task. Indeed, one school operating Flight Design airplanes described them as "awesome." But the general consensus is that it'll take experienced pilots longer to transition into an LSA, and a new pilot may need a few more hours than he'd need in a 152 to solo.

George Hoover with Sport Cub: "New people are much easier to start with. They don't have anything to get in their way."

trol. The reports don't offer enough detail to speculate beyond that. We have noted that the Sport Cruiser's control forces are much lighter than other LSAs we've flown, and instructors we've interviewed say this is a problem. Also, three of the accidents involved issues in closing and securing the airplane's bubble canopy. That came up in other models' accidents, too.

Remos—with four fatals—was unique for having at least two them caused by apparent airframe mechanical failures. The aircraft is among a number of LSAs with readily foldable wings. In one accident, the ailerons were found disconnected, in a second, quick fasteners for the elevator weren't secure. Two of the other fatal accidents can just be considered flukes. A Legend Cub occupant drowned after the airplane ditched in Lake Michigan, and a CubCrafter's LSA disappeared and was assumed to be a fatal accident. CubCrafters also had a stall-related fatal.

EVERYTHING ELSE

Beyond the fatals, the pattern of LSA accidents is somewhat different from the most obvious airplane to compare them to: the Cessna 152. To illuminate the notion of how many 152s are flying, its fleet hours are about seven times that of all the LSAs combined during the survey period. Yet its fatal rate is an admirable 0.19/100,000 hours and its overall rate is 2.2, a third of the GA average.

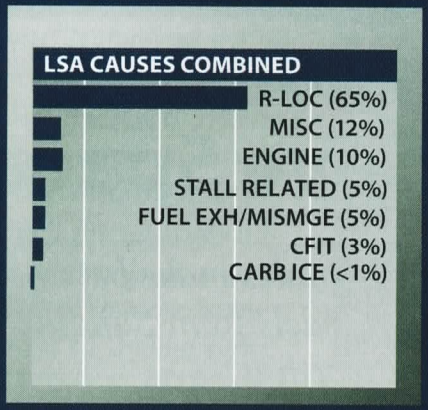
The 152's accident pattern is slightly different than the LSAs as a whole. Things like fuel exhaustion and mismanagement, stalls, carb icing and engine stoppages show up as factors in both the 152 and in LSAs.

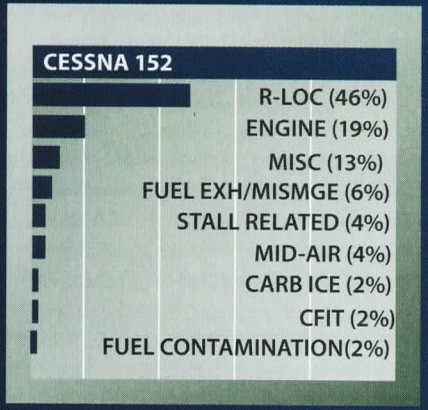
But the larger difference is what happens during landings and takeoffs. Some 65 percent of LSA accidents are what we call R-LOCs—runway loss of control. For the 152, 49 percent are R-LOCs, and the average among the last dozen used aircraft we've researched is about 28 percent.

Conceding the small numbers in our survey, this seems to confirm what we've said in LSA reviews almost from day one: They are simply more difficult to land than heavier airplanes, more susceptible to PIOs and more likely to be easily disturbed by crosswinds and gusts. Some are so exceptionally light in control forces

CRASH CAUSES SORTED

The graphics at right show how LSA crashes as a composite breakdown by cause. By far, runway loss of control (R-LOC) leads the list, followed by miscellaneous causes and engine failures. Stall-related accidents, many of which occur on landing or takeoff, are similar in occurence rate to the Cessna 152. Although the Rotax engines used in most LSAs are generally reliable, the 10 percent failure rate is significant, in our view. In many cases, the causes is listed as unknown.





that instructors tell us they have to constantly guard the controls during landings. (See the sidebar at left for more.) Given that we know we don't have all of the LSA accidents listed, we suspect the R-LOC rate is somewhat higher than we're reporting.

On the other hand, some of the accidents we coded as R-LOCs might more fairly be considered mechanical failures. In a number of accident reports we read, landing gear legs collapsed or wheels departed the airframe during landing. It's not always clear if these happened as a result of a hard landing or just a structural failure. While we wouldn't call them common, they're hardly rare, either. The 152 suffers such damage during some R-LOCs, but it's almost universally limited to the nosegear, which either collapses or bends, damaging the firewall.

We've provided a graphic to illustrate the accident rate for various models expressed on a per-registration basis. This tends to confirm that our flight hours estimates are reasonable, but it also shows that some LSAs seem more accident prone than others. Here, for instance, the Flight Design airplanes do less well.

Despite their favorable fatal accident record, Flight Design airplanes have been involved in 35 accidents, which is about 10 percent of the U.S. fleet or about 9.6 accidents per 100 registrations. Remos, Czech Aircraft Works and Evektor are considerably higher than that, however.

A quarter of the Evektor's U.S. fleet has been involved in accidents, for a whopping 27/100,000 overall rate and the highest accident rate per registration of any of the aircraft examined for this report. We asked Evektor for a comment on this, but the company said it has no explanation. For its part, Flight Design is aware of the high incidence of R-LOCs and it developed a special pilot transition program, which the NTSB made note of in one of its reports.

Design and construction methods were causal factors in some of the LSA accidents we reviewed. For instance, in two cases, pilots of Evektors stepped on the rudder pedal in the opposite control position, commanding left rudder when they wanted right. (Evektor has since added a small bulkhead between the pedal pairs to prevent this.)

We've always been critical of bubble canopies and gullwing doors in airplanes as a post-crash egress risk. However, we haven't seen an established pattern of these design features representing a demonstrated accident hazard in certified airplanes. But that's not true among the LSAs we studied. In one Evektor accident, the canopy opened in flight, causing the pilot to lose control and crash fatally. In the Czech Sport Cruiser, canopy issues were listed in three loss-of-control accidents, two of them involving serious injuries.

One interesting trend is where the Cub clones fit into the accident puzzle. The American Legend and Cub Crafters airplanes—which account for about 440 airplanes between them—are in the middle of the pack for overall rate. Both have low fatal rates, bettered only by the airplanes which have no fatal accidents. Surprisingly, at least to us, a number of these airplanes are in flightschool use.

CONCLUSIONS

We're considering this report as a marker for another review of the topic of LSA safety five years hence, at which time we would expect to see as many as three million flight hours. We'll know more about trends then. In the meantime, we don't think it's fair to draw any take-it-to-the-bank conclusions from the minimal accident data available to us for now.

Nonetheless, some observations are fair. Clearly, instructors, flightschools and the industry in general should consider how the rate of landing accidents might be tamped down. If it's as high five years from now as it is today, the insurers will be looking at a lot of wrecks. And perhaps hiking premiums. Perhaps additional training programs and even some aircraft redesign to address light control forces could help.

Second, in this group of 10 manufacturers, there are three outliers: Evektor, Remos and Czech Sport Aircraft. And they're not just a little outside the mean, but not even visible from inside the wire. In our view, with similar fleet sizes, the huge disparity between Jabiru or the Skycatcher and the three bottom airplanes in our survey is probably meaningful. The higher fatal and overall accident rates could have to do with the airplanes themselves or their operational environments. Our view is that this fleet bears watching.

For the time being, we think the LSA accident record is neither laudable nor alarming, but middle of the road. The takeaway from our research is this: If you fly an LSA, the best way to avoid your own NTSB entry is to keep your landing skills razor sharp and leave it in the hangar when the wind is gusting above 20 knots.