Cirrus Safety
Even with its safety-first parachute, the Cirrus has only an average safety record. Why isn't it better? … page 4
Cirrus Examined: Just Average for Safety

If the much-promoted full-airplane parachute system promised an exceptionally low accident rate, the potential is thus far unrealized. Can it be?

By Paul Bertorelli

When Cirrus kicked open the barroom doors in 1999 with an innovative new airplane equipped with a parachute, it promised to turn the page on light aircraft safety. In our initial report on the Cirrus SR20, we deemed it “one of the most crashworthy airplanes in GA history.”

A dozen years hence, does the accident history support the expectations? Has Cirrus delivered what many buyers hoped it would? And while we’re at it, how does it compare to other models? Which have the best accident rates, which the worst?

To answer these questions, we recently completed an exhaustive research project into the accident history of 11 popular aircraft models. We read and sorted more than 500 accident reports and compiled the data into what we believe is a reasonably accurate and fair assessment of how the airplanes compare.

Bottom line: The Cirrus composite accident rate (both models combined) finishes in the middle of the pack of GA piston aircraft. It’s neither exceptionally good nor exceptionally bad. Its overall accident rate is much better than GA as a whole, but its fatal rate is measurably worse than both the GA average and the average of the 11 models reviewed. The SR20’s accident rate is tied for the second worst.

Worth noting here is that measured accident rate is not the same as safe or unsafe, nor are we able to make unassailable claims and observations about crashworthiness. In our view, the data to do this isn’t available in publicly accessible NTSB records. Further, at least in the case of Cirrus, one of its major safety features—the Cirrus Airframe Parachute System or CAPS—is not passive, but requires active judgment and intervention by the pilot, thus the accident rate is a measure of how these combined factors have worked (or not) in the real world. Given this unique aspect of the Cirrus models, “safety” is more inextricably tied to pilot competence and training than is so in other models.

Push Restart

The long-accepted method of measuring risk and crash rates is to compare accidents against known exposure. In aviation, the accepted increment of exposure is 100,000 flight hours. Unfortunately, until Cirrus came along, if manufacturers maintained hours-flown data on their aircraft, they haven’t made it available to the press or public. But through warranty claims, parachute repack cycles and other methods, Cirrus has maintained this data and we believe it to be accurate.

Here’s how we tested the Cirrus claims: Bluebook Price Digest maintains its own database of average hours flown per year through reports it gathers on actual sales of aircraft.

As a safety feature, the parachute isn’t passive, thus “safety” is more inextricably tied to pilot competence than in other models.
### FATAL AND OVERALL RATES COMPARED

<table>
<thead>
<tr>
<th>OVERALL ACCIDENT RATE</th>
<th>FATAL ACCIDENT RATE</th>
<th>FATAL PERCENTAGE</th>
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<tr>
<td><strong>DIAMOND DA40</strong> 1.19</td>
<td><strong>DIAMOND DA42</strong> 1.45</td>
<td><strong>CESSNA 172</strong> 10%</td>
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<tr>
<td><strong>CIRRUS SR20</strong> 3.2</td>
<td><strong>CESSNA 172</strong> 1.45</td>
<td><strong>CESSNA 182</strong> 21%</td>
</tr>
<tr>
<td><strong>CIRRUS COMPOSITE</strong> 3.25</td>
<td><strong>DIAMOND DA42</strong> 1.54</td>
<td><strong>COLUMBIA/CORVALIS</strong> 26%</td>
</tr>
<tr>
<td><strong>CESSNA 182</strong> 3.3</td>
<td><strong>CESSNA 182</strong> 1.69</td>
<td><strong>MOONEY M20</strong> 29%</td>
</tr>
<tr>
<td><strong>CIRRUS SR22</strong> 3.3</td>
<td><strong>BEECH G36</strong> 1.3</td>
<td><strong>DIAMOND DA40</strong> 30%</td>
</tr>
<tr>
<td><strong>BEECH G36</strong> 3.3</td>
<td><strong>CIRRUS SR22</strong> 1.5</td>
<td><strong>CESSNA 206</strong> 31%</td>
</tr>
<tr>
<td><strong>COLUMBIA/CORVALIS</strong> 3.9</td>
<td><strong>CESSNA 206</strong> 1.6</td>
<td><strong>PIPER SARATOGA</strong> 39%</td>
</tr>
<tr>
<td><strong>CESSNA 172</strong> 4.3</td>
<td><strong>CIRRUS COMPOSITE</strong> 1.6</td>
<td><strong>BEECH G36</strong> 40%</td>
</tr>
<tr>
<td><strong>PIPER SARATOGA</strong> 4.6</td>
<td><strong>CIRRUS SR20</strong> 1.8</td>
<td><strong>CIRRUS SR22</strong> 45%</td>
</tr>
<tr>
<td><strong>CESSNA 206</strong> 5.1</td>
<td><strong>MOONEY M20</strong> 1.9</td>
<td><strong>CIRRUS COMPOSITE</strong> 48%</td>
</tr>
<tr>
<td><strong>MOONEY M20</strong> 6.6</td>
<td><strong>MOONEY M20</strong> 1.9</td>
<td><strong>CIRRUS SR20</strong> 56%</td>
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</tbody>
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**6.3 GA AVERAGE**

**1.2 GA AVERAGE**

### ANALYSIS METHODOLOGY

Accident data given here is accidents per 100,000 hours of flight. Percentage fatal is percentage of total accidents for each model that had at least one fatality. Fleet hours were calculated for each model by multiplying average annual hours flown given by Aircraft Bluebook Price Digest by production figures gleaned from either the General Aviation Manufacturers Association Web site for the FAA registry. Accident reporting period for most models was 1997 to 2011, but for the Saratoga and Mooney models, it was longer. Cessna 172, 182 and 206 combine all versions of those airplanes into a single fleet. Mooney fleet covers M, R and S models. Beech G36 data covers a very small fleet and a small number of accidents. Cessna M20 (6.6) and Mooney M20 (6.6) are as fair as we can make them. We're confident the hours-flown numbers within 4 percent, so we're confident the hours-flown numbers are as fair as we can make them. We have similar confidence in the hours-flown calculations for other models for which we used the same Bluebook data source. Diamond provided additional fleet hours information.

At about the same time that Cessna began production, Cessna's restart of piston production provided us with an opportunity to restart the clock. Cessna's restart models have new model designations which appear in NTSB reports, so we can segregate them from legacy aircraft.

For most of the models reviewed here, our survey period began in 1997, when Cessna re-entered the market. However, for both the Saratoga and the Mooney models, we had to extend the period into the 1980s and 1990s to obtain workable model designations and production numbers. For most production numbers, we used General Aviation Manufacturers Association data but for some, we used FAA registry data. Some caveats: Our survey covers mostly N-number airplanes and U.S. crashes. Where possible, we have obtained some data on foreign crashes, but it's not complete. For reasons not clear to us, we know that the NTSB's Website doesn't list all accidents, especially minor ones. Some simply aren't reported. But it does list most accidents involving fatalities. We've used the best of all data available for our calculations.

For additional fact checking on the Cessna models, Rick Beach, who has studied the airplane's accident history extensively for the Cessna Owners and Pilots Association, generously helped. Last, the tyranny of small numbers. Given the relatively paltry fleet hours (even by Cirrus and Cessna), an additional accident or two can bump the rates noticeably. For that reason, we think the numbers should be seen comparatively, not as absolutes. However, the Cirrus numbers are the most accurate.

### CIRRUS DISSECTED

All together, we found 172 Cirrus accidents for both models, 83 of which involved fatalities, giving Cirrus the dubious distinction of having the highest percentage of accidents that proved fatal among the group of airplanes we studied. As the chart shows, almost half of all Cirrus accidents involve at least one fatality. This high number may relate to both the type of mission Cirrus owners tend to fly and the type of accident that results, namely flights into significant weather in which an upset or loss of control may result in terrain impact at unsurvivably high speeds. Also, if the NTSB reports are accurate, nearly two dozen of the fatal Cirrus accidents we reviewed appeared to be stall or spin related, despite Cirrus's stall/spin-resistant wing and the availability of CAPS.
This is hardly to suggest that other models don’t have stall/spin accidents, but the Cirrus line was near the top of the list for stall accidents. The Mooney series had eight, the Cessna 182 had six and Columbia and Diamond had none that we could find. Although we’ve listed the Cirrus overall and accident rates as a composite, there’s enough data to differentiate the SR20 from the SR22. The SR20’s overall accident rate is 3.2/100,000 hours, which places it squarely in the middle of the surveyed aircraft and at about half the GA rate of 6.3 GA overall rate. The SR22’s overall rate, at 3.3, is a statistical dead heat with the SR20.

But there’s more daylight between the fatal rates. At 1.54, the SR22 is in the middle of the pack and above the 1.2 GA average. The SR20 is near the bottom of our survey, at 1.8/100,000. Given the small numbers involved, we can’t make much of this statistical difference other than to point out that it exists.

If there’s any meaningful pattern between the SR20 and SR22 accidents, we can’t see it other than to observe when accident causes are compared as a percentage of total accidents, there are two vagaries: For the SR22, stalls are mentioned as a cause in 16 percent of accidents, while for the SR20, the number appears to be 7 percent. And note that the incidence of CFIT is higher for the SR20 than for the SR22, which may have something to do with less experienced or non-instrument rated pilots flying it. (Or our interpretation biases.)

OTHER MODELS
When the Cirrus is measured against other aircraft which occupy a similar market niche, there are plusses and minuses. On the plus side, our data shows that the SR22 has a better fatal accident rate and a better overall accident rate than the Mooney M,R,S series, against which we compared it. It also bests the Cessna 206 and 172 on overall accident rates. The SR20 is similarly midstream when overall accidents are considered.

We were especially interested in how the Cirrus models would compare to the Columbia/Corvalis, which competes in the same market space. The Columbia/Corvalis has a slightly worse overall rate, but a better fatal rate. But given the aforementioned small number effect, they’re very similar. Not so the Diamonds, however, which top our list with the both lowest overall and lowest fatal rates.

Cirrus aficionados will point out that the Columbia line has far fewer airframes (about 704 compared to Cirrus’ 5000-plus) and that the Diamond is more of a trainer than a cruiser. While both claims have merit, it’s also true that rates are rates and we’re measuring an airplane’s performance in the design arena for which was intended. Moreover, the SR20 and DA40 are both used in training and in IMC.

The Columbia/Corvalis, which has no parachute system, has an apparent accident rate that’s about the same or maybe a bit better. Is this due to different mission profiles? We doubt it, for the Columbia/Corvalis is a fast, go-places airplane that’s flown in actual IMC on long trips.

Some also believe Cirrus airplanes tackle more serious weather more often than other models and accident data may support this. When we posed this question to COPA’s Rick Beach, his theory was that the Columbia tended to attract pilots more interested in aviation for its own sake, while Cirrus buyers...
CAPS: EFFECTIVE BUT NOT FLAWLESS

With 31 CAPS deployments to date, the Cirrus BRS parachute system has gotten enough of a workout in the field to prove or disprove its efficacy. Considering the human factor, has it worked as Cirrus hoped? Yes, but the results could also be called mixed for several reasons. Some pilots have deployed too late to get the full benefit of CAPS, while many others haven't deployed at all. At least six fatalities have been associated with deployments in sub-optimal circumstances.

On the other hand, there have been no fatalities when CAPS has been deployed within its speed envelope and the injury rate for optimal deployments has been low.

CAPS Vpd or max demonstrated deployment speed is given as 133 knots indicated. While there is no formal altitude limit, Cirrus says 920 feet is required for full canopy inflation in a one-turn spin and deployments as low as 300 feet have been successful, says BRS, maker of CAPS. Speed matters more than altitude, according to BRS. The system has been deployed at a max speed of 187 knots and a minimum speed of 34 knots in inverted flight. In one accident, it appeared to have failed at 270 knots indicated.

The 31 deployments involved 57 total occupants, according to COPA data. Thirty-nine survived without injury, seven were seriously injured and five suffered minor injuries. Although the serious injuries are troubling, when Cirrus was developing the system, it said injuries were possible, if not likely. Further, at least five of those injuries may have been the result of low-altitude deployments.

Although touchdown energy is low, an airplane under a CAPS canopy is still descending at about 17 MPH. It’s not exactly a joy ride.

One curious thing about CAPS is the apparent reluctance or inability of many pilots to use it. COPA’s Rick Beach has studied in detail all of the type’s fatal accidents and concludes that many would not have been fatal had CAPS been deployed. We agree. The number could be over 40, which would substantially lower Cirrus’ fatal rate, thus showing that when the human factor is considered, CAPS hasn’t lived up to its full potential.

So why didn’t they deploy? No one really knows, but simulator exercise outcomes suggest that at least some pilots become “path focused” trying to correct whatever abnormal they’ve encountered until they’re too low or too fast to deploy. Several accidents have involved spins from sufficient altitude to have been saved by CAPS.

COPA has undertaken an educational initiative to encourage pilots to consider pulling earlier if there’s any doubt about the outcome rather than relying on piloting skill to recover—skill the pilot might not have.

“If you present me with more frivolous pulls and fewer fatalities, I’ll take it,” says Beach. “Which would you rather have, skilled pilots who are dead or frivolous pulls? We are trying to teach not to get yourself so wrapped up in a recovery attempt that a recovery by parachute isn’t feasible.”

The other side of the CAPS coin is the so-called theory of risk homeostasis, which postulates that pilots who know they’ve got a parachute to save them will take greater risks and possibly endanger themselves more than if they didn’t have the parachute option. But does Beach believe this exists?

“I absolutely do,” he told us. “It’s certainly something that applies to night flying. There are situations in which I’m well aware that in night flying over unlit areas, I don’t know what I’m going to land on. Am I going to fly down Interstate 5 thinking I’m going to land on the interstate? With the parachute, I don’t make that conservative decision.”

The extreme version is that Cirrus pilots actively seek out higher risk because they have CAPS aboard, then get into circumstances they can’t handle. “That’s where I have a problem,” Beach said. “If it were true, wouldn’t you see more people pulling the parachute? And we don’t see that. And there is not a large body of information suggesting people are pulling the parachute in situations that are frivolous.”

Although COPA’s members have a much better accident record than Cirrus owners in general, Beach has no illusions about the training level ever being elevated to the point where pilot skill would largely trump the CAPS option. “They have permission to fly without a level of skill and proficiency that we might all want. And therein, you have a problem.” Thus far, for some Cirrus pilots, the solution has been a CAPS pull. The data seems to suggest that for many more, pulling could have been an option, too.
comfort and speed. It is not quite as fast as a Mooney 231/252 or Twin Comanche, but 165 knots true is plenty fast when you're sitting comfortably in a wide and tall cabin as the world passes by below. And it's nice to know that with its large doors when on the ground, you don't need to be a wing-walking contortionist to get to and from your seat.

Brian Williams
Via e-mail

My airplane is a 1977 Cardinal RG, and I bought her in January of 2007 after renting Cardinals from a local FBO. I fell in love with the way they handle on my first flight and eventually had to buy one of my own.

The feel of the controls is light, authoritative and nicely harmonized. The IO-360 engine delivers satisfying acceleration, climb and cruise, and there are several STCs available to improve the book performance figures, including the IO-390 upgrade, the Tornado Alley turbo normalizer and the Firewall Forward high-compression pistons.

I usually cruise at or below 12,500 feet and typically see indicated airspeeds in the 140- to 145-knot range at 9 to 10 GPH. The visibility out the windshield and the side windows is unusually good for a high-wing aircraft, since the wing is so far back and there are no struts or gear (during cruise) to get in the way.

I belong to the Cardinal Flyers Online organization, which is a fantastic resource for anyone who flies or owns a Cardinal. I also belong to the Cessna Pilots Association and the Cessna Owners Association, which are also good resources.

John Peck
Everett, Washington

I own and fly a 1971 Cessna Cardinal RG, which I purchased as a worn-out plane, with the intention of going through everything. I had 100 percent of the problems listed on the exceptionally helpful Cardinal Flyers Online website. The CFO website really makes owning an older Cardinal an easy experience.

My aircraft now meets book speeds and performance numbers, which is to say it performs as expected. It's no hot rod and it won't match speeds with a similar HP Mooney in climb or cruise. However, it is far more roomy for both people and cargo. I find that 100 pounds under gross weight is a practical limit here in hot and humid South Florida. A Cardinal RG is a true three-adults-plus-bags aircraft. My aircraft has a 1017-pound useful load. With 33 gallons full fuel, I can carry 699 pounds of people and gear.

I generally cruise at 140 to 143 knots true, full throttle, 2500 RPM, 7500 to 9500 feet on 8.5 to 9.5 GPH. I don't fly lean of peak at 8500 feet cruise altitude, mostly because there really is not enough reserve HP to do so. I adjust the mixture for real world best power. Interestingly enough, at low altitude, slower speed cruise, the aircraft is capable of some incredibly low fuel burns. So, the 50-mile trip to the airport restaurant can be an inexpensive flight. I've seen as low as 5 GPH, 105 knots true at 2000 feet.

Parts availability has been absolutely no problem, but Cessna does charge more than expected for certain items. Maintenance is generally easy, but it is time consuming due to the expected complexity. The gear system is generally trouble free if the hoses are new, and the actuator rod end SB has been complied with.

Conclusion: I really love my Cardinal RG. It’s responsive, fun to fly, quite capable, fast and economical.

Christopher G. Cuneo
Linda Vista Aviation

The Cardinal RG is one of the best multifunctional aircraft I have ever owned. It can carry four people comfortably with some luggage and full fuel to considerable distance.

It has plenty of space, it’s an aircraft easy to get in and out of, very good speed, excellent endurance, under 10 GPH fuel consumption and it has the best looks amongst all the Cessna products of its time.

I have flown it across the Atlantic from Canada to Hungary, where it's registered now, and since then I have been to most European countries, all through the Mediterranean Islands, down to North Africa and it has never let me down.

Paul Tonelli
Via e-mail

Cirrus Examined

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trend more to aviation as a means to an end—a transportation mode that just happens to involve flying.

If Columbia pilots are more experienced than Cirrus pilots, it certainly doesn’t show in the data. Pilot experience is only sketchily provided in NTSB accident summaries. It’s usually available for fatal accident reports, but not always. From what data we could glean—and that’s not for every accident, by any means—Cirrus accident pilots averaged 1454 hours with 240 in type, while Columbia pilots averaged 1631 hours with 237 hours in type. To us, that’s no difference at all. Mooney pilots, who have a worse overall and fatal rate than Cirrus pilots do, averaged 1810 hours and 913 hours in type.

One thing that is noticeable in accident narratives is how willing some low-time Cirrus pilots are to take on challenging weather. In one well-reported accident, an SR22 departed Reno/Tahoe for a night flight in high-overcast IMC over mountainous terrain. The pilot encountered unexpected icing, lost control and may have tried to deploy CAPS outside the max operating speed envelope, causing it to fail. The pilot had 473 hours total time with 69 hours in type.

Although this may or may not be an example of it, some Cirrus owners believe that risk homeostasis—the phenomenon of assuming more flight risk because CAPS is standing by to bail you out—could be a factor in the Cirrus accident rate. (See the sidebar on page 7.) On the other hand, we see these kinds of judgments among pilots of other models, too.

OTHER FACTORS

As discussed in the sidebar, there have been 31 CAPS deployments, representing about 18 percent of all Cirrus accidents. Since the airplane is significantly damaged by deployment, although not always to the point that it can’t be flown again, we consider CAPS deployments an accident.

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Cirrus Examined

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Overall, the outcome of CAPS deployments has been positive and, in fact, perhaps better than Cirrus predicted. The deployments have yielded few injuries and about a dozen of the aircraft involved were repaired and returned to service, something Cirrus didn’t necessarily envision.

Do these models do better than aluminum or other composites in crash survival performance? Crash tests suggest they should, but we can’t say for sure because we don’t have enough information on impact damage and forces. We did, however, track the incidence of injury in crashes that weren’t fatal.

For the Cirrus, the rate was 15 percent; the Cessna 182 was 7 percent, the Mooneys 11 percent and the Columbia/Corvalis 4 percent. The Diamond DA40 had 26 percent—but this data is quite sketchy, especially on foreign crashes.

Self-ignited post-crash fire is always a worry in crash survivability and here, with the exception of Diamond’s DA40, all of the aircraft seem to perform similarly. At 16 percent, the SR22 has the highest rate of post-crash fire incidence, with the Columbia right behind at 14 percent and the Mooneys, SR20 and Cessna 182 at 11 or 12 percent.

Only the DA40, with fuel tanks protected in aluminum cells behind two massive spars, has no history of self-ignited post-crash fire. Diamond told us one DA40 suffered a fire after striking powerlines, but this doesn’t appear in the NTSB database and we don’t have details on it.

CONCLUSION

Critics of Cirrus have claimed that the company simply hasn’t delivered safe airplanes, but we don’t agree and believe this overstates the case. According to our data, Cirrus has more of an average safety record in a market that may have expected better, since it has the CAPS parachute as the ultimate backstop.

Taken together, the SR20 and 22 have an overall accident rate in middle of the road for aircraft we examined. The composite fatal accident rate appears to be worse than the GA average, but somewhat better than other models we examined.

If we could fault Cirrus for anything, it would be two things: In our view, it underestimated the cultural challenge of integrating a parachute into the airplane’s basic safety ethos in a way that would fundamentally improve its safety. And although we think the stall-resistant wing Cirrus used is laudable, the airplanes may have a slightly higher incidence of stall-related accidents than other models appear to. Part of this can be addressed by training, but we wonder what else might be done to make the airplane more stall resistant.

One answer to that may be better training in the use of CAPS, which is, in fact, the recommended spin-recovery response. If just one-third of recorded Cirrus fatal accidents had been CAPS saves instead, the Cirrus fatal rate would be well below the GA average, thus delivering the level of safety many thought that Cirrus promised in the first place.

The direct comparison with the Columbia is revealing because even with CAPS, the Cirrus fatal rate lags a little behind what is essentially a similar airplane.

Cirrus’s Bill King, who tracks safety data for the company, acknowledges that Cirrus has struggled to train pilots to be more aware of CAPS’ safety potential. While he doesn’t dismiss our findings, he said the small numbers may not necessarily be statistically significant. But he also concedes that with CAPS, Cirrus ought to have the potential to have a much better safety record than a similar equipped aircraft without it.

Cirrus has its work cut out for it to make that a reality, in our view. Everyone we talked to agrees that there’s more to the equation than just putting a red handle in the cockpit.