How Safe is a Cirrus?

by Rick Beach

This update to the Cirrus fatal accident statistics offers a summary of what we know about them. As the COPA *de facto* accident historian, I often am asked about the Cirrus accident rate. Usually after a rash of highly publicized Cirrus accidents, news reports and aviation blogs point out the large number of crashes. Critics complain that Cirrus airplanes crash more than other types.

Is that true? How safe is a Cirrus?

- *Way, way safer for COPA members!*
- *Better than the average single-engine piston airplane fleet.*
- *A bit worse than the general aviation fleet.*

Some Basic Statistics

To calculate accident rates, you need some basic information. My data collection includes the following information: (Special thanks to the Cirrus Flight Operations Department for updates on flying times.)

- 41 fatal accidents in SR2X airplanes [NTSB & news media]
  - 11 in SR20s and 30 in SR22s (73%)
  - 82 fatalities and 10 survivors with injuries
- 13 CAPS parachute activations [NTSB & news media]
  - Two in SR20s and 11 in SR22s (85%)
  - Two parachute failures
  - Two fatal parachute activations, included above
  - 11 parachute saves with one fatality and 24 survivors
- 3,986 SR2X airplanes produced by 2008Q2 [GAMA reports]
- 2,688,000 flying hours in Cirrus SR2X fleet [Cirrus Design Flight Operations Dept.]

Cirrus Fatal Accident Rates

Rates of fatal accidents can be computed in many different ways. Using NTSB reports, we know the number of fatal accidents by month. Using SR2X fleet statistics gathered from the GAMA quarterly production reports, we can calculate the number of fatal accidents per airplane. Using the flying hours gathered by Cirrus Design from their warranty and AD compliance reports, we can calculate the number of fatal accidents per 100,000 flight hours.

Fatal Accidents by Quarter

Plotting the frequency of Cirrus fatal accidents by quarter reveals the sporadic pattern in Figure 1, with some quarters having no accidents and other quarters having several. There is a general upward trend, which increased in late 2006 through early 2008. That might be expected as the fleet size increased. Recalling the large portion of Cirrus fatal accidents that involve bad weather, the darker bars represent the fall and winter months from October to March. Clearly, there are more accidents in those months with bad weather than the spring and summer months.

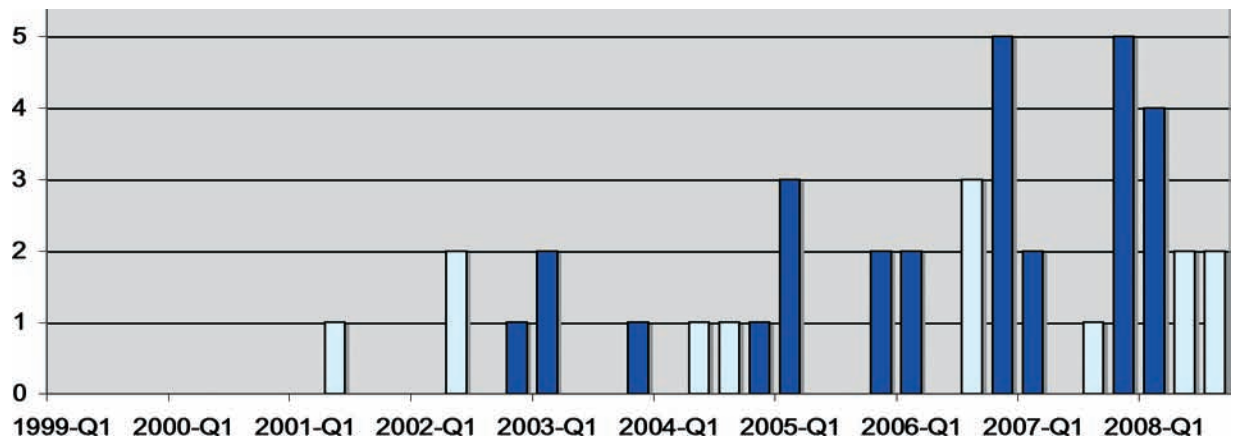

FIGURE 1: *Number of fatal Cirrus accidents by quarter, since production of the SR20 began in mid-1999. Over two-thirds of fatal accidents, 28 of 41 or 68%, occur in the half of the year with bad weather (Note: the dark bars represent accidents in the fall and winter months, October to March).*

Cirrus Fatal Accidents

This table lists the 13 fatal accidents in production Cirrus SR2X airplanes since the previous Safety Issue of *Cirrus Pilot* (Nov/Dec 2007). COPA collects this information from the National Transportation Safety Board (NTSB), except for international accidents that come from other national safety boards or news reports. Note: If you search an on-line database of accidents, please ensure that you avoid the amateur-built VK-30 kit airplane and any gliders which have "Cirrus" in their model names. This table will appear and be updated in COPApedia.

#	LOCATION	DATE	SYNOPSIS
29	New Windsor, NY	21-Nov-07	Plane impacted terrain during second approach in low visibility and low ceilings about 2:00 a.m.
30	Fairbault, MN	25-Nov-07	Plane impacted terrain adjacent to the runway in gusty wind conditions, reportedly during a second landing attempt or aborted landing.
31	Jagel, Germany	28-Nov-07	Plane impacted power lines at night while flying parallel to a highway in low ceilings, reportedly attempting to contact the nearby military airport.
32	Gurupi, Brazil	19-Dec-07	Plane impacted terrain during landing when wing tip hit the ground and the plane cartwheeled.
33	Paso Robles, CA	30-Dec-07	Plane impacted terrain after low altitude maneuvers, including barrel roll described by witnesses.
34	Lindsay, OK	2-Feb-08	Plane impacted terrain while maneuvering near airport, possibly from a simulated engine-out emergency procedure.
35	Rio de Janeiro, Brazil	2-Mar-08	Plane impacted building near airport after smoke observed from engine; reports suggest plane was misfueled with Jet-A because of confusion with "turbo" designation.
36	Front Royal, NC	15-Mar-08	Plane impacted terrain soon after departure at night with low ceilings in location not consistent with Departure Procedure for the airport.
37	Waxhaw, NC	20-Mar-08	Plane impacted terrain during maneuvers to land at private airstrip.
38	Big Bear, CA	8-Apr-08	Plane impacted terrain during VFR approach to mountain airport in low IMC and freezing conditions.
39	Hemphill, TX	22-Apr-08	Plane impacted water during IFR flight after flying NORDO for over an hour.
40	Rock Springs, WY	10-Aug-08	Mid-air collision with a VFR aircraft while on IFR approach.
41	Arbor Vitae, WI	11-Sep-08	Plane impacted terrain during approach to landing in low ceilings.

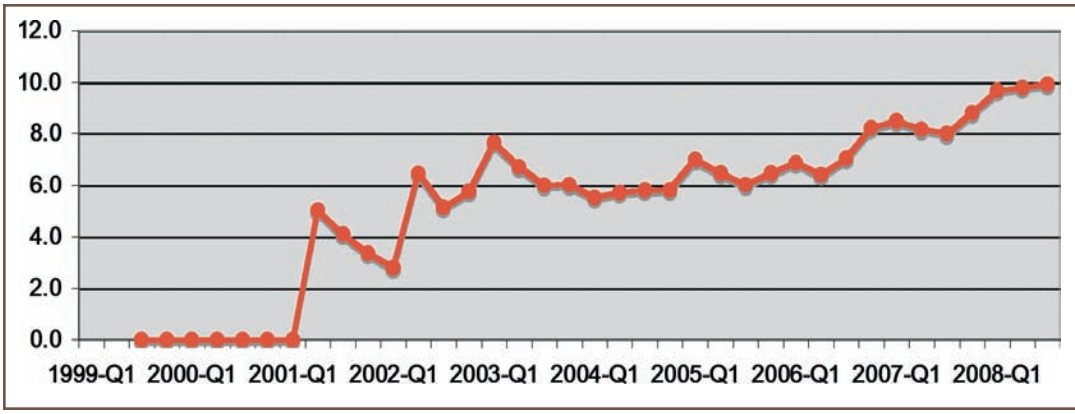

FIGURE 2: *Total number of SR2X fatal accidents per 1,000 aircraft produced since the certification of the SR20 in mid-1999. The upward trend of this line shows that more of the fleet is involved in a fatal accident as the fleet grows larger. The line slopes downward in periods when there were fewer accidents as the fleet grew larger.*

Fatal Accidents by Size of Fleet

Calculating the number of fatal accidents against the growth in the number of SR2X aircraft produced reveals an upward trend, meaning more of the fleet becomes involved in a fatal accident as the fleet grows.

There are several bad patches, each corresponding to fall/winter months. In 2001, our first fatal accident caused the first jump in the curve. In 2002, we had three accidents when the fleet was still small. Then in early 2003, there were two accidents within a week of each other (Hill City, Minn., and San Jose, Calif.) creating a significant jump. Since 2004, there has been a general upward trend indicating more of the fleet was involved in a fatal accident.

This upward trend is worrisome, especially as more of the fleet changes hands due to the sale of used airplanes without the provision of initial factory transition training.

Fatal Accidents per 100,000 Flight Hours

The traditional method of comparing year-over-year trends in fatal accidents is to calculate the number of accidents per 100,000 hours of flying time. This better represents the greater activity of newer airplanes compared with aged airplanes in the GA fleet. So too with Cirrus airplanes, as the oldest SR20 airplanes are now nine years old.

The FAA conducts an annual survey to determine flying time. The NTSB accident reports provide the number of accidents each year. From that, the NTSB publishes an accident rate per 100,000 hours of flying time.

For example, in 2007, the GA fixed-wing fleet of about 260,000 aircraft flew 23.8 million flight hours and had 284 fatal accidents for an overall rate of 1.19 fatal accidents per 100,000 flight hours. This GA accident rate has been slowly declining for the past decade.

With the fleet hours provided by Cirrus Design, we can estimate the Cirrus SR2X flying time for each quarter based upon the production numbers. Then given the number of fatal accidents, we can calculate the fatal accident rate.

Note that small variations can cause large fluctuations in these rates. In Figure 3, the first accident in 2001 caused a huge jump and the spike in 2002 came from just three accidents in a fleet of about 600 airplanes that flew less than 100,000 hours.

With that in mind, let me offer four variations of the fatal accident rate using different time scales:

- 1.53 fatal accidents per 100,000 hours since certification in mid-1999
- 1.54 fatal accidents per 100,000 hours in the past 36 months
- 1.76 fatal accidents per 100,000 hours in the past 12 months
- 1.42 fatal accidents per 100,000 hours in 9 months of 2008 year-to-date.

Therefore, one can say that the Cirrus fatal accident rate is between 1.42 and 1.76 depending on how much aggregation you want to provide to stabilize the trends.

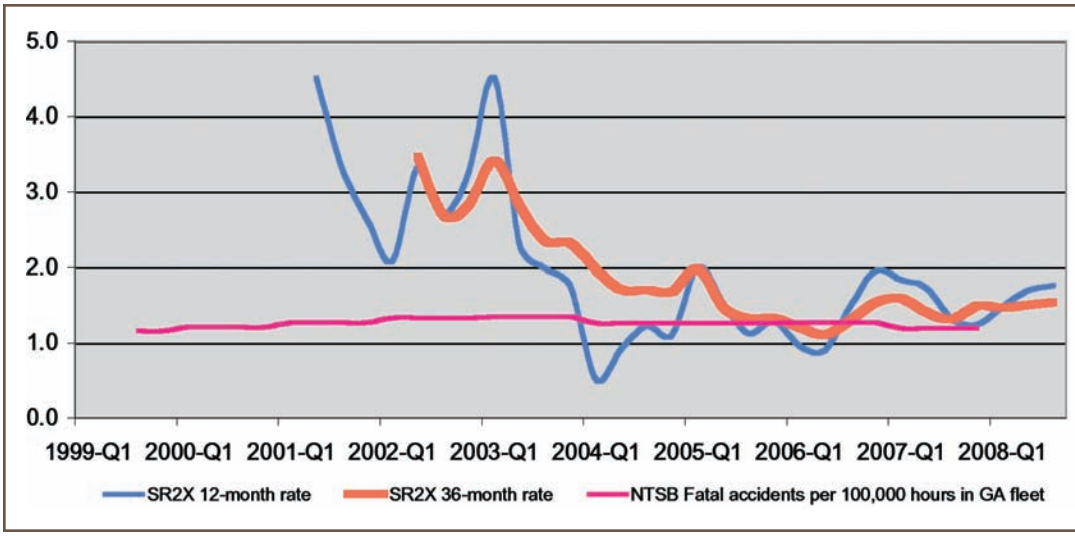

FIGURE 3: *Comparison of SR2X fatal accidents per 100,000 hours of flying time with the GA fleet, and the three-year trend line. Note that when the accident rate was very high in 2001 to 2003, there were only a few accidents (one to three per year) and the fleet was small (less than 1,000 airplanes). In 2007, the fleet grew to 3,700 airplanes, flying 650,000 hours per year, so the eight accidents represent a lower rate.*

Cirrus Parachute Activations

Note: The table below has not changed since last year. There were no new CAPS parachute activations while there have been 13 new fatal accidents in the same time frame.

This table lists all of the known activations of the Cirrus Airframe Parachute System in production Cirrus SR2X airplanes since the introduction of the SR20 in 1999. COPA collects this information from the National Transportation Safety Board (NTSB), except for international accidents that come from other national safety boards or occasional news reports. Some accidents involve post-impact deployment of the parachute, which are not included. Two activations involved parachute failures, which are included. Two activations involved fatalities, which are also included as both a fatal accident and as a CAPS parachute activation. Hence, the notion of "parachute saves" in which people survived a landing under parachute requires an activation, successful deployment and survivors. Of the 13 activations, there were 11 saves with a total of 24 survivors. This table will appear and be updated in COPApedia.

#	LOCATION	DATE	SYNOPSIS
1	Lewisville, TX	4-Oct-02	First CAPS deployment after maintenance failure of aileron, landed in trees near golf course; no injuries
2	Mount O'Leary, BC, Canada	9-Apr-04	High-altitude upset during VFR night flight landed in mountaneous terrain; no injuries
3	Fort Lauderdale, FL	11-Apr-04	Low-altitude loss of instruments due to water in static system, landed in trees; no injuries
4	Peters, CA	20-Sep-04	High-altitude upset during VFR flight over cloud layer, landed in walnut tree orchard; no injuries
5	Norden, CA	7-Feb-05	Icing encounter at 16,000 feet, parachute separated from airplane during extraordinary high-speed descent; pilot fatality
6	Haverstraw, NY	1-Jul-05	Pilot lost conciousness, recovered from a V_{ne} dive, activated CAPS to ensure landing, impacted water with severe injury
7	Childersburg, AL	14-Jan-06	Icing encounter at 9,000 feet, pilot provided PIREP during descent; no injuries
8	Wagner, SD	7-Feb-06	Pilot disorientation after takeoff; no injuries
9	Indianaoplis, IN	29-Aug-06	Pilot incapacitated, passenger activated CAPS close to ground, impacted water, pilot fatality, serious injuries to passengers
10	Bull Bay, Jamaica	26-Sep-06	Passenger activated CAPS when observed fuel leaking from wing; plane sufficiently undamaged that it was ferried to U.S. for repairs
11	Sydney, Austraila	7-Feb-07	Engine failiure prompted CAPS deployment, parachute rocket took anomalous trajectory and parachute wrapped around tail; no serious injuries
12	Luna, NM	10-Apr-07	Icing encounter without pitot heat resulted in loss of control and terrain warning, deployed CAPS; no injuries
13	Nantucket, MA	13-Aug-07	Pilot disorientation during VFR-into-IMC encounter, impacted tower; serious injuries

Comparing Cirrus Accident Rates to Other Fleets

We can now see that the Cirrus fatal accident rate is higher than the overall general aviation (GA) rate of 1.19 fatal accidents per 100,000 flight hours.

Comparing Cirrus to the GA fleet is a tough comparison because GA includes multi-engine turboprops and turbojets flown by two pilots. This redundancy and professionalism produces significantly fewer fatal accidents. Backing out the flight hours and fatalities for those aircraft from the survey reduces flight time to about 14 million flight hours and produces about 261 fatal accidents.

Thus, the single-engine piston accident rate is about 1.86 fatal accidents per 100,000 flight hours.

The Cirrus rates of 1.42 to 1.76, depending on the time scale, compares very favorably with single-engine piston aircraft rate of 1.86.

But what about other competitive aircraft like Cessna, Beechcraft, Mooney, Columbia, or Diamond? Unfortunately, none of those manufacturers publish their fleet hours. The legacy manufacturers have produced considerably more aircraft over a long period of time, so fleet comparisons may not be meaningful. For instance, the FAA survey of GA activity reports planes less than five years old fly about 200 hours a year, while planes 25 years or older only fly 125 hours per year.

As for fleet sizes, other new manufacturers have such small fleets in comparison to Cirrus Design, perhaps one-tenth to one-third the number of airplanes, that just a few accidents can cause a huge fluctuation in their accident rates. Until more information becomes available, no meaningful comparisons are possible.

Predicting Accident Rates

That's history. What about the future? How many accidents do we expect?

As we start the fall and winter season, remember that most Cirrus accidents happen in the months from October to March, in bad weather, from pilot causes.

At the current three-year rate of 1.54 fatal accidents per 100,000 flight hours, expect about nine more fatal accidents before next summer. Even if the accident rate declines to 1.00, we can expect six more fatal accidents by summer.

How can we change that?

Actions by Cirrus pilots that demonstrate an unparalleled commitment to safety as advocated by COPA will help. Outreach to other Cirrus pilots who are not members of COPA will help. Take action to break your own accident chain. Fly safe.

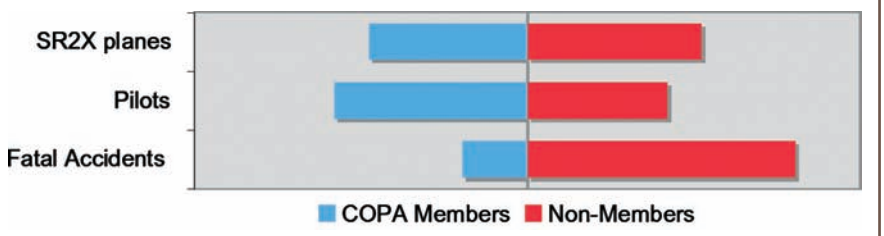

FIGURE 4: *COPA member percentages of SR2X airplanes, Cirrus pilots and fatal accidents. COPA members have a dramatically lower number of fatal accidents despite representing more than half of the pilot population and SR2X airplanes in the fleet.*

COPA Membership and Accident Rates

Finally, a reason to appreciate the dramatic safety record of COPA members! In terms of airplanes, COPA members represent about 50% of the airplanes (1,900 of 4,000). In terms of pilots, we estimate that COPA members represent about 60% of the Cirrus pilots (2,900 of 5,000). Yet, in terms of accidents, COPA members were involved in only 20% of the fatal accidents (8 of 41), way less than the expected numbers (see Figure 4).

As a predictor of fatal accidents per airplane, non-members of COPA are ***four times*** more likely to have a fatal accident: COPA members had eight accidents among 1,900 planes (1 in 237), non-members had 33 in 2,100 (1 in 60).

In terms of fatal accidents per pilot, non-members of COPA are also ***six times*** more likely to have a fatal accident: COPA members had eight accidents among 2,900 pilots (1 in 362), non-members had 33 in approximately 3,000 (1 in 91).

If you examine the COPA activities of those eight fatal accident pilots, you find several who were members but did not participate in either the forums or the safety programs.

Participate in COPA safety activities! Only you can break your accident chain of events. COPA

SIDEBAR

Sources for Cirrus Accident History

NTSB Accident Reports

COPA relies upon the National Transportation Safety Board (NTSB) accident reports to compile our statistics. The NTSB maintains an on-line database at http://www.ntsb.gov/ntsb/query.asp that can be queried for various manufacturers, injury severity, location, and operation, as well as to find a specific report. NTSB reports may be classified as **Preliminary**, when initial information is entered into the database for an NTSB investigation, **Factual**, when information from other sources is provided, usually from other national investigations or to supplement the final report, and **Probable Cause**, when the accident investigation releases its final reports.

Note that the NTSB database records for Cirrus Design aircraft do not have a consistent version of Make/Model information from report to report, so care should be taken with searches for "Cirrus" to avoid including amateur-built VK-30 kit airplanes and gliders that have the word "Cirrus" in their model names.

Air Safety Foundation Database

Another on-line source for the same information is available to AOPA members. From the Air Safety Foundation website, http://www.aopa.org/asf/, click on the link to search the accident database. Links are provided to the NTSB reports, airport diagrams and approach plates.

FAA Preliminary Accident/Incident Reports

For more timely information about accidents, you can check the FAA reports of preliminary information published daily at http://www.faa.gov/data_statistics/ and click on Preliminary Data.

Other Sources

COPA benefits from close relationships with both Cirrus Design and BRS. The NTSB frequently invites accident investigators from the manufacturers to provide expertise during the accident investigation process. While they are diligent in maintaining confidentiality of the process, we have learned useful insights about Cirrus accidents that help shape these safety lessons.

Finally, the COPA forum often contains posts with the most comprehensive, up-to-the-minute breaking news about accidents involving Cirrus aircraft. Occasionally, COPA members have contacted news organizations to correct misinformation, especially factual errors.

COPA Call to Action

After reading this special safety issue of *Cirrus Pilot*, what can you do?

- **First, commit yourself to safe flying.**
  Recall that your pilot certificate is a license to learn, so keep learning!

- **Review the COPA Code of Conduct.**
  On long commercial flights, read a section and think about how that applies to your love of flying.

- **Attend a CPPP (Cirrus Pilot Proficiency Program).**
  The ground sessions address safety issues, including sections on Cirrus accident history, emergency procedures, weather, survival, and single pilot resource management.

- **Attend a Critical Decision Making (CDM) seminar.**
  Bring a friend, especially someone who flies with you often. Explore your own decisions and personal minimums for flying safely. Talk with others about how they handle different situations.

- **Enroll new Cirrus pilots in COPA.**
  Expand the choir that sings about safe flying. Participation in COPA correlates with a significantly lower risk of fatal accidents. Point that out to reluctant Cirrus pilots. If you get beyond their personal objections and find something about COPA that we should change to get them to participate, let us know.

- **Take a stand for safe practices.**
  When you do something unsafe, or at least more risky than you wanted, discuss it with an instructor to learn how to avoid it in the future. If you see another Cirrus pilot doing something unsafe, ask them about it, not to judge, but to inquire about how it came to happen. Offer support and COPA resources to help them fly more safely.