

SAFER FINISHES

By John Cochrane

A study of the history of final glide accidents leads to some thoughts on how problems develop and how to make final glides and finishes safer.

As part of a study of contest safety, I looked up all the crashes at U.S. soaring contests in the National Transportation Safety Board database. I was quite surprised at the number that took place at and near the home airport, involving the last portions of the final glide, finish, and landing. We all know that midair collisions and off-field landings pose dangers, but we usually heave a sigh of relief when the home airport comes into view.

Table 1 summarizes these accidents. This is surely an undercount, as many accidents don't make it to the NTSB's files. Still, it's enough to help us think about the safety issues in this phase of flying.

One pattern is clear: a good half of the accidents ended in a stall/spin. The root cause of stall/spin accidents isn't "improper manipulation of the controls" – they happen when the pilot's attention is overloaded, and usually follow a 10-15 minute period in which one thing after another goes wrong. Many of the remaining accidents also tell this story: a white-knuckle final glide, then quick decisions over how to handle the finish, pattern and landing, plus other distractions such as traffic in the air and on the ground or small mechanical problems.

Off-field landing crashes typically start when the pilot deviates to an airport or a field as the lift dies, finds "unexpected" sink, has to pick a new field quickly at low altitude, has to adjust for trees or wires, etc. He is overloaded and distracted from flying mechanics.

We have all encountered these high-stress, attention-overload situations. Usually, the pilots' skill, training and quick thinking combine to save the day. Alas, these qualities are not perfect. We all pride ourselves in our ability to handle tough situations, but any pilot can reach a point at which his attention is so overloaded that mistakes are easy to make. It takes only a *small chance* of making a mistake to produce the accidents we see.

The Critical Zone

To understand these accidents, we have to understand how pilots get to the high-stress situation in the first place. There is an underappreciated "coffin corner" on final glides: a sequence of little decisions, each apparently sensible, that sets up a crash.

Figure 1 shows three glide slopes to the finish. At the top is a MacCready 3 glide with a 300 ft margin. The slope is about 30:1 in a Standard Class glider, and has you flying 80 knots dry or 90 knots wet – it's pretty conservative. The bottom slope is a MacCready zero glide with no reserve. It's 40:1; you're flying 55 knots dry and hoping for the best. Notice how close euphoria is to desperation, and how they converge as you get close to the airport.

Follow the solid line, and think "when would I stop and commit to landing out?" Start five miles out, at the "critical zone" for final glide decisions. The GPS reports a hundred feet or so over MacCready zero – "you can get back." In a competition, you'll lose 400 points if you stop and land – the whole contest is on the line. All those stories will ring in your head: "Well, it was a squeaker, but, heh, heh, we popped over the fence and rolled in for the win." Outside a contest, it's the difference between looking like a hero who got home and a chump who needs a retrieve. Even if you are one of the few pilots who will stop and land out with 100 feet still showing over a MacCready zero glide, admit that you will be sorely tempted – and that less cautious pilots will zoom on by.

The critical zone is the last opportunity to do a proper off-field landing or to look for thermals with any chance of success. After this point, you're committed to trying for the airport, and accepting a last-minute landing or a low-energy finish if it doesn't work out.

Why a "last-minute" landing? In a proper off-field landing out on course, you divert towards fields, stopping around 1,000' to look down at them while looking for a ther-

mal, so you can check for crops, slopes, ditches, wires, fences, obstructions, alternates, etc. None of this can happen past the critical zone. You'll be making a beeline for the airport, saving every foot. All your field selection and evaluation will be done from less than 300 feet, after a straight glide – if you had 400 feet two miles out, you'd be blasting for the finish, not landing.

A last-minute landing or a low-energy finish does not guarantee a crash. If you are prepared – if you know the fields around the airport well enough to safely glide straight into them at 40:1, if your skill and experience level are high enough to fly accurately while thinking really fast – you can make a safe last-minute landing. A close look at contest score sheets reveals that our final glide experts do this once every few years, and they pull it off. It's still a very high-stress experience! With preparation and skill, showing up at the airport with low energy is also only a difficult moment. Several of the crashes seem to stem from indecision whether to attempt a flying finish or to roll the finish; preparing ahead of time for that decision would seem to help.

The critical zone is only a few hundred feet high. Most of the time at 5 miles out you have a comfortable, several-hundred-foot margin and you're barreling along. Occasionally, heavy sink has put you well under MacCready zero: it's clear you won't make it, so you stop and do a proper landing. Only rarely will you enter the critical zone that leads to the hard decisions. Few pilots have much experience of this situation. That, and the fact that most of the time pilots do handle the high-stress decisions, keeps the crashes thankfully rare. Still, assembly failures and midairs are rare too, yet we worry about them.

The accuracy of GPS may contribute to the problem. In the good old days, a pilot 50 feet over MacCready zero had a lot less confidence in the calculation and might have given up much sooner. Knowing that you have

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exactly 50 feet extra adds to the temptation to keep going.

You can't completely protect yourself by saying "I'll just do cautious final glides." My own 2-mile-out landing (into a well-scouted field, I'm proud to report) resulted from a glide that started 1,500' over MacCready 3, as illustrated by the dashed line. It can happen, and, eventually, it will. Once you arrive at the critical zone, by whatever means, you face a tough decision, and once past it you are committed. Better be prepared!

The High Finish

During a soaring contest, the temptation to keep going from the critical zone is entirely a creation of the rules. What's ringing through the pilot's head is the chance to stretch in to the airport and do a rolling finish for speed points. The following rules changes could essentially eliminate these crashes during contests:

1. A substantial minimum finish altitude (at least 500 ft; 800-1000 ft would be better).
2. Rolling finishes get distance points only.

Look at Figure 2 and think about the decisions you would make under these new rules. Above the MacCready 3 line, you push the nose down and blast home. Between MacCready 3 and MacCready zero, you "enjoy" most of the white-knuckle stress of a marginal final glide. If you don't make the minimum finish altitude, it's scored like a landout, but you actually have a safe landing at the home field.

Below the MacCready zero line, you won't be able to glide in for speed points, so you stop and deviate to good fields and thermals. If you can't climb, a safe landing into a good field costs you very few points compared to stretching your glide to the airfield, so there's

no reason to risk a close-in crash. The critical zone is gone – it's just like being at 1,000' on course. You don't fly straight into the ground for 5 more miles of distance points on course, and there's no reason to do it here.

The *race* is exactly the same as under current rules – it's just higher up. You and the 20 others that finished with you sequence in to a regular pattern and landing with time and altitude to spare. If you blew your final glide, you land at home with a decent margin rather than doing a last-minute landing a few miles out.

Objections

You can see how the high finish eliminates the last-minute landings and low-energy finishes. Let me anticipate some of the objections.

"But we'll miss the fun and spectator appeal of low finishes."

Low finishes *are* fun. Sure, they're a high-skill maneuver – witness the two fatalities in 2001, and the rash of gear-up landings and other mishaps, even by skilled pilots, at contests – but most pilots feel *they're* not going to mess up; why ruin the fun?

A simple modification can preserve the traditional low pass. I call it the *altitude check*. Pass 1000 feet 2 miles out, then finish as usual over the airport. If you don't make the 1000' hurdle, you get distance points only. Figure 3 illustrates the idea.

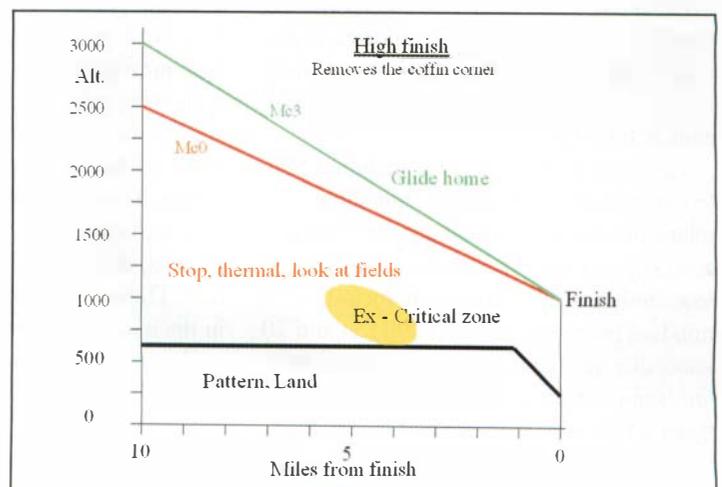
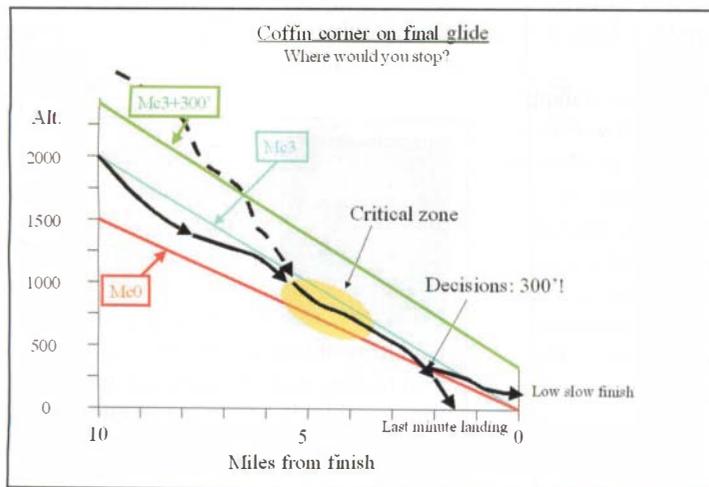
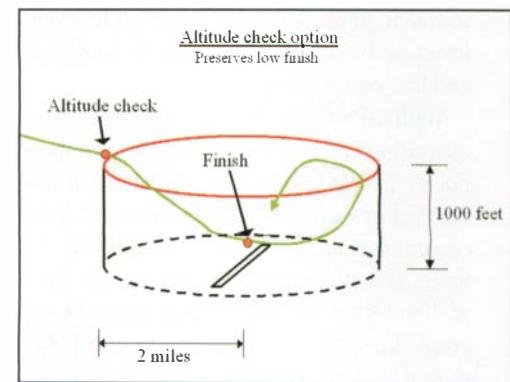
Preserving the low pass has its disadvantage too – note how many crashes happen after the finish. The standard aircraft pattern is gone, with the time it gives for traffic sequencing, dealing with problems, doing checklists and so on. Still, having passed the altitude check, pilots will do their low pass with a lot of energy, so many of the problems will disappear.

This is a good compromise, especially for experienced pilots. You might miss the low *finishes*, and this option keeps them. Will you really miss low (over the ground) *final glides*? Will you really miss heart-stopping decisions whether to land in the last field or press on at 300 feet over the ground? Wouldn't you really prefer it if everyone had to finish the race at 1000 feet, and nobody could beat you by daring to fly lower? If so, then this option is for you.

"It's unfair not to give speed points for rolling finishes"

Imagine the poor pilot who does a rolling finish. He's "made the task." Why can't he get speed points? It seems a far too harsh penalty.

It's critical to the success of the idea that rolling finishes do *not* get speed points. Put yourself in the mind of a pilot at the critical point, 5 miles out and 800 feet with the GPS showing 50 – 100 feet over MacCready zero. If a rolling finish is an option, will you do a proper pattern and land out, losing 400 points? Will you deviate to good fields or lift, raising the chance of not making it back? Will you work a ratty thermal for 10 minutes to gain a decent safety margin? Probably not. If a rolling finish for speed points is an



Serious accidents after finishing at the home airport

1986	Uvalde	ASW-20	Serious	Stall/spin. 50 foot 85 kt finish
1986	Uvalde	LS-6	Substantial	Relight, lands short. Traffic distraction
1990	Cal. City	Nimbus 2	Fatal	Slow finish, stall-spin
1991	Hinckley	Kestrel 19	Serious	Collision on final. 1 above/behind
1991	Hinckley	Pegasus	Serious	Despite radio contact.
1994	Littlefield	SGS 1-26	Serious	Stall spin after low slow finish
1995	Newcastle	Discus	Destroyed	Lands short. High wind, rotor
2000	Sugarbush	Ventus 2 CM	Serious	Stall spin on base to final after finish
2001	Montague	Nimbus 3	Injury	Cartwheel, landing in strong x wind
2001	Uvalde	SZD-55	Fatal	Stall spin after low finish (rest day)
2001	Wurtsburo	Discus CS	Fatal	Stall spin after low finish (not at contest)

Accidents near the home airport

1993	Ionia	ASW-20	Substantial	Landed short on final glide.
1994	Ionia	ASW-20	Substantial	1 mile out. Did not get back off tow.
1995	Uvalde	ASW-24	Destroyed	A few miles N of airport on final glide.
1997	Minden	ASW-20	Serious	8 miles out. Sink, wind, "too much altitude to land straight, not enough for pattern."
1997	Hobbs	Ventus 2	Fatal	2-3 miles out. Seen circling. Passed field upwind, turned downwind, stall/spin.

Table 1. Accidents at and near the home airport. "Serious" or "Fatal" describes pilot injury; "Substantial" or "Destroyed" describes glider damage when there is no injury

option, pushing on is a nearly irresistible temptation.

Why is it fair now that you can't get speed points for landing two feet shy of the fence? We've all blown final glides. It seems a large penalty for a little bad luck. I think everyone understands why we do this. If it didn't cost so much, pilots would start their glides even lower, and we'd have more close-in landouts and low-energy finishes.

With GPS flight recorders, we can end the race anywhere we want to. We can give speed points for any landout. We can let any landout within 5 miles of the airport count. We can put the line at the top of the airport fence, as we do now. Or we can put the finish line higher up. Decide what kind of race you'd like to fly, what temptations you'd like to face and resist.

Of course, under these new rules tasks should be called about 5 miles shorter: if you could "just do" a 250-mile task with a rolling finish, you can "just do" a 245-mile task that ends at 1000 feet.

The 2002 Sports Class rules include a 500 foot minimum finish altitude, but allow rolling finishes with a small penalty. This is a good step in the right direction. The 500 foot minimum flying finish will focus the minds of pilots who arrive at 200 feet and 70 knots that they should commit to a rolling finish and not attempt (and stall out of) a flying finish. Still, it doesn't address the pilot 5 miles out in the critical zone. He will still be irresistibly tempted to press on for the

rolling finish and speed points.

Details: If you're worried about pilots blasting at redline and then zooming over the altitude check, make them stay above 1000' for, say, a mile before the finish or altitude check. To minimize instrument problems, the rule should take the most favorable of pressure altitude at start and pressure altitude at finish as the ground altitude. As with the start gate height, the rule should just give a penalty for being slightly (less than 100 feet) low.

"Only a Bozo would do that. Can't we rely on pilot judgment?"

Clem Bowman's accident changed a lot of minds. Until Clem's accident, many pilots dismissed assembly failures as the sort of thing that only happens to lesser mortals. But Clem was a better, more experienced pilot than almost all of us. If he could do it, any of us could. We changed rules and procedures. Now we do a Critical Assembly Check and sign our wing tape.

Blowing a last-minute landing or stalling and spinning in a fast, confused, low-energy finish are much easier to do than an assembly failure. It's not just Bozos who crash. And even if the top pilots are immune, not every pilot has the skill and experience of the winners. The contest has to be safe for the pilots in the middle and bottom of the scoresheet.

Of course in the end, we (and the FARs) do ultimately rely on pilot judgment, and we can't and shouldn't try to legislate safety. We do, however, structure our contest rules so that there are fewer temptations to succeed

by sacrificing safety. We don't start all gliders at once, we don't do distance tasks, we give an airport landing bonus, we don't give speed points for landouts, we check weight rather than leave it to pilots' judgment, and we ban cloud-flying instruments. These well-established rules have a much greater effect on the race than would the high finish. A high finish isn't a new concept, it's just another little safety choice like these long-accepted rules.

We can stress the dangers of low finishes, stall-spins and close-in landings in safety talks. We do, and we will. But the safety talk, mentoring and education programs in American contest soaring are already excellent. They are a real credit to those that organize contest soaring, and have helped keep the accident rate as low as it is. They have been especially successful in reducing accidents that do not involve any competitive temptation, such as dehydration, assembly errors, and premature termination of tow crashes. Alas, since they are already so good, they are unlikely to reduce this kind of accident dramatically. If we do nothing new, the next 20 years are likely to produce another Table 1. Like seatbelts and airbags in cars, safer rules and procedures throughout contest soaring can complement pilot education and judgment to really reduce the accident rate.

In the last 20 years, the NTSB reports 9 contest fatalities (plus two more in rest and practice days) and 15 serious injuries. Per pilot, that's not a lot more than in soaring overall, which is reassuring — contest soaring is not particularly dangerous. But, alas, soaring in general is not particularly safe. I think we all would like it if the numbers were lower. If contests were statistically safer, they might attract more pilots. Only about 1 in 30 SSA members has ever flown a contest. And it sure would be a lot easier to get out the door if I could honestly tell my patient wife, "Honey, there hasn't been a fatal crash at a U.S. contest in the last 20 years."



About the author:
John Cochrane started flying in 1972 at Windy City in Chicago, and soloed at 14. In "real" life, he teaches at the University of Chicago. He lives in Chicago with his very understanding wife Elizabeth Fama and children Sally, Eric, Gene and Lydia, who love to go out for a glider ride.