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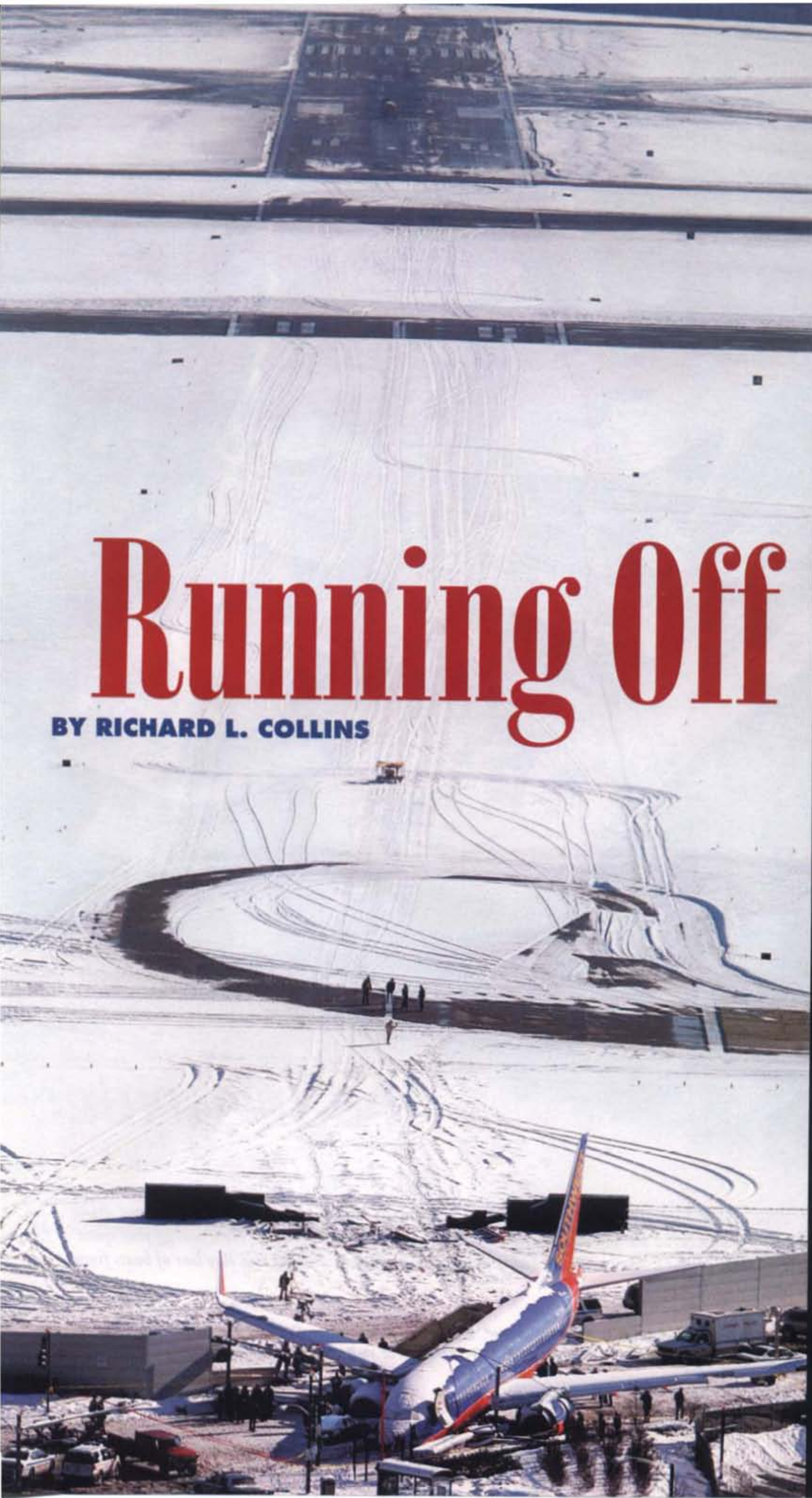
Running Off the

BY RICHARD L. COLLINS



PHOTOGRAPH: CHARLES REX ARBOGAST / ASSOCIATED PRESS

Whoaaaaa ...
Analysis of Runway Overrun Accidents

End

Whenever there is an accident, pilots should get into that old "learning from events" mode. The recent 737 runway overrun at Chicago Midway created a lot of food for thought.

In a preliminary NTSB report, it was noted that the dispatchers and the crew had calculated that Runway 31C at Midway was okay for landing even though it was snow covered and there was a downwind component of almost 10 knots before the airplane landed.

After the accident, the NTSB disagreed with their calculations, showing that the airplane would definitely go off the end, given the conditions and the touchdown point, which was with 4,500 feet of runway remaining. The runway is 6,522 feet long with 5,826 available for landing because of a displaced threshold. Further, if the glideslope is followed to the runway there is but 4,925 feet available for stopping. Where the media led the public to believe that the crew gave away 2,000 feet of the runway, that was, as are so many things in the media, incorrect. It was a fairly normal touchdown point.

One other runway length item of note is that air carriers are only allowed to calculate the use of 60 percent of the available runway for landing. So, on this approach to minimums, with a snow-covered runway and a tailwind, they would presumably have had to calculate the ability to fly the glideslope, land, and stop in 2,955 feet.

In the NTSB report it was noted that had Runway 13C been used, in the other direction, with a little headwind instead of a little tailwind, the landing might have been successful. The controllers were using 31C because it has slightly lower runway visual-range landing minimums, and they felt airplanes would be more successful approaching that runway because the runway visual range was higher than on 13C.

Finally, in relation to the runway, the mindless folks who always come up with something like this after an accident said the runway was too short and didn't have adequate overrun. A runway is an inanimate object that has known quantities, like length. It is what it is. The runway at Midway has been deemed adequate for 737 operations for a long time and nothing has changed. To suggest that the runway or the airport had anything to do with an accident is to show complete ignorance on the subject. It is also an insult to the airlines and the pilots who operate there routinely, day after day.

Here we come to the first lesson. It's important for GA pilots because in the 10-day period in which the 737 went off the end, six general aviation airplanes did the same thing. Project that out to a year and we would have about 214 general aviation airplanes a year running out of runway before they stop. In many cases the airplanes are not damaged enough to become an NTSB accident so only the daily FAA reports have meaningful information on this.

Ten knots is the downwind component limit for most airplanes. Land in a 10-knot downwind and you'll see why it is a limit. Nothing feels right and if the component is a quartering tailwind the airplane can be squirrelly.

Another important thing is that a 10-knot tailwind at the surface can be effectively greater than 10 knots unless the pilot understands the effects of changing wind with altitude and has a plan to deal with that.

Let's say the wind at 1,000 feet is 20 knots, not unusual when it is 10 at the surface. In this case, if the airspeed is bang on VREF while descending through 1,000 feet, that means the groundspeed is VREF plus 20 and the pilot has to deal with all 20 knots for the landing to be precise and within acceptable parameters. Ten of the 20 have to come off as the airplane descends and the other 10 is dealt with in the stopping process. Presumably the autothrottles system on a modern jet would handle this.

This makes our GPS a key to managing such a situation. GPS gives up-to-the-minute groundspeed and that is what counts. If descending for an approach in a stratified wind condition, the GPS will give a heads up on the wind change to anticipate. If the groundspeed is 20 higher than the indicated airspeed going through 1,000 feet, that's a clear message that you are going to have to work a little harder to keep from arriving at the threshold with too much airspeed.

In a condition like this, at what altitude is the change in wind velocity likely to occur? Certainly within 1,000 feet of the ground and probably gradually. The wind change should be complete by the time the airplane is 200 to 300 feet high. Wind changes in descents are often accompanied by light jiggles in the atmosphere because while not severe, such a condition is wind shear.

Another lesson is in runway length versus technique. In piston airplanes we seldom fly ILS approaches to runways that, for our airplanes, would be considered "short." However, a tailwind and a slick runway can make what seems to be a long runway a lot shorter.

Let's do the numbers. If we follow airline rules, never a bad idea, the calculated landing length must result in a full stop within 60 percent of the available runway.

Using my P210 as an example, at 20°C the distance shown for coming over the end of the runway at 50 feet, landing, and stopping, is 1,930 feet. That is using short field procedures, which we seldom do on an ILS.

So, we have to start adding required runway length for other factors. For a tailwind, the drill in the pilot's operating handbook is to increase the landing length by 10 percent for each 2.5 knots tailwind, up to a maximum of the 10 allowable knots of tailwind. That's 40 percent for the tailwind. Next, add 10 percent for each 2.5 knots over the 72-knot speed used for the POH short field calculations. If the speed over the threshold is 80, as it would probably be, that's another 30 percent. There is no number given for runway contamination but 40 percent is the addition for a dry grass runway. If you add those percentages cumulatively, that's 110 percent for a total of 4,053 feet. That means, using the air carrier 60 percent rule, the runway would have to be almost 7,000 feet long. Of course we don't have to use the 60 percent rule.

Before you scoff at needing over 4,000 feet as a minimum to land and stop a 210, remember how many GA airplanes go off the ends of runways every year. I actually recall a P210 that slid off the end of a slick runway of about that length after a normal approach and landing. I did a query of the NTSB database and it's not there, so a lot of these events don't make recorded history. The point is that if there is any question, run the numbers.

I was talking with an airline pilot and he said pilots on his line with Midway experience would always approach that runway one dot low on the glideslope and go for an early and firm touchdown instead of looking for style points on the landing. Some would suggest this is illegal because of a FAR that requires turbine airplanes to stay on the VASI or glideslope, but the rule says that it is applicable only as far in as the middle marker (of which there are not a lot left). On a VASI, the rule says you must stay on or above the visual glideslope until a lower altitude is necessary for a safe landing.

With the visibility reduced to minimums in snow, which is hard to see through, I don't think anyone would suggest that going below the glideslope is a very good idea, though with a displaced threshold there would be some margin.

Any airplane will float if extra speed is carried into ground effect on landing. Some float more than others. The shorter the landing gear and the closer the wing is to the ground, the more likely the airplane is to float. Mooneys float but in a five-year period I couldn't find a single Mooney 201 that had been damaged enough in an overrun accident to rate an NTSB report. Citation 500s also float if the approach speed isn't right-on and they have had more than their share of overrun accidents.

There is a lesson to be learned from two Citation accidents. On one, the pilot was flying an ILS approach. VREF was calculated to be 110 knots but the airspeed on final was reported as 130-140 knots by the crew. The airplane was also high. It landed well down the runway and went off the end, through the localizer antenna, and to the edge of a trailer park. One person was seriously injured and two had minor injuries.

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On the other Citation accident in question the crew approached an ice-and slush-covered runway with a 10-knot tailwind. They landed, didn't like what they saw, and attempted a go-around. There wasn't sufficient runway remaining, the airplane went off the end with quite a bit of speed, crashed, and five people died.

The moral there is that it is far better to go off the end while trying to stop than to do so while accelerating and trying to fly. In every airline overrun accident I can recall, there hasn't been an attempt to salvage things by going around. The pilots have, always correctly, stuck with their decision to land and accepted the trip off the end. That might end a career but usually not a life.

A lot of us now have ground prox systems that tell us when we are 500 feet above the ground. In a light airplane this means you are about one minute from a landing. In a jet it would be more like 30 seconds.

Whatever, when we are 500 feet above the ground that is a good time to examine all factors and make the decision that it is okay to continue and to land. Altitude, airspeed, groundspeed, sink rate, aircraft configuration, wind, and the runway all have to be considered and this is a good time for a final check that everything is okay. If the decision is to go around, it's not a difficult thing to do when starting from 500-feet high.

There is an airplane-specific consideration related to this subject. Brakes and braking are important elements because with no brakes or no braking action an airplane almost seems to accelerate after you land.

So, add something else to that 500-foot check. Test the brakes for resistance. If one brake pedal goes to the floor it is better to know it before than after landing. If there is a brake problem then the longest runway within safe fuel range would be the best bet.

Once down, some pilots like to use aerodynamic braking by holding the elevator control full aft to maximize the drag and thus slow the airplane. This is not a good thing to do in all airplanes if the need is to stop as soon as possible.

On some airplanes, this will keep the airplane light on the wheels and compromise the effectiveness of the brakes. On others it won't. Better know what works best on each airplane that you fly.

Braking will usually be more effective if the flaps are retracted and, on some airplanes, holding the elevator control aft will help as well after the flaps are retracted. However, a lot of us don't like the idea of retracting the flaps while still on the runway, because a lot of pilots every year mistake the gear switch for the flaps switch if they don't wait until after the airplane is clear of the runway and there's time to double-check. The gear on a lot of retractables will come up on the ground when this is done. Then, runway length ceases to be a consideration.

Jets have anti-skid brakes just like cars do. The tires won't skid because when the system senses this it momentarily releases the brakes. On most of the airplanes that we fly the pilot has to be the anti-skid system and release the brakes when the tires start to slide. There's no way to be quick enough to avoid flat-spotting a tire, especially on a wet runway. In the worst case, a tire might blow. When that happens, the brakes become ineffective and a trip off the end of the runway might become inevitable.

Of all the things we deal with on a runway, snow and ice and too much height and/or groundspeed are the main ones that might lead to a trip past the numbers. So, get it right and be kind to localizer antennae and fences.