

# Miracle Ingredients

**Flight 1549 was a triumph of decision making and piloting skill.**

## Extraordinary Concentration

### **Fly by Wire: The Geese, the Glide, the Miracle on the Hudson**

Langewiesche, William. New York: Farrar, Straus and Giroux, 2009. 208 pp.

If there is such a thing as a feel-good accident, US Airways Flight 1549 was it. On Jan. 15, 2009, at 3,000 ft after takeoff from New York LaGuardia, the Airbus A320 and a flock of Canada geese tried to occupy the same space at the same time. Geese were ingested into the engines, which lost almost all thrust. Chesley “Sully” Sullenberger, the captain, and Jeffrey Skiles, the first officer, glided the airliner to a landing in the Hudson River. All passengers and crew evacuated the floating A320 and were rescued; the aircraft was destroyed.

It was a great story with a happy ending, and the news media ate it up. Sullenberger was proclaimed a hero — most of the non-pilot public does not think about first officers or crew resource management — and indeed, the maneuver was a tribute to pilot skill and training, along with built-in layers of protection in modern passenger aircraft.

Langewiesche is not a revisionist; he gives full credit to the flight crew and praises the LaGuardia controller who worked with them during the flight that lasted five minutes from takeoff to touchdown. Nevertheless, his book

takes a somewhat skeptical view of the “miracle” angle in popular culture, and examines the accident’s facts and background. Along the way, he writes of the problem of wildlife strikes, the aerodynamics of gliding, pilot abilities, psychology and mental states during stressful moments, accident investigation, the political clashes of pilot unions following airline mergers, the state of the airline industry, and the differing design philosophies of Boeing and Airbus.

While the accident is described in detail based on information in the public record, *Fly by Wire* presents the big picture subjectively. A 10,000-flight-hour private pilot, Langewiesche offers his own opinions about many aspects of the accident and the airline industry.

The writing style is geared to the general public, but aviation professionals will also find it interesting. Langewiesche’s writing is deft and somewhat informal. It is at times ironic, humorous and colorful — this reviewer has never before encountered a book about an accident whose text includes four-letter words, apart from directly quoting speech.

Langewiesche writes that Sullenberger “was capable of intense mental focus and exceptional self-control. Normally these traits do not much matter for airline pilots, because teamwork and cockpit routines serve well enough. But they



had emerged in full force during the glide to the Hudson, during which Sullenberger had ruthlessly shed distractions, including his own fear of death. He had pared down his task to making the right decision about where to land, and had followed through with a high-stakes flying job. His performance was a work of extraordinary concentration, which the public misread as coolness under fire. Some soldiers will recognize the distinction.”

Sullenberger was willing, following the accident, to accept all kinds of awards, privileges and offers, including one for his autobiography, which has since been published. But it was not egotism that prompted him, Langewiesche believes.

“After decades of enduring the insults of an airline career — the bankruptcies, the cutbacks, the union strife, a 40 percent reduction in salary, the destruction of his retirement pension — he was determined to leverage this unexpected opportunity to maximum advantage,” the book says. “He was due to retire in seven years, at age 65. Now he was suddenly on a ride as critical to his family as the glide to the river had been . . .” Married, with two teenage daughters heading for college, Sullenberger focused on practical goals.

“The first was financial stability,” Langewiesche says. “He was forthright about it from the start, when he announced through the press that he would consider all offers and possibilities. He was going to gain from this event, and why not? The second goal was slightly less obvious. It was to promote a union argument, couched as usual in the language of safety, that holds that if pilots are not better paid, airline travel may become increasingly unsafe. . . . His message was that successive generations of pilots willing to work for lower wages might perform less well in flight, and especially during emergencies.”

Langewiesche doesn't buy the argument. He says, “It is a questionable assertion, since it links financial incentive to individual competence, and ignores the fact that, with exceptions, the ‘best and brightest’ have never chosen to become airline pilots, at whatever salary, because

of the terrible . . . monotony of the job. Furthermore, although unusual stupidity is often fatal in flying, the correlation between superior intelligence and safety is unproven, given the other factors that intrude — especially arrogance, boredom and passive rebellions of all kinds. If you had to pick the most desirable trait for airline pilots, it would probably be placidity.”

Langewiesche does not make light of the accident, but he is prone to irreverence about certain aspects of the flying experience. The chapter on bird strikes is one example. This may be the first-ever account of a bird strike accident that pauses for a moment to consider it from the birds' point of view.

“Much about these particular geese will never be known — for instance, where they had come from that day, and where they were headed, and why — but it is likely that they were well-fed and self-satisfied,” he says. “Evidently they were also fairly dumb. Their stupidity cannot be held against them, since they were just birds, after all, but geese are said to be adaptive creatures, and it is hard not to think that they should have had better sense than to go blithely wandering through New York City's skies. New York is a busy place, and January 15 was a typical day there, propelled by all those schedules to keep. Was that so difficult to understand?”

In the case of New York's Canada geese, human intervention was to no one's benefit. The geese were once welcomed features of the natural environment. But “in the early 1960s, however, the situation began to change after state wildlife agencies came up with a bioengineering scheme whose purpose in part was to enhance state revenues by stimulating the purchase of bird-hunting licenses. The agencies captured breeding pairs of an endangered but supersize species known as the giant Canada goose and, by clipping their wings, forced them to settle permanently into authorized nesting grounds along the Eastern Seaboard and elsewhere in the United States. The offspring of the clipped-wing geese imprinted to the new locations and, having lost the collective memory of

**This may be the first-ever account of a bird strike accident that pauses for a moment to consider it from the birds' point of view.**

**'The cabin turned eerily silent. An engine slowly clanked. The cabin filled with a trace of smoke, accompanied by a burning smell.'**

migration, became full-time resident populations — endowed, however, with the urge and ability to fly.”

Presently, thanks to banning of pesticides harmful to birds, environmental protection laws and the conversion of former farmlands, “the newly non-migratory giant Canada geese settled comfortably into a paradise with few predators, where hunting was frowned upon, where food was abundant and where there were plenty of golf courses, corporate lawns and preserved wetlands to dominate.” Langewiesche says their U.S. population grew from about 200,000 in 1970 to 4 million today.

The description of the accident — which is interrupted by chapters about its causal factors — offers few surprises but is thorough and detailed. We learn, for example, that Sullenberger was carrying in his flight bag a library book, *Just Culture: Balancing Safety and Accountability* (ASW, 4/08, p. 53).

Langewiesche’s narrative of the accident captures the drama:

“In the cabin, the veteran flight attendant Doreen Welsh was sitting in the aft galley strapped into a forward-facing jump set with a view up the aisle toward the front. The other two flight attendants, Donna Dent and Sheila Dail, were sitting side by side just behind the cockpit, facing aft. They felt the thumps and heard the engines wind down. Dail whispered, ‘What was that?’ Dent answered, ‘Probably a bird strike.’ The cabin turned eerily silent. An engine slowly clanked. The cabin filled with a trace of smoke, accompanied by a burning smell. ...

“Passengers behind the wing saw large flames trailing from the left engine, and concluded that the engine was on fire. It was not. Unburned fuel was passing through the crippled combustion chamber and torching harmlessly in the slipstream. ...

“Skiles still had the controls at that time [about 15 seconds after the strike]. Sullenberger urgently tried to restore thrust to the engines. They were still turning, but at very low speed. It was possible that they had simply flamed out, and that with the standard engine-start igniters

he could relight the fires. He said, ‘Ignition start’ and rotated a knob one click to that position. The igniters began to click, but the engines failed to respond. They simply were not meant to swallow geese and survive.”

The full account of the glide and ditching is engagingly written, with enough carefully rendered detail to maintain interest, even suspense, but not so much as to bog down in minutia. From a literary standpoint, this will probably remain the best book about Flight 1549. That applies to the digressions as well — for example, an explanation of how engines are tested for bird strikes by a cannon firing bird carcasses of different weights into spinning engines: “The cannons are known variously as chicken guns, turkey guns or rooster boosters. The tests are filmed with high-speed cameras and can be viewed on the Internet in slow-motion videos, some set to music. In real time, the birds pass almost instantaneously through the test engines. They go in whole and come out as spray.”

*Fly by Wire* contains a good deal of editorializing, especially about the modern Airbus design philosophy, which features sidestick controls and automation designed to override pilot control before a control input would result in a stall, a dangerous attitude or control surfaces working at cross-purposes. Boeing fly-by-wire models, the 777 and 787, do not include this feature.

Langewiesche describes the flight-envelope protection in the Airbus with striking imagery and wit. In wings-level flight, “if you slam the sidestick fully back, the airplane will pitch up rapidly, but ... will impose no greater gravity load than the maximum safe 2.5 g. You can be as rough as you want, and you won’t shed your wings or tail. During this maneuver, with the stick held fully back, the airplane will not go vertical and into a loop as any conventional airplane would, but will freeze its attitude at 30 degrees up and refuse to pitch any higher.

“Then, if you reverse yourself and push the stick fully forward, the nose will pitch down at a rate that will cause the airplane to pass through 0 g (weightlessness), but not exceed the negative flight load limit of minus 1.0 g. Incidentally, at

minus 1.0 g, the passengers could walk around on the cabin ceiling, upside down in relation to the earth, but feeling normal. This might be amusing to them if they were in the right frame of mind.”

Langewiesche knows, of course, that airline pilots flying any manufacturer’s product are expected to be fully aware of the safe limits to control inputs, and that they have cockpit displays and warning systems to alert them to anomalies. His main argument for the Airbus control concept is that even qualified, very experienced pilots can lose situational awareness — rarely, but it happens, particularly in emergencies.

To illustrate his thesis, he includes an account of the American Airlines Boeing 757 crash near Cali, Colombia, on Dec. 20, 1995. The approach turned into a tragedy of errors. After noting that “the two pilots in the front that night were both former Air Force fighter pilots, each with more than 2,000 hours of experience in this type,” and admitting that by all reasonable standards they were fully qualified, he says after quoting their cockpit conversation:

“To err is human, but to persist is diabolical. Maybe it should be posted in polling stations. Certainly it should be posted in cockpits. The captain was having a hard time with it that night. He never admitted that he had screwed up. He never even admitted that he and the copilot together had screwed up. Instead he said that they had gotten screwed up, as if it had been done to them by outside forces — presumably some mysterious equipment failure.

“The distinction may seem like a semantic quibble, but it fits into larger patterns at play that night and helps to explain the ongoing and maddening descent. Even now the captain did not fully accept what the navigational instruments showed — that they had overshot the entry gate, that they had proceeded into uncharted territory far to the east of the final approach course and that after all these years spent flying airplanes, this time his mental map was wrong.”

Langewiesche believes that the last-minute attempt to pull up as a mountain ridge loomed

ahead might have succeeded had the speed brakes, which were still selected, been retracted when the climb was commanded. “Had [the pilots] been in a fly-by-wire design, it seems likely that everyone would have survived,”

Langewiesche says.

“But there is also a negative element, a paradox that pertains particularly to the Airbus and its fly-by-wire design. It is the fundamental twist in human nature that causes people to take increased risks in direct relation to feeling especially safe. Call it the Titanic Effect. If you believe that your ship is practically unsinkable, you might start charging across oceans of icebergs — and later wish that you had not. ... The danger of claiming that an airplane is unusually safe has always been that pilots will then go out of their way to prove you wrong.”

— Rick Darby

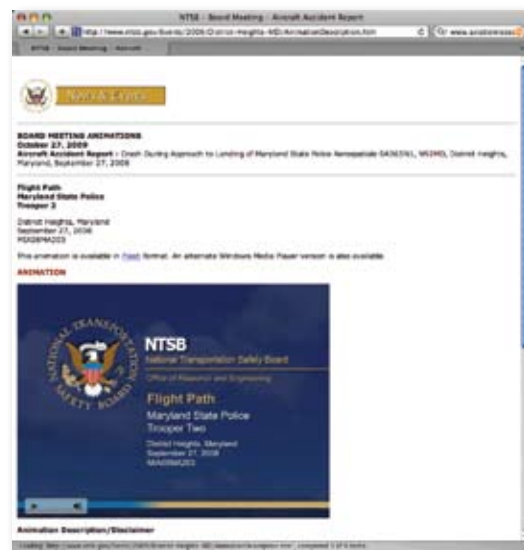
### Accident Animations

U.S. National Transportation Safety Board, Accident Animations, <[www.nts.gov/Publictn/animations.htm](http://www.nts.gov/Publictn/animations.htm)>

The U.S. National Transportation Safety Board (NTSB), an independent agency, is tasked with investigating accidents in civil aviation and other modes of transportation.

One resource that may not be well known is the “accident animations” section of its Web site. The NTSB has reconstructed sequences of events from significant accidents that occurred during 2004–2010 using combinations of animated flight paths, videos, transcriptions of air traffic control communications and cockpit voice recorders (CVRs), narrator voice-overs, photographs and more.

For example, the last two minutes of the Colgan Air Flight 3407 crash during approach to



Buffalo, New York, U.S., on Feb. 12, 2009, is reconstructed in three-dimensional (3-D) animation. The NTSB says, “The upper portion of the animation shows a 3-D model of the airplane and the airplane’s motions during the accident sequence. In this area, selected content from the CVR transcript or other annotations are superimposed as text at the time that the event occurred. . . . The lower portion of the animation depicts instruments and indicators, which display selected FDR [flight data recorder] or calculated parameters.”

Animations and videos are available online in multiple formats. Animations may contain links to additional NTSB information on a specific accident, such as testimony, the investigation docket and board meeting presentations. All resources are free.

The NTSB’s main Web site at <www.ntsb.gov> gives public access to the agency’s cache of information by mode of transportation. Aviation resources include a searchable database of aviation accident information, special studies on transportation safety issues of national importance, aircraft accident reports, annual reviews of aircraft accident data, safety recommendations, statistics and much more.

— Patricia Setze

### Audit Results

**Argus International, <www.aviationresearch.com>**

Argus International performs “on-site safety audits for corporate flight departments, charter operators and commercial airlines,” according to its Web site.

Argus shares some of its information with the aviation community through the “Free Data” section of its Web site. Most topics require free online registration to access the information. Once registered, a researcher can download documents about safety management systems (SMS), audits and other subjects.

The “2007–2009 ARGUS SMS Audit Results” document reports on results and recommendations following 116 audits of flight departments operating under U.S. Federal Aviation Regulations Parts 91 and 135. The



cumulative report, which covers January 2007–February 2009, says, “The goal of each audit is to seek evidence of effective and efficient operations and industry best practices, including implementation of a safety management system . . . as defined by [U.S. Federal Aviation Administration Advisory Circular] 120-92. The objective of this report is to highlight those common problem areas found in SMS implementation and execution.”

This report graphically illustrates numbers of operators having deficiencies in particular areas — SMS training, operations manuals, risk assessment, safety committees and other areas. The report says, “The vast majority of the audit findings point to a deficient internal evaluation program (IEP). This program is especially important because it is designed to uncover latent process or program deficiencies within operations and maintenance focus areas before they become causal factors in an accident or incident.”

Recommendations from the audit report covering January 2007–March 2008 are also available online at no cost. The top three recommendations identify three areas of deficiency: IEPs; on-scene accident responder protections against blood-borne pathogens, along with personal protection equipment training and Hepatitis B inoculation; and SMS manuals. Supporting statistics and illustrations are included in the report. ➤

— Patricia Setze