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Crisis Aloft

Electronics and All, Airliners Still Run Out Of Fuel in Midair

A Chain of Errors Caused Air Canada Jet to Make Spine-Tingling Landing

Silent Crying, but No Panic

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Robert Pearson, the pilot of an Air Canada Boeing 767 jet, felt all was going well as his plane flew westward 41,000 feet over Red Lake, Ontario. "I'm going to sit here and watch the trout swimming in the lake," he jokingly told his co-pilot.

But suddenly warning lights blinked on in the cockpit, then alarm gongs sounded, and the jet's two engines both flamed out. The plane, carrying 68 passengers and crew, had run out of fuel in midair.

What followed on that flight on July 23 of last year marked one of the most harrowing half-hours in aviation history. The Boeing 767 can glide, and the captain, a former glider pilot, decided to try for Winnipeg airport, 65 miles away. Alerted by radio, air controllers cleared the skies around Winnipeg. Fire trucks were called to the runways. But the Air Canada jet was dropping too fast—it couldn't make Winnipeg.

Capt. Pearson made a sharp right turn toward Gimli, a former air-force base nearby. There were people and vehicles on one end of the Gimli runway, which was being used an an automobile race track. As the plane touched down, its nose hit the runway. Amid a shower of sparks and grinding metal, the jet slid nose-down to a safe stop, just short of the throng of people and vehicles.

Electronic Age

Even though the world's airlines have entered the age of electronic fuel gauges and have long had redundant fuel warning systems and spare tanks, airplanes are still running out of fuel. In the last few years, in fact, there has been a rash of incidents involving planes that ran out, or nearly ran out, of fuel supplies.

Some examples:

—Last year, a Republic Airlines DC-9 ran short of fuel en route from Fresno, Calif., to Phoenix, Ariz. After the jet was forced to land at Luke Air Force Base, Ariz., 25 miles from Phoenix's commercial airport, safety investigators found that just five gallons of usable fuel remained in the tanks, enough for a few minutes of flying.

—A 747 jumbo jet flown by Pan American World Airways barely made it into Newark, N.J., airport a few years ago. As the big plane touched down on the runway, two of its four engines flamed out, and on a taxiway a third died, all for lack of fuel.

—While circling near Portland, Ore., a United Airlines DC-8 ran out of fuel and crashed in 1978. Among the 186 aboard, two crew members and eight passengers were killed.

Although such accidents are relatively rare, eliminating them is difficult. That is because the causes often are complex, sometimes involving mechanical failures, sometimes human faults, and often a combination of both, safety experts say.

The Air Canada case is in many ways typical. There was a long string of both mechanical and human problems that led up to the spine-tingling landing at Gimli. Details of the case have emerged in months of hearings before a board of inquiry set up in Winnipeg by the Canadian government.

Ominous Signs

The jet involved wouldn't seem a likely candidate for the Gimli drama. It was Boeing Co.'s newly designed 767, a big, wide-body plane with two powerful engines and the most advanced electronic systems—including fuel gauges—in the world.

A Near Disaster

8:10 p.m.	First indication of low fuel pressure
8:12 p.m.	Jet turns towards Winnipeg
8:14 p.m.	Jet, at 41,000 feet, begins descending
8:18 p.m.	Left engine fails
8:21 p.m.	Right engine fails, jet at 26,000 feet begins gliding
8:31 p.m.	35 miles to Winnipeg, "we'll never make it"
8:33 p.m.	Jet turns towards Gimli
8:35 p.m.	Six miles to Gimli
8:38 p.m.	Touchdown

Months before the Air Canada accident, however, some ominous signs began appearing. After United Airlines had taken delivery and was ferrying one of its new 767s from Boeing's production plant near Seattle, the pilots noticed a problem. The fuel gauge showed an amount of fuel in the tanks different from the amount the plane's flight computer calculated should have been there.

According to Boeing, later tests showed that "an undetected fault could cause erroneous readings (in 767 fuel gauges) of 1,000 to 3,400 pounds above the actual fuel quantity." Because that posed the threat of running out of fuel in midair, Boeing quickly told airlines around the world to inspect 767 fuel-measuring systems for the fault. Honeywell Inc., which supplies the fuel-measuring system to Boeing, began redesigning it.

Meanwhile, Conrad Yaremko, an Air Canada mechanic in Edmonton, began working on aircraft No. 604 on July 5 of last year. Because it was one of Air Canada's brand-new Boeing 767s, he checked for the

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fuel-measuring system fault. Mysteriously, each of the three fuel gauges—one for each of the three fuel tanks—went blank during the test. Later, all seemed to work properly.

The night of July 22-23 saw the same big jet back in Edmonton. Mr. Yaremko was performing the same check, and again the gauges mysteriously went blank. It was a warm night, and Mr. Yaremko knew that heat is the enemy of electronic circuits. So he removed the small box of electronic gear that feeds data to the fuel gauges in the cockpit.

'In the Fridge'

Then, he said in testimony at the board of inquiry, "We put it [the electronics box] in the fridge for a little bit to see if it would cool it down." The tactic didn't work.

Eventually the gauges did begin working again, and the plane flew to Montreal—where they went blank again. As Capt. Pearson boarded the jet the afternoon of July 23 to fly it from Montreal to Ottawa and then to Edmonton, he saw all the fuel gauges were blank. This time mechanics couldn't get them to work again.

A hubbub in the cockpit area ensued. Capt. Pearson, his co-pilot, Maurice Quintal, some mechanics and a stewardess were there. According to testimony at the board of inquiry, it was decided to use dipsticks to measure the amount of fuel in the tanks.

The dipsticks were calibrated in centimeters. That measurement should have been converted to liters and then to kilograms, because the 767 is Air Canada's first plane to use the metric system and its fuel is measured in kilograms. The Air Canada men, however, didn't do that. Instead of multiplying liters by 0.8 to arrive at kilograms, they mistakenly multiplied by 1.77 and arrived at pounds—the measure used for other Air Canada planes. Then, on the basis of the erroneous calculation, they added fuel. Capt. Pearson checked the figures, not realizing they were faulty, and ordered a bit more fuel to balance the tanks in two wings.

Robert Desjardins, the chief flight attendant, was a bit nervous about the unusual fueling procedure. "We better have more than not enough," he remarked as mechanics were closing the jet's door.

"You've got more than enough. You can go all the way to Vancouver," one mechanic replied.

The flight from Montreal to Ottawa was uneventful. Then the jet took off for Edmonton—with only about half the fuel needed to reach that destination.

As the jet passed Red Lake (and Capt. Pearson joked about watching the trout), co-pilot Quintal began making an announcement to the passengers, according to the cockpit voice recording.

'Beautiful Day'

"Good evening, ladies and gentlemen, this is your first officer. We're presently coming up over Red Lake . . . cruising at 41,000 feet, the temperature in Edmonton is, beautiful day. . . ."

But 10 minutes later, at 8:10 p.m., four beeps warning of low fuel pressure sounded.

Capt. Pearson: Holy [expletive]!

Co-pilot Quintal: Something's wrong with the fuel pump. . . .

Capt. Pearson: Left-forward fuel pump, okay, what have we got here? I hope it's just the [expletive] pump failing, I'll tell you that. . . .

BEEP, BEEP, BEEP, BEEP. . . .

Capt. Pearson: Let's head for Winnipeg *Now*. . . . Hundred and twenty-eight miles (from Winnipeg), okay. . . .

Capt. Pearson had his co-pilot radio air controllers to tell them the jet had some problems and was diverting to Winnipeg. He also had his co-pilot brief Mr. Desjardins, the chief flight attendant, telling him to prepare passengers for an emergency landing. And the captain began descending from 41,000.

Then more beeps, indicating problems at more fuel pumps.

Co-pilot Quintal: [Expletive], they're all going out. . . .

Capt. Pearson: All the [warning] lights are on!

A chilling conviction settled over the cockpit. As Capt. Pearson tells it later, "Maurice and I knew that one fuel pump might fail, but to have all the pumps fail all at once, and on a brand-new airplane, that was beyond probability. We realized we had more than a pump problem, we had a fuel problem."

A few minutes later that was confirmed, a deep "bong" sounded.

Capt. Pearson: Okay, we've lost the left engine.

Co-pilot Quintal: Okay, what will we do . . .?

Capt. Pearson: Yeah, just run on one [engine], let's just run on one [to save fuel].

Co-pilot Quintal radioed Winnipeg air-control center warning the jet had lost one engine and requesting that fire trucks be called out. Three minutes later the second engine flamed out. With power gone, eight bright video tubes in the cockpit displaying most of the plane's instruments went blank. ("That cockpit became the darkest place in the world," Capt. Pearson said later.) The captain radioed Winnipeg air-control center.

Capt. Pearson: Center, (Air Canada flight) 143. This is a Mayday, and we require a vector (direction) onto the closest available runway. We are (down to) 22,000 feet (altitude) on—with both engines have failed due to, looks like fuel starvation, and we are on emergency instruments. . . . Now please give us a vector to the nearest runway."

Back in the passenger compartment, stewardesses were rushing to secure the drink trolleys. Then they briefed the 61 passengers, who had been told the plane had a fuel problem, but no more than that, on how to brace themselves. There were businessmen on board, an older couple, some teenagers and some young mothers with infants. After the briefing, all fell silent.

"Obviously there was no engine noise . . ., it was very quiet in the airplane except for a few people crying," Mr. Desjardins, the flight attendant, told the board of inquiry. "People were very afraid, and some were crying silently, but there was no panic," Anne Swift, another flight attendant, told the board.

Among the few emergency instruments functioning was the air-speed indicator. Capt. Pearson's first job was to select the right speed. Too slow, and the jet would stall and crash; too fast, and the plane would dive toward the ground. There is nothing in pilot manuals on how to handle a gliding 767. So, using the controls, the captain nosed the plane down just enough to maintain 220 knots, the speed that he guessed would provide the longest, safest glide.

(The flight controls worked only because, when the last engine had flamed out, a tiny air turbine had descended automatically from the belly of the 767. Spun by the passing air, the turbine provided power for the 767's "power steering"—hydraulics that enable the captain to operate controls such as ailerons on the wings and the rudder on the tail. All 767s have such turbines; but many other jets, including 747s and 727s, do not have them.)

Useless Compass

Capt. Pearson tried to steer for Winnipeg, but his compass heading had disappeared along with the video displays. He still had a small emergency magnetic compass on the dashboard, but it was swinging too much and was mounted too far to his side for him to find it.

"So I steered by the clouds underneath us," the captain said later in an interview. "I would ask Winnipeg center for a heading, they would say 'left to 220 degrees,' and I would turn left about that much, judging by the clouds, and then I'd ask Winnipeg how my heading was. Using the clouds, I kept eyeballing it."

The 767 had also lost its vertical-speed indicator, a measure of how fast the plane was dropping. And it was dropping much faster than Capt. Pearson thought. Co-pilot Quintal tried to calculate the rate of descent. The jet's altitude was 14,500 feet when the Winnipeg controller said his radar showed the plane 45 miles away. The jet had dropped to 9,500 feet by the time the plane was 35 miles away.

"We had dropped 5,000 feet in 10 miles," Co-pilot Quintal says. "With only about 10,000 feet of altitude left, we could glide only another 20 miles. But Winnipeg was 35 miles away—I told Bob (Pearson) that we'd never make it."

Capt. Pearson radioed Winnipeg, and the Winnipeg controller told him that Gimli was just 12 miles away, on his right. Co-pilot Quintal, who had been based at Gimli while serving in the Canadian air force, told the captain the airport had long runways. The base, which had been obscured by a cloud, was suddenly visible.

"Bob turned right towards Gimli like

"whoomph!' " co-pilot Quintal says.

The captain asked the Winnipeg controller for details on Gimli. Use the right-hand runway, 6,800 feet long, the controller replied.

Capt. Pearson: There will be nobody on the runway when we get there, eh! Nothing?

Winnipeg Controller: I don't know—I can't tell you for sure. . . .

Co-pilot Quintal saw the Gimli strip and pointed it out.

Capt. Pearson: We're going to make Gimli okay.

Winnipeg Controller: Great! We show you about six miles to touchdown.

Rare Technique

But all wasn't great. The jet was coming in too fast and too high. The captain and his co-pilot discussed circling once before landing but rejected the idea because they would lose sight of the runway while circling and because they might lose too much altitude.

To cut the jet's speed and altitude, Capt. Pearson then tried a rarely used technique, a side-slip, which he had practiced as a glider pilot. With the rudder, he turned the nose of the plane right, but with the ailerons he banked the plane to the left. The net effect was to make the plane fly toward the runway in a sideways attitude that would create drag and rapidly slow the plane.

The captain's maneuver, in which the plane seemed to plummet to the left, frightened passengers and flight attendants. "I thought he had lost control," Mr. Desjardins said. But the plane began losing altitude quickly, and speed began dropping from 210 knots to 170 knots, still much faster then normal landing speed of 130 knots.

Winnipeg Controller: Five miles to touchdown.

Capt. Pearson: Roger, we have the field in sight. . . .

Co-pilot Quintal flipped the landing-gear lever. But without power, nothing happened. "There wasn't any noise (from the gear going down), and that was a terrible feeling," the co-pilot says. He turned another switch allowing the gear to fall by gravity. The gear on each wing dropped, but the nose landing gear deployed only partway down.

The plane bored in at 170 knots. As it hit the runway, the captain's eyes were fixed on the runway threshold. The co-pilot was frantically scanning a checklist on how to get the nose gear all the way down.

Hitting the Brakes

Then both looked up—and ahead on the runway they saw vehicles, people walking and youngsters bicycling. They hadn't landed on the right-hand runway, which was still used for aircraft, because its dark color had blended in with the earth. They had landed on the lighter and more visible left runway, which was being used as an auto-racing strip. The last race of the day had finished, and scores of people were strolling and biking on the far end of the runway, while others were finishing dinner in camping vehicles parked on the runway.

Without power, the captain couldn't use reverse thrust to slow the plane. He hit the brakes. Because the nose landing gear wasn't fully down, the plane tilted forward. Its nose ground into the concrete, sending up a huge shower of sparks. "I thought the underneath of the airplane was being torn apart," Mr. Desjardins, the flight attendant, said.

As the plane continued sliding, Jo-Ann Barry was washing dinner dishes in the family camper parked on the runway. Suddenly a boy on a bike yelled that a jet was coming in. "I opened the camper door and there was this huge plane coming at us," she says. "It seemed very quiet, but it was coming 70-80 miles an hour." Her husband yelled at their five-year-old son to get off the runway, then grabbed their two-year-old son under his arm and sprinted off himself. "Everybody was hollering, grabbing their kids and running," Mrs. Barry says.

Fortunately, the jet's nose acted as an excellent brake. The big plane, its tail high in the air and its nose on the runway, shuddered to a stop just short of the throng of people and vehicles. No one had been injured.

What had gone wrong with the plane's fuel-measuring system? Because of a loose wire in the Honeywell electronic box, one data processor failed and couldn't provide information to the fuel gauges. The system then should have shifted automatically to a second, redundant data processor in the electronic box. But because of a shortcoming in the Honeywell system's logic, it failed to do so. Hence, all the fuel gauges went totally blank.

There were, of course, other problems, including the fuel conversion to pounds instead of kilograms. Even if the fuel had been calculated correctly, however, Capt. Pearson shouldn't have taken off. According to the 767's Minimum Equipment List, if at least two fuel gauges (for two of the three fuel tanks) aren't functioning, the pilot isn't allowed to depart. Capt. Pearson testified mechanics convinced him that, even though the fuel gauges were all blank, the dipstick procedure was sufficient to bypass the Minimum Equipment List. Mechanics denied that.

Although Capt. Pearson and co-pilot Quintal were praised for landing the plane safely, Air Canada said it would demote the captain to co-pilot for six months and suspend the co-pilot for two weeks. Both are appealing the disciplinary measures under union procedures, Air Canada says.

Meanwhile, Air Canada has revised its fueling procedures and has retrained its crews in fueling methods. And Boeing 767s in airline fleets around the world are getting a redesigned Honeywell fuel-measuring system.

As for the plane itself, Air Canada's aircraft No. 604 is still in service. In aviation circles, the big jet has come to be called "the Gimli Glider."

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