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Danger Aloft

Despite Major Gains, Airliners Still Present Mechanical Hazards

Metal Fatigue Is Common; Landing Gear and Tires Also Cause Fatal Mishaps

Pushing People Out a Door

By WILLIAM M. CARLEY
Staff Reporter of THE WALL STREET JOURNAL

LOS ANGELES—It was to be a festive event: Capt. Eugene Hersche's last flight as a Continental Airlines pilot before retiring. His wife, according to aviation tradition, was a passenger on the flight to Honolulu, along with 198 other passengers and crew members. Although it was rainy and gusty that morning, March 1, 1978, spirits were high.

After the DC10 taxied to the end of the runway at Los Angeles International Airport, the big jet began its takeoff roll normally. But when it reached 175 miles an hour, one tire on the left landing gear blew out, then another, and then a third.

As the plane sagged to the left, Gene Hersche screamed, "Abort!" He reversed

This is the first in a series of articles on air safety.

engine thrust and hit the brakes. But the jet rolled off the end of the runway at nearly 80 miles an hour. The left landing gear collapsed, fuel tanks ruptured, and the plane burst into flames. While most passengers and crew members, including the pilot and his wife, managed to flee to safety, four people were killed and 30 seriously injured by fire.

In the annals of U.S. aviation accidents, the number of casualties in the Continental crash was relatively small. But subsequent investigations showed that without quick action by airport firemen, the accident could have been far more serious. It might even have ranked among the worst disasters in U.S. airline history.

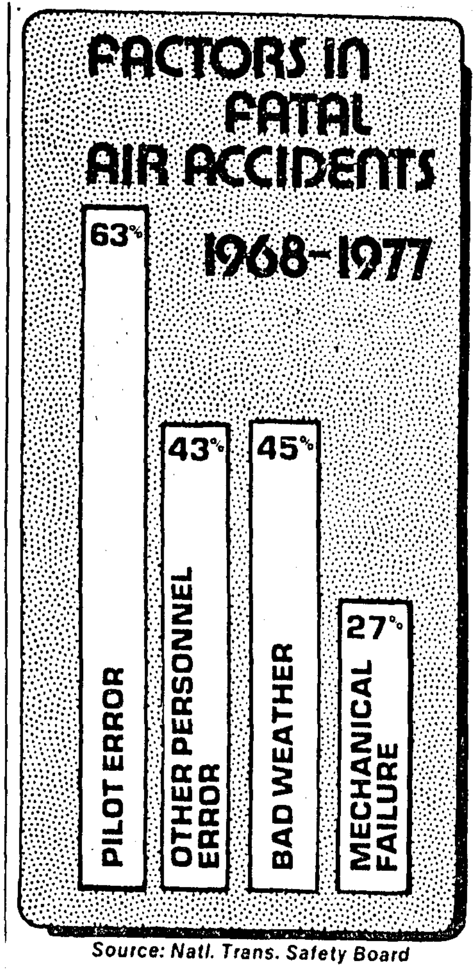
The Continental accident also illustrates an aspect of the industry's safety record that sometimes is overlooked. As dependable and safe as the big new jets are, they still have shortcomings. Something as simple as a tire blowout can jeopardize a jumbo jet and all its passengers. Tire blowouts, in fact, have become far more common and potentially far more dangerous than many people realize.

Steady Improvement

Undoubtedly, the overall safety record of U.S. airlines has been improving steadily in recent years. Prior to 1965, the number of fatal accidents per million commercial aircraft miles ranged around 0.010, according to the National Transportation Safety Board. Since then, the rate has dropped 80% to 0.002. Taking a scheduled flight, the National Safety Council says, is about 33 times safer than driving your own car.

Responsible for the improving safety record are several developments. James Robinson, chief of the Federal Aviation Administration's engineering and manufacturing division, cites jet engines, which are more reliable than the old piston engines, and better pilot training, which is aided by more-sophisticated simulators.

The FAA official and others also credit improved aircraft design and electronics.



Source: Natl. Trans. Safety Board

Newer planes have super-precise navigation systems, for example. When Lockheed Corp. delivered an L-1011 jet to British Airways recently, the plane took off from Lockheed's plant at Palmdale, Calif., and was put on automatic pilot. The L-1011 then flew 6,000 miles to England and landed at Heathrow Airport without the pilot ever touching the controls.

But as good as the air-transport system is, it has fatal flaws. Witness the American Airlines DC10 crash in Chicago this year, the Pacific Southwest Airlines collision with a Cessna over San Diego last year, and the Pan American World Airways collision with a KLM Royal Dutch Airlines plane on a runway in the Canary Islands in 1977. These three accidents killed a total of 984 persons. And just yesterday, a Western Air Lines DC10 crashed while attempting to land at Mexico City; at least 69 persons died.

What flaws lead to such fatalities? And

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Danger Aloft: Despite Major Gains, Jets Still Have Mechanical Hazards

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how are engineers and other safety experts working to eliminate them?

In a study of 71 fatal airline accidents in the decade through 1977, the National Transportation Safety Board found pilot error in 63% of the cases and other human error in 43%. Bad weather was blamed in 45%, and mechanical failures in 27%. (The figures total in excess of 100% because, oftentimes, more than one factor was involved.)

That big jets have mechanical problems isn't surprising, if only because the planes are so complex. Just designing the new 767 is keeping more than 3,000 engineers and other workers busy, Boeing says.

Some problems with jets are so common as to be almost routine. An example: metal fatigue, which over time causes numerous structural cracks. To combat this problem, planes are designed to be "fail-safe"—that is, if one structure cracks and fails, others can carry the load, at least long enough for the plane to land. And inspections are designed to catch cracks even before the first structure fails.

Nevertheless, the system can fail—disastrously. As a Dan-Air 707 cargo jet came in for a landing at Lusaka, Zambia, in 1977, the starboard tail plane broke off and the aircraft fell, killing the crew of five. That accident touched off checks of 707s around the world, and cracks were found in the tail structures of 26 more of the Boeing planes. Airlines, including U.S. carriers such as Pan Am, Trans World Airlines and American, are beefing up the tail structures on their 707s. Meanwhile, they are inspecting the 707 tails more often.

Another example of how the safety system can break down involves lightning. Jets are frequently struck by lightning, and they are built to absorb it safely. But in 1976, as an Iranian Air Force 747 jumbo jet was landing at Madrid, Spain, lightning hit the plane and evidently triggered a fuel-tank explosion. The left wing fell off, the plane crashed, and the crew died. Now, 747s around the world are being fixed to improve resistance to lightning.

Among the more difficult problems vexing airplane designers, however, are the landing gear in general and tires in particular. On most planes, inclusion of a second, or redundant, landing-gear system simply isn't practical. As a result, engineers can't use the fail-safe design philosophy applied in most other parts of the plane.

"Safe-Life" Strategy

As a substitute, engineers use a "safe-life" design strategy. Under this method, a landing gear is built tough enough to go through at least three times the takeoffs and landings that the plane normally would encounter in its life. Thus, the Boeing 737 can be expected to make about 75,000 takeoffs and landings, but its landing gear is designed to handle at least 225,000.

Things still go wrong. Last year, a malfunction due to corrosion in the landing gear of a United Airlines DC8 so distracted the crew that the plane ran out of fuel and crashed near Portland, Ore. That accident killed 10 and seriously injured 23.

Landing-gear tires have long been a special problem. The nylon used in the tires' basic structure loses its strength at high temperatures, and then a tire can blow out. Unfortunately, airliners often build up high temperatures in tires by taxiing long distances and by taxiing fast. If the tires are slightly underinflated—and airlines sometimes keep them that way to protect tires from foreign objects on runways—the fast-rolling tires are heated up still further.

Blowouts Common

And because of heat and other stresses, tire blowouts are fairly common. Usually, they don't lead to fatal consequences. In June, for instance, an Air France Concorde supersonic jet blew some tires as it took off from Washington's Dulles Airport. After the Dulles runway was covered with a fire-preventing foam and the Concorde dumped most of its fuel, the plane landed safely on its remaining tires.

But the coming of the big, heavy, wide-body jets—the Boeing 747, the Lockheed L-1011 and the McDonnell Douglas DC10—has exacerbated tire problems. In the mid-1970s, "a series of accidents" stemming from tire failures in wide-body jets began, the FAA found. The agency ordered a step-up in its surveillance of tires and started an investigation into the cause of the blowouts. "It was determined that the advent of large wide-body-type aircraft designed with complex landing-gear systems (and) their unprecedented high operating gross weights . . . were among the significant factors in the tire failures," the FAA says.

Aircraft builders also have been getting worried about the wide-body tire problem. They have asked tire makers for a material unaffected by high temperatures. In response, says Robert Rothl, chief design engineer for hydromechanical systems at the Douglas Aircraft unit of McDonnell Douglas, tire producers suggested a new fiber. But, he adds, it didn't work. "It didn't like compression at all (and tires must withstand lots of compression). And they couldn't find any adhesive that would cement the stuff together to give you a good bond between the various plies."

Unencouraging Replies

McDonnell Douglas also sent out a "Heavy Duty Tire Specification" for tougher tires made of any sort of material. "We sent that tire 'spec' out to some 17 different tire manufacturers throughout the world, U.S. and Europe," Mr. Rothl says. "The replies we got back were all very negative. We were informed by the tire manufacturers that it would be almost impossible to design and build" such a tire. Major tire makers declined to comment.

While the manufacturers were having difficulty trying to improve tires, Capt. Hersche was taking the DC10's controls for his last flight. The pilot faced more than his share of hurdles that day. Heavily loaded with passengers and fuel for the long trip to Honolulu, the plane was very close to its maximum gross weight of 430,000 pounds. A heavy load would make stopping the big plane on the runway difficult in case the takeoff had to be aborted. With the runways at Los Angeles International wet from rain, braking effectiveness was reduced, and thus the plane would be still harder to stop.

At a hearing subsequently convened by the National Transportation Safety Board, Gene Hersche and his copilot, Michael Provan, told what happened:

Gene Hersche: "We were cleared for takeoff . . . and we started a takeoff roll which would use every bit of the runway."

Mike Provan: "Acceleration was good. It is a big, overpowered airplane—that is the feeling I have always had taking this thing off."

Critical Moment

As the plane sped down the runway, it reached nearly 156 knots. That was the most critical moment because it was the "V1" speed, the speed at which the pilot must decide to either continue to take off, or abort. At that moment, the first of four tires on the left landing gear blew. Apparently overloaded, a second tire blew. As the bare wheels rolled on the ground, one shattered, the fragments puncturing a third tire. With the plane leaning to the left, Mr. Hersche chose to abort—reversing engines and stepping on the brakes. At first, he thought he could stop the plane in time. But then it began to vibrate.

Gene Hersche: "The vibration was increasing very, very much. I mean it was just getting wild. In fact, I didn't feel like I was even sitting in the seat—I was being bounced off it."

Mike Provan: Vibration "got violent. . . . The (steering) yoke is out of my grasp and I was thrashing around like I couldn't—I had to clutch myself in because I was flailing against the seat."

Gene Hersche: "With this vibration, it seemed like we just started floating, and nothing was stopping us."

Braking Problem

With three out of four tires on the left landing gear gone and on a wet runway, the DC10 had lost much of its braking power. The 218-ton airplane was hurtling toward the end of the runway, and a parking lot full of cars beyond, at nearly 80 miles an hour.

Mike Provan: "I am watching, I am talking him through this darn thing. . . . 'Fight, fight, Gene, stay there. . . .' I kept telling him, 'Cars coming. . . .' He is on the brakes and reverse. We are vibrating—banging, banging, banging—all of a sudden (as the jet rolls off the runway and the left landing gear collapses), this sudden swerve over to the left, down on the left side. We stopped."

The plane stopped short of the parking lot. But the landing gear, as it collapsed, ruptured fuel tanks in the left wing. Fire broke out on the plane's left side. Flight attendants opened doors on the right, inflated slides to the ground and began herding passengers to the slides. But with the plane canted to the left, the slides from the right side were steep. Passengers were frightened.

Janna Harkrider, flight attendant: "It was very steep at that point, and the people were old, and . . . I saw a pair of plaid pants standing at the door, and I told him to go . . . and I was getting more people up to go and I turned around and he was still there, and I said, 'I said go, goddamn, I mean go, the plane is on fire and I want you to go,' and pushed him out."

Hesitant Passengers

Judy Blair, flight attendant: "I started screaming for the people to get out, and there was a slight reluctance. . . . And I just started kicking and shoving and hitting and screaming as loud as I could scream . . . trying to impress for them to move faster, because I could see the fire coming closer and closer."

But some passengers were caught by the fire anyway.

John Woodman, flight attendant: "The passenger started sliding down the fuselage and off the end of the wing. As soon as he hit the ground, he was on fire. He came towards me and either fell or I threw him down, but I was yelling at him to roll over and—it was a quagmire, like I was in a foot of dirt or silt or mud—and I was grabbing handfuls of mud and throwing it on him, trying to extinguish the fire."

An airport fireman had heard the plane's tires blowing, and his fire truck was rolling even before the jet went off the runway. The truck arrived at the plane only seconds after the plane had come to a halt, and the truck immediately began spraying foam, which drove back the flames. That fast action saved lives, the Safety Board has said.

FAA Proposal

In the aftermath of the Continental accident, the FAA has proposed that all planes be equipped with tougher tires—not as tough as McDonnell Douglas had originally sought, but still with 61% more load-bearing ability. Even that, it's said, isn't easy.

McDonnell Douglas also is developing wheels that won't shatter after a blowout and thus won't hurl fragments out to puncture other tires and reduce braking power. And the company is working on new landing-gear parts designed so that if a gear should fail as the Continental DC10's did, it will collapse without puncturing a fuel tank.

But meanwhile, there are still close calls. A few months ago, a Philippine Airlines DC10 blew all four tires on the left landing gear as the plane was taking off from Guam. The pilot aborted and managed to is, if one structure cracks and fails, others can carry the load, at least long enough for the plane to land. And inspections are designed to catch cracks even before the first structure fails.

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