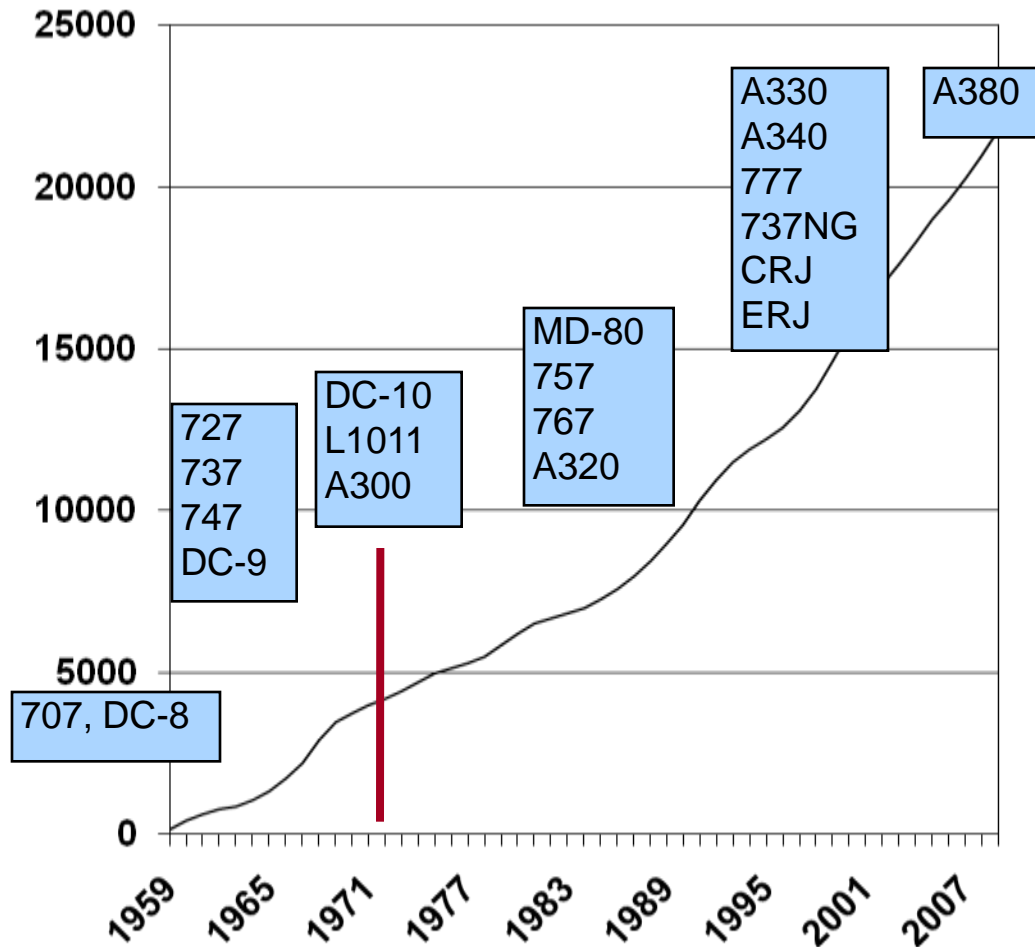


Commercial Airplane Safety

right attitude/right approach/right alongside
www.goodrich.com

The logo graphic consists of three red, curved, parallel lines that sweep upwards and to the right, positioned above the word 'GOODRICH'.
GOODRICH

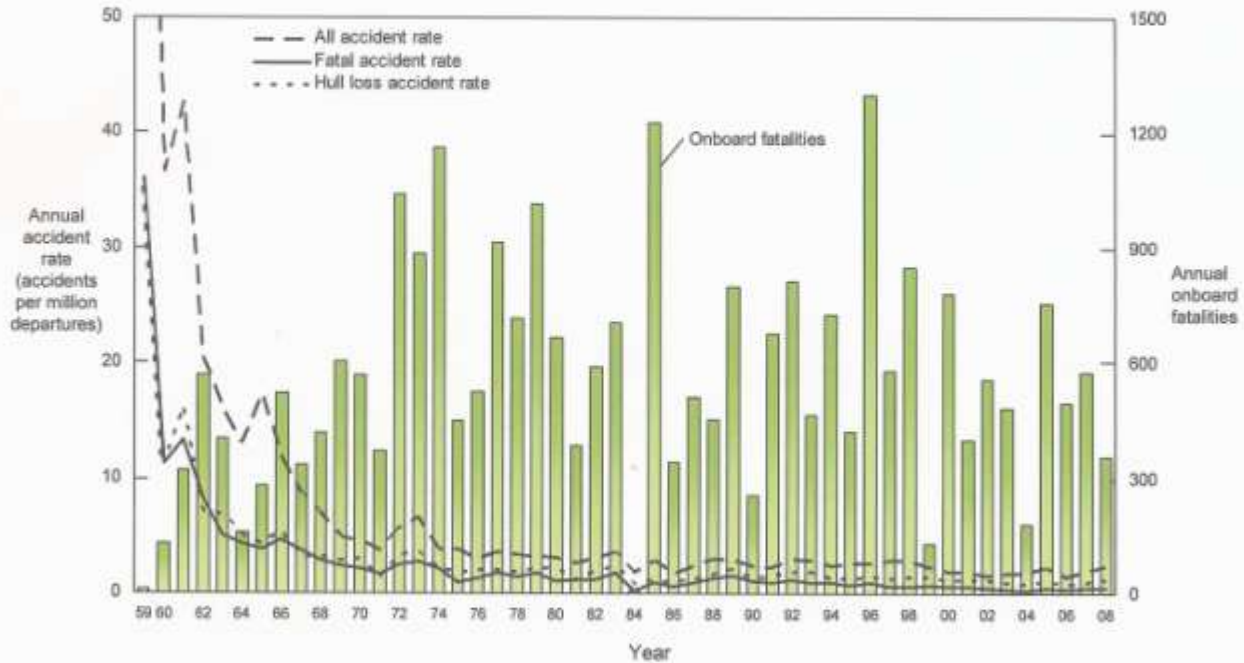
- Commercial Airplane Growth
- Safety Statistics
- Major Safety Improvements
- Conclusion



*BAC 111, F28, Comet, Trident
 Mercure, Convair, VC10,
 Concorde, Caravelle
 Boeing 7 Series, Airbus Family
 DC and MD Series, L1011
 BAe 146, F100, F70
 Bombardier RJ family
 Embraer RJ family

Source: Airline Monitor May 2010
 Excludes Military and Business Jets

Accident Rates and Onboard Fatalities by Year Worldwide Commercial Jet Fleet – 1959 Through 2008



0.7 accidents per million departures

2A · WEDNESDAY, AUGUST 18, 2010 · USA TODAY

Engineers: Passengers' survival was miracle by design

Years of safety advances protected fliers in crash

By Alan Levin
USA TODAY

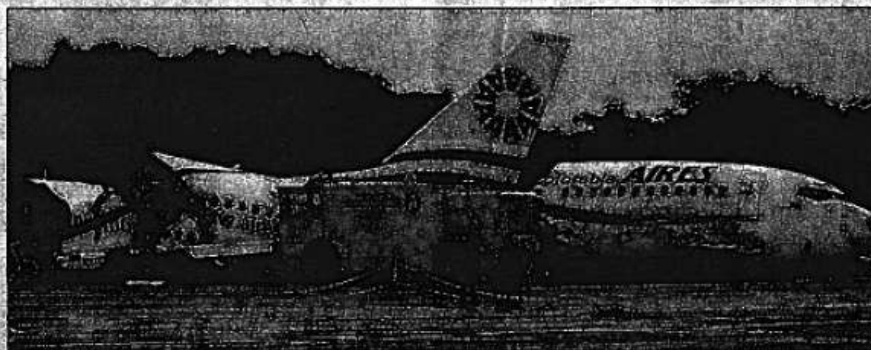
When an airliner slammed onto a rainy Caribbean runway early Monday and split into three shredded pieces, passengers called it a miracle that no one died in the impact.

To the engineers and accident investigators who pushed for decades to improve airliner safety, the outcome was by design.

"I cringe when I see these headlines that this was a miracle," said John Hickey, the Federal Aviation Administration's (FAA) deputy safety chief. "We as engineers and scientists don't believe that this is a miracle. We are totally convinced that the work that we did in the 1980s has proven its value."

At that time, a crash severe enough to break a jet into pieces was almost certain to kill passengers. Since then, the FAA — pushed at times by federal crash investigators — has required tougher seats, better emergency lighting, more accessible exits and numerous protections against fire.

The AIRES airline Boeing 737-700 that crashed while attempting to land on the Colombian island of San Andrés is just the latest example of recent accidents that caused severe damage to large jets but



By Richard Garcia, Periodico El Istemo, via AP

"This can't be all luck": No passengers died on impact Monday when an AIRES airline Boeing 737-700 crashed while attempting to land on the Colombian island of San Andrés.

caused few, if any, deaths. In Monday's crash, one 68-year-old female passenger died. The Associated Press reported that she suffered a heart attack after escaping from the plane.

Since 2005, there have been at least seven crashes around the world with similar outcomes, according to federal officials and aviation safety experts.

"This can't all be luck," said Bill Voss, president of the non-profit Flight Safety Foundation. "I think you have a series of unglamorous incremental improvements making a difference."

The recent accidents include:

- ▶ An American Airlines 737-800 slid off a rainy runway on Dec. 22 in Kingston, Jamaica, slamming into rocks on the seashore and breaking into three pieces. No one died.
- ▶ A Continental Airlines 737-500 trying to take off in stiff crosswinds in Denver ran off the runway on Dec. 20, 2008. The jet broke apart and caught fire, but no one died.
- ▶ An Air France Airbus A340 carrying 309 people skidded off a runway in Toronto on Aug. 2, 2005,

bursting into flames. Everyone escaped.

The investigation into Monday's crash has just begun, but among the factors that almost certainly helped prevent deaths were the seats.

Investigators probing crashes in the 1980s and 1990s noticed that seats often tore loose during an impact, heaving passengers about the cabin. The results could be grim.

In 1990, an Avianca airlines jet approaching New York's John F. Kennedy International Airport ran out of fuel and glided to the ground. Despite the impact, the jet remained mostly in one piece and there was no fire.

However, large sections of seats came loose, said Rick DeWeese, who heads the crash laboratory at the FAA's Civil Aerospace Medical Institute in Oklahoma City. As a result, 73 of the 158 people aboard died.

By contrast, the AIRES jet was equipped with newer seats that are far more likely to stay put upon impact, according to the FAA and Boeing.

Hickey acknowledges that luck may have played a role in reducing fatalities in some recent accidents. The outcome Monday might have been different if a fire had broken out, for example.

Still, Hickey is certain that the safety enhancements pushed by the FAA gradually over the past two decades have made a difference.

"When you get into one of these accidents, you are more likely to survive than before," he said.







"I cringe when I see these headlines that this was a miracle," said John Hickey, the [Federal Aviation Administration](#)'s (FAA) deputy safety chief. "We [as](#) engineers and scientists don't believe that this is a miracle. We are totally convinced that the work that we did in the 1980s has proven its value."

Safety record depends on:

The quality of designs,
The quality of production,
The quality of airline operations,
The capability of the air management system
Utilizing lessons learned

Accidents are typically caused by multiple factors
We need to learn from every accident or near miss

- 1954 Comet
- 1965 UAL 727 Salt Lake City
- 1969 UAL 727 Santa Monica
- 1974 Turkish DC-10 France
- 1979 AAL DC-10 Chicago
- 1985 737 Manchester
- 1985: L1011 Dallas
- 1988 Aloha 737 “Convertible”
- 1991 Lauda Air Thailand
- 1996 Value Jet DC-9 Everglades
- 1996 TWA 800 747

- 1954 Comet: **Metal fatigue/stress concentrations**

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- 1965 UAL 727 Salt Lake City: **Exit path lighting**

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- 1965 UAL 727 Salt Lake City: **Exit path lighting**
- 1969 UAL 727 Santa Monica: **Electrical power redundancy**
- 1974 Turkish DC-10 France: **Flight Control cable routing**
- 1979 AAL DC-10 Chicago: **Fail safe/Damage tolerance**

- 1954 Comet: **Metal fatigue/stress concentrations**
- 1965 UAL 727 Salt Lake City: **Exit path lighting**
- 1969 UAL 727 Santa Monica: **Electrical power redundancy**
- 1974 Turkish DC-10 France: **Flight Control cable routing, venting**
- 1979 AAL DC-10 Chicago: **Fail safe/Damage tolerance**
- 1985 737 Manchester: **Interior flammability, exit row seating**

- 1954 Comet: **Metal fatigue/stress concentrations**
- 1965 UAL 727 Salt Lake City: **Exit path lighting**
- 1969 UAL 727 Santa Monica: **Electrical power redundancy**
- 1974 Turkish DC-10 France: **Flight Control cable routing, venting**
- 1979 AAL DC-10 Chicago: **Fail safe/Damage tolerance**
- 1985 737 Manchester: **Interior flammability, exit row seating**
- 1985: L1011 Dallas: **Windshear training/warning systems**



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- 1988 Aloha 737 “Convertible”: **Aging aircraft inspection criteria**
- 1991 Lauda Air Thailand: **Thrust Reverser lockout redundancy**

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- 1991 Lauda Air Thailand: **Thrust Reverser lockout redundancy**
- 1996 Value Jet DC-9 Everglades: **Cargo compartment fire suppression**
- 1996 TWA 800 747: **Fuel system design philosophy**

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- A grayscale world map with white outlines for continents and countries. The map is centered on the Atlantic Ocean, showing North America on the left, South America at the bottom left, Europe and Africa in the center, and Asia and Australia on the right.
- Pan Am 747 SFO
 - Eastern Airlines L1011
 - China Air 747
 - TWA 727
 - Air Canada 767
 - Air Transit A330
 - US Air A320

- The first civil mid-air collision?
- The first passenger-carried bomb?
- The first hijacking?
- Suicides?
- Volcanic ash?

1920	1930	1940	1950	1960
1922 Mid-air Collision France	1933 Passenger Bomb USA	Airline shot down USSR	1948 Hi-jacking Macao	

- Hijackings: 41
- Bombings: 26
- Mid air collisions: 27
- Shot down: 10
- Water ditchings: 8 (417 of 601 people survived)
- Flight Crew Suicides: 2
- Volcanic ash multiple engine shutdown: 2

More than 570 million flights since 1959

The Safety Culture = Safe Airplanes

Design

Production

Maintenance

Operations

Air Traffic Management

Bob Gibbs Had it Right!



Thank You

(Odds are you will have a safe flight home)