



Statistical Summary of Commercial Jet Airplane Accidents

Worldwide Operations | 1959 – 2019



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Since Boeing published its first Statistical Summary of Commercial Jet Airplane Accidents in 1969, the world has changed. Air travel has changed. Technology has changed how we design, build and service airplanes.

Yet our commitment to a data-driven approach to ensure the safety of our products remains constant. We continue to strengthen that commitment every day by making progress to establish an enterprise Safety Management System (SMS) in which every Boeing employee plays a role. The primary goal of this SMS is to reduce risk through a disciplined and data-driven decision-making process. By proactively using data to inform how we design, build and service our products, we are in a better position to address potential hazards and perform predictive analysis to avoid possible future issues. It is through this combination of practices and our people that we will continue to shape the aerospace industry – always with our sights set on safety.



Our work is both highly technical and deeply personal. With each accident and near-miss, we examine and learn from every detail to further improve safety and quality because all who rely on our products and services deserve our best. Data is the key to unlocking these opportunities for continuous improvement; it helps us understand risks and identify where changes are needed.

We will never forget the 346 lives lost in the Lion Air Flight 610 and Ethiopian Airlines Flight 302 accidents. We honor them by holding close the hard lessons learned from this chapter in our history. As we reflect on all of the accidents included in this report, we will always remember that people – the crews, passengers and those who create and maintain jet airplanes – are at the heart of what we do.

Beth Pasztor

Vice President and General Manager,
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Statistical Summary 2019

This document has been published every year since 1969. It tells the story of commercial aviation dating back to the launch of the jet age in 1959. The data and Boeing's analyses in the following pages underline the vast improvements that have been made in the first six decades of commercial flight, and call out those areas where we must continue to make improvements. Thanks in part to documents like this and the thinking that drives them, commercial aviation has evolved into one of the safest forms of travel ever devised.

2019 Airplane Accidents | Worldwide Commercial Jet Fleet

Event Date	Airline	Model (Age in Years)	Type of Operation	Accident Location	Phase of Flight	Event Description	Damage Category	Hull Loss	Injury Category	Onboard Fatalities / Occupants (External Fatalities)	Major Accident
8-Jan-19	Frontier Airlines	A320 (6)	Sched Pax	Denver, United States	Tow	During pushback the airplane sustained substantial damage. No injuries were reported.	Substantial				
14-Jan-19	Saha Airlines	707-300 (43)	Charter Cargo	Fath, Iran	Landing	After landing, the aircraft overran the end of the runway. Damage resulted in a hull loss and multiple fatalities.	Destroyed	X	Fatal	15/16 (0)	X
21-Jan-19	Serve Air	737-300 (30)	Sched Cargo	Kinshasa, Democratic Republic of the Congo	Landing	While landing, the left hand wheel was punctured and the left hand main landing gear collapsed. The aircraft sustained substantial damage. No injuries were reported.	Substantial				
28-Jan-19	Kalitta Air	727-200 (42)	Sched Pax	Tuscaloosa, United States	Landing	The aircraft landed with the nose landing gear retracted. The aircraft sustained substantial damage. No injuries were reported.	Substantial				
3-Feb-19	United Airlines	787-8 (5)	Sched Pax	Chengdu, China	Cruise	A flight attendant fell while exiting the crew bunk, resulting in serious injury.	None		Serious		
8-Feb-19	Novair	A321 (2)	Sched Pax	Billund, Denmark	Landing	While landing in crosswind conditions the aircraft bounced and made a hard landing. The aircraft sustained substantial damage. No injuries were reported.	Substantial				
16-Feb-19	Lion Air	737-800 (1)	Sched Pax	Pontianak, Indonesia	Landing	After landing, the aircraft experienced runway excursion. The aircraft sustained minor damage and there were 2 minor injuries.	Minor				
23-Feb-19	Atlas Air	767-300 (27)	Charter Cargo	Houston, United States	Final Approach	The aircraft impacted the water in poor weather conditions. There were 3 fatalities.	Destroyed	X	Fatal	3/3 (0)	X
28-Feb-19	Flybe	ERJ 195 (11)	Sched Pax	Exeter, United Kingdom	Takeoff	Just prior to takeoff smoke filled the cabin and the aircraft was evacuated. One passenger sustained a broken ankle.	None		Serious		
3-Mar-19	Oceanair	A320 (3)	Sched Pax	Rio de Janeiro, Brazil	Landing	After touchdown the aircraft lost control and crossed the lateral limits to the right of the runway. The aircraft suffered substantial. No injuries were reported.	Substantial				
10-Mar-19	Ethiopian Airlines	737 MAX 8 (0.3)	Sched Pax	Addis Abbaba, Ethiopia	Climb	During initial climb the aircraft experienced loss of control and impacted the ground. There were 157 fatalities.	Destroyed	X	Fatal	157/157 (0)	X
19-Mar-19	Iran Air	Fokker F-100 (28)	Sched Pax	Tehran, Iran	Landing	The aircraft landed with the main landing gear in the up position. Substantial damage was sustained. No injuries were reported.	Substantial				
27-Mar-19	Southwest Airlines	737-700 (13)	Sched Pax	Nashville, United States	Final Approach	During final approach the aircraft suffered a bird strike. The aircraft sustained substantial damage. No injuries were reported.	Substantial				
3-Apr-19	EasyJet	A320 (7)	Sched Pax	Belfast, United Kingdom	Tow	During pushback, the towbar broke, the aircraft rolled forward and struck the tug. The aircraft sustained substantial damage. There were no injuries reported.	Substantial				

2019 Airplane Accidents | Worldwide Commercial Jet Fleet (cont.)

Event Date	Airline	Model (Age in Years)	Type of Operation	Accident Location	Phase of Flight	Event Description	Damage Category	Hull Loss	Injury Category	Onboard Fatalities / Occupants (External Fatalities)	Major Accident
10-Apr-19	American Airlines	A321 (5)	Sched Pax	New York, United States	Takeoff	The aircraft struck a runway marker during takeoff causing substantial damage to the left hand wing. No injuries were reported.	Substantial				
12-May-19	Myanmar National Airlines	ERJ 190 (10)	Sched Pax	Mandalay, Myanmar	Landing	The aircraft landed with the nose landing gear retracted. The aircraft sustained minor damage. No injuries were reported.	Minor				
9-Jun-19	United Airlines	737-900 (10)	Sched Pax	Denver, United States	Landing	The aircraft experienced a tail strike on landing resulted in substantial damage. There were no injuries reported.	Substantial				
15-Jun-19	United Airlines	757-200 (22)	Sched Pax	Newark, United States	Landing	The aircraft experienced a hard landing and veered off to the left of the runway. The aircraft sustained substantial damage. No injuries were reported.	Substantial	X			
17-Jun-19	Southwest Airlines	737-800 (6)	Sched Pax	Pittsburgh, United States	Parked	While parked the aircraft was struck by a catering vehicle. The aircraft sustained substantial damage and the driver sustained minor injury.	Substantial				
1-Jul-19	Spicejet	737-800 (17)	Sched Pax	Mumbai, India	Landing	The aircraft landed and overran the end of the runway. The aircraft sustained substantial damage. No injuries were reported.	Substantial				
23-Jul-19	Air Peace	737-300 (21)	Sched Pax	Lagos, Nigeria	Landing	The aircraft experienced nose gear failure upon landing. The aircraft sustained substantial damage. No injuries were reported.	Substantial				
30-Jul-19	National Jet Express	Bae 146-RJ85 (26)	Sched Pax	Perth, Australia	Taxi	During engine start-up, the aircraft rolled forward and struck a light pole resulting in substantial damage.	Substantial				
30-Jul-19	Lufthansa	A319 (12)	Sched Pax	Frankfurt, Germany	Parked	The aircraft was struck by a staircase being towed by another vehicle. The aircraft sustained substantial damage. Three minor injuries were reported.	Substantial				
3-Aug-19	Boliviana de Aviacion	737-300 (22)	Sched Pax	La Paz, Bolivia	Landing	The aircraft experienced a main landing gear malfunction during landing. The aircraft sustained substantial damage. No injuries were reported.	Substantial				
8-Aug-19	Frontier Airlines	A321 (2)	Sched Pax	Orlando, United States	Landing	The aircraft experienced a tail strike on landing resulted in substantial damage. There were no injuries reported.	Substantial				
15-Aug-19	Ural Airlines	A321 (15)	Sched Pax	Zhukovsky, Russia	Initial Climb	The aircraft experienced bird strikes and engine failure shortly after takeoff and forced to land in a field. The aircraft sustained substantial damage. There were ten injuries reported.	Destroyed	X	Serious		X
18-Aug-19	Delta Air Lines	757-200 (23)	Sched Pax	Ponta Delgada, Portugal	Landing	The aircraft experienced a hard landing. The aircraft sustained substantial damage. No injuries were reported.	Substantial				

2019 Airplane Accidents | Worldwide Commercial Jet Fleet (cont.)

Event Date	Airline	Model (Age in Years)	Type of Operation	Accident Location	Phase of Flight	Event Description	Damage Category	Hull Loss	Injury Category	Onboard Fatalities / Occupants (External Fatalities)	Major Accident
27-Aug-19	Air China	A330 (5)	Sched Pax	Beijing, China	Parked	While parked at the gate the aircraft caught fire. The aircraft sustained substantial damage. No injuries were reported.	Destroyed	X			X
3-Nov-19	Avianca	787-8 (1)	Sched Pax	Barcelona, Spain	Descent	The aircraft experienced a sharp deceleration during descent. One passenger and one flight attendant sustained serious injuries. No damage to the aircraft was reported.	None		Serious		
21-Nov-19	Turkish Airlines	737-800 (11)	Sched Pax	Odessa, Ukraine	Landing	The aircraft experienced a runway excursion and nose landing gear collapse. The aircraft sustained substantial damage. No injuries were reported.	Substantial				
22-Nov-19	Avior Airlines	737-400 (30)	Sched Pax	Bogota, Colombia	Landing	The aircraft experienced a right hand landing gear collapse while landing. The aircraft sustained substantial damage. No injuries were reported.	Substantial	X			
23-Nov-19	Ryanair	737-800 (12)	Sched Pax	Nuremberg, Germany	Parked	A passenger fell from stairs. No damage to the aircraft was reported. One serious injury was reported.	None		Serious		
19-Dec-19	United Airlines	737-900 (6)	Sched Pax	Chicago, United States	Taxi	The aircraft made an abrupt stop during taxi. Flight Attendant sustained severe injury. No damage to the aircraft was reported.	None		Serious		
22-Dec-19	United Airlines	737-800 (11)	Sched Pax	Denver, United States	Landing	The aircraft experienced a left main gear collapse during landing roll. The aircraft sustained substantial damage. No injuries were reported.	Substantial				
27-Dec-19	Bek Air	F-100 (24)	Sched Pax	Almaty, Kazakhstan	Initial Climb	Lost height shortly after takeoff and impacted building. Damage resulted in a hull loss and 12 fatalities and 47 reported injuries.	Destroyed	X	Fatal	12/101 (0)	X
35	Total Accidents							8		187 Onboard (0 External)	6

Accident Summary by Injury and Damage

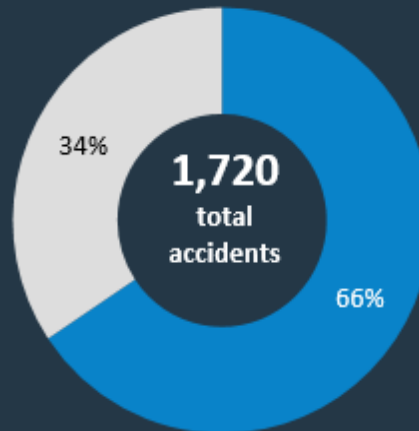
Worldwide Commercial Jet Fleet 1959 through 2019

Historically, hull losses have been associated with high fatality rates. That trend is reversing. Despite dramatic increases in air travel and air traffic, the number of fatalities that occur with hull losses has fallen by half over the past eight years. This downward trend in the correlation between hull losses and fatalities is due, in part, to improvements made to hull design and cabin equipment over the past 20 years.

The terms "hull damage" and "hull loss" refer to the severity of damage an airplane incurs from an accident.

In this data, "fatal accident" refers to any onboard fatality, including deaths resulting from non-accident-related medical emergencies.

1959 – 2009



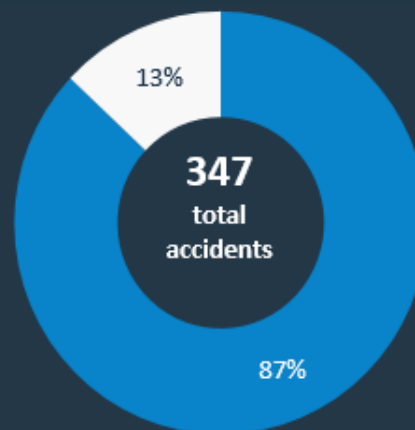
• 1,129 Non-fatal accidents

- 414 with hull loss
- 658 with substantial hull damage
- 57 without substantial hull damage

• 591 Fatal accidents

- 479 with hull loss
- 25 with substantial hull damage
- 87 without substantial hull damage

2010 – 2019



• 301 Non-fatal accidents

- 92 with hull loss
- 187 with substantial hull damage
- 22 without substantial hull damage

• 46 Fatal accidents

- 37 with hull loss
- 2 with substantial hull damage
- 7 without substantial hull damage

Departures, Flight Hours, and Jet Airplanes in Service*

Worldwide Commercial Jet Fleet 1999 through 2019

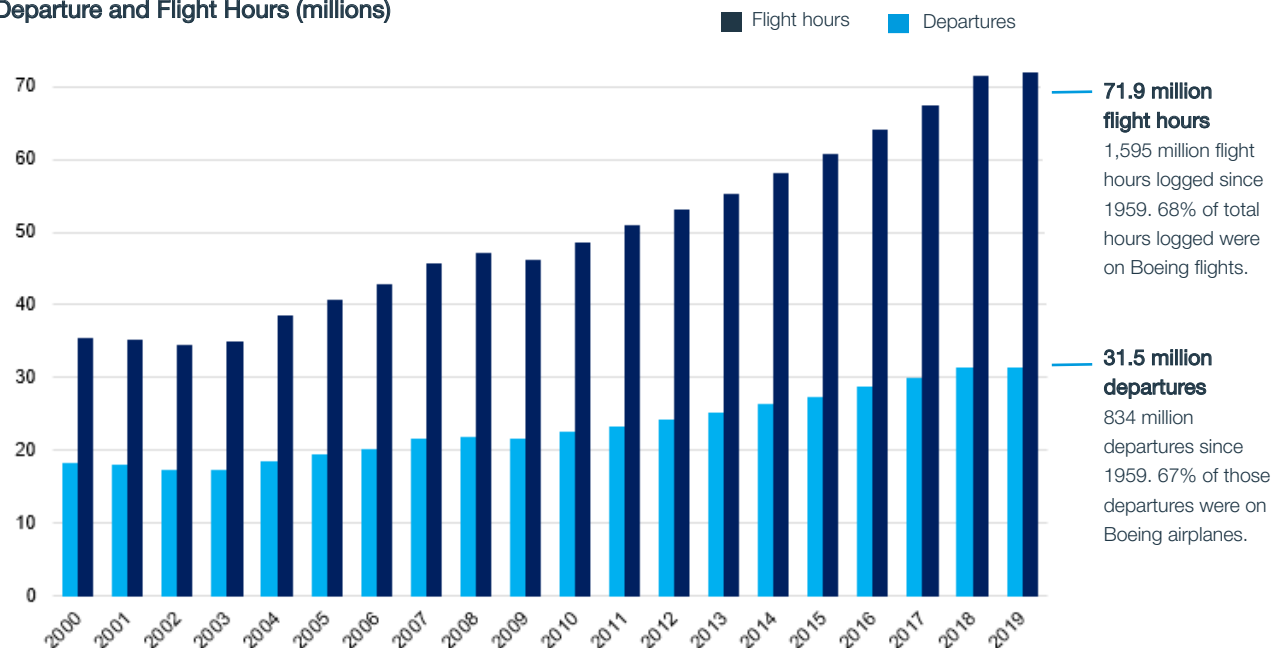
Over the past 20 years, the gap has grown between total number of departures and total flight hours (top chart). Today, average flight time is 2.3 hours compared to 1.9 hours in 1998. Modern airplanes are designed for the heavier workloads, which is good news for the industry: Worldwide commercial air traffic is rising steadily (bottom chart), and is projected to double by 2035.

52% of commercial airplanes flying today were made by Boeing.

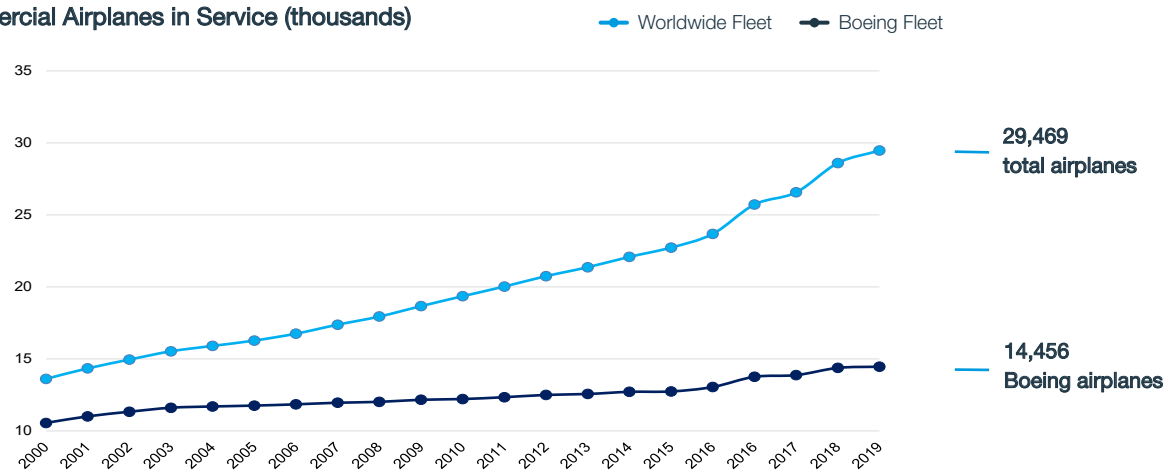
Source: Jet Information Services, Inc.

* Certified jet airplanes greater than 60,000 pounds maximum gross weight, including those in temporary nonflying status and those in use by non-airline operators. Excluded are commercial airplanes operated in military service and CIS- or USSR-manufactured airplanes.

Departure and Flight Hours (millions)



Commercial Airplanes in Service (thousands)



Accident Summary by Type of Operation

Worldwide Fleet 60- and 10-Year Totals

Despite the exponential increase in air travel over the past 60 years, the total number of airplane accidents in the last ten years is flat or just slightly up compared to the past 60 years. This is true across all categories and regions except in the U.S. and Canada, where the number of accidents in the past decade has actually decreased by 33 percent compared to the 60-year totals. The trend is amplified in another vital metric—fatal accidents—which are down 74 percent in the U.S. and Canada over the past ten years.

Worldwide Commercial Jet Fleet

Type of Operation	All Accidents		Fatal Accidents		Onboard Fatalities (External Fatalities)*		Hull-Loss Accidents	
	1959–2019	2010–2019	1959–2019	2010–2019	1959–2019	2010–2019	1959–2019	2010–2019
Passenger	1,651	290	509	35	30,024 (804)	2,191 (27)	755	96
- Scheduled	1,528	279	462	33	25,827	2,108	684	92
- Charter	123	11	47	2	4,197	83	71	4
Cargo	292	50	83	10	285 (385)	30 (56)	192	30
Maintenance test, ferry, positioning, training, and demonstration	123	6	44	0	208 (66)	0 (0)	75	3
Totals	2,066	346	636	45	30,517 (1,255)	2,221 (83)	1,022	129

U.S. / Canada vs. Rest of World

Type of Operation	All Accidents		Fatal Accidents		Onboard Fatalities (External Fatalities)*		Hull-Loss Accidents	
	1959–2019	2010–2019	1959–2019	2010–2019	1959–2019	2010–2019	1959–2019	2010–2019
U.S. and Canadian operators	604	64	184	6	6,206 (381)	27 (0)	238	19
Rest of World	1,462	282	452	39	24,311 (874)	2,194 (83)	784	110
Totals	2,066	346	636	45	30,517 (1,255)	2,221 (83)	1,022	129

* External fatalities include on-ground fatalities as well as fatalities on other aircraft involved.

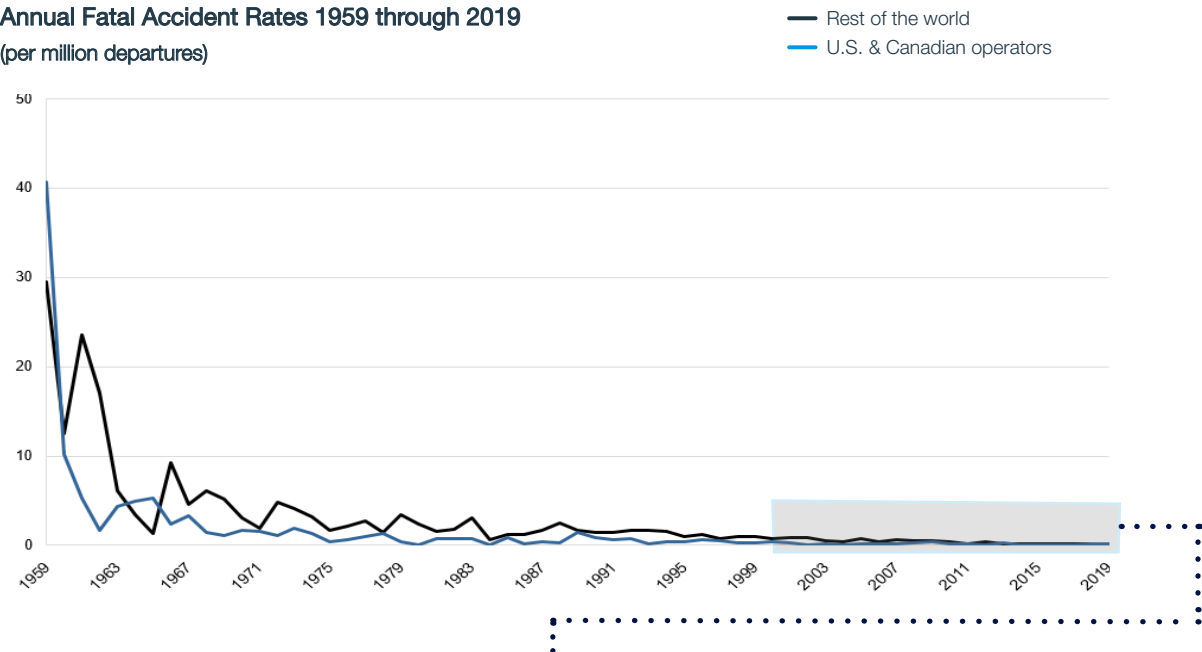
U.S. and Canadian Operator Accident Rates by Year

[Fatal Accidents | Worldwide Commercial Jet](#)

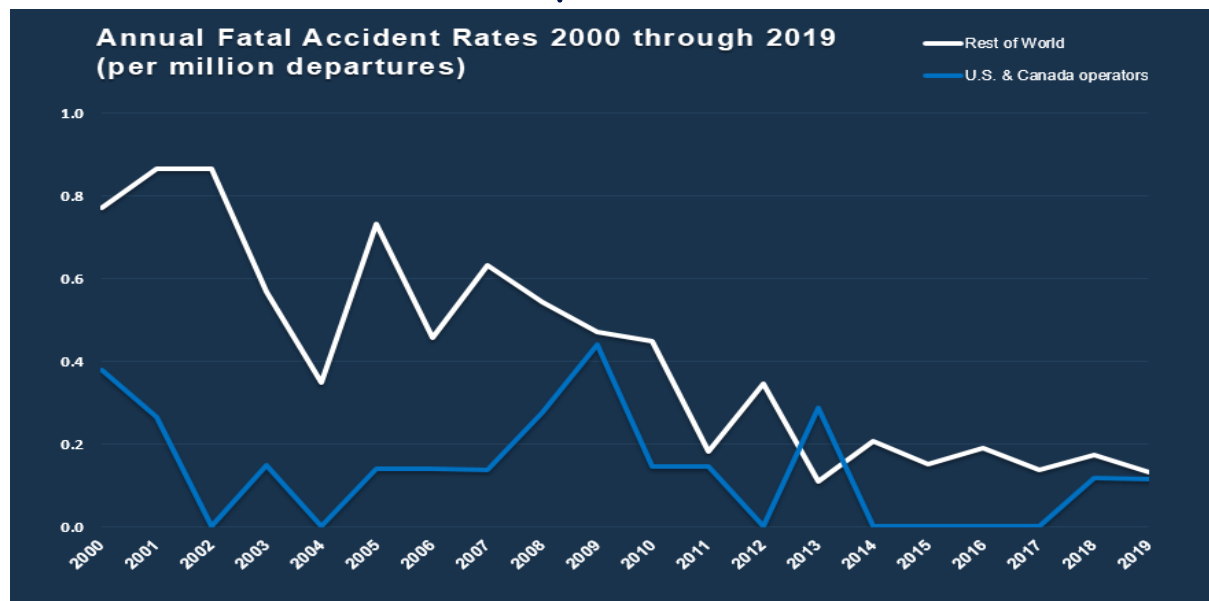
[Fleet 2000 through 2019](#)

In the first decade of the jet age, two key metrics—accident rates and fatality rates—saw dramatic improvements. Since then, metrics appear to taper off. That's not the case. Fatalities are still declining worldwide—a testament to the industry's relentless focus on safety.

Annual Fatal Accident Rates 1959 through 2019
(per million departures)



Annual Fatal Accident Rates 2000 through 2019
(per million departures)

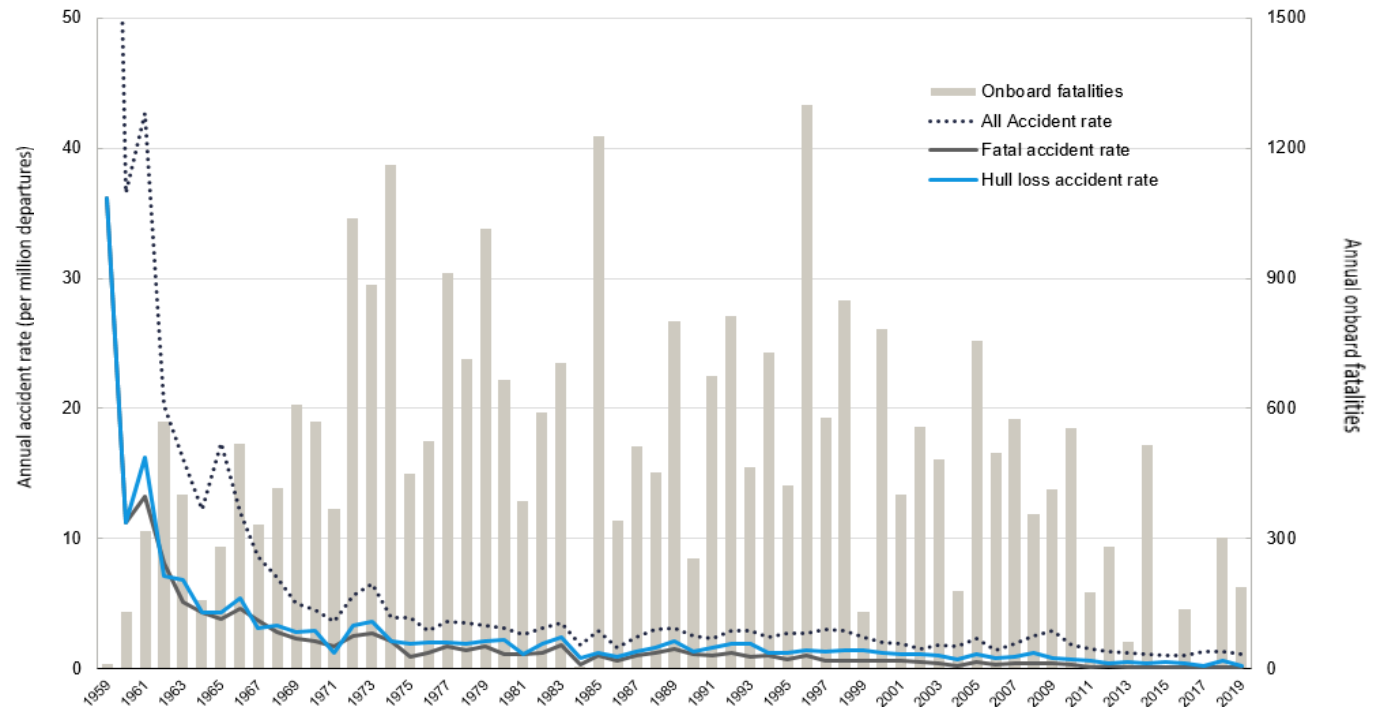


Accident Rates and Onboard Fatalities by Year

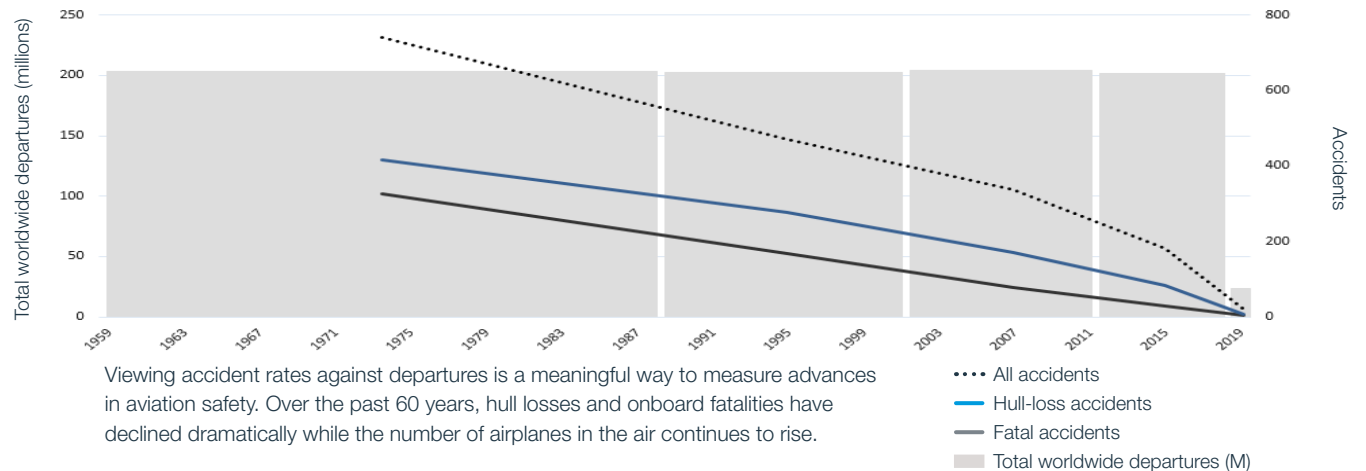
Worldwide Commercial Jet Fleet 1959 through 2019

It took 30 years for the commercial aviation industry to achieve its first 200 million flights. Yet it took only 13 years to reach the second 200 million, and 10 years to reach the next 200 million. The most recent 200 million flights will be reached after a mere eight years. Despite this exponential growth in air traffic, the accident rate has been reduced by half over the past 18 years.

Accident Rates and Onboard Fatalities per One Million Departures

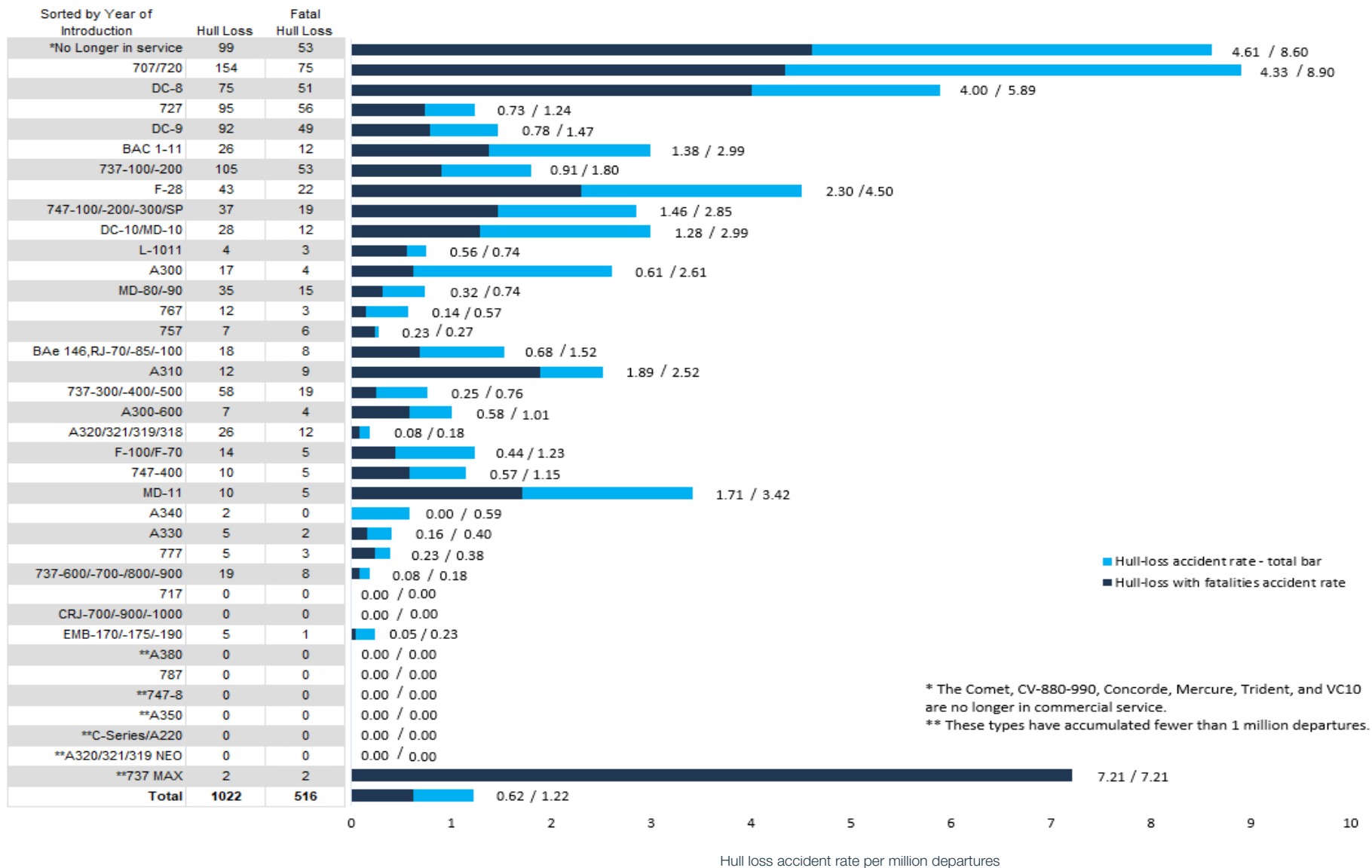


Accident Rates and Onboard Fatalities per 200 Million Departures



Accident Rates by Airplane Type

Hull Loss Accidents | Worldwide Commercial Jet Fleet | 1959 - 2019



CAST/ICAO Common Taxonomy Team Aviation Occurrence Categories

The International Civil Aviation Organization (ICAO) and the Commercial Aviation Safety Team (CAST), which includes government officials and aviation industry leaders, have jointly chartered the CAST/ICAO Common Taxonomy Team (CICTT). CICTT includes experts from several air carriers; aircraft manufacturers; engine manufacturers; pilot associations; regulatory authorities; transportation safety boards; ICAO; and members from Canada, the European Union, France, Italy, the Netherlands, the United Kingdom, and the United States. CICTT is co-chaired by one representative each from ICAO and CAST.

The team is charged with developing common taxonomies and definitions for aviation accident and incident reporting systems. Common taxonomies and definitions establish a standard industry language, thereby improving the quality of information and communication. With this common language, the aviation community's capacity to focus on common safety issues is greatly enhanced.

The CICTT Aviation Occurrence Taxonomy is designed to permit an assignment of multiple categories as necessary to describe the accident or incident. Since 2001, the Safety Indicator Steering Group (SISG) has met annually to assign CICTT occurrence categories to the prior year's accidents.

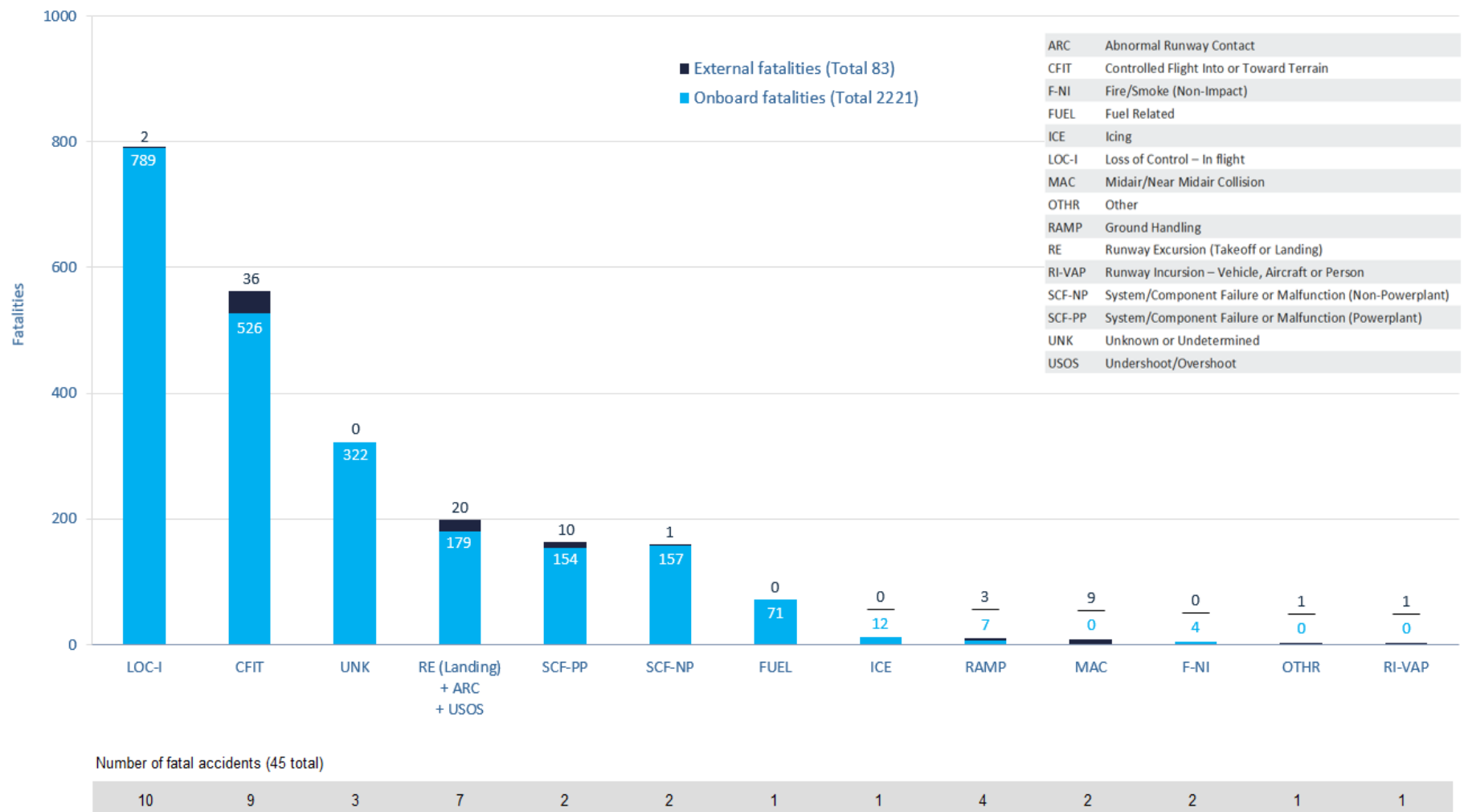
In a separate activity, the CAST assigned each fatal accident to a single principal category. Those accident assignments and a brief description of the categories are reported in the following chart.

The CAST use of principal categories has been instrumental in focusing industry and government efforts and resources on accident prevention. Charts using principal categories are used by CAST to identify changes to historical risk and to help to determine if the safety enhancements put in place are effective.

For a complete description of the categories, go to www.intlaviationstandards.org.

Fatalities by CICTT Aviation Occurrence Categories

Fatal Accidents | Worldwide Commercial Jet Fleet | 2010 through 2019



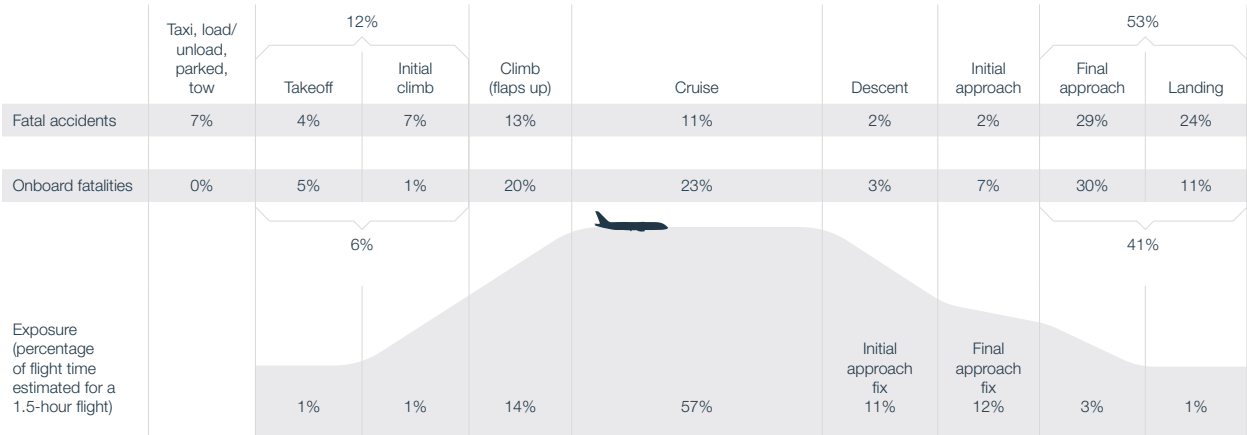
Note: Principal categories as assigned by CAST.
For a complete description of CAST/ICAO Common Taxonomy Team (CICTT) Aviation Occurrence Categories, go to www.intlaviationstandards.org.

Fatal Accidents and Fatalities by Phase of Flight

Worldwide Commercial Jet Fleet 2010 through 2019

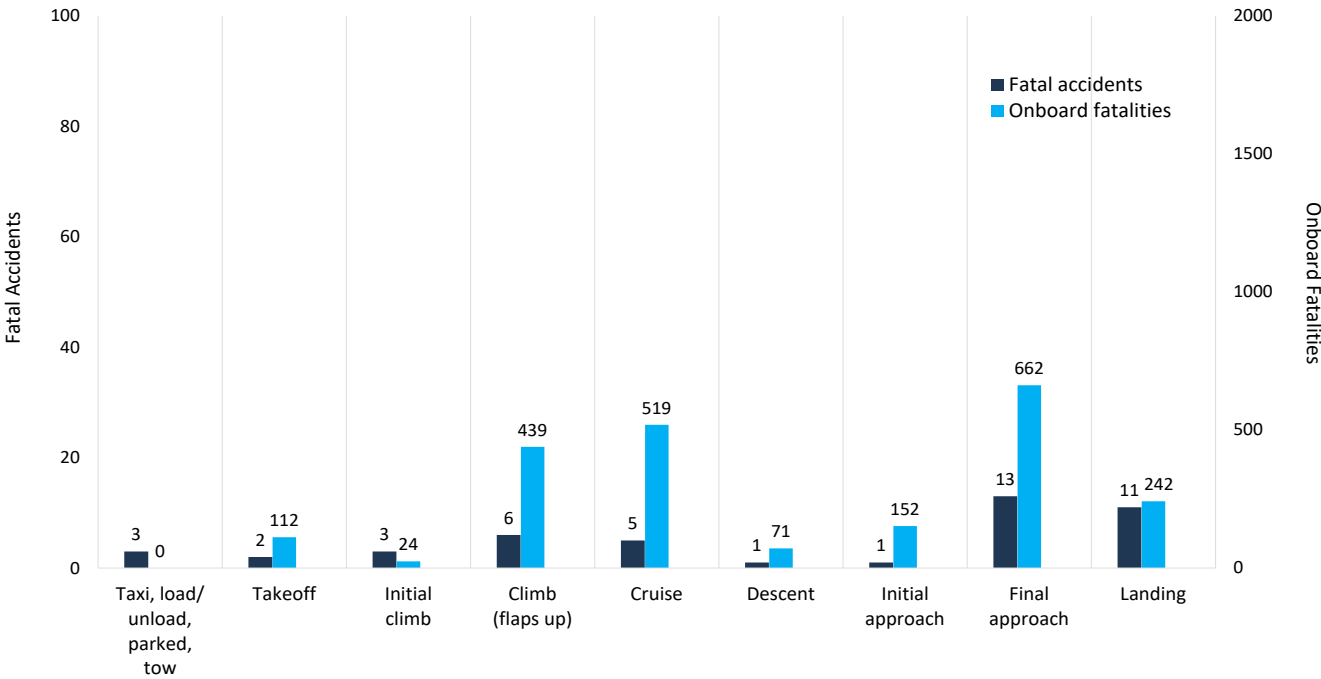
Cruising at altitude is the safest phase of a flight. Around 7 percent of aviation fatalities occur before an airplane leaves the ground, while 12 percent occur during takeoff and initial climb. Over half of all fatalities occur on final approach and landing. Although the actual numbers remain low, most technology improvements over the past few decades have focused on taxiing, climbing, approach, and landing as critical safety factors.

Percentage of fatal accidents and onboard fatalities | 2010 through 2019



Note: Percentages may not sum to 100% because of numerical rounding.

Distribution of fatal accidents and onboard fatalities | 2010 through 2019



About this Document

The accident statistics presented in this summary are confined to worldwide commercial jet airplanes that are heavier than 60,000 pounds maximum gross weight. Within that set of airplanes, there are two groups excluded:

1. Airplanes manufactured in the Commonwealth of Independent States (CIS) or the Union of Soviet Socialist Republics (USSR), excluded because of the lack of operational data.

2. Commercial airplanes operated in military service. (However, if a military-owned commercial jet transport is used for civilian commercial service, those data will be included in this summary.)

The following airplanes are included in the statistics:

Boeing		Airbus	BAE SYSTEMS (Avro)	BAE SYSTEMS (HS)	Embraer	Lockheed
707/720	717	A300	Avro RJ70/85/100	BAe 146	E170/175	L-1011
727	DC-8	A300-600		Comet 4	E190/195	
737	DC-9	A310	BAE SYSTEMS (BAC)	Trident		Dassault Aviation
747	DC-10/MD-10	A320/321/319/318	Concorde		Fokker	Mercure
757	MD-11	A330	One-Eleven	Bombardier	F28	
767	MD-80/-90	A340	VC10	CRJ700/900/1000	F70	General Dynamics
777		A350			F100	(Convair)
787		A380		Aerospatiale		CV-880/-990
717		C Series		Caravelle		

Flight operations data for Boeing airplanes are developed internally from airline operator reports. Flight operations data for non-Boeing airplanes are compiled by Cirium. The source of jet airplane inventory data is Jet Information Services, Inc.

Accident data are obtained, when available, from government accident reports. Otherwise, information is from operators, manufacturers, various government and private information services, and press accounts.

Readers may note that cumulative accident totals from year to year may not exactly correlate with the expected change from the previous year's accidents. This is a result of periodic audits of the entire accident history for updates to the data.

Definitions related to development of statistics in this summary are primarily based on corresponding International Civil Aviation Organization (ICAO), U.S. National Transportation Safety Board (NTSB), and Flight Safety Foundation (FSF) terms, as explained in the next section.

Definitions

Airplane Accident

An occurrence associated with the operation of an airplane that takes place between the time any person boards the airplane with the intention of flight and such time as all such persons have disembarked, in which:

- The airplane sustains substantial damage.
- The airplane is missing or is completely inaccessible. An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.
- Death or serious injury results from:
 - Being in the airplane.
 - Direct contact with the airplane or anything attached thereto.
 - Direct exposure to jet blast.

Excluded Events

- Fatal and nonfatal injuries from natural causes.
- Fatal and nonfatal self-inflicted injuries or injuries inflicted by other persons.
- Fatal and nonfatal injuries of stowaways hiding outside the areas normally available to the passengers and crew.
- Nonfatal injuries resulting from atmospheric turbulence, normal maneuvering, loose objects, boarding, disembarking, evacuation, and maintenance and servicing.
- Nonfatal injuries to persons not aboard the airplane.

The following occurrences are **not** considered airplane accidents: those that are the result of experimental test flights or the result of a hostile action, including sabotage, hijacking, terrorism, and military action.

Note: This is generally consistent with the ICAO and the NTSB definition of an accident. (See the Referenced ICAO and NTSB Definitions section.)

The differences are:

1. The ICAO and NTSB references to “aircraft” were changed to “airplane” and references to propellers and rotors were eliminated.
2. This publication excludes events that result in nonfatal injuries from atmospheric turbulence, normal maneuvering, etc.; nonfatal injuries to persons not aboard the airplane; and any events that result from an experimental test flight or from hostile action, such as sabotage, hijacking, terrorism, and military action.

Note: Within this publication, the term “accident” is used interchangeably with “airplane accident.”

Definitions

Destroyed

The estimated or likely cost of repairs would have exceeded 50 percent of the new value of the airplane had it still been in production at the time of the accident.

Note: This definition is consistent with the FSF definition. NTSB defines “destroyed” as damaged due to impact, fire, or in-flight failures to an extent not economically repairable.

Fatal Injury

Any injury that results in death within 30 days of the accident.

Note 1: This is consistent with both the ICAO and the NTSB definitions.

Note 2: External fatalities include on-ground fatalities as well as fatalities on other aircraft involved.

Major Accident

An accident in which any of three conditions is met:

- The airplane was destroyed.
- There were multiple fatalities.
- There was one fatality and the airplane was substantially damaged.

Note: This definition is consistent with the NTSB definition. It also is generally consistent with FSF, except that the FSF definition specifies that fatalities include only occupants of the airplane. ICAO does not normally define the term “major accident.”

Serious Injury

An injury that is sustained by a person in an accident and that:

- Requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received.
- Results in a fracture of any bone (except simple fractures of fingers, toes, or nose).
- Causes severe hemorrhage, nerve, muscle, or tendon damage.
- Involves injury to any internal organ.
- Involves second- or third-degree burns, or any burns affecting more than five percent of the body surface.
- Involves verified exposure to infectious substances or injurious radiation.

Note: This is generally consistent with the ICAO definition. It is also consistent with the NTSB definition except for the last bullet item, which is not included in the NTSB definition.

Definitions

Substantial Damage

Damage or failure that adversely affects the structural strength, performance, or flight characteristics of the airplane, and that would normally require major repair or replacement of the affected component.

Substantial damage is **not** considered to be:

- Engine failure or damage limited to an engine, if only one engine fails or is damaged.
- Bent fairings or cowlings.
- Dents in the skin.
- Small puncture holes in the skin.
- Damage to wheels.
- Damage to tires.
- Damage to flaps.
- Damage to engine accessories.
- Damage to brakes.
- Damage to wingtips.

Note 1: This definition is generally consistent with the NTSB definition of substantial damage except it (1) deletes reference to “small puncture holes in the fabric” and “ground damage to rotor or propeller blades,” and (2) deletes “damage to landing gear” from the list of items not considered to be substantial damage.

Note 2: ICAO does not define the term “substantial damage.” Still, the above definition is generally consistent with the ICAO definition of damage or structural failure contained within part (B) of the ICAO accident definition.

Note 3: Boeing does not consider damage to be substantial if repairs to an event airplane enable it to be flown to a repair base within 48 hours of the event.

Boeing Terms*

Accident Rates

In general, this expression is a measure of accidents per million departures. Departures (or flight cycles) are used as the basis for calculating rates because there is a stronger statistical correlation between accidents and departures than there is between accidents and flight hours, or between accidents and the number of airplanes in service, or between accidents and passenger miles or freight miles. Airplane departures data are continually updated and revised as new information and estimating processes become available. These form the baseline for the measure of accident rates and, as a consequence, rates may vary between editions of this publication.

Airplane Collisions

Events involving two or more airplanes are counted as separate events, one for each airplane. For example, destruction of two airplanes in a collision is considered to be two separate accidents.

Fatal Accident

An accident that results in fatal injury.

Hull Loss

Airplane totally destroyed or damaged and not repaired. Hull loss also includes, but is not limited to, events in which

- The airplane is missing. An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.
- The airplane is completely inaccessible.

*The terms on this page were created by Boeing for this publication and do not have corresponding equivalents in ICAO or NTSB.

Exclusions^{*}

Excluded Airplanes

Airplanes manufactured in the Commonwealth of Independent States (CIS) or the Union of Soviet Socialist Republics (USSR) are excluded because of the lack of operational data. Commercial airplanes operated in military service are generally excluded. (If a military-owned commercial jet transport is used for civilian commercial service, those data are included in this summary.)

Excluded Events

- Fatal and nonfatal injuries from natural causes.
- Fatal and nonfatal self-inflicted injuries or injuries inflicted by other persons.
- Fatal and nonfatal injuries of stowaways hiding outside the areas normally available to the passengers and crew.
- Nonfatal injuries resulting from atmospheric turbulence, normal maneuvering, loose objects, boarding, disembarking, evacuation, and maintenance and servicing.
- Nonfatal injuries to persons not aboard the airplane.
- Experimental test flights. (However, maintenance test flights, ferry, positioning, training, and demonstration flights are not excluded.).
- Sabotage, hijacking, terrorism, and military action.

^{*}Certain airplanes and events are excluded from consideration as accidents in this summary. This is a complete list of those exclusions.

Referenced ICAO and NTSB Definitions*

Accident

ICAO defines an “accident” as follows:

Accident. An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

A. A person is fatally or seriously injured as a result of:

- Being in the aircraft, or
- Direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
- Direct exposure to jet blast, *except* when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew.

B. The aircraft sustains damage or structural failure which:

- Adversely affects the structural strength, performance, or flight characteristics of the aircraft, and
- Would normally require major repair or replacement of the affected component, except for engine failure or damage, when the damage is limited to a single engine (including its cowlings or accessories), to propellers, wingtips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes), or for minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome).

C. The aircraft is missing or is completely inaccessible.

NTSB defines an “aircraft accident” as follows:

Aircraft accident means an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage. For purposes of this part, the definition of “aircraft accident” includes “unmanned aircraft accident,” as defined in 49 CFR 830.2.

*International Civil Aviation Organization (ICAO) and National Transportation Safety Board (NTSB) definitions are included below for reference.

Referenced ICAO and NTSB Definitions*

Serious Injury

ICAO defines “serious injury” as follows:

Serious Injury. An injury that is sustained by a person in an accident and which:

- A.** Requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or
- B.** Results in a fracture of any bone (except simple fractures of fingers, toes or nose); or
- C.** Involves lacerations that cause severe hemorrhage, nerve, muscle, or tendon damage; or
- D.** Involves injury to any internal organ; or
- E.** Involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface; or
- F.** Involves verified exposure to infectious substances or injurious radiation.

NTSB defines “serious injury” as follows:

Serious injury means any injury that

- 1.** Requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received;
- 2.** Results in a fracture of any bone (except simple fractures of fingers, toes, or nose);
- 3.** Causes severe hemorrhages, nerve, muscle, or tendon damage;
- 4.** Involves any internal organ; or
- 5.** Involves second- or third-degree burns, or any burns affecting more than five percent of the body surface.

Substantial Damage

NTSB defines “substantial damage” as follows:

Substantial damage means damage or failure that adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Engine failure or damage limited to an engine if only one engine fails or is damaged, bent fairings or cowling, dented skin, small puncture holes in the skin or fabric, ground damage to rotor or propeller blades, and damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wingtips are not considered “substantial damage” for the purpose of this part.

ICAO does not define the term “substantial damage.”

Notes

