



Statistical Summary of Commercial Jet Airplane Accidents

Worldwide Operations | 1959 – 2018

50th Edition

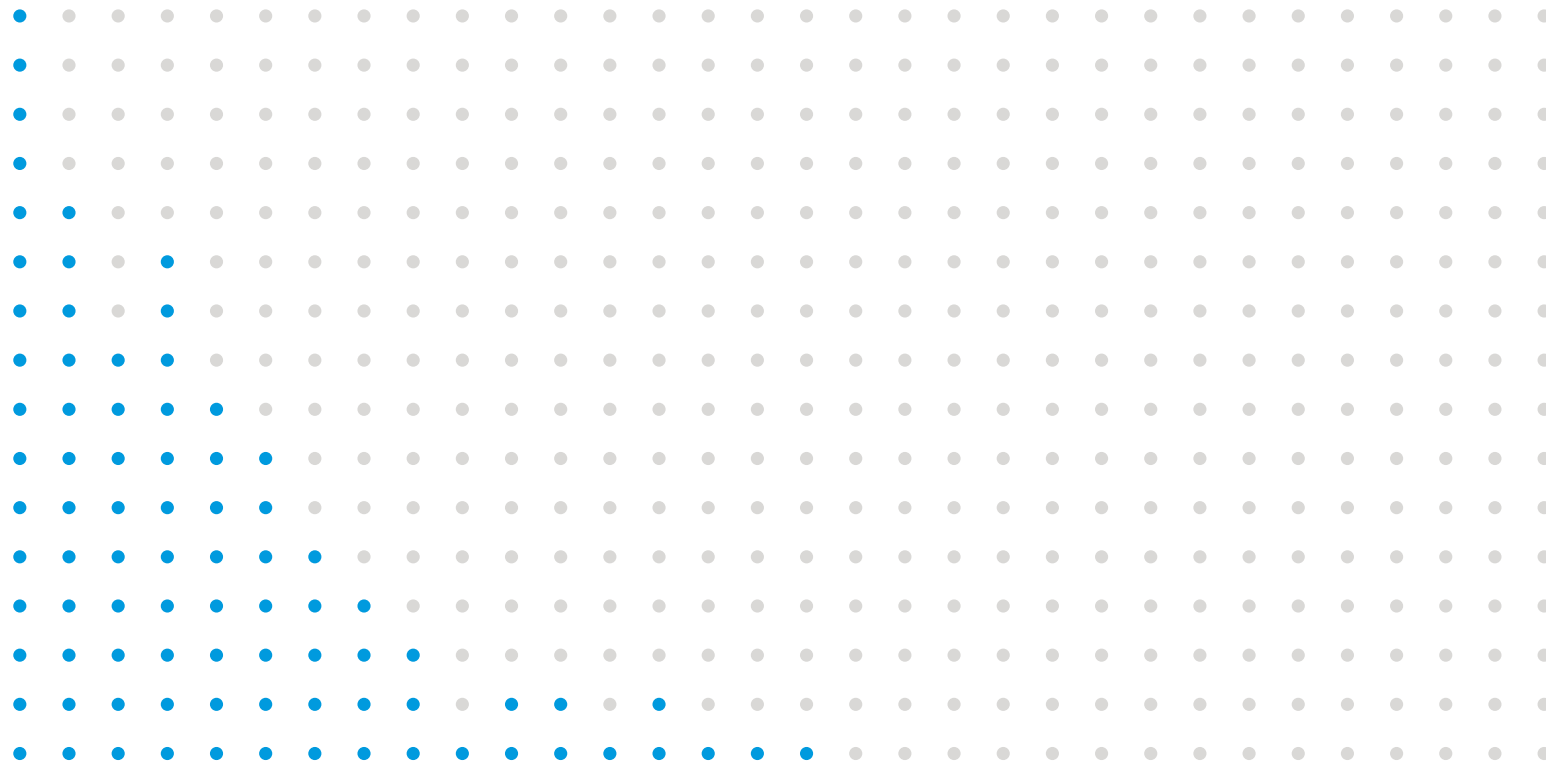


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In 1969, Boeing published its first Statistical Summary of Commercial Jet Airplane Accidents with charts, graphs, and statistics reflecting the first 10 years of the jet age. The data revealed that within a decade air travel progressed to become a refined, comfortable experience—increasingly viable, safe, and accessible. The data also revealed that we still had more work to do.

Today, advances in the use of data continue to play a role in improving the industry’s approach to safety, allowing us to be more proactive in assessing and solving issues. This includes big data streaming in from in-flight telemetry, air traffic surveillance, and weather, along with in-service safety reports. These advancements provide actionable intelligence like activity tracking, anomaly and event detection, and real-time situational awareness to those flying and to the support teams on the ground.

Data is the ultimate form of transparency. It helps us analyze and understand risks and identify where changes are needed. Data communicates the truth; integrity reveals how hard you’re willing to fight for it. The way forward will continue to rely on data, as well as on the enduring integrity of Boeing and our industry to maintain safety as our top priority.

This is the 50th edition of our Statistical Summary and you will notice that it looks a little different than previous issues. We have included highlights from the past sixty years of commercial aviation, we describe what’s on the horizon for aviation safety, and we have called out some of the more compelling historical statistics and stories. Mostly, though, the data is left to speak for itself. Because, as the first Statistical Summary revealed 50 years ago, data is where we find the truth about how far we’ve come and how far we have to go.

Beth Pasztor

Vice President, Safety and Regulatory Compliance
Boeing Commercial Airplanes

Statistical Summary 2018

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.

2018 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
5-Jan-18	WestJet	737-800 (4)	Sched Pax	Toronto, Canada	Taxi	The airplane was struck by another airplane under tow. A fire broke out in the area of the APU. The passengers evacuated. Both airplanes sustained damage. Minor injuries were reported.	Substantial				
6-Jan-18	Kuwait Airways	777-300 (2)	Sched Pax	New York, USA	Tow	While taxiing, the airplane collided with another airplane. There were no reported injuries.	Substantial				
13-Jan-18	Pegasus Airlines	737-800 (6)	Sched Pax	Trabzon, Turkey	Landing	After landing, the airplane veered off the runway. Damage resulted in a hull loss. There were no reported injuries.	Substantial	X			
20-Feb-18	Dana Airlines	MD-83 (28)	Sched Pax	Port Harcourt, Nigeria	Landing	After landing, the airplane overran the end of the runway. Damage resulted in a hull loss. There were no reported injuries.	Substantial	X			
4-Mar-18	Serve Air	737-300 (30)	Charter Cargo	Lubumbashi, The Democratic Republic Congo	Landing	The airplane landed and veered off the runway. The airplane sustained damage. There were no reported injuries.	Substantial	X			
27-Mar-18	easyJet	A319 (15)	Sched Chargo	Murcia, Spain	Takeoff	During the takeoff several birds impacted against aircraft engines. As a result of this both engines stopped. The crew rejected the takeoff and the airplane stopped on the runway. Substantial damage to both engines. There were no reported injuries.	Substantial				
28-Mar-18	Germania	737-700 (10)	Sched Pax	Tel Aviv, Israel	Tow	The airplane struck another airplane during pushback. Both airplanes received substantial damage. There were no reported injuries.	Substantial				
28-Mar-18	El Al Israel Airlines	767-300 (22)	Sched Pax	Tel Aviv, Israel	Tow	The airplane struck another airplane during pushback. Both airplanes received substantial damage. There were no reported injuries.	Substantial	X			
1-Apr-18	Vietnam Airlines	A321 (13)	Sched Pax	Hanoi, Viet Nam	Final Approach	It was reported there was a tail strike on landing. There was substantial damage. There were no reported injuries.	Substantial				
17-Apr-18	Southwest Airlines	737-700 (18)	Sched Pax	Philadelphia, USA	Climb	The number one engine was damaged during climb. A passenger window was broken and the cabin lost pressure. There was one fatality and a number of minor injuries.	Minor		Fatal	1/148 (0)	
20-Apr-18	Caribbean Sun Airlines	MD-83 (26)	Sched Pax	Alexandria, USA	Landing	During landing, the right main landing gear collapsed and the airplane came to a stop on the runway. There was substantial damage. There were no reported injuries.	Substantial	X			
29-Apr-18	Lion Air	737-800 (5)	Sched Pax	Gorontalo, Indonesia	Landing	The airplane landed then veered left off the runway, receiving substantial damage. There were no reported injuries.	Substantial				
30-Apr-18	Ryanair	737-800 (1)	Sched Pax	Stansted, United Kingdom	Taxi	During a taxi procedure, the elevator of the airplane contacted a blast fence causing substantial damage to the airplane. There were no reported injuries.	Substantial				
4-May-18	BoA	737-300 (20)	Sched Pax	Buenos Aires, Argentina	In Flight	Airplane was damaged by hail during flight resulting in hull loss. There were no reported injuries.	Substantial	X			
12-May-18	Air Niugini	737-800 (14)	Sched Pax	Port Moresby, Papua New Guinea	Parked	The right winglet of an airplane was contacted by another aircraft while taxiing, resulting in substantial damages. There were no reported injuries.	Substantial	X			
13-May-18	Asiana Airlines	A330 (10)	Sched Pax	Istanbul, Turkey	Taxi	An airplane wing collided with the tail of another while taxiing, causing substantial damage to the parked airplane. There were no reported injuries.	Substantial				
18-May-18	Aerolineas Damojh, S.A. de C.V	737-200 (39)	Sched Pax	Havana, Cuba	Takeoff	The airplane impacted the ground after takeoff in poor weather conditions. There were 112 fatalities and one survivor with severe injuries.	Destroyed	X	Fatal	112/113 (0)	X
21-May-18	Onur Air	A330 (16)	Sched Pax	Jeddah, Saudi Arabia	Climb	Airplane landed with nose landing gear retracted. There were minor injuries.	Substantial				

2018 Airplane Accidents | Worldwide Commercial Jet Fleet (cont.)

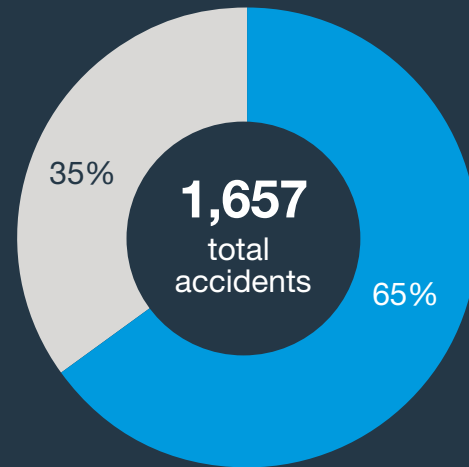
Event Date	Airline	Model (Age in Years)	Type of Operation	Accident Location	Phase of Flight	Event Description	Damage Category	Hull Loss	Injury Category	Onboard Fatalities / Occupants (External Fatalities)	Major Accident
25-May-18	Jayawijaya Dirgantara	737-200C (44)	Charter Cargo	Wamena, Indonesia	Landing	The airplane landed and veered off to the right of the runway into soft ground, receiving substantial damage. There were no reported injuries.	Substantial	X			
8-Jun-18	Skyjet	BAe 146-100 (31)	Sched Pax	Busuanga, Philippines	Landing	The airplane landed and overran the end of the runway. There was complete hull loss. There were no injuries reported.	Substantial	X			
11-Jun-18	Swift Air LLC	737-800 (12)	Sched Chargo	Heraklion, Greece	Landing	Tail strike occurred during landing, resulting in substantial damage to the fuselage. There were no reported injuries.	Substantial				
14-Jun-18	Bravo Airways	MD-83 (27)	Sched Pax	Kiev, Russia	Landing	The airplane landed, veered off the runway and sustained heavy damage. There were no reported injuries.	Substantial	X			
27-Jul-18	Atlas Air	767-300 (27)	Sched Chargo	Portsmouth, USA	Landing	The airplane landed hard and sustained damage. There were no reported injuries.	Substantial				
31-Jul-18	Aeromexico	ERJ 190 (10)	Sched Pax	Durango, Mexico	Takeoff	The airplane impacted the terrain shortly after takeoff and caught fire. There were 14 serious injuries.	Destroyed	X	Serious		X
5-Aug-18	American Airlines	757-200 (17)	Sched Pax	Tulsa, USA	Landing	The airplane incurred tail strike damage. There were no reported injuries.	Substantial				
9-Aug-18	Royal Air Maroc	787-8 (2)	Sched Pax	Istanbul, Turkey	Taxi	The airplane's right wing tip impacted the underside of the tail section of another airplane while on the taxiway. No injuries were reported.	Substantial				
13-Aug-18	Hawaiian Airlines	A321 (2)	Sched Pax	Los Angeles, USA	Landing	The airplane suffered tail strike upon landing, resulting in substantial damage. There were no reported injuries.	Substantial				
16-Aug-18	Xiamen Airlines	737-800 (9)	Sched Pax	Manila, Philippines	Landing	The airplane landed then veered off the runway, resulting in substantial damage. There were no injuries reported.	Substantial				
28-Aug-18	Capital Airlines	A320 (7)	Sched Pax	Macau, China	Landing	During landing the airplane's nose landing gear broke, resulting in substantial damage. There were no reported injuries.	Substantial				
31-Aug-18	Utair	737-800 (16)	Sched Pax	Sochi, Russia	Landing	The airplane landed, overran the runway and caught fire. There were no reported injuries.	Destroyed	X			X
6-Sep-18	American Airlines	757-200 (17)	Sched Pax	New York, USA	Descent	During descent, the airplane experienced a sudden drop before normal flight resumed. There were two injuries reported.	None		Serious		
24-Sep-18	Philippine Airlines	A340 (20)	Sched Pax	Vancouver, Canada	Takeoff	The airplane impacted the runway after takeoff, resulting in substantial damage. There were no reported injuries.	Substantial				
27-Sep-18	Air Niugini	737-800 (14)	Sched Pax	Chuuk, Federated States of Micronesia	Landing	The airplane landed short of the runway resulting in hull loss. There was one fatality reported.	Destroyed	X	Fatal	1/48 (0)	X
8-Oct-18	THAI	747-400 (15)	Sched Pax	Bangkok, Thailand	Landing	The airplane landed then slid off the runway resulting in substantial loss. There were no reported injuries.	Substantial	X			
12-Oct-18	Air India Express	737-800 (9)	Sched Chargo	Mumbai, India	Takeoff	The airplane contacted the localizer antenna array and airport perimeter fence and wall. Damage to the underside of the airplane was substantial. No injuries were reported.	Substantial				
29-Oct-18	Lion Air	737-8 (0)	Sched Pax	Jakarta, Indonesia	Climb	During climb, control of the airplane was lost and it impacted the sea. There were 189 fatalities.	Destroyed	X	Fatal	189/189 (0)	X
31-Oct-18	Air France	A330 (17)	Sched Pax	Paris, France	Taxi	The airplane suffered a ground collision. There were no reported injuries.	Substantial				

2018 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
7-Nov-18	Skylease Cargo	747-400F (22)	Sched Chargo	Halifax, Canada	Landing	The airplane overran the runway during landing resulting in substantial loss. There were minor injuries reported.	Destroyed	X			X
9-Nov-18	Fly Jamaica	757-200 (19)	Sched Pax	Georgetown, Guyana	Landing	The airplane turned back, landed and went off the runway. One passenger died a week after the accident and that fatality may be attributable to the accident.	Destroyed	X	Fatal	0/126 (1)	X
22-Nov-18	Peruvian Air Line S.A.	737-500 (28)	Sched Pax	La Paz, Bolivia	Landing	The airplane landed and experienced collapse of landing gear resulting in substantial damage. There were no reported injuries.	Substantial	X			
10-Dec-18	Air Canada	777-300ER (12)	Sched Pax	Hong Kong, China	Landing	The airplane experienced a tail strike on landing resulted in substantial damage. There were no reported injuries.	Substantial				
41	Total Accidents							19		303 Onboard (1 External)	7

Accident Summary by Injury and Damage

1959 – 2008



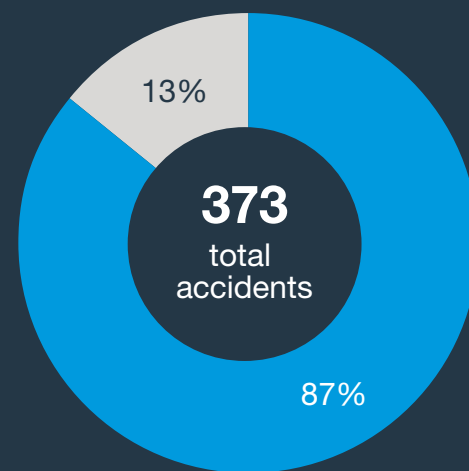
• **1,076 Non-fatal accidents**

- 405 with hull loss
- 617 with substantial hull damage
- 54 without substantial hull damage

• **581 Fatal accidents**

- 471 with hull loss
- 25 with substantial hull damage
- 85 without substantial hull damage

2009 – 2018



• **322 Non-fatal accidents**

- 96 with hull loss
- 208 with substantial hull damage
- 18 without substantial hull damage

• **51 Fatal accidents**

- 41 with hull loss
- 2 with substantial hull damage
- 8 without substantial hull damage

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.

Departures, Flight Hours, and Jet Airplanes in Service*

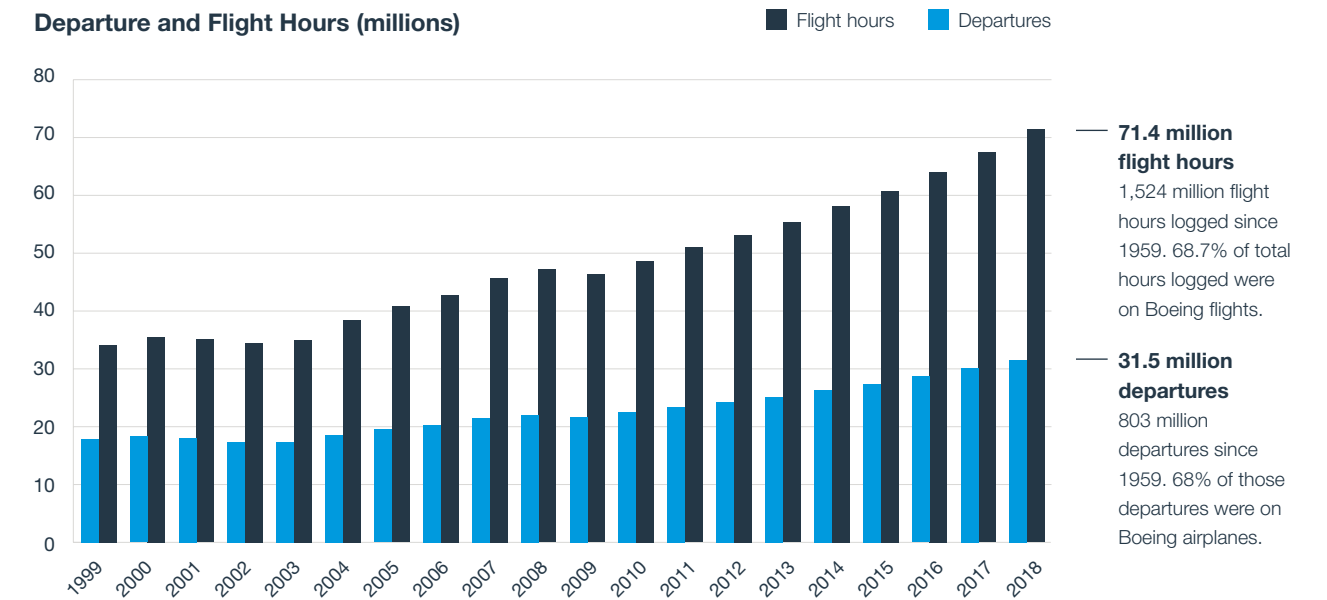
Worldwide Commercial Jet Fleet 1999 through 2018

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.

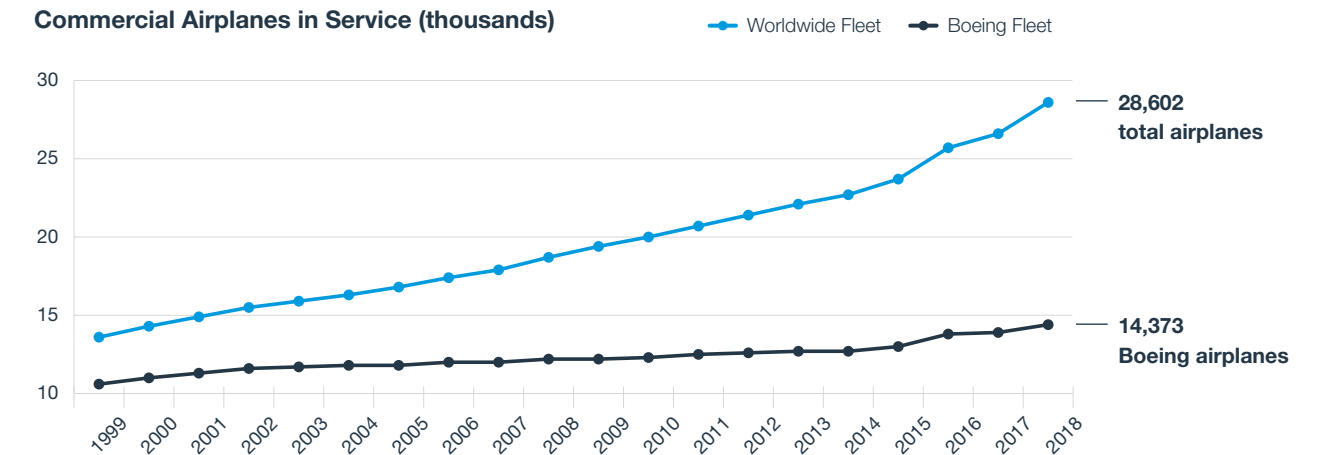
52% of commercial airplanes flying today were made by Boeing.

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 traffic 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	
	1959–2018	2009–2018	1959–2018	2009–2018	1959–2018	2009–2018	1959–2018	2009–2018
Passenger	1,619	308	506	37	29,840 (804)	2,396 (29)	747	99
• Scheduled	1,496	293	459	35	25,643	2,313	676	94
• Charter	123	15	47	2	4,197	83	71	5
Cargo	288	57	82	13	282 (385)	44 (56)	191	33
Maintenance test, ferry, positioning, training, and demonstration	123	8	44	1	208 (66)	7 (0)	75	5
Total	2,030	373	632	51	30,330 (1,255)	2,447 (85)	1,013	137

U.S. / Canada vs. Rest of world

Type of Operation	All Accidents		Fatal Accidents		Onboard Fatalities (External Fatalities)*		Hull-Loss Accidents	
	1959–2018	2009–2018	1959–2018	2009–2018	1959–2018	2009–2018	1959–2018	2009–2018
U.S. and Canadian operators	590	62	183	8	6,203 (381)	26 (2)	236	21
Rest of the world	1,440	311	449	43	24,127 (874)	2,421 (83)	777	116
Total	2,030	373	632	51	30,330 (1,255)	2,447 (85)	1,013	137

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

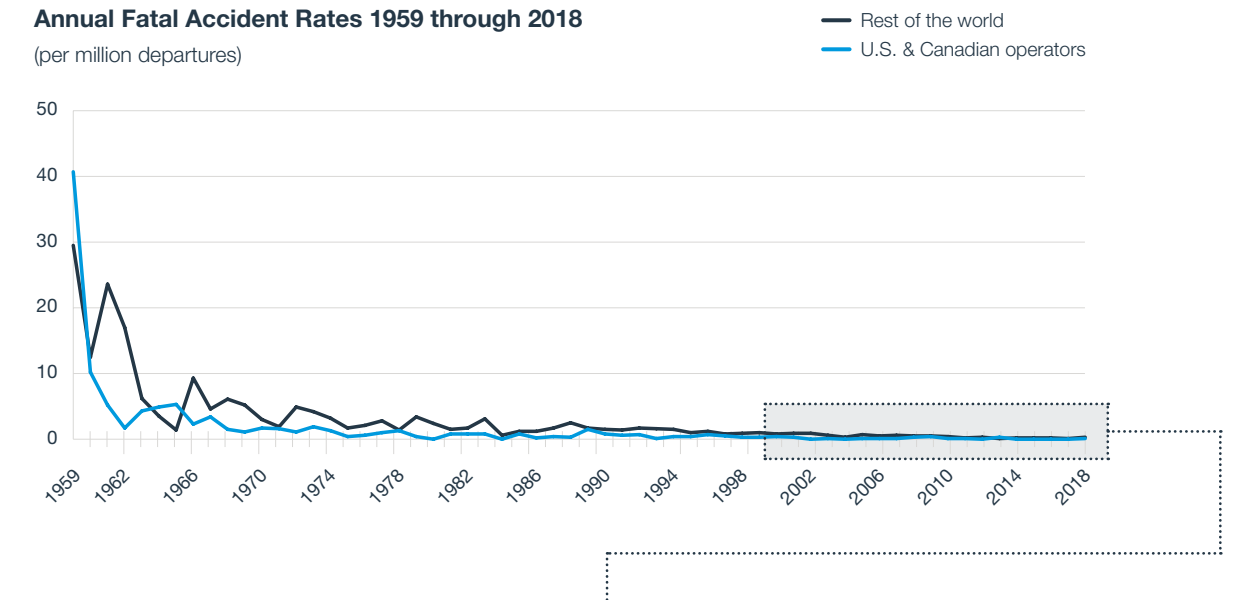
U.S. and Canadian Operator Accident Rates by Year

Fatal Accidents | Worldwide Commercial Jet Fleet 1999 through 2018

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.

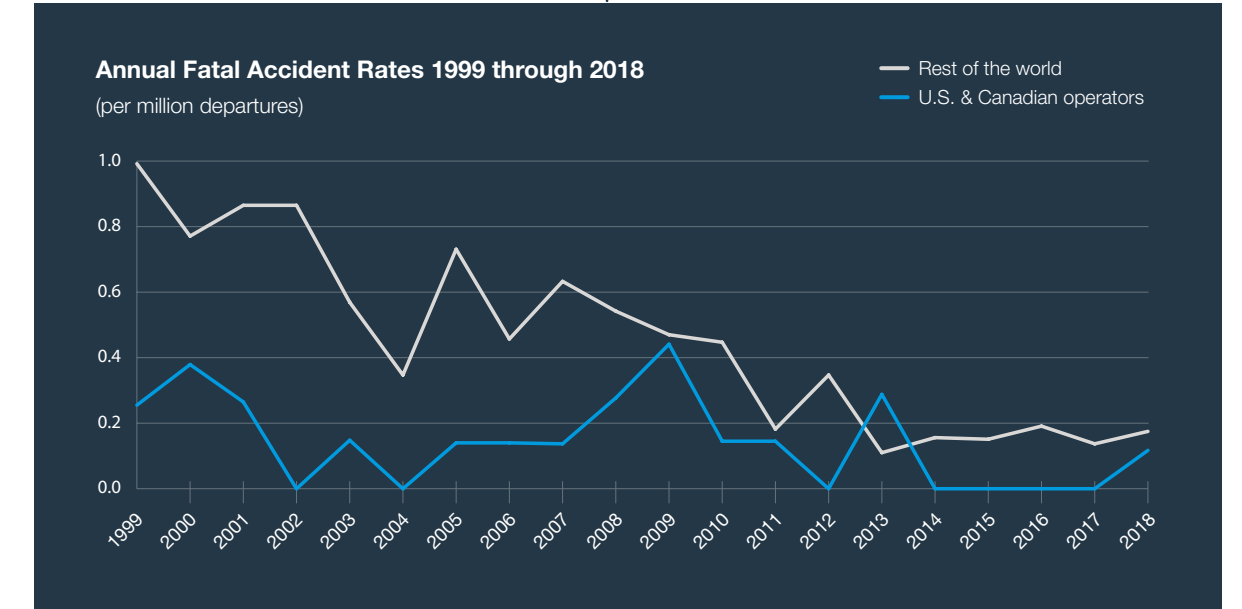
Annual Fatal Accident Rates 1959 through 2018

(per million departures)



Annual Fatal Accident Rates 1999 through 2018

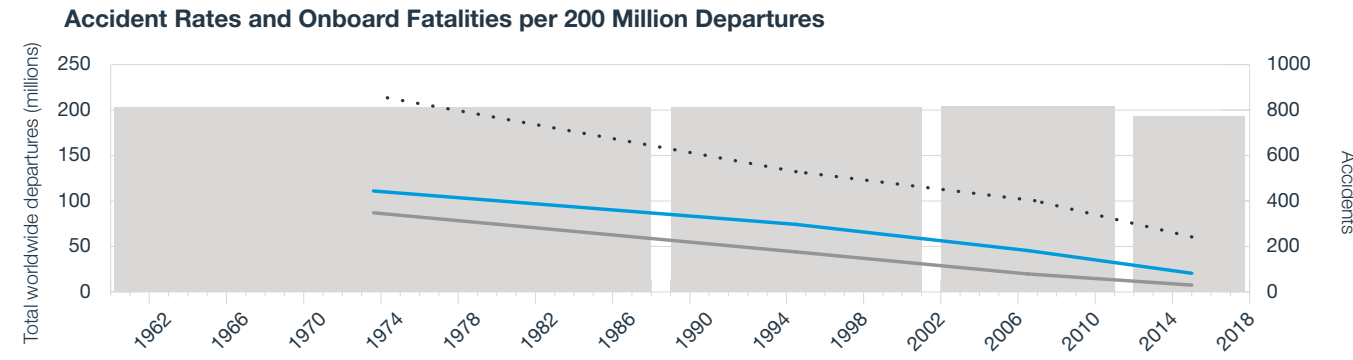
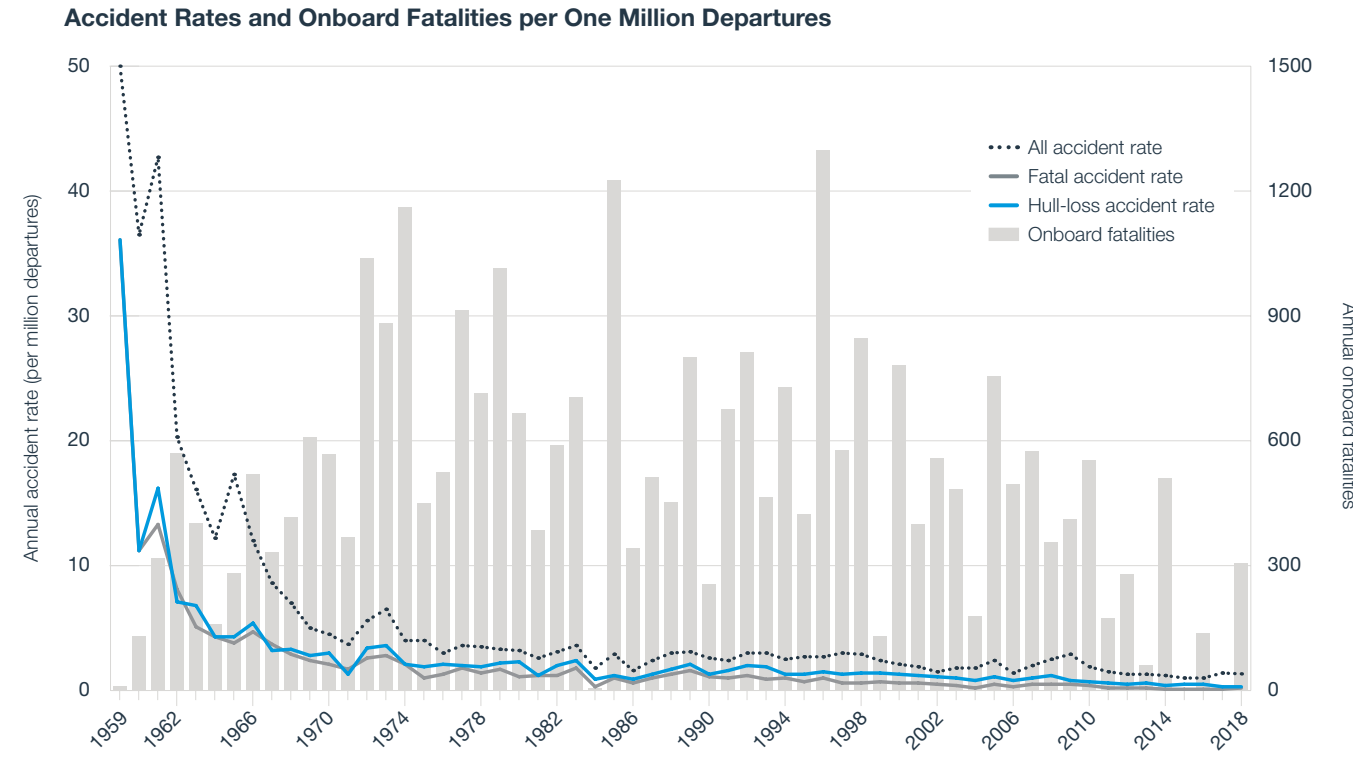
(per million departures)



Accident Rates and Onboard Fatalities by Year

Worldwide Commercial Jet Fleet 1959 through 2018

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.

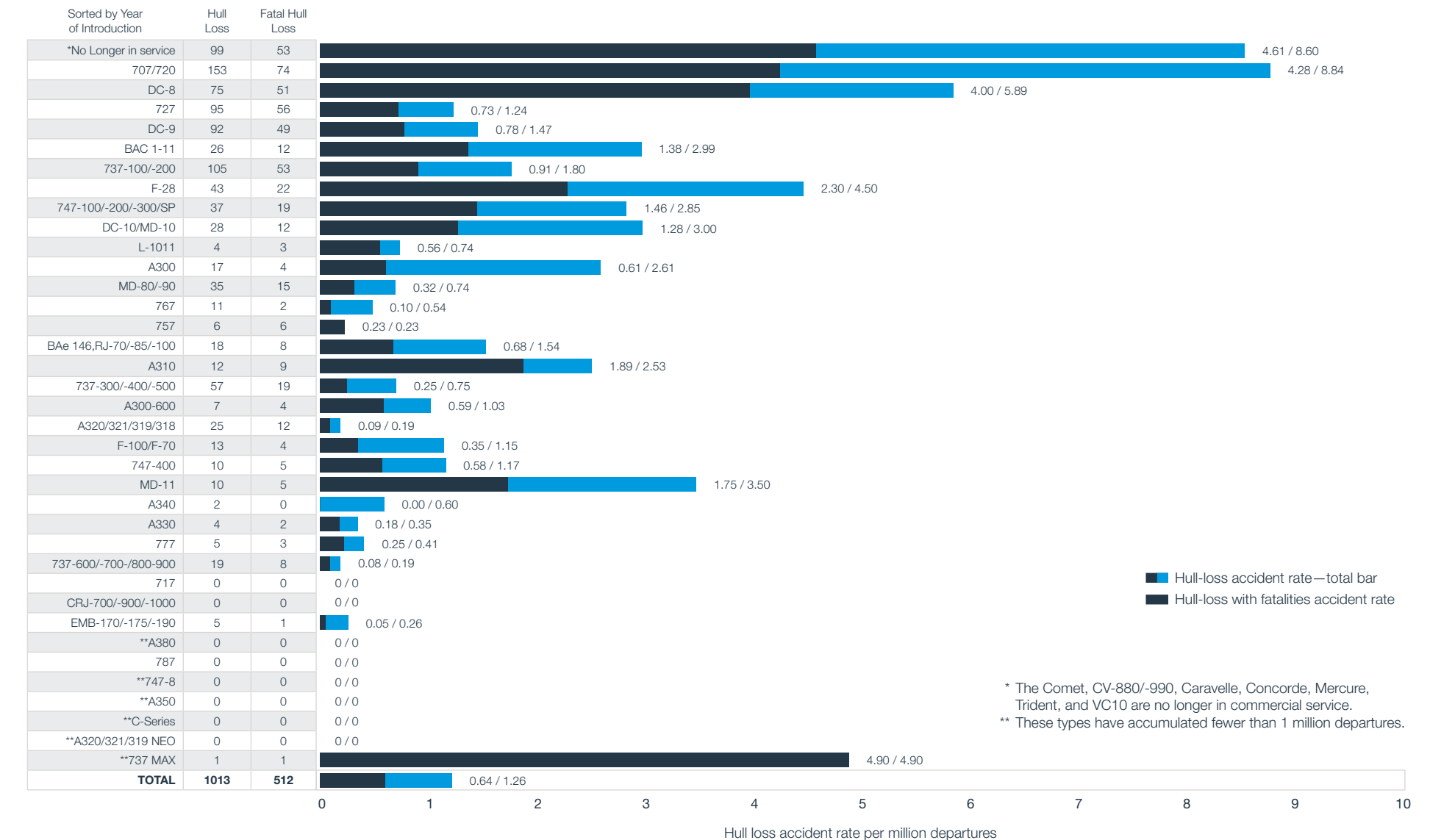


Viewing accident rates against departures is a meaningful way to measure advances in aviation safety. Over the past 60 years, hull losses and onboard fatalities have declined dramatically while the number of airplanes in the air continues to rise.

..... All accidents
 — Hull-loss accidents
 — Fatal accidents
 ■ Total worldwide departures (M)

Accident Rates by Airplane Type

Hull Loss Accidents | Worldwide Commercial Jet Fleet | 1959 - 2018



* The Comet, CV-880/-990, Caravelle, Concorde, Mercure, Trident, and VC10 are no longer in commercial service.
** These types have accumulated fewer than 1 million departures.

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.

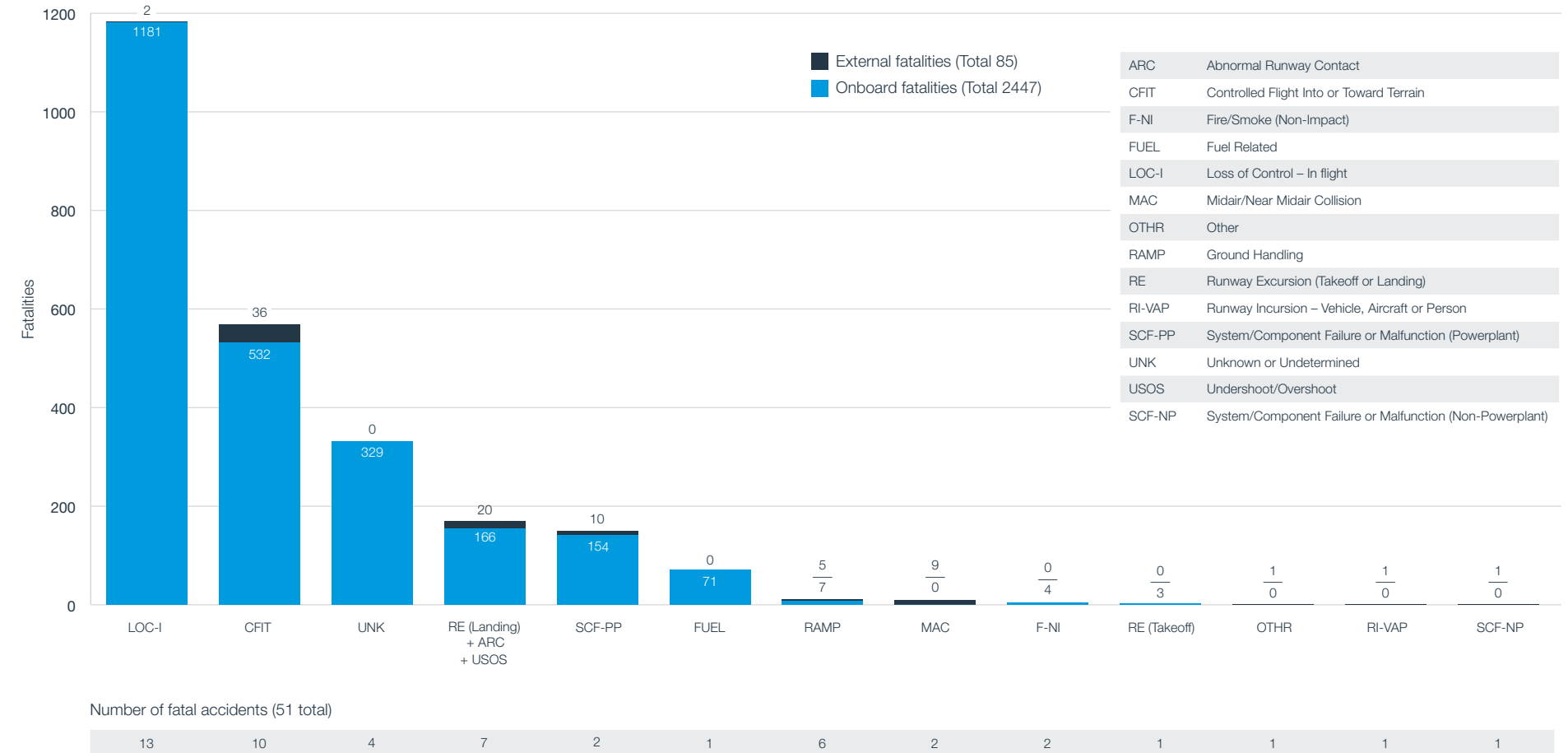
In a separate activity, the CAST assigned each fatal accident to a single principal category. Those accident assignments and a brief description of the categories are reported in the following chart.

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 | 2009 through 2018



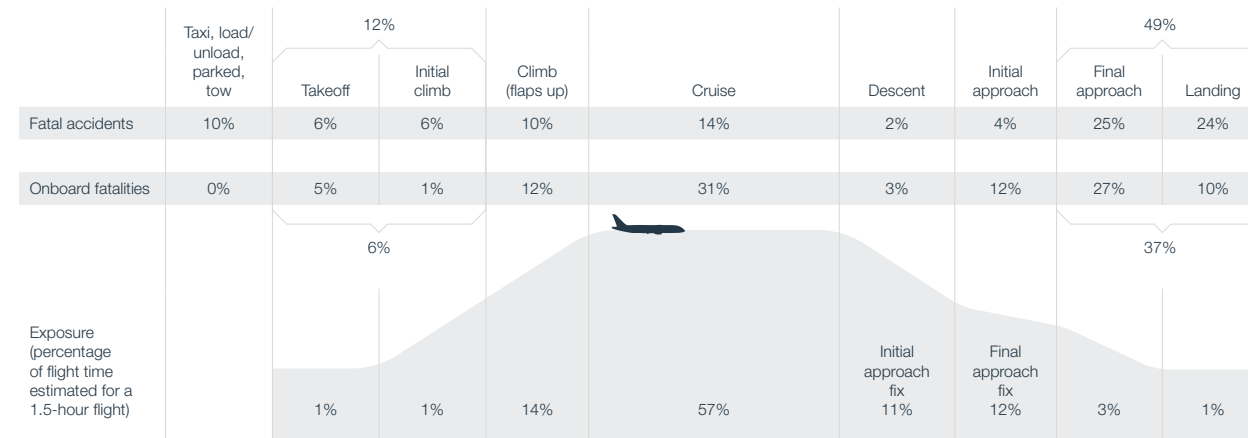
Note: Principal categories as assigned by CAST. For a complete description of CAST/ICAO Common Taxonomy Team (CICTT) Aviation Occurrence Categories, go to www.intlaviationstandards.org.

Fatal Accidents and Fatalities by Phase of Flight

Worldwide Commercial Jet Fleet 2009 through 2018

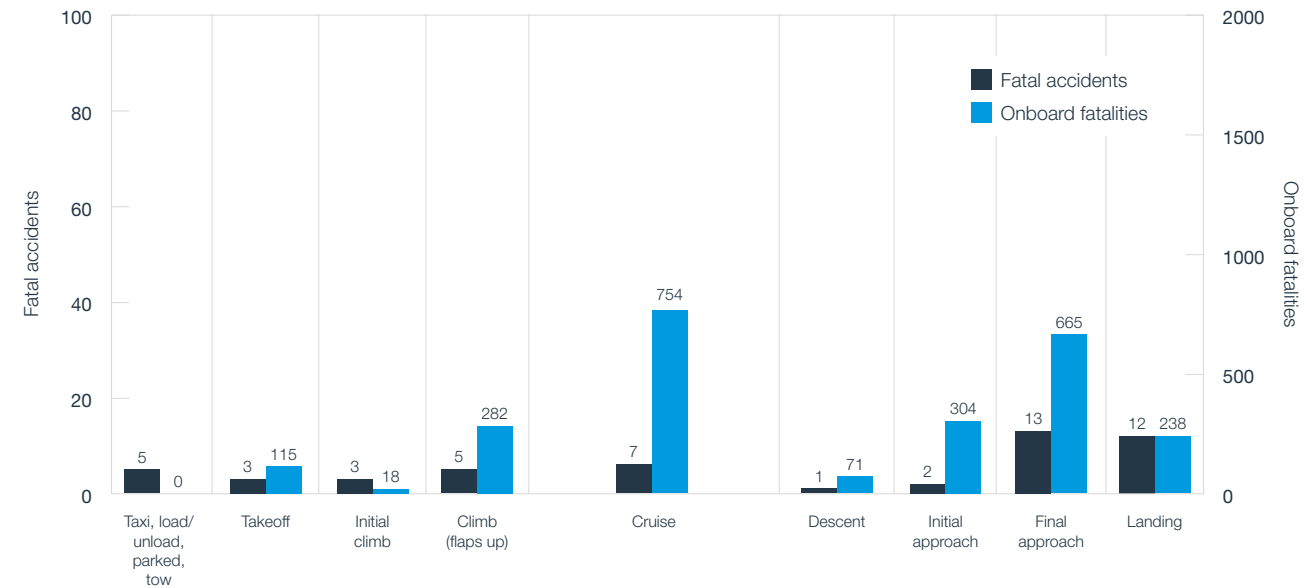
Cruising at altitude is the safest phase of a flight. Around 10 percent of aviation fatalities occur before an airplane leaves the ground, while 12 percent occur during takeoff and initial climb. Nearly half of all fatalities occur on final approach and landing. Although the actual numbers remain low, 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 | 2009 through 2018



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

Distribution of fatal accidents and onboard fatalities | 2009 through 2018



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	DC-8	A300	BAe 146	E170/175	L-1011
727	DC-9	A300-600	Comet 4	E190/195	
737	DC-10/MD-10	A310	Trident		Dassault Aviation
747	MD-11	A320/321/319/318	Concorde	Fokker	Mercure
757	MD-80/-90	A330	One-Eleven	F28	
767		A340	VC10	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 from <https://www.cirium.com> 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.

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.

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.

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.”

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

Notes



Notes



