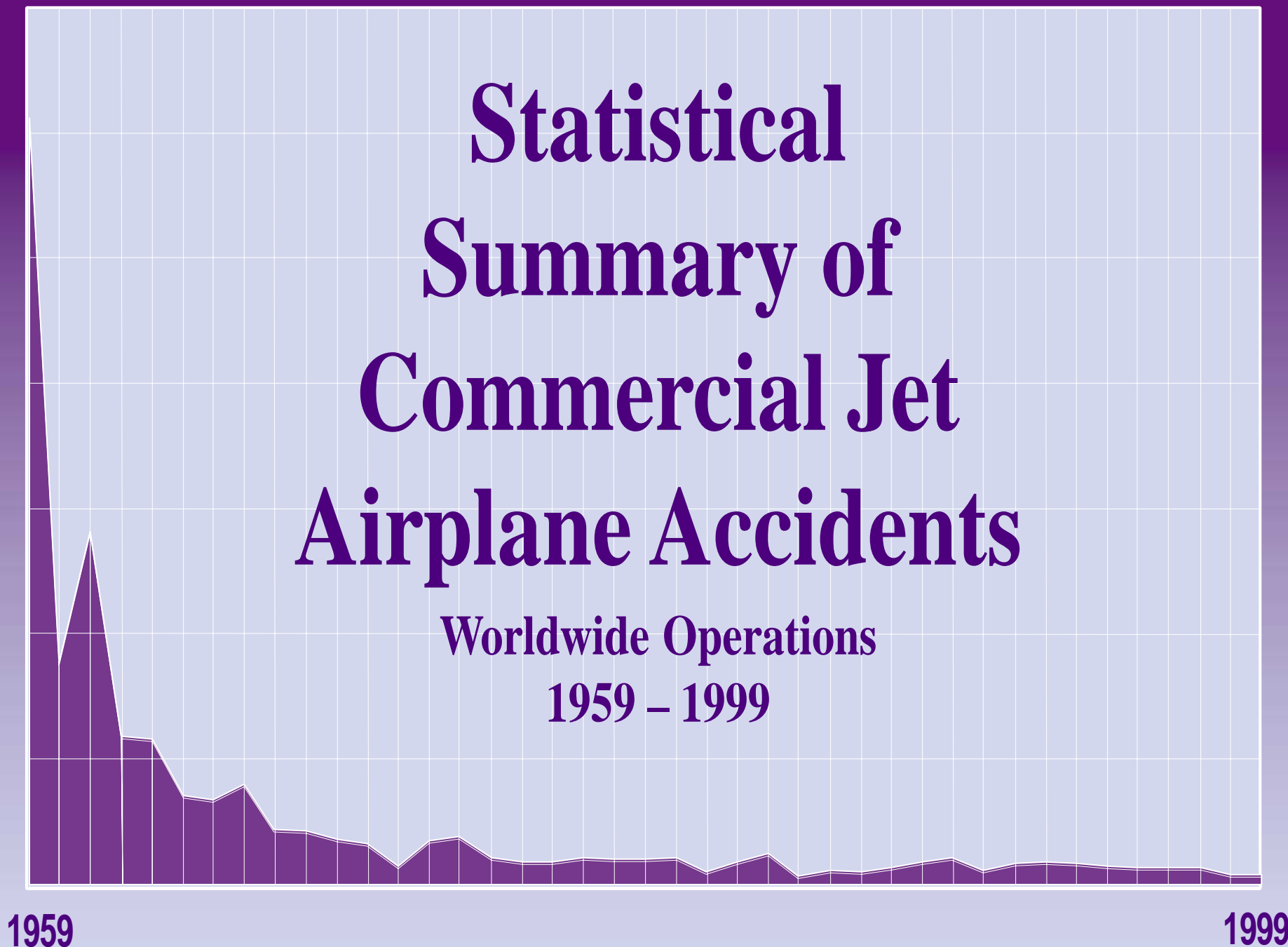


# Statistical Summary of Commercial Jet Airplane Accidents

Worldwide Operations  
1959 – 1999



# Contents

Introduction .....	3
Definitions .....	4
Terms and Exclusions .....	6
Airplane Accidents .....	7
Excluded Events .....	8
Departures, Flight Hours, and Jet Airplanes in Service .....	10
Accident Summary by Type of Operation .....	11
Accident Summary by Damage and Injury .....	12
Accident Rates and Fatalities by Year .....	13
Accident Rates by Years Following Introduction .....	14
U.S.A. and Canadian Operators Accident Rates .....	15
Accident Rates by Type of Operation .....	16
Accident Rates by Airplane Type .....	17
Accident Categories by Airplane Generation .....	18
Fatalities by Accident Categories .....	19
Accidents and Onboard Fatalities by Phase of Flight .....	20
Accidents by Primary Cause .....	21
Takeoff Accidents by Event Descriptor .....	22
Landing Accidents by Event Descriptor .....	23

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# Introduction

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The accident statistics presented in this document apply to worldwide commercial jet airplanes that are heavier than 60,000 pounds maximum gross weight with the following exceptions:

- Airplanes manufactured in the Commonwealth of Independent States (CIS) (former Soviet Union) are excluded because of the lack of operational data.
- Commercial airplanes in military service are excluded.

The following airplane types are included:

717	DC-8	A300	BAe 146	F-28	Concorde	L-1011	BAC 1-11	>Comet 4
707	DC-9	A300-600	RJ-70*	F-70				>Trident
720	DC-10	A310	RJ-85*	F-100				>Caravelle
727	MD-11	A320/319/321	RJ-100*					>Mercure
737	MD-80	A330	CRJ					>CV-880/990
747	MD-90	A340						>VC-10
757								
767								
777								

\* Included in BAe 146 data.

> These airplane types are no longer in commercial service, or there are too few airplanes to be statistically significant

Airplane flight time and departures are primarily obtained from airplane and engine manufacturer compilations. Flight operations data for non-Boeing manufactured airplanes are augmented by the AirCraft Analytical System (ACAS) electronic database that is published by AvSoft, Limited, of Rugby, England.

Accident data are obtained, when available, from government accident reports. Otherwise, information is solicited from operators, manufacturers, various government and private information services, and press accounts. Definitions related to development of statistics in this book are primarily based on corresponding International Civil Aviation Organization (ICAO) terms as explained in the next section. Some variations to the ICAO definitions are applied to facilitate the purposes of this document.

# Definitions

---

Events in this publication are classified according to the following definitions. These definitions are consistent with those of the National Transportation Safety Board (NTSB) and International Civil Aviation Organization (ICAO).

**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:

- Airplane sustains substantial damage.
- Death or serious injury results from:
  - Being in or upon the airplane.
  - Direct contact with the airplane or anything attached thereto.
  - Direct exposure to jet blast.

**Hull loss:** Airplane damage that is substantial and is beyond economic repair. Hull loss also includes events in which:

- Airplane is missing.
- Search for the wreckage has been terminated without it being located.
- Airplane is substantially damaged and inaccessible.

**Substantial damage:** Damage or structural failure that adversely affects the structural strength, performance, or flight characteristics of the airplane and 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 aerodynamic fairings.
- Dents in the skin.
- Damage to landing gear.
- Damage to wheels.
- Damage to tires.
- Damage to flaps.

**Fatal accident:** An accident that results in fatal injury.

**Fatal injury:** An injury that results in death within 30 days as a result of the accident.

# Definitions (continued)

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**Serious injury:** An injury sustained in the accident that:

- Requires hospitalization for more than 48 hours that begins within 7 days of the date of injury.
- Results in a fracture of any bone (except simple fractures, toes, or nose).
- Produces lacerations that result in severe hemorrhage or nerve, muscle, or tendon damage.
- Involves injury to any internal organ.
- Involves second or third degree burns over 5 percent or more of the body.

**Generation:** Airplane types are classified by generation groups in order of introduction to service as follows:

<u>First</u>	<u>Second</u>	<u>Early Widebody</u>	<u>Current</u>
707/720	727	747-100/-200/-300/SP	MD-80/-90
DC-8	BAC 1-11	DC-10	767
Comet 4 *	DC-9	L-1011	757
CV-880/-990 *	737-100/-200	A300	BAe 146
Caravelle *	F-28		A310
Mercure*	Trident *		A300-600
	VC-10 *		737-300/-400/-500
			A320/319/321
			F-100
			747-400
			MD-11
			A340
			A330
			777
			737-600/-700/-800
			717
			RJ-70, -85, -100
			CRJ

\* These types are no longer in commercial service, or there are too few airplanes to be statistically significant.

# Terms and Exclusions

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**Regional identification:** Events are identified by operators' national domicile and not by event location.

**Airplane collisions:** Events involving two or more airplanes are counted as separate events for each airplane. For example, total destruction of two airplanes in a collision is considered two separate hull loss accidents.

**Accident Rates:** In general, this expression is a measure of accidents per million departures. Departures (or flight cycles) are used as the basis for computing rates, since 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. 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 appear to vary between editions of this publication.

**Excluded accidents:**

- Fatal and nonfatal injuries from natural causes.
- Fatal and nonfatal self-inflicted injuries
- Fatal and nonfatal injuries of stowaways hiding outside the areas normally available to the passengers and crew.
- Experimental test flight accidents are excluded. (Maintenance test flights, ferry, positioning, training and demonstration flights are included.)
- Nonfatal injuries resulting from atmospheric turbulence, maneuvering, loose objects, boarding, disembarking, evacuation, and maintenance and servicing are excluded.
- Nonfatal injuries to persons not onboard the airplane are excluded.

# Airplane Accidents

## Worldwide Commercial Jet Fleet — 1999

Date	Airline	Airplane Type	Accident location	Hull loss	Fatalities	Phase	Description
15-Jan-99	American Airlines	767-300	London			Landing	Fuselage damage
28-Jan-99	Alitalia	MD-82	Catania, Italy			Landing	Hard landing, windshear
31-Jan-99	Air Algerie	727-200	Constantine			Landing	NLG collapsed
07-Feb-99	Clipper International	707-320C	Bratislava	X		Takeoff	RTO overrun
04-Mar-99	Air France	737-200	Biarritz, France	X		Landing	Veered off side
05-Mar-99	Air France	747-200F	Chennai, India	X		Landing	NLG failed, fire
10-Mar-99	Air Algerie	727	Algiers			Landing	Landing overrun
11-Mar-99	World Airways	DC-10	San Jose, Costa Rica		1	Parked	Push back, run over
15-Mar-99	Korean Airlines	MD-80	Pohang, Korea	X		Landing	Landing overrun
20-Mar-99	Egyptair	A321	Luxor, Egypt			Landing	Landing overrun
24-Mar-99	Amiri Flight	A300	Rhodes, Greece			Landing	Landing overrun
30-Mar-99	Air Niugini	F-28	Goroka, New Guinea			Landing	MLG collapsed
05-Apr-99	Mandala Airlines	737-200	Indonesia			Landing	Landing overrun
07-Apr-99	Turkish Airlines	737-400	Adana, Turkey	X	6	Climb	Crashed during climb
15-Apr-99	Korean Airlines	MD-11	Shanghai, China	X	7	Climb	Crashed during climb
22-Apr-99	Million Air Charter	727-200	Lanseria, Zaire	X		Approach	Hail damage not repaired
01-Jun-99	American Airlines	MD-80	Little Rock	X	11	Landing	Landing overrun
09-Jun-99	Shantou Airlines	737-300	Zhanjiang, China	X		Landing	Landed short
28-Jun-99	Federal Express	A310	Manila			Landing	Landing overrun
07-Jul-99	Lufthansa Cargo India	727-100	Kathmandu, Nepal	X	5	Climb	Crashed after takeoff
15-Jul-99	American Airlines	A300B4	New York (JFK)			Landing	Bounced hard landing
01-Aug-99	Candadian Regional	F-28	St. John's			Landing	Runway overrun
08-Aug-99	China Eastern	MD-11	Shanghai, China			Landing	Hard landing overrun
14-Aug-99	Trans Arabian Air	707-320C	Juba, Sudan	X		Landing	Landing overrun
22-Aug-99	China Airlines	MD-11	Hong Kong	X	3	Landing	Crashed during landing
24-Aug-99	Uni Airlines	MD-90	Hualien, Tiawan	X		Landing	Overhead bin fire
31-Aug-99	LAPA	737-200	Buenos Aires	X	80	Takeoff	Crashed on takeoff
14-Sep-99	Britannia	757-200	Gerona, Spain	X	1	Landing	Ran off side
23-Sep-99	Quantas	747-400	Bangkok			Landing	Runway overrun
17-Oct-99	Federal Express	MD-11	Subic Bay	X		Landing	Overran into bay
18-Oct-99	Air Cargo Chartering	DC-8	Kinshasa	X		Landing	Veered off side/burned
26-Oct-99	Indian Airlines	A320	Yangon			Landing	Hard landing, MLG collapsed
31-Oct-99	Egyptair	767-300	Nantucket	X	217	Climb	Crashed into ocean
07-Nov-99	Air Dolomiti	F-100	Barcelona			Landing	MLG vibration collapse
09-Nov-99	Taesa	DC-9-31	Uruapan, Mexico	X	18	Climb	Crashed after takeoff
18-Nov-99	Tam Brasil	F-100	Rio de Janeiro			Landing	Hard landing, MLG collapsed
30-Nov-99	Lauda Air	CRJ	Timisoara			Landing	MLG collapsed
18-Dec-99	Das Air	DC-10	Amsterdam			Takeoff	Uncontained engine failure - damage
21-Dec-99	Cubana	DC-10-30	Guatemala City	X	26	Landing	Landing overrun
22-Dec-99	Korean Airlines	747-200F	Stansted, England	X	4	Climb	Crashed after takeoff
27-Dec-99	Royal Jordanian	A310	Shannon, Ireland			Landing	Bounced hard landing
	41 Total Accidents			21	379		

# Excluded Accidents

## Accidents Occurring in 1999

---

### Turbulence:

- Flight attendant injury – 12 events
- Passenger injury – 7 events
- Evasive maneuver – 1 flight attendant injury

### Pushback:

- Aircraft pushed into other aircraft – 2 events
- Aircraft pushed into jetway – 3 events
- Ground collision with lavatory truck – 1 event
- Ground collision with catering truck – 1 event

### Hit by vehicle:

- Lavatory service truck struck aircraft – 1 event
- Ground collision with parked aircraft – 1 event

### Boarding:

- Flight attendant fell out door – 1 injury

### Ground crew:

- Aircraft wheel ran over ground crew – 1 injury
- Ground crew wedged between vehicle and airplane – 1 injury

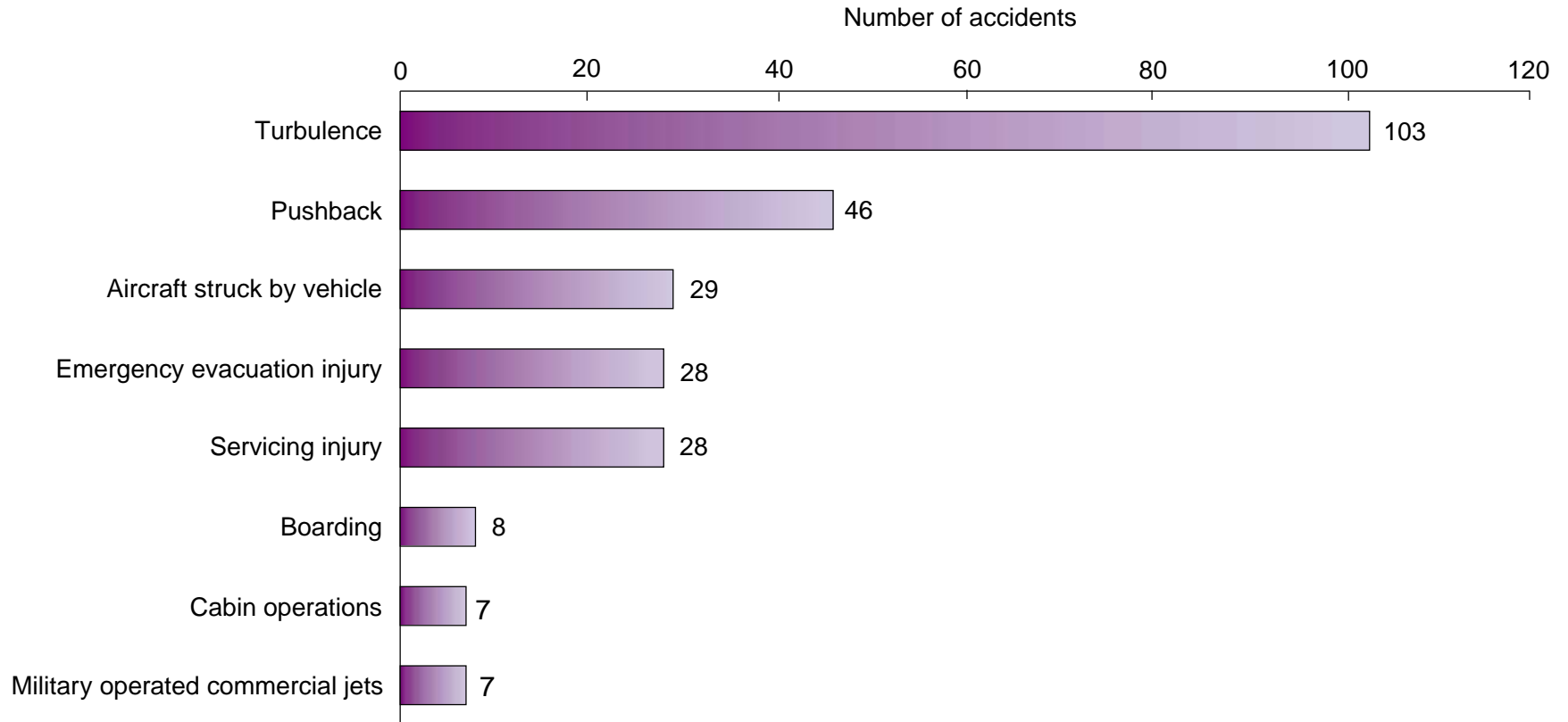
### Cabin operation:

- Lift injured flight attendant – 1 injury

**Note:** These events are excluded from the statistical analysis in the remainder of the document and may not be a complete listing due to inconsistent reporting.

# Excluded Accidents

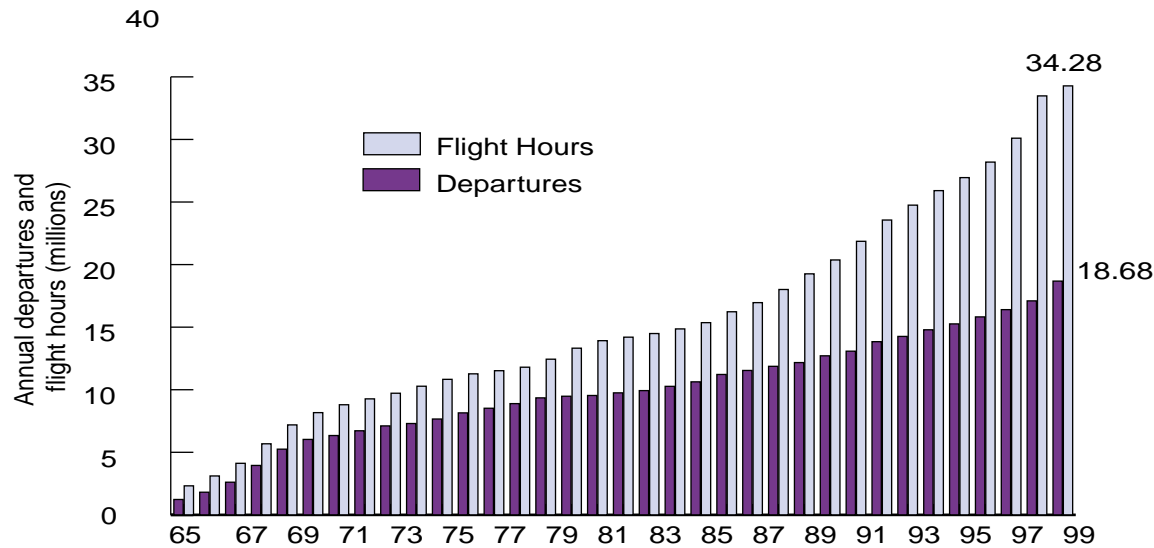
## Accidents Occurring From 1990 through 1999



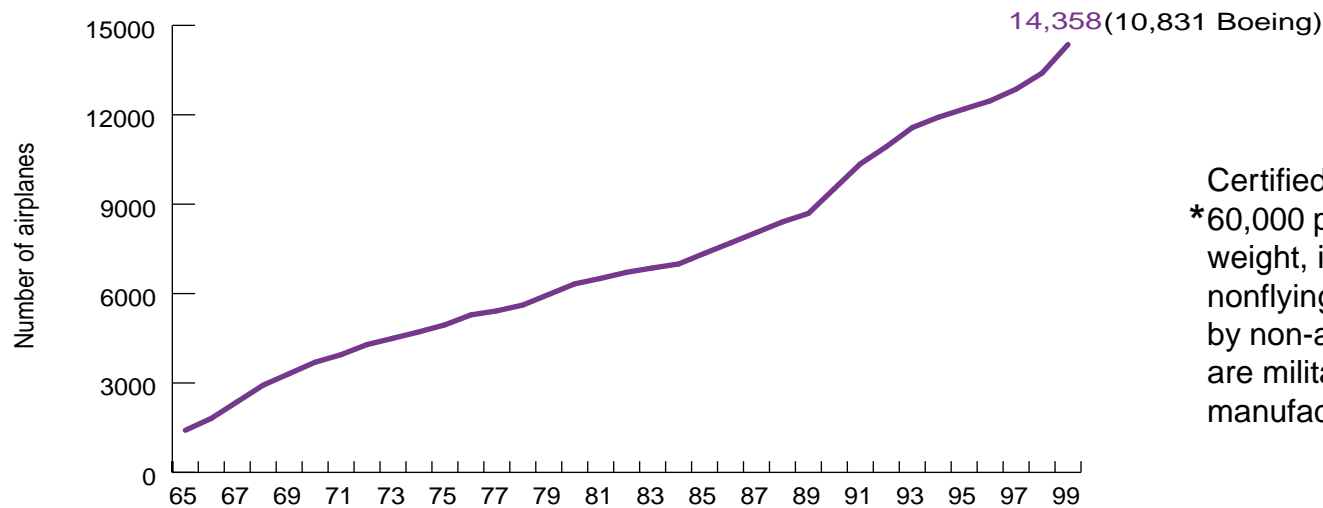
Note: Sabotage, hijacking, terrorism, or military action events are not considered accidents and are not listed in this table.

# Departures, Flight Hours, and Jet Airplanes in Service\*

## Worldwide Operations 1965 to 1999



- 351.3 million cumulative departures (300.2 million on Boeing airplanes)
- 601.0 million cumulative flight-hours (483.8 million on Boeing airplanes)
- 7 manufacturers – 32 significant types (15 Boeing) in service as of 12/31/99

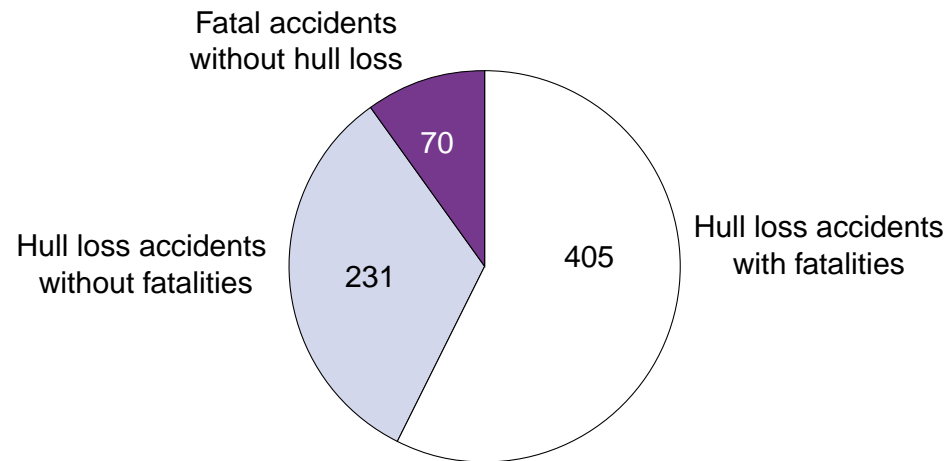


Certified jet airplanes greater than \*60,000 pounds maximum gross weight, including those in temporary nonflying status and those in use by non-airline operators. Excluded are military airplanes and CIS-manufactured airplanes.

# Accident Summary by Type of Operation

## Worldwide Commercial Jet Fleet

Type of operation	All accidents		Hull loss and/or fatal accidents		Onboard fatalities	
	1959-1999	1990-1999	1959-1999	1990-1999	1959-1999	1990-1999
Passenger	983	295	541	166	23,116	6,342
Cargo	153	71	105	50	209	70
Ferry, test, training, and demonstration	103	19	60	13	189	53
<b>Totals</b>	<b>1,239</b>	<b>385</b>	<b>706</b>	<b>229</b>	<b>23,514</b>	<b>6,465</b>
U.S.A. and Canadian operators	427	91	209	50	5,727	1,049
Rest of the world	812	294	497	179	17,787	5,416
<b>Totals</b>	<b>1,239</b>	<b>385</b>	<b>706</b>	<b>229</b>	<b>23,514</b>	<b>6,465</b>



**706 Hull Loss and/or Fatal Accidents  
1959 through 1999**

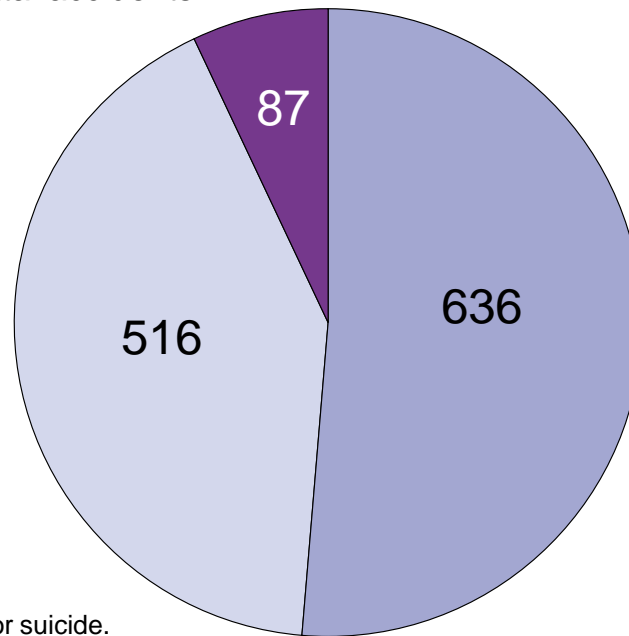
# Accident Summary by Damage and Injury

All Accidents — Worldwide Commercial Jet Fleet — 1959 Through 1999

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1,239 accidents worldwide

87 personal injury accidents  
- 54 fatal accidents



636 hull loss accidents  
- 405 hull losses  
with fatalities

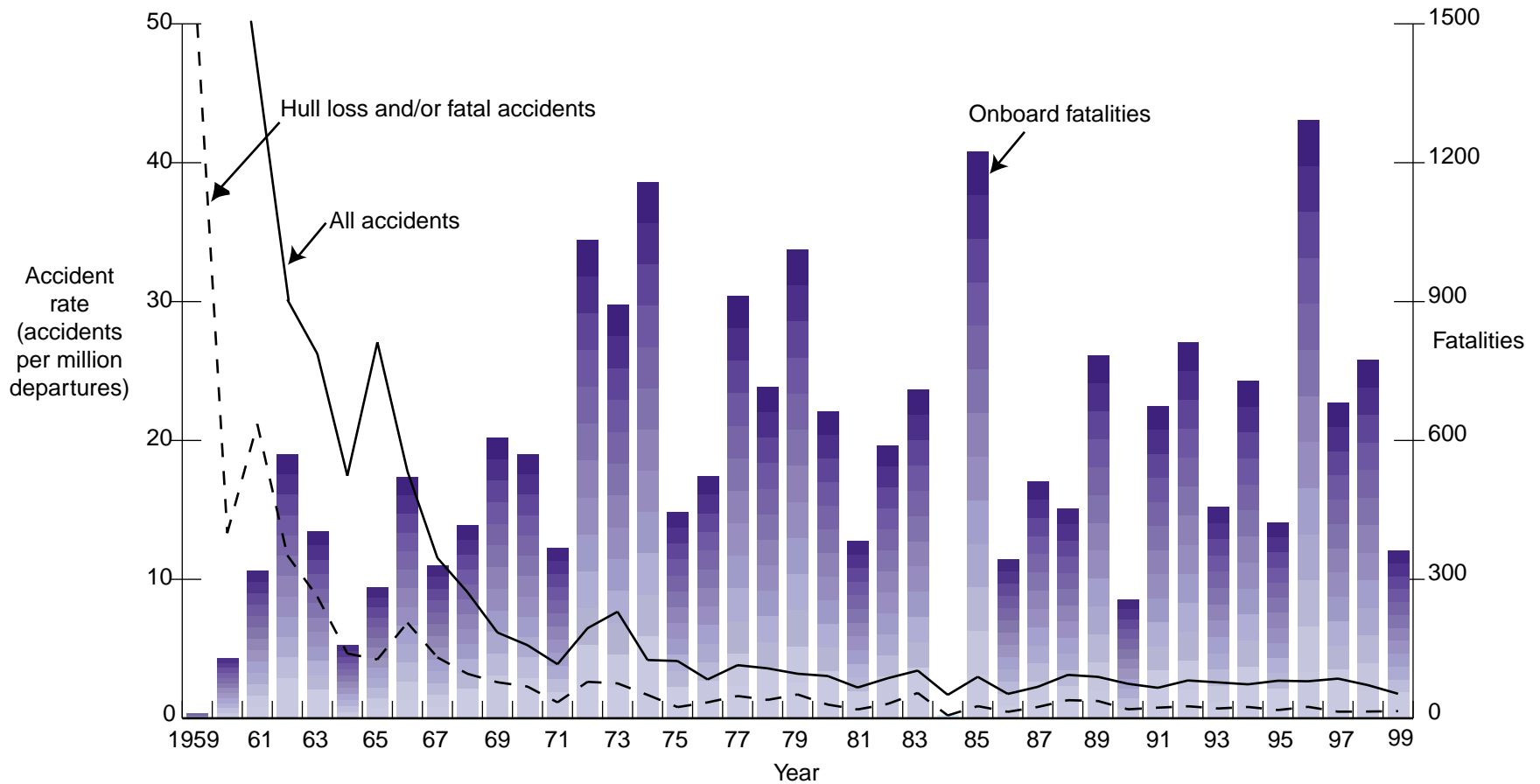
516 substantial damage  
accidents  
-16 substantial damage  
with fatalities

Excludes:

- Fatal injuries from natural causes or suicide.
- Experimental test flights.
- Military airplanes.
- Sabotage, hijacking, terrorism, or military action.
- Nonfatal injuries involving:
  - Atmospheric turbulence, maneuvering, or loose objects.
  - Boarding, disembarking, or evacuation.
  - Maintenance and servicing.
  - Persons not on board the airplane.

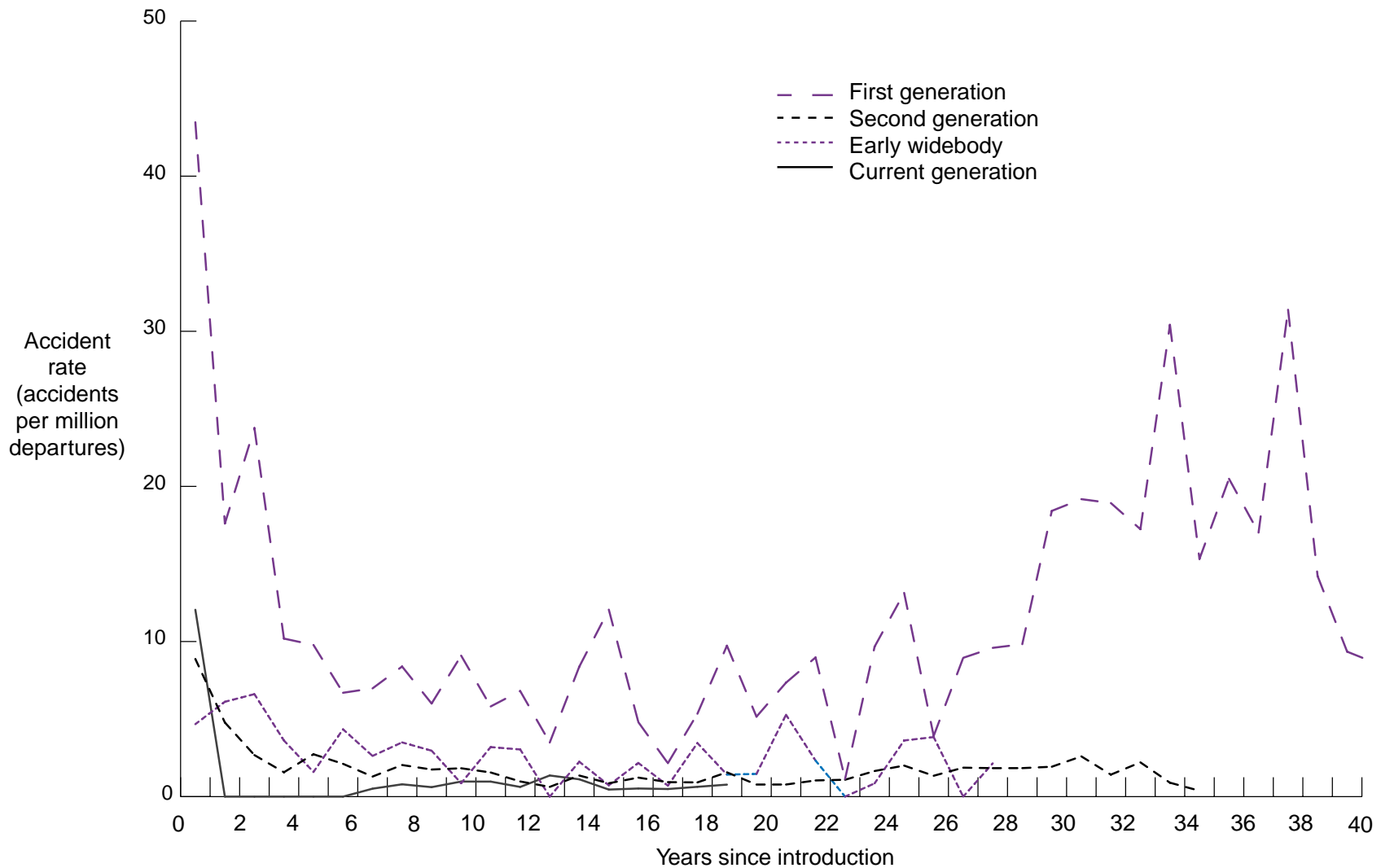
# Accident Rates and Fatalities by Year

All Accidents — Worldwide Commercial Jet Fleet — 1959 Through 1999



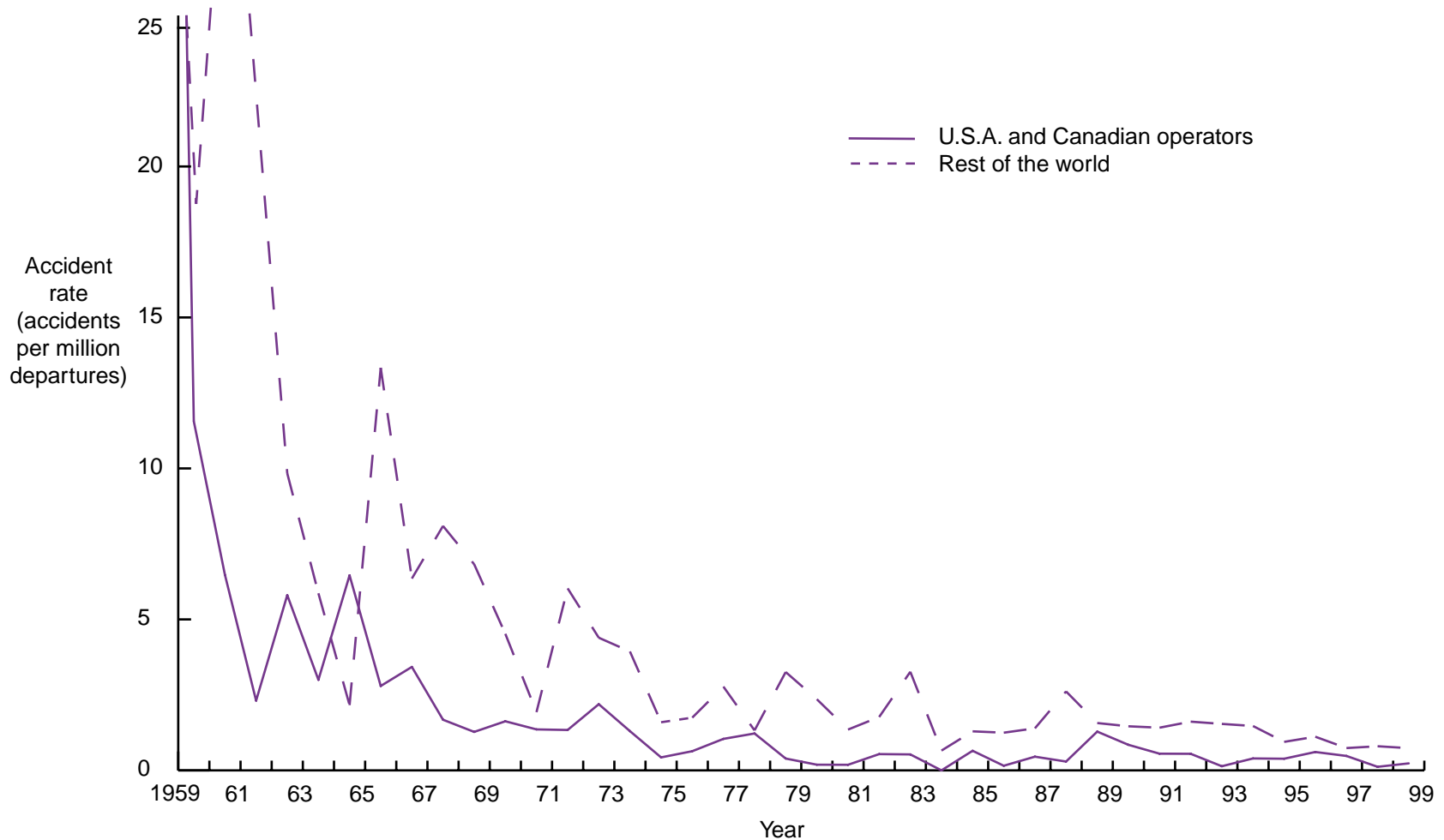
# Accident Rates by Years Following Introduction

Hull Loss and/or Fatal Accidents – Worldwide Commercial Fleet – 1959 Through 1999



# U.S.A. and Canadian Operators Accident Rates

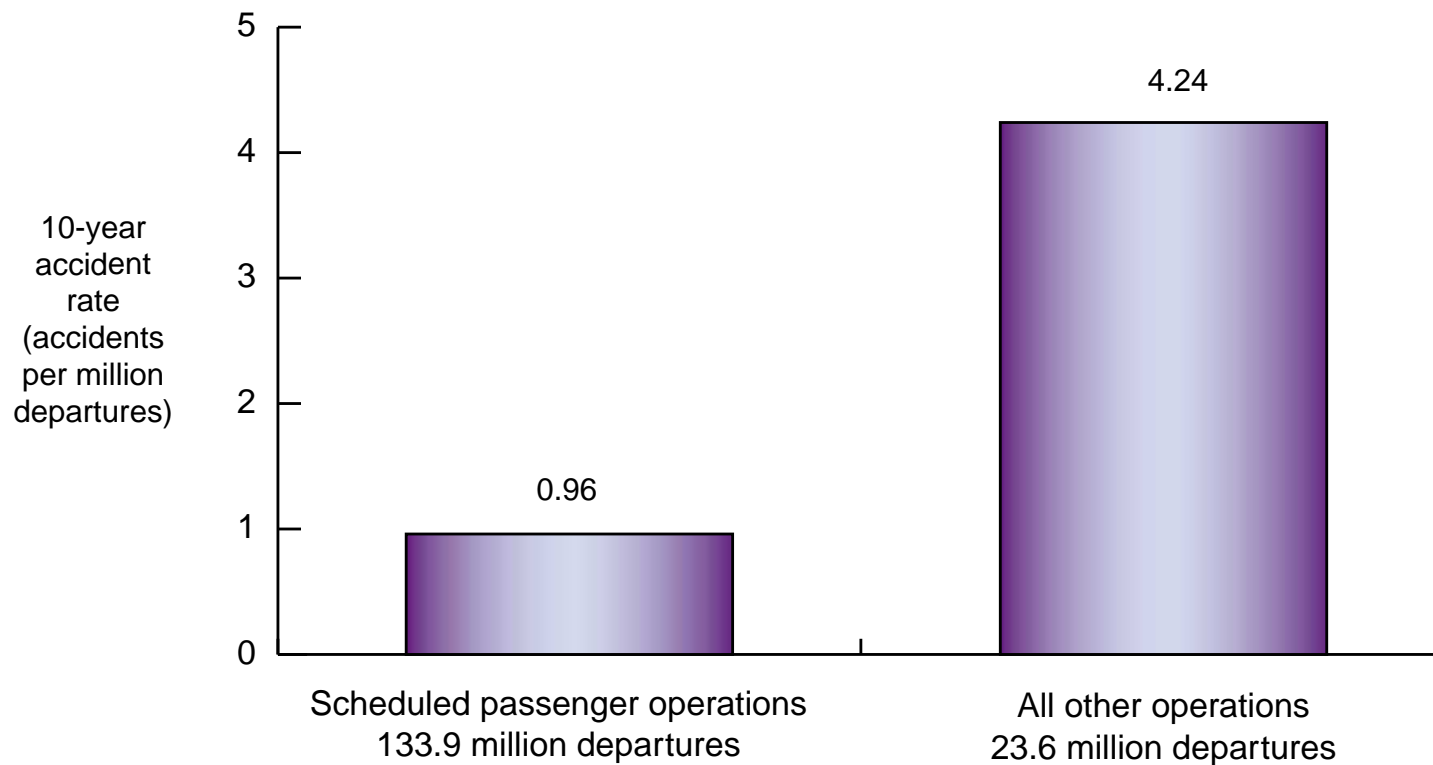
Hull Loss and/or Fatal Accidents — Worldwide Commercial Jet Fleet — 1959 Through 1999



# Accident Rates by Type of Operation

Hull Loss and/or Fatal Accidents — Worldwide Commercial Jet Fleet — 1990 Through 1999

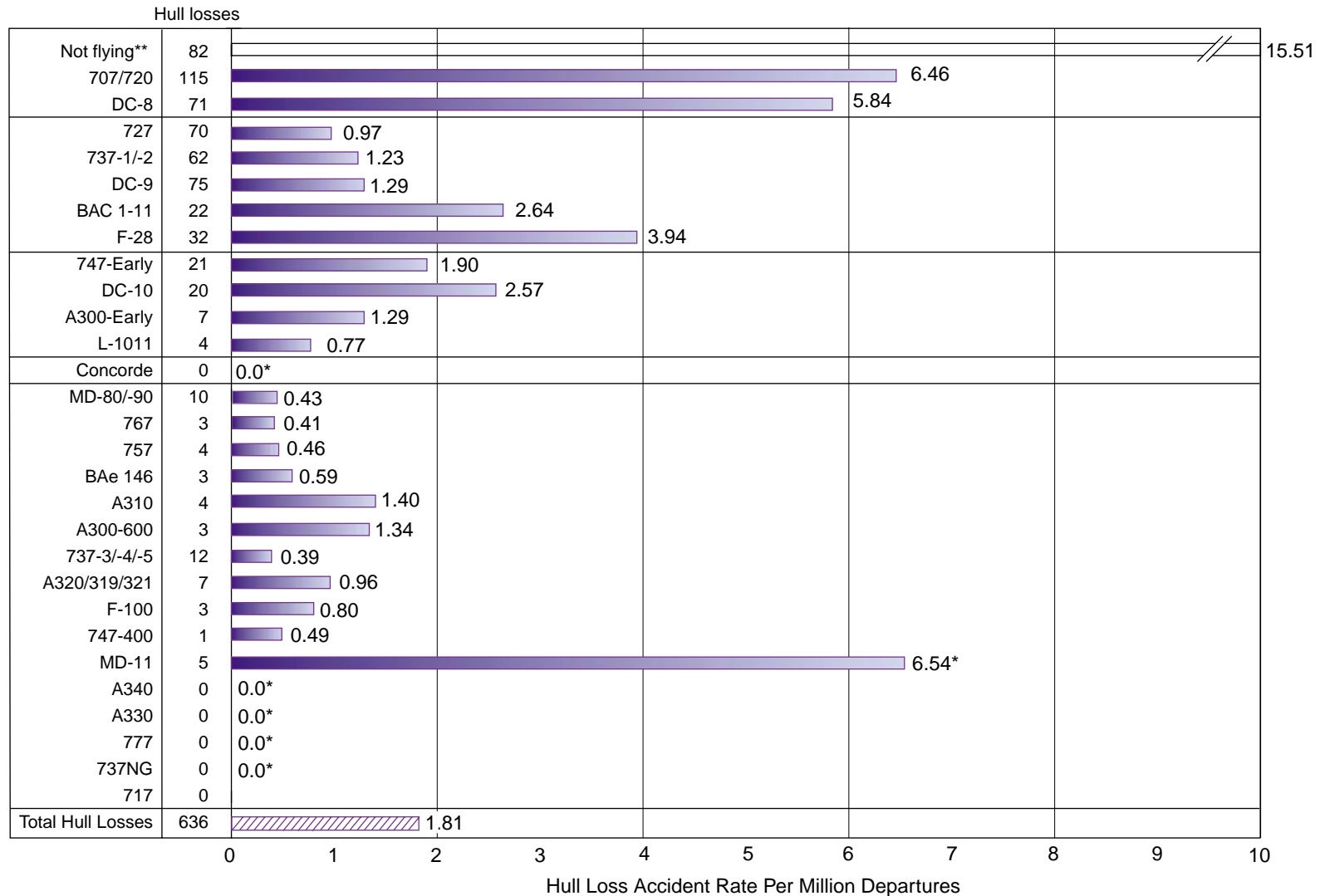
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\*Unscheduled passenger and charter, cargo, ferry, test, training, and demonstration.

# Accident Rates by Airplane Type

## Hull Loss Accidents — Worldwide Commercial Jet Fleet — 1959 Through 1999



\*\* The Comet, CV-880/-990, Caravelle, Mercure, Trident & VC-10 are no longer in commercial service, and are combined in the "Not Flying" bar.

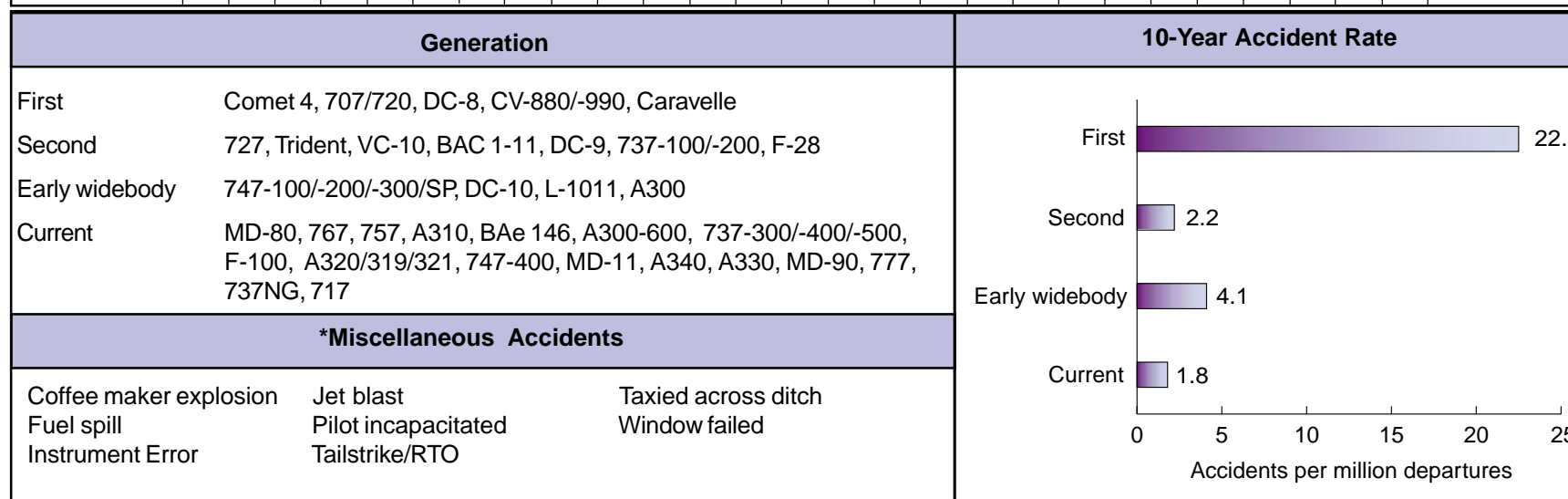
\* These types have accumulated fewer than 1 million departures.



# Accident Categories by Airplane Generation

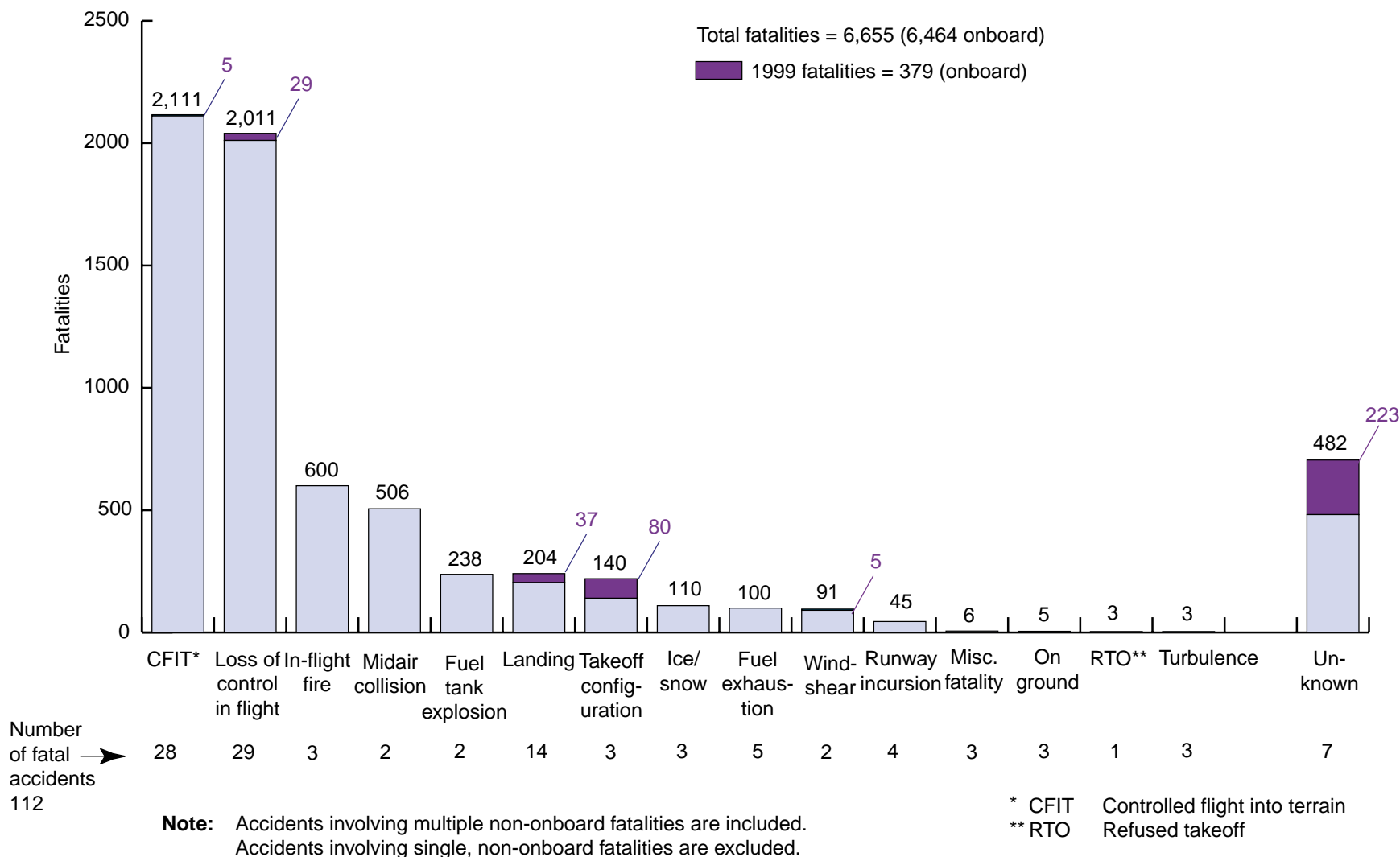
All Accidents — Worldwide Commercial Jet Operations — 1990 Through 1999

Generation	Landing																							Total				
	Controlled flight into terrain	Loss of control	Midair collision	In-flight fire	Fuel tank explosion	Off end on landing	Off side on landing	Hard landing	Landed short	Gear collapse/fail/up	Ice/snow	Fuel management/fail/up	Windshear	Takeoff configuration	Takeoff side on takeoff	Runway incursion	Wing strike	Engine failure/exhaustion	Ground collision	Boarding/deplaning	Turbulence injury	Miscellaneous fatality	Fire on ground		Aircraft structure	Refused takeoff - off end	Unknown	
First	5	8		1		7	3	3	4	8		2		1	1		2	3					1	1		3	1	54
Second	17	7	1	2		17	20	15	9	8	3	4	1	1	1	5		2	2	3		1	2	2	2	6	3	134
Early widebody	3	2	1	1	1	3	3	5	1	2		1	1		3	1		4	2	2	2	1	2	3	2	3	49	
Current	11	13		1	1	22	11	32	2	13	3		1	1	3	10		1	6	2	2	1	3	2	2	2	3	148
Total	36	30	2	5	2	49	37	55	16	31	6	7	3	3	8	16	2	10	10	7	4	3	8	8	6	14	7	385



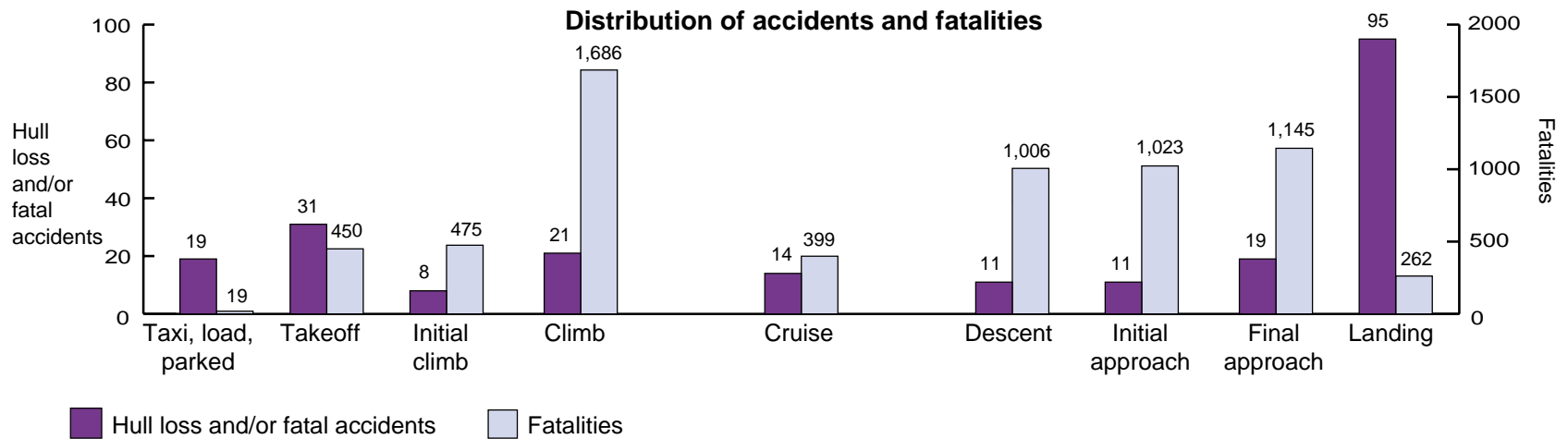
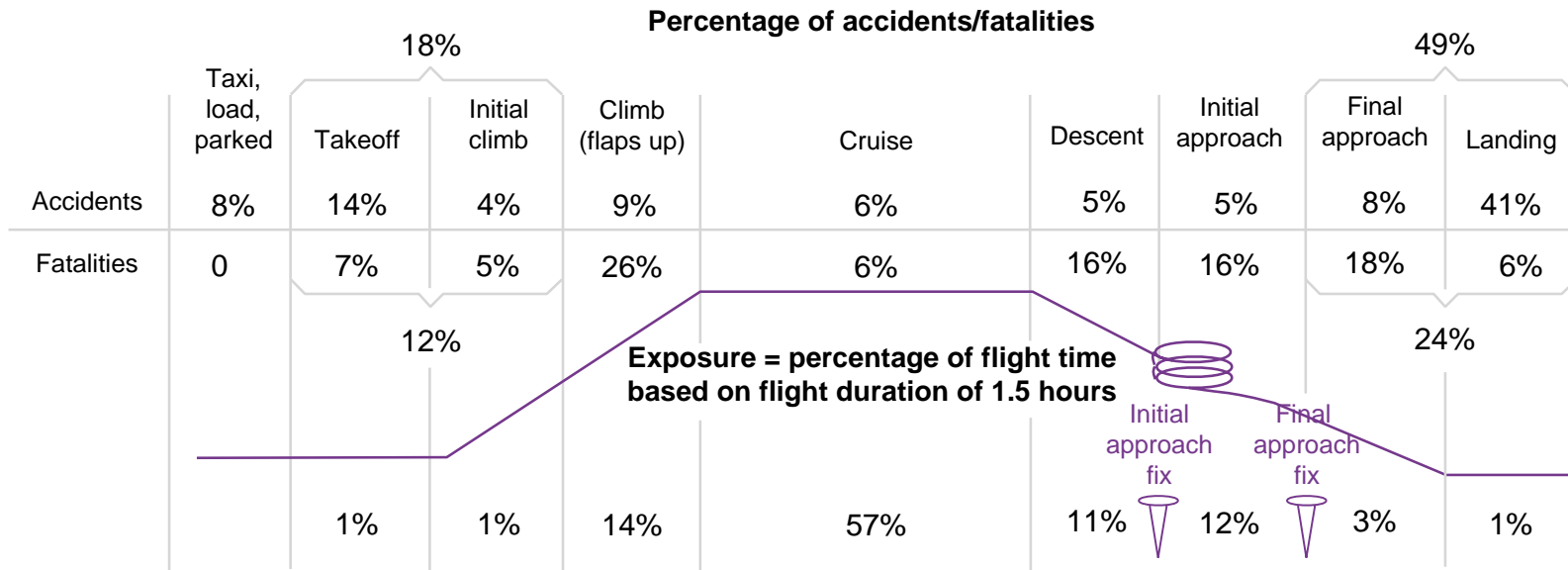
# Fatalities by Accident Categories

## Fatal Accidents — Worldwide Commercial Jet Fleet — 1990 Through 1999



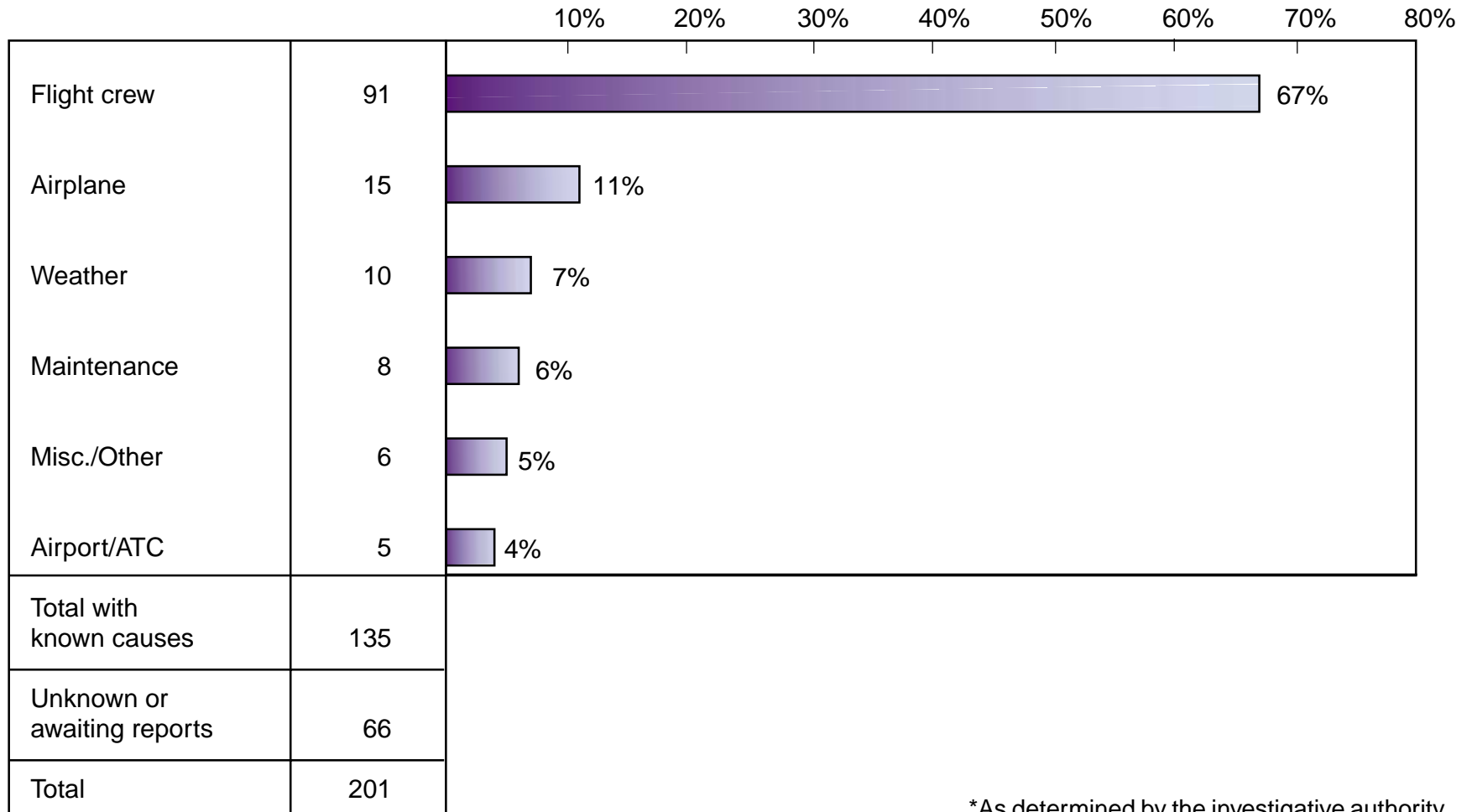
# Accidents and Onboard Fatalities by Phase of Flight

Hull Loss and/or Fatal Accidents — Worldwide Commercial Jet Fleet — 1990 through 1999



# Accidents by Primary Cause\*

## Hull Loss Accidents — Worldwide Commercial Jet Fleet — 1990 Through 1999

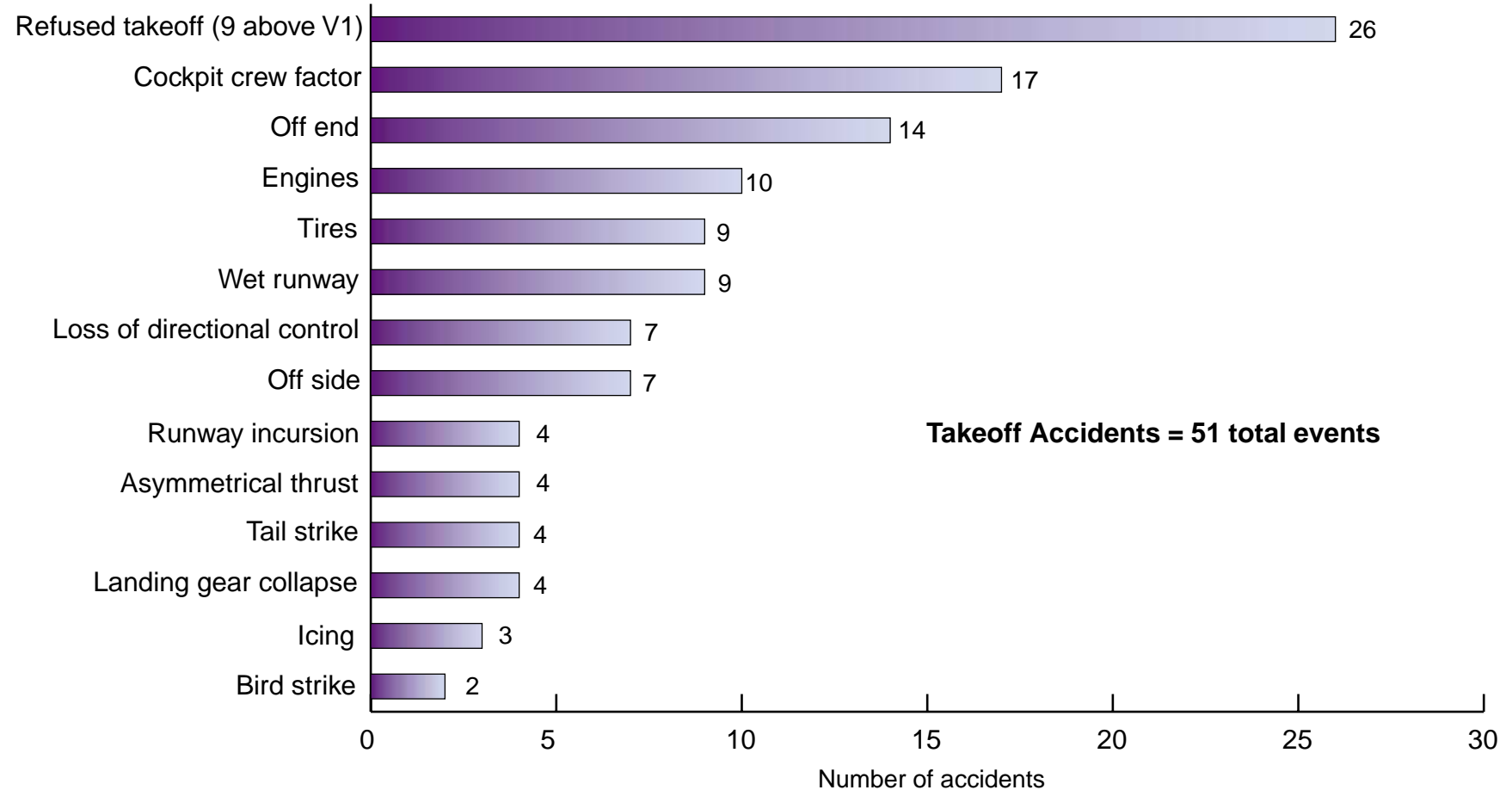


\*As determined by the investigative authority.

# Takeoff Accidents by Event Descriptor

Worldwide Commercial Jet Operations – 1990 Through 1999

## Event Descriptor

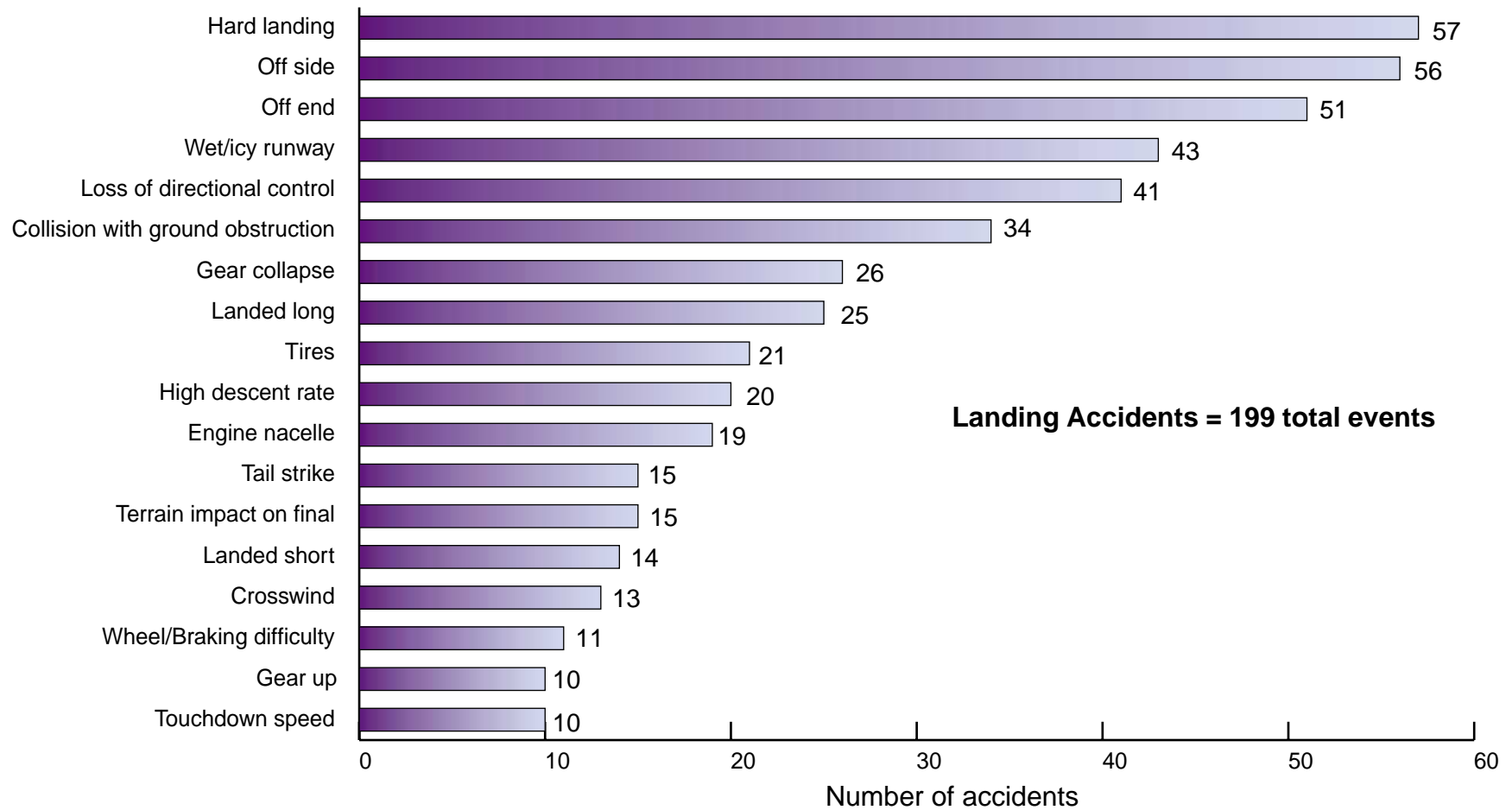


**Note:** Each event may involve more than one event descriptor; therefore, the sum of the items may be more than the total accidents of this type.

# Landing Accidents by Event Descriptor

Worldwide Commercial Jet Operations – 1990 Through 1999

## Event Descriptor



**Note:** Each event may involve more than one event descriptor; therefore, the sum of the items may be more than the total accidents of this type.



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