

# U.S. Commercial Aviation Safety in the 1990s

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An accident is defined as "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".

## **DEFINITIONS OF LEVEL OF AIRCRAFT DAMAGE**

**Destroyed** - Damage due to impact, fire, or in-flight failures to an extent not economically repairable.

**Substantial** - Damage or failure which 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.

**Minor** - Any damage that neither destroys the aircraft nor causes substantial damage.

**None** - No damage.

## One way to think about fatality rates.

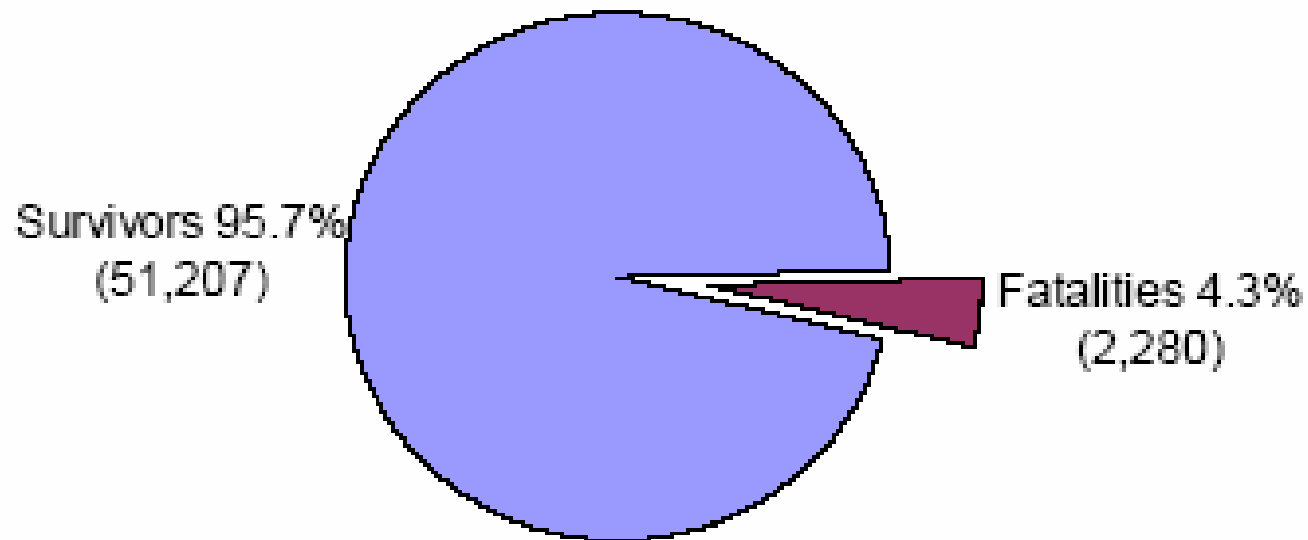
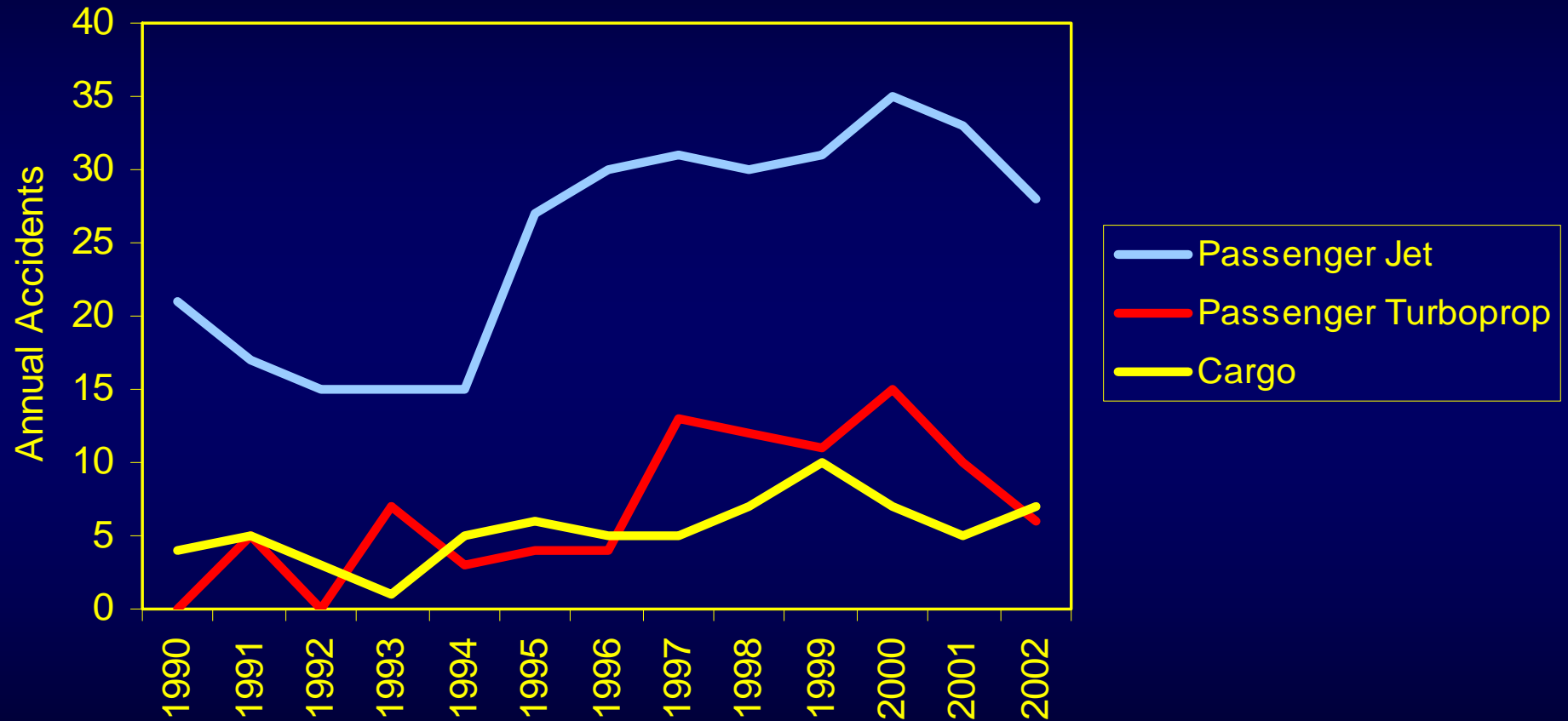


Figure 1. Fatality and survivor data for all accidents involving U.S. air carrier flights (cargo and passenger) operating under Title 14 Code of Federal Regulations Part 121, 1983 through 2000.

# US Part 121 1990 - 2002

	All Accidents	Fatal Accidents	Onboard Fatalities	People Onboard	Onboard Fatality Rate
Part 121	488	44	1475	2665	55%
Passenger Jet	328	28	1381	2571	54%
Passenger Turboprop	90	6	68	68	100%
Cargo	70	10	26	26	100%

## Part 121 Accidents -- All Injury Levels

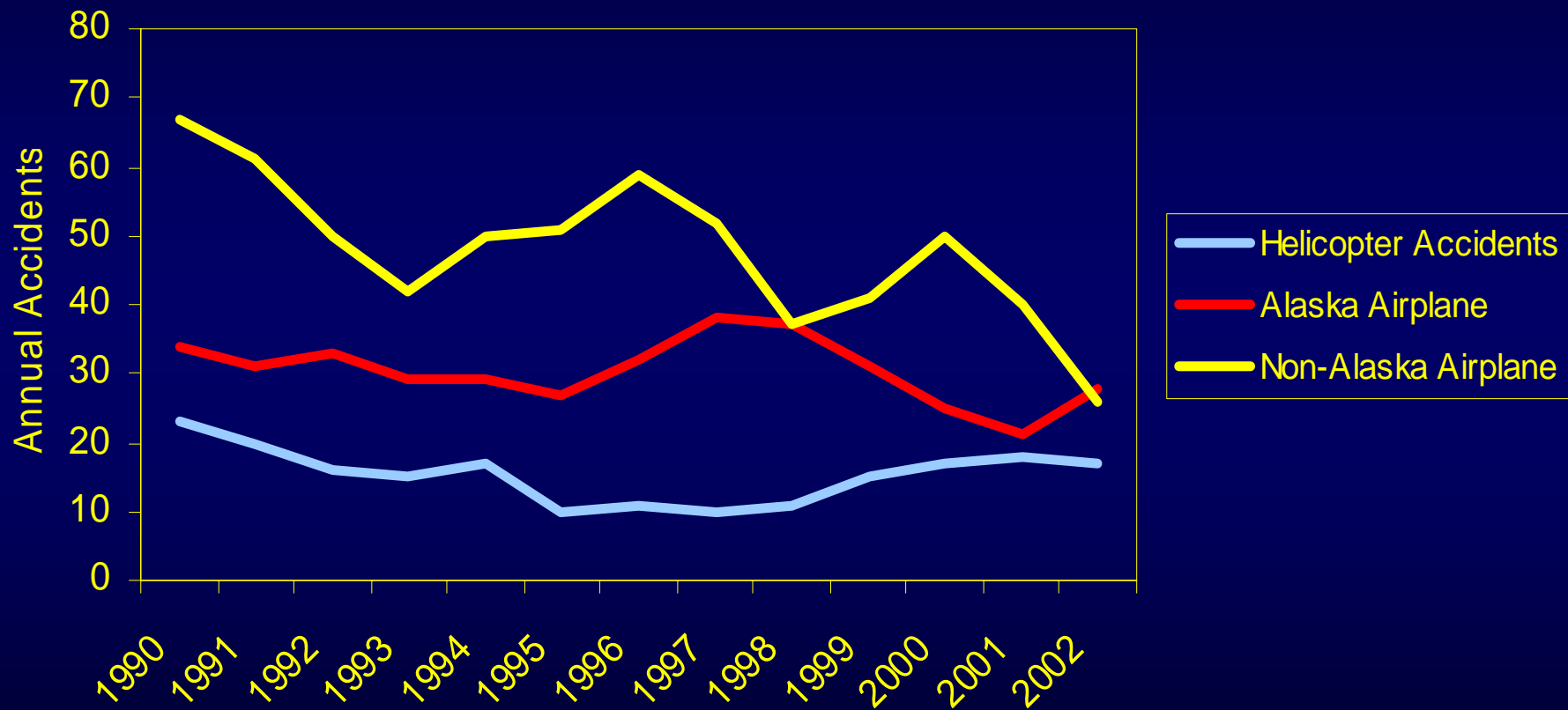


Since March 20, 1997, aircraft with 10 or more seats used in scheduled passenger service have been operated under 14 CFR 121.

# US Part 135 1990 - 2002

	All Accidents	Fatal Accidents	Onboard Fatalities	People Onboard	Onboard Fatality Rate
Part 135	1221	323	934	1157	81%
Helicopter	200	53	157	216	73%
Airplane	1021	270	777	941	83%
Alaska	395	62	178	211	84%
Outside Alaska	626	208	599	730	82%

## Part 135 Accidents - All Injury Levels



## FAA's Ambitious Goal

The Commercial Aviation Safety Team (CAST) aims to reduce the commercial aviation accident rate by 80 percent by 2007. CAST focuses on the leading causes of commercial aviation fatalities:

- uncontained engine failures
- controlled flight into terrain
- approach and landing
- loss of control
- runway incursions
- weather (including turbulence)

In CFIT accidents, a fully qualified and certificated crew flies a properly working airplane into the ground, water or obstacles with no apparent awareness by the pilots.

## DEFINITIONS OF HIGHEST LEVEL OF INJURY

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

**Serious** - Any injury which:

- (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 5 percent of the body surface.

**Minor** - Any injury that is neither fatal nor serious.

**None** - No injury.

# Assigning Accident Causes

- Most commercial aviation accidents have more than one cause.
- We read each accident brief, over 1700 for this presentation.
- We select the cause which initiated the sequence of events that resulted in an accident – what started it.
- We use a system of 91 different causes.

# Causes of Part 121 Passenger Jet Accidents

	All Accidents	Fatal + Serious	Minor + None
Equipment Failure	18%	15%	24%
Seatbelt Turbulence	32%	<b>50%</b>	0%
Animals Runway	1%	0%	3%
Pilot Error	19%	10%	35%
Ground / Cabin Crew	19%	<b>15%</b>	25%
Other	11%	10%	13%
Number of Accidents	310	202	108

# Causes of Part 121 Passenger Turboprop Accidents

	All Accidents	Fatal + Serious	Minor + None
Equipment Failure	19%	10%	23%
Seatbelt Turbulence	15%	<b>43%</b>	0%
Animals Runway	12%	3%	16%
Pilot Error	17%	3%	25%
Ground Cabin Crew	26%	<b>30%</b>	23%
Other	12%	10%	13%
Number of Accidents	86	30	56

# Causes of Part 121 Cargo Accidents

	All Accidents	Fatal + Serious	Minor + None
Equipment Failure	31%	33%	31%
Seatbelt Turbulence	2%	0%	2%
Animals Runway	6%	0%	7%
Pilot Error	43%	33%	45%
Ground Cabin Crew	15%	33%	10%
Other	4%	0%	5%
Number of Accidents	54	12	42

# Causes of Part 135 Accidents

	All Helicopters	Alaska Airplanes	Non-Alaska Planes
Equipment Failure	34%	17%	28%
Weather	3%	6%	9%
Animals Runway	9%	9%	2%
Pilot Error	<b>50%</b>	<b>62%</b>	<b>50%</b>
Other	4%	7%	11%
Number of Accidents	186	382	559

# Causes of Part 135 Helicopter Accidents

	All Accidents	Fatal + Serious	Minor + None
Equipment Failure	34%	26%	40%
Weather	3%	5%	2%
Animals Runway	9%	6%	10%
Pilot Error	50%	<b>54%</b>	47%
Other	4%	9%	1%
Number of Accidents	186	80	106

# Causes of Part 135 Alaska Airplane Accidents

	All Accidents	Fatal + Serious	Minor + None
Equipment Failure	17%	13%	18%
Weather	6%	4%	6%
Animals Runway	9%	0%	12%
Pilot Error	62%	<b>80%</b>	56%
Other	7%	2%	8%
Number of Accidents	382	90	292

# Causes of Part 135 Non-Alaska Airplane Accidents

	All Accidents	Fatal + Serious	Minor + None
Equipment Failure	28%	24%	31%
Weather	9%	8%	9%
Animals Runway	2%	0%	3%
Pilot Error	50%	<b>57%</b>	45%
Other	11%	11%	11%
Number of Accidents	559	238	321

# Types of Pilot Error for Fatal and Serious Accidents

	Helicopters	Alaska Airplanes	Non-Alaska Airplanes
Flying Skills	18%	17%	12%
Unstabilized Approach	0%	0%	2%
CFIT	1%	1%	2%
In-flight Judgment	20%	<b>41%</b>	<b>22%</b>
On-ground Judgment	13%	16%	13%
Fuel Management	0%	4%	5%
Alcohol Drugs	3%	1%	1%
Number of Accidents	43	72	136

# Categories of Pilot Error

- Flying Skills
  - Failure to maintain physical or directional control of the aircraft
  - Landing long or short
  - Hard landings
  - Stalls

# Categories of Pilot Error

- In-flight Judgment
  - Errors in judgment when the plane is airborne
  - Failure to do the landing checklist
  - Failure to correct for carb icing or maintain proper mixture control
  - Continuing VFR flight into IMC
  - Flying into known hazardous weather
  - Choosing to land in unsuitable terrain
  - Improper flap setting for landing
  - Flying into terrain that exceeds the aircraft's climbing or turning capability

# Categories of Pilot Error

- On-ground Judgment
  - Mistakes made by the flight crew when the plane is safely on the ground
  - Failure to get weather briefing
  - Failure to do pre-flight or post-landing checklist
  - Takeoff into known hazardous weather
  - Failure to detect water in fuel or misfueling

# Types of Pilot Error for Minor and None Accidents

	Helicopters	Alaska Airplanes	Non-Alaska Airplanes
Flying Skills	25%	24%	18%
Unstabilized Approach	0%	0%	0%
CFIT	0%	0%	0%
In-flight Judgment	8%	11%	7%
On-ground Judgment	10%	17%	12%
Fuel Management	3%	3%	8%
Alcohol Drugs	0%	0%	0%
Number of Accidents	50	163	145

# Limited Lessons

- For passenger jet flights, the largest safety problem is the failure of passengers and flight attendants to be seated and belted in when turbulence is encountered.
- For Part 135 flights, most accidents are caused by pilot error, but it is error in judgment while in flight rather than an inability to control the aircraft.
- Most of the FAA CAST effort on improving safety seems focused on relatively minor causes of serious commercial accidents in the United States.