
General Aviation Accident Analysis

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Based on:

1996, 1998 Nall Report

Air Safety Foundation

AOPA

Frederick, Md

Accident Facts

National Safety Council

Itasca, Il

Traffic Safety Facts

US Department of Transportation

National Highway Safety Administration

National Center for Statistics and Analysis

Washington, D.C.

General Aviation Basic Dimensions

Number of Airplanes	160,000 airplanes
Flight Hours	20,000,000
Total Accidents	1853
Fatal Accidents	383
Fatalities	679

1985-1995 Accident Rate

8-10 / 100,000 hours

1985 - 1995 Accident Rate

8-10 per 100,000 flight hours

- “Accident rate has remained relatively steady over the last six years.”
- “Fatal accidents rate remains relatively constant of the past 16-17 years.”
- “... due to the same causes occurring at the same rates as over the past several years.”

-- 1998 Nall Report, AOPA ASF

Accident Causes: ASF Categories

- **Mechanical and Maintenance**
- **Mid-Air, Drugs, Medical, Ground**
- **Pilot-Related**
- **Unknown**

Proportion of Accidents by Major Cause

- **Pilot-related** **80%**
- **Mechanical and Maintenance** **16%**
- **Other** **2%**
- **Unknown** **2%**

Mechanical / Maintenance Cause Breakdown

Engine / Prop	70%
Gear / Brakes	15%
Oil System	5%
Controls/Airframe	2%
Fuel System	3%
Electrical / Ignition	3%
Vacuum Sys / Instruments	2%

MDMG Causes

Midair Collisions (15)

8 fatal collisions, 24 fatalities

5 collisions during flight instruction

8 collisions during personal flying

Alcohol and Drugs (2)

Medical and Pilot Incapacitation (0)

Ground Injuries

7 off-airport fatalities

5 prop strike fatalities

Pilot-Related Causes

- Preflight/Taxi
- Takeoff/Climb
- Weather
- Fuel Management
- Other Cruise
- Approach
- Go-around
- Maneuvering
- Landing
- Other

“Maneuvering” Subcategory

Low and Slow Flight

Aerial application

Banner towing

Law enforcement

Personal (56% of the fatal accidents in this sub-category)

Collision with terrain, wires, towers (not on approach)

Structural failure during unauthorized aerobatics

“Landing” Subcategory

Loss of control

Accidents due to “loss of control while landing in crosswinds or gusts”

SEFG: 40% of landing accidents

SERG: 17% of landing accidents

Hard Landings

Landed long and/or fast

Gear up

Major Pilot-Related Causes: SEFG

Non-Fatal

Landing (286)

Fatal

Maneuvering flight

Weather

Major Pilot-Related Causes: **SERG**

Non-Fatal

Landing (57)

Fatal

Weather

Takeoff/Climb

Maneuvering flight

Approach

Major Pilot-Related Causes: **ME**

Non-Fatal

Landings (36)

Fatal

Weather

Takeoff/Climb

Approach

Of All Accident Causes

80%

Pilot-Related Causes

Compared to Our Favorite Fears

5 Times

more likely than mechanical/maintenance failure

Compared to Our Favorite Fears

5 Times

more likely than mechanical/maintenance failure

100 Times

More likely than a mid-air collision

Compared to Our Favorite Fears

5 Times

more likely than mechanical/maintenance failure

100 Times

More likely than a mid-air collision

200 Times

More likely than a mid-air collision during personal flying

Compared to Our Favorite Fears

5 Times

more likely than mechanical/maintenance failure

100 Times

More likely than a mid-air collision

200 Times

More likely than a mid-air collision during personal flying

300 Times

More likely than a mid-air collision during flight instruction

A Closer Look at Pilot-Related Causes

The Major Pilot-Related Accident Causes

	<i>SEFG</i>	<i>SERG</i>	<i>ME</i>	
Take-off/ Climb	23.5%	19.9%	20.5%	
Maneuvering	13.5	6.6	1.0	
Landing	31.7	31.5	30.8	
Sub-Total	68.7	58.0	52.3	-- 60%
Weather	6.2	16.0	18.8	
Fuel Mgmt	8.0	9.4	8.5	
Approaches	3.9	6.1	8.5	
Sub-Total	18.1	31.5	35.8	-- 28%
% of Total	87%	89%	88%	

Of the Total Pilot-Related Accident Causes

60%

**Caused by Piloting (Stick and Rudder)
Deficiency**

28%

**Caused by Pilot-in-Command (Cognitive)
Deficiency**

The Major Pilot-Related *FATAL* Accident Causes

	<i>SEFG</i>	<i>SERG</i>	<i>ME</i>	
Take-off/ Climb	12.9	16.9	20.0	
Maneuvering	31.6	16.9	2.5	
Landing	4.5	3.4	0.0	
Sub-Total	49.0	37.2	22.5	-- 36%
Weather	22.6	33.9	47.5	
Fuel Mgmt	1.9	3.4	7.5	
Approaches	9.7	13.6	15.0	
Sub-Total	34.2	50.9	70.0	-- 52%
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% of Total	83%	83%	93%	

Of the Total **Fatal** Accident Causes

36%

**Caused by Piloting (Stick and Rudder)
Deficiency**

52%

**Caused by Pilot-in-Command
(Cognitive) Deficiency**

Of the Total Accident Causes

Piloting Deficiencies
Cause more accidents

Pilot-in-Command Deficiencies
Kill more people

Review

Of All Accident Causes

80%

Pilot-Related Causes

Of the Pilot-Related Accident Causes

87% of those

Due to:

- **Basic inability to fly the airplane**

Takeoff and Climb

Maneuvering

Landing

- **Basic inability to act as Pilot-in-Command**

Weather

Fuel Management

Approaches

A Pilot-Caused Accident is:

5 Times

more likely than mechanical/maintenance failure

100 Times

More likely than a mid-air collision

200 Times

More likely than a mid-air collision during personal flying

300 Times

More likely than a mid-air collision during flight instruction

Of the Total Accident Causes

Piloting Deficiencies
Cause more accidents

Pilot-in-Command Deficiencies
Kill more people

Comparison with Air Carrier Operations

Comparison to Air Carrier

**How does General Aviation compare to
Air Carriers?**

(A good yardstick - probably the best)

Compare **Non-Fatal** Accidents per Flight Hour

	Non-Fatal Accidents	Multiple
	(per 100,000 hours)	
General Aviation	6.876	47
Air Carrier	0.1434	1

Data from National Safety Council

Compare **Fatal** Accidents per Flight Hour

	Fatal Accidents (per 100,000 hours)	Multiple
General Aviation	1.732	53
Air Carrier	0.0324	1

Data from National Safety Council

Comparison to Air Carrier 1990-1995

Per flight hour* accident rates from 1990-1995 show that GA operations are 50 times more dangerous than air carrier operations.

Data from National Safety Council

Some Questions

Is it reasonable to expect the same level of safety?

- Three times more landings and takeoffs than air carriers
- Extreme variety of missions and flight operations
- Extreme variety of flight and ground equipment
- Extreme variety of airport conditions
- Significantly greater pilot workload
- Less control
- More freedom
- Individual responsibility for determining safety level of ops

Some Questions

Oh?

What if you put the question to your passengers?

Question

Just how careful do GA pilots have to be to reduce the GA accident rate to air carrier levels?

GA Accident Statistics Reduced to Air Carrier Safety Levels

<u>Cause</u>	<u>1995 Accidents</u>	<u>1995 Accidents Reduced to Air Carrier Rate</u>
Preflight/Taxi	60	1
Takeoff/Climb	388	10
Weather	153	3
Fuel Management	141	2
Other (cruise)	21	1 in 3 years
Approach	80	2
Go-around	85	2
Maneuvering	192	5
Landing	540	9
Other	49	1

The Answer:

- Real Good
- Real Careful

Preflight/Taxi	60
Takeoff/Climb	388
Weather	153
Fuel Management	141
Other (cruise)	21
Approach	80
Go-around	85
Maneuvering	192
Landing	540
Other	49

Comparison with Motor Vehicle Operations

Examine Population Statistics (not a good measure)

<u>Cause</u>	<u>Fatalities / 100,000 Population</u>
Motor Vehicle	16.5
Firearms	13.0
Falls	5.1
Poison (L,S)	3.1
Fire	1.6
Drowning	1.5
Choking	1.2
Poison (G,V)	0.30
General Aviation	0.24
Railroad	0.20
Pedacycle, Streetcar, Horse	0.10
Air Carrier	0.02

Data from National Safety Council

Compare **Non-Fatal** Accidents per Mile Traveled*

<u>Cause</u>	<u>Non-Fatal Accidents</u>	<u>Multiple</u>
	(per 100,000 miles)	
Motor Vehicles	0.274	781
General Aviation	0.0455	130
Air Carrier	0.00035	1

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* Per mile basis is probably not a good yardstick for air carrier comparison since air carriers benefit from much higher speed, but it is essentially the only yardstick for motor vehicle comparison.

Data reduced from the Nall Report, DOT statistics, and National Safety Council

Compare **Fatal** Accidents per Mile Traveled

<u>Cause</u>	<u>Fatal Accidents</u> (per 100,000 miles)	<u>Multiple</u>
General Aviation	0.0115	144
Motor Vehicle	0.00183	23
Air Carrier	0.00008	1

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Data reduced from the Nall Report, DOT statistics, and National Safety Council

General Aviation vs. Motor Vehicle

- **5 times more likely to get injured in the car**
- **5 times more likely to get killed in the GA airplane.**

Summary

Measured by Total, Non-Fatal, and Fatal Accidents per Flight Hour:

General aviation is about 50 times more dangerous than air carriers.

Measured by Non-Fatal Accidents per Mile:

General aviation is about 5 times safer than motor vehicle travel.

Measured by Fatal Accidents per Mile:

General aviation is about 5 times more dangerous than motor vehicle travel.

The Point

- **Statistics reflect the current training standards and piloting practices**
- **Without a rededicated effort by flight instructors and command pilots to elevate the level of basic piloting skills and basic pilot-in-command skills ...**

... it is 5 times safer to drive and 50 times safer to fly commercial.

Implications for General Aviation Flight Instructors

Flight Instructors' Assignment

- **Expand our ground school program to emphasize:**
 - **Motivation**
80/87
5/50
 - **Basic pilot-in-command training**
Weather, Fuel Management, Approaches
PIC Responsibilities
 - Procedures**
 - Judgement**
 - Vigilance**
 - Leadership**

Flight Instructors' Assignment

- Re-energize our flight training program to elevate our standards for:
 - Performance
 - Higher performance expectations for both instructor and student
 - Basic Airplane Handling Techniques
 - Takeoff and climb
 - Maneuvering
 - Landing

Basic Safety Statistics

We must teach “80/87”.

Basic Safety Statistics

That 80% of all accidents have pilot-related causes. That 87% of those are due to:

BASIC piloting deficiencies:

Takeoff and Climb

Maneuvering

Landing

BASIC pilot-in-command deficiencies:

Weather

Fuel management

Approaches

Basic Safety Statistics

We must teach “5/50”.

Basic Safety Statistics

That without continuing effort by the command pilot to elevate his piloting skills and pilot-in-command procedures, it is 5 times safer to drive and 50 times safer to fly commercial.

That if they cannot generate the discipline to be the command pilot of a passenger carrying airplane, they are better off on the ground or with a recreational pilot's license.