27TH JOSEPH T. NALL REPORT

General Aviation Accidents in 2015

AOPA AIR SAFETY INSTITUTE

DEDICATION

The *Joseph T. Nall Report* is the AOPA Air Safety Institute's review of general aviation accidents during the most recent year for which reasonably complete data are available. The report is dedicated to the memory of Joe Nall, a National Transportation Safety Board member who died as a passenger in an airplane accident in Caracas, Venezuela, in 1989.

INTRODUCTION

WHAT IS GENERAL AVIATION?

General aviation (GA) is all flight activity except that done by the uniformed armed services and the scheduled airlines. In addition to personal and recreational flying, it includes public-benefit missions such as law enforcement and fire suppression, flight instruction, freight hauling, passenger charters, crop-dusting, and other types of aerial work that range from news reporting to helicopter sling loads.

Similar to its predecessors, the *27th Nall Report* analyzes general aviation accidents in United States national airspace and on flights departing from or returning to the U.S. or its territories or possessions. The report covers airplanes with maximum rated gross takeoff weights of 12,500 pounds or less and helicopters of all sizes. Collectively, these types of aircraft account for 99 percent of GA flight activity. Other categories are excluded, including gliders, weight-shift control aircraft, powered parachutes, gyrocopters, and lighter-than-air crafts of all types.

Due to the nature of accident investigation, specifically fatal accidents, the National Transportation Safety Board (NTSB) requires substantial time and resources to investigate accidents. The Air Safety Institute's (ASI) Nall report covers the most recent year for which probable cause has been determined in at least 80 percent of accidents.

The total amount of flight activity nationwide can vary substantially from year to year. For that reason, the most informative measure is usually not the number of accidents but the accident rate, commonly expressed as the number of accidents per 100,000 flight hours. GA flight time is estimated using the FAA's annual General Aviation and Part 135 Activity Survey, which breaks down aircraft activity by category and class and purpose of flight, among other characteristics.

NOTE: Because the 2011 activity survey was not completed, the *Nall Report* and *GA Accident Scorecard* do not estimate rates for that year.

As a supplement to the information contained in this report, ASI offers its accident database online. To search the database, visit www.aopa.org/training-and-safety/air-safety-institute/accident-analysis.

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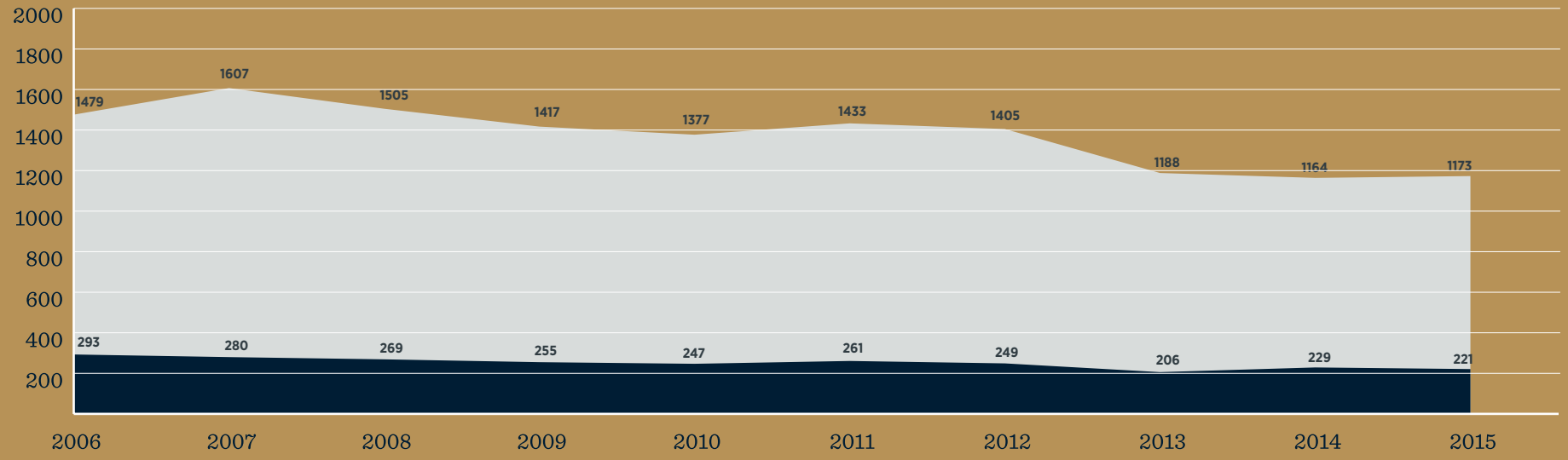
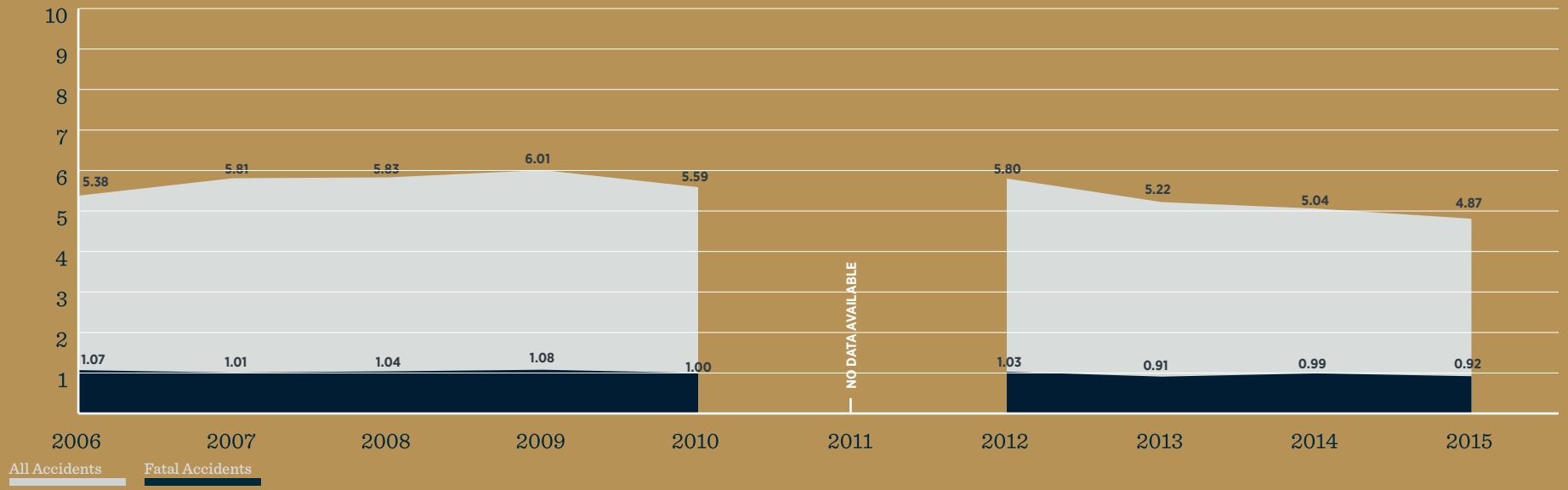


FIGURE 2. OVERALL GENERAL AVIATION ACCIDENT RATE, 2006-2015



PUBLISHER'S VIEW

Since its inaugural version in 1991, the Joseph T. Nall report has been accepted as the leading source for in-depth, factual reporting of general aviation accidents and accident trend analysis. This 27th edition is no exception. As we continually strive to improve the report's layout for better readability, we're pleased to provide this year's Nall in a sharp and concise format while retaining the important data that industry analyst have come to expect and rely on for decades.

We recently unearthed the Nall's inaugural edition, and compared it to today's. In 1991, the Nall comprised 12 pages of accident analysis based on preliminary NTSB findings. Several graphs illustrated 1990 statistics compared to the previous year and the 1982-1988 accident database average—an effort to provide insight into long-term trends. The 1991 edition called for collecting data to study accident profiles, help accident prevention, and lead the way to new training programs and improved aircraft designs. Interestingly, the booklet noted that 1990 was the safest year on record, quoting a drop in the total accident rate to 7.01 per 100,000 hours flown—"the lowest ever recorded." But the fatal accident rate for all general aviation remained steady, at 1.39 per 100,000 hours flown.

To put these numbers in context, we must look back even farther: In 1950, the total accident rate was 46.68 per 100,000 flight hours; the fatal accident rate was 5.17 per 100,000 hours flown. Fast forward to today: The accident and fatal accident rates have plunged to an estimated 5.32 and 0.84 per 100,000 hours, respectively. Clearly, we've come a long way in aviation safety.

Studying accident causes and breaking down accidents by aircraft types, phase of flight, and pilot profiles has helped us dramatically decrease the overall and fatal accident rates measured per 100,000 hours flown. The 27th Nall Report highlights yet another record setting year confirming this positive trend. Although the total accident number increased, the overall accident rate decreased thanks to a 3.6 percent increase in flight activity to 24 million flight hours. The number of fatal accidents decreased by 4 percent. So, we're flying more and having fewer fatalities.

Imagine a year without a single fatal accident in GA. We aren't there yet, but we're getting closer every year. There is so much more work to be done and so much more progress ahead of us. We need to shake the persistent, stubborn recurrence of pilot-related accidents, accounting for approximately 74 percent of all accidents and all fatal accidents—a trend that continues from year to year. These accidents are often caused by lack of proficiency and poor decision making, and they typically lead to controlled flight into terrain, loss of control, or continued VFR flight into IMC. We will continue to provide critical education in these areas. But as an industry we need to do more to improve these undesirable statistics, and foremost, accelerate our effort to reach those that are vulnerable to pilot error. 2015 had 221 fatal accidents, resulting in 375 fatalities. And while the overall fatal accident trend is downward—any fatality, any accident, is one too many. We must not lose sight of the fact that every fraction of a point drop in our fatal accident rate equals lives saved.

The industry has done a superb job of coming together to achieve positive, measurable safety advances to date. We must guard against complacency and take charge or we will undo any progress made so far. Together, we—government, associations, and private industry—can find new ways to improve knowledge, training, proficiency, equipment, and culture. Together we'll save lives and continue to improve GA's reputation as safe, fun recreation and transportation.

Let's press harder, strengthen our goals, and make fatal accidents a thing of the past.

Safe flying,

GENERAL AVIATION

ACCIDENT DATA

Both overall accident and fatal accident rates as measured per 100,000 flight hours declined again in 2015. The fatal accident rate fell below 1 fatal event per 100,000 hours.

The 2015 total accident count was 1,173; 221 of those were fatal accidents, resulting in 375 fatalities. While the number of total accidents increased from 2014 to 2015, the number of fatal accidents declined by 4 percent, down from 229 in 2014 to 221 in 2015. This decrease in GA fatal accidents can be attributed to numerous industry initiatives designed to reduce fatal accidents by one percent every year from 2008 to 2018.

While some areas are not improving as quickly as others, the overall trends show a reduction in accident rates and simultaneously an increase in GA activity (total flight hours flown). The FAA estimated 2015 flight time around 23.98 million flight hours—a year to year increase of 3.6 percent.

The overall accident rate downward trend is encouraging and highlights the impact of government agencies, associations, and industry working together toward a shared goal.

Figure 3 shows a detailed breakdown of GA accidents by type of operation and aircraft.

FIGURE 3. GENERAL AVIATION ACCIDENTS IN 2015

	Non-Commercial		Commercial	
	Fixed-Wing	Helicopter	Fixed-Wing	Helicopter
Number of accidents	967	89	77	40
Number of aircraft*	977	89	77	40
Number of fatal accidents	196	10	8	7
Lethality (percent)	20.3	11.2	10.4	17.5
Fatalities	331	16	16	12

**Each aircraft involved in a collision is counted separately.*

SECTION 1

FIXED WING NON-COMMERCIAL

Trends 2006-2015

Figure 4 shows the 10-year trend data for non-commercial fixed-wing GA aircraft. Total accidents increased slightly from 2014 to 2015 while total fatal accidents remained steady over the same period. Flight activity increased in 2015 resulting in lower total and fatal accident rates.

RATES 2006-2015

The accident rate for GA non-commercial fixed-wing aircraft decreased for the third year in a row to 5.57 accidents per 100,000 hours. The fatal accident rate also decreased to 1.13 fatal accidents per 100,000 flight hours. The estimated flight time during 2015 for fixed-wing non-commercial aircraft was over 17.3 million hours, compared to the previous year of 16.4 million flight hours.

FIGURE 4. GENERAL AVIATION ACCIDENT TRENDS, 2006-2015

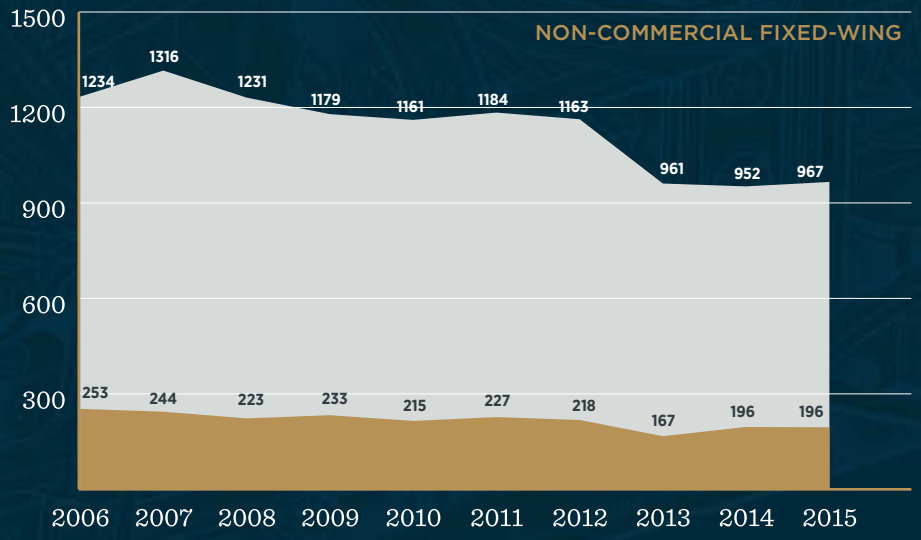
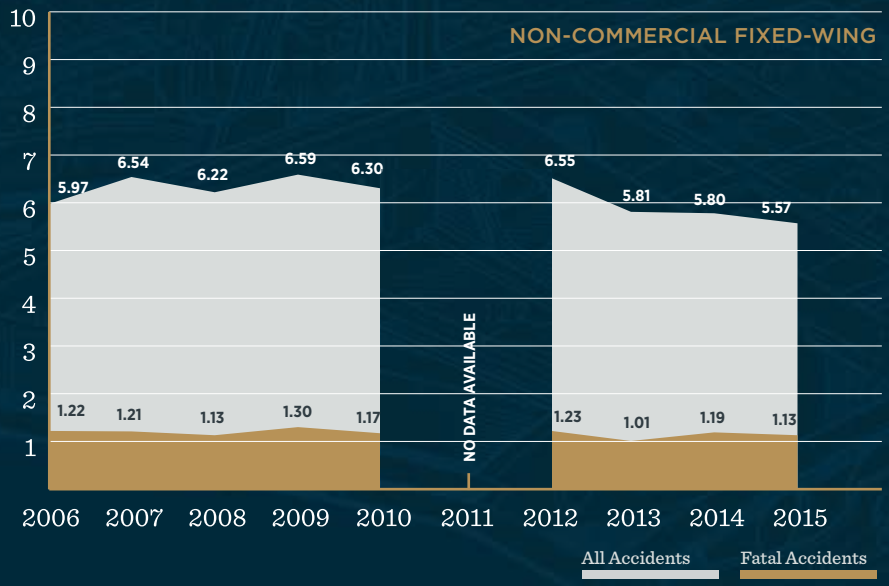


FIGURE 5. GENERAL AVIATION ACCIDENT RATES, 2006-2015




PIPER

MAJOR CAUSES

GA accident causes are typically grouped into three broad categories (Figure 6):

PILOT-RELATED | accidents arising from the improper actions or inactions of the pilot.

MECHANICAL/MAINTENANCE | accidents arising from mechanical failure of a component or an error in maintenance.

OTHER/UNKNOWN | accidents for reasons such as bird strikes and unexplained losses of engine power, plus those for which a specific cause has not been determined.

As with previous years pilot-related was the major cause of non-commercial fixed wing aircraft accidents, accounting for roughly 74 percent of all total and fatal accidents. Mechanical-related accidents accounted for roughly 16 percent of accidents and 8 percent of fatal accidents. Other or unknown causes accounted for 10 percent of accidents and 17 percent of fatal accidents.

While these numbers follow a long trend of data and appear consistent year to year, progress is being made to reduce the types of pilot- and mechanical-related accidents. The following sections will highlight the breakdown of pilot-related, mechanical/maintenance, and other/unknown causes, as well as provide a detailed look at subcategories for each area.

To address the overwhelming percent of pilot-related accidents, stakeholders are in the process of developing new training, policy, and technology to combat pilot-related accidents. The preliminary results of that process are positive.

FIGURE 6. MAJOR CAUSES: NON-COMMERCIAL FIXED-WING GENERAL AVIATION ACCIDENTS

	All Accidents		Fatal Accidents	
Pilot-related	714	73.8%	146	74.5%
Mechanical	152	15.7%	16	8.2%
Other or unknown	101	10.4%	34	17.3%

FIGURE 7. AIRCRAFT CLASS: NON-COMMERCIAL FIXED-WING

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-engine fixed-gear (SEF)	725	74.2%	118	60.2%	16.3%
SEF tailwheel	297		37		12.5%
Single-engine retractable	195	19.9%	62	31.6%	31.8%
Single-engine turbine	25		10		40.0%
Multiengine	57	5.8%	16	8.2%	28.1%
Multiengine turbine	16		3		18.8%

AIRCRAFT CLASS:
NON-COMMERCIAL FIXED-WING

The majority of accidents and fatal accidents occurred in single-engine aircraft; 909 and 175 respectively. Single-engine fixed gear accounted for a larger percentage of accidents; however single-engine turbine aircraft had the highest lethality rate. While several factors could account for the high lethality of single-engine turbine aircraft, the trend is similar to 2014 data.

TYPE OF OPERATION

Personal flights accounted for 78 percent of accidents and 85 percent of fatal accidents, an increase of approximately two percent from the previous year. This relatively high percentage is consistent with a 20-year trend. Instructional flight was again the second highest, accounting for 12 percent of accidents and 5 percent of fatal accidents. 2015 had a one-percent decrease in instructional accidents compared to 2014.

FLIGHT CONDITIONS

As with the previous years, day visual meteorological conditions (VMC) had the largest portion of accidents and fatal accidents by a wide margin, roughly 84 percent. Furthermore, day VMC had 71 percent of the total fatal accidents.

This trend continues from the previous year with day VMC accounting for the majority of accidents. Furthermore, this trend has remained constant for several years. However, IMC, day and night, had the highest lethality at 72 percent and 73 percent respectively.

PILOT QUALIFICATIONS

The private pilot certificate category had the highest number of total and fatal accidents, 481 and 90 respectively. Additionally, 52 percent of accident aircraft had an IFR rated pilot on board. While the number for private pilots appears high, it is worth noting that the majority of pilots flying in the non-commercial fixed-wing category are private pilots.

FIGURE 8. TYPE OF OPERATION: NON-COMMERCIAL FIXED-WING

Type of Operation	Accidents		Fatal Accidents		Fatalities	
Personal	762	78.0%	166	84.7%	289	87.3%
Instructional	119	12.2%	11	5.6%	15	4.5%
Public use	3	0.3%	1	0.5%	2	0.6%
Positioning	11	1.1%	1	0.5%	1	0.3%
Aerial observation	7	0.7%	1	0.5%	1	0.3%
Business	27	2.8%	6	3.1%	9	2.7%
Executive/corporate	2	0.2%	0	0.0%	0	0.0%
Other work use	18	1.8%	4	2.0%	6	1.8%
Other or unknown*	28	2.9%	6	3.1%	8	2.4%

**Includes air shows, flight tests, and unreported.*

FIGURE 9. FLIGHT CONDITIONS: NON-COMMERCIAL FIXED-WING

Light and Weather	Accidents		Fatal Accidents		Fatalities	
Day VMC	831	85.9%	139	70.9%	221	66.8%
Night VMC*	83	8.6%	19	9.7%	33	10.0%
Day IMC	32	3.3%	23	11.7%	42	12.7%
Night IMC*	15	1.6%	11	5.6%	27	8.2%
Unknown	6	0.6%	4	2.0%	8	2.4%

**Includes dusk.*

1.1 PILOT-RELATED ACCIDENTS

(714 ACCIDENTS / 146 FATAL):

GENERAL TRENDS

Pilot-related accidents have decreased to their lowest point in 10 years. In 2015, there were 714 accidents attributed to pilots. Worth mentioning is the percent of fatal events that have decreased year over year since 2011.

The rate of pilot-related accidents appears to be decreasing year to year. The 2015 fatal accident rate is under one event per 100,000 flight hours. Looking over the 10-year trend information, we can see a general downward trend from 2012 onward.

PILOT-RELATED ACCIDENTS BY TYPE:

As with other years the majority of accidents occurred during the takeoff and climb and landing phases of flight. While landing accidents have the fewest fatalities, pilot-related weather accidents account for the highest lethality. Additionally, total accidents in the maneuvering category decreased in 2015, but fatal accidents increased, which resulted in an increase in lethality from 55 percent in 2014 to 73 percent in 2015.

1.1.1 FUEL MANAGEMENT ACCIDENT TRENDS

(76 ACCIDENTS / 13 FATAL):

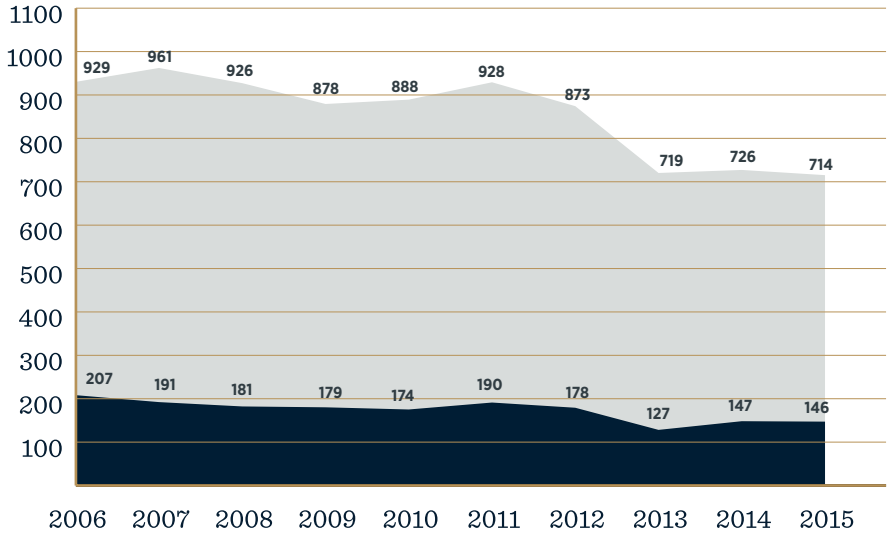
Flight planning was once again the largest cause of fuel management accidents. Contamination spiked from 2014 and accounted for three fatalities.

FIGURE 10. PILOTS INVOLVED IN NON-COMMERCIAL FIXED-WING ACCIDENTS

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	125	12.8%	31	15.8%	24.8%
Commercial	261	26.7%	56	28.6%	21.5%
Private	481	49.2%	90	45.9%	18.7%
Sport	27	2.8%	1	0.5%	3.7%
Recreational	3	0.3%	1	0.5%	33.3%
Student	65	6.7%	10	5.1%	15.4%
Other or unknown	15	1.5%	7	3.6%	46.7%
Second pilot on board	138	14.1%	31	15.8%	22.5%
CFI on board*	208	21.3%	44	22.4%	21.2%
IFR pilot on board*	509	52.1%	115	58.7%	22.6%

**Includes single-pilot flights.*

FIGURE 11. PILOT-RELATED ACCIDENT TREND



1.1.2 WEATHER ACCIDENT TRENDS
(38 ACCIDENTS / 29 FATAL):

2015 marks the end of a two-year downward trend in weather-related accidents. However, the two additional accidents that occurred in 2015 versus 2014 can likely be attributed to an increase in flying activity in 2015. Overall, the percent of pilot-related weather accidents remained constant from 2014 to 2015, around 4 percent.

Weather accident types remained relatively stable from the previous year. The majority of weather accidents were VFR flights into IMC. Additionally, this category had the largest number of fatal accidents and the highest lethality rate. This trend of VFR into IMC is among the higher percentages in terms of lethality, up from the previous year by four percent.

FIGURE 13. TYPES OF PILOT-RELATED ACCIDENTS

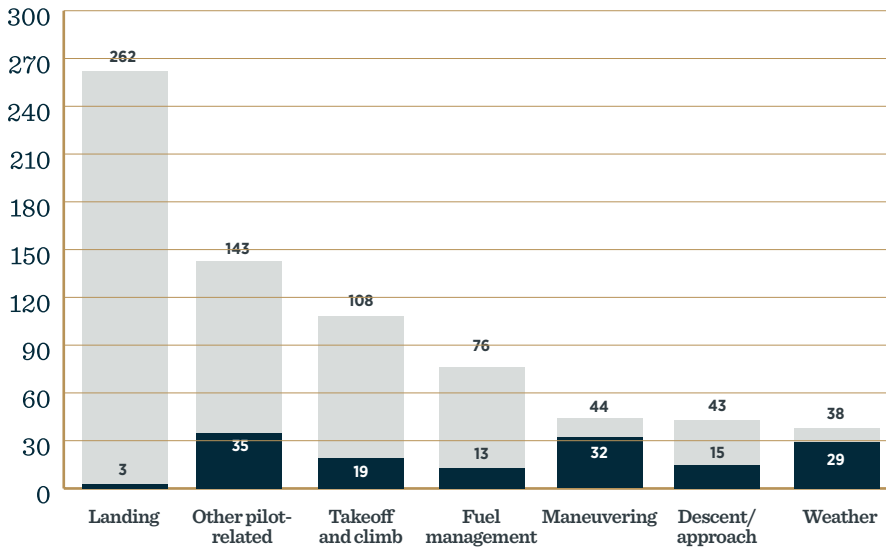


FIGURE 12. PILOT-RELATED ACCIDENT RATES 2006-2015

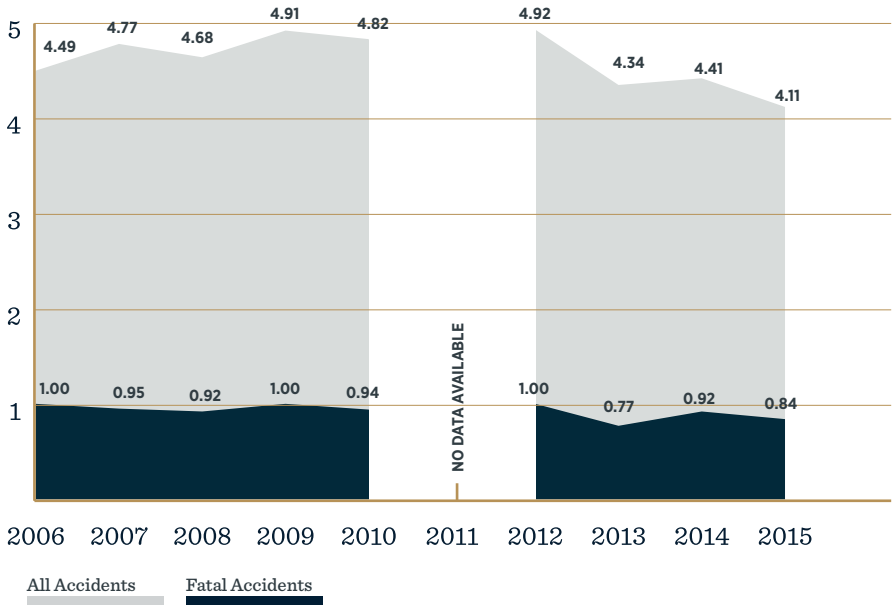


FIGURE 14. FUEL MANAGEMENT ACCIDENT TREND

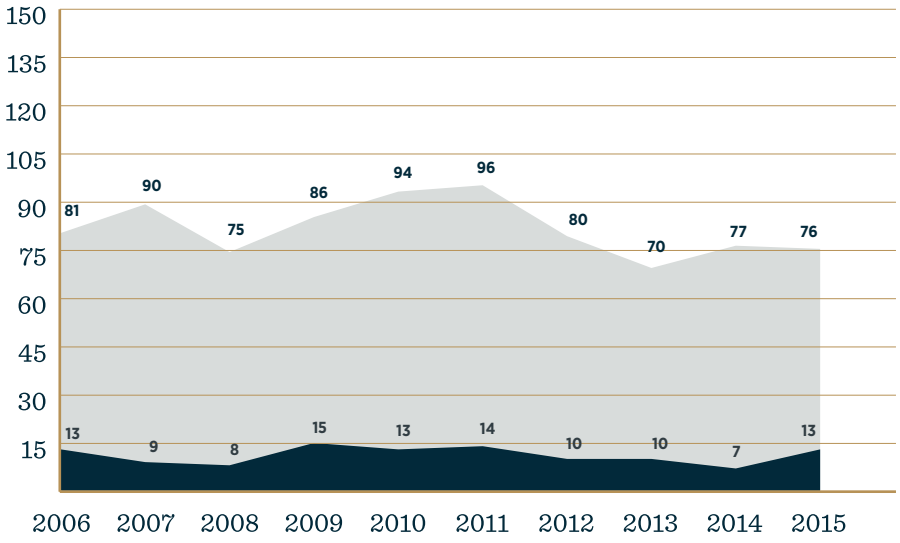


FIGURE 15. TYPES OF FUEL MANAGEMENT ACCIDENTS

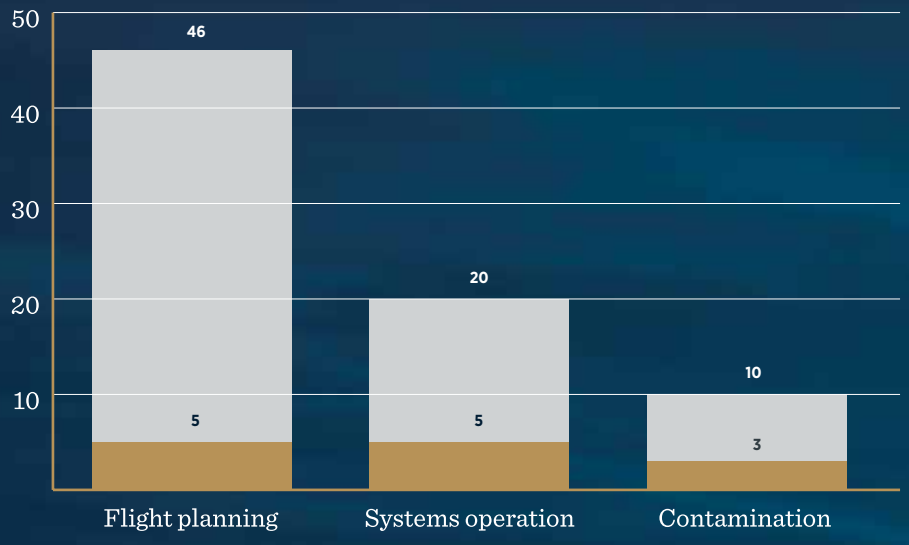


FIGURE 16. TYPES OF WEATHER ACCIDENTS

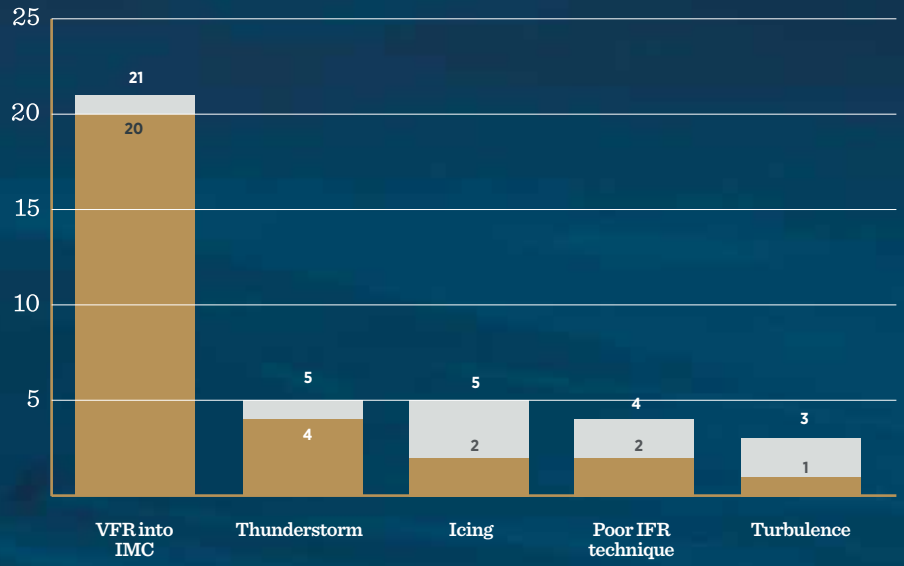


FIGURE 17. WEATHER ACCIDENT TREND

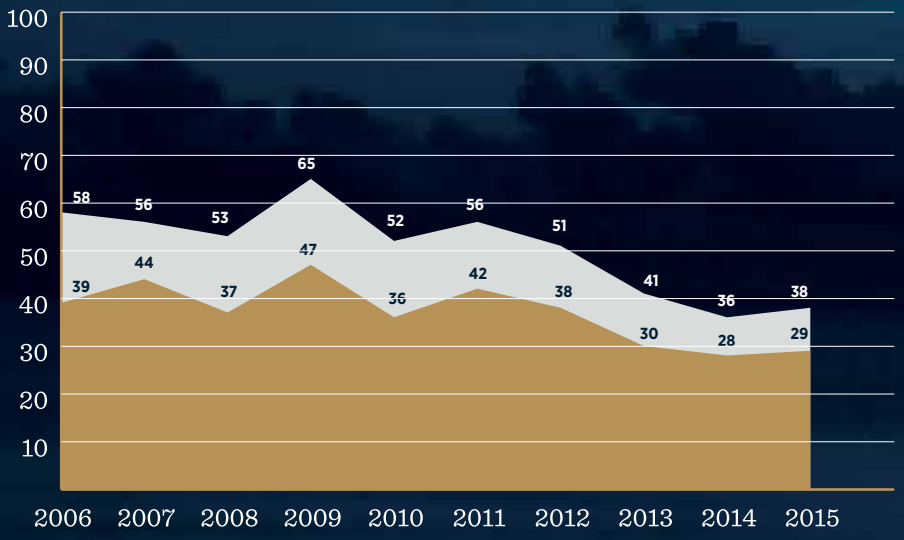
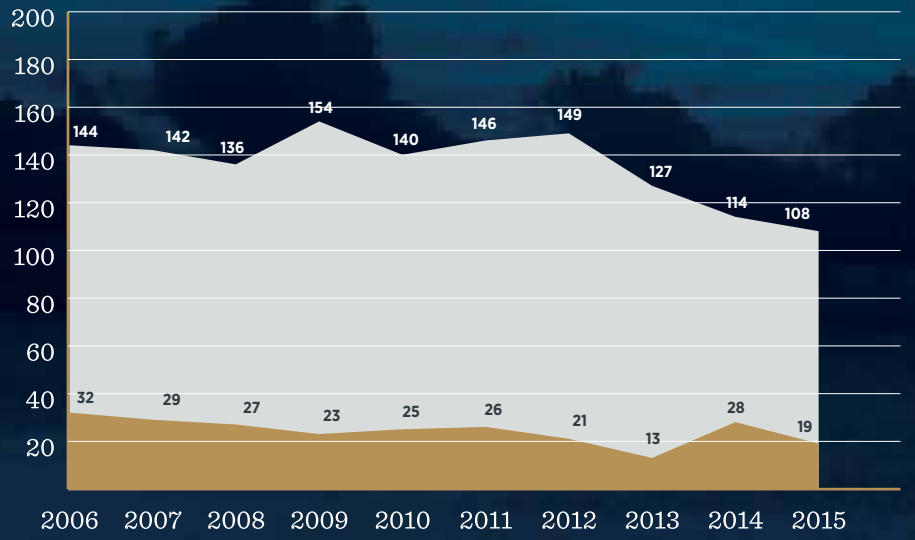


FIGURE 18. TAKEOFF AND CLIMB ACCIDENT TREND



1.1.3 TAKEOFF AND CLIMB ACCIDENT TRENDS
(108 ACCIDENTS / 19 FATAL):

Takeoff and climb accidents continues a three-year downward trend of total accidents, including a marked decrease in fatal accidents from 2014 to 2015. The overall trend of takeoff and climb fatal accidents has remained relatively flat with a potential small downward trend.

The bulk of takeoff and climb accidents were the result of loss of control and stalled or settled on takeoff, at 40 and 36 respectively. Loss of control had the highest number of accidents, but stalled or settled on takeoff had the highest number of fatal accidents.

1.1.4 MANEUVERING ACCIDENTS
(44 ACCIDENTS / 32 FATAL):

2015 had nine fewer maneuvering accidents than 2014. This helped reverse the previous year's increase and contributes to the overall downward trend of maneuvering accidents. However, in terms of fatal accidents there is a two-year upward spike.

As with 2014 the major cause of maneuvering accidents is stall/LOC. While there is a decrease from 2014 to 2015 in terms of total accidents, the number of fatal accidents increased by four. Additionally, stall/LOC accidents have the highest percent of lethality.

FIGURE 19. TYPES OF TAKEOFF AND CLIMB ACCIDENTS

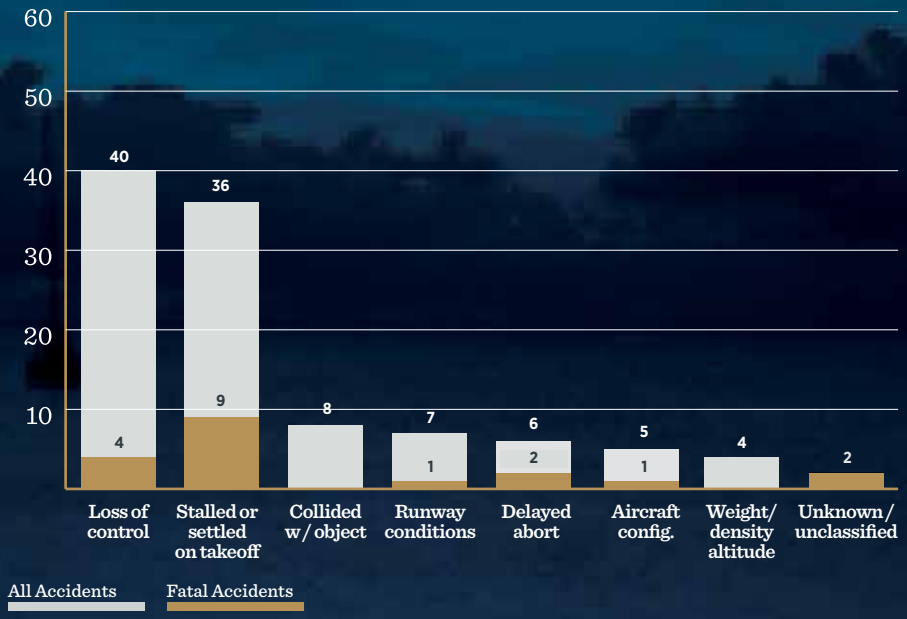
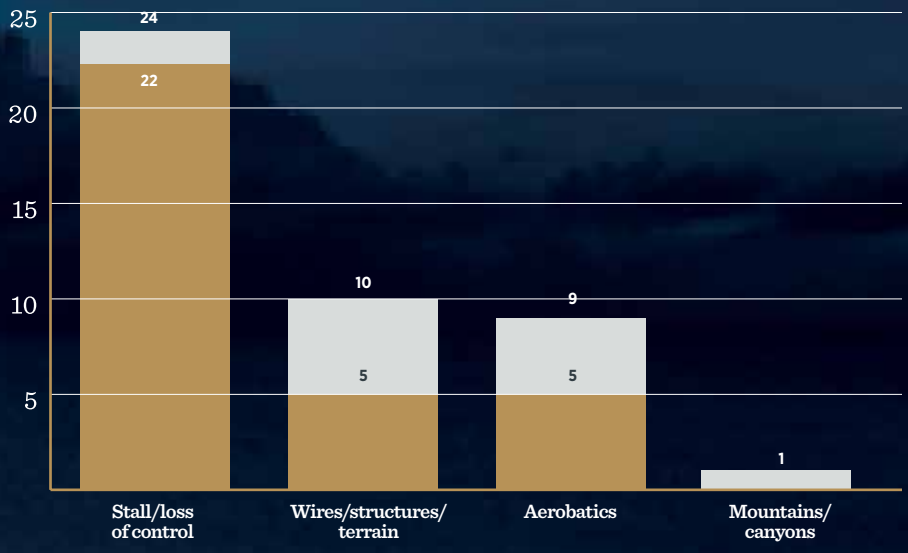


FIGURE 20. TYPES OF MANEUVERING ACCIDENTS



1.1.5 DESCENT/APPROACH ACCIDENTS
(43 ACCIDENTS / 15 FATAL):

The descent/approach accident trend appears cyclical. Often there are years where a decrease in the number of accidents is evident. However, there are also years where the trend reverses itself and increases. Looking at the historical data shows a small overall decrease. In terms of fatal accidents there is a small overall downward trend, but the year-to-year is subject to spikes.

The types of descent/approach accidents are spread approximately evenly across the four categories. Of note is the deficient instrument approach procedures (IAP) which resulted in the most fatal accidents and highest lethality rate.

1.1.6 LANDING ACCIDENTS
(262 ACCIDENTS / 3 FATAL):

Landing accidents is again the largest "phase of flight" accident category. While landing accidents make up the largest category of pilot-related accidents, often it has some of the lowest number of fatal accidents relative to the total accidents. Thus, the lethality of landing accidents is low compared to other areas.

The downward trend continues for landing accidents, but the number of fatal accidents remains mostly flat with single-digit events. Loss of control was the single largest type of landing event by a wide margin.

FIGURE 21. DESCENT AND APPROACH ACCIDENT TREND

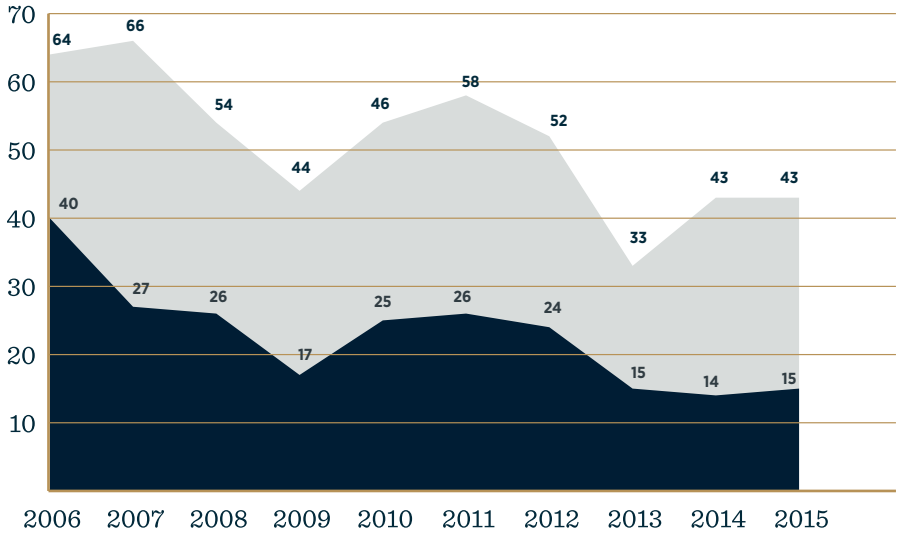


FIGURE 22. TYPES OF DESCENT AND APPROACH ACCIDENTS

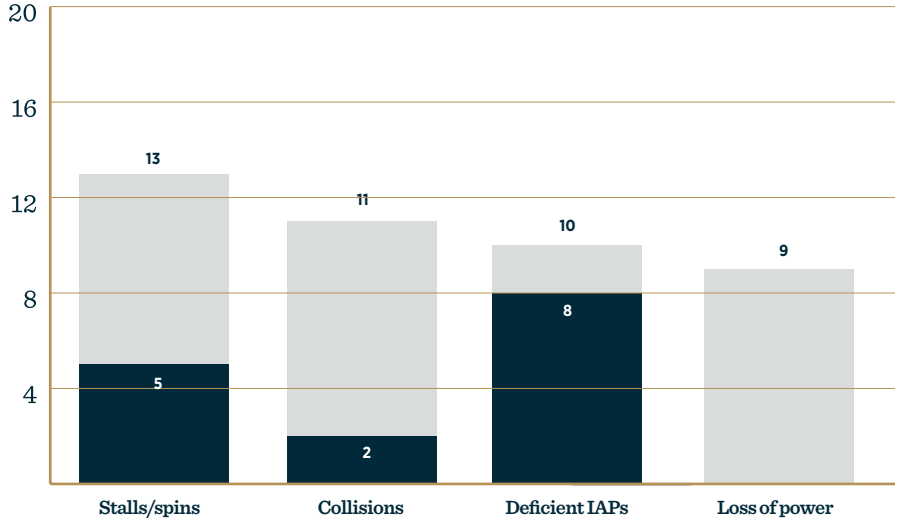
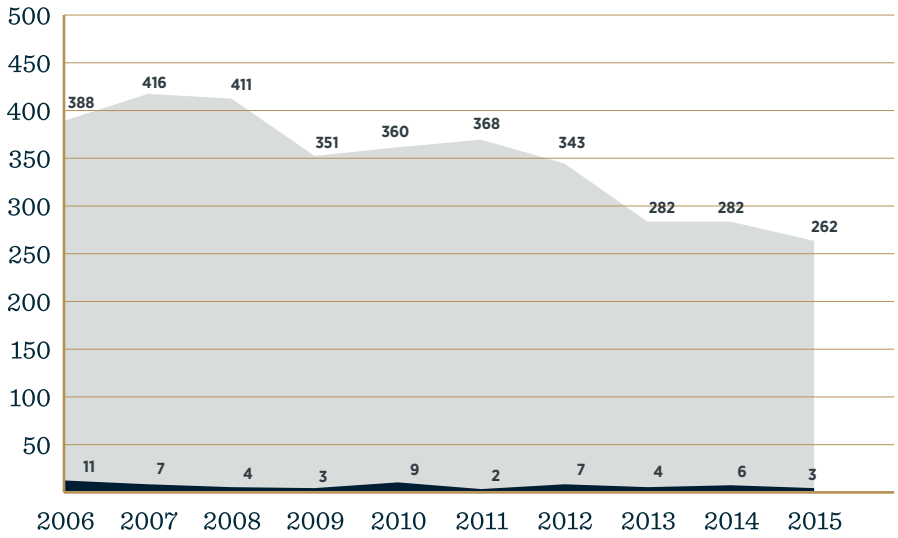


FIGURE 23. LANDING ACCIDENT TREND



1.1.7 OTHER PILOT-RELATED AND UNUSUAL ACCIDENTS

The remaining accidents that could not be classified into a phase of flight, but were reasonably inferred based on preliminary data, fall into the other pilot-related accidents category. In addition, unusual accidents—typically too small in number to bear their own category—include physical incapacitation, alcohol and drugs, collisions, off-airport ground injuries, and on-airport ground injuries. The majority of accidents were power loss (i.e., engine/powerplant issues).

FIGURE 24. TYPES OF LANDING ACCIDENTS

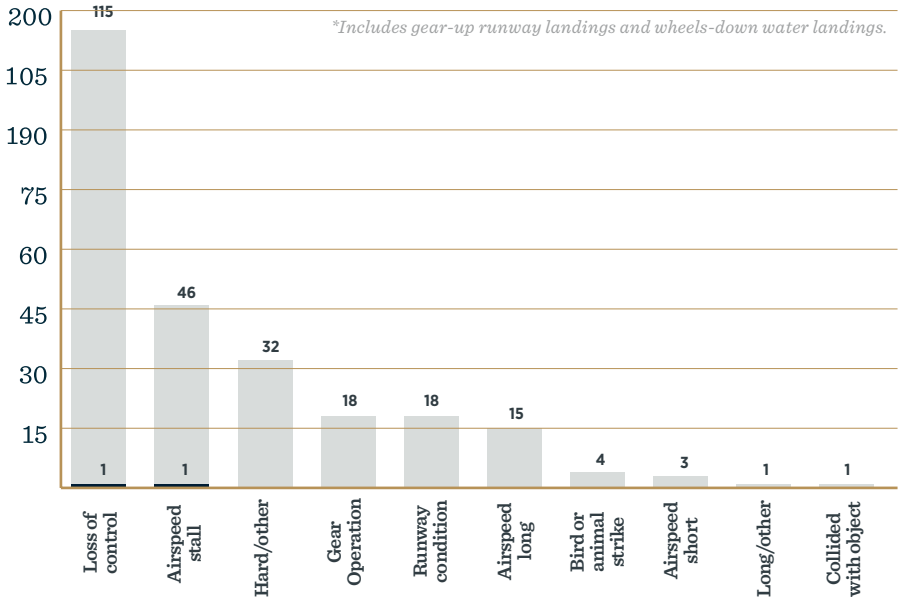


FIGURE 25. 'OTHER' AND UNCLASSIFIED ACCIDENTS: NON-COMMERCIAL FIXED-WING

Major Cause	Accidents		Fatal Accidents		Lethality
Not yet assigned	1	1.0%	1	2.9%	100.0%
Other	48	47.5%	21	61.8%	43.8%
Other (Power Loss)	52	51.5%	12	35.3%	23.1%

All Accidents | Fatal Accidents

THE ACCIDENT BREAKDOWN FOR THE OTHER/UNUSUAL CATEGORY IS AS FOLLOWS:

#	ACCIDENT:	RESULT:
2	CRASHED FOR REASONS UNKNOWN	1 FATAL
2	COLLIDED WITH TERRAIN	
1	DITCHED FOR UNKNOWN REASONS	1 FATAL
2	CONTROL LOSS FOR UNKNOWN REASONS	
1	HAD UNREPORTED DAMAGE FROM A PREVIOUS FLIGHT	
1	WAS THE RESULT OF ENGINE ISSUES	1 OFF AIRPORT LANDING
2	AIRCRAFT PITCHED UP AND LOST CONTROL FOR UNKNOWN REASONS	
16	HAD FIRE IN THE ENGINE AREA FOR UNKNOWN REASONS	
1	CRASHED FOR UNDETERMINED REASONS	14 FATAL
1	PASSENGER INTERFERED WITH THE CONTROLS	
1	AIRCRAFT WAS HIT BY A MOTOR VEHICLE	
1	DISAPPEARED DURING FLIGHT	1 FATAL
3	WERE THE RESULT OF BIRD STRIKES	
1	IMPACTED POOR OR DAMAGED AIRPORT SURFACE	
1	HAD SMOKE IN THE COCKPIT FOR UNKNOWN REASONS	1 FATAL
1	HAD FAILED/LOCKED BRAKES	
1	WAS ENTANGLED WITH A BANNER	
1	WAS THE RESULT OF AN UNCERTIFIED PILOT OPERATING THE AIRCRAFT	
1	WERE THE RESULT OF IMPROPER MAINTENANCE/SERVICE BY THE PILOT	
6	HAD IMPROPER MAINTENANCE PERFORMED BY THE PILOT/OWNER	1 FATAL
2	PHYSICAL INCAPACITATION (CO POISONING, HYPOXIA, MEDICAL INCAPACITATION, AND SUICIDE)	2 FATAL
13	ALCOHOL AND DRUGS	11 FATAL
3	COLLISIONS	2 FATAL
12	OFF-AIRPORT GROUND INJURIES	7 FATAL
1	ON-AIRPORT GROUND INJURIES	2 FATAL
1		1 FATAL

1.2 MECHANICAL ACCIDENTS GENERAL TRENDS

(152 ACCIDENTS /16 FATAL):

Mechanical accidents increased in 2015. Overall, the data show a slight decrease over the 10-year timeframe. The 2015 spike bears watching, particularly in light of the continuing advance in the avereage age of the GA fleet.

Unlike the previous section, mechanical accidents are often the result of factors outside of the pilot's control. This does not remove the pilot from the responsibility of operating a safe and properly maintained aircraft, but it does indicate issues that may not be readily apparent or easily identified. While there was an increase in the total number of accidents, fatal accidents fell in 2015 compared to 2014.

TYPES OF MECHANICAL ACCIDENTS:

The largest contributor to mechanical accidents was a powerplant issue, followed by gear and brakes and fuel systems. Unlike pilot-related accidents the majority of mechanical accidents resulted in few fatal accidents. Thus mechanical accidents have a lower overall lethality rate.

FIGURE 26. MECHANICAL ACCIDENT TREND

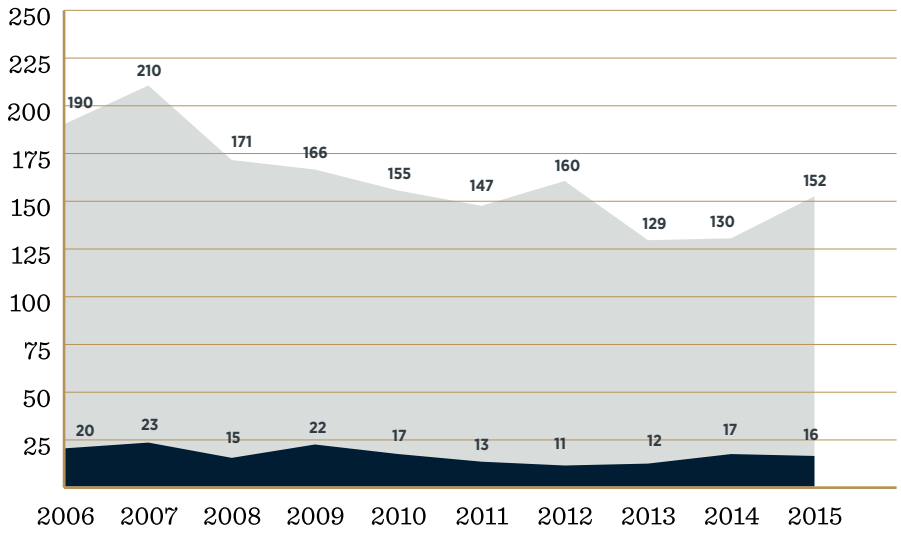
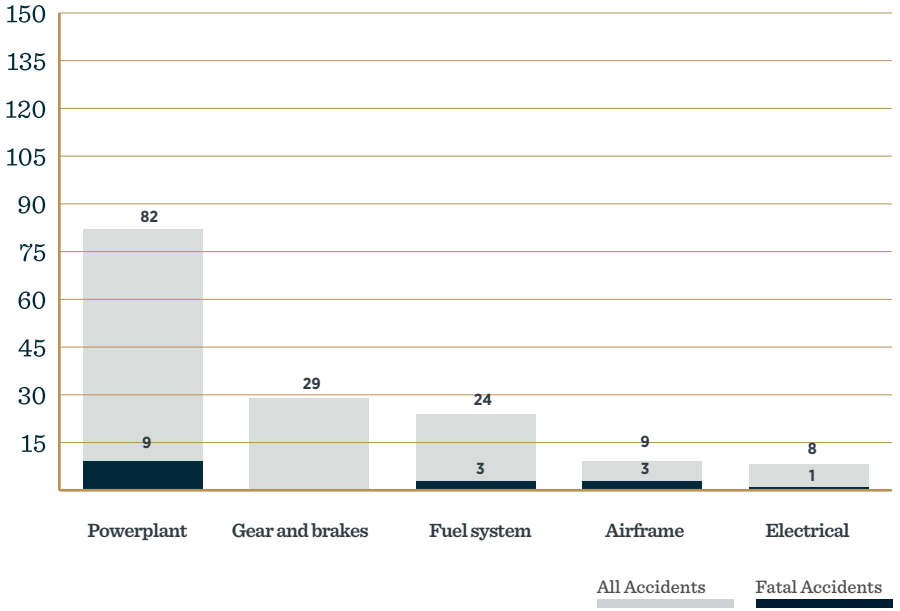


FIGURE 27. TYPES OF MECHANICAL ACCIDENTS



SECTION 2

FIXED-WING COMMERCIAL

Trends 2006-2015

The total number of GA accidents in 2015 increased from 2014; however, the total fatal accidents decreased during that same time. Commercial fixed-wing operations again delivered a better safety record than their non-commercial fixed-wing counterparts. This lower rate could be attributed to several factors and that may bear future study.

Due to the low number of total accidents, fixed-wing commercial operations accident trends have a cyclical appearance. For this reason, it is difficult to accurately assess the difference in overall performance. While it may be difficult to show an improvement, fixed-wing commercial operations are among some of the safest in the GA sphere of operation.

Similar to non-commercial fixed-wing, pilot-related accidents account for the majority of all commercial fixed-wing aircraft accidents. Second is mechanical followed by other or unknown. Of interest is the proportions of total accidents, which are similar for non-commercial and commercial fixed-wing. Targeted efforts to reduce aircraft accidents caused by pilots would help improve commercial and non-commercial fixed-wing operations, alike.

Part 137 aerial application, commonly referred to as crop dusting, accounted for the majority of commercial fixed-wing accidents and fatal accidents. Part 135 charter or cargo operations held the remainder.

Aerial application had only single-engine aircraft accidents. This is due primarily to the Part 137 fleet composition. Single-engine accounts for the majority of the accidents in charter/cargo operations as well.

In both Part 137 and 135 the majority of accidents and fatal accidents occurred during day VMC conditions.

Most accidents for Part 137 occurred during the takeoff phase of flight, followed closely by maneuvering accidents. Mechanical accidents followed third. In Part 135 operations, landing accidents were number one followed by mechanical, then takeoff. However, the only fatal accidents that occurred were a single mechanical-related accident and the two that were weather-related accidents.

FIGURE 28. GENERAL AVIATION ACCIDENT RATES, 2006-2015

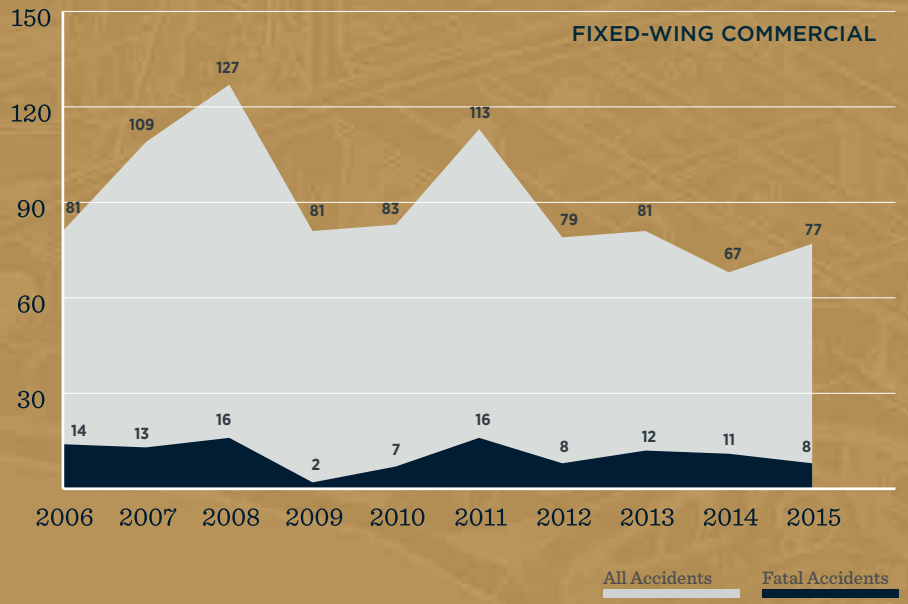


FIGURE 29. GENERAL AVIATION ACCIDENT RATES, 2006-2015

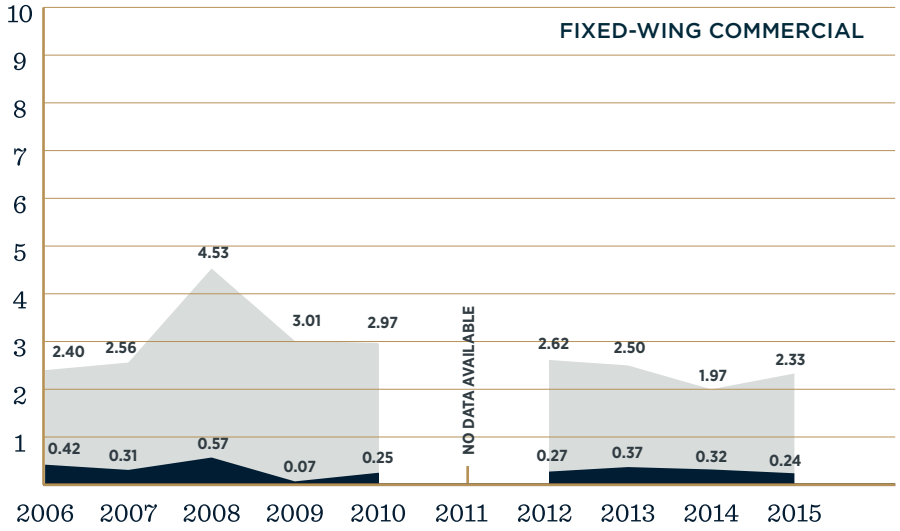


FIGURE 30. MAJOR CAUSES: FIXED-WING GENERAL AVIATION ACCIDENTS

	Commercial			
	All Accidents		Fatal Accidents	
Pilot-related	54	70.1%	6	75.0%
Mechanical	14	18.2%	2	25.0%
Other or unknown	9	11.7%	0	0.0%

All Accidents Fatal Accidents

FIGURE 31. COMMERCIAL FIXED-WING ACCIDENTS

Type of Operation	Accidents		Fatal Accidents		Fatalities	
Aerial Application (Part 137)	51	66.2%	5	62.5%	5	31.3%
Charter or Cargo (Part 135)	26	33.8%	3	37.5%	11	68.8%

FIGURE 32. AIRCRAFT CLASS: COMMERCIAL FIXED-WING

Aircraft Class	Accidents		Fatal Accidents		Lethality
Part 137: Aerial application					
Single-engine fixed-gear (SEF)	51	100.0%	5	100.0%	9.8%
SEF tailwheel	46		4		18.7%
Single-engine turbine	21		4		19.0%
Part 135: Charter and cargo					
Single-engine fixed-gear (SEF)	15	57.7%	2	66.7%	13.3%
SEF tailwheel	7		1		14.3%
Single-engine retractable	2	7.7%	1	33.3%	50.0%
Single-engine turbine	6		1		16.7%
Multiengine	9	34.6%	0	0.0%	0.0%
Multiengine turbine	3		0		0.0%

FIGURE 33. FLIGHT CONDITIONS: COMMERCIAL FIXED-WING

Light and Weather	Accidents		Fatal Accidents		Lethality
Part 137: Aerial Application					
Day VMC	49	96.1%	5	100.0%	10.2%
Night VMC*	2	3.9%	0	0.0%	0.0%
Part 135: Charter and Cargo					
Day VMC	17	65.4%	3	100.0%	17.6%
Night VMC*	5	19.2%	0	0.0%	0.0%
Day IMC	2	7.7%	0	0.0%	0.0%
Night IMC*	2	7.7%	0	0.0%	0.0%

**Includes dusk.*

FIGURE 34. PILOTS INVOLVED IN COMMERCIAL FIXED-WING ACCIDENTS

Certificate Level	Accidents		Fatal Accidents		Lethality
Part 137: Aerial application					
ATP	6	11.8%	0	0.0%	0.0%
Commercial	45	88.2%	5	100.0%	11.1%
Cfi on board*	8	15.7%	1	20.0%	12.5%
IFR pilot on board*	22	43.1%	4	80.0%	18.2%
Part 135: Charter and cargo					
ATP	13	50.0%	0	0.0%	0.0%
Commercial	13	50.0%	3	100.0%	23.1%
Second pilot on board	4	15.4%	0	0.0%	0.0%
CFI on board*	12	46.2%	1	33.3%	8.3%
IFR pilot on board*	26	100.0%	3	100.0%	11.5%

**Includes single-pilot flights.*

FIGURE 35. TYPES OF COMMERCIAL FIXED-WING ACCIDENTS: PART 137 (AERIAL APPLICATION)

Accident Type	Accidents		Fatal Accidents		Lethality
Fuel management	2	3.9%	0	0.0%	0.0%
Incapacitation	1	2.0%	1	20.0%	100.0%
Landing	8	15.7%	0	0.0%	0.0%
Maneuvering	12	23.5%	2	40.0%	16.7%
Mechanical	10	19.6%	1	20.0%	10.0%
Other (power loss)	5	9.8%	0	0.0%	0.0%
Takeoff	13	25.5%	1	20.0%	7.7%

FIGURE 36. TYPES OF COMMERCIAL FIXED-WING ACCIDENTS: PART 135 (CHARTER AND CARGO)

Accident Type	Accidents		Fatal Accidents		Lethality
Collision	1	3.80%	0	0.0%	0.0%
Descent / approach	1	3.80%	0	0.0%	0.0%
Fuel management	2	7.70%	0	0.0%	0.0%
Landing	7	26.90%	0	0.0%	0.0%
Mechanical	4	15.40%	1	33.3%	25.0%
Other	2	7.70%	0	0.0%	0.0%
Other (power loss)	2	7.70%	0	0.0%	0.0%
Takeoff	3	11.50%	0	0.0%	0.0%
Taxi	2	7.70%	0	0.0%	0.0%
Weather	2	7.70%	2	66.7%	100.0%

SECTION 3

HELICOPTER NON-COMMERCIAL

Trends 2006-2015

Non-commercial helicopter accidents in 2015 were below 100 for the first time since 2010. While fatal accidents appeared to remain mostly flat during this time period, 2015 does continue a three-year downward trend for total accidents.

Overall, helicopter non-commercial accident and fatality rates have remained stable with small up and down movement. It is worth noting that the accident rate has enjoyed a small decrease since 2012, but the overall trend remains relatively flat. Only in the last three years are there any indications of a progressive stable downward trend.

As with other operations, non-commercial helicopters had the majority of accidents attributed to pilots. Mechanical issues followed in a distant second. 2015 saw an increase in pilot-related accidents, but a decrease in mechanical accidents compared to 2014.

Single-engine piston helicopters had the majority of accidents and fatal accidents. Single-engine turbine was second with regard to accidents and fatal accidents. Around 90 percent of helicopter accidents occurred during day VMC conditions.

The largest causes of helicopter accidents were maneuvering, then rotorcraft aerodynamics followed by mechanical. Mechanical accidents accounted for the largest portion of fatal accidents. Weather and maneuvering were tied for the second highest.

All Accidents Fatal Accidents

FIGURE 37. GENERAL AVIATION ACCIDENT TRENDS
2006-2015

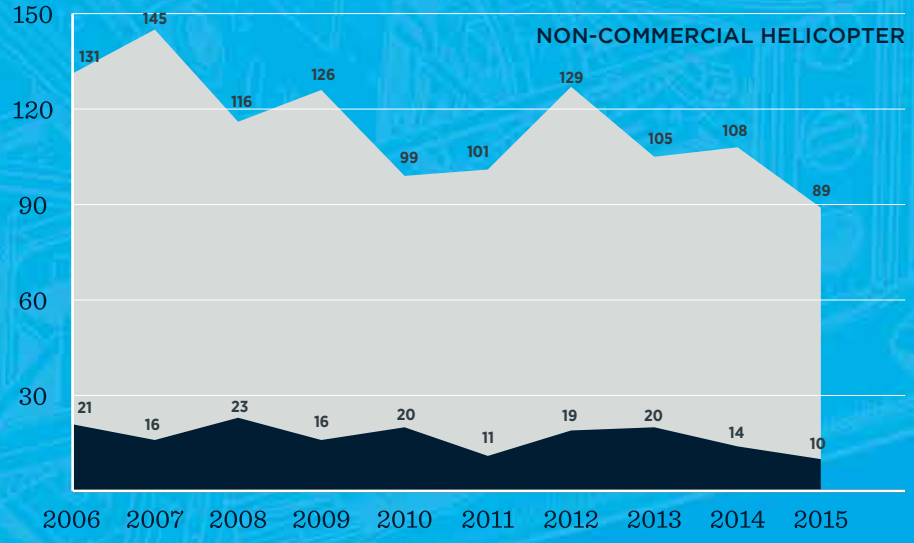


FIGURE 38. GENERAL AVIATION ACCIDENT RATES
2006-2015

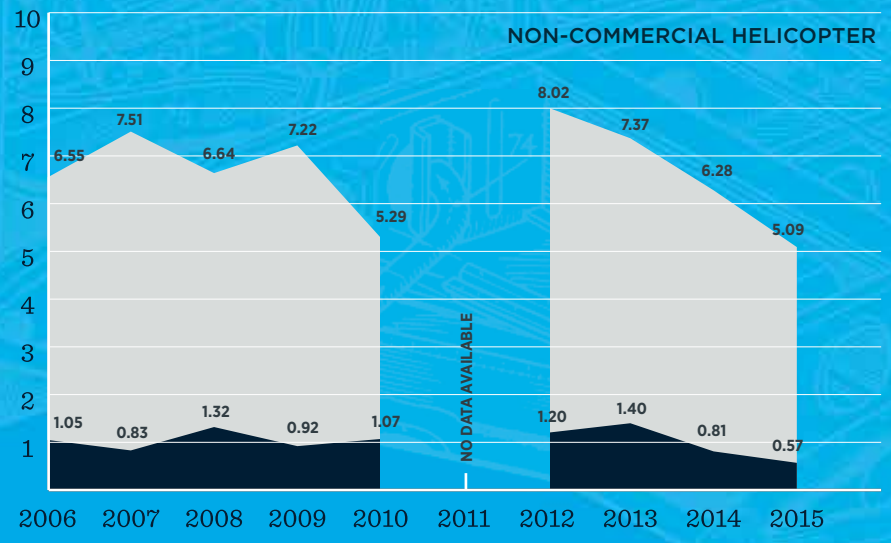


FIGURE 39. MAJOR CAUSES: NON-COMMERCIAL HELICOPTER GENERAL AVIATION ACCIDENTS

	All Accidents		Fatal Accidents	
Pilot-related	71	79.8%	7	70.0%
Mechanical	17	19.1%	3	30.0%
Other or unknown	1	1.1%	0	0.0%

FIGURE 40. AIRCRAFT CLASS: NON-COMMERCIAL HELICOPTER

Aircraft Class	Accidents		Fatal Accidents		Fatalities	
Single-engine piston	63	70.8%	6	60.0%	11	68.8%
Single-engine turbine	23	25.8%	3	30.0%	4	25.0%
Multiengine turbine	3	3.4%	1	10.0%	1	6.3%

FIGURE 41. TYPE OF OPERATION: NON-COMMERCIAL HELICOPTER

Type of Operation	Accidents		Fatal Accidents		Fatalities	
Personal	37	41.6%	4	40.0%	8	50.0%
Instructional	23	25.8%	3	30.0%	5	31.3%
Public use	4	4.5%	1	10.0%	1	6.3%
Positioning	6	6.7%	2	20.0%	2	12.5%
Aerial observation	6	6.7%	0	0.0%	0	0.0%
Business	4	4.5%	0	0.0%	0	0.0%
Other work use	5	5.6%	0	0.0%	0	0.0%
Other or unknown	4	4.5%	0	0.0%	0	0.0%

FIGURE 42. FLIGHT CONDITIONS: NON-COMMERCIAL HELICOPTER

Conditions	Accidents		Fatal Accidents		Fatalities	
Day VMC	79	88.8%	6	60.0%	11	68.8%
Night VMC*	7	7.9%	3	30.0%	4	25.0%
Day IMC	2	2.2%	1	10.0%	1	6.3%
Night IMC*	1	1.1%	0	0.0%	0	0.0%

**Includes dusk.*

FIGURE 43. PILOTS INVOLVED IN NON-COMMERCIAL HELICOPTER ACCIDENTS

Certificate Level	Accidents		Fatal Accidents		Fatalities	
ATP	11	12.4%	0	0.0%	0	0.0%
Commercial	53	59.6%	6	60.0%	8	50.0%
Private	21	23.6%	3	30.0%	7	43.8%
Sport	1	1.1%	0	0.0%	0	0.0%
Student	3	3.4%	1	10.0%	1	6.3%
Second pilot on board	24	27.0%	3	30.0%	6	37.5%
CFI on board*	37	41.6%	2	20.0%	4	25.0%
IFR pilot on board*	61	68.5%	7	70.0%	10	62.5%

**Includes single-pilot flights.*

FIGURE 44. TYPES OF NON-COMMERCIAL HELICOPTER ACCIDENTS

Accident Type	Accidents		Fatal Accidents		Lethality
Cruise	2	2.2%	0	0.0%	0.0%
External load	2	2.2%	1	10.0%	50.0%
Fuel management	2	2.2%	0	0.0%	0.0%
Landing	11	12.4%	1	10.0%	9.1%
Maneuvering	21	23.6%	2	20.0%	9.5%
Mechanical	17	19.1%	3	30.0%	17.6%
Not yet assigned	1	1.1%	0	0.0%	0.0%
Other / miscellaneous	8	9.0%	0	0.0%	0.0%
Pre-flight / static	1	1.1%	0	0.0%	0.0%
Rotorcraft aerodynamics	19	21.3%	1	10.0%	5.3%
Takeoff / climb	1	1.1%	0	0.0%	0.0%
Weather	4	4.5%	2	20.0%	50.0%

SECTION 4 HELICOPTER COMMERCIAL

Trends 2006-2015

Commercial helicopter tends to have the fewest total accidents compared to other operations. 2015 is similar to the historic trend, with fatal accidents remaining in the single digits. There is some cause for concern as the accident rates have remained flat. Thus it is difficult to show improvement within this operation type.

Part 137, aerial application, had the most accidents in 2015. Part 135, charter or cargo, came in second with regard to total accidents, but had the highest total of fatal accidents. External load, Part 133, had the fewest accidents and zero fatal accidents. Repeating a recurrent trend, the majority of Part 137, 135, and 133 accidents all occurred during day VMC conditions.

FIGURE 45. GENERAL AVIATION ACCIDENT TRENDS 2006-2015

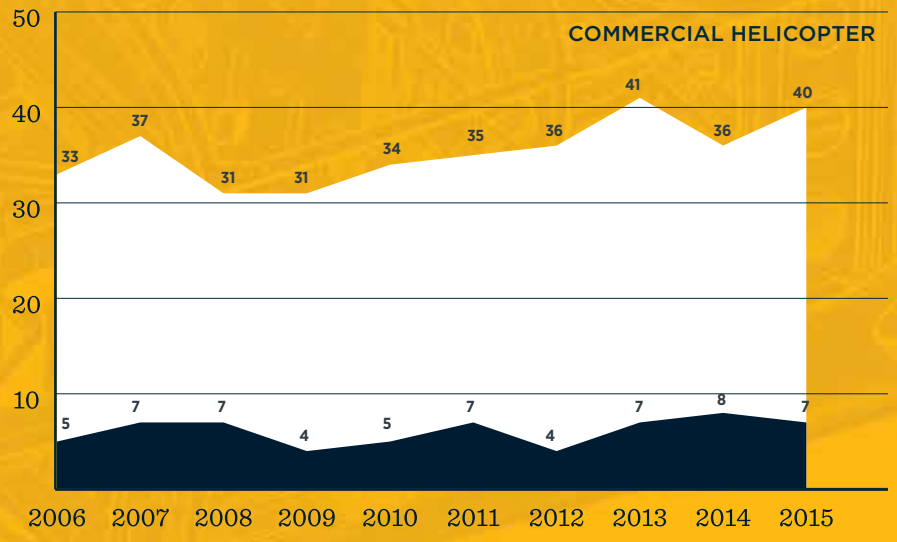


FIGURE 46. GENERAL AVIATION ACCIDENT RATES 2006-2015

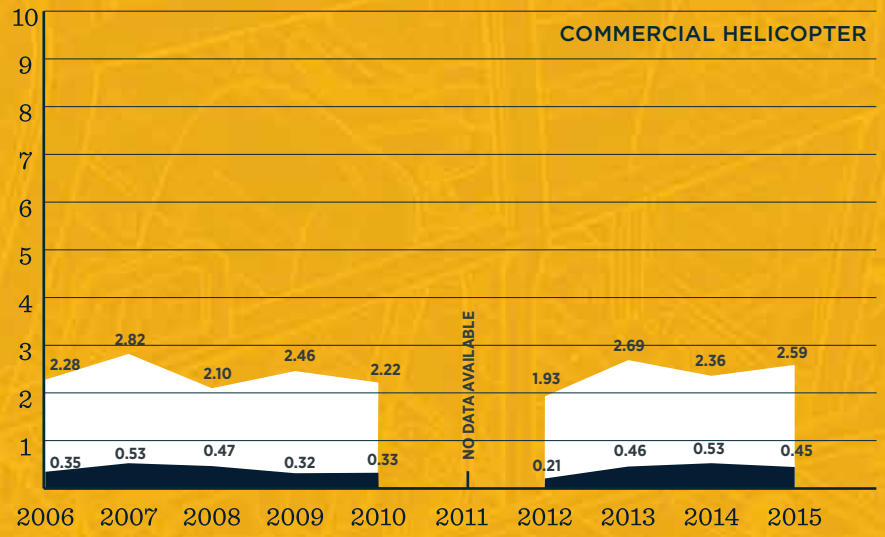


FIGURE 47. MAJOR CAUSES: COMMERCIAL HELICOPTER GENERAL AVIATION ACCIDENTS

	All Accidents		Fatal Accidents	
Pilot-related	28	70.0%	6	85.7%
Mechanical	12	30.0%	1	14.3%
Other or unknown	0	0.0%	0	0.0%

All Accidents Fatal Accidents

FIGURE 48. SUMMARY OF COMMERCIAL HELICOPTER ACCIDENTS

	Accidents		Fatal Accidents		Fatalities	
Aerial Application (Part 137)	**19**	47.5%	**3**	42.9%	**4**	33.3%
Single-engine piston	**10**	52.6%	**2**	66.7%	**2**	50.0%
Single-engine turbine	**9**	47.4%	**1**	33.3%	**2**	50.0%
Day VMC	**17**	89.5%	**2**	66.7%	**3**	75.0%
Night VMC*	**1**	5.3%	**0**	0.0%	**0**	0.0%
Day IMC	**1**	5.3%	**1**	33.3%	**1**	25.0%
ATP	**2**	10.5%	**0**	0.0%	**8**	0.0%
Commercial	**17**	89.5%	**3**	100.0%	**4**	100.0%
Charter or Cargo (Part 135)	**14**	35.0%	**4**	57.1%	**8**	66.7%
Single-engine piston	**1**	7.1%	**0**	0.0%	**0**	0.0%
Single-engine turbine	**11**	78.6%	**4**	100.0%	**8**	100.0%
Multiengine turbine	**2**	14.3%	**0**	0.0%	**0**	0.0%
Day VMC	**11**	78.6%	**3**	75.0%	**7**	87.5%
Night VMC*	**2**	14.3%	**0**	0.0%	**0**	0.0%
Unknown	**1**	7.10%	**1**	25.0%	**1**	12.5%
ATP	**4**	28.6%	**1**	25.0%	**1**	12.5%
Commercial	**10**	71.4%	**3**	75.0%	**7**	87.5%
External Load (Part 133)	**7**	17.5%	**0**	0.0%	**0**	0.0%
Single-engine turbine	**6**	85.7%	**0**	0.0%	**0**	0.0%
Multiengine turbine	**1**	14.3%	**0**	0.0%	**0**	0.0%
Day VMC	**7**	100.0%	**0**	0.0%	**0**	0.0%
Commercial	**7**	100.0%	**0**	0.0%	**0**	0.0%

**Includes dusk.*

SECTION 5

EXPERIMENTAL AND LIGHT SPORT AIRCRAFT

Trends 2006-2015

Experimental and light sport aircraft total accidents continue on a downward trend, though cyclical. Fatal accidents continue to be highly cyclical, though did reflect a welcome decrease from a 2014 spike. These accident numbers should be taken in context with a growth in the fleet of experimental and light sport aircraft.

The types of accidents should help shed some light on the potential issues that this category faces. The majority of accidents occurred during the landing phase; however, the majority of fatal accidents occurred during maneuvering. Mechanical issues was the second largest cause of accidents with takeoffs coming in third.

FIGURE 49. FIXED-WING AMATEUR-BUILT AND EXPERIMENTAL LIGHT SPORT ACCIDENT TREND

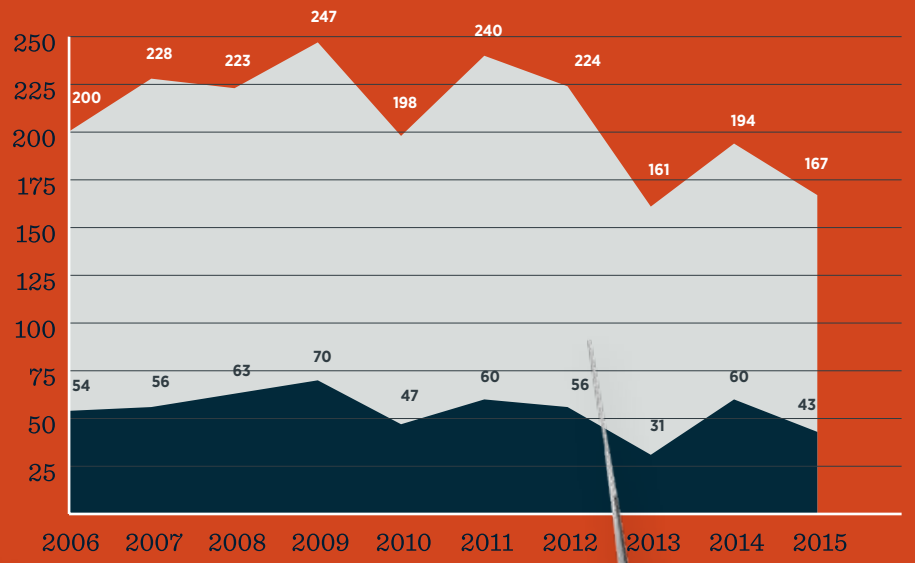


FIGURE 50. TYPES OF ACCIDENTS IN AMATEUR-BUILT AIRCRAFT

Aircraft Class	Accidents		Fatal Accidents		Lethality
Collision	3	1.7%	0	0.0%	0.0%
Cruise	1	0.6%	0	0.0%	0.0%
Descent / approach	5	2.9%	2	4.50%	40.0%
Fuel management	12	6.9%	2	4.50%	16.7%
Go-around	7	4.0%	0	0.0%	0.0%
Incapacitation	4	2.3%	4	9.10%	100.0%
Landing	37	21.1%	2	4.50%	5.4%
Maneuvering	15	8.6%	14	31.80%	93.3%
Mechanical	29	16.6%	2	4.50%	6.9%
Other	10	5.7%	4	9.10%	40.0%
Other (power loss)	14	8.0%	3	6.80%	21.4%
Pre-flight	6	3.4%	4	9.10%	66.7%
Rotorcraft aerodynamics	2	1.1%	0	0.0%	0.0%
Takeoff	25	14.3%	4	9.10%	16.0%
Weather	5	2.9%	3	6.80%	60.0%

FIGURE 51. TYPES OF AMATEUR-BUILT AIRCRAFT INVOLVED IN ACCIDENTS

Aircraft Class	Accidents		Fatal Accidents		Lethality
E-LSA	32	18.3%	11	25.0%	34.4%
Single-engine fixed-gear (SEF)	122	69.7%	27	61.4%	22.1%
SEF tailwheel	72		13		18.1%
Single-engine retractable	13	7.4%	5	11.4%	38.5%
Single-engine turbine	5		2		40.0%
Helicopter	8	4.6%	1	2.3%	12.5%

SUMMARY

The 27th Nall Report highlights another positive record setting year with an overall reduction of the accident rate and number of accidents. While commercial activity showed a rise in accidents, the overall impact was minimal. It appears the accident rise in commercial operations is likely a result of increased flight activity and cyclical in nature. Non-commercial operations along with experimental and light sport aircraft accidents continued their downward trends.

A quick look at major findings:

- Overall GA accident rate is declining
- Overall GA fatal accident rate is declining
- Non-Commercial operations (helicopter and fixed-wing) accident rates are declining
- Commercial operations accident rates increased slightly, likely a continuation of cyclical variation
- GA flight activity is increasing
- Experimental and light sport aircraft accidents decreased
- Pilot-related accidents account for most of all operations and continue to be the leading cause of GA accidents

APPENDIX

GENERAL AVIATION SAFETY VS AIRLINES

GA accident rates have always been higher than airline accident rates. People often ask about the reasons for this disparity. There are several:

Variety of Mission – GA pilots conduct a wider range of operations. Some operations, such as aerial application (a.k.a. crop-dusting) and banner towing, have inherent operational risks.

Variability of pilot certificate and experience levels – All airline flights are crewed by at least one ATP (airline transport pilot), the most demanding rating. GA is the training ground for most pilots, and while the GA community has its share of ATPs, the community also includes many new and low-time pilots and a great variety of experience in between.

Limited cockpit resources and flight support – Usually, a single pilot conducts GA operations, and the pilot typically handles all aspects of the flight, from flight planning to piloting. Air carrier operations require at least two pilots. Likewise, airlines have dispatchers, mechanics, loadmasters, and others to assist with operations and consult with before and during a flight.

Greater variety of facilities – GA operations are conducted at about 5,300 public-use and 8,000 private-use airports, while airlines are confined to only about 600 of the larger public-use airports. Many GA-only airports lack the precision approaches, long runways, approach lighting systems, and the advanced weather reporting and air traffic services of airline-served airports. (There are also 6,000 GA-only landing areas that are not technically airports, such as heliports and seaplane bases.)

More takeoffs and landings – During takeoffs and landings aircraft are close to the ground and in a more vulnerable configuration than in other phases of flight. On a per hour basis, GA conducts many more takeoffs and landings than either air carriers or the military.

Less weather-tolerant aircraft – Most GA aircraft cannot fly over or around weather the way airliners can, and they often do not have the systems to avoid or cope with hazardous weather conditions, such as ice.

WHAT IS GENERAL AVIATION?

Although GA is typically characterized by recreational flying, it encompasses much more. Besides providing personal, business, and freight transportation, GA supports diverse activities such as law enforcement, forest fire fighting, air ambulance, logging, fish and wildlife spotting, and other vital services.

WHAT DOES GENERAL AVIATION FLY?

General aviation aircraft are as varied as their pilots and the types of operations flown. The following aircraft categories and classes are included in this year's *Nall Report*:

- **Piston single-engine**
- **Piston multiengine**
- **Turboprop single-engine**
- **Turboprop multiengine**
- **Turbojet**
- **Helicopter**
- **Experimental**
- **Light Sport**

The following aircraft categories, classes, and operations are not included in this year's *Nall Report*:

- **FAR Part 121 airline operations**
- **Military operations**
- **Fixed-wing aircraft weighing more than 12,500 pounds**
- **Weight-shift control aircraft**
- **Powered parachutes**
- **Gyroplanes**
- **Gliders**
- **Airships**
- **Balloons**
- **Unmanned aerial systems (UAS, or "drones")**

FIGURE 52.
AIRCRAFT INVOLVED IN FUEL MANAGEMENT ACCIDENTS: NON-COMMERCIAL FIXED-WING

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-engine fixed-gear (SEF)	54	71.1%	4	30.8%	7.4%
SEF tailwheel	18		1		5.6%
Single-engine retractable	19	25.0%	8	61.5%	42.1%
Multiengine	3	3.9%	1	7.7%	33.3%

FIGURE 53.
FLIGHT CONDITIONS OF FUEL MANAGEMENT ACCIDENTS: NON-COMMERCIAL FIXED-WING

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	57	75.0%	11	84.6%	19.3%
Night VMC*	18	23.7%	1	7.7%	5.6%
Night IMC*	1	1.3%	1	7.7%	100.0%

**Includes dusk.*

FIGURE 54.
PILOTS INVOLVED IN FUEL MANAGEMENT ACCIDENTS: NON-COMMERCIAL FIXED-WING

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	8	10.5%	2	15.4%	25.0%
Commercial	16	21.1%	2	15.4%	12.5%
Private	46	60.5%	8	61.5%	17.4%
Sport	2	2.6%	0	0.0%	0.0%
Student	4	5.3%	1	7.7%	25.0%
Second pilot on board	8	10.5%	2	15.4%	25.0%
CFI on board*	16	21.1%	4	30.8%	25.0%
IFR pilot on board*	31	40.8%	6	46.2%	19.4%

**Includes single-pilot flights.*

WHAT IS THE ACCIDENT RATE?

The different sectors of GA vary widely in their levels of flight activity, imparting corresponding differences in exposure to the risks of accidents. To make meaningful comparisons, the numbers of accidents is standardized by computing the corresponding rates, conventionally expressed as the average number of accidents per 100,000 hours of flight time. GA activity is estimated in an annual aircraft activity survey conducted by the FAA, which provides breakdowns by category and class of aircraft and purpose of flight, among other characteristics.

NTSB DEFINITIONS

ACCIDENT/INCIDENT (49 CFR PART 830)

The following definitions of terms used in this report have been extracted from NTSB regulations at 49 CFR Part 830. It is included in most commercially available FAR/AIM digests and should be referenced for detailed information.

AIRCRAFT ACCIDENT

An occurrence incidental to flight in which, "as a result of the operation of an aircraft, any person (occupant or non-occupant) receives fatal or serious injury or any aircraft receives substantial damage."

- **A fatal injury is one that results in death within 30 days of the accident.**
- **A serious injury is one that:**
  1. Requires hospitalization for more than 48 hours, commencing within seven 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. Involves lacerations that cause severe hemorrhages, nerve, muscle, or tendon damage.
  4. Involves injury to any internal organ. Or
  5. Involves second- or third-degree burns, or any burns affecting more than five percent of body surface.

FIGURE 55.
AIRCRAFT INVOLVED IN WEATHER ACCIDENTS: NON-COMMERCIAL FIXED-WING

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-engine fixed-gear (SEF)	22	57.9%	18	62.1%	81.8%
SEF tailwheel	6		4		66.7%
Single-engine retractable	12	31.6%	7	24.1%	58.3%
Single-engine turbine	2		0		0.0%
Multiengine	4	10.5%	4	13.8%	100.0%
Multiengine turbine	1		1		100.0%

FIGURE 56.
FLIGHT CONDITIONS OF WEATHER ACCIDENTS: NON-COMMERCIAL FIXED-WING

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	13	34.2%	7	24.1%	53.8%
Night VMC*	3	7.9%	3	10.3%	100.0%
Day IMC	15	39.5%	14	48.3%	93.3%
Night IMC*	6	15.8%	4	13.8%	66.7%
Unknown	1	2.6%	1	3.4%	100.0%

**Includes dusk.*

- **A minor injury** is one that does not qualify as fatal or serious.
- **Destroyed** means that an aircraft was demolished beyond economical repair, i.e., substantially damaged to the extent that it would be impracticable to rebuild it and return it to an airworthy condition. (This may not coincide with the definition of "total loss" for insurance purposes. Because of the variability of insurance limits carried and such additional factors as time on engines and propellers, and aircraft condition before an accident, an aircraft may be "totaled" even though it is not considered "destroyed" for NTSB accident-reporting purposes.)
- **Substantial damage –** As with "destroyed," the definition of "substantial" for accident reporting purposes does not necessarily correlate with "substantial" in terms of financial loss. Contrary to popular misconception, there is no dollar value that defines "substantial" damage. Because of the high cost of many repairs, large sums may be spent to repair damage resulting from incidents that do not meet the NTSB definition of substantial damage.

FIGURE 57.
PILOTS INVOLVED IN WEATHER ACCIDENTS: NON-COMMERCIAL FIXED-WING

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	5	13.2%	4	13.8%	80.0%
Commercial	10	26.3%	8	27.6%	80.0%
Private	20	52.6%	15	51.7%	75.0%
Student	2	5.3%	1	3.4%	50.0%
Other or unknown	1	2.6%	1	3.4%	100.0%
Second pilot on board	5	13.2%	5	17.2%	100.0%
CFI on board*	7	18.4%	6	20.7%	85.7%
IFR pilot on board*	25	65.8%	18	62.1%	72.0%

**Includes single-pilot flights.*

1. Except as provided below, substantial damage means damage or structural 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 part.
2. Engine failure, damage limited to an engine, bent fairings or cowling, dented skin, small puncture holes in the skin or fabric, ground damage to rotor or propeller blades, damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wing tips are not considered "substantial damage."

- **Minor damage** is any damage that does not qualify as "substantial," such as that in item (2) under substantial damage.

FIGURE 58.
AIRCRAFT INVOLVED IN TAKEOFF AND CLIMB ACCIDENTS: NON-COMMERCIAL FIXED-WING

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-engine fixed-gear (SEF)	85	78.7%	11	57.9%	12.9%
SEF tailwheel	40		1		2.5%
Single-engine retractable	19	17.6%	7	36.8%	36.8%
Single-engine turbine	2		0		0.0%
Multiengine	4	3.7%	1	5.3%	25.0%

FIGURE 59.
FLIGHT CONDITIONS OF TAKEOFF AND CLIMB ACCIDENTS: NON-COMMERCIAL FIXED-WING

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	99	91.7%	17	89.5%	17.2%
Night VMC*	6	5.6%	1	5.3%	16.7%
Day IMC	2	1.9%	1	5.3%	50.0%
Night IMC*	1	0.9%	0	0.0%	0.0%

**Includes dusk.*

TYPE OF FLYING

The purpose for which an aircraft is being operated at the time of an accident:

On-Demand Air Taxi | Revenue flights, conducted by commercial air carriers operating under FAR Part 135 that are not operated in regular scheduled service, such as charter flights and all non-revenue flights incident to such flights.

Personal | Flying by individuals in their own or rented aircraft for pleasure or personal transportation not in furtherance of their occupation or company business. This category includes practice flying (for the purpose of increasing or maintaining proficiency) not performed under supervision of an accredited instructor and not part of an approved flight training program.

Business | The use of aircraft by pilots (not receiving direct salary or compensation for piloting) in connection with their occupation or in the furtherance of a private business.

Instruction | Flying accomplished in supervised training under the direction of an accredited instructor.

Corporate | The use of aircraft owned or leased, and operated by a corporate or business firm for the transportation of personnel or cargo in furtherance of the corporation's or firm's business, and which are flown by professional pilots receiving a direct salary or compensation for piloting.

Aerial Application | The operation of aircraft for the purpose of dispensing any substance for plant nourishment, soil treatment, propagation of plant life, pest control, or fire control, including flying to and from the application site.

FIGURE 60.
PILOTS INVOLVED IN TAKEOFF AND CLIMB ACCIDENTS: NON-COMMERCIAL FIXED-WING

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	12	11.1%	1	5.3%	8.3%
Commercial	23	21.3%	8	42.1%	34.8%
Private	61	56.5%	8	42.1%	13.1%
Sport	6	5.6%	0	0.0%	0.0%
Student	6	5.6%	2	10.5%	33.3%
Second pilot on board	12	11.1%	3	15.8%	25.0%
CFI on board*	22	20.4%	8	42.1%	36.4%
IFR pilot on board*	46	42.6%	11	57.9%	23.9%

**Includes single-pilot flights.*

FIGURE 61.
AIRCRAFT INVOLVED IN MANEUVERING ACCIDENTS: NON-COMMERCIAL FIXED-WING

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-engine fixed-gear (SEF)	37	84.1%	26	81.3%	70.3%
SEF tailwheel	18		12		66.7%
Single-engine retractable	7	15.9%	6	18.8%	85.7%
Single-engine turbine	3		2		66.7%

FIGURE 62.
FLIGHT CONDITIONS OF MANEUVERING ACCIDENTS: NON-COMMERCIAL FIXED-WING

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	42	95.5%	30	93.8%	71.4%
Night VMC*	2	4.5%	2	6.3%	100.0%

**Includes dusk.*

Aerial Observation | The operation of an aircraft for the purpose of pipeline/power line patrol, land and animal surveys, etc. This does not include traffic observation (electronic newsgathering) or sightseeing.

Other Work Use | The operation of an aircraft for the purpose of aerial photography, banner/glider towing, parachuting, demonstration or test flying, racing, aerobatics, etc.

Public Use | Any operation of an aircraft by any federal, state, or local entity.

Ferry | A non-revenue flight for the purpose of (1) returning an aircraft to base, (2) delivering an aircraft from one location to another, or (3) moving an aircraft to and from a maintenance base. Ferry flights, under certain terms, may be conducted under terms of a special flight permit.

FIGURE 63.
PILOTS INVOLVED IN MANEUVERING ACCIDENTS: NON-COMMERCIAL FIXED-WING

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	4	9.1%	3	9.4%	75.0%
Commercial	14	31.8%	9	28.1%	64.3%
Private	17	38.6%	11	34.4%	64.7%
Sport	1	2.3%	1	3.1%	100.0%
Student	5	11.4%	5	15.6%	100.0%
Other or unknown	3	6.8%	3	9.4%	100.0%
Second pilot on board	8	18.2%	6	18.8%	75.0%
CFI on board*	9	20.5%	4	12.5%	44.4%
IFR pilot on board*	23	52.3%	15	46.9%	65.2%

**Includes single-pilot flights.*

Positioning | Positioning of the aircraft without the purpose of revenue.

Other | Any flight that does not meet the criteria of any of the above.

Unknown | A flight whose purpose is not known.

FIGURE 64.
AIRCRAFT INVOLVED IN DESCENT AND APPROACH ACCIDENTS: NON-COMMERCIAL FIXED-WING

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-engine fixed-gear (SEF)	28	65.1%	5	33.3%	17.9%
SEF tailwheel	8		2		25.0%
Single-engine retractable	11	25.6%	6	40.0%	54.5%
Single-engine turbine	1		1		100.0%
Multiengine	4	9.3%	4	26.7%	100.0%
Multiengine turbine	1		1		100.0%

FIGURE 65.
FLIGHT CONDITIONS OF DESCENT AND APPROACH ACCIDENTS: NON-COMMERCIAL FIXED-WING

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	24	55.8%	4	26.7%	16.7%
Night VMC*	8	18.6%	1	6.7%	12.5%
Day IMC	5	11.6%	5	33.3%	100.0%
Night IMC*	6	14.0%	5	33.3%	83.3%

**Includes dusk.*

FIGURE 66.
PILOTS INVOLVED IN DESCENT AND APPROACH ACCIDENTS: NON-COMMERCIAL FIXED-WING

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	5	11.6%	3	20.0%	60.0%
Commercial	17	39.5%	5	33.3%	29.4%
Private	20	46.5%	7	46.7%	35.0%
Sport	1	2.3%	0	0.0%	0.0%
Second pilot on board	17	39.5%	3	20.0%	17.6%
CFI on board*	16	37.2%	3	20.0%	18.8%
IFR pilot on board*	31	72.1%	12	80.0%	38.7%

**Includes single-pilot flights.*

FIGURE 67.
AIRCRAFT INVOLVED IN LANDING ACCIDENTS: NON-COMMERCIAL FIXED-WING

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-engine fixed-gear	214	81.7%	3	100.0%	1.4%
SEF tailwheel	102		3		2.9%
Single-engine retractable	35	13.4%	0	0.0%	0.0%
Single-engine turbine	4		0	0.0%	0.0%
Multiengine	13	5.0%	0	0.0%	0.0%
Multiengine turbine	2		0	0.0%	0.0%

FIGURE 68.
FLIGHT CONDITIONS OF LANDING ACCIDENTS: NON-COMMERCIAL FIXED-WING

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	242	92.4%	3	100.0%	1.20%
Night VMC*	17	6.5%	0	0.0%	0.0%
Night IMC	3	1.1%	0	0.0%	0.0%

**Includes dusk.*

FIGURE 69.
PILOTS INVOLVED IN LANDING ACCIDENTS: NON-COMMERCIAL FIXED-WING

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	30	11.5%	0	0.0%	0.0%
Commercial	59	22.5%	2	66.7%	3.4%
Private	136	51.9%	1	33.3%	0.7%
Sport	7	2.7%	0	0.0%	0.0%
Recreational	1	0.4%	0	0.0%	0.0%
Student	28	10.7%	0	0.0%	0.0%
Other or unknown	1	0.4%	0	0.0%	0.0%
Second pilot on board	34	13.0%	1	33.3%	2.9%
CFI on board*	48	18.3%	0	0.0%	0.0%
IFR pilot on board*	125	47.7%	1	33.3%	0.8%

**Includes single-pilot flights.*

FIGURE 70.
AIRCRAFT INVOLVED IN MECHANICAL ACCIDENTS: NON-COMMERCIAL FIXED-WING

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-engine fixed-gear (SEF)	94	61.8%	7	43.8%	7.4%
SEF tailwheel	31		2		6.5%
Single-engine retractable	41	27.0%	5	31.3%	12.2%
Single-engine turbine	3		1		33.3%
Multiengine	17	11.2%	4	25.0%	23.5%
Multiengine turbine	5		0		0.0%

FIGURE 71.
FLIGHT CONDITIONS OF MECHANICAL ACCIDENTS: NON-COMMERCIAL FIXED-WING

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	141	92.8%	14	87.5%	9.9%
Night VMC*	9	5.9%	1	6.3%	11.1%
Day IMC	2	1.3%	1	6.3%	50.0%

**Includes dusk.*

FIGURE 72.
PILOTS INVOLVED IN MECHANICAL ACCIDENTS: NON-COMMERCIAL FIXED-WING

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	26	17.1%	3	18.8%	11.5%
Commercial	53	34.9%	8	50.0%	15.1%
Private	63	41.4%	5	31.3%	7.9%
Sport	5	3.3%	0	0.0%	0.0%
Student	3	2.0%	0	0.0%	0.0%
Other or unknown	2	1.3%	0	0.0%	0.0%
Second pilot on board	28	18.4%	3	18.8%	10.7%
CFI on board*	35	23.0%	4	25.0%	11.4%
IFR pilot on board*	87	57.2%	10	62.5%	11.5%

**Includes single-pilot flights.*

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