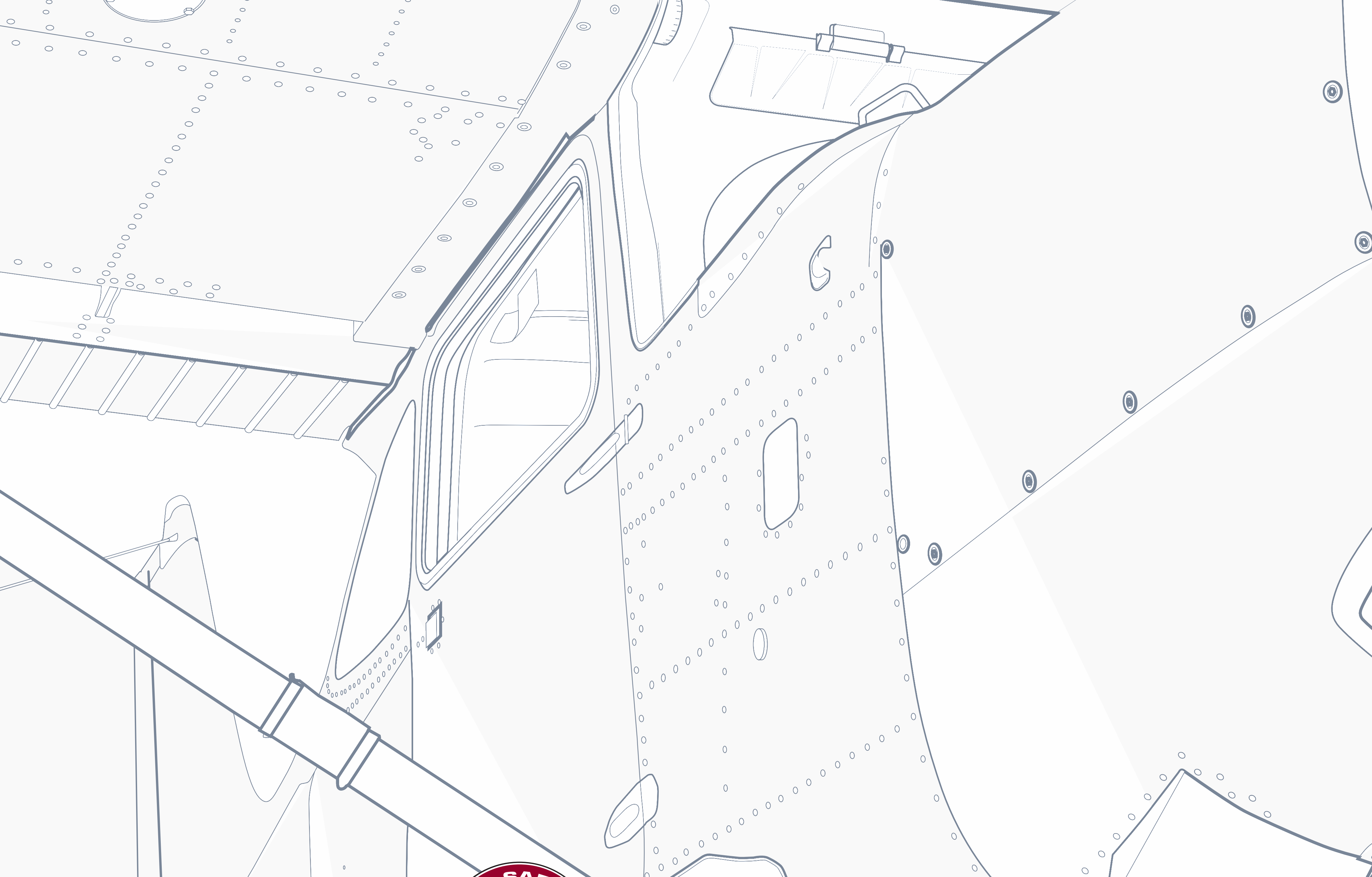

23RD JOSEPH T. NALL REPORT

General Aviation Accidents in 2011

DEDICATION

The *Joseph T. Nall Report* is the Air Safety Institute's (ASI's) annual review of general aviation (GA) accidents that occurred during the previous year. 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

Following the pattern of recent years, this twenty-third edition of the *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. Other categories were excluded, including gliders, weight-shift control aircraft, powered parachutes, gyrocopters, and lighter-than-air craft of all types.

Accidents on commercial charter, cargo, crop-dusting, and external load flights are addressed separately from accidents on non-commercial flights, a category that includes personal and business travel and flight instruction as well as professionally flown corporate transport and positioning legs flown under FAR Part 91 by commercial operators.

ACCIDENTS VS. ACCIDENT RATES

The most informative measure of risk is usually not the number of accidents but the accident rate, expressed as the average number during a specified period of time. Like other institutions including the FAA and the NTSB, the Air Safety Institute has traditionally expressed rates as accidents per 100,000 flight hours. The underlying measures of flight exposure are provided by the FAA's annual *General Aviation and Part 135 Activity Survey*.

Unfortunately, the FAA has been unable to publish results from the 2011 survey. For that reason, this edition of the *Nall Report* does not include any estimates of accident rates. The 2012 survey results have been published, so estimated accident rates will return to the *24th Nall Report*.

FINAL VS. PRELIMINARY STATISTICS

When the data were frozen for the current report, the NTSB had released its findings of probable cause for 1,357 of the 1,428 qualifying accidents (95%) that occurred in 2011, including 233 of 256 fatal accidents (91%). All remaining accidents were categorized on the basis of preliminary information. As in the past, ASI will review the results after the NTSB has completed substantially all of its investigations to assess how the use of provisional classifications has affected this analysis.

As a supplement to the information contained in this report, ASI offers its accident database online. To search the database, visit **airsafetyinstitute.org/database**.

ASI gratefully acknowledges the technical support and assistance of the:

National Transportation Safety Board
Federal Aviation Administration
Aircraft Owners and Pilots Association

Financial support for the *Nall Report* comes from the Manuel Maciel Safety Research Endowment, the AOPA Holdings Company, and **donations to the AOPA Foundation from individual pilots**.

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PRESIDENT'S VIEW

2011 reminds us that one year—or even two—doesn't constitute a trend. Several of the more promising developments of 2010 were not sustained into the following year. The dramatic reduction in the number of accidents and fatalities in amateur-built and experimental light-sport aircraft was short-lived—or 2011's rebound may prove to be a brief interruption of an improving long-term trend. And after two exceptionally good years, the number of accidents on commercial fixed-wing flights returned to what would previously have been considered "normal" levels. Fuel management accidents appear to be stabilizing at numbers 40% below those routinely seen a decade earlier—but also 20% higher than the all-time low recorded in 2008.

Many of this year's case studies share a common element: the willingness of the pilots involved to take passengers on flights that they knew, or certainly should have known, would test the limits of their capabilities. The brand-new instrument pilot taking several passengers into low weather, the guy who packed four other people into an overloaded taildragger for his first takeoff attempt in eight months, the twin pilot who set off VFR in the early morning hours of a poor night forecast to end in low ceilings and fog—all failed to recognize that their marginal capacity to handle the task at hand threatened those whose lives were in their hands. Endangering yourself is one thing. Once you accept responsibility for a passenger, though, you're playing with someone else's marbles.

Since the FAA did complete the 2012 Activity Survey, the 24th Nall Report will once again include estimates of accident rates. In the meantime, we at the Air Safety Institute want to thank our friends and colleagues at the FAA and NTSB, our partners throughout the industry, and most of all the individual pilots whose donations are the bedrock supporting our research and safety education programs.

Safe Flights,

Bruce Landsberg

Bruce Landsberg
President, AOPA Foundation

GENERAL AVIATION ACCIDENTS IN 2011

In 2011, there were 1,428 general aviation accidents involving a total of 1,446 individual aircraft (**Figure 1**). The fatal fall of a wing-walker attempting to climb from an airplane to a helicopter during an air show has been counted in both categories, and a mid-air collision between an airplane on a charter flight and one operated privately is included in the totals for both commercial and non-commercial fixed-wing.

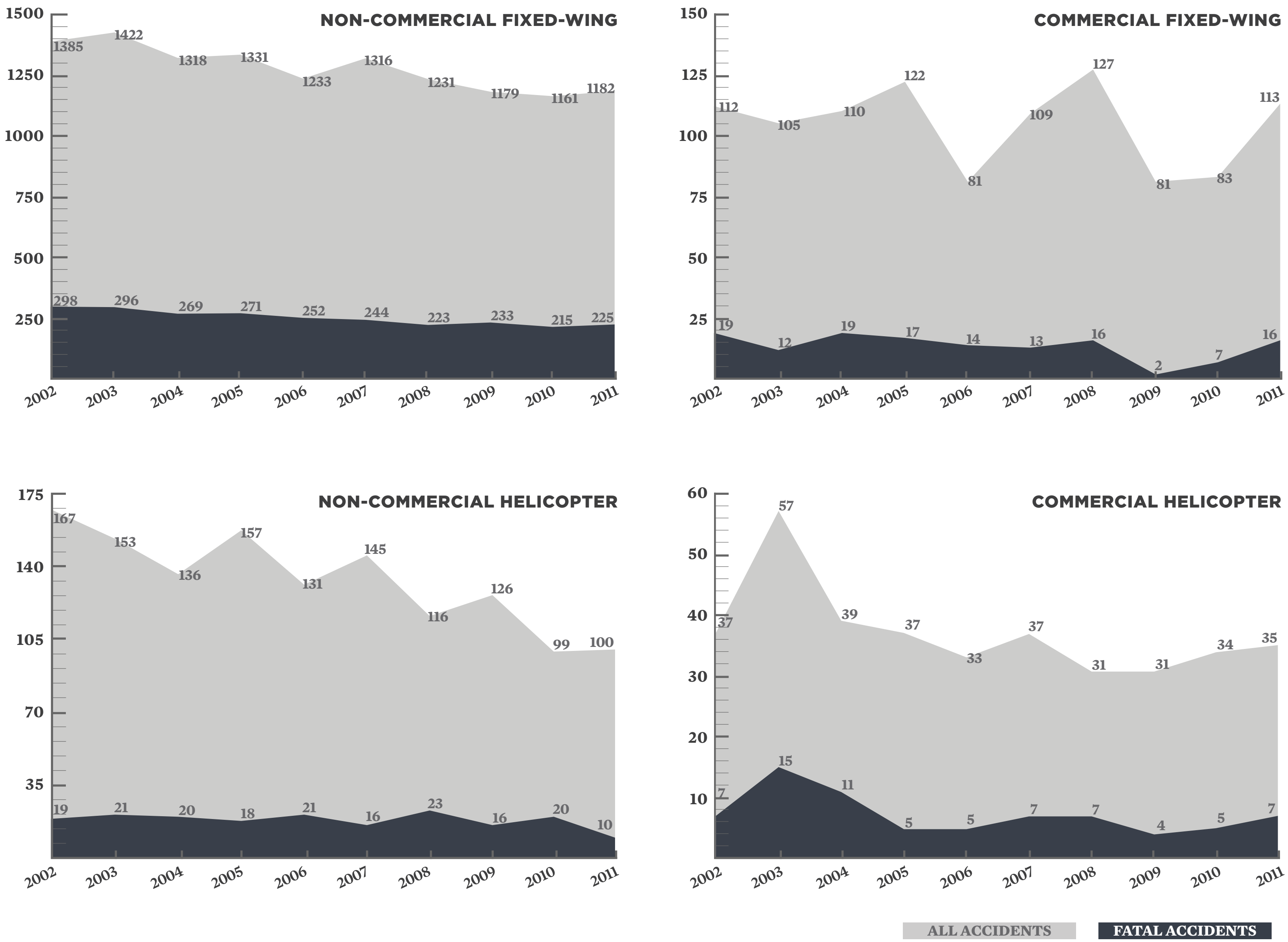
A total of 454 individuals were killed in the 258 fatal accidents, an 8% increase from the year before. A reduction of more than two-thirds in fatalities from non-commercial helicopter accidents was more than offset by increases in the other three segments: 9% in non-commercial fixed-wing, 87% in commercial fixed-wing, and 186% in commercial helicopter (following near-record low fatalities in commercial GA flights in each of the two previous years). As usual, the vast majority of both fatal and non-fatal accidents took place on non-commercial fixed-wing flights, consistently the largest segment of U.S. general aviation. It accounted for 83% of all GA accidents and 87% of fatal accidents in 2011, figures almost identical to those from 2010.

Figure 1: General Aviation Accidents in 2011

	Non-Commercial		**Commercial**	
	Fixed-Wing	Helicopter	Fixed-Wing	Helicopter
Number of Accidents	1182	100	113	35
Number of Aircraft*	1195	100	116	35
Fatal Accidents	225	10	16	7
Lethality	19.0	10.0	14.2	20.0
Fatalities	394	12	28	20

*EACH AIRCRAFT INVOLVED IN A COLLISION COUNTED SEPARATELY

Figure 2: General Aviation Accident Trends, 2002–2011



NON-COMMERCIAL HELICOPTER ACCIDENTS

The number of non-commercial helicopter accidents remained almost constant, increasing by just one from 99 in 2010 to 100 in 2011, but the number of fatal accidents decreased by half, from 20 down to 10. The numbers of fatal accidents and fatalities in 2011 were the lowest in the 30 years covered by ASI's accident database.

AIRCRAFT CLASS As in prior years, nearly two-thirds (65%) involved single-engine piston helicopters (**Figure 3**), including seven of the 10 fatal accidents. Single-engine turbines accounted for about one-third, while only two accidents involved multiengine turbines.

TYPE OF OPERATION Personal flights consistently account for a much smaller share of helicopter than fixed-wing accidents. In 2011, they led to 30% of non-commercial helicopter accidents (**Figure 4**) compared to nearly 75% of fixed-wing (**Figure 10**). Even so, prior years' experience suggests a disproportionate risk on personal helicopter flights. In 2010, for example, personal use made up less than 7% of flight time but led to one-third of all accidents, one-fourth of all fatal accidents, and more than a quarter of individual fatalities. In 2011, eight of 11 fatalities also occurred on personal flights.

Flight instruction, on the other hand, figured more prominently on the rotorcraft side, where it led to 32% of all accidents compared to just 14% of those in airplanes. Both were highly survivable, with fatalities in just one of 32 helicopter accidents and less than 10% of those in airplanes.

As in 2010, there were no accidents on professionally crewed executive transports. One fatality did occur on a public-use flight by the Pima County, Arizona Sheriff's Department. The pilot was killed when the aircraft went out of control following a tail-rotor strike during an attempted pinnacle landing. The three passengers survived with injuries of varying severity.

FLIGHT CONDITIONS As in the past, the vast majority of helicopter accidents (91%) occurred in visual meteorological conditions (VMC) during daylight hours (**Figure 5**), including 80% of all fatal accidents. Two-thirds of the rest took place in VMC at night. There were no fatal accidents in daytime instrument meteorological conditions (IMC) but one each in VMC and in IMC at night.

PILOT QUALIFICATIONS More than 70% of the accident pilots held either commercial or airline transport pilot (ATP) certificates (**Figure 6**). Unlike the prior year, these only accounted for four of 10 fatal accidents. Two-thirds of the commercial pilots and ATPs were also certificated flight instructors (CFIs).

PERCENTAGES ARE PERCENT OF ALL ACCIDENTS, OF ALL FATAL ACCIDENTS, AND OF INDIVIDUAL FATALITIES, RESPECTIVELY

Figure 3: Aircraft Class—Non-Commercial Helicopter Accidents

Aircraft Class	Accidents		Fatal Accidents		Fatalities	
Single-Engine Piston	65	65.0%	7	70.0%	7	63.6%
Single-Engine Turbine	33	33.0%	3	30.0%	4	36.4%
Multiengine Turbine	2	2.0%	0			

Figure 5: Flight Conditions—Non-Commercial Helicopter Accidents

Light and Weather	Accidents		Fatal Accidents		Fatalities	
Day VMC	91	91.0%	8	80.0%	9	75.0%
Night VMC*	6	6.0%	1	10.0%	1	8.3%
Day IMC	1	1.0%	0			
Night IMC*	2	2.0%	1	10.0%	2	16.7%

*INCLUDES DUSK

Figure 4: Type of Operation—Non-Commercial Helicopter Accidents

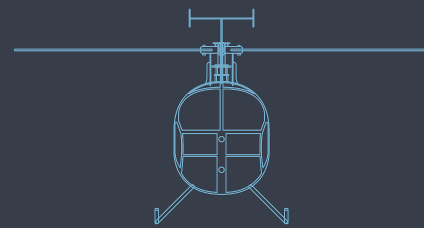
Type of Operation	Accidents		Fatal Accidents		Fatalities	
Personal	30	30.0%	6	60.0%	8	72.7%
Instructional	32	32.0%	1	10.0%	1	9.1%
Public Use	6	6.0%	1	10.0%	1	9.1%
Positioning	7	7.0%	0			
Aerial Observation	6	6.0%	0			
Business	4	4.0%	0			
Other Work Use	10	10.0%	0			
Other or Unknown*	5	5.0%	2	20.0%	1	9.1%

*INCLUDES FLIGHT TESTS AND UNREPORTED

Figure 6: Pilots Involved in Non-Commercial Helicopter Accidents

Certificate Level	Accidents		Fatal Accidents		Fatalities	
ATP	18	18.0%	2	20.0%	1	9.1%
Commercial	53	53.0%	2	20.0%	3	27.3%
Private	26	26.0%	5	50.0%	6	54.5%
Student	2	2.0%	0			
Other or Unknown	1	1.0%	1	10.0%	1	9.1%
CFI on Board	48	48.0%	2	20.0% *	1	9.1%

*IN ONE ACCIDENT, THE ONLY FATALITY WAS A WING WALKER WHO FELL TO HIS DEATH



ACCIDENT CASE STUDY

NTSB ACCIDENT NO. WPR11GA115
MCDONNELL-DOUGLAS 369FF, MARANA, ARIZONA
ONE FATALITY, TWO SERIOUS INJURIES, AND ONE MINOR INJURY

HISTORY OF FLIGHT The flight was intended to take three non-pilot staff of the Pima County Wireless Integrated Network to assess a proposed site for a communications repeater tower on Waterman Mountain. The pilot made two orbits to reconnoiter his intended landing zone, a "relatively level area" on a pinnacle on the northeast side of the mountain, before approaching from the southeast.

The passengers reported that during the landing they felt a bump, after which the helicopter rose again, pitched down, and began to spin to the right. A witness downslope saw it make "four or five rotations" before disappearing from his view. The main rotor blades struck a rock outcropping, tumbling the helicopter into a shallow canyon. It slid about 120 feet before coming to a stop. The pilot was killed and two of the three passengers suffered serious injuries.

Both the main and tail rotor blades showed evidence of rotor strikes under power. The rocky terrain showed no unmistakable evidence of a tail-rotor strike, but investigators concluded that was most likely the event that initiated the accident sequence.

PILOT INFORMATION The pilot held a commercial certificate with instrument rating for rotorcraft helicopter and a private certificate for single- and multiengine airplanes. Pima County Sheriff's Department records showed that he had flown helicopters for the Arizona Department of Public Safety and the Maricopa County Sheriff's Department "for about 30 years," accumulating 11,500 hours of flight experience that included 186 in the accident make and model. Since joining the PCSD in November 2008, "he had satisfactorily completed training for and demonstration of confined area, slope, and pinnacle landings."

WEATHER The two nearest weather reporting sites, located 19 and 30 miles southeast of the accident site, reported winds from 090 at 11 knots gusting to 16 and from 300 at 9 gusting to 16, respectively, and 10 miles visibility. Analysis of cloud movements captured by satellite photographs suggested winds at the scene were predominantly from the north. Several embedded storm cells were visible in a stratocumulus layer downwind of the accident site.

PROBABLE CAUSE An inadvertent tail rotor strike during an attempted pinnacle landing, which resulted in the pilot's loss of control of the helicopter. Inhospitable terrain/topography contributed to the severity of the accident.

ASI COMMENTS The ability to operate from confined spaces in remote locations was one of the principal goals driving the invention of the helicopter, but pinnacle and confined-area landings remain exacting maneuvers requiring great precision. Tail rotor clearance is crucial but difficult to gauge from the cockpit. The fact that even a pilot of this experience can be vulnerable to misjudging it shows how small the margin of error really is, and how catastrophic even slight errors can be.

COMMERCIAL HELICOPTER ACCIDENTS

There were 35 accidents on commercial helicopter flights in 2011, the same number as the year before. Seven (20%) were fatal, an increase of two. More than half (54%) took place on crop-dusting flights (**Figure 7**), slightly fewer than the previous year. Two of the pilots were killed. Five fatal accidents on Part 135 flights, a sharp increase, accounted for 90% of all fatalities; no one on board any of those aircraft survived. Nine of the 18 victims were either pilots or crew members; the remaining nine were passengers. A solo pilot succumbed to medical incapacitation during a positioning flight in Alaska. A fuel-exhaustion accident in Missouri claimed the lives of the pilot, flight nurse, paramedic, and the patient they were transporting, and a transplant surgeon and his assistant were lost in a night VFR-into-IMC accident on an organ procurement flight in Florida. Two air-tour accidents killed four passengers apiece: a mountain crash in Hawaii with thunderstorms in the vicinity, and a flight-control failure attributed to improper maintenance on a twilight cruise of the Grand Canyon.

Four Part 135 accidents took place at night. Two of three in VMC and the only one in IMC were fatal. Aside from these, all of 2011's commercial helicopter accidents occurred in VMC during the daytime. Twelve crop-dusting accidents (63%) involved piston helicopters, but all charter and external-load accidents were in turbine-powered helicopters.

Figure 7: Summary of Commercial Helicopter Accidents

	Accidents		Fatal Accidents		Fatalities	
Aerial Application (Part 137)	19	54.3%	2	28.6%	2	10.0%
Single-Engine Piston	12	63.2%	1	50.0%	1	
Single-Engine Turbine	7	36.8%	1	50.0%	1	
Day VMC	19	100.0%	2	100.0%	2	
ATP	1	5.3%	1	50.0%	1	
Commercial	18	94.7%	1	50.0%	1	
Charter or Cargo (Part 135)	11	31.4%	5	71.4%	18	90.0%
Single-Engine Turbine	10	90.9%	5	100.0%	18	
Multiengine Turbine	1	9.1%	0			
Day VMC	7	63.6%	2	40.0%	9	
Night VMC*	3	27.3%	2	40.0%	6	
Night IMC	1	9.1%	1	20.0%	3	
ATP	1	9.1%	1	20.0%	3	
Commercial	10	90.9%	4	80.0%	15	
External Load (Part 133)	5	14.3%	0			
Single-Engine Turbine	4	80.0%	0			
Multiengine Turbine	1	20.0%	0			
Day VMC	5	100.0%	0			
Commercial	5	100.0%	0			

*INCLUDES DUSK

FIXED-WING ACCIDENTS: SUMMARY AND COMPARISON

The causes of general aviation accidents may be grouped into three broad categories for analysis:

- **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 pilot incapacitation, and those for which a specific cause has not been determined.

In 2011, unlike previous years, pilot-related causes led to almost as large a share of commercial as non-commercial fixed-wing accidents (**Figure 8**). The proportion of fatal accidents was likewise almost identical, as was the breakdown of accidents due to other causes.

NON-COMMERCIAL FIXED-WING ACCIDENTS

2011 saw modest increases in the numbers of both total and fatal accidents, from 1,161 to 1,182 and from 215 to 225, respectively. Without reliable estimates of flight activity, it's impossible to guess whether these indicate meaningful changes in the fixed-wing safety record. If recent patterns continued to hold, however, they most likely did not. As in the past, more than 70% were attributed to pilot-related causes (**Figure 8**), and less than 15% to documented mechanical failures.

AIRCRAFT CLASS Nearly three-quarters of the accident aircraft (74%) were single-engine fixed-gear (SEF) airplanes (**Figure 9**), which were involved in 61% of all fatal accidents. More than 40% of the SEF airplanes involved in accidents were equipped with conventional landing gear (tailwheels). Lethality was consistently higher in multiengine, retractable, and turbine aircraft. Of course, some of the difference represents less access to that equipment by low-time pilots, historically more prone to runway excursions, hard landings, and similarly survivable low-speed impacts.

TYPE OF OPERATION Personal flights resulted in 74% of 2011's accidents (**Figure 10**), including 81% of fatal accidents. These proportions typify the pattern that's characterized at least the past 20 years. Accidents on corporate and executive transport flights, on the other hand, are almost non-existent despite millions of hours of exposure in the typical year. Instructional flights continue to make up the second largest category, but accounted for less than 20% as many accidents and barely 8% as many fatal accidents. Whether in airplanes or helicopters, the lethality rate of flight instruction is one of the lowest anywhere in general aviation. A detailed analysis of instructional accidents can be found under the "Special Reports" tab of the Safety Publications page at **airsafetyinstitute.org**.

FLIGHT CONDITIONS The pattern reported earlier continued in 2011: Barely 5% of all accidents occurred in instrument meteorological conditions, but they included 15% of the fatal accidents. Sixty percent of all accidents in IMC were fatal compared to just over 15% of those in VMC during daylight hours and 35% of those in VMC at night. However, since the overwhelming majority of all accidents (more than 85%) took place in daytime VMC, it still accounted for more than 70% of all fatal accidents and two-thirds of individual fatalities (**Figure 11**).

PILOT QUALIFICATIONS About half of all accident flights, fatal and non-fatal alike, were commanded by private pilots (**Figure 12**). This is the same pattern seen in earlier years. More than 60% of all pilots with private or higher certificates hold instrument ratings, but that figure includes commercial and airline transport pilots who do little or no GA flying beyond positioning legs flown under Part 91 in company aircraft. Those uncertainties suggest that the 57% of both fatal and non-fatal accidents involving instrument-rated pilots aren't greatly different from their share of the relevant population.

Accidents on flights commanded by private pilots were fatal 44% more often than those on flights commanded by ATPs. This stands in contrast to last year, when there was little apparent difference in lethality between certificate levels. As before, accidents on student solos were least likely to be fatal (7%).

ACCIDENT CAUSES After excluding accidents due to mechanical failures or improper maintenance, accidents whose causes have not been determined, and the handful due to circumstances beyond the pilot's control, all that remain are considered pilot-related. Most pilot-related accidents reflect specific failures of flight planning or decision-making or the characteristic hazards of high-risk phases of flight. Six major categories of pilot-related accidents consistently account for large numbers of accidents overall, high proportions of those that are fatal, or both. Mechanical failures and an assortment of relatively rare occurrences (such as taxi collisions or accidents caused by discrepancies overlooked during preflight inspections) make up most of the rest.

Figure 8: Major Causes—Fixed-Wing General Aviation Accidents

	Non-Commercial				Commercial			
	All Accidents		Fatal Accidents		All Accidents		Fatal Accidents	
Pilot-Related	911	77.1%	174	77.3%	78	69.0%	12	75.0%
Mechanical	147	12.4%	15	6.7%	19	16.6%	1	6.3%
Other or Unknown	124	10.5%	36	16.0%	16	14.2%	3	18.8%

Figure 9: Aircraft Class—Non-Commercial Fixed-Wing Accidents

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed Gear	884	74.0%	141	61.3%	16.0%
SEF, Tailwheel	382		60		15.7%
Single-Engine Retractable	229	19.2%	66	28.7%	28.8%
Single-Engine Turbine	21		7		33.3%
Multiengine	82	6.9%	23	10.0%	28.0%
Multiengine Turbine	18		5		27.8%

Figure 10: Type of Operation—Non-Commercial Fixed-Wing Accidents

Type of Operation	Accidents		Fatal Accidents		Fatalities	
Personal	889	74.4%	186	80.9%	320	81.2%
Instructional	173	14.5%	14	6.1%	22	5.6%
Public Use	6	0.5%	2	0.9%	3	0.8%
Positioning	16	1.3%	7	3.0%	8	2.0%
Aerial Observation	9	0.8%	0			
Business	31	2.6%	2	0.9%	5	1.3%
Other Work Use	29	2.4%	3	1.3%	3	0.8%
Other or Unknown*	42	3.5%	16	7.0%	33	8.4%

*INCLUDES CORPORATE, AIR SHOWS, FLIGHT TESTS, AND UNREPORTED

Figure 11: Flight Conditions—Non-Commercial Fixed-Wing Accidents

Light and Weather	Accidents		Fatal Accidents		Fatalities	
Day VMC	1058	88.5%	166	72.2%	268	68.0%
Night VMC*	79	6.6%	29	12.6%	56	14.2%
Day IMC	40	3.3%	23	10.0%	46	11.7%
Night IMC*	18	1.5%	12	5.2%	24	6.1%

*INCLUDES DUSK

Figure 12: Pilots Involved in Non-Commercial Fixed-Wing Accidents

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	168	14.1%	26	11.3%	15.5%
Commercial	346	29.0%	63	27.4%	18.2%
Private	556	46.5%	124	53.9%	22.3%
Sport	24	2.0%	6	2.6%	25.0%
Recreational	1	0.1%	0		
Student	83	6.9%	6	2.6%	7.2%
Other or Unknown	17	1.4%	5	2.2%	29.4%
Second Pilot on Board*	134	11.2%	23	10.0%	17.2%
CFI on Board*	286	23.9%	41	17.8%	14.3%
IFR Pilot on Board*	679	56.8%	130	56.5%	19.1%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 14: Types of Pilot-Related Accidents

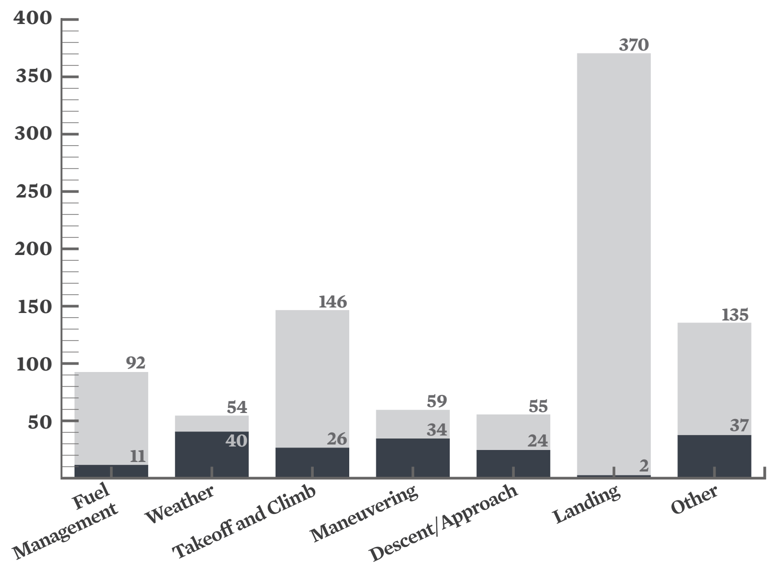


Figure 13: Pilot-Related Accident Trend

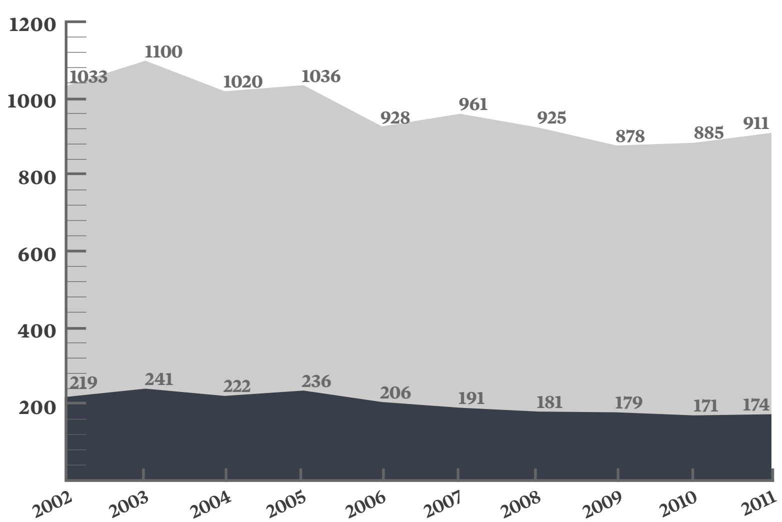
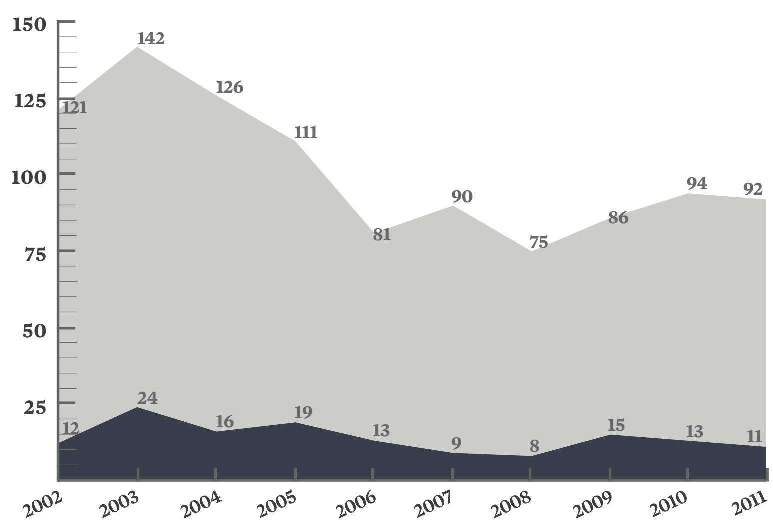


Figure 15: Fuel Management Accident Trend



ALL ACCIDENTS FATAL ACCIDENTS

PILOT-RELATED ACCIDENTS *(911 TOTAL / 174 FATAL)* Pilot-related causes consistently account for about 75% of non-commercial fixed-wing accidents. That pattern held true in 2011 (**Figure 8**) for fatal and non-fatal accidents alike.

The relative frequency of different types of pilot-related accidents followed the familiar pattern (**Figure 14**). Landing accidents were the most common at more than 30%, but only two of 370 were fatal. Adverse weather caused the largest number and by far the highest proportion of fatal accidents. About half of all maneuvering accidents and accidents during descent and approach were fatal as well.

The "Other" category of pilot-related accidents includes:

- 26 accidents (six fatal) attributed to inadequate preflight inspections
- 36 accidents during attempted go-arounds, five of which were fatal
- 40 non-fatal accidents while taxiing, including eight collisions between aircraft on the ground
- Seven accidents in which loss of engine power during cruise was blamed on the pilot's failure to use carburetor heat; one was fatal
- Five fatal episodes of controlled flight into terrain during cruise flight
- Five instances, four of them fatal, of pilot incapacitation blamed on alcohol and/or drugs
- Nine accidents, all fatal, due to physical incapacitation of the pilots
- Six fatal and three non-fatal mid-air collisions, all between airplanes; no helicopters were involved in mid-airs in 2011
- The fatal fall of a wing-walker during an airshow performance.

Accidents caused by fuel mismanagement or adverse weather generally give reasonable warning to the pilot. As such, they can be considered failures of flight planning or in-flight decision-making. Takeoff and landing accidents in particular tend to happen very quickly, focusing attention on the pilot's airmanship (though the decision-making that leads airmanship to be tested can usually be called into question).

ACCIDENT CAUSES: FLIGHT PLANNING AND DECISION-MAKING

FUEL MANAGEMENT *(92 TOTAL / 11 FATAL)*

The decline in fuel management accidents through 2008 was one of the rare success stories in GA safety, showing a 50% decrease in 10 years. Since then, fuel management accidents have become more frequent again, increasing from 75 to 92 in 2011 even as the overall number of fixed-wing accidents has decreased (**Figure 15**). Fuel mismanagement caused just over 6% of the accidents in 2008, but almost 8% in 2011.

Inadequate flight planning—failures to determine the amount of fuel required for the flight or the amount actually on board, or to verify the rate of fuel consumption en route—accounted for the largest share (47%). Errors in operating the aircraft's fuel system (choosing an empty tank or the incorrect use of boost or transfer pumps) were almost as widespread, implicated in 45% (**Figure 16**). Eight non-fatal accidents were attributed to fuel contamination.

Sixty-five percent of the accident airplanes were fixed-gear singles (**Figure 17**), which accounted for 75% of all non-commercial fixed-wing accidents. Aside from one single-engine turboprop, all of 2011's fuel management accidents were in piston aircraft. The credentials of the accident pilots also showed no obvious differences from other types of accidents; half involved private pilots, and 45% were flown by commercial or airline transport pilots. Only 12% of fuel management accidents took place at night (**Figure 18**), just half the share reported for 2010.

WEATHER *(54 TOTAL / 40 FATAL)* Fatal weather accidents are among the most difficult to investigate, and weather accidents are the most consistently fatal. Aside from spikes in 2003, 2004, and 2009, the number of weather accidents has been largely stable from year to year (**Figure 20**).

As always, attempts to fly by visual references in instrument conditions ("VFR into IMC") accounted

Figure 16: Types of Fuel Management Accidents

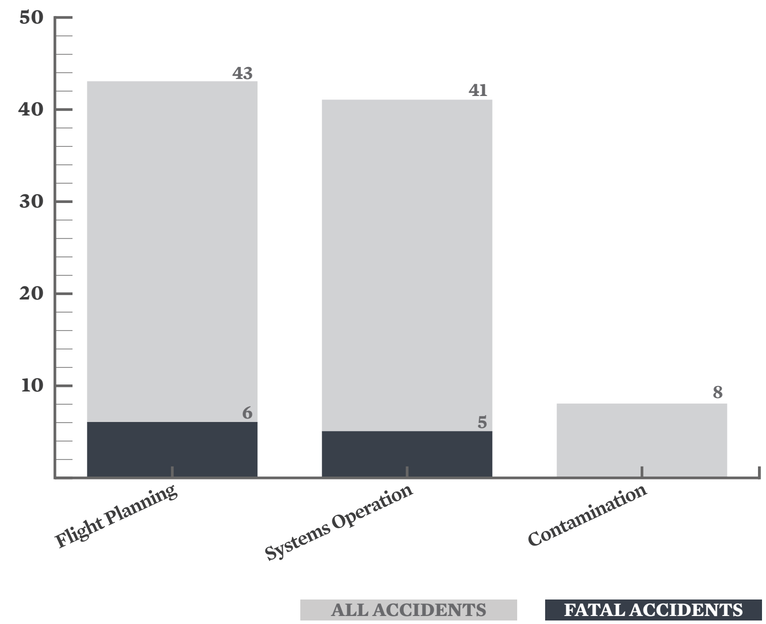


Figure 17: Aircraft Involved in Fuel Management Accidents—Non-Commercial Fixed Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	60	65.2%	6	54.5%	10.0%
SEF, Tailwheel	15		3		
Single-Engine Retractable	26	28.3%	5	45.5%	19.2%
Single-Engine Turbine	1		0		
Multiengine	6	6.5%	0		

ACCIDENT CASE STUDY—FUEL MANAGEMENT

NTSB ACCIDENT NO. ERA11FA285
LANCAIR LEGACY, RICHLANDS, NORTH CAROLINA
TWO FATALITIES

HISTORY OF FLIGHT Almost four hours after taking off from Morrisville-Stowe Airport in Vermont, the pilot checked in with approach control for Wilmington, North Carolina, and was cleared to descend to 4,000 feet. As the airplane passed through 6,000 feet, the pilot declared an emergency due to "low fuel pressure" and was given vectors for the Albert J. Ellis Airport in Jacksonville, seven miles northeast. About 15 minutes later emergency services notified the controller that the airplane had crashed in a corn field three miles southwest of the airport.

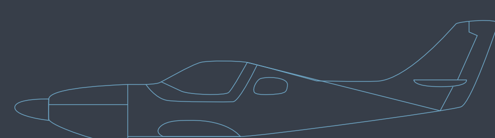
Before departure, the pilot had added 46.1 gallons of fuel from the self-service pump. The Lancair had two wing tanks with a combined capacity of 67 gallons. The fuel selector valve was found set to the left tank. Data retrieved from the airplane's engine data monitor suggested that the left tank ran dry three hours and 39 minutes into the flight, at which point roughly 20 gallons should have remained in the right tank. However, the NTSB's factual report notes that both tanks were breached, and there were no signs of fuel around either one.

PILOT INFORMATION The 52-year-old instrument-rated private pilot was also the builder of the accident airplane, which he'd registered in March 2004. His most recent medical application, filed nearly two years before the date of the accident, claimed 1,100 hours of flight experience. At its last condition inspection, the airplane's tachometer showed 459.2 hours of operation.

WEATHER A METAR recorded at Albert Ellis two minutes before the accident listed winds from 270 degrees at 6 knots and 10 miles visibility under a scattered layer at 7,500 feet.

PROBABLE CAUSE The pilot's improper in-flight fuel management, which resulted in a loss of engine power due to fuel starvation.

ASI COMMENTS Fuel totalizers and engine data monitors are excellent tools for monitoring fuel flow in flight—but their estimates of fuel and range remaining are only as good as the starting values input by the pilot. In this case, the discrepancy between the EDM's calculation that 20 gallons remained in the right tank and the lack of fuel staining after that tank was breached suggests that perhaps the pilot had not started with full tanks, as he'd intended. This would also be consistent with his failure to make an earlier diversion for fuel and his initial interpretation of the engine indications as "low fuel pressure" rather than fuel starvation or exhaustion.



for the lion's share of fatalities (**Figure 21**). About half of all accidents precipitated by thunderstorm encounters, icing, and non-convective turbulence were fatal as well, as were all four accidents attributed to deficient instrument flying by rated pilots on active IFR flight plans.

Private pilots made up about 60% of those involved in identified weather accidents; almost all the rest held commercial (31%) or airline transport pilot (7%) certificates (**Figure 24**). More than half of the pilots held instrument ratings, including 20 of the 40 in fatal accidents, but instructors were on board only nine of the accident flights.

ACCIDENT CAUSES: HIGH-RISK PHASES OF FLIGHT

TAKEOFF AND CLIMB *(146 TOTAL / 26 FATAL)*

Takeoffs consistently see the second-highest number of pilot-related accidents and account for more than 10% of fatalities. This pattern continued to hold in 2011. The numbers of both fatal and non-fatal takeoff accidents were almost unchanged from the year before, as were the proportions of non-commercial fixed-wing accidents blamed on takeoff errors.

Losses of aircraft control accounted for 40% of all accidents during takeoff and climb and 20% of the fatal accidents (**Figure 26**). Most were losses of directional control during the takeoff roll, but the category also includes pitch and roll excursions after lift-off. Departure stalls accounted for half the fatal accidents in this category; settling back onto the runway due to premature rotation was usually survivable, while stalls after the airplane had succeeded in climbing were frequently lethal. Excessive aircraft weight or high density altitude; attempts to use soft, contaminated, or otherwise unsuitable runways; and errors in setting flaps, fuel mixtures, and other details of aircraft configuration caused about equal numbers of accidents but relatively few fatalities. Of these, configuration errors were the most likely to result in fatal accidents. Two of the six collisions with objects or structures were fatal, but no deaths resulted from any of the six accidents ascribed to late decisions to reject the takeoff attempts.

All of 2011's takeoff accidents involved piston airplanes. More than 80% were fixed-gear single-engine models (**Figure 27**), and more than half of those had conventional landing gear. Nearly 95% took place in daytime VMC, and the only three

Figure 18: Flight Conditions of Fuel Management Accidents—Non-Commercial Fixed-Wing

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	79	85.9%	8	72.7%	10.1%
Night VMC*	10	10.9%	2	18.2%	20.0%
Day IMC	2	2.2%	1	9.1%	50.0%
Night IMC*	1	1.1%	0		

*INCLUDES DUSK

Figure 19: Pilot Involved in Fuel Management Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	18	19.6%	2	18.2%	11.1%
Commercial	24	26.1%	2	18.2%	8.3%
Private	46	50.0%	6	54.5%	13.0%
Student	2	2.2%	1	9.1%	50.0%
Other or Unknown	2	2.2%	0		
CFI on Board*	27	29.3%	3	27.3%	11.1%
IFR Pilot on Board*	67	72.8%	9	81.8%	13.4%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 20: Weather Accident Trend

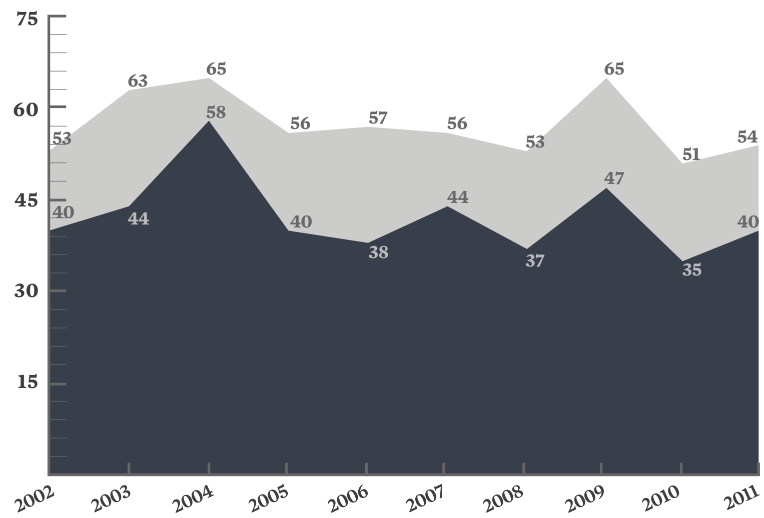


Figure 21: Types of Weather Accidents

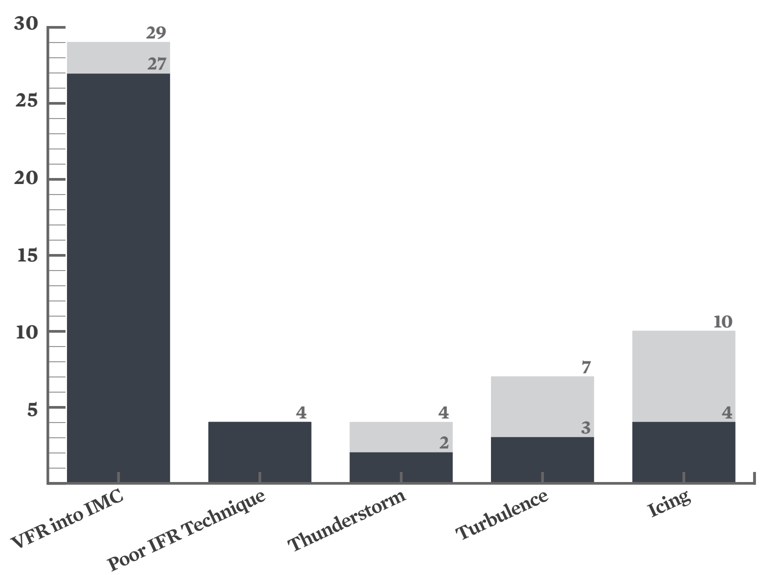


Figure 22: Flight Conditions of Weather Accidents—Non-Commercial Fixed-Wing

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	20	37.0%	12	30.0%	60.0%
Night VMC*	5	9.3%	4	10.0%	80.0%
Day IMC	21	38.9%	16	40.0%	76.2%
Night IMC*	8	14.8%	8	20.0%	100.0%

*INCLUDES DUSK

Figure 23: Aircraft Involved in Weather Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	32	59.3%	24	60.0%	75.0%
SEF, Tailwheel	9		5		55.6%
Single-Engine Retractable	17	31.5%	14	35.0%	82.4%
Single-Engine Turbine	3		3		100.0%
Multiengine	5	9.3%	2	5.0%	40.0%
Multiengine Turbine	3		0		

Figure 24: Pilots Involved in Weather Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	4	7.4%	0		
Commercial	17	31.5%	11	27.5%	64.7%
Private	32	59.3%	28	70.0%	87.5%
Student	1	1.9%	1	2.5%	100.0%
CFI on Board*	9	16.7%	3	7.5%	33.3%
IFR Pilot on Board*	31	57.4%	20	50.0%	64.5%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 26: Types of Takeoff and Climb Accidents

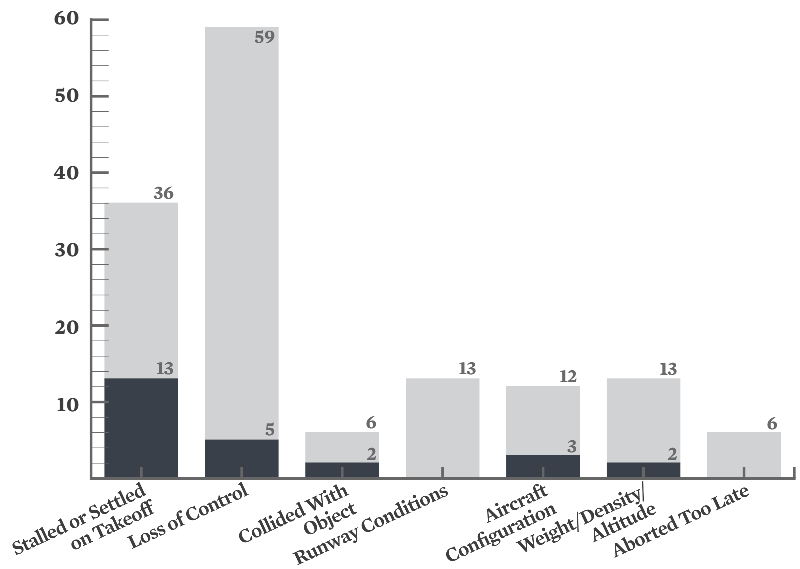


Figure 25: Takeoff and Climb Accident Trend

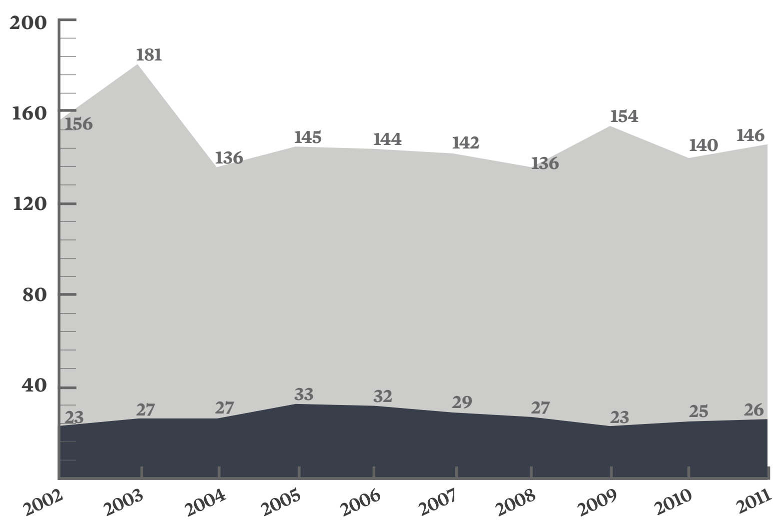
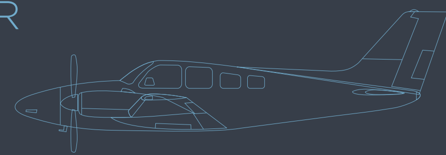


Figure 27: Aircraft Involved in Takeoff and Climb Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	122	83.6%	19	73.1%	15.6%
SEF, Tailwheel	65		7		10.8%
Single-Engine Retractable	17	11.6%	5	19.2%	29.4%
Multiengine	7	4.8%	2	7.7%	28.6%

ALL ACCIDENTS FATAL ACCIDENTS

ACCIDENT CASE STUDY—WEATHER



NTSB ACCIDENT NO. CEN11FA302
BEECH 58C, TOPEKA, KANSAS
FOUR FATALITIES

HISTORY OF FLIGHT About an hour after departing from Scott City, Kansas, on an instrument flight plan to Topeka, the pilot contacted Kansas City Center and was cleared to descend to 5,000 feet. The controller advised that Topeka was using the back-course localizer approach to Runway 31 and offered the pilot vectors to the final approach course, which he accepted. However, the controller instructed the pilot to "intercept the Topeka 129 radial for the back course," and the pilot initially flew through the localizer and apparently began tracking the 129-degree radial to the Topeka VOR five miles north of the approach corridor. After receiving a corrected vector he intercepted the localizer at the final approach fix some 700 feet above the charted stepdown altitude. The Baron broke out long and well left of the runway before the pilot initiated a missed approach and asked "if he could circle." He requested the GPS approach to Runway 36. Topeka Tower issued missed approach instructions and handed him back to Center, who cleared him for the GPS approach to Runway 31 instead.

The pilot's readback of this approach clearance was the last transmission received from him. Radar data showed the Baron passing over the airport at 1,500 feet, making a climbing right turn to the east and then southeast and levelling at 3,400, and then making an abrupt 180-degree turn to the west. After another turn back to the southeast, the radar target abruptly disappeared. The wreckage was found about four miles northeast of the airport; its condition suggested that it crashed in a 25-degree nose-down attitude banked 45 degrees to the left with both engines operating at high power.

PILOT INFORMATION The 35-year-old private pilot held ratings for airplane single- and multiengine land and instrument airplane. His logbook showed 438 hours of total flight time that included 28.7 hours of multiengine time, 17.5 in the Baron, and 11 hours in actual instrument conditions. In the five months preceding the accident, he'd logged just 0.7 hours of instrument time.

WEATHER A METAR recorded at Topeka 20 minutes before the accident reported winds from 010 degrees at 9 knots, a 500-foot overcast with 10 miles visibility underneath, and a temperature-dew point spread of 1 degree Celsius. Ceilings varied between 400 and 800 feet. The subsequent METAR recorded an hour later was fairly similar: winds from 340 at 5 knots, 6 miles visibility in light rain under a 700-foot overcast varying between 400 and 900 feet, with both temperature and dew point unchanged.

PROBABLE CAUSE The pilot failed to maintain control of the airplane while maneuvering in instrument meteorological conditions. Contributing to the accident was the pilot's minimal experience flying in actual instrument conditions.

ASI COMMENTS Topeka was down to minimums that day: minimum descent altitudes for both the localizer back course and GPS approaches to Runway 31 are about 500 feet agl. While that's a normal day's work for a career pilot, it can easily become a handful for a newcomer with minimal experience in actual IMC even without the added complication of reverse sensing on a back-course approach. Throw in not only an unfamiliar airplane but little time in class, and the pilot faced daunting challenges for his level of experience. It's unfortunate that he chose to bring three passengers on a flight that could have been expected to tax his airmanship to its limits.

accidents in IMC were also during daylight hours (**Figure 28**). More than one-third of the pilots involved held commercial or airline transport pilot certificates (**Figure 29**), but the share involving sport or student pilots was almost double that in the overall accident record. CFIs were present on just 31 of the accident flights (21%), and only seven of those flights were classified as instructional.

MANEUVERING *(59 TOTAL / 34 FATAL)* Even though the last two years have seen the smallest number of maneuvering accidents of the decade (**Figure 30**), it remains one of the two leading causes of pilot-related fatalities. Returning to the usual pattern, the most common cause was unintentional stalls at altitudes too low to allow recovery (**Figure 31**). Nearly two-thirds of these were fatal, a rate surpassed only by the lethality of accidents during aerobatic practice or performances. More than one-third of all maneuvering accidents were controlled flight into wires, structures, terrain, or other obstructions. Nine of those 21 were fatal, and lethality in all types of maneuvering accidents exceeded 40%.

Just two maneuvering accidents were classified as having taken place in instrument meteorological conditions. One (during daylight hours) was fatal, as were all five that occurred in VMC at night. Fifty-two (88%) took place in VMC during daylight hours, including 28 of 34 fatal accidents (82%).

Ninety-three percent of the accident aircraft (55 of 59) were piston singles, 46 of them fixed-gear (**Figure 32**). Twenty-two (all fixed-gear) were tailwheel models. All four accidents in turbine-powered airplanes were fatal, as were one of the two in piston twins and all seven in retractable-gear piston singles. Private pilots commanded 25 of the accident flights (42%), while 27 were flown by either commercial pilots or ATPs (**Figure 33**).

DESCENT AND APPROACH *(55 TOTAL / 24 FATAL)*

Descent and approach accidents are defined as those that occur between the end of the en route phase of flight and either entry to the airport traffic pattern (if VFR) or the missed approach point or decision height of an instrument approach procedure on an IFR flight. 2011 saw 10 more descent/approach accidents than 2010 (**Figure 34**), but the number of fatal accidents was identical. In 2011, they made up 4.7% of all accidents and 10.7% of fatal accidents.

Figure 28: Flight Conditions of Takeoff and Climb Accidents—Non-Commercial Fixed-Wing

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	138	94.5%	24	92.3%	17.4%
Night VMC*	5	3.4%	1	3.8%	20.0%
Day IMC	3	2.1%	1	3.8%	33.3%

*INCLUDES DUSK

Figure 29: Pilots Involved in Takeoff and Climb Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	17	11.6%	4	15.4%	23.5%
Commercial	37	25.3%	3	11.5%	8.1%
Private	68	46.6%	13	50.0%	19.1%
Sport	8	5.5%	3	11.5%	37.5%
Student	15	10.3%	2	7.7%	13.3%
Other or Unknown	1	0.7%	1	3.8%	100.0%
CFI on Board*	31	21.2%	4	15.4%	12.9%
IFR Pilot on Board*	68	46.6%	10	38.5%	14.7%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 30: Maneuvering Accident Trend

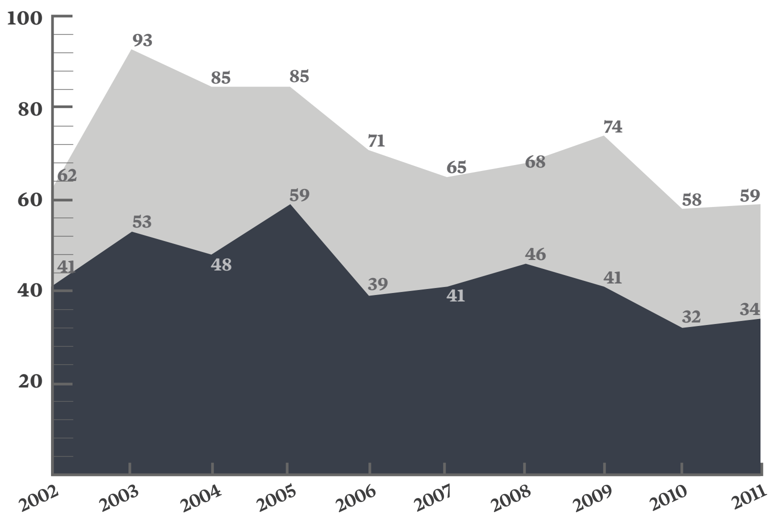


Figure 31: Types of Maneuvering Accidents

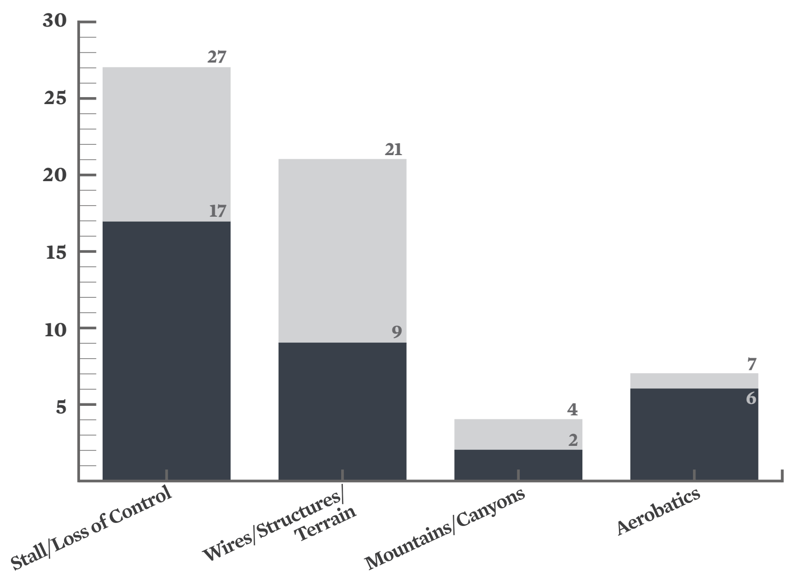


Figure 32: Aircraft Involved in Maneuvering Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	46	78.0%	22	64.7%	47.8%
SEF, Tailwheel	22		13		59.1%
Single-Engine Retractable	9	15.3%	9	26.5%	100.0%
Single-Engine Turbine	2		2		100.0%
Multiengine	4	6.8%	3	8.8%	75.0%
Multiengine Turbine	2		2		100.0%

Figure 33: Pilots Involved in Maneuvering Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	9	15.3%	4	11.8%	44.4%
Commercial	18	30.5%	13	38.2%	72.2%
Private	25	42.4%	15	44.1%	60.0%
Sport	2	3.4%	1	2.9%	50.0%
Student	3	5.1%	0		
Other or Unknown	2	3.4%	1	2.9%	50.0%
CFI on Board*	18	30.5%	9	26.5%	50.0%
IFR Pilot on Board*	36	61.0%	24	70.6%	66.7%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 34: Descent and Approach Accident Trend

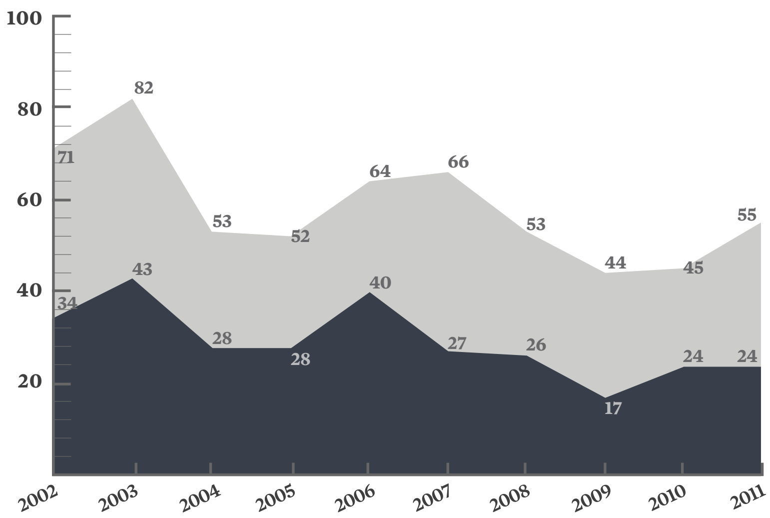


Figure 35: Types of Descent and Approach Accidents

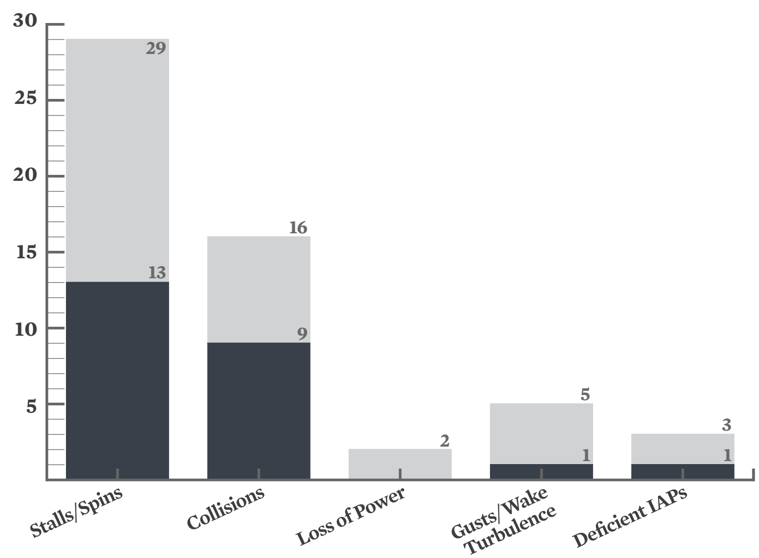


Figure 36: Aircraft Involved in Descent and Approach Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	36	65.5%	11	45.8%	30.6%
SEF, Tailwheel	14		4		28.6%
Single-Engine Retractable	12	21.8%	8	33.3%	66.7%
Multiengine	7	12.7%	5	20.8%	71.4%
Multiengine Turbine	1		0		

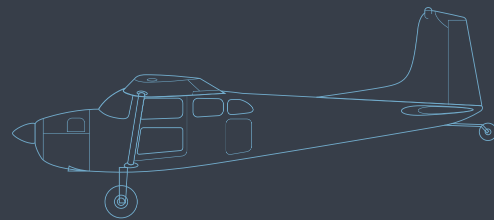
Figure 37: Flight Conditions of Descent and Approach Accidents—Non-Commercial Fixed-Wing

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	42	76.4%	17	70.8%	40.5%
Night VMC*	9	16.4%	5	20.8%	55.6%
Day IMC	4	7.3%	2	8.3%	50.0%

*INCLUDES DUSK

ALL ACCIDENTS FATAL ACCIDENTS

ACCIDENT CASE STUDY—TAKEOFF



NTSB ACCIDENT NO. ANC11FA037
CESSNA 180, CHUGIAK, ALASKA
FOUR FATALITIES

HISTORY OF FLIGHT The pilot loaded four passengers—one adult and three children—a substantial amount of cargo, and full fuel. Several witnesses saw the airplane lift off of Runway 19R in a "very nose-high attitude," and one reported that it had actually departed the left side of the runway before taking off, headed for a row of trees. The Cessna cleared the trees, began a turn to the south, then rolled right and crashed nose-first. The witnesses agreed that the engine sounded as though it was running at full power throughout.

A post-crash fire consumed much of the wreckage, but investigators were able to determine that the airplane had been loaded at least 10 percent above its certified maximum gross weight. The estimated center of gravity was near the middle of the approved range. The pilot had received his initial checkout in the 180 nearly a year earlier, and he hadn't logged any flights since then. While he wasn't in the habit of recording every flight in his logbook, friends believed that he hadn't flown at all in at least eight months. An acquaintance who'd flown with him a year before the accident recalled that he'd nearly stalled the Cessna on takeoff; he'd advised the accident pilot to get additional training before trying to fly it by himself (which he had done).

PILOT INFORMATION The 46-year-old private pilot had received his tailwheel and high-performance endorsements and completed a flight review in the accident airplane eleven and a half months before the accident. His logbook did not record any subsequent flight time, though he was known to have made other flights since. It listed 198.9 hours total experience and 3.7 hours in the Cessna 180. His actual make-and-model experience is unknown.

WEATHER Two minutes before the accident, Birchwood, Alaska, the nearest official weather station, reported winds from 250 degrees at 4 knots, 10 miles visibility, and clear skies.

PROBABLE CAUSE The pilot's loss of control of the airplane during takeoff, which resulted in an aerodynamic stall. Contributing to the accident was the pilot's lack of experience in make and model, his lack of currency in FAA required takeoffs and landings, and his excessive loading of the airplane.

ASI COMMENTS This accident provides a compelling illustration of why the currency requirement for carrying passengers (at least three takeoffs and landings in the preceding 90 days) is more than an annoying technicality—and of why any pilot does well to seek systematic refresher training after a long layoff. A low-time pilot without much make-and-model experience should anticipate needing expert assistance to knock the rust off safely. With the airplane lightly loaded and a CFI poised to take the controls, any deficiencies in technique might have been corrected before he put any passengers at risk.

Inadvertent stalls were implicated in 53% (29 of 55), including 13 of 24 fatal accidents (**Figure 35**). Nine of 16 collisions with wires, structures, terrain, or other solid objects were fatal. Only three accidents (one fatal) were attributed to deficient execution of instrument approaches by rated pilots, and there was only one fatal accident among the seven that resulted from wake turbulence, wind gusts, or unexpected losses of engine power.

Only one of the accident aircraft was turbine-powered, a King Air 200 air ambulance flying a positioning leg in Alaska. (Only minor injuries resulted.) Two-thirds of the 54 piston airplanes were fixed-gear singles (**Figure 36**). As in the past, fatalities were less than half as common in these (31%) as in multiengine airplanes or retractable-gear singles (68% combined). Almost half the aircraft involved (19 of 41) were single-engine retractables (12) or multiengine (7). More than 60% of the accidents in those aircraft were fatal compared to only 22% of those in fixed-gear singles with tailwheels. About one-quarter occurred at night and/or in IMC (**Figure 37**), but even accidents in day VMC were two and a half times as likely to be fatal as day VMC accidents in general.

Sixty percent of the accident flights were commanded by private pilots (**Figure 38**), a proportion one-third higher than their share of all non-commercial fixed-wing accidents. Unlike in prior years, the proportion holding instrument ratings was essentially the same (just over half). Three accidents took place on student solos, one of which was fatal. Only one flight in six had an instructor on board the aircraft.

LANDING *(370 TOTAL / 2 FATAL)* Year after year, far and away the largest number of fixed-wing accidents result from attempts to get those airplanes back onto the ground. Almost all those pilots live to try again, and 2011 was no exception. The number of landing accidents increased for the second year in a row (**Figure 39**) but only two were fatal, the lowest number in at least 30 years. Consistent with a long-established pattern, landing accidents were more than twice as frequent as any other pilot-related category. Only seven (less than 2%) took place in instrument conditions; 93% were in VMC during daylight hours.

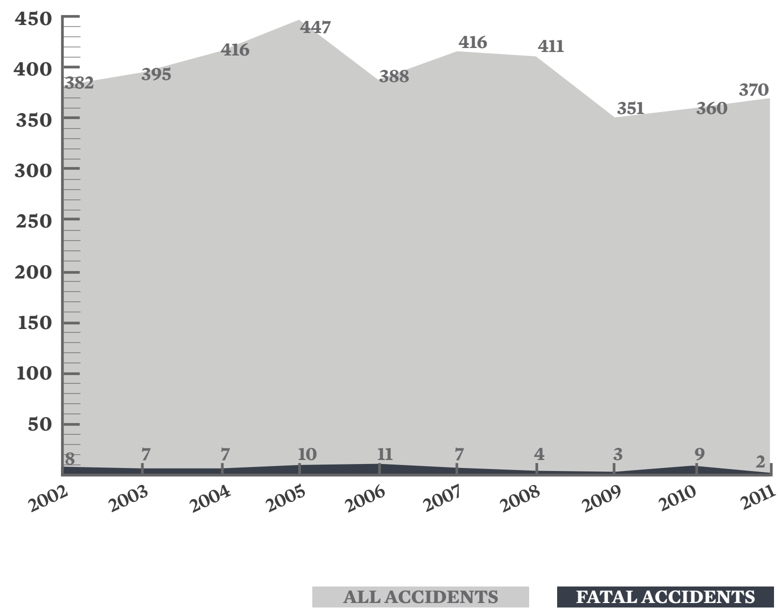
As in the past, losses of directional control remain the most common problem, accounting for almost

Figure 38: Pilots Involved in Descent and Approach Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	5	9.1%	1	4.2%	20.0%
Commercial	14	25.5%	6	25.0%	42.9%
Private	33	60.0%	16	66.7%	48.5%
Student	3	5.5%	1	4.2%	33.3%
CFI on Board*	9	16.4%	3	12.5%	33.3%
IFR Pilot on Board*	29	52.7%	12	50.0%	41.4%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 39: Landing Accident Trend



ACCIDENT CASE STUDY—MANUEVERING

NTSB ACCIDENT NO. ERA12FA068
CIRRUS SR22, BOYNTON BEACH, FLORIDA
TWO FATALITIES

HISTORY OF FLIGHT The accident aircraft was following two aerobatic airplanes, a Sukhoi Su-29 and an Extra EA-300, back to their base after watching an airshow performance. After the Cirrus joined them in formation, the flight descended below 500 feet; the Cirrus was not much more than 100 feet above the ground. At that point the Su-29 pilot saw it smoothly pitch up to a roughly 30-degree angle and climb, then roll to the left "as fast as a Cirrus could roll." The nose dropped when it reached an inverted attitude and it descended straight into the ground. Data recovered from the onboard recorder showed that two days before the accident, the airplane had completed a roll at an altitude of about 2,000 feet; en route to the airshow, it had done another beginning at 600. The accident sequence began at a GPS-estimated altitude of 129 feet.

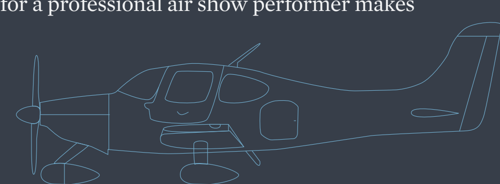
PILOT INFORMATION The left seat was occupied by a 23-year-old instrument-rated private pilot. His logbook was not found, but information from various sources placed his total flight experience at 207 hours. None was known to be in the SR22.

The 34-year-old pilot in the right seat held a commercial certificate with ratings for single- and multiengine airplanes, helicopters, instrument airplane, and instrument helicopter. He had obtained all these ratings in 22 months after having voluntarily surrendered his commercial certificate "with numerous category and class ratings ... and a type rating" in 2006 in anticipation of FAA enforcement action. The pilots of the other aircraft described him as "a really good stick" and "an adrenaline junkie." He had relatively little aerobatic experience, but was generally believed to have rolled the Cirrus on other occasions.

WEATHER Palm Beach International Airport, 12 nautical miles to the northeast, reported winds from 060 degrees at 8 knots, visibility of 10 statute miles, and a few clouds at 3,100 feet.

PROBABLE CAUSE The right seat pilot's decision to attempt a low-altitude aerobatic maneuver in a non-aerobatic airplane.

ASI COMMENTS Accidents during legitimate aerobatic training are rare but generally fatal. More common, and far more baffling, are those in which untrained pilots try to teach themselves aerobatics, often in non-aerobatic aircraft. The outcomes are predictably catastrophic. The decision to try it at an altitude that would require a demonstration of competence and special waiver for a professional air show performer makes this pilot's thought processes particularly difficult to understand.



half (**Figure 40**). Stalls and hard landings made up more than one-quarter. For a change, overruns and undershoots were about equally common, but together made up less than 10% of the total. (In most recent years, long landings have led to five to ten times as many accidents as short landings.) Wet, soft, or contaminated runways were blamed for 28, errors operating retractable gear led to 22, and seven aircraft suffered substantial damage in collisions with birds or other animals.

Five accidents didn't fit easily into any of these categories: a collision with a pole during a precautionary off-airport landing by a pilot who got lost at night, a poorly executed precautionary landing on a runway within easy gliding distance, one engine stoppage due to an overly rich fuel mixture at a high-elevation field, a mistaken downwind landing, and a noseover due to frozen brakes on a snow-covered strip in Alaska.

In 2011, 79% of landing accidents involved fixed-gear singles (**Figure 41**), the same percentage as in 2010. Nearly half (47%) were taildraggers. Their extensive use as trainers does not seem to account for the prevalence of fixed-gear singles in the record of landing accidents; only 65 of 292 (22%) were actually on training flights, including 39 student solos (**Figure 42**).

This year's data were a little more consistent with the belief that the prevalence of SEF aircraft reflects generally lower experience among these pilots, at least as indexed by certificate level. Private, sport, and student pilots accounted for 62% of landing accidents compared to 52% of all other types; 36% of landing accidents involved commercial pilots and ATPs compared to 46% of all other accidents.

MECHANICAL / MAINTENANCE

(147 TOTAL / 15 FATAL) Documented mechanical failures or errors in aircraft maintenance caused 12% of all non-commercial fixed-wing accidents in 2011 (**Figure 43**), including 7% of the fatal accidents. Both figures were at or near historic lows: The total of 147 was the smallest in the modern era, while 15 fatal accidents is just one more than the record of 14 set in 2005.

Figure 40: Types of Landing Accidents

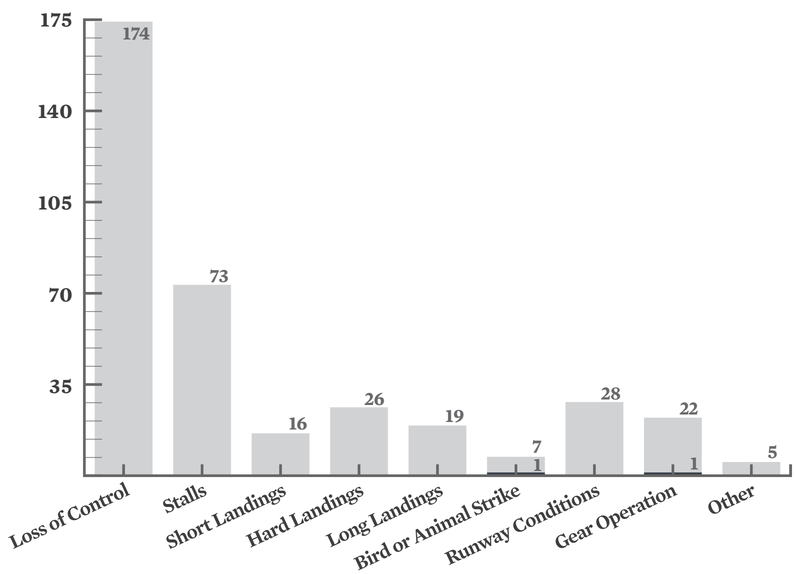
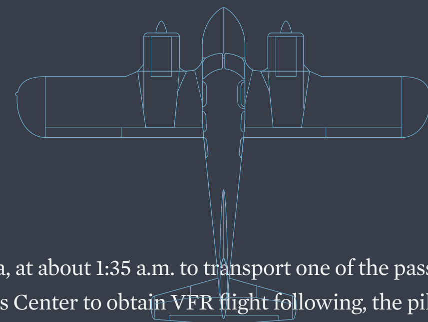


Figure 41: Aircraft Involved in Landing Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	292	78.9%	2	100.0%	0.7%
SEF, Tailwheel	138		1		0.7%
Single-Engine Retractable	57	15.4%	0		
Single-Engine Turbine	5		1		20.0%
Multiengine	21	5.7%	0		
Multiengine Turbine	6		0		

ALL ACCIDENTS FATAL ACCIDENTS

ACCIDENT CASE STUDY—DESCENT/APPROACH



NTSB ACCIDENT NO. CEN11FA557
PIPER PA-23-160, MILLERSBURG, OHIO
THREE FATALITIES

HISTORY OF FLIGHT The flight departed from Sullivan County, Indiana, at about 1:35 a.m. to transport one of the passengers to the Jefferson County Airport in Steubenville, Ohio. After contacting Indianapolis Center to obtain VFR flight following, the pilot made several altitude changes to avoid clouds, eventually levelling at 5,500 feet. The flight was subsequently handed off to Cleveland Center and then Pittsburgh Approach, which cleared it to descend to 3,000 and provided vectors to the airport. The controller subsequently told the pilot that he was directly over the airport, but the pilot replied that he couldn't see it, as conditions were "a little too thick."

Asked for his intentions, the pilot said he wanted to fly back toward Columbus, then three minutes later changed his destination to Carrollton County, 21 nautical miles to the northwest. Pittsburgh handed him back to Cleveland Center, where the controller advised the pilot that Carrollton County's landing lights were out of service. The pilot then decided to return to Columbus at 6,500 feet, but 21 minutes later changed his destination again, this time to the Holmes County Airport near Millersburg.

The pilot was initially unable to find the Holmes County Airport, whose beacon was out of service, but succeeded in activating the pilot-controlled runway lighting after the controller provided him with the correct frequency. A pilot living near the airport heard the Apache make three passes over the airport from different directions over a 15-minute period; another about two miles to the northeast saw it fly over his house southbound at low altitude. At 4:53 radar contact was lost. The wreckage was found at about 11:30 in an upsloping forested area about a quarter mile southeast of the approach end of Runway 27. A path of broken trees led to the spot where it had hit the ground nose-first and flipped.

PILOT INFORMATION The 48-year-old commercial pilot held single-engine, multiengine, and instrument ratings. He had logged 412 hours of total flight experience; 73 of his 74 hours of multiengine time were in the accident airplane. His logbook also listed 72 hours of simulated instrument time and 11 hours in actual IMC.

WEATHER Witnesses reported fog in the area and noted that this was not unusual. At the time of the accident, the nearest reporting station (some 16 nautical miles to the north) recorded calm winds, a scattered layer at 300 feet, 4 miles visibility in mist, and temperature and dew point both 19 degrees Celsius.

PROBABLE CAUSE The pilot's failure to maintain clearance with terrain during the landing approach in night conditions and fog. Contributing to the accident was the pilot's inadequate preflight planning.

ASI COMMENTS Before the flight, the pilot advised a Flight Service briefer that the aircraft was IFR-capable with a Garmin 430 GPS installed, but despite repeated difficulties locating different airports, he chose to continue VFR. The NTSB report doesn't indicate why. Whether he lacked currency, confidence, or simply hadn't brought the approach plates, he might still have availed himself of the course guidance provided by the instrument approach procedures stored in the GPS database. Even in visual conditions, locating an unfamiliar airport at night can prove very difficult. Following an IAP while VFR greatly simplifies that problem, and of course there's no virtue in not using every resource available in the aircraft.

Fifty-six of the 147 accidents (38%) were attributed to powerplant failures (**Figure 44**), traditionally the most common cause. Landing gear or brake problems were the next most common at 40 (27%), but caused no fatalities. None were attributed primarily to vacuum system or instrument failures, but 18 involved airframe or flight-control problems and eight were caused by electrical malfunctions. Eighty percent of the fatal accidents (12 of 15) were traced to losses of engine power due to breakdowns of either powerplants or fuel systems.

Mechanical failures in retractable-gear singles were at least three times as likely to be fatal as those in either fixed-gear singles or twins (**Figure 45**). This has not generally been the case in the past; given the small numbers involved, it may well be due to chance. The ten accidents (7%) involving turbine aircraft is about double their prevalence in the overall accident fleet, but again, the numbers are small. One fatal accident apiece occurred in a single-engine turbine and a piston twin.

Disproportionately high numbers of commercial and airline transport pilots were involved in mechanical accidents (**Figure 46**), 58% compared to a combined 41% of all other types of accidents. The

Figure 42: Pilots Involved in Landing Accidents—
Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	45	12.2%	1	50.0%	2.2%
Commercial	90	24.3%	1	50.0%	1.1%
Private	185	50.0%	0		
Sport	6	1.6%	0		
Recreational	1	0.3%	0		
Student	39	10.5%	0		
Other or Unknown	4	1.1%	0		
CFI on Board*	68	18.4%	0		
IFR Pilot on Board*	190	51.4%	1	50.0%	0.5%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 44: Types of Mechanical Accidents

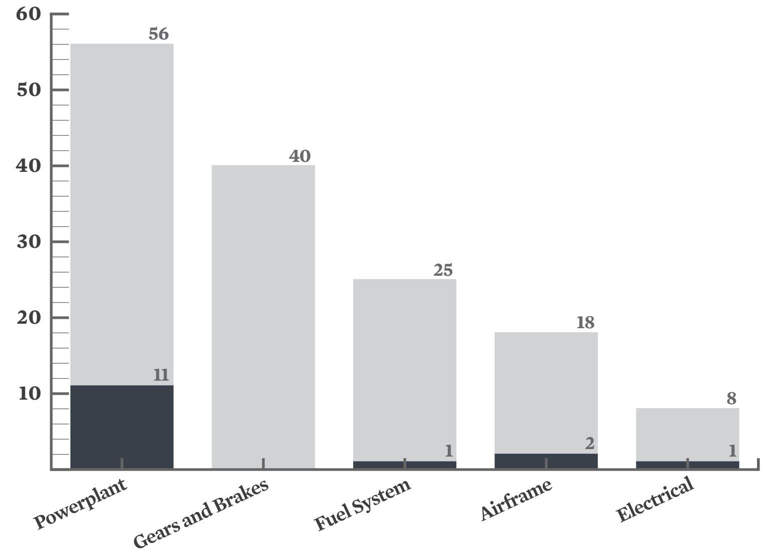


Figure 43: Mechanical Accident Trend

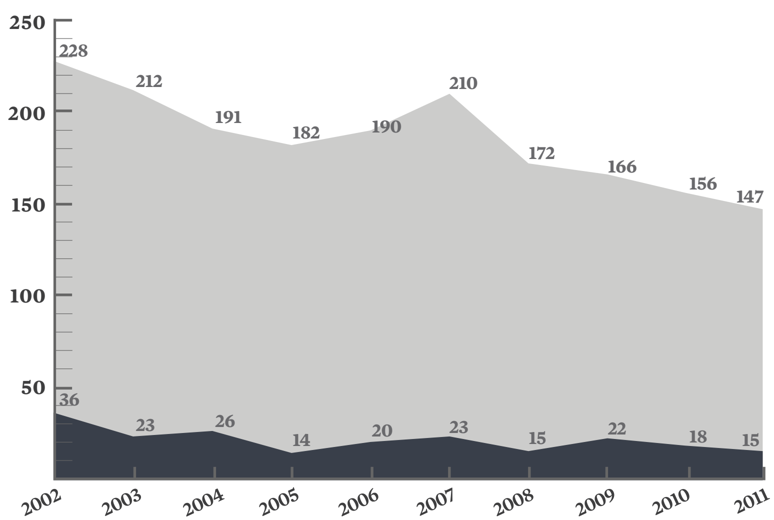


Figure 45: Aircraft Involved in Mechanical Accidents—
Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	92	62.6%	5	33.3%	5.4%
SEF, Tailwheel	39		3		7.7%
Single-Engine Retractable	41	27.9%	9	60.0%	22.0%
Single-Engine Turbine	8		1		12.5%
Multiengine	14	9.5%	1	6.7%	7.1%
Multiengine Turbine	2		0		

ALL ACCIDENTS   FATAL ACCIDENTS

ACCIDENT CASE STUDY—LANDING

NTSB ACCIDENT NO. WPR11LA096
RYAN ST3KR, WARNER SPRINGS, CALIFORNIA
ONE FATALITY AND ONE SERIOUS INJURY

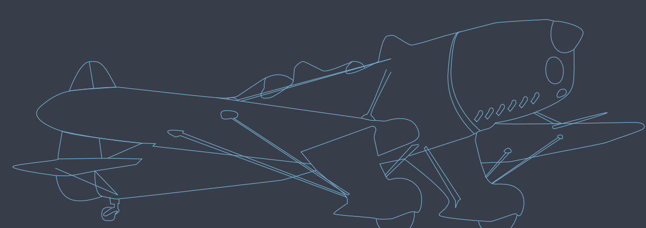
HISTORY OF FLIGHT Because of darkness and deteriorating weather, the pilot decided to divert from his original destination of the Borrego Valley Airport and land at the Warner Springs Gliderport. The airplane reached Warner Springs, which does not have pilot-controlled lighting, almost exactly at sunset. During an attempted landing on Runway 8, the left wing hit the windsock pole located about 30 yards left of the runway and 70 yards short of the threshold. The airplane cartwheeled and both people on board suffered serious injuries; the pilot later succumbed to his.

PILOT INFORMATION The 87-year-old commercial pilot was rated for single- and multiengine airplanes. The NTSB factual report lists him as having 7,000 hours of flight experience. His most recent third-class medical certificate had expired 11 days before the accident.

WEATHER The nearest weather observing facility, located 19 nautical miles south, reported winds from 040 degrees at 4 knots, 10 miles visibility, and clear skies.

PROBABLE CAUSE The pilot's failure to maintain clearance from the wind sock pole during landing.

ASI COMMENTS Landing accidents are almost always survivable—unless the aircraft collides with something solid. An earlier decision to divert or more thorough research into facilities available at potential alternates would have avoided the trap of approaching an unfamiliar airport in failing light. Having a current *FAA Airport/Facilities Directory* (A/FD) on board the aircraft can be invaluable when changing circumstances require a last-minute change of plans.



same phenomenon was noted in 2010, and the explanation remains obscure. Only two mechanical accidents took place in IMC; 93% occurred in VMC in daylight, including all 15 fatal accidents.

OTHER, UNKNOWN, OR NOT YET DETERMINED

(124 TOTAL / 36 FATAL) Seven percent of all non-commercial fixed-wing accidents (82) arose from losses of engine power for reasons that could not be determined after the fact (**Figure 47**): Adequate amounts of fuel were present, and examination of the engines found no evidence of malfunctions prior to impact. Many of those that escaped serious accident damage were successfully test-run during the investigations.

Two-thirds of the remaining 42 were fatal. Their causes were a mixture of unusual events including one flight instructor walking into a moving propeller, a banner-tow plane snagged by the banner it was towing, a turbulence upset during a glider tow, four unauthorized flights by non-pilots, one aircraft disappearance, two unexplained in-flight fires, and two cases of people falling from airplanes in flight. There were also two bird or animal strikes, one loss of power after the pilot accidentally switched off the ignition and a precautionary landing in response to abnormal engine indications, and two airframes damaged by excessive maneuvering loads. Fifteen crashes remain entirely unexplained, as do the circumstances behind seven cases of controlled flight into terrain and two apparent losses of control in flight.

Figure 46: Pilots Involved in Mechanical Accidents—
Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	30	20.4%	1	6.7%	3.3%
Commercial	55	37.4%	3	20.0%	5.5%
Private	53	36.1%	10	66.7%	18.9%
Sport	4	2.7%	1	6.7%	25.0%
Student	4	2.7%	0		
Other or Unknown	1	0.7%	0		
CFI on Board*	50	34.0%	1	6.7%	2.0%
IFR Pilot on Board*	101	68.7%	9	60.0%	8.9%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 47: Other and Unclassified Aircraft Accidents—
Non-Commercial Fixed-Wing

Major Cause	Accidents		Fatal Accidents		Lethality
Unexplained Power Loss	82	66.1%	8	22.2%	9.8%
Other	42	33.9%	28	77.8%	66.7%

COMMERCIAL FIXED-WING ACCIDENTS

After two exceptionally good years, 2011 saw a sharp increase in the number of commercial fixed-wing accidents, up 36% from 2010. The number of fatal accidents more than doubled, from seven to 16 (**see Figure 1**). Aerial application and charter accidents jumped by similar margins: there were 75 on crop-dusting flights (Part 137) compared to 56 the year before and 41 on Part 135 transports, up from 28 (**Figure 48**). Fatalities increased from three to five under Part 137. The number of fatal accidents under Part 135 nearly tripled from four to 11, and the number of fatalities rose from 12 to 23. While distinctly worse than the record of 2009-2010, these numbers are similar to those from most years through 2008.

AIRCRAFT CLASS All but two of the crop-dusting accidents were in single-engine tailwheel models (**Figure 49**), which carry out the vast majority of these operations. Forty-seven were powered by reciprocating engines and 28 were turboprops. Nearly 60 percent of Part 135 accidents were in singles, only one of which had retractable landing gear, but more than half the fatal accidents (six of 11) occurred in twins. Both of the fatal Part 135 accidents in turboprops occurred in Alaska; a Cessna Caravan crashed after a mid-air collision with a Cessna 206, and a de Havilland DHC-3 Otter stalled after hitting trees during an unplanned approach to a lake.

FLIGHT CONDITIONS All but two aerial application accidents were in daytime VMC (**Figure 50**). There was one fatal VFR-into-IMC accident during daylight hours, and one non-fatal accident in visual conditions at night. Two-thirds of the Part 135 accidents also occurred in visual conditions in daylight, but half the fatal accidents took place in IMC and/or at night.

PILOT QUALIFICATIONS Eight of the pilots in aerial application accidents held airline transport pilot certificates (**Figure 52**); all survived. The fatalities were five of the 49 commercial pilots who were not CFIs. Part 135 accident pilots were almost evenly divided between commercial pilots and ATPs; 12 of 22 ATPs held flight instructor certificates compared to eight of 19 commercial pilots. Four of the six CFIs involved in fatal accidents were ATPs. Five accident flights operated with two-pilot crews, a higher number than in most recent years. Two of the five were fatal.

ACCIDENT CAUSES Aerial application flights consist almost entirely of low-altitude maneuvering that leaves little room to recover from aircraft malfunctions. In that light, it's not surprising that their accident record continues to be dominated by maneuvering accidents and emergencies arising from mechanical failures (29% and 19%, respectively). Only two were ascribed to fuel mismanagement, but unexplained losses of engine power caused almost as many as confirmed equipment problems (**Figure 54**). Takeoffs—characteristically while heavily loaded and often from unimproved strips—led to twice as many accidents as landings, a pattern that's consistent within crop-dusting but unusual in other segments of GA.

The Part 135 record for 2011 is remarkable for its diversity. Takeoffs and landings accounted for about one-third combined; the remaining 28 were scattered across the range of possible causes.

Figure 48: Type of Operation—Commercial Fixed Wing

Type of Operation	Accidents		Fatal Accidents		Fatalities	
Agricultural	75	64.7%	5	31.3%	5	17.9%
Charter: Non-Medical	39	33.6%	10	62.5%	20	71.4%
Charter: Medical	2	1.7%	1	6.3%	3	10.7%

Figure 49: Aircraft Class—Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Part 137					
Single-Engine Piston	47	62.7%	4	80.0%	8.5%
Single-Engine Turbine	28	37.3%	1	20.0%	3.6%
SEF, Tailwheel	73		5		6.8%
Part 135					
Single-Engine Fixed-Gear	23	56.1%	5	45.6%	21.7%
SEF, Tailwheel	6		1		16.7%
Single-Engine Retractable	1	2.4%	0		
Single-Engine Turbine	7		2		28.6%
Multiengine	17	41.5%	6	54.4%	35.3%
Multiengine Turbine	2		0		

Figure 50: Flight Conditions—Part 137

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	73	97.3%	4	80.0%	5.5%
Night VMC*	1	1.3%	0		
Day IMC	1	1.3%	1	20.0%	100.0%

*INCLUDES DUSK

Figure 51: Flight Conditions—Part 135

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	27	65.9%	5	45.5%	22.2%
Night VMC*	5	12.2%	2	18.2%	40.0%
Day IMC	6	14.6%	3	27.3%	50.0%
Night IMC*	3	7.3%	1	9.1%	33.3%

*INCLUDES DUSK

Figure 52: Pilots Involved in Part 137 Accidents

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	8	10.7%	0		
Commercial	66	88.0%	5	100.0%	7.6%
Private*	1	1.3%	0		
Flight Instructors	17	22.7%	0		

*HELD A PRIVATE PART 137 CERTIFICATE

Figure 53: Pilots Involved in Part 135 Accidents

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	22	53.7%	7	58.3%	31.8%
Commercial	19	46.3%	5	41.7%	26.3%
Two-Pilot Crews	5	12.2%	2	16.7%	40.0%
Flight Instructors	20	48.8%	6	50.0%	30.0%

Figure 54: Types of Accidents—Part 137

Light and Weather	Accidents		Fatal Accidents		Lethality
Collision	2	2.7%	0		
Descent/Approach	1	1.3%	0		
Fuel Management	2	2.7%	0		
Landing	5	6.7%	0		
Maneuvering	22	29.3%	2	40.0%	9.1%
Mechanical	14	18.7%	0		
Not Yet Assigned	1	1.3%	1	20.0%	100.0%
Other	3	4.0%	1	20.0%	33.3%
Other (Power Loss)	10	13.3%	0		
Preflight	1	1.3%	0		
Takeoff	12	16.0%	0		
Taxi	1	1.3%	0		
Weather	1	1.3%	1	20.0%	100.0%

Figure 55: Types of Accidents—Part 135

Certificate Level	Accidents		Fatal Accidents		Lethality
Collision	3	7.3%	2	16.7%	66.7%
Descent/Approach	2	4.9%	2	16.7%	100.0%
Fuel Management	3	7.3%	1	8.3%	33.3%
Go-Around	2	4.9%	0		
Landing	6	14.6%	1	8.3%	16.7%
Maneuvering	1	2.4%	1	8.3%	100.0%
Mechanical	5	12.2%	1	8.3%	20.0%
Other	2	4.9%	1	8.3%	50.0%
Other (Power Loss)	1	2.4%	0		
Takeoff	7	17.1%	1	8.3%	14.3%
Taxi	4	9.8%	0		
Weather	5	12.2%	2	16.7%	40.0%

AMATEUR-BUILT AND EXPERIMENTAL LIGHT-SPORT AIRCRAFT

FIXED-WING *(239 TOTAL / 59 FATAL; INCLUDES 33 E-LSA / 7 FATAL)*

HELICOPTER *(5 TOTAL / 0 FATAL)* 2010's dramatic decrease in accidents in amateur-built and experimental light-sport aircraft (E-LSAs) was not sustained (**Figure 56**) in the numbers of either total or fatal accidents. Instead, 2011 saw the second-highest number of accidents in homebuilt aircraft in the past decade, and the number of fatal accidents was about equal to the ten-year average.

Thirty-three of the accident aircraft (13%) were classified as E-LSAs (**Figure 57**). Another 173 were fixed-gear single-engine piston airplanes that were not designed to meet the light-sport aircraft (LSA) weight limits; there were also 33 single-engine retractables and five amateur-built helicopters.

All of the 239 airplanes involved were piston singles. As with Part 135 accidents, no particular cause stood out, though the number of fatalities was especially high in accidents during takeoff and initial climb (**Figure 58**). Takeoffs, landings, and mechanical problems were the most prevalent categories. The number of accidents caused by known mechanical failures actually decreased 22% (from 50 to 39), and the proportion due to either those or unexplained power losses was just 24% (58 of 239), down from 33% the year before. Only two accidents, neither fatal, were attributed to pilot technique while attempting go-arounds.

Eight homebuilts were involved in mid-air collisions and a ninth was hit by another aircraft during taxi. Four other accidents also occurred while taxiing, and four more were blamed on inadequate preflight inspections. Physical incapacitation of the pilots caused five fatal accidents, and two accidents (one fatal) were ascribed to alcohol intoxication. The causes of 15 accidents, 12 fatal, have not yet been resolved.

UNUSUAL ACCIDENT CATEGORIES

Twenty-one fatal accidents and another 14 that were not fatal arose from circumstances too rare to support tabulation as separate categories for statistical analysis:

COLLISIONS *(17 TOTAL / 6 FATAL)* There were nine mid-air collisions in 2011. Six were fatal, causing ten individual deaths. Only three collisions involved commercial flights. The pilot of a Cessna Caravan was killed when its empennage was severed in a collision with a Cessna 207 near Nightmute, Alaska, while the 207's pilot was able to maintain control and land safely. Both were operating under Part 135. Two Air Tractor crop-dusters operated by the same company collided during application runs in Missouri; one pilot suffered serious injuries while the other was unhurt. No one was injured when a privately operated Cessna 206 collided with a

Piper Navajo making a charter flight in the opposite direction in the Lake Clark Pass in Alaska.

Fatal collisions on non-commercial flights included one between a fixed-gear Piper Cherokee and a Piper Comanche near New Hampton, New York; the two were attempting to travel in train without apparently having planned a formation flight. Two Cessna floatplanes, a U206 and a 180, collided over Amber Lake near Talkeetna, Alaska, killing all four on board the 180, and an RV-6 crashed out of control in Texas after colliding with an RV-8 while practicing formation flight. In New Jersey, a Lancair IV-P on a cross-country flight collided with a Yak-55 maneuvering in a designated aerobatic box. Finally, a Beech V35 Bonanza was destroyed and its solo pilot killed in a collision with a Piper Seminole on a training flight near Hillsboro, Oregon. Both pilots in the Seminole escaped injury after the instructor made a successful forced landing in a field.

No injuries resulted from the collision between an RV-4 and an RV-8 during an attempted formation flight at Madera, California.

Figure 56: Fixed-Wing Amateur-Built and Experimental Light Sport Accident Trend

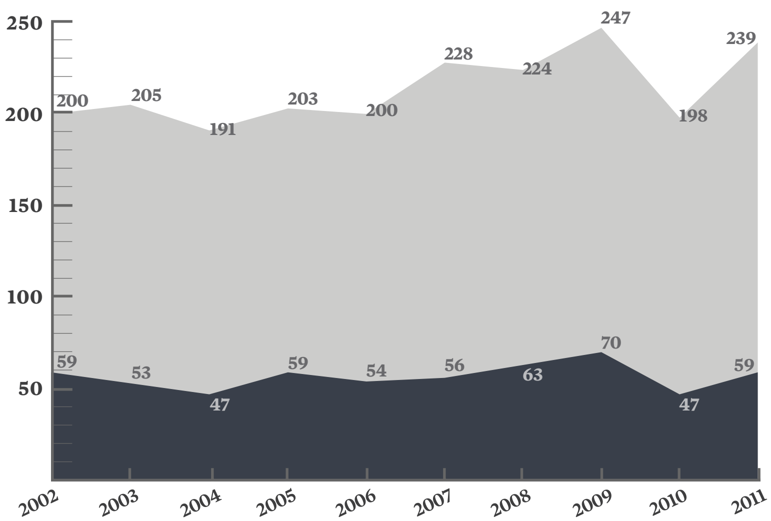


Figure 57: Types of Amateur-Built and Experimental Light-Sport Aircraft Involved in Accidents

Aircraft Class	Accidents		Fatal Accidents		Lethality
E-LSA	33	13.5%	7	11.9%	21.2%
Single-Engine Fixed-Gear *(Not LSA-Eligible)*	173	70.9%	36	61.0%	20.8%
SEF, Tailwheel	110		25		22.7%
Single-Engine Retractable	33	13.5%	16	27.1%	48.5%
Helicopter	5	2.0%	0		

ALL ACCIDENTS FATAL ACCIDENTS

Eight non-fatal collisions occurred between aircraft on the ground. Seven involved airplanes not being operated commercially, including one in which a Pitts landed on top of an RV-6. There was also one collision between two crop-dusters.

In addition to the seven collision accidents, a wing-walker fell to his death during an airshow performance while attempting to climb from an airplane to a helicopter. Neither aircraft was damaged, and no one on board was hurt.

ALCOHOL AND DRUGS *(5 TOTAL / 4 FATAL)* Four accidents, all on personal flights, were blamed on the pilots' impairment by alcohol. Three were fatal, and the fourth caused serious injuries to both persons on board. In two, the pilots' impairment led to additional lapses of judgement: attempted aerobatics in an unregistered experimental amphibian, and a night instrument approach in a Cessna 310. Recent marijuana use was thought to have contributed to the fatal loss of control during a banner-tow flight in a Piper Pawnee.

PHYSICAL INCAPACITATION *(9 TOTAL / 9 FATAL)* Physical incapacitation led to nine accidents in 2011, all fatal. In eight, the pilots themselves were the only casualties, but a passenger was also killed when a Cessna 172 crashed in the traffic pattern at the Dutchess County Airport in New York. The passenger of a Piper Navajo whose pilot collapsed in flight was able to regain control of the airplane and return to New Orleans' Lakefront Airport, suffering minor injuries in a hard landing.

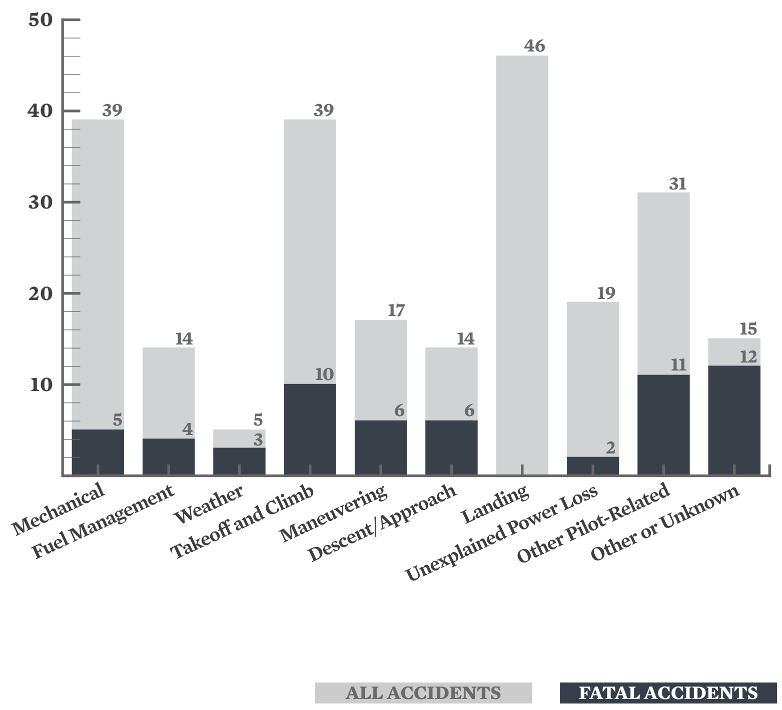
Six occurred on personal flights, all in fixed-gear piston singles. The Navajo was being ferried; in addition, a North American T-28 crashed during an airshow performance at Martinsburg, West Virginia, and a homebuilt Cassutt III M was lost on its first test flight. Eight of these accidents were attributed to cardiac or cardiovascular events, while the pilot of a Cessna 150 practicing for a flight review in South Carolina apparently succumbed to the toxic effects of ethylene glycol ingested under circumstances that remain unknown.

OFF-AIRPORT GROUND INJURIES *(1 ACCIDENT / 1 GROUND FATALITY)* Only one accident caused off-airport ground injuries in 2011. The pilot of a Cessna 172 practicing instrument approaches in actual IMC lost control while initiating a missed approach and crashed into a trailer park near North Myrtle Beach, South Carolina. One resident was killed and another seriously injured; the crash also killed the solo pilot.

ON-AIRPORT GROUND INJURIES *(3 ACCIDENTS / 1 FATAL / 10 FATALITIES)* Two people were injured by propellers in 2011. A flight instructor left the engine running when she exited the cockpit of a Cessna 152 to let her student fly his second supervised solo, then walked toward the front of the airplane rather than the rear. The propeller caught her headset cord, which pulled her into the propeller arc. A passenger attempting to hand-prop a Piper J3C-65 Cub suffered a broken forearm when the engine caught unexpectedly.

The only accident that caused on-airport fatalities was the crash of the “Galloping Ghost,” a modified P-51 Mustang, at the Reno Air Races. Ten spectators were killed in addition to the pilot, and serious injuries were inflicted on 66 more.

Figure 58: Types of Fixed-Wing Amateur-Built Accidents



SUMMARY

– The lack of FAA flight-activity data for 2011 made it impossible to estimate accident rates for that year.

– Except for commercial fixed-wing flights, the numbers of accidents, fatal accidents, and fatalities in 2011 were very similar to those from 2010.

– After two exceptionally good years, the number of commercial fixed-wing accidents increased 36%, while the numbers of fatal accidents and fatalities doubled. These figures would have been fairly typical of that sector's record through 2008.

– 2010's dramatic improvement in the safety record of amateur-built and experimental light-sport aircraft was not sustained. The number of accidents rebounded more than 20%, and the number of fatal accidents increased 16%. No one cause appears to explain the increase, and the number caused by mechanical problems actually declined by more than 20%. As with commercial fixed-wing accidents, it is impossible to determine how much of the change, if any, is due to increased activity.

– Unlike previous years, pilot-related accidents were almost equally prevalent in the records of commercial (69%) and non-commercial (77%) fixed-wing flights. Nearly half of all non-commercial accidents involved poor airmanship during takeoffs, landings, or go-arounds.

– The number of fuel management accidents on non-commercial fixed-wing flights seems to have stabilized at a level about 20% higher than the record low set in 2008.

– While adverse weather did not cause an exceptionally high number of accidents in 2011, they did prove unusually lethal, with fatalities in 74%.

– The number of non-commercial accidents attributed to mechanical failures decreased 15%; the number that were fatal dropped nearly one-third. Both were at or near all-time lows for the modern era. Physical malfunctions of the aircraft caused only 12% of all non-commercial airplane accidents and just 7% of fatal accidents in 2011.

– For the second consecutive year, only about 10% of landing accidents occurred during student solos.

– The number of fatal accidents on non-commercial helicopter flights dropped by half. The total number of accidents was almost unchanged, as was the commercial helicopter record.

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 missions**—GA pilots conduct a wider range of operations. Some operations, such as aerial application (crop-dusting, in common parlance) and banner towing, have inherent mission-related 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 services of airline-served airports. (There are also another 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. For a breakdown of GA activities and their accident statistics, see “What Does General Aviation Fly?” on page 44.

Figure 59: What Does General Aviation Fly?

Aircraft Class	Commercial		Non-Commercial	
Piston Single-Engine	2,711	23%	136,808	66%
Piston Multiengine	1,149	10%	14,751	7%
Turboprop Single-Engine	1,822	16%	2,392	1%
Turboprop Multiengine	846	7%	4,309	2%
Turbojet	1,726	15%	9,758	5%
Helicopter	3,163	27%	6,939	3%
Experimental	191	2%	24,593	12%
Light Sport	0		6,528	3%
Total	11,608		206,078	

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

Figure 59 shows the FAA's estimate of the number of powered GA aircraft that were active in 2010, sorted by category and class, separately for aircraft primarily operated commercially and other GA users. The estimates of total flight time used in this report are based on 99.2 percent of the GA fleet.

INTERPRETING AVIATION ACCIDENT STATISTICS: WHAT IS THE ACCIDENT RATE?

Meaningful comparisons are based on equal exposure to risk. However, this alone does not determine total risk. Experience, proficiency, equipment, and flight conditions all have a safety impact. To compare different airplanes, pilots, types of operations, etc., we must first "level the playing field" in terms of exposure to risk. The most common way to do this is to compare accidents per 100,000 flight hours. GA flight hours are estimated using data from an annual aircraft activity survey conducted by the FAA. Unfortunately, the FAA was unable to complete the activity survey for 2011, so it was not possible to estimate accident rates for that year. The 2012 survey has been completed, so estimates and discussions of accident rates will return in the *24th Nall Report*.

NTSB DEFINITIONS

ACCIDENT/INCIDENT (NTSB PART 830)

The following definitions of terms used in this report have been extracted from 49 CFR Part 830 of the Federal Aviation Regulations. 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.
- **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.

  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.

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.
- **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.
- **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.

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