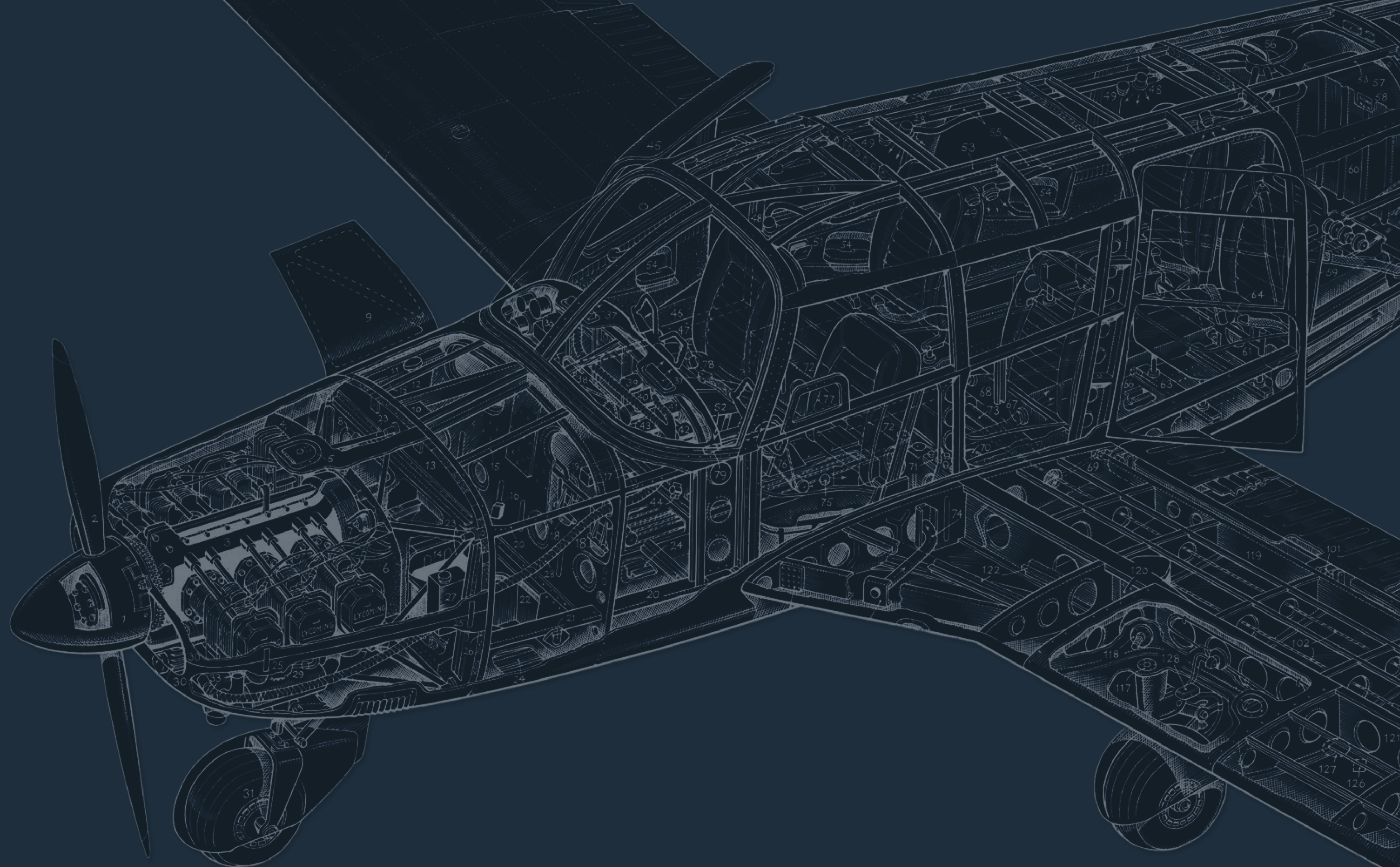

24TH JOSEPH T. NALL REPORT

General Aviation Accidents in 2012

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DEDICATION

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

INTRODUCTION

Following the pattern of recent years, this twenty-fourth 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 Federal Aviation Regulations 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 number of accidents standardized by a specified measure of flight time. Like other institutions including the Federal Aviation Administration (FAA) and the National Transportation Safety Board (NTSB), the AOPA Air Safety Institute has traditionally expressed rates as accidents per 100,000 hours. The underlying measures of flight exposure are provided by the FAA's annual *General Aviation and Part 135 Activity Survey*.

While the FAA has not been able to publish results from the 2011 survey, the 2012 survey was completed on schedule. For that reason, this edition of the *Nall Report* omits estimates of accident rates for 2011, but does present estimates for the years 2003-2010 and 2012.

FINAL VS. PRELIMINARY STATISTICS

When the data were frozen for the current report, the NTSB had released its findings of probable cause for 1,345 of the 1,402 qualifying accidents (95.9%) that occurred in 2012, including 235 of 248 fatal accidents (94.8%). 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 and **donations to the AOPA Foundation from individual pilots.**

TABLE OF CONTENTS

PUBLISHER'S VIEW

SAFETY IN PERSPECTIVE—HOW GENERAL AVIATION STACKS UP. Each year AOPA's Air Safety Institute (ASI) publishes what has become the cornerstone document for GA safety information, the *Nall Report*. It is an in-depth analysis of accident data and general aviation safety trends. However, viewed in isolation the data lack the context for readers unfamiliar with general aviation to derive real understanding from the report. To address this I wanted to begin the 24th edition of the AOPA Air Safety Institute's *Nall Report* with some thoughts that might help those unfamiliar with general aviation better understand the meaning of the data and how it relates to other, more familiar, discussions about safety.

I find it fascinating how people view risk and how perceptions help inform and influence decisions. For instance, when non-pilots think about GA flying, they want to make the obvious comparison to the form of flight they're most familiar with, the airlines. That seems logical on its face, but doesn't do a good job of putting things in the correct perspective. Allow me to explain. Commercial airline travel is widely recognized as one of the safest of all forms of transportation, and the United States has the safest airline transportation system in the world. It's also one of the most heavily regulated activities on earth. General aviation covers nearly every kind of civilian flying that's not included under what we consider the traditional airlines. A short list of its operational areas includes:

- Recreational / personal flying
- Flight training / instructional flying
- Corporate and executive transportation
- Medical transport
- Sightseeing
- Business travel
- Aerial application (pest control, fire suppression, etc.)
- On-demand air-taxi and charter operations
- Aerial photography and aerial advertising
- Law enforcement
- Search and rescue
- Charity and public-benefit flights

Each requires a different and unique type of aircraft: everything from a single-engine Cessna trainer to a helicopter to a multi-million-dollar corporate jet and everything in between. The range of pilot qualifications, landing sites, and support systems is just as wide. This is why comparing general aviation to commercial airlines isn't really meaningful or accurate.

To put general aviation safety into perspective and in a way that the average person can better understand, it's important to make well-defined comparisons that quantify risks in a way that accurately shows how one type of activity ranks against another—an "apples-to-apples" comparison, if you will. It's also important to address public perceptions to better put the discussion into context. We live in the age of information, and mass media provide us that information in near-real time. News providers determine what to report on based on historic levels of public interest. When compared to other more mundane forms of transportation, general aviation accidents are fairly rare occurrences and when an accident does occur, public interest and media coverage levels tend to be quite high. As such, coverage of aircraft accidents is disproportionate in terms of the actual effect on public safety when compared to other forms of transportation. To make it simple, think of general aviation safety this way: When driving down a two-lane road at night in the rain, both drivers are depending on someone they've never met but who's closing on them at over 100 mph to stay in their own lanes. Most Americans do this routinely and don't give these risks a second thought. That being the case, statistically speaking and based on current levels of participation, a person is much more likely to be involved in a vehicular accident than an accident in a general aviation aircraft.

All this is not to say that general aviation is perfectly safe or even safer than driving, but rather that the levels of risk associated with different forms of recreation and transportation need to be viewed in the proper context. Every activity carries with it some level of risk and general aviation is no exception, but it is not nearly as dangerous as press reports would have us believe.

Accidents do happen, but the facts are clear: Safety within general aviation in all its various facets is trending positively. For example: Pilots in the United States flew more than 23 million hours last year, and the total number of accidents involving helicopters and light airplanes dropped 32 percent compared to a decade earlier. Additionally, in 2013 (the subject of next year's *Nall Report*), the fatal accident rate dropped to an all-time low of 0.90 per 100,000 flight hours. Based on the data, what we know is that over the long term, GA safety is on a positive trajectory and continues to improve. It is also helpful to compare general aviation to other more common modes of transportation and recreation. Most people are not aware how activities that are viewed as "commonplace" actually compare (**Figure 1**).

At the Air Safety Institute, we believe that even one accident is too many. General aviation is our passion, our community, and our extended family. Our ever-growing library of more than 300 training products demonstrates our solemn responsibility to provide all pilots with engaging educational content that offers tools to help them become safer pilots and better enjoy the freedom of flight. While statistics are a good measure of past failures and trends indicate areas for targeted effort and improvement, the true measure of success—accidents that didn't happen—is difficult to observe.

I want to close by extending a special word of thanks to safety-minded pilots everywhere, to our industry partners, and to our colleagues at the FAA and NTSB for helping the Air Safety Institute produce this 24th edition of the *Nall Report*. Together we are making a difference and if we've done our jobs, our efforts help save lives and prevent accidents from ever taking place.

Safe Flights,

George Perry
Senior Vice President, AOPA Air Safety Institute

Figure 1: US Fatalities in 2012

Accident Type	Deaths
Driving	33,561
In-Home Accidents	(EST) 18,000
Motorcycling	4,957
Swimming	3,533
Cycling	726
Boating	651
General Aviation	378
Lightning Strikes	28

GENERAL AVIATION ACCIDENTS IN 2012

In 2012, there were 1,402 general aviation accidents involving a total of 1,416 individual aircraft (**Figure 2**). Only one, the non-fatal collision between a Robinson R22 helicopter and a Beech 35-A33 single-engine airplane in Antioch, California, involved aircraft in two different categories. It has been counted in both.

A total of 378 individuals were killed in the 248 fatal accidents, 17% fewer than the year before. While fatalities in non-commercial helicopter accidents jumped to 29 from 12 the year before, there were 15% fewer on non-commercial fixed-wing flights. The commercial GA record improved even more dramatically. Fatalities on fixed-wing flights dropped 71%, from 28 to eight, and helicopter fatalities decreased from 20 to just six, a 70% decline. 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 88% of fatal accidents in 2012, figures almost identical to the two previous years.

TRENDS IN GENERAL AVIATION ACCIDENTS, 2003-2012

According to FAA estimates, non-commercial flight time decreased from 2010 to 2012, declining 4% in airplanes and 15% in helicopters. Commercial activity grew by 8% and 22%, respectively. Except for a sharp uptick in non-commercial helicopters, the numbers of accidents were almost unchanged from two years earlier (**Figure 3A**), resulting in increased accident rates on non-commercial flights and reduced rates of commercial accidents (**Figure 3B**). Both fatal and non-fatal accident rates on commercial helicopter flights attained new lows: 1.93 per 100,000 hours overall with 0.21 per 100,000 fatal. Fixed-wing rates remained close to their minima over the preceding decade at 2.62 accidents and 0.27 fatal accidents per 100,000 hours.

Non-commercial fixed-wing accident rates edged up from two years earlier, but the overall rate of 6.54 accidents per 100,000 flight hours was just 3% higher than the 10-year average of 6.33. The fatal accident rate of 1.22 per 100,000 remained in line with the average of 1.24. The rate of non-commercial helicopter accidents, however, was the highest since 2005. It exceeded the 10-year average rate of 7.69 per 100,000 hours by 4%, while the corresponding fatal-accident rate was 7% above the 10-year average of 1.12 per 100,000 hours.

Figure 2: General Aviation Accidents in 2012

	Non-Commercial		**Commercial**	
	Fixed-Wing	Helicopter	Fixed-Wing	Helicopter
Number of Accidents	1162	126	79	36
Number of Aircraft*	1171	128	81	36
Number of Fatal Accidents	217	19	8	4
Lethality	18.7	15.1	10.1	11.1
Fatalities	335	29	8	6

*EACH AIRCRAFT INVOLVED IN A COLLISION COUNTED SEPARATELY

Figure 3A: General Aviation Accident Trends, 2003–2012

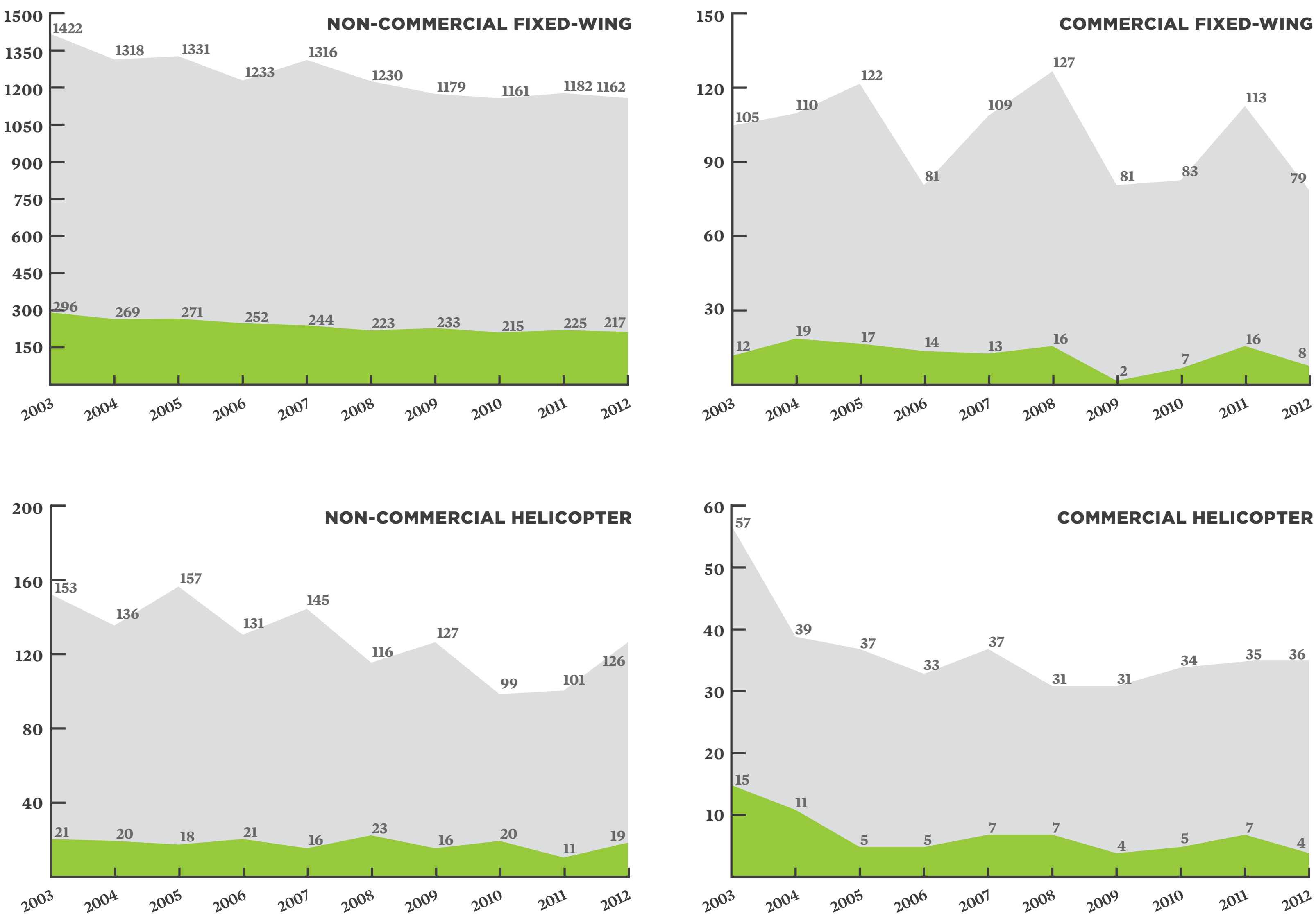
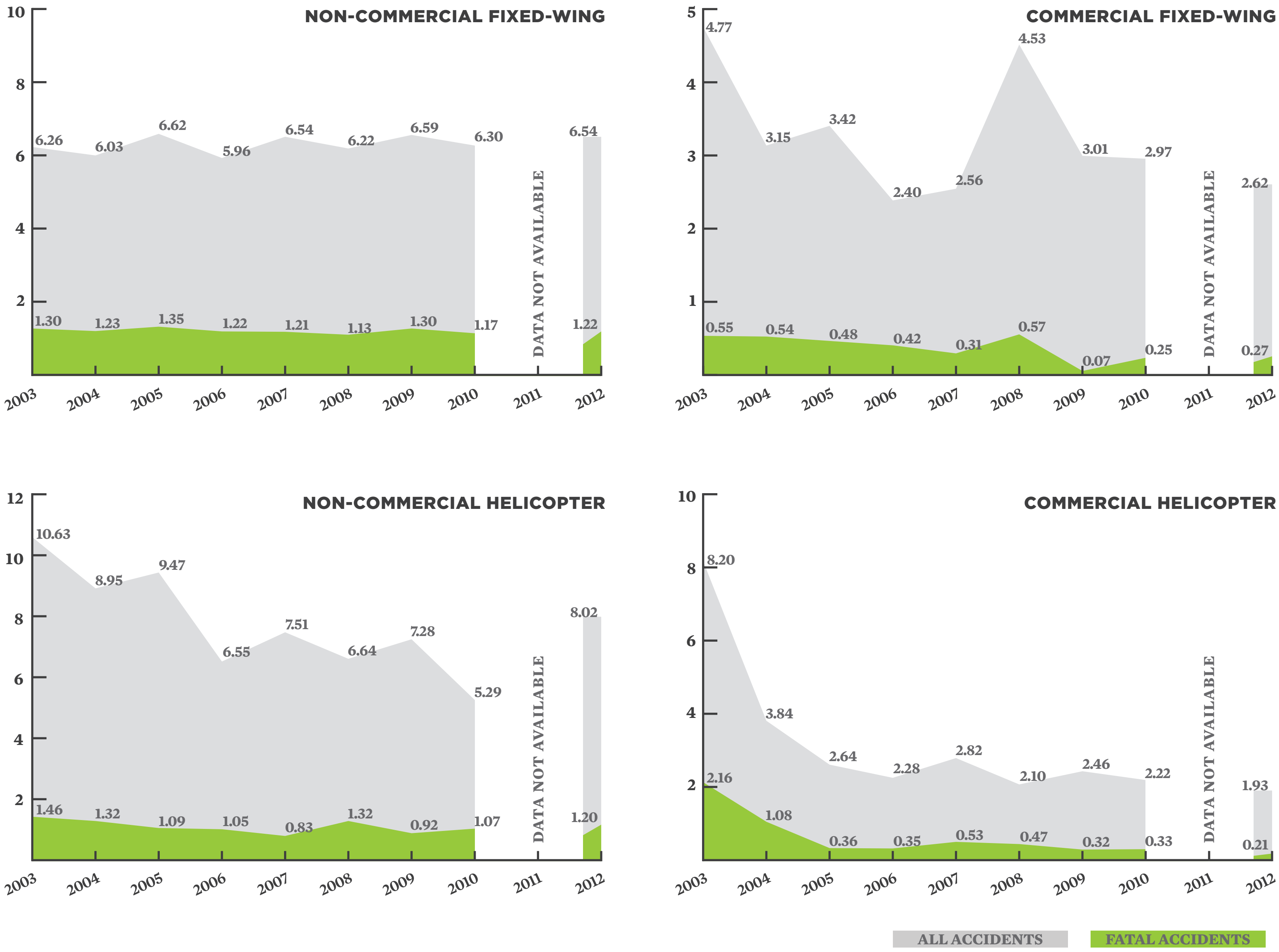


Figure 3B: General Aviation Accident Rates Per 100,000 Flight Hours, 2003–2012



HELICOPTER 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 2012, pilot-related causes were implicated in 74% of non-commercial and 69% of commercial helicopter accidents (**Figure 4**), proportions very similar to their fixed-wing counterparts (**Figure 11**). All but three fatal accidents (two non-commercial and one commercial) were attributed to pilot-related causes. Two of the remaining three were due to mechanical failures, while the third involved a loss of engine power for reasons that could not be explained.

Figure 4: Major Causes—General Aviation Helicopter Accidents

Major Cause	Non-Commercial				Commercial			
	All Accidents		Fatal Accidents		All Accidents		Fatal Accidents	
Pilot-Related	93	73.8%	17	89.5%	25	69.4%	3	75.0%
Mechanical	23	18.3%	1	5.3%	10	27.8%	1	25.0%
Other or Unknown	10	7.9%	1	5.3%	1	2.8%	0	

NON-COMMERCIAL HELICOPTER ACCIDENTS

The number of non-commercial helicopter accidents increased from 101 in 2011 to 126 in 2012, and the number of fatal accidents almost doubled from 11 to 19. These results mark a return to levels more typical of the previous decade after the best year for non-commercial helicopter safety in the 30 years covered by the ASI accident database. However, this sector's estimated flight activity declined 15% from 2010, making the rate per 100,000 hours the highest since 2005 and the fatal-accident rate the highest since 2008.

AIRCRAFT CLASS Each class of helicopter suffered more accidents than in 2011, with the greatest proportional increases coming in turbine models. Single-engine piston accidents increased 20%, single-engine turbine accidents were up 27%, and multiengine turbine accidents more than quadrupled, from two to nine. Unlike prior years, fewer than half of all fatalities occurred in single-engine piston models (**Figure 5**), in part because 20% of turbine accidents proved fatal compared to just 12% of piston accidents.

TYPE OF OPERATION Personal flights account for a much smaller share of both flight activity and accidents in helicopters than in airplanes, but the excess risk of personal flights is even greater. In 2012, personal use made up less than 7% of helicopter flight time but resulted in one-third of all accidents and more than 40% of both fatal accidents and individual fatalities (**Figure 6**). Flight instruction, on the other hand, accounted for 30% of flight activity and 23% of all accidents, but less than 15% of fatal accidents and fatalities. Aerial observation was the single largest category of non-commercial helicopter activity but was involved in only seven accidents nationwide. As in the past two years, no accidents occurred on professionally crewed executive transports.

The number of helicopters involved in accidents on public-use flights more than doubled, from six in 2011 to 13 in 2012. This increase is not explained by any obvious common factors; indeed, no two of these accidents shared the same cause. A landing police helicopter struck a parked helicopter at their home port. Ground resonance, a main rotor stall, and loss of tail rotor effectiveness caused one accident each, as did fuel exhaustion, a wire strike, takeoff and landing mishaps, failures of a main rotor transmission and a turbine blade, and an in-flight upset. Two accidents occurred during autorotations. One was a training maneuver; the other followed an unexplained loss of engine power.

FLIGHT CONDITIONS Non-commercial helicopter flight is overwhelmingly carried out in visual meteorological conditions (VMC), the vast majority of it during daylight hours. Only 3% of 2012's accidents took place in instrument conditions (**Figure 7**), and only 10% were in VMC at night. As in fixed-wing accidents, lethality increased as visibility diminished: There were fatalities in 11% of the accidents that occurred in visual conditions in the daytime, 25% of those in VMC at night, and all four of the accidents that took place in instrument meteorological conditions (IMC).

PILOT QUALIFICATIONS Nearly 80% of the accident pilots held either commercial or airline transport pilot (ATP) certificates (**Figure 8**), including 80% of those involved in fatal accidents. More than 60% of that group also held flight instructor certificates, and more than 70% of all accident pilots held the instrument-helicopter rating. Only 40 accidents (31%) took place on two-pilot flights; half of these occurred during dual instruction, and there were only three (none fatal) on student solos.

ACCIDENT CAUSES Twenty-four of the 126 accidents (19%) were attributed to physical failures of aircraft components (**Figure 9**). Only one was fatal, and only six involved engine systems, parts, or accessories (three piston and three turbine). Tail-rotor drive systems were implicated in five accidents and damaged or defective main rotor blades in four. Three involved problems or malfunctions in flight-control systems inside the cockpit, while the one fatal accident was caused by the separation of an inadequately torqued upper rod end in the main rotor's fore-aft servo, leading to departure of a main rotor blade. Fuel-system problems led to two accidents while deficiencies in drive belts, a main rotor drive shaft, and landing gear accounted for the rest.

Hazards of flight such as fuel exhaustion and adverse weather are common to all powered aircraft, but some risks peculiar to helicopters have no direct fixed-wing equivalents. Phenomena such as mast bumping, dynamic rollover, ground resonance, and loss of tail rotor effectiveness (LTE) have been grouped together in the category called "rotorcraft aerodynamics" and accounted for 21% of non-commercial accidents, fatal and non-fatal alike. LTE and loss of main rotor RPM were the most common, causing seven accidents apiece. One LTE accident was fatal, as were one of the three cases of dynamic rollover, one of the three due to settling with power, and the only reported instance of mast bumping. Two non-fatal accidents apiece were caused by ground resonance and hard landings following emergency autorotations to unobstructed areas, and one resulted from the inability to sustain a hover out of ground effect.

Fuel management and unfavorable weather were only slightly less prominent than in the fixed-wing record, accounting for a combined 8% of all accidents compared to 11% of those on non-commercial airplane flights. However, all four weather accidents were fatal, and all involved losses of control or collisions in poor visibility (IMC or marginal VMC). Not surprisingly, helicopters were substantially less susceptible to takeoff and landing accidents, which together accounted for 43% of fixed-wing accidents but only 12% of those in rotorcraft.

In addition to the collision at the police heliport mentioned earlier, helicopters were involved in two mid-air collisions in 2012. A Robinson R22 was struck by a Beech 35-A33 airplane during a night cross-country training flight in California, and two Hughes 369A rotorcraft collided while hover-taxiing at a helicopter airshow in Pennsylvania. No one was injured in either case. Five of the other eight accidents grouped together as "other / miscellaneous" involved losses of engine power for reasons that could not be determined afterwards. Four of those aircraft had piston engines, including the Robinson R22 that crashed on a photo flight in Houston, Texas, killing the pilot and photographer. No injuries resulted from one bird strike or two instances in which the tail rotors were struck by objects that had departed the helicopters in flight.

Five of the six fatal accidents during low-altitude maneuvering were wire strikes; a sixth wire strike caused serious injuries to the pilot but no deaths. The other fatal accident was one of the five involving low-altitude collisions with other kinds of obstructions. More than half the accidents classified as "maneuvering" (16 of 29) came during practice autorotations, none of which proved fatal. The remaining two involved losses of control during a simulated hydraulic failure and while making a low-altitude pedal turn.

Figure 5: Aircraft Class—Non-Commercial Helicopter Accidents

Aircraft Class	Accidents		Fatal Accidents		Fatalities	
Single-Engine Piston	77	60.2%	9	47.4%	13	44.8%
Single-Engine Turbine	42	32.8%	8	42.1%	14	48.3%
Multiengine Turbine	9	7.0%	2	10.5%	2	6.9%

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

Figure 6: Type of Operation—Non-Commercial Helicopter Accidents

Type of Operation	Accidents		Fatal Accidents		Fatalities	
Personal	43	33.6%	8	42.1%	12	41.4%
Instructional	29	22.7%	2	10.5%	4	13.8%
Public Use	13	10.2%	2	10.5%	3	10.3%
Positioning	10	7.8%	1	5.3%	1	3.4%
Aerial Observation	7	5.5%	2	10.5%	4	13.8%
Business	10	7.8%	1	5.3%	1	3.4%
Other Work Use*	9	7.0%	3	15.8%	4	13.8%
Other or Unknown	7	5.5%	0			

*INCLUDES FLIGHT TESTS AND UNREPORTED

Figure 7: Flight Conditions—Non-Commercial Helicopter Accidents

Light and Weather	Accidents		Fatal Accidents		Fatalities	
Day VMC	110	87.3%	12	63.2%	18	62.1%
Night VMC*	12	9.5%	3	15.8%	6	20.7%
Day IMC	1	0.8%	1	5.3%	1	3.4%
Night IMC*	3	2.4%	3	15.8%	4	13.8%

*INCLUDES DUSK

Figure 8: Pilots Involved in Non-Commercial Helicopter Accidents

Certificate Level	Accidents		Fatal Accidents		Fatalities	
ATP	21	16.4%	5	26.3%	7	24.1%
Commercial	80	62.5%	11	57.9%	16	55.2%
Private	19	14.8%	2	10.5%	5	17.2%
Sport	1	0.8%	0			
Student	3	2.3%	0			
Other or Unknown	4	3.1%	1	5.3%	1	3.4%
Second Pilot on Board	40	31.3%	5	26.3%	9	31.0%
CFI on Board*	63	49.2%	9	47.4%	14	48.3%
IFR Pilot on Board*	92	71.9%	15	78.9%	24	82.8%

*INCLUDES SINGLE-PILOT FLIGHTS

Figure 9: Types of Non-Commercial Helicopter Accidents

Accident Type	Accidents		Fatal Accidents		Lethality
Cruise	4	3.2%	1	5.3%	25.0%
Fuel Management	6	4.8%	1	5.3%	16.7%
Landing	8	6.3%	0		
Maneuvering	29	23.0%	6	31.6%	20.7%
Mechanical	24	19.0%	1	5.3%	4.3%
Other/Miscellaneous	10	7.9%	1	5.3%	10.0%
Preflight/Static	4	3.2%	0		
Rotorcraft Aerodynamics	26	20.6%	4	21.1%	14.8%
Takeoff/Climb	7	5.6%	1	5.3%	14.3%
Taxi/Ground Operations	4	3.2%	0		
Weather	4	3.2%	4	21.1%	100.0%

ACCIDENT CASE STUDY—NON-COMMERCIAL HELICOPTER

NTSB ACCIDENT NO. ERA13GA046
HUGHES OH-6A, ATLANTA, GEORGIA
TWO FATALITIES

HISTORY OF FLIGHT The helicopter, operated by the Atlanta Police Department, took off from Hartsfield Jackson International Airport at 10:24 p.m. to assist ground-based officers in searching for a missing child. Radar track data showed that it maintained an altitude of about 300 feet agl until reaching the search area six nautical miles northwest of the airport, then began to descend. Multiple witnesses saw it maneuvering at very low altitude with its searchlight pointed straight down before its skids snagged power lines near the top of a 42-foot-high pole. The helicopter then pitched forward, crashed into the street, and exploded.

PILOT INFORMATION The pilot in command held a commercial certificate for rotorcraft helicopter. All of his 2,933 flight hours had been logged in helicopters, including 2,354 hours of night experience. The Tactical Flight Officer was undergoing on-the-job training at the time of the accident. He held a commercial certificate for single- and multiengine airplanes and an instrument rating. His most recent medical application reported 600 hours of flight experience, all fixed-wing.

WEATHER The Fulton County Airport, located three miles northwest of the accident site, reported clear skies, calm winds, and 10 miles visibility.

PROBABLE CAUSE The pilot's failure to maintain sufficient altitude during maneuvering flight, which resulted in his failure to see and avoid a power pole and wires.

ASI COMMENTS Helicopters are prized for their abilities to operate from confined areas and fly at extremely low airspeeds. Taking full advantage of these often requires their pilots to work in close proximity to obstructions, making precise situational awareness essential. The need to maintain a buffer from surface hazards becomes still more critical at night, even if that conflicts with the purpose of the flight.

COMMERCIAL HELICOPTER ACCIDENTS

There were 36 accidents on commercial helicopter flights in 2012, one more than the year before, but only four (11%) were fatal, three fewer than in 2011. Unlike recent years, no single activity dominated the accident record: 14 took place on crop-dusting flights, 13 during external-load operations, and nine on Part 135 charter or cargo flights (**Figure 10**), including three of the four fatal accidents. The pilots were the only casualties in a rollover on a rough pad in Alaska and a collision with a derrick on an offshore oil rig in the Gulf of Mexico; a paramedic and flight nurse were also killed when the pilot of a medical transport helicopter lost control in marginal visibility on a night flight in Illinois.

That accident was one of only three that did not occur in daytime VMC; one crop-dusting accident also occurred at night, and serious injuries but no deaths resulted when an EMS helicopter crashed while setting up for an instrument approach during daylight hours. Only seven accidents (19%) involved piston helicopters; five were crop-dusters and two were flying external loads. Twenty-six of the 29 turbine helicopters (90%) were single-engine models, including seven of the nine being operated under Part 135. Two-thirds of the Part 135 pilots held airline transport pilot certificates, while all the external-load and crop-dusting accidents involved commercial pilots.

Figure 10: Summary of Commercial Helicopter Accidents

	Accidents		Fatal Accidents		Fatalities	
Aerial Application (Part 137)	14	38.9%	0			
Single-Engine Piston	5	35.7%	0			
Single-Engine Turbine	9	64.3%	0			
Day VMC	13	92.9%	0			
Night VMC	1	7.1%	0			
Commercial	14	100.0%	0			
Charter or Cargo (Part 135)	9	25.0%	3	75.0%	5	83.3%
Single-Engine Turbine	7	77.8%	2	66.7%	2	40.0%
Multiengine Turbine	2	22.2%	1	33.3%	3	60.0%
Day VMC	7	77.8%	2	66.7%	2	40.0%
Night VMC*	1	11.1%	1	33.3%	3	60.0%
Day IMC	1	11.1%	0			
ATP	6	66.7%	2	66.7%	4	80.0%
Commercial	3	33.3%	1	33.3%	1	20.0%
External Load (Part 133)	13	36.1%	1	25.0%	1	16.7%
Single-Engine Piston	2	15.4%	0			
Single-Engine Turbine	10	76.9%	1	100.0%	1	100.0%
Multiengine Turbine	1	7.7%	0			
Day VMC	13	100.0%	1	100.0%	1	100.0%
Commercial	13	100.0%	1	100.0%	1	100.0%

*INCLUDES DUSK

FIXED-WING ACCIDENTS: SUMMARY AND COMPARISON

2011 saw a marked departure from earlier years in that pilot-related causes figured almost as prominently in commercial as in non-commercial fixed-wing accidents. That pattern continued in 2012 (**Figure 11**), when 75% of non-commercial and 73% of commercial accidents were found to be pilot-related. The shares attributed to mechanical breakdowns, other factors, or left unexplained were likewise very similar.

NON-COMMERCIAL FIXED-WING ACCIDENTS

The number of non-commercial fixed-wing accidents decreased a little less than 2%, from 1,182 in 2011 to 1,162 in 2012 (**Figure 3A**). Fatal accidents declined nearly 4% from 225 to 217. Both numbers are almost identical to those recorded in 2010. However, 2012 saw almost 4% less flight activity, so both total and fatal accident rates ticked up from two years earlier (**Figure 3B**). Some 75% were attributed to pilot-related causes (**Figure 11**) and less than 15% to documented mechanical failures, continuing the pattern that has characterized this sector for years.

AIRCRAFT CLASS More than 70% of the accident aircraft were single-engine fixed-gear (SEF) models (**Figure 12**), but these included just 57% of the fatal accidents. More than 40% of these were conventional-gear (tailwheel) models. Lethality increased progressively from SEF to single-engine retractable-gear to multiengine and turbine aircraft, a relationship that's been consistent for many years. Some of that difference can be attributed to the typically greater experience and more advanced credentials of pilots who fly higher-performance models, making them less vulnerable to runway excursions, hard landings, and similar low-energy mishaps.

TYPE OF OPERATION Personal flights resulted in 74% of 2012's accidents (**Figure 13**), including 81% of fatal accidents. Both proportions were identical to those in 2011, and typify the pattern that's characterized at least the past 20 years. Instructional flights continue to make up the second largest category, but while they made up more than half of the remainder they still accounted for slightly more than 15% of the total and only 8% of fatal accidents. Flight instruction in both airplanes and helicopters enjoys among the lowest lethality rates in general aviation. Accidents on corporate and executive transport flights remained almost non-existent despite millions of hours of exposure, but 2012 did see an unusually high number of fatalities on business flights. However, the small numbers of these accidents from year to year make it difficult to assess whether this represents more than chance fluctuation.

FLIGHT CONDITIONS Less than 5% of all accidents occurred in instrument meteorological conditions, but these included nearly 15% of all fatal accidents and 19% of individual deaths (**Figure 14**). More than 60% of all accidents in IMC were fatal compared to just over 15% of those in VMC during daylight hours and 34% of those in VMC at night. However, since the overwhelming majority of all accidents (some

88%) took place in daytime VMC, it still accounted for more than 70% of all fatal accidents and nearly two-thirds of individual fatalities. This, too, is a familiar pattern; these statistics are nearly identical to those from each of the past five years.

PILOT QUALIFICATIONS Nearly half of all accident flights were commanded by private pilots (**Figure 15**), including 52% of fatal accidents. Thirty percent were flown by commercial pilots and 15% by ATPs. Fifty-eight percent of all accident pilots were instrument-rated, slightly less than the 64% of all pilots with private or higher certificates who held that rating in 2012. However, that population includes commercial and airline transport pilots who do little or no GA flying beyond positioning legs flown under Part 91 in company aircraft. Restricting the comparison to private pilots shows similarly small differences but in the opposite direction: One-third of the accident pilots were instrument-rated compared to 28% of private pilots nationwide.

For the second consecutive year, higher certificate levels were associated with reduced lethality. This stands in contrast to previous years, when there was little apparent difference between certificate levels. Only five of the 77 accidents on student solos were fatal.

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.

PILOT-RELATED ACCIDENTS *(870 TOTAL / 177 FATAL)* Pilot-related causes consistently account for about 75% of non-commercial fixed-wing accidents. This was true again in 2012 (**Figure 16**) when they led to 82% of fatal and 73% of non-fatal accidents. Modestly increased lethality has characterized the pilot-related group for the past decade.

Scaled by estimated flight time, the rates of pilot-related accidents have also remained remarkably stable.

Landing accidents were once again the most common type (**Figure 17**), outnumbering takeoff accidents by more than two to one. In the past few years, adverse weather has supplanted low-altitude maneuvering in causing the largest number of fatal accidents. Weather accidents have traditionally suffered the greatest lethality, but nearly 60% of all maneuvering accidents and almost half of all accidents during descent and approach were fatal as well.

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

- 28 accidents (five fatal) attributed to inadequate preflight inspections
- 51 accidents during attempted go-arounds, 10 of which were fatal

Figure 11: Major Causes—Fixed-Wing General Aviation Accidents

	Non-Commercial				Commercial			
	All Accidents		Fatal Accidents		All Accidents		Fatal Accidents	
Pilot-Related	870	74.9%	177	81.6%	58	73.4%	6	75.0%
Mechanical	163	14.0%	9	4.1%	14	17.7%	1	12.5%
Other or Unknown	129	11.1%	31	14.3%	7	8.9%	1	12.5%

Figure 12: Aircraft Class—Non-Commercial Fixed-Wing Accidents

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed Gear	825	70.5%	125	56.8%	15.2%
SEF, Tailwheel	349		41		11.7%
Single-Engine Retractable	256	21.9%	65	29.5%	25.4%
Single-Engine Turbine	29		10		34.5%
Multiengine	90	7.7%	30	13.6%	33.3%
Multiengine Turbine	16		5		31.3%

Figure 13: Type of Operation—Non-Commercial Fixed-Wing Accidents

Type of Operation	Accidents		Fatal Accidents		Fatalities	
Personal	870	74.3%	178	80.9%	271	80.9%
Instructional	181	15.5%	17	7.7%	29	8.7%
Public Use	5	0.4%	0			
Positioning	19	1.6%	6	2.7%	8	2.4%
Aerial Observation	11	0.9%	2	0.9%	3	0.9%
Business	26	2.2%	9	4.1%	15	4.5%
Other Work Use	29	2.5%	3	1.4%	4	1.2%
Other or Unknown*	30	2.6%	5	2.3%	5	1.5%

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

Figure 14: Flight Conditions—Non-Commercial Fixed-Wing Accidents

Light and Weather	Accidents		Fatal Accidents		Fatalities	
Day VMC	1031	88.0%	158	71.8%	219	65.4%
Night VMC*	85	7.3%	29	13.2%	53	15.8%
Day IMC	36	3.1%	22	10.0%	43	12.8%
Night IMC*	16	1.4%	10	4.5%	19	5.7%
Unknown	3	0.3%	1	0.5%	1	0.3%

*INCLUDES DUSK

Figure 15: Pilots Involved in Non-Commercial Fixed-Wing Accidents

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	176	15.0%	29	13.2%	16.5%
Commercial	346	29.5%	61	27.7%	17.6%
Private	531	45.3%	115	52.3%	21.7%
Sport	21	1.8%	5	2.3%	23.8%
Student	77	6.6%	5	2.3%	6.5%
Other or Unknown	20	1.7%	5	2.3%	25.0%
Second Pilot on Board	174	14.9%	35	15.9%	20.1%
CFI on Board*	301	25.7%	42	19.1%	14.0%
IFR Pilot on Board*	681	58.2%	127	57.7%	18.6%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 16B: Pilot-Related Accident Rates Per 100,000 Flight Hours, 2003–2012

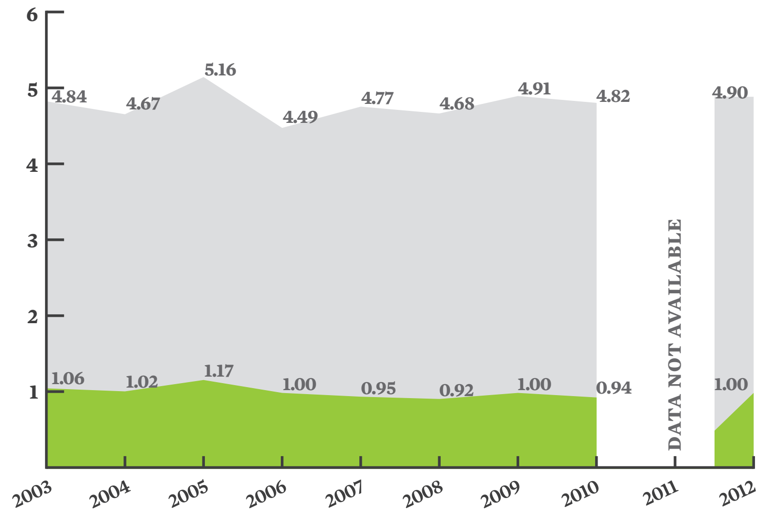


Figure 16A: Pilot-Related Accident Trend

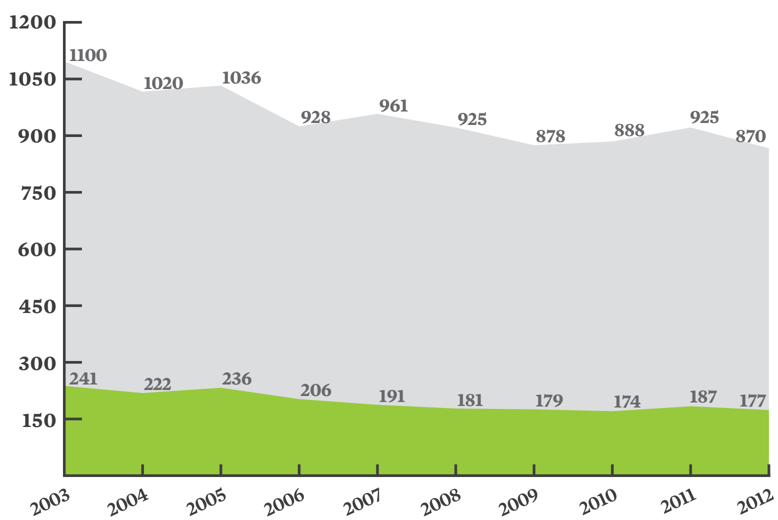
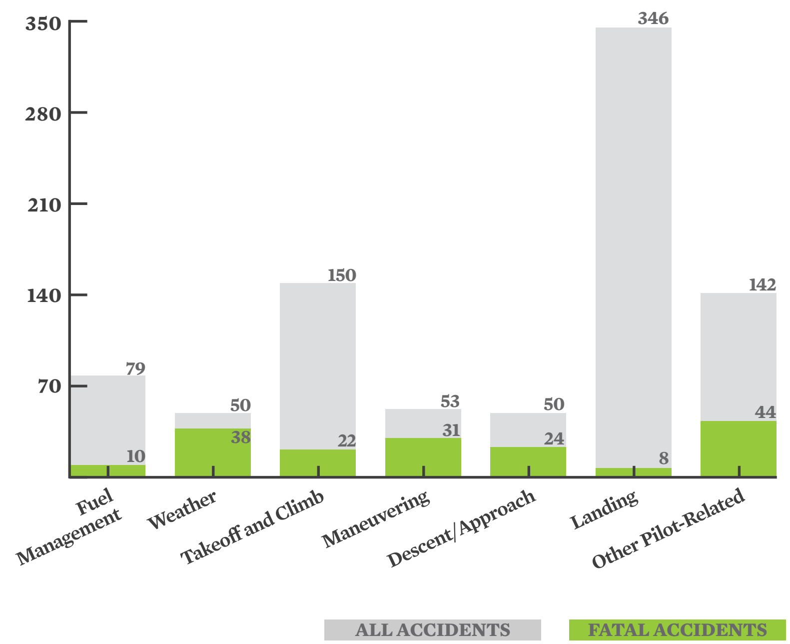


Figure 17: Types of Pilot-Related Accidents



- 19 non-fatal accidents while taxiing, including four 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; two were fatal
- Six episodes (three fatal) of controlled flight into terrain during cruise flight
- Three unexplained losses of control during cruise flight; all were fatal, and two occurred at night
- Nine instances, six of them fatal, of pilot impairment by alcohol and/or drugs
- 11 fatal accidents triggered by physical incapacitation of the pilots involved
- Three fatal and three non-fatal mid-air collisions, all between airplanes except one non-fatal collision between an airplane and a helicopter
- Two in-flight collisions with foreign objects, one of which was fatal.

Accidents caused by poor fuel management or hazardous weather generally give some 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 decisions that put that airmanship to the test are not always beyond question.

ACCIDENT CAUSES: FLIGHT PLANNING AND DECISION MAKING

FUEL MANAGEMENT *(79 TOTAL / 10 FATAL)* Following four successive years of increases, the number of fuel-management accidents dropped to its lowest level since 2008 (**Figure 18**). The 18% decline from 2011 is comparable to the 20% decrease from 2007 to 2008 but falls short of the 27% drop observed between 2005 and 2006. They accounted for less than 5% of all fatal accidents for only the third time. 2012 marked only the third year in which fuel-management errors accounted for less than 5% of all fatal accidents.

For the first time in recent memory, errors in operating the aircraft's fuel system (choosing an empty tank or the incorrect use of boost or transfer pumps) caused more accidents than flight-planning deficiencies (inaccurate estimation of fuel requirements or failure to monitor fuel consumption in flight) leading to complete fuel exhaustion (**Figure 19**). Water was the culprit in seven of the eight ascribed to fuel contamination, including both fatal accidents; in the eighth, fuel lines were blocked by residue from a tank sealant whose use had been disapproved for aviation use nearly 20 years **after** its application to the accident airplane.

Retractable-gear and multiengine models made up 43% of the airplanes involved in fuel-management accidents (**Figure 20**). This is almost one and a half times their proportion of non-commercial fixed-wing accidents overall, in which they accounted for slightly less than 30%. Only three, none fatal, involved turboprops. Just 10% of fuel management accidents took place at night (**Figure 21**), the second straight year this has decreased, and only 5% occurred in IMC. As in 2011, only two fuel-management accidents took place on student solos (**Figure 22**). Both that and the greater prevalence of complex and multiengine aircraft help account for the slightly higher percentage of accident flights commanded by commercial and airline transport pilots.

WEATHER *(50 TOTAL / 38 FATAL)* Previous editions of the *Nall Report* have often shown short-term decreases in weather accidents that were later adjusted upward as more complete data became available. This is because weather accidents are the most consistently fatal, and fatal weather accidents are among the most difficult and time-consuming to investigate, leading some to remain unresolved at the time the data are frozen for each edition of the report. The number of confirmed weather accidents in 2012 presently appears to be the lowest of the past decade **(Figure 23)**. Regardless of whether this holds up, however, hazardous weather's contribution to the accident record has been largely stable since 2005.

The characteristics of weather accidents have changed very little over time. As usual, attempts to fly by visual references in instrument conditions ("VFR into IMC") accounted for the lion's share of fatalities in 2012 (**Figure 24**). More than 80% of the

Figure 18: Fuel Management Accident Trend

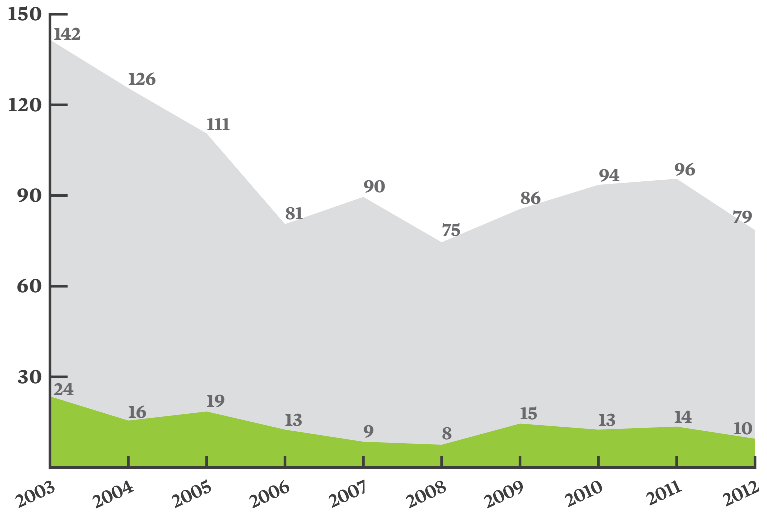
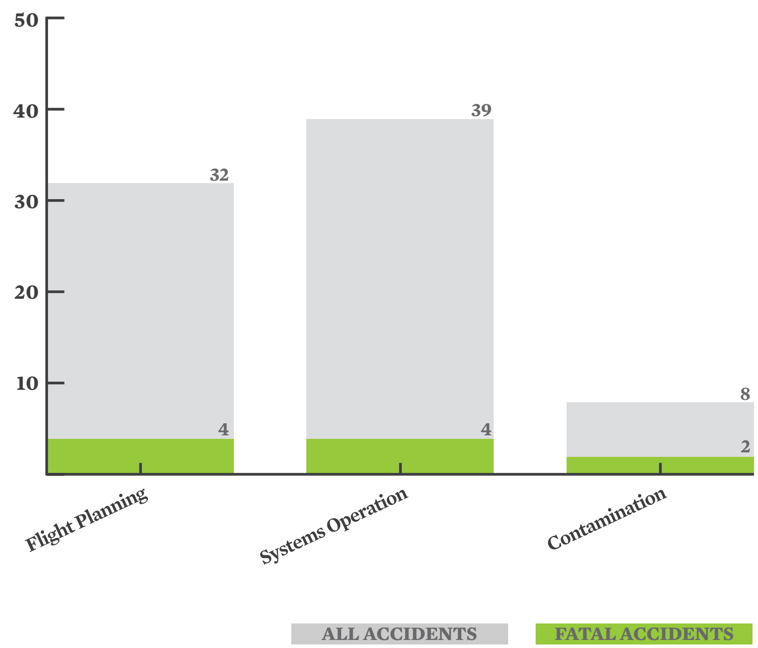


Figure 19: Types of Fuel Management Accidents



ACCIDENT CASE STUDY—FUEL MANAGEMENT

NTSB ACCIDENT NO. ERA12FA262
BEECH 58, CALHOUN, KENTUCKY
ONE FATALITY

HISTORY OF FLIGHT The pilot had kept the airplane at his private airstrip since buying it four months earlier. Its Hobbs meter showed that it had been flown approximately five hours during that time. Two witnesses saw him take off from the 1,800-foot grass runway at about 4:00 p.m. to buy fuel at a nearby public airport. Contrary to his usual practice, he began a left turn before reaching the departure end. After the pilot failed to return, the airplane was reported missing; the wreckage was located about 11:30 p.m.

There was no post-crash fire, and the patterns of damage to the propellers suggested that only the right engine was producing power at impact. Rust-colored water was found throughout both engines' fuel systems, and extensive corrosion was found in the fuel strainers and drains; multiple drain lines were blocked by rust and other debris, and fuel samples tested positive for water. The fuel cap adapters were heavily corroded and the caps' O-rings were brittle and deteriorated. Testing confirmed that water readily leaked past the caps and into the tanks. At that time, the relevant Beechcraft maintenance manual did not require periodic overhauls of the fuel caps.

PILOT INFORMATION The 46-year-old pilot held a commercial certificate for airplane single-engine land and instrument airplane, plus private pilot privileges for multiengine airplane that were limited to VFR only. He had about 1,750 hours of total flight experience and had completed a flight review the day he bought the accident airplane.

WEATHER At 3:56 p.m., approximately four minutes before the accident, an airport 13 miles southwest reported winds from 230 degrees at 11 knots gusting to 16, scattered clouds at 8,500 feet agl, and 10 miles visibility. The temperature was 31 degrees Celsius, the dew point was 17, and the altimeter setting was 29.68 inches of mercury.

PROBABLE CAUSE The failure of the pilot to maintain airplane control after experiencing a loss of power from the left engine due to water contamination of the fuel system. Contributing to the accident were the pilot's inadequate preflight inspection of the airplane and maintenance personnel's inadequate annual inspection, because both failed to detect the long-term water contamination of the fuel system and the deteriorated outer O-rings on both fuel caps. Also contributing to the water contamination of the fuel system was the inaccurate information and instructions in the airplane maintenance manual pertaining to overhaul requirements of the fuel filler caps.

ASI COMMENTS Contamination by water causes roughly 10 times as many accidents as misfuelling, and most involve abrupt losses of engine power shortly after takeoff. Careful attention should be paid to the condition of fuel caps and the associated gaskets and O-rings of any aircraft parked outdoors. Even hangared aircraft can accumulate significant condensation if left with partially filled tanks in humid conditions. Above all, a thorough preflight inspection is essential. *All* traces of moisture must be sumped from the tanks. Visible corrosion to any fuel-system component, rust particles in a fuel sample, or a stuck or blocked drain all justify grounding the aircraft until repairs can be completed.

accidents attributed to thunderstorm penetration or deficient instrument technique during IFR flight proved fatal as well. Non-convective turbulence and in-flight icing were more forgiving, with fatalities in just over one-third combined.

Almost two-thirds of all weather accidents took place in instrument conditions and/or at night (**Figure 25**). Seven-eighths of those accidents were fatal, including all 16 that occurred in daytime IMC, compared to 56% of those in visual conditions in daylight.

Turboprop airplanes were rarely involved in weather accidents, but five out of eight were fatal, about the same proportion as in fixed-gear single-engine piston airplanes (**Figure 26**). All told, 84% of the accident airplanes (including 87% of those in fatal accidents) were piston singles.

Private pilots made up nearly two-thirds (66%) of those involved in identified weather accidents; almost all the rest held commercial (24%) or airline transport pilot (6%) certificates (**Figure 27**). More than half of the pilots held instrument ratings, including 17 of the 38 in fatal accidents, but only six of the accident flights had instructors on board.

ACCIDENT CAUSES: HIGH-RISK PHASES OF FLIGHT

TAKEOFF AND CLIMB *(150 TOTAL / 22 FATAL)*

Takeoffs consistently see the second-highest number of pilot-related accidents and account for more than 10% of fatalities. This pattern continued unchanged in 2012 (**Figure 28**); indeed, the numbers of both fatal and non-fatal takeoff accidents have barely fluctuated over the past four years, as have the proportions of non-commercial fixed-wing accidents blamed on takeoff errors.

Half of 2012's takeoff and climb accidents resulted from losses of aircraft control, including five of the 22 fatal accidents (**Figure 29**). Losses of directional control during the takeoff roll were most common, but the category also includes pitch and roll excursions after lift-off. Departure stalls accounted for nearly one-third of the fatal accidents; settling back onto the runway due to premature rotation was usually survivable, while stalls after the airplane had climbed out of ground effect were frequently lethal. Errors in setting flaps, fuel mixtures, and other details of aircraft configuration led to 17 accidents, about 50% more than in either of the two preceding years.

Figure 20: Aircraft Involved in Fuel Management Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	45	57.0%	3	30.0%	6.7%
SEF, Tailwheel	17		2		11.8%
Single-Engine Retractable	20	25.3%	3	30.0%	15.0%
Single-Engine Turbine	2		0		
Multiengine	14	17.7%	4	40.0%	28.6%
Multiengine Turbine	1		0		

Figure 21: Flight Conditions of Fuel Management Accidents—Non-Commercial Fixed-Wing

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	68	86.1%	8	80.0%	11.8%
Night VMC*	7	8.9%	0		
Day IMC	3	3.8%	2	20.0%	66.7%
Night IMC*	1	1.3%	0		

*INCLUDES DUSK

Figure 22: Pilot Involved in Fuel Management Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	16	20.3%	2	20.0%	12.5%
Commercial	22	27.8%	1	10.0%	4.5%
Private	37	46.8%	5	50.0%	13.5%
Sport	1	1.3%	1	10.0%	100.0%
Student	2	2.5%	0		
Other or Unknown	1	1.3%	1	10.0%	100.0%
Second Pilot on Board	6	7.6%	0		
CFI on Board*	20	25.3%	1	10.0%	5.0%
IFR Pilot on Board*	51	64.6%	6	60.0%	11.8%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 23: Weather Accident Trend

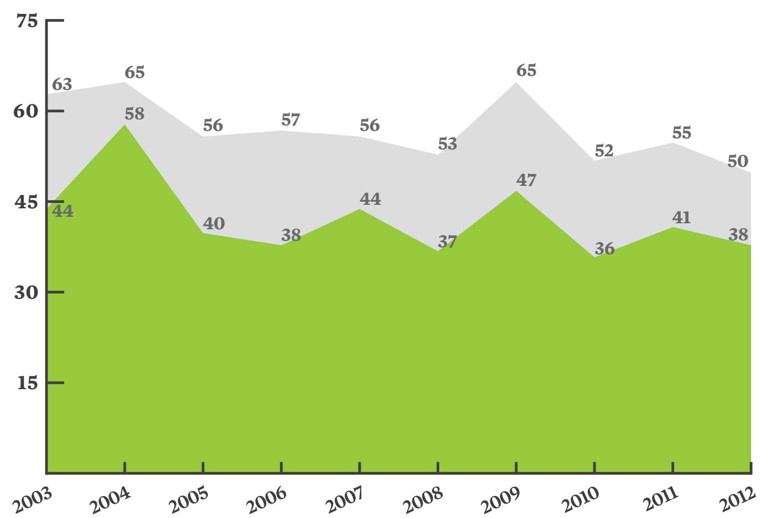


Figure 24: Types of Weather Accidents

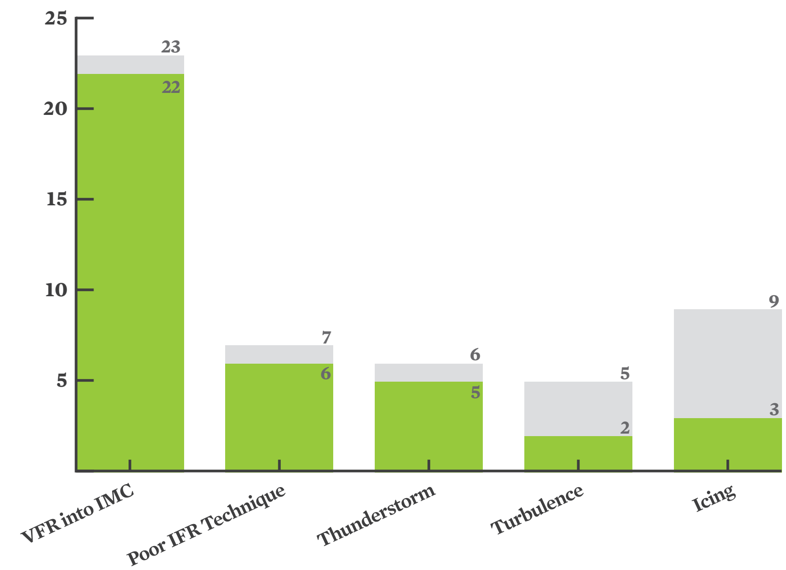


Figure 25: Flight Conditions of Weather Accidents—Non-Commercial Fixed-Wing

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	18	36.0%	10	26.3%	55.6%
Night VMC*	6	12.0%	5	13.2%	83.3%
Day IMC	16	32.0%	16	42.1%	100.0%
Night IMC*	10	20.0%	7	18.4%	70.0%

*INCLUDES DUSK

Figure 26: Aircraft Involved in Weather Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	23	46.0%	16	42.1%	69.6%
SEF, Tailwheel	4		1		25.0%
Single-Engine Retractable	19	38.0%	17	44.7%	89.5%
Single-Engine Turbine	4		3		75.0%
Multiengine	8	16.0%	5	13.2%	62.5%
Multiengine Turbine	4		2		50.0%

Figure 27: Pilots Involved in Weather Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	3	6.0%	1	2.6%	33.3%
Commercial	12	24.0%	7	18.4%	58.3%
Private	33	66.0%	28	73.7%	84.8%
Sport	2	4.0%	2	5.3%	100.0%
Second Pilot on Board	4	8.0%	3	7.9%	75.0%
CFI on Board*	6	12.0%	3	7.9%	50.0%
IFR Pilot on Board*	27	54.0%	17	44.7%	63.0%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 28: Takeoff and Climb Accident Trend

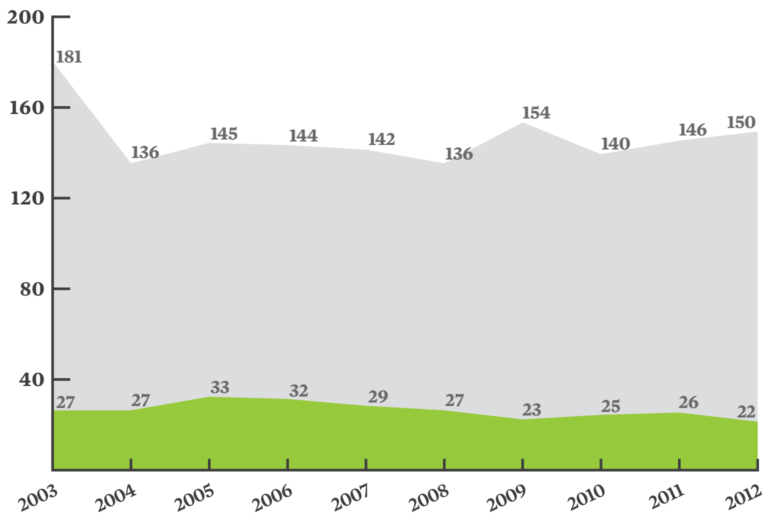
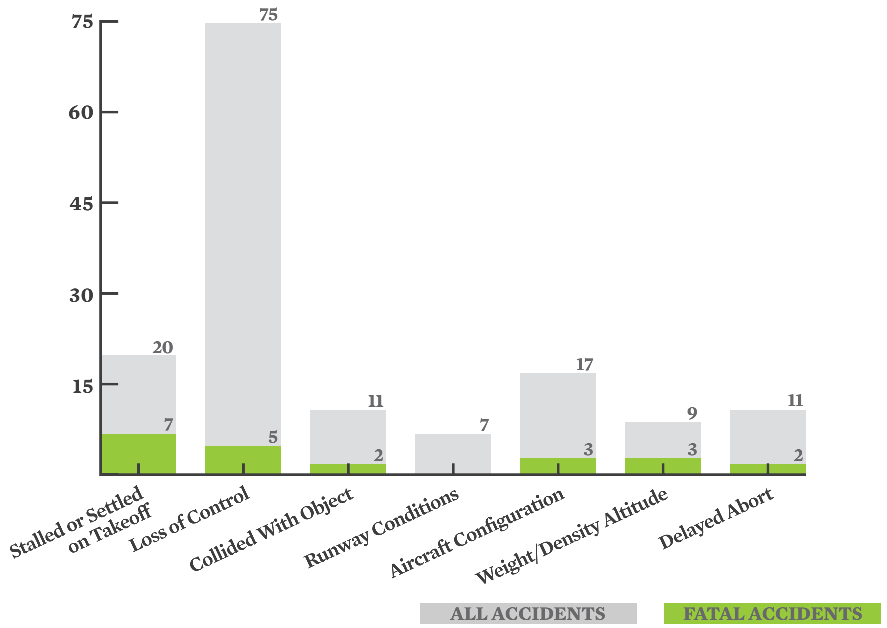


Figure 29: Types of Takeoff and Climb Accidents



ACCIDENT CASE STUDY—WEATHER

NTSB ACCIDENT NO. ANC12FA066
PIPER PA-32R-301, FAIRBANKS, ALASKA
TWO FATALITIES

HISTORY OF FLIGHT The accident airplane was one of three participating in a group sightseeing tour. On a planned leg from Inuvik in Canada's Northwest Territory to Fairbanks, two of the three made a precautionary stop at Fort Yukon, Alaska after encountering deteriorating weather. (The airplane that departed first arrived safely in Fairbanks.)

After taking on fuel, they took off from Fort Yukon at 4:00 p.m., but again encountered marginal weather. The other pilot requested and was given an IFR clearance to Fairbanks, but the accident pilot radioed that he'd found "a good VFR track." However, at 4:41 he also contacted the Anchorage ARTCC to request an IFR clearance and was instructed to climb to 7,000 feet. Radio contact was lost four minutes later as the airplane made an approximately 90-degree right turn. It was reported overdue at 5:19, and a Civil Air Patrol search-and-rescue mission located the wreckage in "mountainous, tundra-covered terrain" at 7:48.

PILOT INFORMATION The 63-year-old pilot held a U.S. private pilot certificate issued on the basis of his Australian pilot certificate, which included complex and tailwheel privileges but not an instrument rating. His rental agreement with the airplane's California-based operator listed 804 hours of flight experience.

WEATHER There are no weather observation stations within 40 miles of the accident site. VFR conditions prevailed at both Fort Yukon and Fairbanks at the time of the accident. However, infrared satellite imagery showed that the accident site was beneath an overcast layer with tops estimated at 20,500 feet, and radar returns indicated that it was on the edge of an area of moderate precipitation. Conditions at Fairbanks deteriorated later in the evening, alternating between marginal VFR and IFR for the next 17 hours.

PROBABLE CAUSE The non-instrument-rated pilot's decision to continue visual flight into instrument meteorological conditions likely leading to spatial disorientation, which resulted in a loss of airplane control and in-flight structural failure.

ASI COMMENTS Attempts to fly VFR in IMC are both the most common and the deadliest type of weather accident, accounting for more fatalities than thunderstorms, icing, and non-convective turbulence combined. The majority involve attempts to press on into deteriorating weather rather than reversing course. A timely decision to return to Fort Yukon would almost certainly have saved the lives of this pilot and his passenger.

More than 97% of the accident aircraft were single-engine models, and more than 80% were fixed-gear (**Figure 30**). Just under half of those in the SEF class were tailwheel designs. Three takeoff accidents involved single-engine turbine airplanes. More than 97% of these accidents (146 of 150) took place in daytime VMC, with only two in IMC and two more at night (**Figure 31**). However, three of those four were fatal. Unlike prior years, sport and student pilots were not disproportionately involved (**Figure 32**). CFIs were present on less than one-quarter of the accident flights, and most of those were not instructional: 87% of takeoff accidents came while flying single-pilot.

MANEUVERING *(53 TOTAL / 31 FATAL)* Even though the last three years have seen the smallest numbers of maneuvering accidents in the past decade (**Figure 33**), they remain one of the two leading causes of pilot-related fatalities. The most common cause was unintentional stalls at altitudes too low to allow recovery (**Figure 34**), which caused an outright majority of all maneuvering accidents and corresponding fatalities in 2012. More than 60% were fatal, a rate surpassed only by the lethality of accidents during aerobatic practice or performances. A total of 18 accidents involved controlled flight into wires, structures, terrain, or other obstructions, but only three of those occurred during mountain flights or canyon runs.

Fifty-two of the 53 maneuvering accidents took place in visual meteorological conditions, 48 of them during daylight hours. However, three of the four that occurred at night were fatal.

Ninety-two percent of the accident aircraft (49 of 53) were piston singles, 41 of them fixed-gear (**Figure 35**). Twenty (all fixed-gear) were tailwheel models. All eight accidents in retractable-gear singles were fatal, as were the four accidents in multiengine airplanes (including one of just two in turbine aircraft). Only a little over one-third of the accident flights were commanded by private pilots (**Figure 36**); lethality was actually highest among ATPs (86%) and on two-pilot flights (88%).

DESCENT AND APPROACH *(50 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. After spiking the year before, 2012 saw 50 of these accidents (**Figure 37**). Twenty-four were fatal. This was

Figure 30: Aircraft Involved in Takeoff and Climb Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	122	81.3%	13	59.1%	10.7%
SEF, Tailwheel	59		6		10.2%
Single-Engine Retractable	24	16.0%	7	31.8%	29.2%
Single-Engine Turbine	3		2		66.7%
Multiengine	4	2.7%	2	9.1%	50.0%

Figure 31: Flight Conditions of Takeoff and Climb Accidents—Non-Commercial Fixed-Wing

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	146	97.3%	19	86.4%	13.0%
Night VMC*	2	1.3%	2	9.1%	100.0%
Day IMC	2	1.3%	1	4.5%	50.0%

*INCLUDES DUSK

Figure 32: Pilots Involved in Takeoff and Climb Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	23	15.3%	2	9.1%	8.7%
Commercial	33	22.0%	7	31.8%	21.2%
Private	74	49.3%	11	50.0%	14.9%
Sport	4	2.7%	1	4.5%	25.0%
Student	12	8.0%	0		
Other or Unknown	4	2.7%	1	4.5%	25.0%
Second Pilot on Board	20	13.3%	6	27.3%	30.0%
CFI on Board*	36	24.0%	5	22.7%	13.9%
IFR Pilot on Board*	72	48.0%	12	54.5%	16.7%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 33: Maneuvering Accident Trend

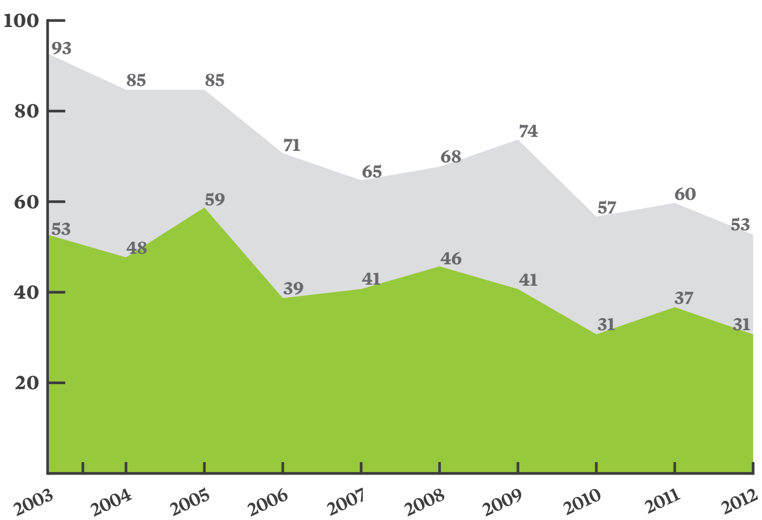


Figure 34: Types of Maneuvering Accidents

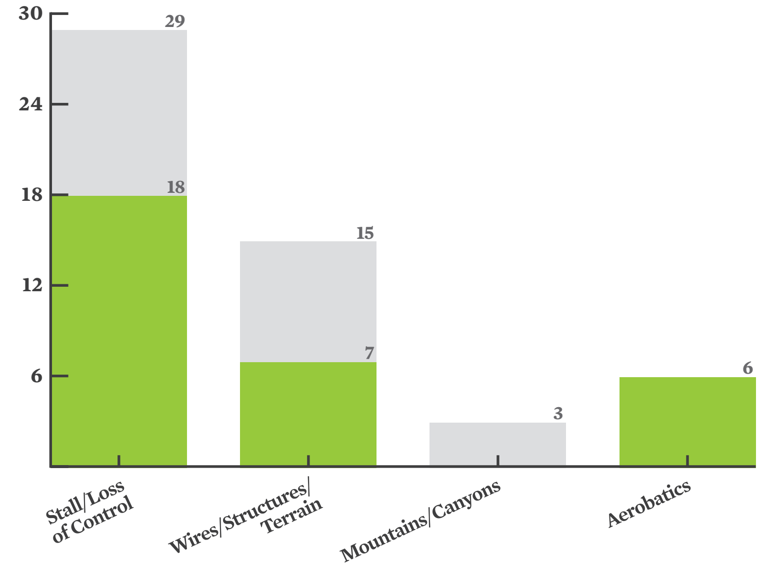


Figure 35: Aircraft Involved in Maneuvering Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	41	77.4%	19	61.3%	46.3%
SEF, Tailwheel	20		9		45.0%
Single-Engine Retractable	8	15.1%	8	25.8%	100.0%
Single-Engine Turbine	1		0		
Multiengine	4	7.5%	4	12.9%	100.0%
Multiengine Turbine	1		1		100.0%

Figure 36: Pilots Involved in Maneuvering Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	7	13.2%	6	19.4%	85.7%
Commercial	21	39.6%	11	35.5%	52.4%
Private	19	35.8%	12	38.7%	63.2%
Sport	2	3.8%	1	3.2%	50.0%
Student	2	3.8%	0		
Other or Unknown	2	3.8%	1	3.2%	50.0%
Second Pilot on Board	8	15.1%	7	22.6%	87.5%
CFI on Board*	13	24.5%	9	29.0%	69.2%
IFR Pilot on Board*	32	60.4%	21	67.7%	65.6%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 38: Types of Descent and Approach Accidents

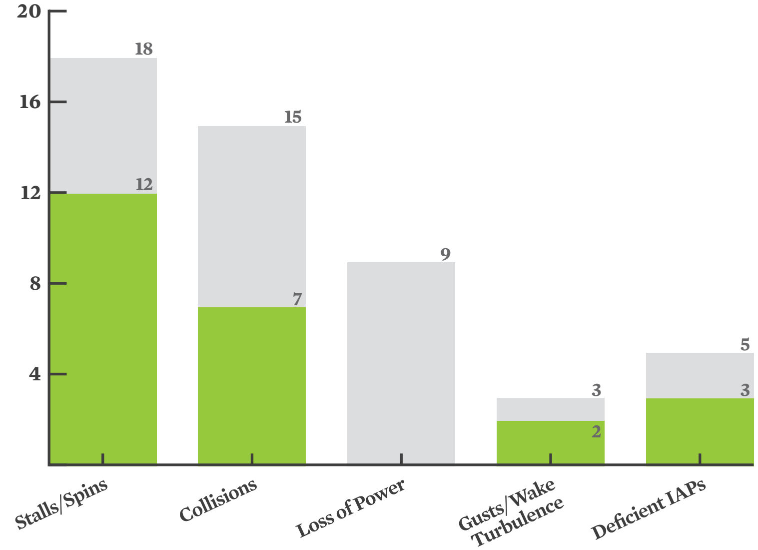


Figure 37: Descent and Approach Accident Trend

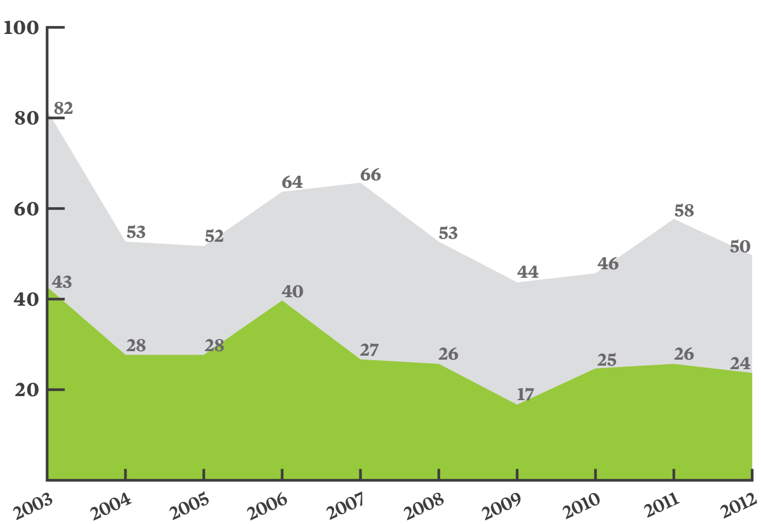


Figure 39: Aircraft Involved in Descent and Approach Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	36	72.0%	17	70.8%	47.2%
SEF, Tailwheel	11		5		45.5%
Single-Engine Retractable	12	24.0%	7	29.2%	58.3%
Multiengine	2	4.0%	0		

ALL ACCIDENTS FATAL ACCIDENTS

ACCIDENT CASE STUDY—TAKEOFF

NTSB ACCIDENT NO. WPR12FA326
BEECH B60, SEDONA, ARIZONA
THREE FATALITIES

HISTORY OF FLIGHT After an apparently normal run-up, the airplane taxied onto Runway 21 (5,132 feet). Density altitude was calculated to be 7,100 feet. Six witnesses saw part or all of the takeoff roll; several reported that the airplane seemed to accelerate somewhat slowly.

By midfield it had not rotated and no longer seemed to be accelerating, but didn't begin to slow down. The airplane went through the airport fence and down a steep gully, where it was largely consumed by fire. Examination of the wreckage found no evidence of pre-impact abnormality in the engines, airframe, landing gear, or flight controls, which appeared to be unlocked.

Representatives of the manufacturer determined that the airplane had been within its weight and center-of-gravity limits. They calculated that its required ground roll under those conditions should have been 2,805 feet, with an accelerate-stop distance of 4,600 feet. The reason the pilot did not abort the takeoff could not be determined.

PILOT INFORMATION The 53-year-old instrument-rated private pilot held privileges for single- and multiengine airplanes. His logbook showed 545 hours in single-engine and 118 hours in multiengine airplanes that included 62 in the accident make and model. He had completed SimCom's initial B60 training course 16 months earlier and a refresher course four months before the accident. The SimCom instructor described him as "very attentive...very disciplined...and a very good student."

WEATHER A METAR recorded five minutes after the accident reported clear skies, calm winds, and 10 miles visibility with a temperature of 26 degrees Celsius, a dew point of 13, and an altimeter setting of 30.17 inches of mercury.

PROBABLE CAUSE The airplane's failure to rotate and the pilot's failure to reject the takeoff, which resulted in a runway overrun for reasons that could not be determined because post-accident examination of the airplane and engines did not reveal any malfunctions or failures that would have precluded normal operation.

ASI COMMENTS Investigators were unable to determine what performance calculations, if any, the pilot had performed. One popular rule of thumb (cited in Section 7-5-7 of the *Aeronautical Information Manual*) is to discontinue the takeoff if the airplane hasn't reached at least 70% of takeoff speed halfway down the runway. Standard procedures for light twins call for a more systematic approach, including formal calculation of the required accelerate-stop distance and specification of the abort point. The fact that the calculated accelerate-stop distance constituted 90% of the available runway distance should have prompted especially close attention to initial acceleration and a readiness to reject the takeoff if aircraft performance was in any doubt.

the second lowest number in the past decade, but still made up 11% of all fatal accidents.

Inadvertent stalls were implicated in 18 of the 50, including half the fatal accidents (**Figure 38**). Seven of the 15 collisions with wires, structures, terrain, or other solid objects were also fatal. Five accidents, three of them fatal, were attributed to deficient execution of instrument approaches by rated pilots. Two of the three caused by wake turbulence or wind gusts also proved fatal, but no deaths resulted from the nine accidents precipitated by unexpected losses of engine power.

No turbine aircraft and only two piston twins were involved in descent / approach accidents in 2012 (**Figure 39**). All fatalities were in single-engine piston airplanes, and while three-quarters of those had fixed gear, lethality was not dramatically higher in retractable-gear models. This stands in contrast with earlier years, when accidents in complex airplanes were more than twice as likely to prove fatal. Lethality was likewise unaffected by flight conditions. While three-quarters took place in day VMC (**Figure 40**), just under half involved fatalities – not materially different from six of 13 (46%) that occurred at night, in IMC, or in a remote location under circumstances that made the exact ceiling and visibility impossible to determine.

Two of the three accidents on student solos were fatal, as were three of the four on dual-pilot flights (**Figure 41**). Survivability was actually best in accidents where the pilot in command held a flight instructor's certificate even though the majority of these were not instructional flights. About half involved private pilots (54%) and pilots who held instrument ratings (46%), slightly fewer than the year before.

LANDING *(346 TOTAL / 8 FATAL)* Landing attempts led to 30% of all non-commercial fixed-wing accidents in 2012, a proportion that has shown remarkable stability over time (**Figure 42**). Eight of 346 were fatal, a more typical result than the all-time low of two reported last year. All eight occurred in VMC during daylight, the setting for 94% of all landing accidents; another 5% took place in visual conditions at night. Only four occurred in IMC or unknown meteorological conditions.

Losses of directional control, always the most common problem, accounted for just over half (**Figure 43**), including half the fatalities. Stalls

Figure 40: Flight Conditions of Descent and Approach Accidents—Non-Commercial Fixed-Wing

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	37	74.0%	18	75.0%	48.6%
Night VMC*	6	12.0%	2	8.3%	33.3%
Day IMC	4	8.0%	1	4.2%	25.0%
Night IMC*	2	4.0%	2	8.3%	100.0%
Unknown	1	2.0%	1	4.2%	100.0%

*INCLUDES DUSK

Figure 41: Pilots Involved in Descent and Approach Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	4	8.0%	2	8.3%	50.0%
Commercial	14	28.0%	5	20.8%	35.7%
Private	27	54.0%	15	62.5%	55.6%
Sport	1	2.0%	0		
Student	3	6.0%	2	8.3%	66.7%
Other or Unknown	1	2.0%	0		
Second Pilot on Board	4	8.0%	3	12.5%	75.0%
CFI on Board*	10	20.0%	3	12.5%	30.0%
IFR Pilot on Board*	23	46.0%	10	41.7%	43.5%

*INCLUDES SINGLE-PILOT ACCIDENTS

ACCIDENT CASE STUDY—MANUEVERING

NTSB ACCIDENT NO. WPR12FA184
CESSNA A185F, BLANDING, UTAH
THREE FATALITIES

HISTORY OF FLIGHT The airplane's owner, his father (also a private pilot), and a CFI with extensive experience flying in the local mountains departed from Price, Utah at about 7:00 a.m. on a sightseeing flight with the goal of landing at several back-country airstrips. Both the owner and the CFI carried SPOT satellite locator devices; the instructor's was configured to send position reports at 10-minute intervals, while the pilot's was not.

After stops at three remote airports and replacement of a flat tire, they took off at 2:50 p.m. At 3:38, the instructor's SPOT reported a position 1.2 miles southeast of a strip on the south rim of Dark Canyon. It continued to report from the same location for the next 12 hours with no emergency or alert notification; no ELT signals were detected.

The CFI's employer reported the aircraft missing at about 9:00 p.m. after discovering that the SPOT locator had not moved since mid-afternoon, but the search had to wait for the nearest available aircraft, a Utah Highway Patrol helicopter, to arrive from Salt Lake City some 230 miles away. Once on scene, the coordinates provided by the SPOT device enabled the search-and-rescue team to find the accident site within an hour.

The wreckage was located on the edge of a plateau at an elevation of 6,900 feet, about 100 feet above and 1.2 miles beyond a dirt airstrip. Post-accident reconnaissance showed the strip to be overgrown and unusable, with no sign of recent landings. The airplane's owner survived the initial impact and extricated himself from the wreckage before it was consumed by fire. Its 406-MHz emergency locator transmitter had activated, but was separated from its antenna. The owner's SPOT device was destroyed in the fire, while the CFI's was ejected beyond reach.

PILOT INFORMATION The 28-year-old private pilot was rated for airplane single-engine land and instrument airplane. His last application for a medical certificate, filed nearly five years earlier, listed 150 hours of flight experience, but family members reported that he'd flown regularly throughout that five-year period.

The 57-year-old CFI was his employer's chief pilot and held commercial and instrument privileges for airplane single-engine land, multiengine land, and single-engine sea. Company records indicated that he had a total of 6,200 hours of flight experience. Five days before the accident, he'd passed Part 135 competence and line checks administered by an FAA inspector.

WEATHER The Blanding Municipal Airport 30 nautical miles east-southeast reported winds from 250 degrees at 15 knots gusting to 25 and visibility of 50 miles; a scattered layer at 9,000 feet below a 14,000-foot broken ceiling; a temperature of 22 degrees Celsius and a dew point of 4; and an altimeter setting of 30.16 inches of mercury. An Airmet Tango for moderate turbulence below 15,000 feet was in effect.

PROBABLE CAUSE The pilot's failure to maintain airplane control during low-level maneuvering flight. Contributing to the pilot's death was the lack of a timely emergency rescue response due to the lack of effective emergency signal transmissions from both the airplane's emergency locator transmitter and the personal locator device, which were both ejected from the wreckage.

ASI COMMENTS The pilot and his father had hired the instructor as a guide specifically because they were not comfortable with their level of experience in mountain flying. That, their use of SPOT locators, and the installation of the 406 MHz ELT all attest to their desire to manage risk prudently while learning to enjoy back-country aviation. However, bush flying inherently involves greater risks than operations from long, paved runways, specifically including upsets at altitudes and in locations that make recovery impossible. The difficulty of conducting search-and-rescue missions in remote areas also raises the stakes in any accident. Even a successful forced landing with no injuries can become a crisis if help is beyond reach.

and hard landings made up slightly less than one-quarter (24% combined). Overruns were more frequent than undershoots but both were rare, making up only 9% of the total combined. Wet, soft, or contaminated runways were blamed for 23, errors operating retractable gear led to 30, and five aircraft suffered substantial damage in collisions with birds or other animals.

Fixed-gear singles made up 77% of the accident aircraft (**Figure 44**), nearly half of them (48%) taildraggers. Both figures are virtually unchanged from the year before. There were no fatal landing accidents in either complex singles or turboprops but three in piston twins.

MECHANICAL / MAINTENANCE

(163 TOTAL / 9 FATAL) The number of non-commercial fixed-wing accidents caused by documented mechanical failures or errors in aircraft maintenance jumped 11% in 2012 (**Figure 46**), but only nine of 163 were fatal, the lowest tally in the history of the ASI accident database.

As in most recent years, powerplant failures (37%) and gear and brake anomalies (27%) were most common. Unlike recent years, however, airframe

Figure 42: Landing Accident Trend

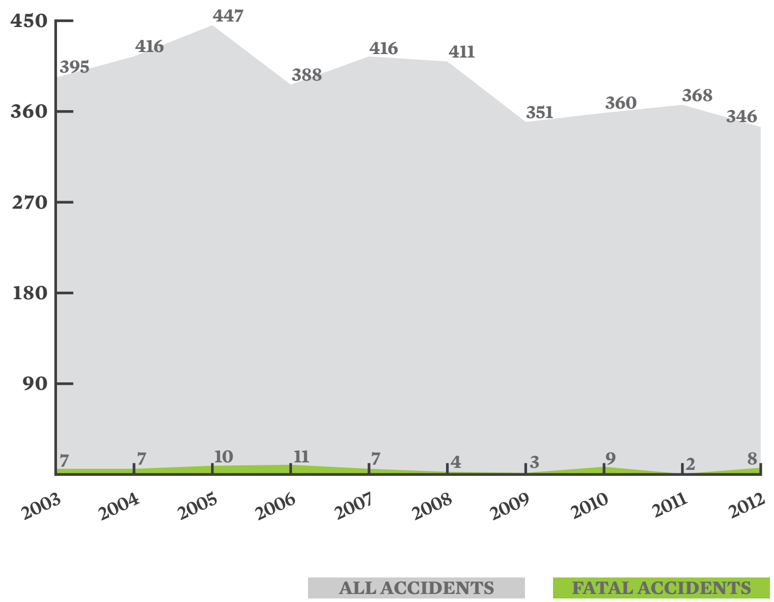
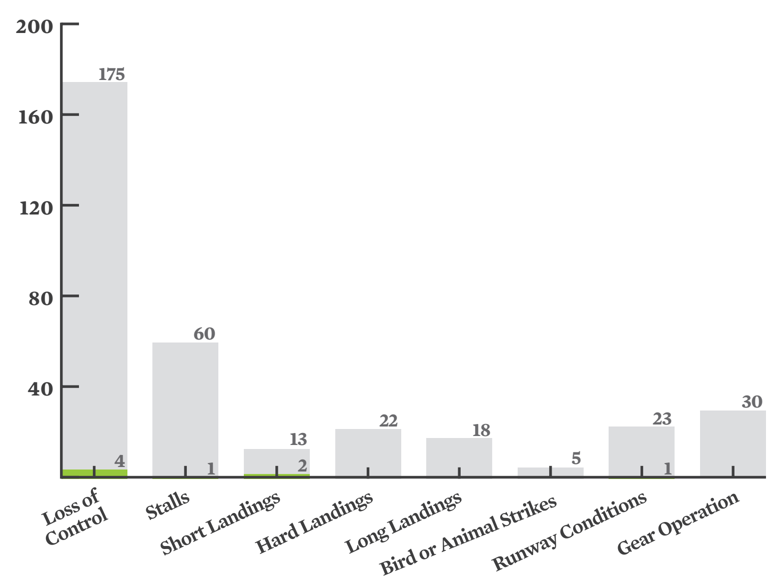


Figure 43: Types of Landing Accidents



ACCIDENT CASE STUDY—DESCENT/APPROACH

NTSB ACCIDENT NO. CEN12FA633
CIRRUS SR22, WILLARD, MISSOURI
FIVE FATALITIES

HISTORY OF FLIGHT The pilot departed VFR with four passengers at 11:30 p.m. Eight minutes later he contacted the Kansas City TRACON to request an IFR clearance. The flight continued uneventfully, and at 12:14 the pilot was cleared for the ILS to Runway 14 at Springfield-Branson, Missouri with the instruction to cross the initial approach fix at or above 3,000 msl.

Radar track data showed that the Cirrus passed just south of the localizer at the initial approach fix, which was also the charted glideslope intercept. It crossed the localizer, then flew parallel to it but did not begin to descend. At 12:17 the pilot was transferred to the tower frequency and cleared to land; at 12:20, he requested vectors for a second approach and was instructed to maintain 3,000 feet and turn left to a heading of 360. Forty seconds after reading back that clearance, the pilot transmitted, "I need some help." No further transmissions were received. Radar showed the airplane turning left and descending at a rate that reached 6,000 feet per minute.

PILOT INFORMATION His instructor estimated that the instrument-rated private pilot had about 1,000 hours of total flight time that included 650 in type, 100-200 at night, and about 75 hours in actual IMC. The instructor also said that the pilot was very active, flying perhaps 200 hours per year, and described him as "the best student I ever had."

WEATHER The area forecast called for an overcast layer at 3,000 feet with tops at 15,000. At the time of the accident, Springfield-Branson reported an overcast ceiling at 700 with 8 miles visibility and winds from 070 degrees at 6 knots. The temperature was 16 degrees Celsius, the dew point 14, and the altimeter setting was 30.27 inches of mercury. There is no record of the pilot having gotten a weather briefing.

PROBABLE CAUSE The pilot's loss of airplane control as a result of spatial disorientation experienced in night instrument meteorological conditions.

ASI COMMENTS According to press reports, the passengers were the pilot's three children, ages 10, 14, and 16, and an adult friend. They were returning home from a major-league baseball game. The NTSB noted that the 2002 SR22 was configured for four occupants, and no modifications were available that would enable it to carry a fifth person. This and the decision to make an instrument flight at night under conditions conducive to fatigue suggest that the pilot may have become too comfortable in the aircraft – or succumbed to the temptation to extract more utility from it than it was intended to provide.

failures and flight-control malfunctions caused an outright majority of fatal accidents. These included a fractured wing spar in an owner-designed homebuilt, a broken aileron cable in a Cessna 172, and the in-flight separation of a portion of the right wing in a kit-built Quad City Challenger II. A fire started by a faulty combustion heater destroyed a Cessna 404, and the elevator an Extra EA-300 was jammed by an unsecured GPS antenna. Losses of engine power due to either powerplant or fuel system problems still caused a majority of the accidents in this category, but only three of the nine that were fatal.

The greater lethality of mechanical failures in fixed-gear singles, especially taildraggers, in 2012 (**Figure 48**) was also unusual. Given the very small numbers involved, this could easily be due to chance. Only seven of 163 (4%) involved turbine-powered aircraft, none of them fatal.

The excess involvement of commercial and airline transport pilots was less pronounced than in 2010 or 2011; still, they made up 52% of pilots involved in mechanical accidents (**Figure 49**) compared to 43% of those in all other types combined. The prevalence of complex and multiengine airplanes (40% of mechanical vs. 28% of non-mechanical accidents) accounts for at least part of this difference. Only four mechanical accidents, one fatal, took place in IMC; 150

Figure 44: Aircraft Involved in Landing Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	267	76.9%	5	62.5%	1.9%
SEF, Tailwheel	129		1		0.8%
Single-Engine Retractable	55	15.9%	0		
Single-Engine Turbine	7		0		
Multiengine	25	7.2%	3	37.5%	12.0%
Multiengine Turbine	2		0		

ALL ACCIDENTS FATAL ACCIDENTS

Figure 46: Mechanical Accident Trend

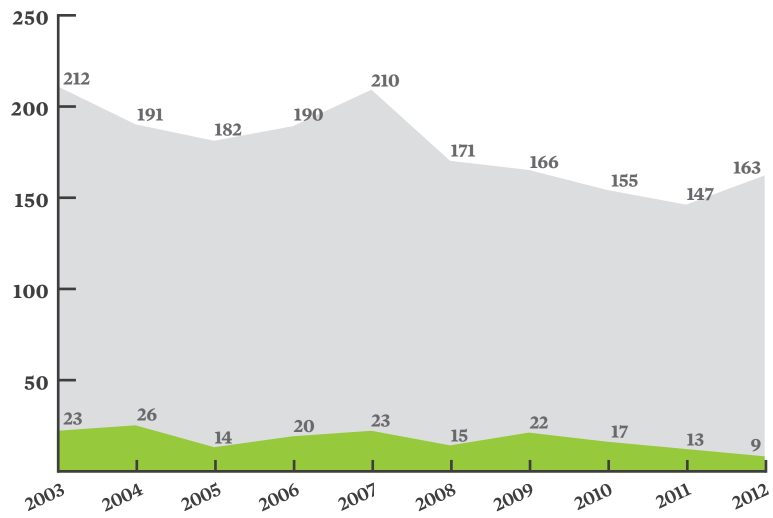
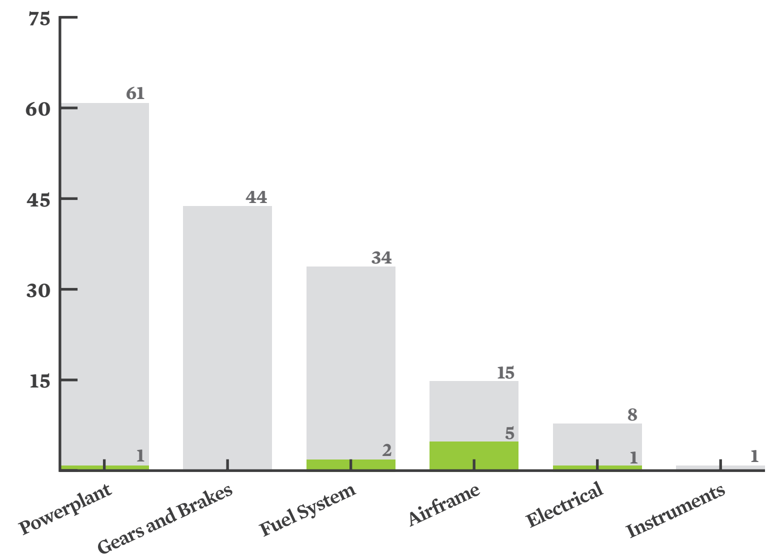


Figure 45: Pilots Involved in Landing Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	55	15.9%	1	12.5%	1.8%
Commercial	90	25.9%	5	62.5%	5.6%
Private	153	44.1%	2	25.0%	1.3%
Sport	5	1.4%	0		
Student	39	11.2%	0		
Other or Unknown	5	1.4%	0		
Second Pilot on Board	55	15.9%	2	25.0%	3.6%
CFI on Board*	93	26.8%	4	50.0%	4.3%
IFR Pilot on Board*	195	56.2%	7	87.5%	3.6%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 47: Types of Mechanical Accidents



ACCIDENT CASE STUDY—LANDING

NTSB ACCIDENT NO. WPR12FA432
VANS RV-7A, LARAMIE, WYOMING
ONE FATALITY

HISTORY OF FLIGHT The 79-year-old pilot flew non-stop from Duluth, Minnesota, a distance of 635 nautical miles, on an IFR flight plan. His time en route was five hours and 15 minutes. Despite gusty north winds, witnesses saw him make a mid-field crosswind entry into left traffic for Runway 21. An off-duty airline pilot reported that the airplane appeared normal on final approach until it crossed a highway about a quarter mile from the threshold, at which point there was a slight wing rock "similar to a small Dutch roll." The airplane stabilized again; then, on short final at an altitude of about 100 feet, it rolled slightly to the left before entering a spin to the right. Impact was near-vertical, and fire consumed most of the fuselage.

PILOT INFORMATION The 5,000-hour commercial pilot was also the builder of the RV-7A. He held ratings for airplane single-engine land, multiengine land, and instrument airplane in addition to an expired flight instructor's certificate.

WEATHER Eight minutes after the accident, the Laramie airport reported winds from 350 degrees at 14 knots with gusts to 24, clear skies, and 10 miles visibility. The temperature was 22 degrees Celsius, the dew point -4, and the altimeter setting was 30.28 inches of mercury.

PROBABLE CAUSE The pilot's decision to attempt a landing with a gusting tailwind, which resulted in his loss of airplane control during final approach and a subsequent aerodynamic stall/spin.

ASI COMMENTS The reasoning behind the pilot's decision to land with a gusty quartering tailwind remains unknown. The airplane's usable fuel capacity was 42 gallons, but at 55% power and a best-economy mixture, he would have arrived with the required 45-minute reserve. In any case, the post-crash fire is evidence that some fuel remained on board. The Laramie airport's elevation is 7,284 feet, and the pilot's experience with high-altitude airfields was not reported. The need to fly approaches at higher true airspeeds in the thinner air frequently surprises pilots unused to those conditions, and the tailwind would have made his groundspeed higher still. The perception of excessive speed on final likely led him to try to slow the airplane, precipitating the stall.

of 163 (92%) occurred in day VMC, including eight of the nine fatal accidents.

OTHER, UNKNOWN, OR NOT YET DETERMINED

(129 TOTAL / 31 FATAL) Six percent of all non-commercial fixed-wing accidents (72) were triggered by losses of engine power for reasons that could not be determined after the fact (**Figure 50**): 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.

Twenty-two of the remaining 57 were fatal. In 16 of these (as well as another seven non-fatal accidents), sufficient information is not yet available to determine the causes. Accidents whose causes are known include half a dozen on-ground encounters with deer, three aircraft damaged by unqualified individuals attempting unauthorized repairs, two airplanes crashed by non-pilots and a third damaged in a collision with a skydiver, three noseovers after brakes locked for no apparent reason, four unexplained engine fires, and two possible fires in or under the instrument panel. Four airplanes disappeared in flight and three were hit by ground vehicles. There were also two bird strikes and four in-flight losses of control that were never satisfactorily explained.

Figure 48: Aircraft Involved in Mechanical Accidents—Non-Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Single-Engine Fixed-Gear	97	59.5%	7	77.8%	7.2%
SEF, Tailwheel	41		4		9.8%
Single-Engine Retractable	53	32.5%	1	11.1%	1.9%
Single-Engine Turbine	4		0		
Multiengine	13	8.0%	1	11.1%	7.7%
Multiengine Turbine	3		0		

Figure 49: Pilots Involved in Mechanical Accidents—Non-Commercial Fixed-Wing

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	26	16.0%	1	11.1%	3.8%
Commercial	58	35.6%	3	33.3%	5.2%
Private	68	41.7%	5	55.6%	7.4%
Sport	3	1.8%	0		
Student	7	4.3%	0		
Other or Unknown	1	0.6%	0		
Second Pilot on Board	27	16.6%	2	22.2%	7.4%
CFI on Board*	46	28.2%	1	11.1%	2.2%
IFR Pilot on Board*	108	66.3%	5	55.6%	4.6%

*INCLUDES SINGLE-PILOT ACCIDENTS

Figure 50: Other and Unclassified Aircraft Accidents—Non-Commercial Fixed-Wing

Major Cause	Accidents		Fatal Accidents		Lethality
Other	57	44.2%	22	71.0%	39.3%
Other (Power Loss)	72	55.8%	9	29.0%	12.5%

COMMERCIAL FIXED-WING ACCIDENTS

The number of commercial fixed-wing accidents dropped 30% from 2011 to 2012, returning to the record low levels of 2009-2010 (**Figure 3A**). The number of fatal accidents decreased by half, from 16 to eight, while the number of individual fatalities declined by more than 70% (from 28 to eight). Aerial application and charter flights saw similar overall improvements of 28% and 34%, respectively, but the reduction in fatalities was almost entirely on Part 135 transports, where there were four (**Figure 51**) compared to 23 a year earlier.

AIRCRAFT CLASS All but one of the crop-dusting accidents were in single-engine tailwheel models (**Figure 52**), which carry out the vast majority of these operations. Thirty were turbine-powered models, while 24 had reciprocating engines. More than 80 percent of Part 135 accidents involved single-engine airplanes, only one of which had retractable landing gear, and these included three of the four with fatalities. Three of the five multiengine airplanes involved were also turboprops, as were four of the fixed-gear singles.

FLIGHT CONDITIONS Every one of the aerial application accidents took place in daytime VMC (**Figure 53**). There was one fatal VFR-into-IMC accident during daylight hours, and one non-fatal accident in visual conditions at night. More than 80% of the Part 135 accidents also occurred in visual conditions in daylight, with just two having occurred in instrument meteorological conditions.

PILOT QUALIFICATIONS Five of the pilots in aerial application accidents and 12 of those who crashed during charter flights held airline transport pilot certificates (**Figure 54**); all survived. Commercial pilots dominated the crop-dusting record but accounted for just 56% of Part 135 accidents, and all Part 135 pilots were instrument-rated compared to just over half under Part 137. Charter pilots were also nearly three times as likely to hold flight instructor certificates.

ACCIDENT CAUSES Aerial application flights consist almost entirely of low-altitude maneuvering that leaves little room to recover from aircraft malfunctions. The airplanes typically depart heavily loaded from short, rough airstrips. It's therefore not surprising that their accident record continues to be dominated by aborted takeoffs, maneuvering accidents, and emergencies arising from mechanical failures; these made up 20%, 30%, and 15% of their accident record, respectively (**Figure 55A**). Fuel mismanagement and unexplained losses of engine power caused three accidents apiece, almost as many as confirmed equipment problems. The four collisions included three wire strikes and an Arkansas mid-air between two aerial applicators.

Landing accidents and mechanical malfunctions caused a combined 56% of all Part 135 accidents in 2012 (**Figure 55B**). Fuel mismanagement and adverse weather, which continue to pose significant problems for non-commercial pilots, were no more common than errors while taxiing (one on land and one on water). The fatal takeoff accident involved an unexplained loss of power during an intersection departure on Guam; the two non-fatal were due to low-level wind shear and inadvertent runway contact while maneuvering to avoid a flock of Canada geese.

Figure 51: Type of Operation—Commercial Fixed Wing

Type of Operation	Accidents		Fatal Accidents		Fatalities	
Agricultural	54	66.7%	4	50.0%	4	50.0%
Charter: Non-Medical	26	32.1%	4	50.0%	4	50.0%
Charter: Medical	1	1.2%	0			

Figure 52: Aircraft Class—Commercial Fixed-Wing

Aircraft Class	Accidents		Fatal Accidents		Lethality
Part 137: Aerial Application					
Single-Engine Fixed-Gear	54	100.0%	5	100.0%	9.3%
SEF, Tailwheel	53		5		9.4%
Single-Engine Turbine	30		4		13.3%
Part 135: Charter and Cargo					
Single-Engine Fixed-Gear	21	77.8%	3	75.0%	14.3%
SEF, Tailwheel	8		0		
Single-Engine Retractable	1	3.7%	0		
Single-Engine Turbine	4		1		25.0%
Multiengine	5	18.5%	1	25.0%	20.0%
Multiengine Turbine	3		0		

Figure 53A: Flight Conditions—Part 137: Aerial Application

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	54	100.0%	5	100.0%	9.3%

Figure 54A: Pilots Involved in Part 137 (Aerial Application) Accidents

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	5	9.3%	0		
Commercial	49	90.7%	5	100.0%	10.2%
CFI on Board*	12	22.2%	1	20.0%	8.3%
IFR Pilot on Board*	28	51.9%	3	60.0%	10.7%

*INCLUDES SINGLE-PILOT FLIGHTS

Figure 53B: Flight Conditions—Part 135: Cargo and Charter

Light and Weather	Accidents		Fatal Accidents		Lethality
Day VMC	22	81.5%	3	75.0%	13.6%
Night VMC*	3	11.1%	0		
Day IMC	2	7.4%	1	25.0%	50.0%

*INCLUDES DUSK

Figure 54B: Pilots Involved in Part 135 (Charter and Cargo) Accidents

Certificate Level	Accidents		Fatal Accidents		Lethality
ATP	12	44.4%	0		
Commercial	15	55.6%	4	100.0%	26.7%
Second Pilot on Board	3	11.1%	0		
CFI on Board*	16	59.3%	3	75.0%	18.8%
IFR Pilot on Board*	27	100.0%	4	100.0%	14.8%

*INCLUDES SINGLE-PILOT FLIGHTS

Figure 55A: Types of Accidents—Part 137: Aerial Application

Light and Weather	Accidents		Fatal Accidents		Lethality
Collision	4	7.4%	2	40.0%	50.0%
Fuel Management	3	5.6%	0		
Landing	4	7.4%	0		
Maneuvering	16	29.6%	3	60.0%	18.8%
Mechanical	8	14.8%	0		
Other	3	5.6%	0		
Other (Power Loss)	3	5.6%	0		
Takeoff	11	20.4%	0		
Taxi	1	1.9%	0		
Weather	1	1.9%	0		

Figure 55B: Types of Accidents—Part 135: Charter and Cargo

Certificate Level	Accidents		Fatal Accidents		Lethality
Cruise	1	3.7%	0		
Descent/Approach	1	3.7%	0		
Fuel Management	1	3.7%	0		
Landing	9	33.3%	0		
Maneuvering	1	3.7%	1	25.0%	100.0%
Mechanical	6	22.2%	1	25.0%	16.7%
Other	1	3.7%	1	25.0%	100.0%
Preflight	1	3.7%	0		
Takeoff	3	11.1%	1	25.0%	33.3%
Taxi	2	7.4%	0		
Weather	1	3.7%	0		

AMATEUR-BUILT AND EXPERIMENTAL LIGHT-SPORT AIRCRAFT

FIXED-WING *(224 TOTAL / 56 FATAL; INCLUDES 31 E-LSA / 8 FATAL)*

HELICOPTER *(8 TOTAL / 1 FATAL)* The total number of accidents in amateur-built and experimental light-sport aircraft (E-LSAs) decreased by 12, from 244 to 232. These included 224 fixed-wing aircraft (**Figure 56**) and eight helicopters. Thirty-one of the fixed-wing designs were classified as E-LSAs (**Figure 57**), while 149 were single-engine fixed-gear airplanes not intended for operation under sport-pilot rules. Some three-quarters of those (112) were built with tailwheels. There were also 42 retractable-gear singles and two multiengine airplanes.

One of the two accidents in piston twins and four of the seven in single-engine turbines were fatal, the highest lethalities in this year's amateur-built record. Retractable singles were not far behind at 40%. The lack of protective structure in most E-LSAs also leaves their occupants vulnerable to impact injuries; more than one-fourth of those accidents resulted in fatalities. Even the 20% lethality in more conventional fixed-gear singles was about one and a half times higher than in comparable certified airplanes.

Known mechanical failures and unexplained losses of engine power caused almost as many accidents (30%) as deficient technique during takeoffs, landings, and go-arounds (37%). The number of mechanical failures increased from 39 to 51, while the number of unexplained engine stoppages was unchanged at 19. Only three accidents were blamed on adverse weather (**Figure 58**), and less than 5% were due to fuel mismanagement. Sixty percent of go-around accidents were fatal, as were 59% of those during low-altitude maneuvering.

Four amateur-built aircraft were involved in mid-air collisions and three pilots suffered episodes of incapacitation. Three accidents occurred while taxiing, and six more resulted from discrepancies that should have been detected by preflight inspections.

UNUSUAL ACCIDENT CATEGORIES

Twenty-one fatal accidents and another 18 that were not fatal arose from circumstances too rare to support tabulation as separate categories for statistical analysis:

COLLISIONS *(14 TOTAL / 4 FATAL)* There were nine mid-air collisions in 2012. Four were fatal, causing six individual deaths. Only one involved commercial flights, a collision between fixed-wing crop-dusters. One of the two pilots was killed. There was also one collision between two police helicopters on a department helipad, but no casualties resulted.

The other three fatal mid-airs included the collision between a Cessna 180 and a Cessna 172 over Longmont, Colorado that killed the pilot and flight instructor in the 172; a landing RV-6 that struck an RV-4 on the runway in Valentine, Nebraska while operating as part of a flight of four, causing the death of the RV-4 pilot three weeks later; and the deaths of a Beech 35 owner and the instructor administering a flight review after they collided with a Cherokee 140 over Fauquier County, Virginia. Because the two pilots involved were employees of the NTSB and FAA, respectively, that accident was investigated by the Transportation Safety Board of Canada.

Non-fatal collisions included the police helicopter accident mentioned above; a collision between two Hughes 369A helicopters during a formation hovering exercise at a helicopter airshow in West Chester, Pennsylvania; and the night collision between a Robinson R22 helicopter on a cross-country flight and a Beech 35-A33 on a local flight near Antioch, California. No injuries resulted when a Piper PA-28-161 Warrior struck a PA-28R-201 Arrow south of Chandler, Arizona while students

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

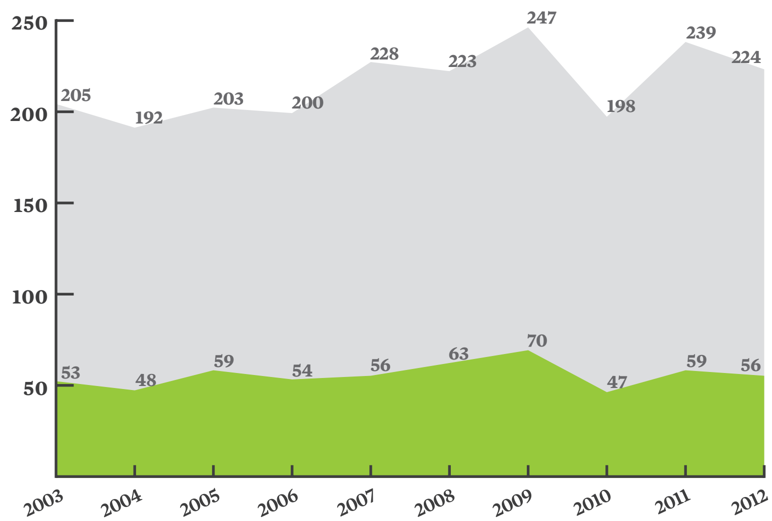


Figure 57: Types of Amateur-Built Aircraft Involved in Accidents

Aircraft Class	Accidents		Fatal Accidents		Lethality
E-LSA	31	13.4%	8	14.0%	25.8%
Single-Engine Fixed-Gear	149	64.2%	30	52.6%	20.1%
SEF, Tailwheel	112		22		19.6%
Single-Engine Retractable	42	18.1%	17	29.8%	40.5%
Single-Engine Turbine	7		4		57.1%
Multiengine	2	0.9%	1	1.8%	50.0%
Helicopter	8	3.4%	1	1.8%	12.5%

ALL ACCIDENTS FATAL ACCIDENTS

in both airplanes practiced instrument procedures under the hood. Both pilots also landed without injury when an RV-12 hit a Boeing E75 Stearman over the airport during a fly-in in Williamson, Georgia.

No serious injuries resulted from any of the five on-ground collisions. All involved airplanes. One was between two crop-dusters; the other four were between aircraft being operated non-commercially. In addition, an Aeropro Aerotrek A340 struck a hangar door during taxi; a Piper PA-28-180 hit a parked airplane after being started at an excessive power setting; and the pilot of a Beech V35A found himself unable to make a left turn after landing and struck a parked vehicle. No abnormalities were found in the landing gear or steering mechanisms afterwards.

ALCOHOL AND DRUGS *(9 TOTAL / 6 FATAL)* Three accidents, two of them fatal, were blamed on the pilots' impairment by alcohol alone; in two more (one fatal), alcohol was combined with other drugs. These resulted in a total of six deaths plus serious injuries to the two surviving pilots. Two fatal accidents were attributed to the impairing effects of prescription drugs, while in a third, a non-certificated pilot crashed a stolen airplane while under the influence of methamphetamine. The pilots were the only casualties in these cases. A second accident attributed to methamphetamine impairment caused serious injuries to the pilot and his only passenger.

All nine accidents involved fixed-wing aircraft. All of the accident flights were made under FAR Part 91, and none caused any injuries to anyone on the ground. These numbers are typical of the recent record; the number of accidents caused by drugs and/or alcohol has been between five and nine every year since 2000.

PHYSICAL INCAPACITATION *(11 TOTAL / 11 FATAL)* Ten pilots, all in airplanes, died after becoming incapacitated during flight. One passenger was also killed. Three cases were definitively attributed to cardiac disease, and unmistakable signs of underlying heart disease were present in three others. One pilot fell asleep 17 miles from the end of a nearly 2,000-nautical-mile ferry flight. There was one confirmed case of hypoxia; the circumstances of a second accident were also consistent with hypoxia, but its role could not be confirmed because neither the aircraft nor the pilot's body was recovered from the Gulf of Mexico. The cause of one apparent loss of consciousness in flight was not determined.

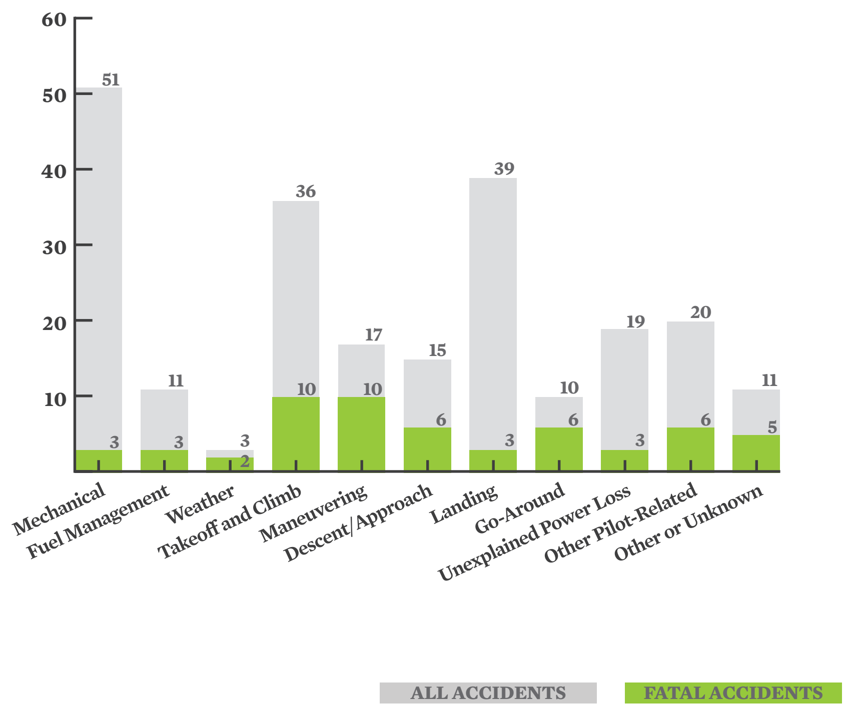
In addition to these 10 accidents, 2012 saw one of the rare instances of "suicide by airplane" when the owner of a Cessna 172B deliberately flew it into the Atlantic. All 11 of these flights were conducted under Part 91.

By FAA estimates, the active U.S. pilot population exceeded 610,000 in 2012. These 11 pilots therefore represent less than two one-thousandths of one percent (.002%) of that total.

OFF-AIRPORT GROUND INJURIES *(2 TOTAL / 0 FATAL; 1 SERIOUS INJURY / 4 MINOR INJURIES)* General aviation caused no ground fatalities in 2012, either on- or off-airport. One customer suffered serious injuries and two more incurred minor injuries when a Seawind 3000 crashed into the roof of a supermarket in DeLand, Florida after a total loss of engine power. The pilot and passenger also suffered serious injuries. Rotor wash caused minor injuries to two children during a low-altitude enforcement flight by a police helicopter in Pontiac, Michigan.

ON-AIRPORT GROUND INJURIES *(3 TOTAL / 0 FATAL; 2 SERIOUS INJURIES / 2 MINOR INJURIES)* A ground crewman suffered a serious electric shock during helicopter external load operations in Concrete, Washington after current arced from a live power line to the helicopter's hoist line. In Albemarle, North Carolina, a student pilot walked into a moving propeller, which inflicted serious injuries to his left arm. Finally, an automobile driver and his passenger in Roanoke, Texas suffered minor injuries when their car was struck by a landing airplane. The car was in the act of crossing the runway on an intersecting road at the moment of collision.

Figure 58: Types of Accidents in Amateur-Built Aircraft (Including Helicopters)



SUMMARY

- The number of non-commercial helicopter accidents increased 26% from 2011 to 2012, while the number of commercial fixed-wing dropped 30%. The corresponding accident rates were the highest since 2005 and the lowest since 2006, respectively.

- The numbers of commercial helicopter and non-commercial fixed-wing accidents were almost unchanged. However, commercial helicopter activity increased while non-commercial fixed-wing flight time continued to decline. Both the fatal and non-fatal accident rates on commercial helicopter flights were the lowest on record.

- While personal flights account for a much smaller share of helicopter flights than of fixed-wing, the excess accident risk is even greater.

- Low-altitude maneuvering (including wire strikes), mechanical failures, and aerodynamic phenomena that have no fixed-wing counterparts were the most prevalent causes of non-commercial helicopter accidents. Collectively, they accounted for 62% of the total, including 11 of the 19 fatal accidents.

- External-load accidents figured much more prominently in the commercial helicopter accident record, while the number of aerial application accidents diminished.

- For the second straight year, pilot-related accidents were equally prevalent in the records of commercial (73%) and non-commercial (75%) fixed-wing flights. Poor airmanship during takeoffs, landings, and go-arounds once again caused nearly half of all non-commercial accidents (47%).

- 2012 saw a welcome decline in the number of fuel-mismanagement accidents on non-commercial fixed-wing flights. This year's total of 79 was barely higher than the record low of 75 set in 2008.

- There was no similar improvement in accidents triggered by adverse weather, which occurred in numbers similar to most of the past decade. More than three-quarters were fatal. For the second year in a row, weather supplanted low-altitude maneuvering as the leading cause of fatal accidents.

- After decreasing in 2010 and 2011, the number of non-commercial accidents attributed to mechanical failures returned to a more typical level. However, only nine of these were fatal, an all-time low.

- Accidents in experimental amateur-built and experimental light-sport aircraft continue to be both more numerous and more lethal than in certified aircraft. 2012 was very similar to most of the past decade in this respect.

- The reduction in commercial fixed-wing accidents was shared almost equally between agricultural and charter flights.

- General aviation caused no ground fatalities in 2012.

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 operational risks.
- **Variability of pilot certificate and experience levels**—All airline flights are crewed by at least one ATP (airline transport pilot), the most demanding rating. GA is the training ground for most pilots, and while the GA community has its share of ATPs, the community also includes many new and low-time pilots and a great variety of experience in between.
- **Limited cockpit resources and flight support**—Usually, a single pilot conducts GA operations, and the pilot typically handles all aspects of the flight, from flight planning to piloting. Air carrier operations require at least two pilots. Likewise, airlines have dispatchers, mechanics, loadmasters, and others to assist with operations and consult with before and during a flight.
- **Greater variety of facilities**—GA operations are conducted at about 5,300 public-use and 8,000 private-use airports, while airlines are confined to only about 600 of the larger public-use airports. Many GA-only airports lack the precision approaches, long runways, approach lighting systems, and the advanced weather reporting and air traffic services of airline-served airports. (There are also 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, see “What Does General Aviation Fly?” on page 50 and “Type of Flying” on page 52.

Figure 59: What Does General Aviation Fly?

Aircraft Class	Commercial		Non-Commercial	
Piston Single-Engine	2,555	18%	126,292	66%
Piston Multiengine	1,113	8%	13,200	7%
Turboprop Single-Engine	2,253	16%	2,837	1%
Turboprop Multiengine	1,474	10%	3,741	2%
Turbojet	2,943	21%	8,850	5%
Helicopter	3,593	25%	6,462	3%
Experimental	185	1%	26,530	14%
Light Sport*	0		2,001	1%
Total	14,116		189,913	

*NOTE: FOR THE 2012 SURVEY, THE FAA COUNTED EXPERIMENTAL LIGHT-SPORT AIRCRAFT IN THE "EXPERIMENTAL" RATHER THAN "LIGHT SPORT" CATEGORY

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 2012, 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, which provides breakdowns by category and class of aircraft and purpose of flight, among other characteristics.

NTSB DEFINITIONS

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 (NTSB PART 830)

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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