



## Data Show Downward Trends in U.S.-registered Helicopter Accidents in 1991–98

*An analysis of information gathered by government agencies and a helicopter trade organization shows an average accident rate of 8.74 accidents per 100,000 flight hours during the period and declining trends in the number of accidents and fatal injuries.*

—  
*Joel S. Harris*

U.S.-registered helicopters were involved in 1,482 accidents from 1991 through 1998.<sup>1</sup> Of those accidents, 277 resulted in fatal injuries. This report presents a statistical review of the accidents, using data from the Helicopter Association International (HAI), the U.S. National Transportation Safety Board (NTSB) and the U.S. Federal Aviation Administration (FAA).

FAA data show that the number of U.S.-registered helicopters decreased from 1991 to 1993, then increased each year through 1997, the last year for which estimates were available.<sup>2</sup> From 1994 through 1997, the number of piston-powered helicopters increased more than 39 percent, and the number of turbine-powered helicopters increased more than 46 percent (Figure 1, page 2).

Figure 2 (page 2) shows the FAA-estimated number of multi-engine turbine-powered helicopters and single-engine turbine-powered helicopters from 1993 through 1997.

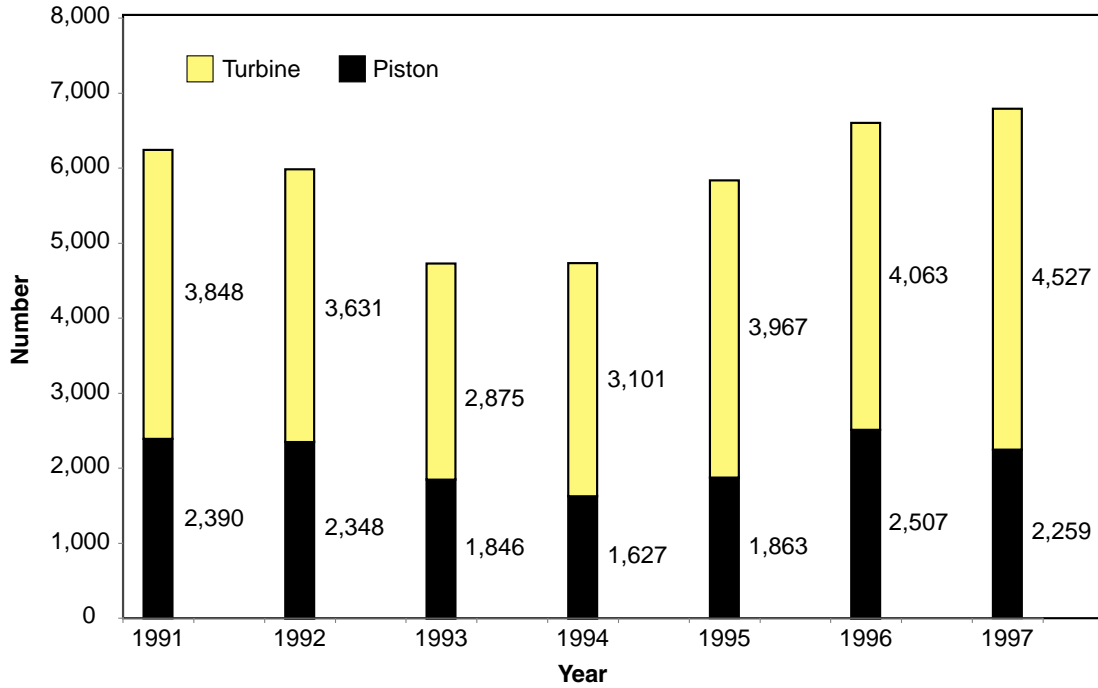
Accident trends were mixed during the period. HAI data on helicopter accidents during the period 1991 through 1998 show the following trends:



- An average of 185 helicopters were involved in accidents each year. Although more helicopters were involved in accidents in 1998 than in the three previous years, the linear trend line (the graphical representation of the trend of the data) shows a slight decline during the eight-year period (Figure 3, page 3);
- An average of 35 helicopters were involved in accidents that resulted in fatal injuries each year. The data show a declining trend during the eight years, although the 1998 figure of 34 fatal helicopter accidents was the highest number recorded since 1994 (Figure 4, page 3);
- The average accident rate for the eight-year period was 8.74 accidents per 100,000 flight hours. Annual accident rates ranged from a low of 6.79 accidents per 100,000 flight hours in 1991 to a high of 12.27 accidents per 100,000 flight hours in 1994. The trend during the eight-year period was statistically level (Figure 5, page 4); and,

*continued on page 4*

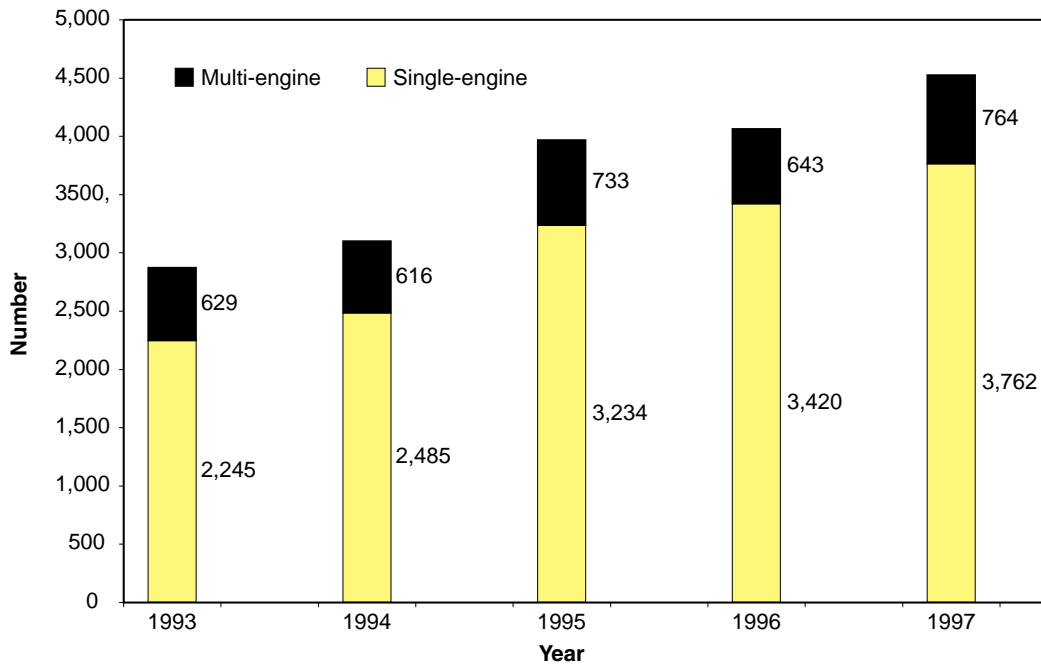
### Estimated Number of Active U.S.-registered Rotorcraft, 1991–1997



Source: Joel S. Harris

Figure 1

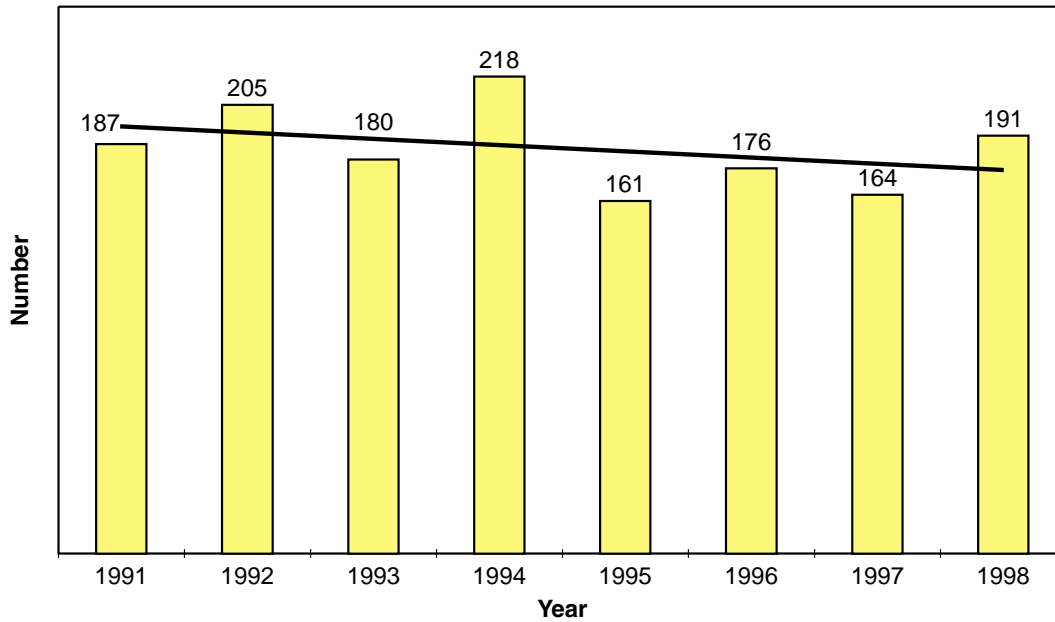
### Estimated Number of Active Single-engine and Multi-engine Turbine-powered U.S.-registered Rotorcraft, 1993–1997



Source: Joel S. Harris

Figure 2

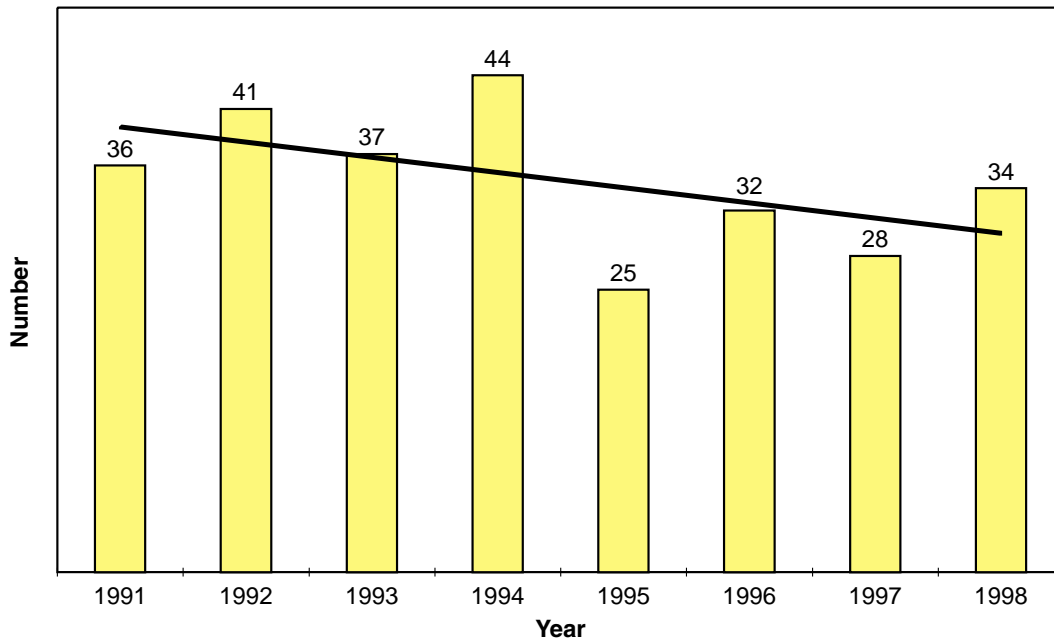
### U.S.-registered Helicopters Involved in Accidents and Linear Trend Line, 1991–1998



Source: Joel S. Harris

Figure 3

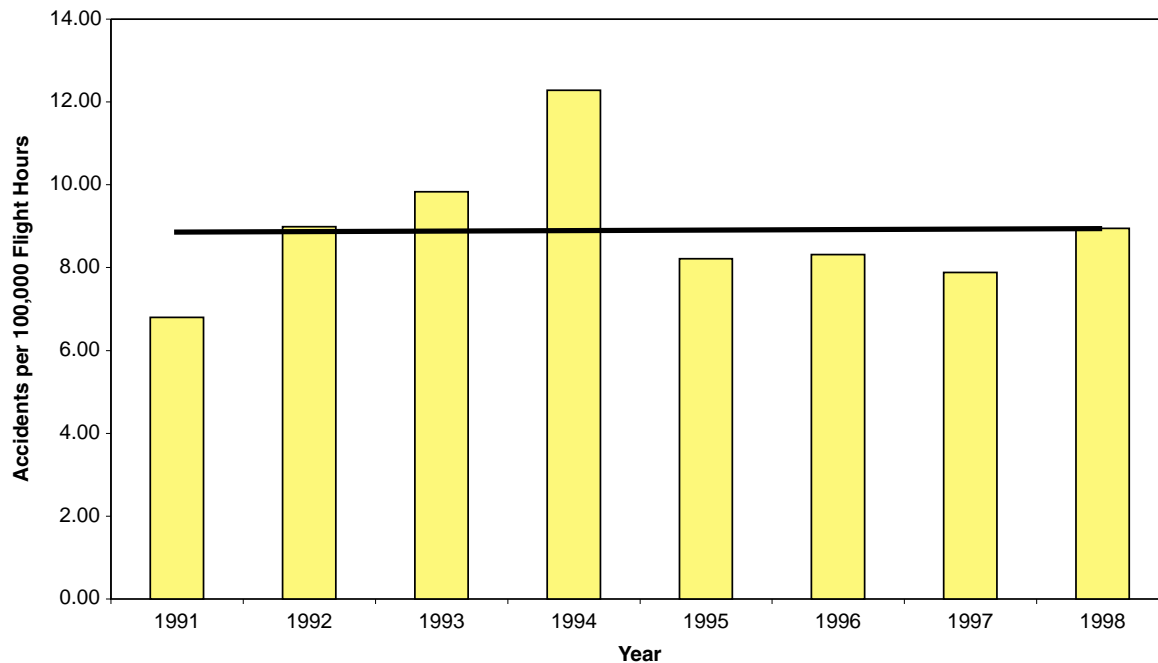
### U.S.-registered Helicopters Involved in Fatal Accidents and Linear Trend Line, 1991–1998



Source: Joel S. Harris

Figure 4

## Accident Rate of U.S.-registered Helicopters and Linear Trend Line, 1991–1998



Source: Joel S. Harris

**Figure 5**

- The average fatal accident rate was 1.63 accidents per 100,000 flight hours. Data show a downward trend in the fatal accident rate, even though the 1998 rate of 1.59 fatal accidents per 100,000 flight hours was the highest since 1994 (Figure 6, page 5).

Three types of aircraft were represented in the data: piston-powered helicopters, single-engine turbine-powered helicopters and multi-engine turbine-powered helicopters. Figure 7 (page 5) shows the accident rates and fatal accident rates for each type.

Helicopters with a single piston engine were involved in about 55 percent of the accidents during the period 1991–1998. Data show 810 accidents during the period and a rate of 24.11 accidents per 100,000 hours flown in this type of helicopter. Single-engine piston helicopters were involved in 106 fatal accidents with 149 fatalities, and the fatal accident rate was 3.15 per 100,000 flight hours.

Helicopters with a single turbine engine were involved in approximately 39 percent of the accidents. There were 587 accidents, including 137 fatal accidents with 284 fatalities; the accident rate was 6.03 per 100,000 flight hours, and the fatal accident rate was 1.41 per 100,000 hours flown.

Multi-engine turbine helicopters were involved in 6 percent of accidents. Data show a total of 85 accidents and 34 fatal

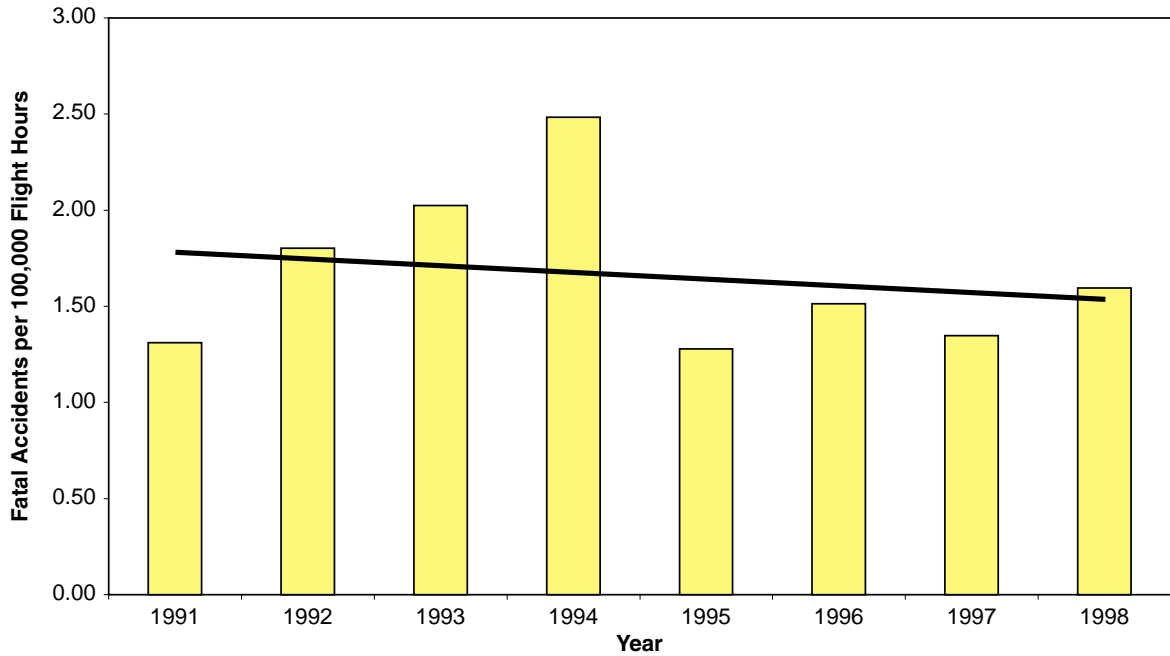
accidents with 74 fatalities; the accident rate was 2.20 per 100,000 flight hours, and the fatal accident rate was 0.88 per 100,000 hours flown in this helicopter type.

The NTSB accident/incident database<sup>3</sup> for 1991–1998 includes final reports for 1,336 U.S.-registered helicopter accidents. In 1,259 of these reports (94 percent), basic weather conditions at the time of the accident are described as visual meteorological conditions (VMC). Sixty-nine reports (5 percent) described weather conditions as instrument meteorological conditions (IMC). The accidents that occurred in IMC typically were more serious than accidents that occurred in VMC. NTSB data show that 53 percent of accidents in IMC resulted in fatalities, compared with 17 percent of accidents in VMC. Eight final reports did not describe weather conditions. Nevertheless, NTSB reports indicate that the percentage of accidents occurring each year in IMC is decreasing (Figure 8, page 6).

NTSB final accident reports indicated light conditions for 1,328 accidents. Of that number, 1,179 accidents occurred in daylight conditions, 98 accidents occurred in darkness, 18 accidents occurred at dawn and 33 accidents occurred at dusk (Figure 9, page 6).

NTSB accident reports typically cite multiple causes and contributing factors to accidents. Therefore, the probable cause determination often identifies the combined influence of more than one factor in an accident. An analysis of 74

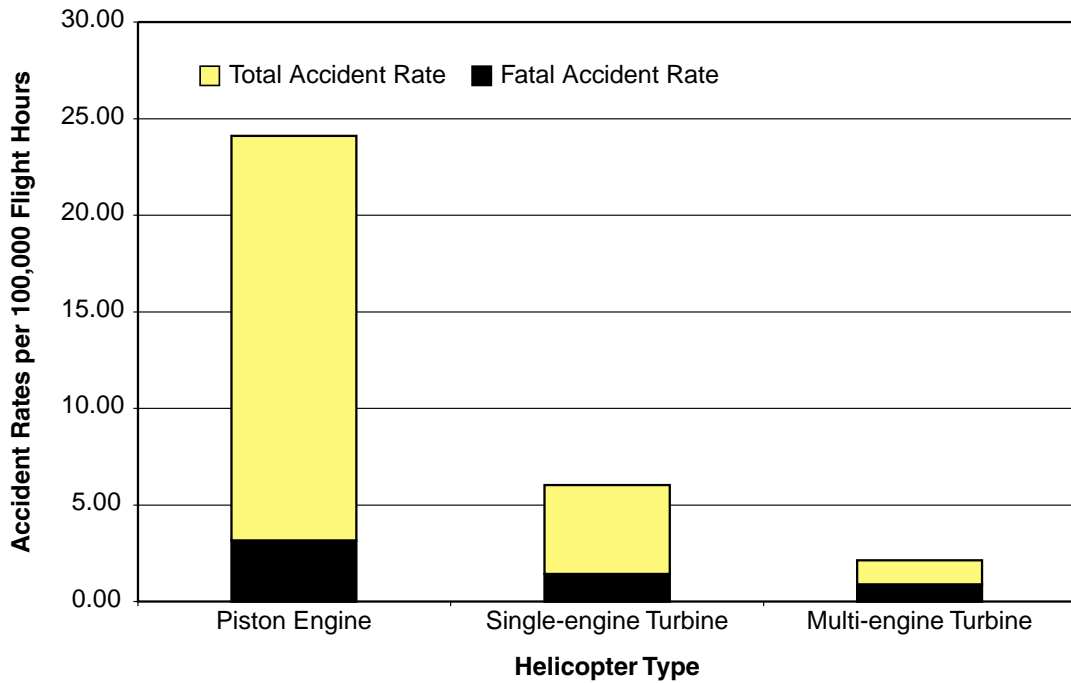
### Fatal Accident Rate of U.S.-registered Helicopters and Linear Trend Line, 1991–1998



Source: Joel S. Harris

Figure 6

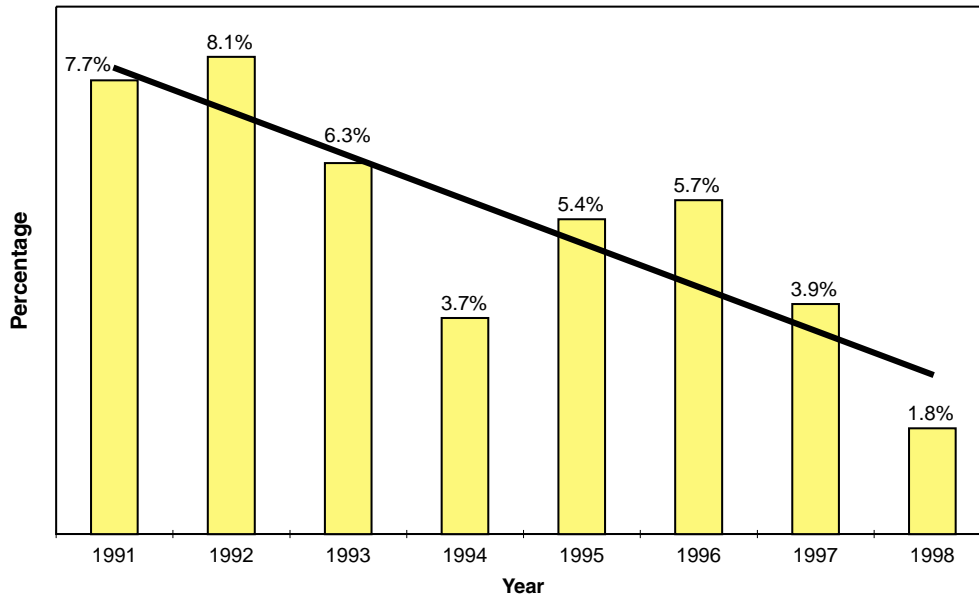
### Accident Rate Comparison of U.S.-registered Helicopters, 1991–1998



Source: Joel S. Harris

Figure 7

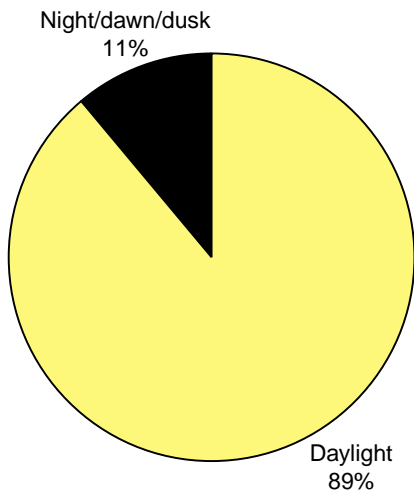
## U.S.-registered Helicopter Accidents in Instrument Meteorological Conditions and Linear Trend Line, 1991–1998



Source: Joel S. Harris

**Figure 8**

## Visual Conditions During Fatal Accidents Involving U.S.-registered Helicopters, 1991–1998



Source: Joel S. Harris

**Figure 9**

NTSB final reports (5.6 percent) on fatal helicopter accidents and nonfatal helicopter accidents from 1991 to 1998 shows that pilot error was either a cause or a contributing factor in 78 percent of all accidents and 88 percent of fatal accidents.<sup>4</sup>

Table 1 (page 7) shows NTSB data for accident rates<sup>5</sup> for all general aviation and air taxi aircraft, as well as HAI data for accident rates among U.S.-registered helicopters during the period 1991 through 1998.

HAI data show that 2,908 people were involved in the 1,482 helicopter accidents that occurred from 1991 through 1998. Of these, 1,496 people received no injuries, 566 people received minor injuries, 362 people were injured seriously and 484 people were injured fatally (Figure 10, page 7).

NTSB final helicopter accident reports show that between 1991 and 1998, 378 helicopters were destroyed, 947 helicopters were damaged substantially and 11 helicopters received minor damage or no damage (Figure 11, page 7).<sup>6</sup>◆

## Notes and References

1. Data is available from the Helicopter Association International, 1635 Prince St., Alexandria, VA 22314-2818 U.S.
2. U.S. Federal Aviation Administration (FAA) estimates of the number of active aircraft are on the Internet: [www.api.faa.gov/ga97/TAB\\_1-2.DOC](http://www.api.faa.gov/ga97/TAB_1-2.DOC).
3. The U.S. National Transportation Safety Board (NTSB) accident/incident database is on the Internet: [www.asy.faa.gov/asp/asy\\_ntsb.asp](http://www.asy.faa.gov/asp/asy_ntsb.asp).

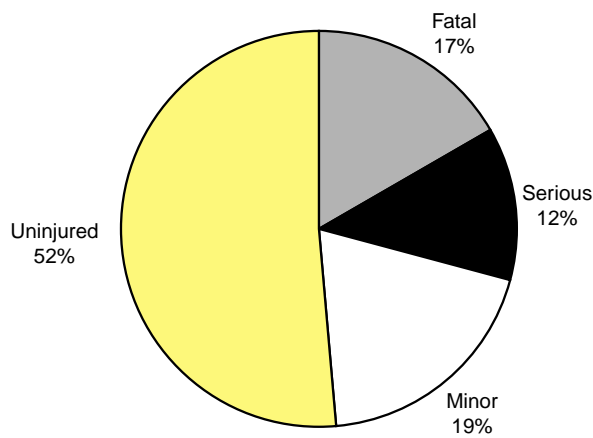
**Table 1**  
**Accident Rates and Fatal Accident Rates for**  
**U.S.-registered General Aviation and Air Taxi Aircraft, 1991–1998**

Year	General Aviation*		Air Taxi*		All Helicopters		Piston Turbine Helicopters		Single-engine Turbine Helicopters		Multi-engine Turbine Helicopters	
	Total	Fatal	Total	Fatal	Total	Fatal	Total	Fatal	Total	Fatal	Total	Fatal
1991	7.85	1.56	3.93	1.25	6.79	1.31	20.00	2.22	3.70	1.19	1.91	0.70
1992	8.36	1.80	3.86	1.22	8.98	1.80	29.33	4.33	5.32	1.53	2.02	0.40
1993	8.94	1.74	4.16	1.15	9.82	2.02	26.76	4.59	6.71	1.49	2.31	1.03
1994	8.97	1.81	4.59	1.40	12.27	2.48	29.54	4.34	8.96	1.91	4.18	2.23
1995	8.24	1.66	4.39	1.41	8.21	1.27	26.41	2.08	5.41	1.33	2.21	0.60
1996	7.67	1.45	4.43	1.43	8.30	1.51	13.87	2.20	7.81	1.22	2.35	1.28
1997	7.28	1.39	3.64	0.67	7.87	1.34	25.00	2.33	5.79	1.34	1.50	0.56
1998	7.12	1.36	3.03	0.71	8.93	1.59	30.46	4.02	6.04	1.29	1.82	0.73

\* General aviation and air taxi categories include fixed-wing aircraft and rotary-wing aircraft.

Source: Joel S. Harris

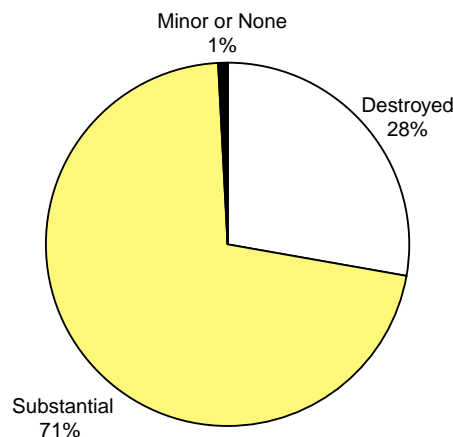
**Injuries in Accidents Involving**  
**U.S.-registered Helicopters, 1991–1998**



Source: Joel S. Harris

**Figure 10**

**Aircraft Damage in Accidents Involving**  
**U.S.-registered Helicopters, 1991–1998**



Source: Joel S. Harris

**Figure 11**

4. The author randomly selected for analysis 74 (5.6 percent) of 1,328 final helicopter accident reports in the NTSB online database. Sixteen of the accidents that were selected involved fatal injuries.

5. FAA. *Statistical Handbook of Aviation*. 1999.

6. U.S. Federal Aviation Regulations Part 830 defines “substantial” damage as “damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component.” Ted Lopatkiewicz of the U.S. National Transportation Safety Board public affairs

office said that “minor” damage typically is considered to be any damage that is less than substantial.

### *About the Author*

*Joel S. Harris holds an airline transport pilot certificate and a flight instructor certificate with ratings in both helicopters and airplanes. He is a U.S. Federal Aviation Administration-designated pilot-proficiency examiner, a Federal Aviation Regulations Part 135 check airman and safety counselor. Harris is assistant director of standards for quality assurance at FlightSafety International. He has administered more than 10,000 hours of flight, simulator and ground-school training to professional pilots.*

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