

# Flying Too High: Worker Fatalities in the Aeronautics Field

The aeronautics field has developed from a series of “huge steps for mankind.” However, the dream of flying was not accomplished without risk. Many lives have been lost in realizing this feat. According to the Bureau of Labor Statistics Census of Fatal Occupational Injuries, between 1992 and 1998, 853 pilots and another 1,286 workers in other occupations lost their lives on the job in aircraft crashes.

PEGGY SUAREZ

Beginning in the late 1400s, Leonardo DaVinci envisioned human-kind soaring through the clouds in a flying machine. He was not the first one to have this dream, nor the last. The realization of this dream, however, was not without risks. Many people have lost their lives in realizing this feat. According to the Bureau of Labor Statistics Census of Fatal Occupational Injuries (CFOI),<sup>1</sup> during the 1992-98 period, 853 pilots<sup>2</sup> lost their lives on the job in aircraft crashes—making piloting aircraft among the most dangerous occupations. (See table 1.)

### Some early pioneers

From its conception, aviation has taken many lives, even as it has contributed to better lives for human-kind. The initial successes in the aviation field began with the first human balloon flight in November 1783. At this time, Pilatre de Rozier flew his balloon through the air to an altitude of 500 feet, covering almost 5½ miles. However, work on inventing an airplane did not really begin until 1890.

There were several pioneers in the aeronautics field, including Otto Lilienthal, Octave Chanute, and Sir Haram

TABLE 1. Number and rate of work-related fatal injuries by selected occupations, 1998

Occupation	Fatalities	Rate <sup>1</sup>	Index of relative risk <sup>2</sup>
Total (all workers) .....	6,026	4.5	1.0
Timber cutters .....	109	141.6	31.5
Fishers .....	71	137.3	30.5
Structural metal workers .....	52	82.5	18.3
Aircraft pilots .....	91	80.5	17.9
Extractive occupations .....	60	48.0	10.9
Construction laborers .....	335	40.7	9.0
Taxicab drivers .....	82	30.0	6.7
Truckdrivers .....	879	29.2	6.5
Farm occupations .....	592	28.6	6.4
Roofers .....	50	20.7	4.6

<sup>1</sup> Rate = (Fatal work injuries / Employment) X 100,000 workers.

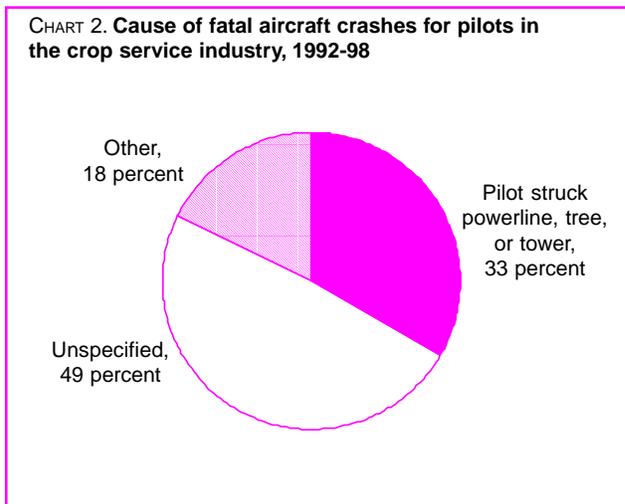
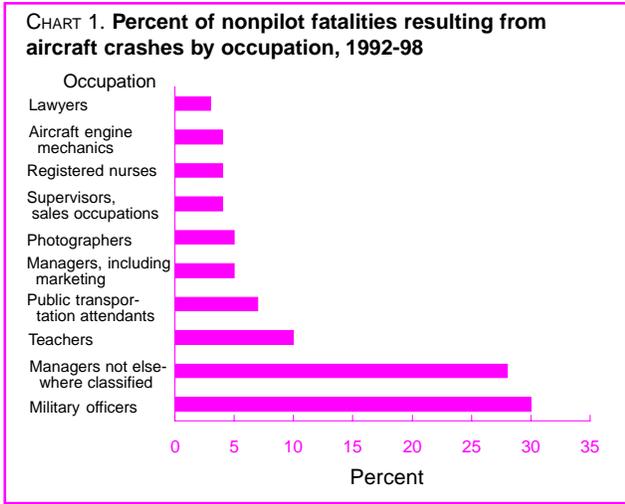
<sup>2</sup> Index of Relative Risk = Fatality rate for a given group / fatality rate for all workers.

NOTE: Employment figures are based on the 1998 Current Population Survey.

Maxim. Lilienthal, who died from injuries sustained in a crash of his experimental hang glider in 1896, once said, “Sacrifices must be made.”<sup>3</sup>

Research by these men contributed to the historic flight of the Wright brothers on December 17, 1903. Piloting the Kitty Hawk, Orville Wright traveled 120 feet in 12 seconds.

Peggy Suarez is an economist in the Division of Safety, Health, and Working Conditions, Bureau of Labor Statistics.  
Telephone: (202) 691-6175  
E-mail: Suarez\_P@bls.gov



According to the Wright brothers, although they had been interested in flying since youth, their interest was rekindled upon hearing about Lilienthal's death.<sup>4</sup>

After the Wright brothers' historic flight, it did not take long for aircraft to become sophisticated and commonplace. Only 21 years later, the first flight around the world was completed. In 1947, the first piloted supersonic airplane flight took place. Astronauts continue to break new aeronautic barriers. And, most recently, in 1999, a balloon traveled nonstop, nonrefueled around-the-world. However, all of this has come at a cost.

**More sacrifices**

The death of Lilienthal was not the only tragedy to befall early aviators. In 1785, two people were fatally injured in an attempt to cross the English Channel by balloon. In the years 1921, 1925, 1930, and 1933, dirigible crashes led to numerous fatalities. And, in 1937, the Hindenburg explosion left 36 dead.

Even the first airplane pilot, Orville Wright, was a victim of an aircraft injury. In 1908, he was severely injured in a plane crash while flying for the U.S. Army. His passenger, Lt. Thomas E. Selfridge, was killed. Selfridge, thus, became the first American worker to die on the job in an aircraft incident.

Other notable aircraft disasters included the death of Bessie Coleman, the first U.S. black female pilot in 1926; the disappearance of Amelia Earhart while she was attempting to fly around the world in 1937; and the explosion of the Challenger space shuttle in 1986.

**Importance of aviation**

The sacrifices made by these aviators were great; however, the return on mankind's investment has been tremendous. Whereas it took Magellan almost 3 years to travel around the world in a ship, today, by airplane, this can be done in hours. Moreover, aircraft are used for many diverse activi-

ties including transporting people, mail, and cargo; conducting research; entertaining; and fighting wars. Still, each year, people lose their lives in job-related aircraft incidents. From 1992 to 1998, 2,139 fatalities resulted from job-related aircraft incidents. (See table 2.) Of these 2,139 aircraft incidents, 853 occurred to pilots. The other victims (including teachers, attorneys, farmers, accountants, nurses, flight attendants, and armed forces personnel) were flying while in work status. (See chart 1.)

According to the Federal Aviation Administration, the leading cause of aviation incidents is an error in pilot decisionmaking. "Pilots were cited as either a cause or contributing factor in 77 percent of accidents and 83 percent in fatal accidents."<sup>5</sup>

**Aircraft pilots**

Since 1992, the first year that CFOI collected fatality data, the annual fatality rate for aircraft pilots has hovered around 80 deaths per 100,000 workers.<sup>6</sup> This number has consistently placed piloting among the 10 occupations with the highest fatality rates. The piloting occupation, however, spans many industries. Although most people immediately think of airline pilots, many other pilots fly for a living. Examples include agricultural pilots who work in the crop service industry, cargo pilots, helicopter pilots, balloonists,

**TABLE 2. Work-related fatalities resulting from aircraft crashes, 1992-98**

Year	Fatalities
1992-98 .....	2,139
1992 .....	350
1993 .....	281
1994 .....	424
1995 .....	282
1996 .....	320
1997 .....	259
1998 .....	223

TABLE 3. **Work-related fatalities resulting from aircraft crashes by selected industry, 1992-98**

Industry	SIC	Fatalities
Total .....		981
Crop planting and protecting .....	0721	91
Air transportation, scheduled .....	451	154
Air transportation, nonscheduled .....	452	249
Schools and educational services .....	8299	82
National security .....	9711	405

and even aerial hurricane hunters. All of these workers are classified under the occupational category aircraft pilots (pilots and navigators).

### Aircraft incidents by industry

Of the total 2,139 aircraft fatalities, almost half—981—occurred in the following industries: crop service, transportation by air, national security, and schools and educational services. (See table 3.) Closer examination of these industries reveals why.

**Crop service industry.** According to the National Agricultural Aviation Society, “Without crop protection products to control insects, weeds, and diseases, crop yields per acre would drop by more than 50 percent.”<sup>7</sup> The first aerial application of insecticide occurred in 1921, and was a huge success.<sup>8</sup> Today, aerial applicators do more than just protect; they also spread seed and apply fertilizer.

Unfortunately, the loss of life in this industry has been high. This can be attributed to the many dangers that agricultural pilots, or aerial applicators, face working in this industry. They fly at low levels with speeds in excess of 100 miles per hour. They must turn quickly and sometimes land on fields instead of runways. Flying at low altitudes, they face the possibility of crashing into power lines, trees, towers, and sometimes buildings and mountainsides.<sup>9</sup> Although most reports on crashes do not indicate the specific cause, in 33 percent of the crashes occurring in this industry, the pilot is reported to have struck a power line, tree, or tower. (See chart 2.)

In response to the dangers and the fatalities involved with crop dusting, many aerial applicators have chosen to participate in either the Professional Aerial Application Support System developed by the National Agricultural Aeronautics Association or the Operation SAFE (Self-regulating Application and Flight Efficiency) program. Both of these programs require that participants’ aviation skills be evaluated regularly.

Although 4 percent of fatalities resulting from aircraft crashes occurred to those individuals who worked in the crop service industry, crop service industry workers accounted for 10 percent of the fatalities that occurred to pilots. That is, of the 853 pilots that were fatally injured in aircraft crashes during the 1992-98 period, 84 worked in crop dusting. The crop service industry may be a key contributor to the fact

TABLE 4. **Work-related fatalities resulting from aircraft crashes in the nonscheduled air transportation industry by State, 1992-98**

State	Fatalities	Percent
Alaska .....	47	19
California .....	32	13
Texas .....	17	7
Florida .....	13	5
Washington .....	10	4
All other .....	130	52

that pilots have a higher fatality rate than other occupations.

**Air transportation industry.** Almost 24 percent of workers who died in aircraft crashes worked in the air transportation industry. However, it is important to note that the industry encompasses far more than major airline carriers; it is divided into scheduled air transportation and nonscheduled air transportation. The scheduled air transportation industry includes establishments primarily engaged in furnishing air transportation over regular routes and on regular schedules. The nonscheduled air transportation industry includes establishments primarily engaged in furnishing airplane sightseeing services, air taxi services, and helicopter passenger transportation services to, from, or between local airports, whether or not scheduled. Both scheduled and nonscheduled air transportation industries include establishments that transport air cargo as well as passengers.

More worker fatalities occurred in the nonscheduled air transportation industry (249) than in the scheduled air transportation industry (175). Fatalities in the nonscheduled air transportation industry were most likely to occur in the following States: Alaska, California, Texas, Florida, and Washington. (See table 4.) Because of the great amount of tourism in these States and their geographic expanse, this distribution might be expected.

However, the extraordinarily high number of fatalities occurring in Alaska is noteworthy. Pilot inexperience may be one reason for this occurrence.<sup>10</sup> Other reasons may include poor weather and less advanced landing fields.

**Armed forces.** The national security industry encompasses “establishments of the armed forces, including the National Guard, primarily engaged in national security and related activities.”<sup>11</sup> Military training schools are also included in this industry. The nature of the work in the industry is likely to be the primary cause of these fatalities. Fatalities occurring in this industry during times of war come at no surprise; but, even in peace, workers participate in dangerous activities. Pilots fly in dangerous maneuvers and tight formations and engage in difficult training missions. Parachutes<sup>12</sup> sometimes fail to open. Other crashes occur for reasons similar to those in other industries. During the 1992-98 period, helicopters were more likely to crash than jets. (See table 5.) The fatalities in this industry occur primarily to young men.

TABLE 5. **Work-related fatalities resulting from aircraft crashes in the national security industry by aircraft, 1992-98**

Aircraft	Fatalities
Powered fixed wing .....	209
Jet .....	129
Propeller-driven .....	40
Rotary wing .....	183
Helicopter .....	173
Nonpowered .....	6
Parachute .....	6

In fact, 97 percent of these fatalities occurred to men; and 75 percent occurred to men aged 35 or younger.

**Schools and educational services.** The fatal injuries that occurred to workers in this industry make up another 4 per-

cent of all aircraft crash fatalities. The majority of these fatalities involved workers employed as pilot instructors, who teach students all aspects of flying, including spin recoveries and other dangerous maneuvers. They usually worked out of smaller airfields and flew smaller planes. In 65 percent of the cases, the instructor was reported to have been flying the aircraft at the time of the crash.

### Conclusion

Of the occupational fatalities that occurred in the United States from 1992-98, almost 5 percent (2,139) resulted from aircraft crashes. Though this number may be alarming, it is a fraction of the 18,000 fatalities that resulted from all transportation incidents. These figures represent the cost in lives that comes with transporting people and goods.

<sup>1</sup> The CFOI program, which has collected occupational fatality data since 1992, uses diverse data sources to identify, verify, and profile fatal work injuries. Information about each workplace fatality (industry and other worker characteristics, equipment involved, and circumstances of the event) is obtained by cross-referencing source documents such as death certificates, workers' compensation records, and reports to Federal and State agencies. This method assures that counts are as complete and accurate as possible.

<sup>2</sup> The occupation entitled "pilots and navigators" encompasses a broad range of workers, including fishspotters, helicopter pilots, cargo pilots, balloonists, and skydivers. For a full list of workers included, see the 1990 Occupational Classification System published by the U.S. Census Bureau.

<sup>3</sup> Otto Liliethal, "Practical Experiments for the Development of Human Flight," *The Aeronautical Annual*, 1896, pp. 7-20, on the Internet at <http://www.wam.umd.edu/~stwright/WrBr/Lilienthal.html> (visited Feb. 1, 2000).

<sup>4</sup> Orville and Wilbur Wright, "The Wright Brothers Aeroplane," *Century Magazine*, September 1908, on the Internet at <http://www.wam.umd.edu/~stwright/WrBr/Century.html> (visited Feb. 22, 2000).

<sup>5</sup> See "General Aviation," *Safer Skies - A Focused Agenda* (Federal Aviation Administration, 1998) on the Internet at <http://www.faa.gov> (visited Feb. 8, 2000).

<sup>6</sup> Fatal work injury rates included in this article were calculated using annual average employment from the Current Population Survey (CPS).

Rate = (N/W) X 100,000 workers, where:

N = number of civilian worker fatalities, age 15 and older and

W = annual average number of employed civilians, age 15 and older

Because the CFOI program does not collect employment data, annual average employment estimates from the CPS for 1998 were used in the denominator. The CPS employment data used to calculate rates are estimates based upon a sample of persons employed rather than a complete count. Therefore, the CPS estimates and fatality rates have sampling errors, that is, they may differ from figures that would have been obtained if it had been possible to take a complete census of employed persons. See "Explanatory Notes and Estimates of Error" in any BLS monthly *Employment and Earnings* bulletin for an explanation of CPS sampling and estimation methodology, and standard error computations. The relative standard errors of the CPS employment estimates can be used to approximate confidence ranges for the fatality rates.

<sup>7</sup> "Why? Because..." National Agricultural Aviation Association, 1998-99, on the Internet at <http://www.aviation-ag.com/why.html> (visited Feb. 8, 2000).

<sup>8</sup> "Ag Aviation History," National Agricultural Aviation Association, 1998-99, on the Internet at <http://www.aviation-ag.com/history.html> (visited Feb. 9, 2000).

<sup>9</sup> Dean H. Chamberlain, "The Hazards of Low Altitude and Off-Airport Flight Operations" (Federal Aviation Administration) on the Internet at <http://www.faa.gov/avr/new/fliops.htm> (visited Feb. 8, 2000).

<sup>10</sup> See "Fatalities by Accident Type 1992-97, Alaska and U.S.," *Alaska Economic Trends*, November 1998, pp.12-16.

<sup>11</sup> Office of Management and Budget, *Standard Industrial Classification Manual 1987* (Government Printing Office, Washington, 1987), p. 419.

<sup>12</sup> Under the CFOI Occupational Injury and Illness Classification System, aircraft incidents include parachuting incidents.