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Safety Study of Wire Strike Devices Installed on Civil and Military Helicopters

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LIST OF ACRONYMS

AGL	Above ground level
CFR	Code of Federal Regulations
EADS	European Aeronautics and Space Company
EGPWS	Enhanced Ground Proximity Warning System
FAA	Federal Aviation Administration
GPS	Global positioning system
HAI	Helicopter Association International
HELLAS	Dornier's Helicopter Laser Radar
IFR	Instrument flight rules
IKAR	International Commission for Alpine Rescue
LOAS	Laser Obstacle Awareness System
MD	McDonnell Douglas
MOWAT	Marking of Wires and Towers
NTSB	National Transportation Safety Board
OASys	Obstacle Awareness System
OCAS	Obstacle Collision Avoidance System
PTS	Practical Test Standards
UHF	Ultra high frequency
U.S.	United States
Vac	Volts alternating current
Vdc	Volts direct current
VFR	Visual flight rules
VHF	Very high frequency
WSPS	Wire strike protection system

EXECUTIVE SUMMARY

Wire strike accidents involving United States military and civil helicopters for the period 1994-2004 were analyzed using military and the National Transportation Safety Board safety databases.

The objective of the research was to conduct a study on wire strike accidents of civil and military helicopters between 1994 and 2004 to establish trends, assess the potential of existing technology for reducing wire strike accidents, and to recommend solutions that could substantially reduce the number of wire strike accidents.

Trends in accidents were established for both military and civil wire strike accidents. The age group and experience profiles of the pilots involved in civil helicopter wire strike accidents were found to be similar to those found in an earlier study. Devices available for warning pilots about the proximity of wires are described and their relative merits assessed. Recommendations were then made for reducing the number of helicopter wire strike accidents.

1. INTRODUCTION.

1.1 PURPOSE.

The wire strike accident rate to United States (U.S.) civil helicopters accounted for approximately 5% of all accidents from about 1963 to the present. In spite of the excellent reports on the effectiveness of wire cutters in U.S. Army helicopters, no detailed study has been carried out on these accidents and the potential of the currently available devices to reduce the accidents.

The objective of the research was to conduct a study on wire strike accidents of civil and military helicopters between 1994 and 2004 to

- establish trends similar to the ones presented in references 1 and 2.
- assess the potential of existing and evolving technology for reducing wire strike accidents.
- recommend solutions that could substantially reduce the number of wire strike accidents.

1.2 BACKGROUND.

Helicopter wire strikes have been a matter of concern for both civil and military helicopters. Devices to protect the occupants in case of wire strikes have been available for some years. Systems that warn the pilots on the proximity of wires have also been developed. In spite of these developments, wire strikes continue to account for about 5% of all civil and military helicopter accidents.

Tuomela and Brennan [1 and 2] analyzed the National Transportation Safety Board (NTSB) and Federal Aviation Administration (FAA) reports of 208 civil helicopter wire strike accidents for a 10-year period (1970-1979). In these accidents, 37 people lost their lives, 52 people suffered serious injury, 88 aircraft (42%) were destroyed, and 120 aircraft (58%) were damaged substantially. They concluded that some form of pilot warning device would have been beneficial in 76% of the accidents, and that wire cutters would have been effective in 49% of the accidents examined. In addition, pilot training would have been effective in 56% of the accidents. They recommended that pilot training, installation of wire cutters, use of a device to warn the pilot of wires in the flight path, and provisions to protect the main and tail rotor blades from damage due to wire strikes would be beneficial.

Hart [3] reported that wire strikes constituted about 5% of the 1852 civil helicopter accidents between 1986 and 1996. Harris [4] summarized the results of the analysis of accidents from 1996 through 2000 of the U.S.-registered helicopters. Of the 934 accidents, 50 accidents (5.45%) were classified as wire strike accidents. The data showed that in every wire strike accident, the helicopter was either damaged substantially (66%, 33 accidents) or destroyed (34%, 17 accidents). Fifteen (30%) of the accidents resulted in at least one fatality, and nine accidents (18%) resulted in serious injuries.

At the meeting of the International Commission for Alpine Rescue (IKAR) [5], the members noted the seriousness of wire strike accidents and proposed the following recommendation:

REC A 0010 - Cable Detection - Recommendation 3/2000: “In order to improve helicopter flight safety, IKAR strongly recommends that the helicopter industry adopts as a standard the implementation of active cable detection systems combined with heads-up warning devices on all helicopters.”

An analysis of military helicopter accidents conducted as part of the study shows that, similar to accidents of civil helicopters, wire strikes constitute about 5% of the total accidents.

Studies show that wire strikes continue to be a matter of concern because helicopters need to operate at low altitudes, wires are difficult to observe, and the background combined with sunlight can obscure wires. Also, not all helicopters can be equipped with wire cutters, and some of the recently developed devices that warn a pilot of potential wire strikes are very expensive.

In this study, an analysis has been made of both civil and military accidents involving helicopter wire strikes for the period 1994 through 2004. The analysis brings out the factors that are common to the majority of wire strike accidents and also some common features between civil and military wire strike accidents. Devices that warn the pilots about the proximity of wires as well as wire cutters are described, and their potential for reducing the number of wire strike accidents is assessed.

1.3 RELATED ACTIVITIES AND DOCUMENTS.

The following documents relate directly to the issues addressed herein and document the summary of wire strike accidents, as well as recommendations made to prevent future accidents:

- Veillette, Patrick R., “Most Fatal U.S. Commercial Accidents Occur in Instrument Meteorological Conditions,” *Flight Safety Digest* of the Flight Safety Foundation, January 2003, pp. 1-56.
- Australian Transport Safety Bureau, “Light Utility Helicopter Safety in Australia,” *Research paper BE04/73*, June 2004, (Web page: www.atsb.gov.au).
- Anon., “REC A 0010 – Cable Detection, Rec 3/2000,” <http://www.ikar-cisa.org>.

Harris, et al. [4] studied civil helicopter accidents that occurred between mid-1963 and 1997 and found that wire strikes were most frequent in single-piston engine helicopters (9.4% of all accidents of this type). Wire strikes contributed to 5.9% of all accidents of single-turbine engine helicopters and 5.4% of the total of homebuilt and amateur helicopters. Wire strikes contributed to 4.3% of all accidents in twin-turbine helicopters. They recommend discouraging flights below 750 feet above ground level (AGL), marking all man-made objects higher than 500 feet and developing a low-cast proximity spherical sensor to provide the pilot with sufficient warning to avoid obstacles.

The study of Tuomela and Brennan was devoted to civil helicopter wire strikes between 1970 and 1979. They found that helicopters flying agricultural missions were involved in 48% of all wire strike accidents. They noted that 83% of the accidents occurred with clear skies and unlimited visibility. They recommended installation of mechanical wire cutters, development of wire detection/pilot warning devices, and adoption of wire-avoiding flight procedures by all helicopter pilots.

For the period between 1986 and 1996, Hart [3] reported that wire strikes constituted 5% of all civil helicopter accidents. Harris [5] found that wire strikes constituted 5.45% of all accidents in the period 1996 through 2000. He also noted the clear skies and unlimited visibility conditions during most of the wire strikes.

In addition to wire cutters and wire markers, a number of products that give warning of wire proximity are either available or being developed. These are described in references 5-7. The Australian Transport Safety Bureau found that wire strikes constituted about 15% of all accidents to light utility helicopters operating in Australia. The legal viewpoint on wire marking has been given by Wimsatt [8] who recommends installation of markers on wires. The IKAR has made a recommendation for the installation of active cable detection systems combined with heads-up warning devices on helicopters.

A joint work group consisting of experts from the HAI, FAA, IEEE, and the aviation and utilities industries has made specific recommendations for modification of Title 14 Code of Federal Regulations (CFR) Part 77 and to Practical Test Standards (PTS). Implementation of these changes would enhance the marking of obstructions and contribute to pilot awareness of wire hazards.

The effectiveness of wire cutters in U.S. Army helicopters was noted by Walker and White [7]. However, there does not appear to be a detailed study on wire strike accidents to military helicopters.

2. DISCUSSION.

Evaluation tasks accomplished within the framework of this effort included the summary of accidents involving U.S. military and civil helicopters, findings of the Wire Strike Warning and Protection Systems, findings based on human factors/pilot training, and recommendations for preventing wire strikes. The findings for each task are described below.

Summary of accidents involving U.S. military helicopters:

- During the period from 1994-2003, U.S. Army helicopters have been involved in 1160 accidents (Class A to C) of which 34 have been wire strikes. Over these 10 years, Class A-C wire strike accidents are 2.9% of the total.
- There have been 147 fatalities in helicopter accidents of which 7 have been in wire strike accidents. The cost of Class A-C accidents during this period was \$1483 million and the cost of wire strike accidents (Class A-C) was \$87.5 million.

- From 1998 to 2004, the number of wire strike accidents was between 3 and 5 per year.
- There has been a noticeable decrease in the number of wire strike accidents after 1990 when all military helicopters were equipped with Wire Strike Protection Systems (WSPS).
- There have been no fatalities in wire strike accidents between 1996 and 2002.

Summary of accidents involving U.S. civil helicopters:

- The total number of accidents to civil helicopters shows an increasing trend from 1996 onwards. There were 212 accidents involving 67 fatalities in the year 2003.
- The number of accidents per 100,000 flight hours also shows an increasing trend from 1996 onwards. There were 10 accidents per 100,000 flight hours in the year 2003.
- In the year 2003, the number of accidents for fixed-wing aircraft was slightly above 0.3 accidents per 100,000 hours. Thus, the rate of accidents per 100,000 hours for fixed-wing aircraft is about 3% of the accident rate for helicopters.
- Helicopters conducting general aviation operations were involved in 70% to 80% of all the civil helicopter accidents. Helicopters involved in aerial application operations accounted for 10% of all the accidents.
- Between the years 1994 and 2004, there were 124 wire strike accidents in which 41 were fatal accidents. These accidents resulted in 65 fatalities, 45 serious injuries, and 42 minor injuries. The average age of the pilots involved in the wire strike accidents was 43.5 years, and the average rotorcraft flying experience of the pilots was about 4000 hours.
- There was a 40% decrease in the number of wire strike accidents during the period 1994-2003 compared to the period from 1970-1979. However, there was an increase of 76% in the number of fatalities, whereas the number of serious injuries decreased by 13% between 1994 and 2003.
- There were 1.24 fatalities and injuries per wire strike during 1994-2003 compared to 0.84 fatalities and injuries during 1970-1979.
- For the period 1994-2004, general aviation operations accounted for approximately 60% of all the wire strike accidents, while agricultural operations accounted for approximately 27% of the accidents. Other operations accounted for 13% of the accidents. (During the period 1970-1979, general aviation operations accounted for 42% of the wire strike accidents, while agricultural operations accounted for about 48% of all wire strike accidents.)
- The wire strike percentage of accidents in general aviation operations has been increasing since about 1998.

- The Bell 47 helicopter and its variants account for about 20% of all the wire strike accidents, while wire strike accidents of the Bell 206 and its variants account for 18.6% of the wire strikes. The Robinson R22 helicopter (including three R-44 models) accounts for another 15.3% of the total wire strike accidents.
- Bell 206 models were involved in nearly 26% of the fatal wire strikes and Robinson R22 models were involved in about 21% of the fatal accidents. The MD 369 and Bell 47 models accounted for 14% and 12% of the fatal accidents, respectively.
- Of the 124 helicopters involved in wire strike accidents, Wire Strike Protection kits could potentially have been fitted on 32 helicopters (25.8%). Thus, nearly 74% of the helicopters involved in the wire strikes could not have been fitted with wire cutters.
- The NTSB determined that the probable causes for most of the accidents are one or more of the following reasons: inadequate visual lookout (38 accidents), failure to maintain sufficient clearance with the obstacle (59 accidents), failure to maintain proper altitude (9 accidents). Other reasons (for 19 accidents) include improper judgment (e.g., decision to continue flying visual flight rules (VFR) under instrument flight rule (IFR) conditions), inadequate preflight planning, failure to see and avoid wires, intentional buzzing (low altitude flight), and selection of unsuitable area for landing.
- Thirty-seven (86%) of the fatal wire strike accidents occurred in day visual meteorological conditions. Two accidents occurred in day instrument flying conditions and two occurred in night instrument flying conditions.
- The majority of fatal wire strike accidents involve pilots who were between 40 and 59 years old and had more than 2000 hours of flight experience.
- Seventy-eight percent of the pilots involved in the fatal wire strike accidents were over 40 years.
- Fifty-six percent of the pilots had over 2000 hours of rotorcraft flight experience.
- The average age of the pilots involved in fatal wire strike accidents was 47.3 years, and the average flight experience was about 3575 hours.
- Helicopters operating under 14 CFR Part 91 (general aviation) account for 65% of all fatal accidents. Agricultural operations (14 CFR Part 137) and rotorcraft external load (14 CFR Part 133) account for 14% and 12% of the fatalities, respectively.

Summary of the findings of the wire strike warning and protection systems:

- The WSPS is most effective when the helicopter impacts the wires nearly perpendicular to the wires in a level attitude and at flight speeds of more than 30 knots.
- The WSPS is available for about 25% of the helicopters.

- The Powerline Detector system (Safe Flight Instrumentation Corporation) senses the electromagnetic fields surrounding power lines. This detector only senses active power lines and the range of detection depends on the electrical power in the lines. The system will not detect other types of wires such as guy wires, telephone lines, and nonactive power lines. Further, the pilot is not alerted to the direction of the power lines with reference to the aircraft.
- Devices that use lasers or radar to scan the surroundings for the presence of obstructions are Obstacle Awareness System (OASys) (Amphitech System), Laser Obstacle Awareness System (LOAS) (Goodrich Sensor System), and Dornier's Helicopter Laser Radar (HELLAS) (European Aeronautics and Space Company (EADS) Dornier). They are comparatively heavy (between 35 and 60 lb) and expensive (more than \$100,000). Thus, they are too heavy and quite expensive for most civil helicopters.
- Honeywell Enhanced Ground Proximity Warning System (EGPWS) can warn pilots about obstacles that are over 30 ft AGL using a global positioning system (GPS) and the database maintained by Honeywell Aerospace. The EGPWS weighs about 4 lb but costs about \$45,000, which makes the system too expensive for most civil helicopters.
- Developing less expensive devices that can be fitted to light helicopters, such as the Robinson R22, can be helpful to about 75% of the helicopters.
- Spherical markers mounted on wires will help to make the wires more visible and reduce wire strikes. The Marking of Wires and Towers (MOWAT) Work Group [9] recognized the importance of wire markers in preventing wire strikes.
- The Obstacle Collision Avoidance System (OCAS) consists of units located on utility and power line towers and detects all air traffic entering a predefined warning zone and activates warning lights that illuminate the tower. The fact that the OCAS does not require any installations in the helicopters can make it attractive to helicopter operators. It is also attractive to utilities in spite of its cost (\$50,000 per installation). However, the lights on the utility towers can normally be turned off. The OCAS is presently being evaluated by the FAA and has potential to prevent wire strikes.
- The MOWAT Work Group [9] recognized the importance of training in preventing wire strikes and has made a recommendation to the FAA. This is a modification to the PTS that an applicant should be aware of low-level hazards and be knowledgeable in the recognition of wires, towers, and other low-level hazards.

Summary of findings based on human factors/pilot training:

Most of the helicopter wire strikes occur in daytime in conditions of good visibility and involve experienced pilots. These factors have been considered by specialists, who recommend reviewing aeronautical charts and conducting a reconnaissance flight at a higher altitude, before conducting low-altitude operations. Pilots need to be exposed to techniques of recognizing different types of wires, including powered and guy wires, and to anticipate their location. They

need to identify the power grid system and determine wire direction from the orientation of the insulating connectors on various towers.

Summary of recommendations for preventing wire strikes:

- All helicopter pilots flying 14 CFR Part 91 (general aviation) should avoid cruising below 750 ft when the mission does not require it.
- Encourage pilots to review aeronautical charts and to conduct reconnaissance flights at a higher altitude, before conducting low-altitude operations.
- Develop less expensive wire proximity warning devices that can be fitted to light helicopters such as the Robinson R22. These can be of help to about 75% of the helicopters involved in wire strikes.
- Wherever feasible, install mechanical wire cutters on helicopters.
- Implement the MOWAT Work Group recommendations on wire marking and pilot training. (Under consideration by the FAA in 2004.)
- Conduct human factors studies to develop an understanding of the factors involved in wire identification and avoidance by pilots working in the cockpit environment.

3. EVALUATION APPROACH.

3.1 MILITARY HELICOPTER WIRE STRIKE ACCIDENTS.

3.1.1 Analysis Methodology.

Data on military helicopter accidents are available at the U.S. Army Safety Center website [10] (<http://safety.army.mil>). In addition, *Flightfax*, the monthly publication of the U.S. Army Safety Center provides briefs on army helicopter accidents. *Flightfax* also contains papers on safety-related issues.

The U.S. Army classifies accidents into the following classes:

- Class A: Damage costs of \$1,000,000 or more and/or destruction of an Army aircraft, missile or spacecraft, and/or fatality or permanent total disability.
- Class B: Damage costs of \$200,000 or more, but less than \$1,000,000 and/or permanent partial disability and/or three or more people are hospitalized as inpatients.
- Class C: Damage costs of \$20,000 or more, but less than \$200,000 and/or nonfatal injury resulting in loss of time from work beyond day/shift when injury occurred and/or nonfatal illness/disability causes loss of time from work.

- Class D: Damage costs are less than \$20,000.
- Class E: No damage costs.

3.1.2 Analysis of Accidents.

Data on all the helicopter accidents in the U.S. Army (Class A-E) for the period 1994 through 2004 (September) are presented in appendix A. This appendix also contains data on wire strike accidents related to U.S. Army helicopters.

The number of helicopter accidents in Class A-D and their cost for each year from 1994-2003 are given in table 1, which also gives similar data for the accidents due to wire strike. The total cost due to all accidents in this period was \$1483 million, and the cost of wire strike accidents was about \$94 million. During the period from 1994-2003, U.S. Army helicopters were involved in 1160 accidents (Class A-C), in which 34 were wire strikes. Over these 10 years, Class A-C wire strike accidents constituted 2.9% of the total number.

Table 1. U.S. Army Accidents (Class A-D)

Year	Total Number	Cost of All Accidents	Wire Strikes	Cost of Wire Strikes
1994	225	\$110,023,167	9	\$16,964,728
1995	199	\$78,492,980	7	\$10,623,388
1996	191	\$130,372,509	2	\$14,488
1997	153	\$48,429,545	4	\$2,064,623
1998	152	\$111,381,217	5	\$13,987,143
1999	175	\$126,143,508	5	\$92,036
2000	143	\$44,041,440	5	\$1,047,801
2001	141	\$64,492,515	5	\$564,333
2002	190	\$328,139,151	4	\$37,019,345
2003	176	\$296,297,344	6	\$4,316,490

There have been 147 fatalities in helicopter accidents, in which 7 were wire strike accidents. The cost of Class A-C accidents during this period was \$1483 million, and the cost of wire strike accidents (Class A-C) was \$87.5 million.

Figure 1 shows the total number of helicopter accidents in each year from 1994 through 2004. The number for 2003 is high due to the accidents that occurred in Kuwait and Iraq since the beginning of Operation Iraqi Freedom. The accidents and the number of fatalities show an increasing trend after the year 2000.

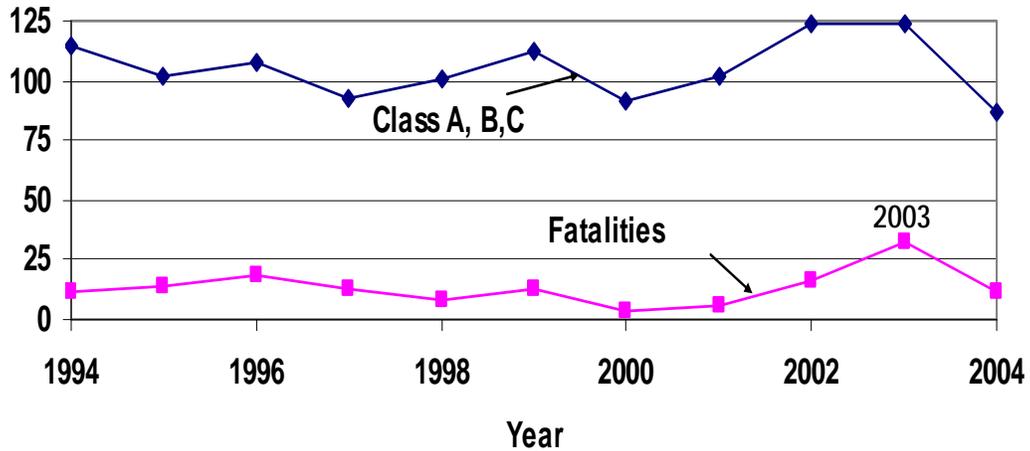


Figure 1. Total Number of U.S. Army Helicopter Accidents and Fatalities (1994-2004)

Figure 2 shows the yearly number of wire strike accidents. Between 1997 and 2002, the number of wire strike accidents was between two and five per year. Figure 2 also shows the number of fatalities in wire strike accidents. After 1995, there were no fatalities in accidents involving wire strikes, even though the number of wire strikes did not decrease. There were two fatalities in 2003 that involved an AH-64A model that was conducting a night reconnaissance and surveillance mission using night vision systems. One reason for this impressive safety record can be the installation of wire cutters (WSPS) on Army helicopters.

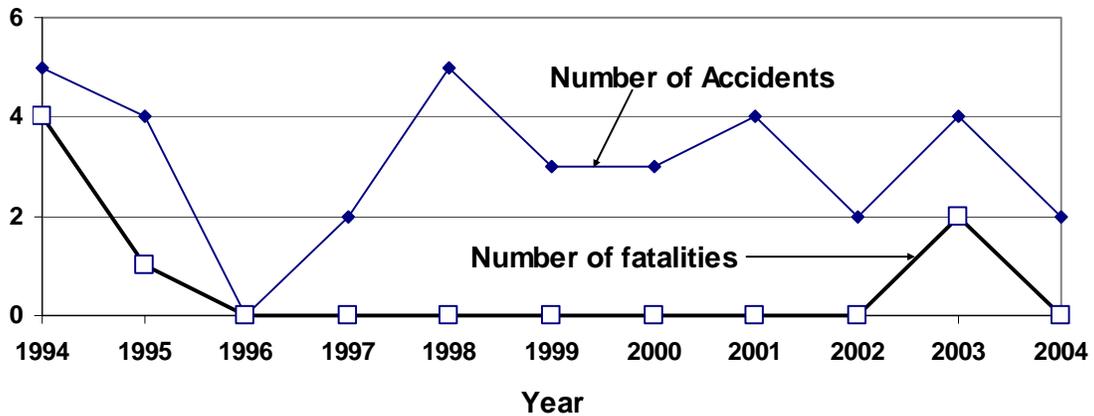


Figure 2. U.S. Army Helicopter Wire Strike Accidents and Fatalities

Figure 3 shows wire strike accidents as a percentage of the total number of accidents. There has been a continuous decrease in the wire strike accidents from about 1998. Wire strikes only constituted about 2% and 3% of all the helicopter-related accidents during the last 3 years (2002-2004). This rate is better than the corresponding rate for civil helicopters (between 4% and 5%).

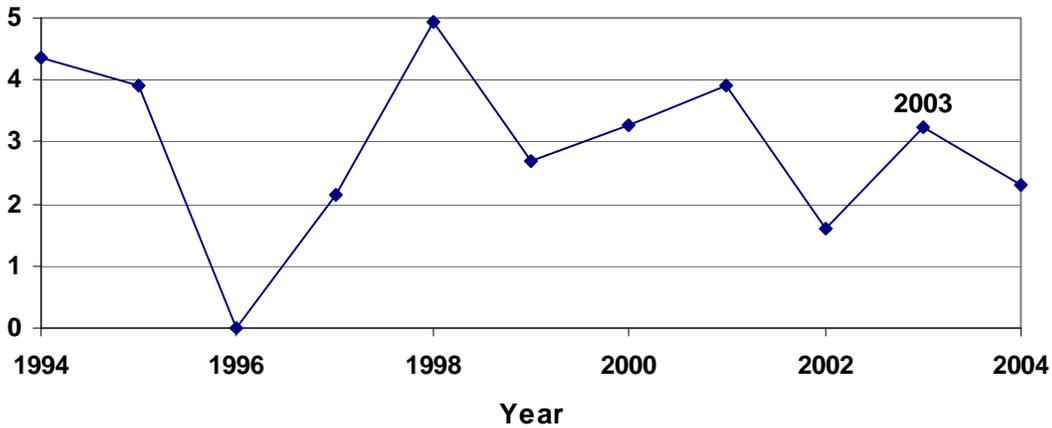


Figure 3. U.S. Army Helicopter Wire Strike Accidents as Percentage of Total Accidents

Figure 4 gives the cost incurred by the Army due to wire strike accidents. These include the cost of the damage and the costs due to injury to military personnel. There is a decrease in the costs after 1998 and is generally less than \$2 million per year. This reduction in costs is a direct result of the reduction in the number of Class A accidents.

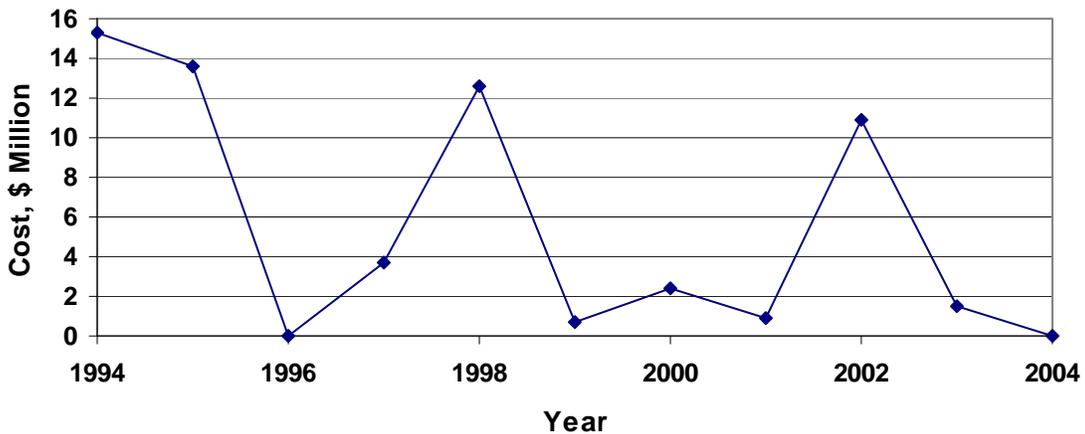


Figure 4. Yearly Costs of U.S. Army Helicopter Wire Strike Accidents

3.1.3 Narrative Description of Wire Strike Accidents From 2002-2003.

3.1.3.1 June 2002.

This Class A accident involved an OH-58 D-R model. “Aircraft reportedly contacted wires during training flight and landed hard on a major thoroughfare, coming to rest on its side (rolled 90 degrees). Crew members were able to egress unassisted and notified the local Chain of Command. Damage initially assessed as Class B. Pending further Estimated Cost of Damage, potential exists for Class A damage to the airframe.”

3.1.3.2 July 2002.

This Class D accident involved a UH-60 L model. “While in flight heading 180 degrees, 100 KIAS, 125 ft AGL, the UH-60L aircraft cut through three sets of electrical wires. The aircraft still had controllability and no visual damage (while in flight); therefore, flight was continued to an approved helicopter landing zone to the west of the wire strike location.”

3.1.3.3 August 2002.

This Class A accident involved an OH-58 D-R model. “While conducting a counter-drug mission, aircraft developed a vibration and made a landing. Crew inspected the damage and noted no damage. Crew spotted fire in the adjacent valley and decided to depart the area. Following take-off, the crew observed a downed power line. Aircraft was flown four miles to sheriff station without incident and shut down. Post flight inspection revealed damage to main rotor system from a wire strike. Property damage to be determined. Estimated cost of damage: \$50,000 to aircraft; property: To be determined.”

3.1.3.4 November 2002.

This Class C accident involved an OH-58 D-R model. “Flight of two was conducting NVG operations vicinity enter/exit point of terrain flight training area when chalk #2 noticed that they were in the wrong ravine. Chalk #2 began to scan the ridgelines when he detected power line poles. As he began to transmit this info to the lead aircraft, Chalk #1 struck three power lines. Aircraft landed without further incident. Damage includes a scratched windscreen and a voided MRB.”

3.1.3.5 January 2003.

This Class B accident involved an AH-64 A model. “Crew was on an approved low level multi-ship screening mission. The aircraft struck a small set of wires that were not marked on the map causing damage to one main rotor blade, two broken antennas, as well as damage to the ALQ144 and possible arcing on one wing.”

3.1.3.6 March 2003.

This Class C accident involved a UH-60 L model. “Aircraft contacted wires during an ATM training flight. The WSPS functioned as designed and severed all three wires. The aircraft sustained damage to the ALQ144 and the tail wheel strut area. (The wires were reportedly not depicted on the published hazard map).”

3.1.3.7 August 2003.

This Class A accident involved an AH-64 A model. “While conducting a night recon and surveillance mission using night vision systems, a flight of two aircraft departed a named area of interest (NAI) en route to another NAI in a loose, staggered right formation. As the flight maneuvered between two hilltops, Chalk 1 struck a series of four mining cables. Both pilots were killed by the impacts and the aircraft was completely destroyed by a post-crash fire.”

3.1.3.8 October 2003.

This Class A accident involved a UH-060 L model. “While conducting night vision goggle terrain flight, the aircraft descended to a sandbar to conduct hoist training when the aircraft struck two cables suspended across the river. After contacting the cables, the aircraft descended aft and impacted the stabilator in the riverbed. The aircraft subsequently rolled left and settled on its left side in the river. No personnel were injured in the accident.”

3.1.4 Analysis of Wire Strike Protection System Use in U.S. Army Helicopters.

The U.S. Army has installed WSPS on all of its helicopters. Data collected from the distributor of WSPS, Aeroproducts Inc., Tempe, Arizona, show that most of the U.S. Army fleet of OH-58, UH-1, OH-6, AH-1, and UH-60 Black Hawk helicopters were retrofitted before 1988. The last major shipment of retrofit kits was made in 1988 for AH-64 Apache helicopters. All AH-64 Apache WSPS installations were to be completed by October 12, 1992. Therefore, all military helicopters would have had a WSPS system installed by the end of 1992.

By examining the number of wire strike accidents and resulting fatalities occurring before and after the years in which WSPS units were installed, a picture of the effectiveness of the system emerges. Figure 5 shows the annual number of Army wire strike accidents (Class A-D) and the fatalities in these accidents from 1980 to 2003.

Figure 5 shows that the annual number of wire strike accidents decreased after 1990. Between 1980 and 1990, the number of wire strikes varied between 8 and 20 accidents per year. After 1990, the number of accidents was reduced to below 10 per year, stabilizing at 5 per year. The reduction in accidents can be attributed to the improved awareness of the pilots to wire strike possibilities after WSPS was installed. The number of fatalities in these accidents shows a dramatic decrease after 1994. Between 1996 and 2002, there were no fatalities. However, because the database does not contain narrative details of all the accidents, it is not possible to ascribe these reductions solely to the installation of WSPS.

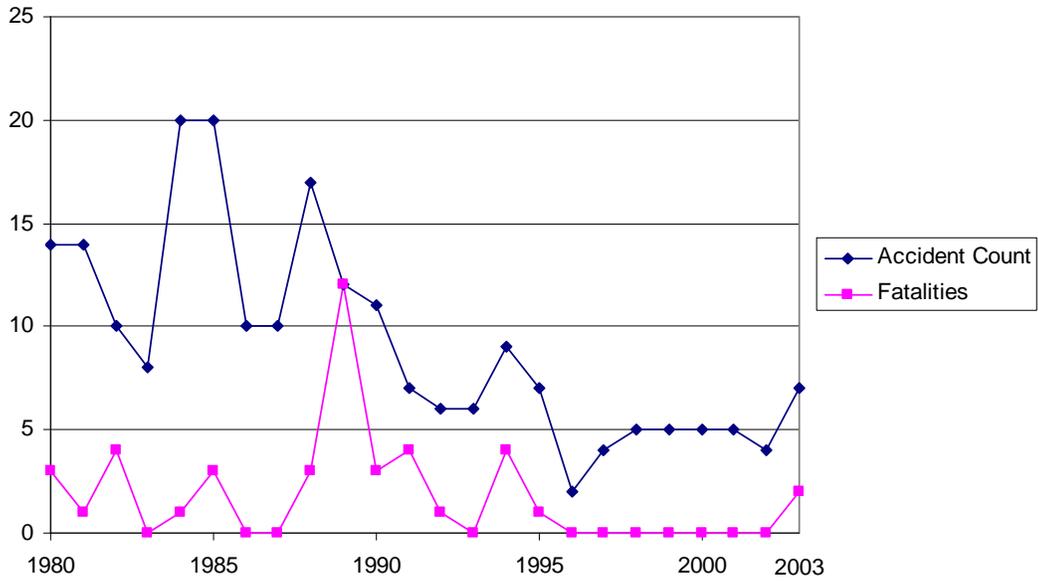


Figure 5. U.S. Army Wire Strike Accidents 1980-2003

To determine whether the WSPS prevents the more serious accidents in a similar manner, the accidents in Classes A-C were examined over the same time span. The results are shown in figure 6.

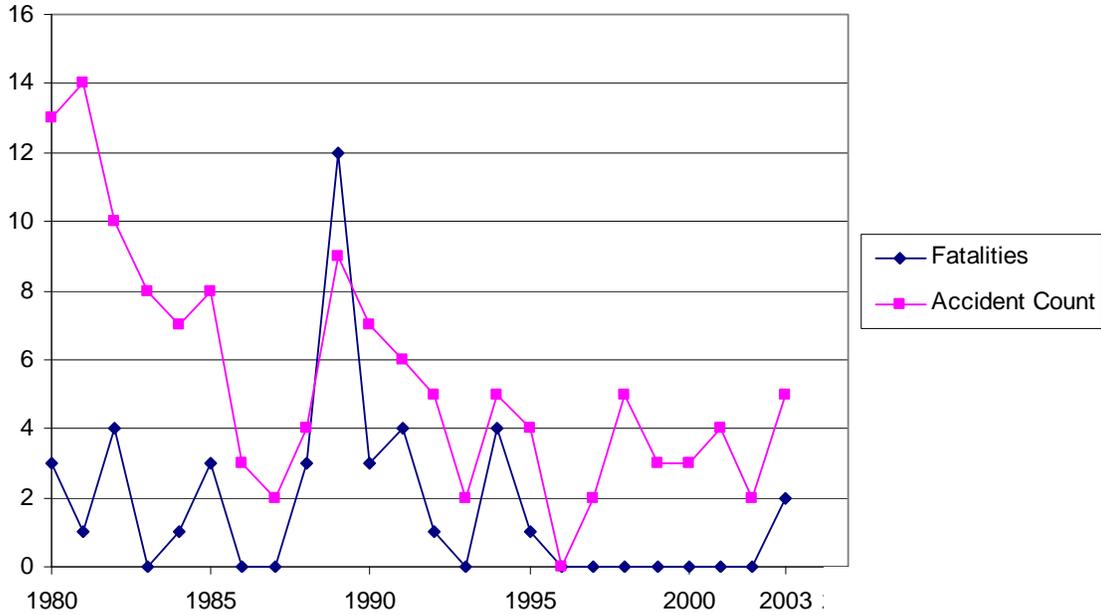


Figure 6. U.S. Army Wire Strike Accidents, Class A-C

Figure 6 shows that there is a significant drop in the annual number of accidents after 1990. This reinforces the conclusion that the reduction in number of wire strikes and the elimination of fatalities in these accidents occurred after the installation of WSPS.

3.1.5 Summary of Military Helicopter Wire Strike Accidents.

From the data and analysis presented in this section, the following points can be highlighted:

- During the period 1994-2003, U.S. Army helicopters were involved in 1160 accidents (Class A-C), in which 34 were attributed to wire strikes. Over these 10 years, Class A-C wire strike accidents constituted a 2.9% of the total accidents.
- There were 147 fatalities in helicopter accidents, in which 7 were attributed to wire strike accidents. During this period, the cost of Class A-C accidents was \$1483 million, whereas the cost of wire strike accidents (Class A-C) was \$87.5 million.
- Since 1998, the number of wire strike accidents were between three and five per year.
- There was a noticeable decrease in the number of wire strike accidents after 1990 when all military helicopters were equipped with WSPS.
- There were no fatalities in wire strike accidents between 1996 and 2002.
- There appears to be convincing evidence supporting the effectiveness of the WSPS.

3.2 CIVIL HELICOPTER WIRE STRIKE ACCIDENTS.

3.2.1 Data Sources and Methodology.

A primary source for the data on civil helicopter accidents was the NTSB website. Accident data for the period 1994 through 2004 were collected and analyzed. The HAI accident database also compiles accident statistics using the NTSB database. The NTSB database can be used to extract accident data on specific types of accidents (e.g., wire strikes) during a specified period (e.g., 1994 to 2004) using keywords to query the database. However, it is necessary to use keywords like wire, wire strike, cable, and guy wire to extract all the accidents from the database. This method was used to correlate the results for the wire strike accidents generated in the present research with the results of HAI. The data included in this report cover those accidents in which wire strike was the primary cause; some cases have been included in which impacting the wires caused airframe damage or injuries to the occupants. For each accident, the NTSB database also provided a factual report that showed details about the helicopter and the pilot.

The data obtained from the NTSB database is in the form of narratives. The narratives for the accidents involving helicopter wire strikes for the years 1994-2004 are compiled and presented in appendix B. Each accident was studied, and the results were tabulated for further analysis, as shown in appendix B. These tables give the date, place, NTSB identification number, number and type of injuries, and type of operation for each accident. Data on wire strike accidents for

the period covering 1994-2003 was analyzed in detail to identify the change in trends from those identified by Tuomela and Brennan [1 and 2] for the period covering 1970-1979.

To understand the data from the NTSB, it is essential that one understands how the NTSB defines an accident, incident, fatal injury, and serious injury, as well as exceptions that apply to each.

The NTSB defines an accident as “an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked,” in which:

1. a person is fatally or seriously injured as a result of:
 - (a) being in the aircraft.
 - (b) being in direct contact with any part of the aircraft, including parts which have become detached from the aircraft.
 - (c) direct exposure to jet blast.

The exceptions are when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew or:

2. the aircraft sustains damage or structural failure which:
 - (a) adversely affects the structural strength, performance, or flight characteristics of the aircraft.
 - (b) would normally require major repair or replacement of the affected component.

The exceptions for engine failure or damage is when the damage is limited to the engine, its cowlings, or accessories; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents, or puncture holes in the aircraft skin or:

- (c) the aircraft is missing or is completely inaccessible.

The NTSB defines an Incident as “an occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of the operation.”

The NTSB defines a Fatal Injury as “an injury which results in death within 30 days of the incident.”

The NTSB defines a Serious Injury as “an injury which: (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; (2) results in a

fracture of any bone; (3) causes severe hemorrhages, nerve, muscle or tendon damage; (4) involves an internal organ; or (5) involves second- or third-degree burns.”

3.2.2 Civil Helicopter Accident Rates (All Accidents).

Table 2 shows data on the accidents in which U.S. civil helicopters were involved from 1994-2003. The total number of hours flown per year shows an increase trend up to 1999 and then a decrease from a peak of 2.74 million hours in 1999 to slightly above 2.1 million hours per year between 2001 and 2003. Figure 7 shows the number of accidents and the number of fatalities per year from 1994 to 2003. The total number of accidents shows an increasing trend from 1997 onwards. There were 212 accidents involving 67 fatalities in the year 2003.

Table 2. U.S. Civil Helicopter Accident Statistics All Accidents

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total hours (Millions)	1.777	1.961	2.120	2.084	2.342	2.744	2.308	2.141	2.110	2.125
Total number of accidents	218	161	176	163	191	197	206	182	205	212
Total fatal accidents	44	25	32	27	34	31	35	29	26	37
Total number of fatalities	79	45	54	43	66	57	63	51	41	67
Total number of serious injuries	53	34	34	62	26	44	42	34	51	51
Total number of minor injuries	92	54	56	79	55	81	81	71	58	82
Total number of no injuries	212	174	184	157	197	205	200	223	267	236
Fatalities/fatal accident	1.80	1.80	1.69	1.59	1.94	1.84	1.80	1.76	1.58	1.81
Total accidents/100,000 hr	12.26	8.21	8.29	7.82	8.15	7.18	8.93	8.50	9.72	9.98
Fatal accidents/100,000 hr	2.48	1.27	1.51	1.30	1.45	1.13	1.52	1.35	1.23	1.74
Fatalities/100,000 hr	4.45	2.37	2.70	2.06	2.82	2.08	2.73	2.38	1.94	3.15
Serious injuries/100,000 hr	2.98	1.73	1.60	2.98	1.11	1.60	1.82	1.59	2.42	2.40
Minor injuries/100,000 hr	5.18	2.75	2.64	3.79	2.35	2.95	3.51	3.32	2.74	3.86

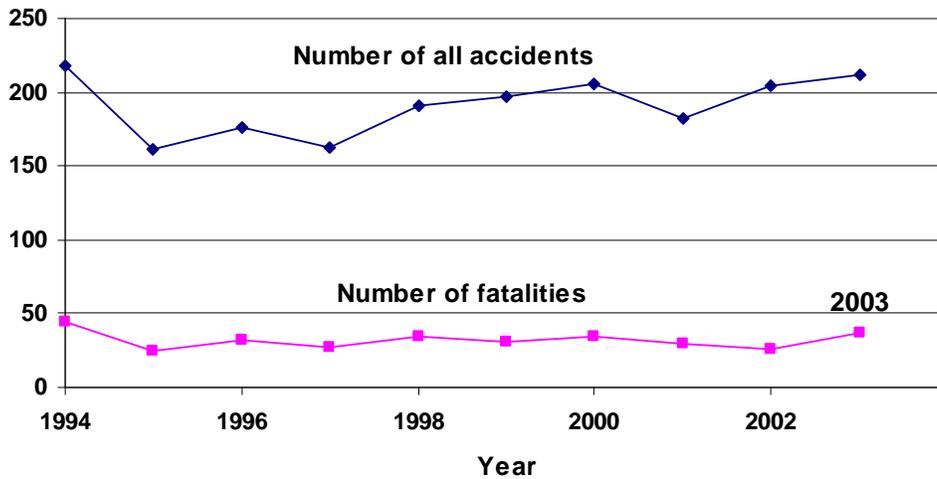


Figure 7. U.S. Civil Helicopter Accidents: Number of Accidents and Number of Fatalities per Year

A commonly used safety metric is the number of accidents per 100,000 flight hours (total number of accidents/total flight hours/100,000). Figure 8 shows the rate of the total accidents, total number of fatal accidents, and the number of fatalities per 100,000 flight hours. All these metrics show an increasing trend from about 1999.

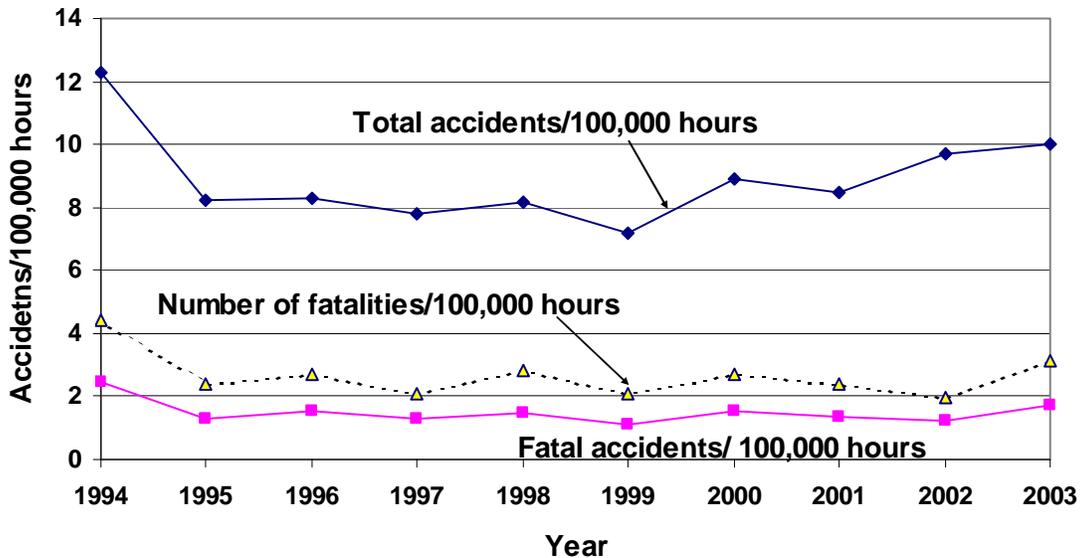


Figure 8. U.S. Civil Helicopter Accidents: Trend of Number of Accidents, Number of Fatalities, and Number of Fatal Accidents per 100,000 Flight Hours

The rate of accidents in 2003 was close to ten accidents per 100,000 flight hours. There were 1.74 fatal accidents per 100,000 hours in the year 2003. The corresponding rates for fixed-wing aircraft operated by air carriers under 14 CFR 121 are shown in figure 9. In the year 2003, the number of accidents for fixed-wing of aircraft was slightly above 0.3 accidents per 100,000 flight

hours. Thus, the rate of accidents per 100,000 hours for fixed-wing aircraft is 3% of the accident rate for helicopters.

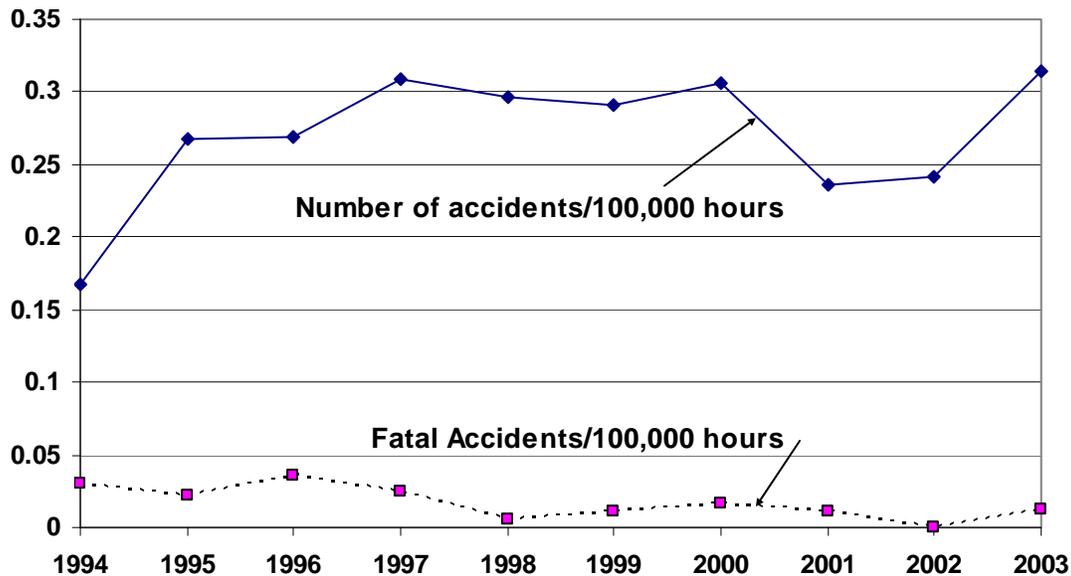


Figure 9. Accident Rates, 1994 Through 2003, for U.S. Air Carriers Operating Under 14 CFR 121

The U.S.-registered civil helicopter fleet consists of helicopters powered by single reciprocating engines, single turbine engines, and multiple turbine engines. Figure 10 shows the accident rate (per 100,000 hours) for each of these types of helicopters. There has been a sharp increase in the number of accidents involving single reciprocating engine helicopters. The multiengine helicopters have been involved in the lowest number of accidents per 100,000 hours; this rate is also showing an increasing trend, about five accidents/100,000 hours in 2003.

Figures 11 and 12 show the number of fatal accidents and the number of fatalities per 100,000 hours for the three types of helicopters. Helicopters with reciprocating engines appear more susceptible to accidents involving fatalities per 100,000 hours.

Figure 13 shows the accidents in which helicopters conducting 14 CFR Part 91 (general aviation) and 14 CFR Part 137 (agricultural application) operations were involved. Helicopters conducting general aviation operations were involved in 70% to 80% of all civil helicopter accidents. Helicopters involved in agricultural application operations accounted for about 10% of all the accidents.

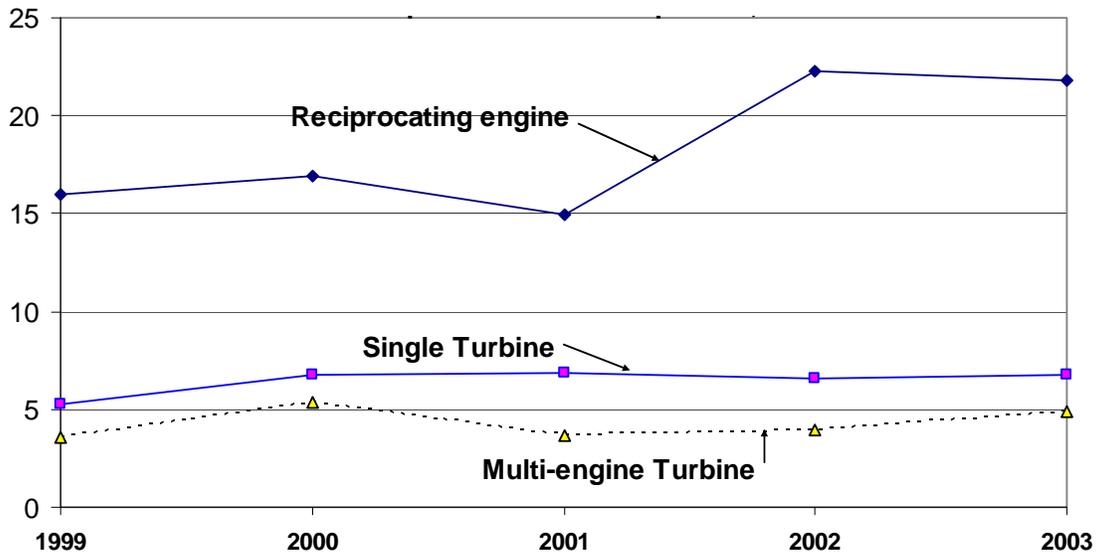


Figure 10. U.S. Civil Helicopter Accident Rates by Engine Type

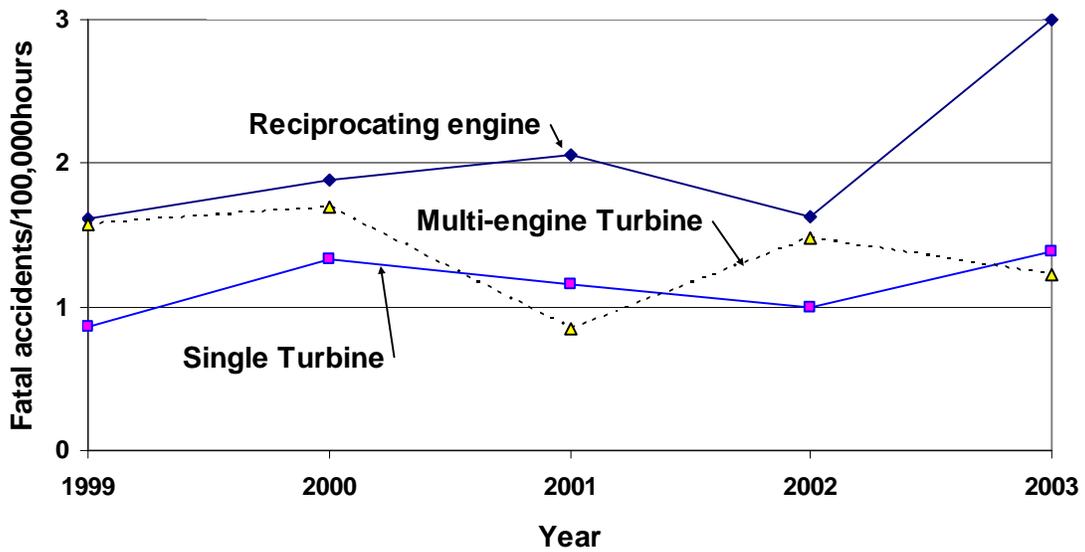


Figure 11. U.S. Civil Helicopter Accidents: Fatal Accidents/100,000 Flight Hours by Engine Type

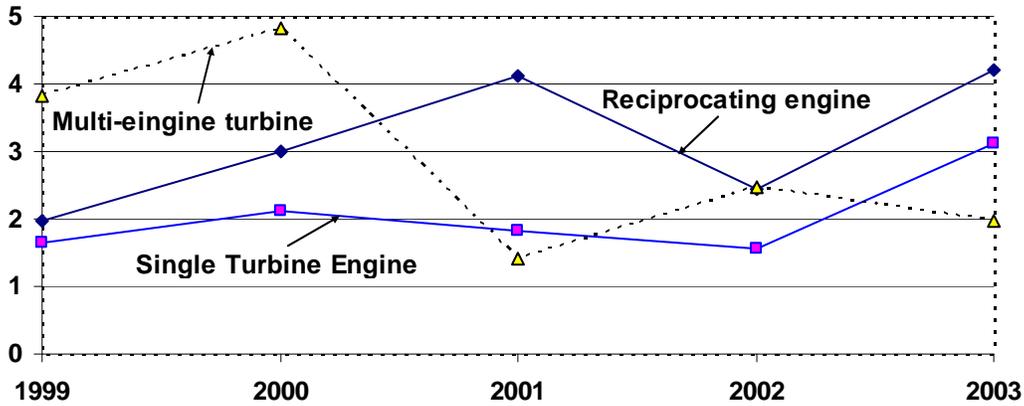


Figure 12. U.S. Civil Helicopter Accidents: Fatalities/100,000 Flight Hours by Engine Type

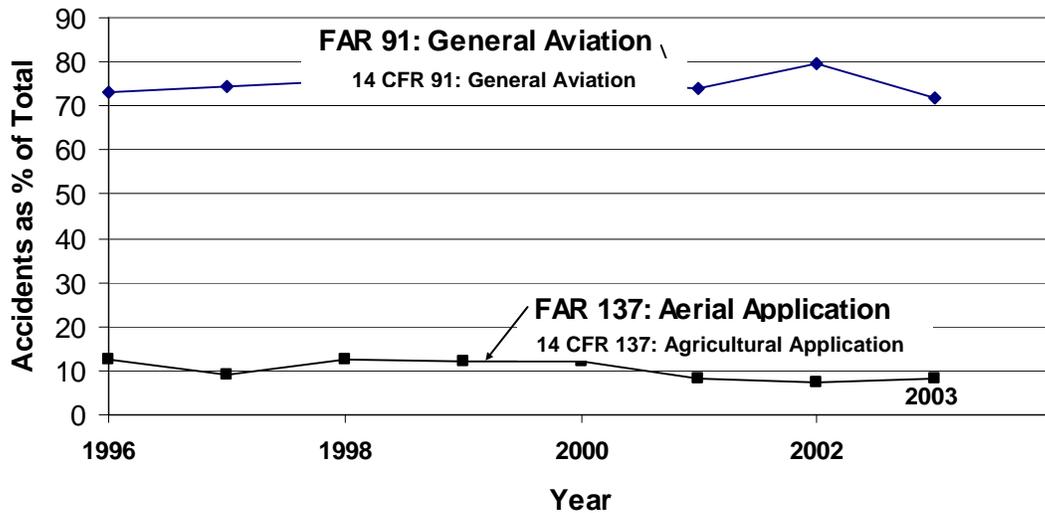


Figure 13. U.S. Civil Helicopter Accidents by Type of Operation

3.3 WIRE STRIKE ACCIDENTS INVOLVING U.S. CIVIL HELICOPTERS.

3.3.1 Overview of Wire Strike Accident Data.

Table 3 provides some details of wire strike accidents for the years 1994 through 2004. The primary cause of these accidents was the helicopter impacting a power line, static wire, telephone wire, cable, or with a supporting structure such as a tower. There were a total of 124 wire strike accidents in which 41 were fatal accidents. The accidents resulted in 65 fatalities, 45 serious injuries, and 42 minor injuries.

Table 3. U.S. Civil Helicopter Wire Strike Accidents

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Number of wire strike accidents	14	10	8	9	13	12	14	12	16	11	5
Number of fatal accidents	7	6	2	1	5	2	4	5	6	2	1
Number of serious injuries	8	8	0	3	4	5	4	3	6	1	3
Number of minor injuries	8	6	1	4	4	1	5	4	4	5	0
Uninjured	6	1	4	5	8	12	4	7	9	7	8
Number of fatalities	11	9	2	4	9	3	5	8	9	3	2

A comparison of the wire strike accident data for the periods 1970-1979 and 1994-2003 is shown in table 4. The data for the years 1970-1979 was extracted from reference 1. Table 4 shows that there is a 40% decrease in the number of wire strike accidents in 1994-2003 compared to those in 1970-1979. However, there is an increase of 76% in the number of fatalities, although the number of serious injuries has decreased by 13% between 1994 and 2003.

Table 4. Comparison of Wire Strike Statistics for Two Decades

Period	1970-1979	1994-2003
Total number of wire strikes	208	124
Number of fatalities	37	65
Number of serious injuries	52	45
Number of minor injuries	85	42
Total number of injuries and fatalities	174	152
Number of injuries and fatalities per wire strike	0.84	1.24

As mentioned in section 3.2.1, a number of key words need to be used when querying the NTSB database to compile a report on a particular type of accident. Because researchers do not use the same keywords to query the database, the result is different statistics being quoted by different researchers. For example, figure 14 shows a comparison of accident data generated in the present study with similar data from Freest [11] and HAI [12]. Even though there is a difference in the number of accidents reported per year, there is fair agreement between the three sets of data.

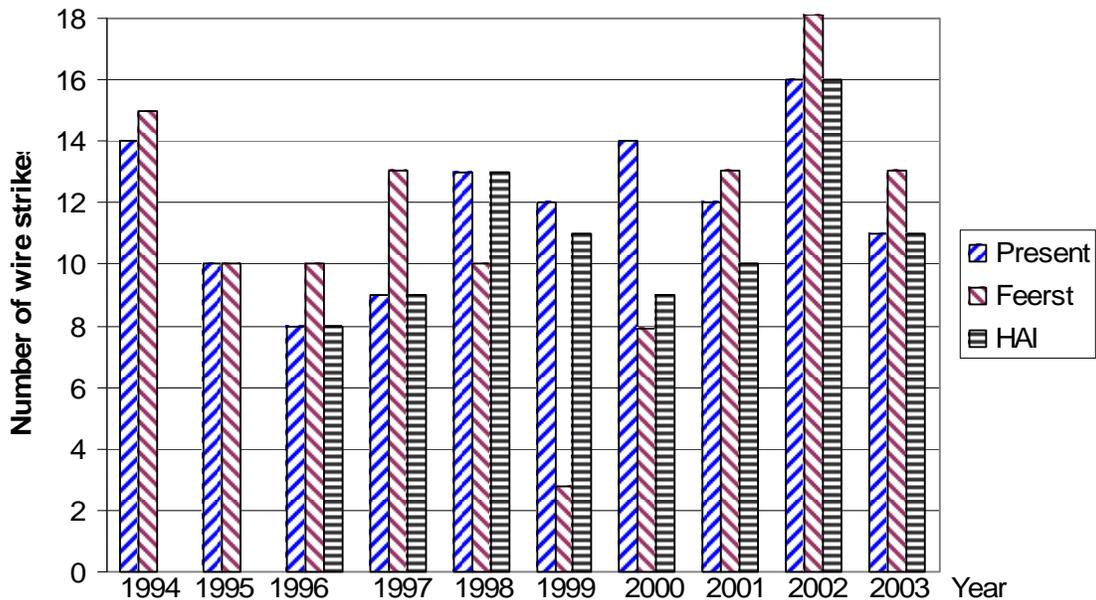


Figure 14. Comparison of Yearly U.S. Civil Helicopter Wire Strike Accidents Obtained in Three Different Studies

3.3.2 Wire Strike Statistics by Type of Operation.

Table 5 presents data on helicopter wire strikes in each year for the period 1994 through 2004 by the type of operation. Table 6 presents the same data in the form of percentage per year. For the period 1994-2004, general aviation operations accounted for approximately 60% of all the wire strike accidents, while agricultural operations accounted for approximately 27% of the accidents.

Table 5. U.S. Civil Helicopter Wire Strike Accidents by Type of Operation

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 CFR Part 91: General Aviation	8	6	4	5	8	6	7	8	12	6	4
14 CFR Part 133: Rotorcraft External Load	0	1	1	0	1	2	0	0	0	0	0
14 CFR Part 135: Air Taxi and Commuter	1	1	0	1	2	1	0	0	0	0	0
14 CFR Part 137: Agricultural	5	2	2	3	2	2	7	2	4	5	0
Other (Public Use)	0	0	1	0	0	1	0	2	0	0	1
Total	14	10	8	9	13	12	14	12	16	11	5

Table 6. U.S. Civil Helicopter Wire Strike Accidents as Percentage of Wire Strikes

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
14 CFR Part 91: General Aviation	57	60	50	56	62	50	50	67	75	55	80
14 CFR Part 133: Rotorcraft External Load	0	10	13	0	8	17	0	0	0	0	0
14 CFR Part 135: Air Taxi and Commuter	7	10	0	11	15	8	0	0	0	0	0
14 CFR Part 137: Agricultural	36	20	25	33	15	17	50	17	25	45	0
Other (Public Use)	0	0	13	0	0	8.3	0	17	0	0	20

As a comparison, the percentage breakdown of civil helicopter accidents was general aviation: between 70% and 80% and agricultural: 10% (figure 13).

Table 7 provides a comparison of wire strike accidents by the type of operation for the two periods: 1970-1979 and 1994-2003. In 1970-1979, general aviation operations accounted for 42% of the wire strikes, while agricultural operations accounted for about 48% of all wire strike accidents. Figure 15 shows the wire strike accidents by type of operation for 1994-2003. Figure 16 shows the yearly distribution of wire strike accidents as a percentage of total in general aviation and agricultural application operations. The wire strike percentage in general aviation operations has increased since about 1999.

Table 7. Comparison of Wire Strike Accidents by Type of Operation (1970-1979 and 1994-2003)

Period	1970-1979	1994-2003
14 CFR Part 91: General Aviation	41.8	59.7
14 CFR Part 133: Rotorcraft External Load	1.9	4.0
14 CFR Part 135: Air Taxi and Commuter	0.6	4.8
14 CFR Part 137: Agricultural	48.0	27.4
Other (Public Use)	7.7	4.0

It may appear that helicopters involved in general aviation operations account for about 60% of wire strikes while helicopters engaged in agricultural operations account for about 27% of the wire strikes is a reflection of the overall accident spectrum. However, it was that all wire strike accidents occur at heights of less than about 150 feet AGL, an altitude band normally used for takeoff and landing operations for general aviation operations. Taking this factor into consideration, the proportion of wire strike accidents in general aviation operations is very high.

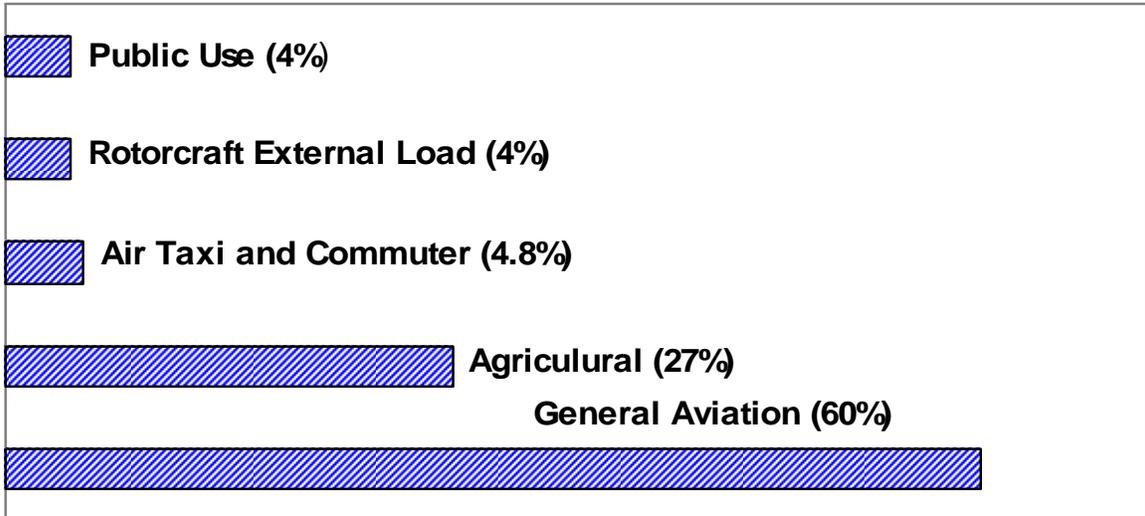


Figure 15. Civil Helicopter Wire Strike Accidents by Type of Operation for 1994-2003

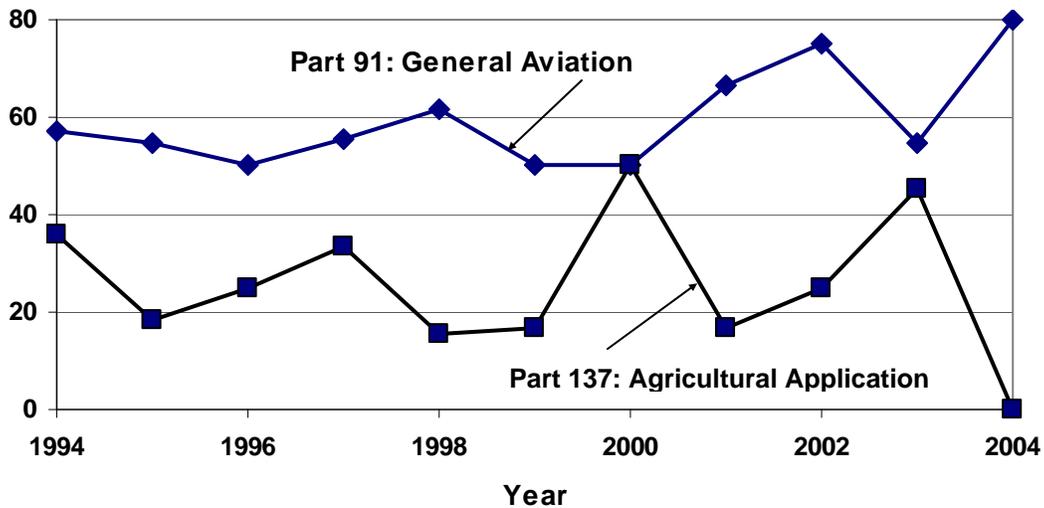


Figure 16. U.S. Civil Helicopter Wire Strike Accidents by Type of Operation

3.3.3 Wire Strike Statistics by Type of Helicopter.

Table 8 gives the list of helicopters involved in wire strike accidents and the number of accidents each year for the period 1994-2004. In this table, generic names have been used for some helicopters and all the variants have not been differentiated. For example, Bell 206 is used to designate the 206B, 206B-3, and 206L-1 models. The Bell 47 is used to designate the 47G, 47G-2, 47G-2A, 47G-5, and 47D1 models. Robinson R22 is used to designate the R22, R22A, R22B, R22-BETA II models. Three R44 helicopters were also involved in wire strike accidents. These have been included in the list of R22 accidents.

Table 8. Helicopters Involved in Wire Strikes

Type	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Bell 206	4	3	2	1	2	1	1	1	3	3	2
MBB BO-105S	2										
Eurocopter AS-350	1					1	1	1	1		
Robinson R22	3				4	4		3	3	3	2
Hiller HU12V	1			2		2	3			1	
Bell 47	2	3	2	2	3		4	2	5	2	
MD369		3	3		1		1	1			
Hughes 269		1		1			1	3			
Enstrom F-280				1	1			1	2		
Bell 407				1							
MD-900					1						
BK-117						1					
Bell 212						1					
Bell OH-58						1					1
Sikorsky S 58							1		1		
Others	1		1	1	1	1	2		1	2	

Figure 17 shows the percentage of wire strike accidents for each of the helicopter types that have been involved. The Bell 47 and its variants account for about 20% of all the wire strike accidents while the Bell 206 and its variants come close with 18.6%. The Robinson R22 (including three R44 models) accounts for another 15.3% of the accidents. Other helicopter models such as the Eurocopter AS-350 and Enstrom F280 accounted for about 31% of the wire strike accidents. Figures 18, 19, and 20 show the number of wire strike accidents for the years 1994 to 2004 for the Bell 206, Bell 47, and Robinson R22 models. Of the helicopters involved in wire strike accidents (table 8), FAA-approved wire strike protection kits (wire cutters) are available for the following models: Bell 205, 212, and 407, Eurocopter AS-350 and BK-117, and McDonnell Douglas (MD) helicopters MD-900. As shown in table 8, these helicopter models account for 32 of the 124 helicopters (25.8%) involved in wire strike accidents. FAA-approved wire cutters were not available for the other helicopters mentioned above. Thus, nearly 74% of the helicopters involved in the wire strikes could not have been fitted with wire cutters.

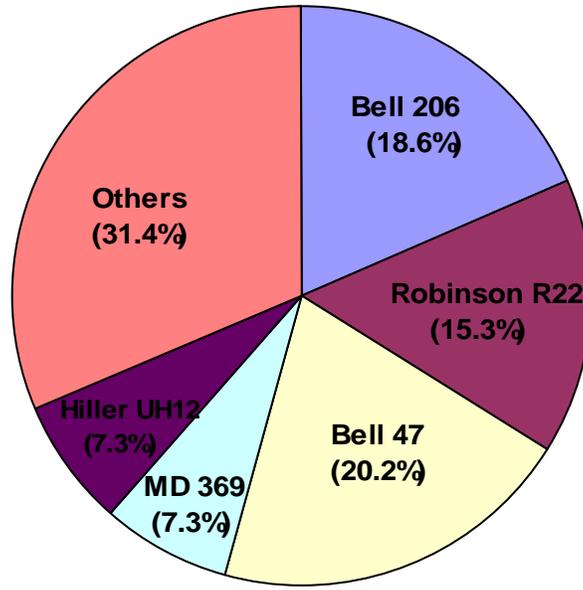


Figure 17. Helicopter Wire Strike Accidents by Model

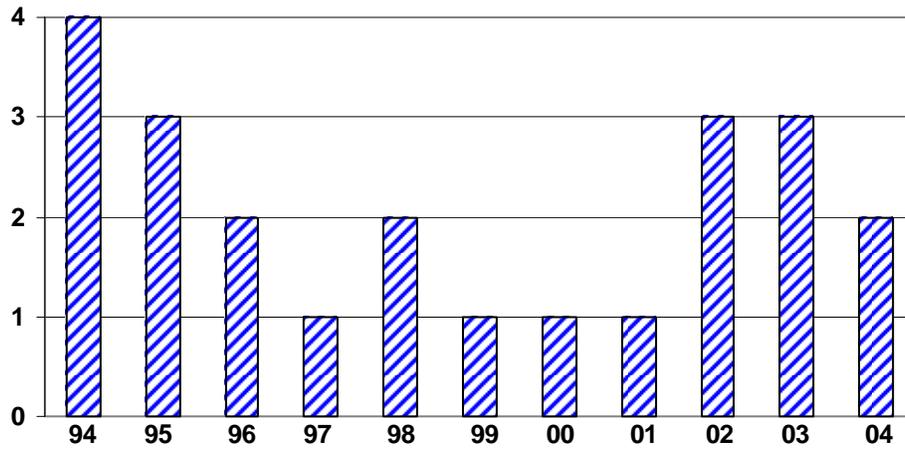


Figure 18. Wire Strike Accidents Involving Bell 206

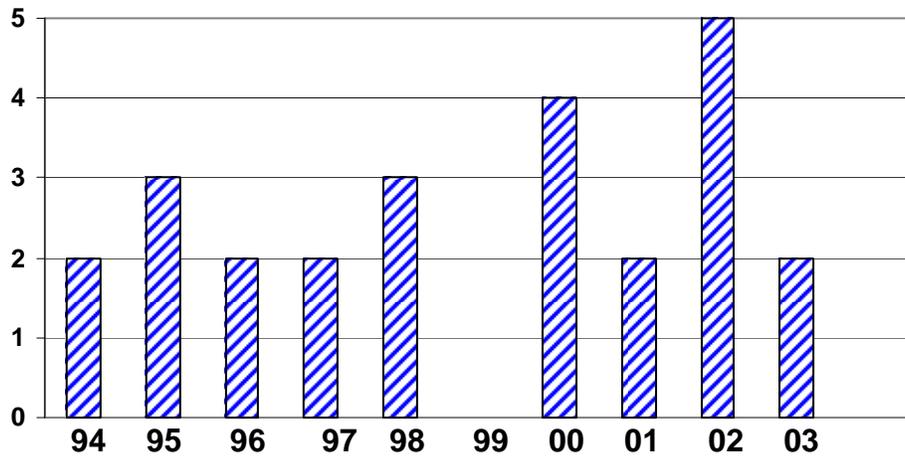


Figure 19. Wire Strike Accidents Involving Bell 47

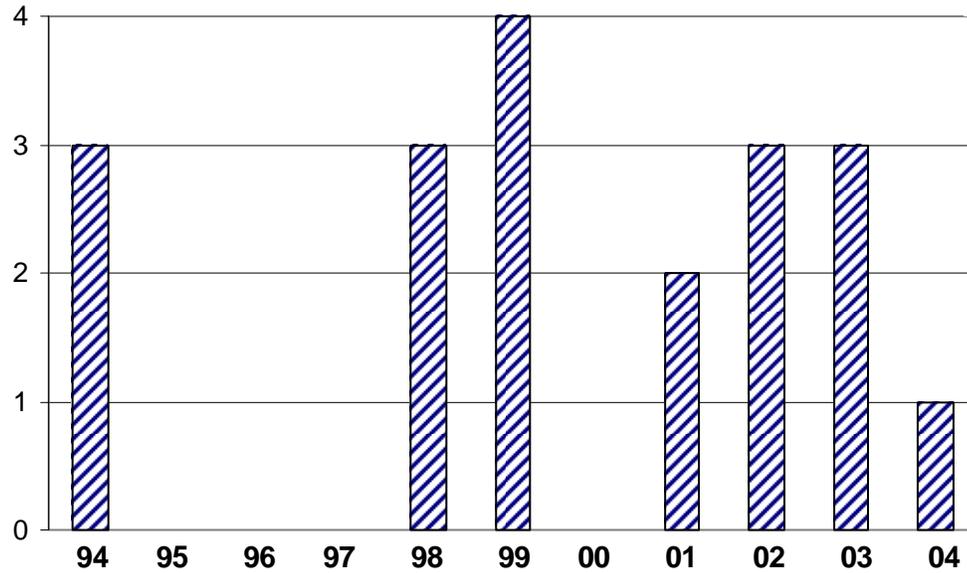


Figure 20. Wire Strike Accidents Involving Robinson R22

3.3.4 Wire Strike Accidents by Probable Cause.

In addition to a narrative description of the accident, the NTSB accident reports also include a list of probable causes in the case of completed investigations. A study of the NTSB wire strike accident reports (given in appendix B) shows the probable causes for most of the accidents are one or more of the following reasons:

- Inadequate visual lookout (38 accidents)
- Failure to maintain sufficient clearance with the obstacle (59 accidents)
- Failure to maintain proper altitude (9 accidents)

- Other reasons for 19 accidents include improper judgment (e.g., decision to continue flying VFR under IFR conditions), inadequate preflight planning, and failure to see and avoid wires, intentional buzzing (low-altitude flight), and selection of unsuitable area for landing.

Thirty-seven of the fatal wire strike accidents occurred in day visual meteorological conditions. Two accidents occurred in day instrument flying conditions and two occurred in night instrument flying conditions. Thus, 86% of the fatal accidents occurred in clear weather with good visibility.

The probable causes have not been identified for all the accidents included in appendix B.

3.3.5 Analysis of Fatal Wire Strike Accidents.

During the period 1994-2004 (September), there were 43 fatal accidents. Tables 9 and 10 give the profile of the age and flight experience of the pilots involved in the accidents. These data are available for 41 of the 43 accidents.

Table 9. Age Profile of Pilots Involved in Fatal Wire Strike Accidents During 1994-2003

Age (years)	29 and under	30 to 39	40 to 49	50 to 59	60 and above
Number	4	5	13	13	6

Table 10. Helicopter Flight Experience of Pilots Involved in Fatal Wire Strike Accidents During 1994

Experience (hours)	0-200	201-500	501-1000	1001-2000	>2001
Number	7	1	6	4	23

The majority of the accidents involved pilots between the ages of 40 and 59 (78%) and who had more than 2000 hours (56%) of rotorcraft flight experience. The average age of the pilots was 47.3 years and the average flight experience was about 3575 hours.

For the period 1970-1979, Tuomela and Brennan [1] found that 95% of the wire strike accidents occurred in weather conditions with clear skies and unlimited visibility. The average age of the pilots involved in (all) wire strike accidents was about 34 years, and the average flight experience of the pilots was over 2200 hours.

Figure 21 shows the distribution of civil helicopter fatal wire strike accidents during 1994-2003 by type of operation. Helicopters operating under general aviation (14 CFR Part 91) account for 65% of all fatal wire strike accidents. Agricultural operations (14 CFR Part 137) and rotorcraft external load (14 CFR Part 133) account for 14% and 12% of the fatalities.

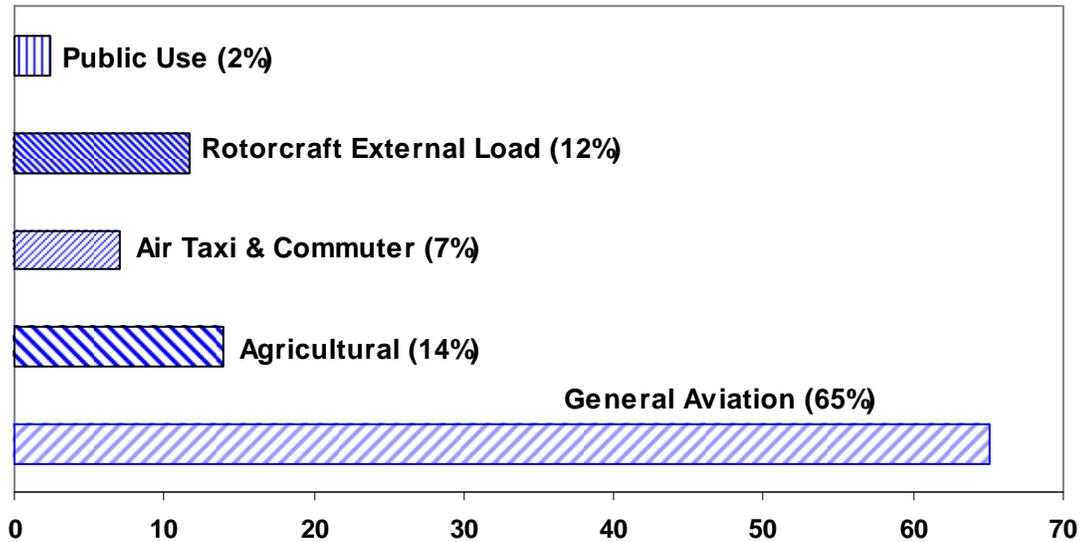


Figure 21. U.S. Civil Helicopter Fatal Accidents by Operation (1994-2003)

Figure 22 shows a comparison of the proportion of all wire strike accidents (as percentage of the total) with the fatalities in each type of operation. Operations under 14 CFR Part 91 general aviation account for about 65% of wire strike accidents and for about 60% of the fatalities. Agricultural operations account for about 27% of wire strike accidents and about 14% of fatalities in wire strikes (14 CFR Part 137).

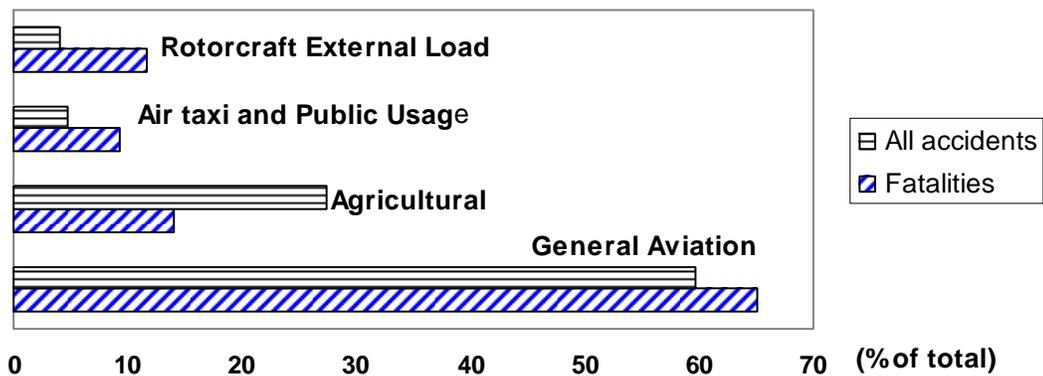


Figure 22. Comparison of Accidents and Fatalities by Type of Operation (1994-2003)

Table 11 shows the helicopters involved in fatal wire strike accidents. Bell 206 models were involved in nearly 26% of the fatal wire strikes, Robinson R22 models were involved in about 21% of the fatal accidents. The MD 369 and Bell 47 models accounted for 14% and 12% of the fatal accidents, respectively.

Table 11. Helicopters Involved in Fatal Wire Strike Accidents

Type	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Total	Percent
Bell 206	1	3	1		1			1	2	1	1	11	25.6
AS-350	1	0				1	1					3	7.0
Tomcat MK5A	1	0										1	2.3
Robinson R22	2	0			2	1		1	2	1		9	20.9
Hiller HU-12E	1	0										1	2.3
BO-105S	1	0										1	2.3
Bell 47		1			1		1	1	1			5	11.6
MD 369		2	1		1		1	1				6	14.0
Bell 407				1								1	2.3
Bell UH 1B						1						1	2.3
Hughes 269							1					1	2.3
Enstrom 280FX								1				1	2.3
Robinson R44								1				1	2.3
Sikorsky S58ET									1			1	2.3

Helicopters flying 14 CFR Part 137 (agricultural) and 14 CFR Part 133 (rotorcraft external load) operations need to fly close to the ground in order to execute their missions. It is natural to expect that these helicopters would be involved in more wire strikes than helicopters involved in 14 CFR Part 91 (general aviation) operations. However, it is surprising to note from figures 21 and 22 that the helicopters in general aviation account for 60% of all wire strikes and for 65% of fatalities in wire strike accidents.

Note that most wire strike accidents occur under visual meteorological conditions, and that the most often cited probable cause for these accidents is the pilot's "inadequate visual lookout." It appears that most of the wire strike accidents in general aviation operations were potentially preventable.

3.3.6 Summary of Civil Helicopter Wire Strike Incidents.

The total number of accidents of civil helicopters shows an increasing trend from 1997 onwards. There were 212 accidents involving 67 fatalities in 2003. The number of accidents per 100,000 flight hours also shows an increasing trend from 1996 onwards. There were ten accidents per 100,000 flight hours in 2003. In 2003, the number of accidents for fixed-wing aircraft was slightly above 0.3 accidents per 100,000 hours. Thus, the rate of accidents per 100,000 hours for fixed-wing aircraft is 3% of the accident rate for helicopters. Helicopters conducting general aviation operations were involved in 70% to 80% of all the accidents to civil helicopters.

Helicopters involved in agricultural application operations accounted for 10% of all the accidents.

Between 1994 and 2004, there were 124 wire strike accidents involving 41 fatal accidents. The accidents resulted in 65 fatalities, 45 serious injuries, and 42 minor injuries. There was a 40% decrease in the number of wire strike accidents during the period 1994-2003 compared to 1970-1979. However, there is an increase of 76% in the number of fatalities, but the number of serious injuries decreased by 13% in 1994-2003. There were 1.24 fatalities and injuries per wire strike during 1994-2003 compared to 0.84 during 1970-1979. For the period 1994-2004, general aviation operations accounted for approximately 60% of all wire strike accidents while agricultural operations accounted for approximately 27% of the accidents. During 1970-1979, general aviation operations accounted for 42% of the wire strike accidents while agricultural operations accounted for about 48%.

The wire strike percentage in general aviation operations has been increasing since 1998. The Bell 47 helicopter and its variants account for about 20% of all the wire strike accidents while the wire strike accidents to the Bell 206 and its variants come close, accounting for about 18.6%. The Robinson R22 helicopter (including three R44 models) accounts for another 15.3% of the wire strike accidents. Wire strike protection kits could potentially have been fitted on 32 of the 124 helicopters (25.8%) involved in wire strike accidents, leaving nearly 74% of the helicopters without wire strike protection.

The probable causes for most of the accidents are one or more of the following three reasons: inadequate visual lookout (38 accidents), failure to maintain sufficient clearance with the obstacle (59 accidents), and failure to maintain proper altitude (9 accidents). Other reasons (for 19 accidents) include improper judgment (e.g., decision to continue flying VFR under IFR conditions), inadequate preflight planning, and failure to see and avoid wires, intentional buzzing (low-altitude flight), and selection of unsuitable area for landing.

Thirty-seven (86%) of the fatal wire strike accidents occurred in day visual meteorological conditions. Two accidents occurred in day instrument flying conditions and two occurred in night instrument flying conditions.

The majority of accidents involved pilots between 40 and 59 years old (with 78% being over 40) and who had more than 2000 hours of flight experience (with 56% having over 2000 hours). The average age of the pilots was 47.3 years and the average flight experience was about 3575 hours.

Helicopters operating under 14 CFR Part 91 general aviation accounted for 65% of all fatal accidents. Agricultural operations (14 CFR Part 137) and rotorcraft external load (14 CFR Part 133) account for 14% and 12% of the fatalities, respectively.

Because most wire strike accidents occur under visual meteorological conditions and the most often cited probable cause for these accidents is the pilot's "inadequate visual lookout," it appears that most of the wire strike accidents in general aviation operations could have been potentially prevented.

3.4 WIRE STRIKE PROTECTION AND WARNING SYSTEMS.

A number of devices are currently available that can provide helicopter pilots warning of the proximity of wires. In addition, a combination of wire deflectors and wire cutters has been available for some time. A description of these devices are discussed in the following sections.

The data for each system were collected from the manufacturer's websites and from discussions with their personnel. The performance figures for each system have been given as stated by the respective manufacturers but have not been independently verified in this research.

3.4.1 Wire Strike Protection System.

Wire impacts have serious consequences to helicopters. For example, a power transmission cable can slice through the windshield if the helicopter impacts the cable at sufficient forward speed. One system that can provide a degree of protection to the helicopter in frontal impacts is the WSPS, manufactured by Bristol Aerospace Limited. A typical installation consists of a roof-mounted cutter and one or more cutters mounted on the fuselage of the helicopter. A deflector running vertically along the middle of the windshield guides the cables into the cutters. Figure 23 shows the system installed on a Bell 206.



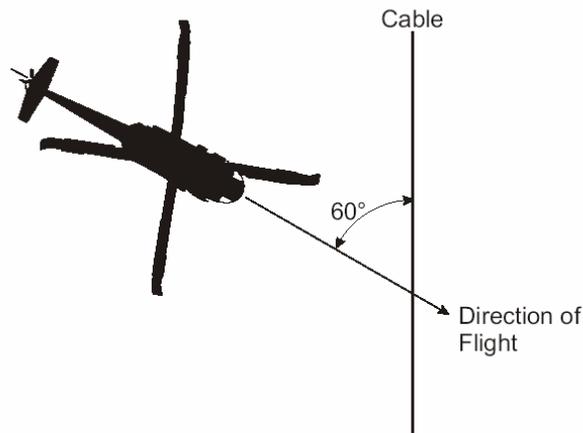
Figure 23. The WSPS Installed on a Bell 206 [13]

The effectiveness of the WSPS was verified by the U.S. Army through pendulum-swing tests conducted at the National Aeronautics and Space Administration Impact Dynamic Test Facility at Langley, Virginia. Table 12 lists the models and costs of WSPS for helicopters that have FAA approval for fitment of WSPS. The installation of WSPS can be performed by a qualified helicopter mechanic in about 40 hours.

Table 12. Price of WSPS for Helicopter Models

Helicopter	Price (U.S. \$)
Bell 204, 205, 212, 412	8,515
Bell 206A, B, L, L-1, L-3, L-4	6,870
Bell 222, 230, 430	34,000
Bell 407	7,370
Bell 427	13,995
MD Helicopters 500, 500C, 500D	7,450
MD Helicopters 500E, 500N, 530FF	7,450
MD Helicopters 600N	12,995
Eurocopter AS-350	13,995
Eurocopter AS-355	13,995
Sikorsky S-76	20,000

For the cutters to be effective, the helicopter must be flying at speeds greater than 30 knots [14]. The manufacturer states that if a helicopter with a WSPS impacts a wire at an angle less than 60° to the wire, the WSPS may not cut the wire (figure 24). In addition, the maximum pitch angle at which the WSPS should strike the wire and still be effective is $\pm 5^\circ$. The system is designed to cut a 3/8-inch steel cable with a breaking strength of 12,000 lb [14].



Angle Strike Design Parameters

Figure 24. Maximum Wire Strike Angle [15]

If wires are contacted during a flight, the manufacturer suggests that the cutter blades be immediately replaced [16]. No measurements of the additional drag created by the WSPS have been made.

3.4.2 Powerline Detector.

The Powerline Detector, manufactured by Safe Flight Instrumentation Corp., is a system that senses the electromagnetic fields surrounding power lines and uses this information to alert the pilot to the proximity of wires. The system consists of an electronics unit mounted in the cockpit (figure 25) and a whip antenna mounted on the fuselage. The antenna can be placed on the nose, roof, or tail boom of the aircraft. The electronic unit measures 1.66" x 2.42" x 5.51", and the total system weight is approximately 3 pounds [17].



Figure 25. Powerline Detector Electronics Control [17]

If a power line is detected in the flight path, the system gives the pilot an audible warning starting from a distance of 1800 feet from the hazard. The warning sound increases in frequency as the power line gets closer. If the pilot continues to approach the power line, a red warning light illuminates in the cockpit. The system can be temporarily muted when flying in an area where there are a number of power lines [17].

The Powerline Detector is compatible with all civil and military helicopters, and Safe Flight suggests that the system be installed by a certified avionics shop or by the manufacturer. The installation takes approximately two days to complete. The unit requires 28 Volts direct current (Vdc), which is provided by the aircraft, and detects the power line signals at 60 Hz. Safe Flight has tested the lifespan of the detector to be greater than 10,000 flight hours. The retail price of the product is \$11,800, not including installation [17].

The aerodynamic drag of the whip antenna is not known, but it is likely to be negligible, especially if it is mounted on the tail boom. This detector only senses active power lines, and the range of detection depends on the electrical power in the lines. The system will not detect other types of wires such as guy wires, weak telephone lines, and nonactive power lines. Also, the

pilot does not get an indication about the direction of the power lines with reference to the aircraft.

3.4.3 The OASys Radar.

The OASys radar (Amphitech Systems) uses a radar mounted on the nose of the helicopter to transmit a 35-GHz radio frequency for detecting obstacles in the flight path. The radar constantly searches for obstacles in its field of view. At a given instant of time, the system uses data from the aircraft's GPS receiver to calculate the aircraft's flight path for the succeeding 19 seconds. Three zones of increasing potential risk are then designated by the system. If the obstacle is located in any of these three zones, the pilot is given a level of alert that depends on the proximity and zone of the obstacle and is notified by a small display in the cockpit that illuminates in accordance with the distance and direction to the obstacle. OASys also adapts to the requirements of the flight. For instance, during takeoff, the system scans a wide angle around the helicopter, but only a short distance in front of it. However, when the aircraft is cruising at high speeds, the scan narrows, but looks far ahead in the flight path [10]. These zones are shown in figures 26 and 27.

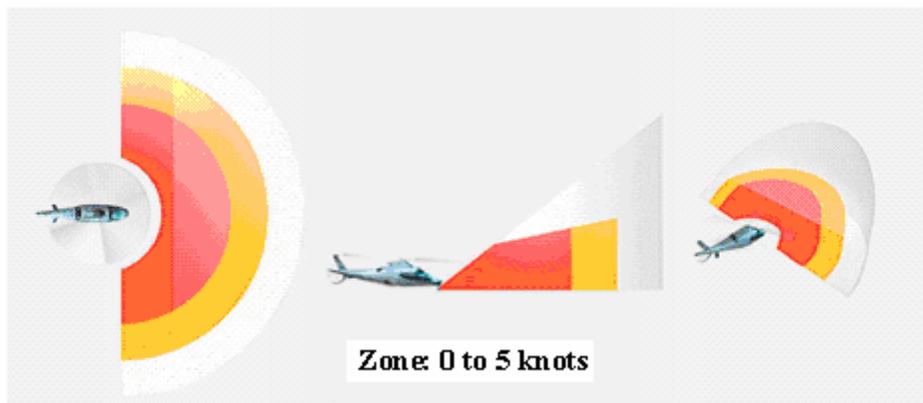


Figure 26. Zones of Scan, OASys (Hover to 5 knots)

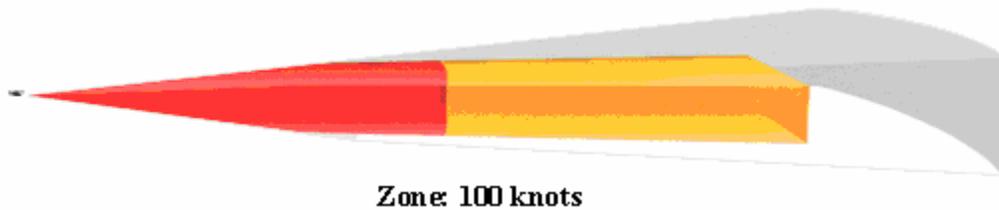


Figure 27. Zone of Scan at 100 Knots, OASys

The OASys radar has a maximum range of 1600 meters, an optimal range of 800 meters, and a minimum range of 2 meters. This system is also effective in rain and fog. The physical unit consists of an electronics box mounted inside the helicopter and a sensor mounted on the nose of

the helicopter (figure 28). The sensor dimensions are 15.48" x 16.78" x 22.44", and the total weight is approximately 54 pounds.



Figure 28. The OASys Scan Head [19]

OASys can currently be installed on the Bell 212, Bell 412, and Eurocopter AS-350 models, with Amphitech installing the system. Eventually, Amphitech plans to sell the radar system as a kit that any helicopter mechanic can install in less than 24 hours. Amphitech is currently working on obtaining approval for installation of OASys in all helicopter models in the U.S. and Europe [18].

The expected lifespan of the OASys radar is 20,000 flight hours or 20 years with proper maintenance. A certain part of the system must be replaced every 2500 flight hours, but this process can be completed by a mechanic in less than 1 hour. The OASys costs \$170,000, not including installation. Installation can cost somewhere between \$5,000 and \$10,000 [18].

Though the mounted sensor may be large, it produces little added drag on the helicopter (see figure 28). The manufacturer, Amphitech, estimates that there will be a loss of 1 knot when cruising at 140 knots. OASys does not detect objects behind or directly above the aircraft. Thus, the system will not warn the pilot of wires near the tail rotor while hovering or taking off.

3.4.4 Laser Obstacle Awareness System.

The LOAS (Goodrich Sensor Systems) detects small obstacles, such as wires, and feeds these data into the aircraft's targeting, control, display, or navigation systems. It uses an eye-safe laser radar to sense the obstacles. The system is composed of a scan head mounted on the fuselage and an electronics control box inside the cockpit. The system weighs about 35 pounds, and the cylindrical scan head measures 8.66" in diameter and 15" high [20].

The LOAS requires 28 Vdc from the helicopter and uses less than 300 watts of power. Goodrich states that the mean time between failures for the electronics and optical components of the system is greater than 1000 hours. However, the laser component's mean time between failures

is lower than this. Goodrich is currently re-evaluating this part of the system to improve its performance.

The LOAS is an adaptable system that can be implemented in naval ships and airplanes as well as in rotorcraft. Thus, the system is intended to be compatible with all commercial rotorcraft and has been successfully tested on the Eurocopter EC155, Bell 412, and Bell UH-1H.

The system has the capability of being pointed in the direction desired by the pilot [21]. The range of the system varies from 2 meters (minimum) to 2 kilometers (maximum). The scan head has a horizontal field of view of 180° and a vertical field of view of +30° to -90° [20]. The scan head and electronics box are shown in figure 29.



Figure 29. The LOAS Scan Head and Electronics [20]

The LOAS can be installed by Goodrich or by the helicopter manufacturer. Goodrich is working with third-party companies to design installation mounts that can be purchased separately so that the LOAS can be installed by the consumer on various helicopter models. The mount and sensor can be placed anywhere on the fuselage, but the system will perform best if it is located at the nose of the helicopter. Goodrich does not provide an exact price for the system, but an estimated cost would be approximately \$100,000, without installation [21].

No drag measurements have been made, but Goodrich states that the drag associated with LOAS is similar to the drag produced by current forward looking infrared mounts [21]. Because of its weight (35 lb), the LOAS can be considered for fitting on larger helicopters.

3.4.5 Laser Radar Visual Display.

EADS Dornier's Helicopter Laser Radar (HELLAS) is an obstacle detection system that can sense objects as thin as wires, thus making it useful for wire strike prevention. The system uses an eye-safe laser that is mounted on the fuselage of the helicopter to give the pilot information about the surrounding environment. Both an optical display and aural warning are used for this purpose. The optical display depicts the airspace surrounding the helicopter and marks the objects that lie in the flight path of the helicopter. The aural signal is used if the pilot moves the

rotorcraft too close to the obstacle [22]. The system is connected to the helicopter by a standard interface, which requires 28 Vdc [23]. Figure 30 shows the optical display box installed on the fuselage.



Figure 30. HELLAS Installed on UH-60 Helicopter

HELLAS is useful as a pilot aid under low visibility conditions. The optical display gives the pilot a view of the environment at night or during inclement weather so that it is possible to pilot the aircraft solely by images from the display. The range of the system decreases in adverse weather. EADS states that the range decreases from 3280 feet in VFR to 1312 feet in bad weather [23].

The system is also useful when sun glare prevents a pilot from visually acquiring the location of power lines. The effectiveness of HELLAS has been proven in its employment by the German Federal Border Guard. EADS Dornier was contracted to deliver 43 units installed on Eurocopter EC 135 and EC 155 helicopters [23]. The Canadian Defense Research Establishment has also tested and purchased the HELLAS unit [24]. The U.S. Army has performed more than 20 tests on the system. EADS says that a more accurate HELLAS unit has been created for the Army's nap-of-the-earth operations, which requires extreme accuracy during flight maneuvers [23].

Because of the high level of integration into the helicopter, this system is currently installed by EADS Dornier only. HELLAS is said to be compatible with all helicopters and has been successfully implemented on a few models, i.e., the Eurocopter BK 117, EC 135, EC 145, EC 155, Sikorsky CH-53, and Bell UH-1D. EADS Dornier does not list a price for the HELLAS system, but the price estimated is above \$100,000 [24].

The HELLAS system has several attractive features that make it useful to the pilot, especially in bad weather (rain and snow) conditions. However, its high cost makes it uneconomical for most light helicopters.

3.4.6 Ground Proximity Warning System.

Honeywell's EGPWS uses a database, maintained by Honeywell, of all obstacles in North America that are 30 feet AGL or higher [25]. The helicopter needs to be equipped with a GPS antenna and an EGPWS computer unit. When the aircraft approaches an obstacle or wire, the pilot is given an audible warning. If the pilot continues on the flight path, a louder aural warning is given. Together with a light inside the cockpit, the audio warning tells the direction towards which the pilot should fly to avoid an obstacle strike. For instance, if a pilot is slowly descending while cruising forward, the EGPWS will aurally tell the pilot to "pull up" to avoid a set of power lines. The system also provides other features such as excessive descent rate call-outs and altitude call-outs [26].

EGPWS is designed to work with all helicopters built in North America. The system consists of a GPS antenna located on the fuselage and an electronics unit located inside the cockpit. The total weight of the EGPWS is approximately 3.9 pounds. The system requires 28-Vdc power. Honeywell states that the life of the EGPWS units is more than 10 years. The system can be installed at a qualified avionics shop [26].

EGPWS is limited in its alerts to prevent wire strikes. The database of obstacles includes only those which are 30 feet AGL or higher. Therefore, any wires that are lower than 30 feet off the ground are not automatically made known to the pilot. Furthermore, Honeywell is constantly updating the database, and acknowledges that all wires above 30 feet are not in the database.

The EGPWS costs about \$45,000, excluding installation [25].

3.4.7 Passive Tower-Based System.

The Obstacle Collision Avoidance System (OCAS) is manufactured by OCAS AS of Norway and is different from the other systems because it is not installed on the helicopters. The system has been refined in formal cooperation with the Royal Norwegian Air Force, Norwegian Civil Aviation Administration, Civil Aviation companies, and Norway's utility company.

According to OCAS AS, the system can be installed nearly anywhere because the OCAS is relatively small. The unit has a modular mast design, which consists of one to three 9-foot, 375-pound tubes. The number of tubes varies, depending on the topography of the region. The unit is powered by either a 220/110-volt alternate current (Vac) connection or self-powered by solar panels and a battery bank. If it is not being operated on solar power, the system can be connected to the nearby power lines. OCAS was originally designed for rural areas of Norway where there is very little sunlight during the winter, and is intended to use as little power as possible. The target detection range is 1.7 to 3.0 miles, depending on the target size, and the very high frequency (VHF) range is approximately 19 nautical miles, depending on radio service area [27].

Typically, the OCAS is located on utility and power line towers and detects all air traffic entering a predefined warning zone and activates warning lights that illuminate the tower.

If no evasive action is taken by the pilot, a voice/audio warning is transmitted on all channels in the airborne VHF or optional ultra-high-frequency (UHF) communication bands. This system also allows the lights on large utility towers to be switched off unless needed [27].

The OCAS also records each encounter with a nearby aircraft. The system's computer documents the speed, position, and size of the aircraft, among other details, and sends this information to a central database, which is usually located at the utility company or tower owner. The records can be used to create historical data of all air traffic in the area [27].

OCAS is not currently approved for use in the U.S. The FAA plans to begin testing the unit in September 2004. The target price for the unit is \$50,000, and the cost is likely to be covered by the utility companies [27]. The helicopter users only need a functioning VHF radio in their aircraft to use this system.

The system is beneficial to adjoining property owners because the towers are illuminated only when an aircraft penetrates the warning zone. Note that the towers are illuminated but not the wires. Therefore, there is no certainty that the pilot will be able to see the unlit wires. There are also questions about the effectiveness of OCAS if multiple aircraft are in the detection zone.

3.4.8 Aerial Markers.

SpanGUARD Helimark Aerial markers, manufactured by P&R Technologies, are colored spherical balls that are attached to wires and power lines to make them more visually prominent to aircraft pilots. The spheres are available in orange, yellow, and white, and in varying diameters. The markers use a wire rod that wraps around the line to grip the wire. The construction includes the rods connected to the outside of the marker and lock nuts for easier live line installation. These markers use a clam shell design so that they can be installed easily by hand from a helicopter or installed before the power lines are strung up. Aerial markers should last many years. They are designed to minimize color degradation caused by the sun. P&R Technologies does not estimate an official life span for the markers, but cites several counties in the U.S. where the markers have been in place for over 20 years [28]. Figure 31 shows a marker being installed from a helicopter. The weight and cost of some spherical markers are given in table 13.



Figure 31. SpanGUARD Installation [29]

Table 13. SpanGUARD Helimark Specifications [28]

Diameter	Weight With Rods (lb)	Weight Without Rods (lb)	Price (each)
9 inches		4	
20 inches	6	5	\$120
24 inches	11.5	10	\$186
36 inches	19	17	\$378

Aerial wire markers are a passive method of wire strike protection and rely on the pilot's ability to spot them during flight. Even though wires with markers are more visible than unadorned wires, they may be of little assistance to an inattentive or sun-blinded pilot. Some spherical markers mounted on power lines have been designed to glow as a result of the electrical field surrounding the power line.

It is recommended that 36-inch-diameter markers be used over rivers, canyons, and lakes, while 20-inch-diameter markers be used within 1500 feet of airports on wires less than 50 feet AGL. Markers can be spaced a maximum of 200 feet apart. If multiple wires are strung between towers, then the markers should be placed on the highest wire [30].

The total cost can vary greatly when installing the aerial markers, depending on the number of markers that are necessary for the length of power line and the time it takes to install them.

3.4.9 Summary of the Systems.

Table 14 summarizes some of the main data on the systems described in the previous sections. In this table, “Install by” refers to whether the system can be installed by the helicopter owner or mechanic, “Compatibility” refers to whether the system is available on all helicopters, and “Range” refers to detection range.

Table 14. Summary of Wire Protection and Detection Devices

System	Cost	Weight (lb)	Install by	Helicopter Compatibility	Power	Life	Range (feet)
WSPS	\$6,870-34,000	20-35	Owner/mechanic	See table 8	N/A	Until wire strike	N/A
Powerline	\$11,800	3	Owner/mechanic	All	28 Vdc	>10,000 hours	1,800
OASys	\$170,000	54	Manufacturer	Few, currently	28 Vdc	20 years	5,249
LOAS	<\$100,000	35	Manufacturer	Few, currently	28 Vdc	>10,000 hours	6,561
HELLAS	>\$100,000	60	Manufacturer	All	28 Vdc		3,280
EGPWS	\$45,000	4	Owner/mechanic	All	28 Vdc	10 years	600
OCAS	\$50,000	375	N/A	All	220 Vac	Not known	15,840
SpanGUARD	\$120-\$378	6-19	Utilities	N/A	N/A	20+ years	N/A

N/A = not applicable

4. SUMMARY.

Data on wire strike accidents involving civil helicopters were presented and analyzed in sections 3.2 and 3.3. It was noted that a majority of the accidents were potentially preventable. Devices that have the potential to protect helicopters from damage after impacting wires or devices that warn the pilot about impending wire strikes were described in section 3.4. The potential of each of these devices to prevent and/or to minimize the number of fatalities and injuries in potential wire strike situations are discussed in the following sections.

4.1 WIRE STRIKE PROTECTION SYSTEM.

As discussed in section 3.1, there was a significant decrease in the number of wire strike accidents in U.S. military helicopters after the installation of WSPS. In addition, there were no fatalities in wire strike accidents after installing WSPS. While the reduction in the number of fatalities is due to the WSPS, it is conjectured that the reduction in the number of wire strike accidents is because the WSPS constantly alerts the pilot to possible wire strikes.

WSPS is most effective when the helicopter impacts the wires nearly perpendicular to the wires in a level altitude and at flight speeds of more than 30 knots.

WSPS is not available for all currently flying helicopters. As discussed in sections 3.2 and 3.3, WSPS can only be installed in about 25% of the helicopters. The other helicopters (e.g., Robinson R22, Robinson R44, Bell 47, and MD 369) cannot be equipped with WSPS.

During the years 1994-2004, there were 65 fatalities in wire strike accidents, in which 21 fatalities (32%) involved the Bell-206 helicopter. The AS 350 and the Bell 407 helicopters each had 4 fatalities (6%).

Thus, assuming that the trend of the past 10 years continues in the coming years, and assuming that all the wire strike accidents occur in conditions when it is most effective, equipping helicopters with WSPS can reduce about 44% of the fatalities. However, this is an overestimate because most of the accidents occurred during the climb and descent phases of flight and involved wire strikes of the main rotor system, the tail boom, or the vertical tail.

4.2 POWERLINE DETECTOR.

The Powerline Detector System (Safe Flight Instrumentation Corporation) senses the electromagnetic fields surrounding power lines. This detector only senses active power lines, and the range of detection depends on the electrical power in the lines. The system will not detect other types of wires such as guy wires, telephone lines, and nonactive power lines. Also, the pilot is not alerted to the direction of the power lines with reference to the aircraft.

Since the retail price (not including installation) is \$11,800 and because it needs a 28-volt power source, this system may be best suited for more expensive helicopters.

This system has the potential to be developed for use in light helicopters if it can be manufactured at a lower cost and use less power.

4.3 HELICOPTER-INSTALLED RADAR AND LASER-BASED SYSTEMS.

Devices that use lasers or radar to scan the surroundings for the presence of obstructions such as wires are OASys (Amphitech System), LOAS (Goodrich Sensor System), and HELLAS (EADS Dornier). These are comparatively heavy (between 35 and 60 lb) and expensive devices (more than \$100,000) for most civil helicopters.

Developing less expensive devices that can be fitted in light helicopters, such as the Robinson R22, can be helpful to about 75% of the helicopters.

4.4 HONEYWELL EGPWS.

The EGPWS can warn pilots about obstacles that are over 30 ft AGL using GPS and a database that is maintained by Honeywell Aerospace. The EGPWS weighs about 4 lb and costs \$45,000, which makes the system too expensive for most civil helicopters.

4.5 AERIAL MARKERS.

Spherical markers mounted on wires enhance their visibility and help to avoid wire strikes. The MOWAT Work Group [9] recognized the importance of wire markers in preventing wire strikes.

4.6 OBSTACLE COLLISION AVOIDANCE SYSTEM.

The OCAS is located on utility and power line towers and detects all air traffic entering a predefined warning zone and activates warning lights that illuminate the tower. If the pilot does not take evasive action, a voice/audio warning is transmitted on all channels in the airborne VHF or optional UHF communication bands.

Because the OCAS does not require installation in the helicopter, there is no expense for the helicopter operators. In spite of its cost (\$50,000 per installation), it can be more economical for the utility company because the utility towers are lighted only when the system detects an aircraft entering the warning zone.

4.7 HUMAN FACTORS/PILOT TRAINING.

It has been noted that most of the helicopter wire strikes occurred at daytime with good visibility and experienced pilots. Specialists have stated that a variety of actions by helicopter pilots can prevent wire strike accidents. Robert Feerst, President of Utilities/Aviation Specialists, teaches courses in wire strike avoidance. He recommends reviewing aeronautical charts and conducting a reconnaissance flight at a higher altitude before conducting low-altitude operations [5].

Wires are difficult to see, partly because of the way the human eye functions, and partly because of the effects of camouflaging. The movement of wires in sunlight and changing sunlight patterns can also obscure wires. Older wires may be difficult to see because, as they age, their color often changes. For example, copper wires oxidize with age, turning a greenish color that makes them difficult to distinguish from grass and trees in the background. The exact location of specific wires may change throughout the day because of fluctuating ambient temperatures, which may cause wires to sag or tighten. Sagging wires may also be blown by the wind [5].

The pilot's view of the outside can be affected by the canopy and the vibratory environment of the cockpit. The canopy may not always be clean, which contributes to lower visibility. It is known that human performance deteriorates after prolonged exposure to certain vibrations. For example, the human eyeball and intraocular structures have natural frequencies in the 20- to 90-Hz range [31]. Most helicopters have structural frequencies in the 20-Hz range. More human factors research is needed to understand how the human eye perceives obstacles, such as wires, in this environment.

Pilots need to be trained to recognize different types of wires, including power and guy wires, and how to anticipate the location of wires. They need to know the power grid system and how to determine wire direction from the location of insulating connectors on various towers.

The MOWAT Work Group [9] recognized the importance of training in preventing wire strikes and has made two recommendations to the FAA. (1) A modification to the PTS to state that "Applicant should be aware of low level hazards and be knowledgeable in recognizing wires, towers and other low level hazards." (2) one-word change in Section 15(a) of 14 CFR Part 77. This recommendation deals with objects that are shielded by existing structures or by natural terrain of equal or greater height. Both recommendations are under consideration by the FAA (in 2004).

4.8 RECOMMENDATIONS.

Recommendations based on the study are as follows:

- a. All helicopter pilots flying 14 CFR Part 91 (general aviation) should avoid cruising below 750 ft, unless required to do so by the mission.
- b. Encourage pilots to review aeronautical charts and to conduct a reconnaissance flight at a higher altitude before conducting low-altitude operations.
- c. Develop less expensive wire proximity warning devices that can be fitted to light helicopters such as the Robinson R22. These less expensive wire proximity warning devices can be helpful to about 75% of the helicopters.
- d. Install mechanical wire cutters on applicable helicopters.
- e. Implement the recommendations made by MOWAT on wire marking and on pilot training.
- f. Conduct human factors studies to develop an understanding of wire identification and avoidance used by pilots in the cockpit environment.

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APPENDIX A—U.S. ARMY HELICOPTER ACCIDENTS

Ref: <http://crc.army.mil/home/>

A.1-U.S. ARMY HELICOPTER ACCIDENTS: ALL ROTARY WING

A.1.1 FY 2003: All Rotary Wing

Accident Class	Accident Count	Injury Count*		Cost		
		Fatal	Non-Fatal**	Damage	Injury*	Total
A	29	32	17	\$212,495,669	\$17,955,513	\$230,451,182
B	18	0	0	\$5,027,184	\$0	\$5,027,184
C	73	0	2	\$3,448,401	\$8,297	\$3,456,698
D	41	0	0	\$404,602	\$0	\$404,602
E	1015	0	0	\$0	\$0	\$0
Total Number of Accidents	1176	32	19	\$221,375,856	\$17,963,810	\$239,339,666

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.1.2 FY 2002: All Rotary Wing

Accident Class	Accident Count	Injury Count*		Cost		
		Fatal	Non-Fatal**	Damage	Injury*	Total
A	25	16	27	\$279,469,896	\$12,067,705	\$291,537,601
B	10	0	3	\$3,407,365	\$15,708	\$3,423,073
C	68	0	1	\$3,894,662	\$1,680	\$3,896,342
D	60	0	0	\$519,231	\$0	\$519,231
Total Number of Accidents	163	16	31	\$287,291,154	\$12,085,093	\$299,376,247

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.1.3 FY 2001: All Rotary Wing

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	8	6	12	\$47,276,897	\$3,791,221	\$51,068,118
B	14	0	0	\$7,766,188	\$4,200	\$7,770,388
C	61	0	1	\$3,685,543	\$23,550	\$3,709,093
D	33	0	0	\$172,681	\$0	\$172,681
Total Number of Accidents	116	6	13	\$58,901,309	\$3,818,971	\$62,720,280

* Army Military Personnel Only

** Degree of Injury = B,C,D

A.1.4 FY 2000: All Rotary Wing

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	6	4	7	\$31,009,678	\$4,548,770	\$35,558,448
B	4	0	0	\$2,545,369	\$240	\$2,545,609
C	59	0	0	\$2,970,212	\$0	\$2,970,212
D	45	0	0	\$236,489	\$0	\$236,489
Total Number of Accidents	114	4	7	\$36,761,748	\$4,549,010	\$41,310,758

* Army Military Personnel Only ** Degree of Injury=B,C,D

A.1.5 FY 1999: All Rotary Wing

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	16	13	13	\$104,857,448	\$8,685,551	\$113,542,999
B	12	0	2	\$6,162,074	\$11,616	\$6,173,690
C	62	0	0	\$4,535,294	\$0	\$4,535,294
D	60	0	0	\$332,138	\$1,680	\$333,818
Total Number of Accidents	150	13	15	\$115,886,954	\$8,698,847	\$124,585,801

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.1.6 FY 1998: All Rotary Wing

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	12	6	14	\$86,294,037	\$6,356,464	\$92,650,501
B	3	0	0	\$1,156,706	\$0	\$1,156,706
C	58	0	0	\$3,542,438	\$0	\$3,542,438
D	43	0	0	\$229,738	\$0	\$229,738
Total Number of Accidents	116	6	14	\$91,222,919	\$6,356,464	\$97,579,383

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.1.7 FY 1997: All Rotary Wing

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	11	13	6	\$36,887,993	\$8,055,859	\$44,943,852
B	12	0	5	\$5,797,929	\$30,580	\$5,828,509
C	50	0	1	\$3,646,322	\$19,572	\$3,665,894
D	52	0	0	\$260,661	\$1,200	\$261,861
Total Number of Accidents	125	13	12	\$46,592,905	\$8,107,211	\$54,700,116

* Army Military Personnel Only

** Degree of Injury = B,C,D

A.1.8 FY 1996: All Rotary Wing

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	8	16	32	\$92,292,100	\$11,307,325	\$103,599,425
B	11	0	1	\$4,936,775	\$1,125	\$4,937,900
C	61	0	0	\$3,392,562	\$0	\$3,392,562
D	68	0	0	\$366,729	\$120	\$366,849
Total Number of Accidents	148	16	33	\$100,988,166	\$11,308,570	\$112,296,736

A.1.9 FY 1995: All Rotary Wing

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	9	13	6	\$49,425,931	\$10,590,237	\$60,016,168
B	14	0	12	\$6,313,087	\$59,829	\$6,372,916
C	60	0	0	\$3,611,785	\$0	\$3,611,785
D	79	0	0	\$441,438	\$0	\$441,438
Total Number of Accidents	162	13	18	\$59,792,241	\$10,650,066	\$70,442,307

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.1.10 FY 1994: All Rotary Wing

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	21	11	15	\$90,498,677	\$10,261,829	\$100,760,506
B	9	0	2	\$4,303,693	\$34,159	\$4,337,852
C	76	0	2	\$3,962,713	\$20,206	\$3,982,919
D	96	0	0	\$489,268	\$0	\$489,268
Total Number of Accidents	202	11	19	\$99,254,351	\$10,316,194	\$109,570,545

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.2-WIRE STRIKE ACCIDENTS (U.S. ARMY HELICOPTERS)

A.2.1 FY 2003: Wire Strike

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	2	2	0	\$2,000,000	\$2,200,000	\$4,200,000
B	1	0	0	\$200,000	\$0	\$200,000
C	3	0	0	\$118,197	\$0	\$118,197
D	1	0	0	\$17,213	\$0	\$17,213
Total Number of Accidents	7	2	0	\$2,335,410	\$2,200,000	\$4,535,410

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.2.2 FY 2002: Wire Strike

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	2	0	0	\$2,000,000	\$0	\$2,000,000
D	2	0	0	\$13,722	\$0	\$13,722
Total Number of Accidents	4	0	0	\$2,013,722	\$0	\$2,013,722

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.2.3 FY 2001: Wire Strike

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
B	1	0	0	\$264,958	\$0	\$264,958
C	3	0	0	\$292,175	\$0	\$292,175
D	1	0	0	\$7,200	\$0	\$7,200
Total Number of Accidents	5	0	0	\$564,333	\$0	\$564,333

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.2.4 FY 2000: Wire Strike

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	1	0	0	\$952,625	\$0	\$952,625
C	2	0	0	\$80,789	\$0	\$80,789
D	2	0	0	\$14,387	\$0	\$14,387
Total Number of Accidents	5	0	0	\$1,047,801	\$0	\$1,047,801

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.2.5 FY 1999: Wire Strike

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
C	3	0	0	\$83,840	\$0	\$83,840
D	2	0	0	\$8,196	\$0	\$8,196
Total Number of Accidents	5	0	0	\$92,036	\$0	\$92,036

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.2.6 FY 1998: Wire Strike

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	2	0	10	\$12,906,970	\$410,503	\$13,317,473
B	1	0	0	\$568,094	\$0	\$568,094
C	2	0	0	\$101,576	\$0	\$101,576
Total Number of Accidents	5	0	10	\$13,576,640	\$410,503	\$13,987,143

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.2.7 FY 1997: Wire Strike

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	1	0	0	\$2,018,973	\$0	\$2,018,973
C	1	0	0	\$38,039	\$0	\$38,039
D	2	0	0	\$7,611	\$0	\$7,611
Total Number of Accidents	4	0	0	\$2,064,623	\$0	\$2,064,623

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.2.8 FY 1996: Wire Strike

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
D	2	0	0	\$14,488	\$0	\$14,488
Total Number of Accidents	2	0	0	\$14,488	\$0	\$14,488

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.2.9 FY 1995: Wire Strike

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	2	1	0	\$9,348,802	\$1,100,000	\$10,448,802
C	2	0	0	\$157,326	\$0	\$157,326
D	3	0	0	\$17,260	\$0	\$17,260
Total Number of Accidents	7	1	0	\$9,523,388	\$1,100,000	\$10,623,388

* Army Military Personnel Only ** Degree of Injury = B,C,D

A.2.10 FY 1994: Wire Strike

		Injury Count*		Cost		
Accident Class	Accident Count	Fatal	Non-Fatal**	Damage	Injury*	Total
A	2	4	1	\$13,801,610	\$2,741,518	\$16,543,128
C	3	0	0	\$395,255	\$0	\$395,255
D	4	0	0	\$26,345	\$0	\$26,345
Total Number of Accidents	9	4	1	\$14,223,210	\$2,741,518	\$16,964,728

* Army Military Personnel Only ** Degree of Injury = B,C,D

APPENDIX B—U.S. CIVIL HELICOPTER WIRE STRIKE ACCIDENTS

B.1 TABULATED DATA.

In the tables below, the following symbols were used to classify injury types:
 F = fatal, S = serious, M = minor and U = uninjured.

1994					
	Date	Place	NTSB Identification	Injuries	Type of Operation
1	1/4/1994	Coolidge Dam, AZ	LAX94LA090	1F/3S	Part 91: General Aviation
2	1/6/1994	Clearwater, OR	SEA94LA047	3M	Part 91: General Aviation
3	1/20/1994	Lebec, CA	LAX94FA100	2F	Part 135: Air taxi and commuter
4	4/21/1994	Braweley, CA	LAX94LA199	1F	Part 137: Agricultural
5	4/24/1994	Summerville, OR	SEA94LA109	1M	Part 137: Agricultural
6	5/5/1994	North Bergen, NJ	NYC94FA078	2F	14 CFR Part 91: General Aviation
7	5/8/1994	Stone Mountain, GA	ATL94LA094	2U	14 CFR part 91: General Aviation
8	5/9/95	Hacienda Heights, CA	LAX94FA214	2F, 3M	14CFR Part 91: General Aviation
9	5/12/1994	Winnebago, IL	CHI94LA161	2U	14 CFR Part 91: General Aviation
10	6/23/1994	Watertown, SD	CHI94LA191	1F	14 CFR Part 137: Agricultural
11	8/11/1994	Sargeant, MN	CHI94LA276	1U	14 CFR Part 137: Agricultural
12	9//23/94	Moorehaven, FL	MIA94LA216	1U	14 CFR Part 137: Agricultural
13	10/26/1994	Inver Groove Hts, MN	CHI95LA026	4S, 1M	14 CFR Part 91: General Aviation
14	11/4/1994	Perry, FL	MIA95FA018	2F,1S	14 CFR Part 91: General Aviation

1995					
1	1/14/1995	Los Angeles, CA	LAX95FA079	2F2S	14 CFR Part 135: Air Taxi & Commuter
2	2/20/1995	Sonoma, CA	LAX95LA113	1S	14 CFR Part 91: General Aviation
3	3/7/1995	Lakecreek, OR	SEA95FA064	1F	Part 91: General Aviation
4	4/1/1995	Flower Mound, TX	FTW95FA151	1F2S4M	Part 91: General Aviation
5	4/25/1995	Ardmore, OK	FTW95FA181	2F	Part 91: General Aviation
6	6/4/1995	Caldwell, ID	SEA95LA112	1M	Part 137: Agricultural
7	7/4/1995	Orting, WA	SEA95LA139	3S	Part 91: General Aviation
8	7/31/1995	Montrose, GA	ATL95LA145	1U	Par 137: Agricultural
9	8/29/1995	Johnsondale, CA	LAX95FA313	2F	Part 91: General Aviation
10	12/5/1995	Thibodoux, CA	FTW96FA060	1F1M	Part133: Rotorcraft Ext load

1996					
1	4/30/1996	Yuma, AZ	LAX96TA186	1U	Part 91: General Aviation
2	5/31/1996	Arock, OR	SEA96LA106	1U	Part 91: General Aviation
3	6/30/1996	Mandan, ND	CHI96LA223	1U	Part 137: Agricultural
4	7/8/1996	Carver, MA	NYC96LA145	1M	Part 91: General Aviation
5	7/9/1996	Bartow, FL	ATL96LA106	2M	Part 91: General Aviation
6	8/3/1996	Barton, AL	MIA96LA200	1F	CFR Part 137: Agricultural
7	9/13/1996	St.Regis, MT	SEA96TA213	1U	14 CFR Public Use
8	10/28/1996	Vestaburg, MI	CHI97LA016	1F	Part 133: Rotorcraft Ext. Load

1997					
1	3/14/1997	Glide, OR	SEA97LA072	1M	Part 137: Agricultural
2	3/19/1997	Donna, TX	FTW97LA131	1S	Part 137: Agricultural
3	6/11/1997	Cedar Rapids, IA	CHI97GA166	2S	Part 91: General Aviation
4	6/13/1997	Sharon, VT	NYC97LA119	2M	Part 91: General Aviation
5	8/11/1997	Holcomb, MS	ATL97LA121	1U	Part 137: Agricultural
6	9/20/1997	McGee, MS	ATL97LA139	3U	Part 91: General Aviation
7	10/14/1997	Grand Forks, ND	CHI98LA021	1U	Part 91: General Aviation
8	12/5/1997	Big Timber, MT	SEA98LA020	1M	Part 91: General Aviation
9	12/14/1997	Littleton, CO	FTW98FA068	4F	Part 135: Air Taxi and Commuter

1998					
1	3/19/1998	Santa Clarita, CA	LAX98TA123	1U	Part 91: General Aviation
2	5/1/1998	Irwindale, CA	LAX98FA149	1F 1S	Part 91: General Aviation
3	5/24/1998	Bixby, OK	FTW98FA238	1F 1S	Part 91: General Aviation
4	5/25/1998	Indian Trail, NC	ATL98FA080.	5F	Part 193 Air Taxi and Commuter
5	6/2/1998	Shoshone, ID	SEA98FA084	1F 1S	Part 133: Rotorcraft Ext Load
6	6/10/1998	Le Center, MN	CHI98LA198	1S	Part 137: Agricultural
7	7/2/1998	Cassville, MO	CHI98LA239	2M	Part 91: General Aviation
8	7/7/1998	Salinas, CA	LAX98LA225	1M	Part 137: Agricultural
9	10/5/1998	Bow, NH	NYC99LA004	1M	Part 91: General Aviation
10	11/6/1998	Clinton, MN	CHI99LA026	1U	Part 91: General Aviation
11	11/29/1998	Idaho City, ID	SEA99LA016	4U	Part 135: Air Taxi and Commuter
12	12/4/1998	Deming, NM	DEN99FA024	1F	Part 91: General Aviation
13	12/6/1998	Carnation, WA	SEA99LA019	2U	Part 91: General Aviation

1999					
1	2/13/1999	Hockley, TX	FTW99LA080	5U	Part 135: Air Taxi and Commuter
2	5/5/1999	Wrangel, AK	ANC99TA058	1F,2U	Part 133: Rotorcraft Ext Load
3	6/8/1999	Ashcamp, KY	NYC99FA136	1F	Part 91: General Aviation
4	6/23/1999	Hurricane, WV	NYC99FA157	1F	Part 91: General Aviation
5	7/23/1999	Spring Green, WI	CHI99LA248	1U	Part 91: General Aviation
6	9/9/1999	Bakersfield, CA	LAX99TA299	1M	Part 133: Rotorcraft Ext Load
7	9/18/1999	Tucumcari, NM	DEN99LA163	1U	Part 91: General Aviation
8	9/18/1999	Salinas, CA	LAX99LA319	1U	Part 137: Agricultural
9	9/22/1999	Randolf, NY	NYC99GA234	2S	Part 91: General Aviation
10	9/25/1999	St.George, UT	DEN99LA171	1U	Part 91: General Aviation
11	10/28/1999	Castroville, CA	LAX00LA027	1S	Part 137: Agricultural
12	11/2/1999	Stites, ID	SEA00TA013	2S,1U	14 CFR Public Usage

2000					
1	1/26/2000	Five Points, CA	LAX00LA077	1U	Part 137: Agricultural
2	2/20/2000	Del Ray, FL	MIA00LA095	1U	Part 91: General Aviation
3	2/21/2000	Byron, CA	LAX00LA107	1M	Part 137: Agricultural
4	3/12/2000	Vacaville, CA	LAX00LA124	1M	Part 137: Agricultural
5	4/2/2000	Stanwood, VA	SEA00FA061	1F1S1M	Part 91: General Aviation
6	5/1/2000	Bloomfield, NM	DEN00FA082	2F	Part 91: General Aviation
7	5/6/2000	Metter, GA	MIA00LA145	1M	Part 91: General Aviation
8	5/25/2000	Buhl, ID	SEA00LA092	1S	Part 137: Agricultural
9	7/23/2000	Circleville, OH	IAD00LA065	1S,1M	Part 91: General Aviation
10	7/28/2000	King City, CA	LAX00LA280	1U	Part 137: Agricultural
11	8/30/2000	Salinas, CA	LAX00LA326	1U	Part 137: Agricultural
12	9/1/2000	Canton, MS	MIA00LA257	1S	Part 137: Agricultural
13	9/7/2000	Rancho Murieta, CA	LAX00LA328	1F	Part 91: General Aviation
14	11/16/2000	Houston, TX	FTW01FA021	1F	Part 91: General Aviation

2001					
1	3/10/2001	Alvarado, TX	FTW01LA076	2U	Part 91: General Aviation
2	3/17/2001	Hayward, CA	LAX01TA119	3U	14 CFR Public Usage
3	4/27/2001	Nacogdoches, TX	FTW01LA109	1M	Part 91: General Aviation
4	5/28/2001	Fairfield, KY	NYC01LA131	1M,1U	Part 91: General Aviation
5	7/26/2001	Wheeler, WI	CHI01LA243	1F	Part 137: Agricultural
6	8/11/2001	Strathmore, CA	LAX01LA276	1M	Part 137: Agricultural
7	10/22/2001	N. Wilkesboro, NC	ATL02FA003	2F	Part 91: General Aviation
8	11/3/2001	Seagoville, TX	FTW02FA028	1F,1S	Part 91: General Aviation
9	11/17/2001	Richmond, TX	FTW02LA038	1S,1U	Part 91: General Aviation
10	11/22/2001	Tallassee, AL	MIA02FA026	2F,1S	Part 91: General Aviation
11	12/12/2001	Waukesha, WI	CHI02FA049	1F,1S,1M	Part 91: General Aviation
12	12/27/2001	Park City, UT	DEN02GA016	3F	14 CFR Public Usage

2002					
1	2/22/2002	Paso Robles, CA	LAX02LA090	1M	Part 91: General Aviation
2	5/21/2002	Marion, AL	ATL02LA102	1U	Part 137: Agricultural
3	5/23/2002	Merlin, OR	SEA02FA085	2F	Part 91: General Aviation
4	6/24/2002	LaBelle, FL	ATL02LA128	1M	Part 137: Agricultural
5	5/27/2002	Raton, NM	DEN02FA065	2F	Part 91: General Aviation
6	7/7/2002	Compton, CA	LAX02LA218	2U	Part 91: General Aviation
7	7/10/2002	Brookville, IN	CHI02FA189	1F2S	Part 91: General Aviation
8	8/24/2002	Oasis, CA	LAX02LA262	1S1U	Part 137: Agricultural
9	8/25/2002	Coopersville, MI	CHI02LA256	1S1U	Part 91: General Aviation
10	8/30/2002	Canon City, CO	DEN02LA101	1S	Part 91: General Aviation
11	9/25/2002	Edmondson, AR	FTW02LA264	1F	Part 137: Agricultural
12	9/26/2002	Freer, TX	FTW02LA266	2U	Part 91: General Aviation
13	11/10/2002	Kingman, AZ	LAX03LA027	2M, 1U	Part 91: General Aviation
14	11/15/2002	Kingman, AZ	ANC03LA015	1F	Part 91: General Aviation
15	11/22/2002	Morrison, CO	DEN03LA018	1M,1U	Part 91: General Aviation
16	12/23/2002	Dolan Springs, AZ	LAX03FA054	2F	Part 91: General Aviation

2003					
1	4/20/2003	Waterford, PA	NYC03LA087.	1U	Part 91: General aviation
2	6/1/2003	Las Vegas, NV	LAX03LA177	1U	Part 91: General aviation
3	6/25/2003	Dexter, MO	CHI03LA182	1F	Part 137:Agricultural
4	7/15/2003	Cleveland, MN	CHI03LA210	1S	Part 137:Agricultural
5	7/30/2003	Tulare, CA	LAX03CA250	1M	Part 137:Agricultural
6	8/19/2003	Mason, TX	FTW03LA197	3M	Part 91: General aviation
7	9/9/2003	Kekaha, HI	LAX03CA284	1U	Part 137:Agricultural
8	9/13/2003	Greenfield, CA	LAX03CA285	1U	Part 137:Agricultural
9	10/14/2003	Swisshome, OR	SEA04LA005	2F	Part 91: General aviation
10	10/24/2003	Cushing, MN	CHI04CA020	1M	Part 91: General aviation
11	12/20/2003	Henryetta, OK	FTW04LA046	3U	Part 91: General aviation

2004					
1	2/28/2004	Burlington, WI	CHI04LA079	2U	Part 91: General Aviation
2	5/3/2004	Bakersfield, CA	LAX04TA202	2U	Public Use
3	6/8/2004	Prosser, WA	SEA04LA102	2U	Part 91: General Aviation
4	6/26/2004	Cushing, OK	FTW04FA167	2F, 3S	Part 91: General Aviation
5	7/11/2004	Beverly, MA	NYC04CA166	2U	Part 91: General Aviation

B.2 NARRATIVES OF CIVIL HELICOPTER ACCIDENTS.

1994

1. NTSB Identification: LAX94LA090.

14 CFR Part 91: General Aviation

Accident occurred Tuesday, January 04, 1994 in COOLIDGE DAM, AZ

Aircraft: BELL 206B, registration: N771GM

Injuries: 1 Fatal, 3 Serious.

After flying uneventfully for about 1.5 hrs, the pilot was directed to reposition the helicopter to another portion of a wildlife population survey flight area. While cruising en route, between 130 and 180 feet agl, the helicopter collided with an unmarked power line and crashed. A post impact fire erupted which destroyed the helicopter. The State of AZ, Dept. of Fish & Game, had contracted for its personnel to be transported via helicopter over mountainous terrain on the survey flight. A mission requirement was to fly within 200 feet of ground level. Prior to departure, the pilot had prepared himself regarding obstructions in the survey area. The accident power lines were depicted on the sectional chart. Several pilots reported that the lines were extremely difficult to observe. The helicopter was not equipped with a wire strike protection system.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's selection of a cruise altitude insufficient to ensure adequate obstacle clearance and his inadequate visual lookout. A factor in the accident was the inconspicuousness of the power lines.

2. NTSB Identification: SEA94LA047.

14 CFR Part 91: General Aviation

Accident occurred Thursday, January 06, 1994 in CLEARWATER, OR

Probable Cause Approval Date: 12/2/94

Aircraft: MBB BO-105S, registration: N204PC

Injuries: 3 Minor.

The pilot was flying the helicopter in a southwesterly direction at 50 feet agl while following a canal on an aerial survey of wildlife. As he adjusted his flightpath to a westerly heading his visibility was restricted by the afternoon sun. The pilot observed power lines in his flight path and attempted to turn and decelerate to avoid contact. The maneuver was unsuccessful and the helicopter's main rotor blade(s) contacted the wires. The helicopter then descended out of control into a forebay (small pond). The sun's position at the time of the accident was approximately +16 degrees above the horizon and 216 degrees true azimuth.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot in command's failure to maintain clearance with the transmission wires. Factors contributing to the accident were the wires and sun glare.

3. NTSB Identification: **LAX94FA100.**

Nonscheduled 14 CFR Part 135: Air Taxi & Commuter

Accident occurred Thursday, January 20, 1994 in LEBEC, CA

Aircraft: AEROSPATIALE AS-350D, registration: N5795X

Injuries: 2 Fatal.

An aerospatiale AS350D helicopter collided with two power transmission cables in mountainous terrain while preparing to land at an off-airport site. The helicopter was not scheduled to land at the site and the pilot had not landed at the site in the past. Higher mountainous terrain in the area masked the unmarked wires and support towers. The power transmission cables were depicted on the aeronautical sectional chart and were not required to be marked.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot-in-command's inadequate in-flight planning and inadequate visual lookout. Factors in the accident were mountainous terrain which masked the presence of the wires and the pilot-in-command's lack of familiarity with the geographic area.

4. NTSB Identification: **LAX94LA199.**

14 CFR Part 137: Agricultural

Accident occurred Thursday, April 21, 1994 in BRAWLEY, CA

Aircraft: Continental Copters TOMCAT MK5A, registration: N9061T

Injuries: 1 Fatal.

The helicopter was being used for night aerial application. According to 2 company loaders, the pilot had completed the application and was maneuvering to make an approach into the southwesterly wind for a landing at the truck. While maneuvering about 1/2 mile from the truck, the helicopter collided with a power line and crashed. The average height of the power line was about 25 feet. No evidence of a preimpact mechanical discrepancy was found during an examination of the wreckage.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Failure of the pilot to maintain sufficient altitude, while maneuvering to land after completing aerial application. Factors related to the accident were: darkness and the lack of visual cues for the pilot to detect the obstruction (power line).

5. NTSB Identification: **SEA94LA109.**

14 CFR Part 137: Agricultural

Accident occurred Monday, April 25, 1994 in SUMMERVILLE, OR

Aircraft: BELL 206B, registration: N35BL

Injuries: 1 Minor.

The pilot reported that shortly after take off with a load of chemical, the helicopter struck power lines. The pilot was unable to maintain control of the helicopter which collided with the terrain just beyond the wires. The pilot stated that because of the overcast sky, he did not see the wires. The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot did not maintain clearance from the wires. The overcast sky conditions

6. NTSB Identification: **NYC94FA078.**

14 CFR Part 91: General Aviation

Accident occurred Thursday, May 05, 1994 in NORTH BERGEN, NJ

Aircraft: ROBINSON R22A, registration: N503TH

Injuries: 2 Fatal.

The helicopter was headed east when it struck and severed a static wire, suspended over high tension power lines perpendicular to the flight course. The helicopter caught fire, descended, and struck the ground on a highway (interstate 495) and came to rest against the center divider. The severed wire fell into a parking lot and a fire occurred damaging about 100 cars. About 7 minutes earlier, the pilot reported to air traffic control at the departure point, that he would proceed on the 'sierra' charted vfr helicopter route. The wire strike occurred where the route passes over the wire. The wire was suspended between two towers, which were respectively 172 and 162 feet high. The private pilot was on a cross-country flight in conjunction with formal training for the commercial pilot certificate. The passenger was a certificated flight instructor and he had about 967 hours of total flight time. He was not acting in the capacity of an instructor on this flight.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain adequate visual lookout and adequate obstacle clearance, which resulted in an in-flight collision with a static wire.

7. NTSB Identification: **ATL94LA094.**

14 CFR Part 91: General Aviation

Accident occurred Sunday, May 08, 1994 in STONE MOUNTAIN, GA

Aircraft: ROBINSON R-22B, registration: N54BA

Injuries: 2 Uninjured.

The helicopter had been landed in a residential cul-de-sac. It remained parked there while the pilot and his passenger ate at a nearby residence. The pilot reported that a telephone wire was located behind, and about 20 feet above the aircraft. On departure, the tail rotor contacted the wire when the pilot lowered the nose to begin the transition from a hover to forward flight. After contacting the wire, the pilot experienced directional control problems and an autorotation was made back to the street. The helicopter landed hard, which resulted in spreading the skids and bending the helicopter frame. According to the pilot, the tail rotor was mangled.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's improper vertical takeoff in that he allowed the helicopter to drift rearward, and his failure to maintain clearance from the wire.

8. NTSB Identification: **LAX94FA214.**

14 CFR Part 91: General Aviation

Probable Cause Approval Date: 5/9/95

Aircraft: ROBINSON R-22, registration: N8047Y

Injuries: 2 Fatal, 3 Minor.

The helicopter collided with the upper static cable of power transmission lines while on a night cross-country flight. Witnesses reported seeing the helicopter flying low for several miles before the collision. After the collision, the helicopter came to rest on an interstate highway. Examination of the wreckage indicated the center post of the canopy struck the cable first. The visibility was reported as 6 statute miles with haze and fog. The wires are depicted on the helicopter route chart and the VFR terminal area chart. The cable support towers were lighted on the night of the accident. There was no evidence of pre-accident mechanical failure or malfunction of the helicopter. Three automobiles were damaged when the helicopter crashed. One automobile stopped in the westbound lanes short of crashed helicopter and another automobile struck the rear of the stopped vehicle. An automobile in the eastbound lanes struck the helicopter's mast and was damaged. All reported injuries on the ground were a result of automobiles colliding in the westbound lanes.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's selection of an en route cruise altitude, which provided insufficient obstruction clearance, and his inadequate visual lookout. Factors in the nighttime accident were the reduced visibility as a result of the fog and haze.

9. NTSB Identification: **CHI94LA161.**

14 CFR Part 91: General Aviation

Accident occurred Thursday, May 12, 1994 in WINNEBAGO, IL

Aircraft: BELL 206B, registration: N49585

Injuries: 2 Uninjured.

The pilot was flying the helicopter below the tree line about 30 feet above the ground while following some cars on the highway. He attempted a sharp pull-up to avoid some power lines across the highway, but the helicopter struck the wires. The pilot executed an autorotation to a field north of the highway. The helicopter rolled-over after touchdown.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

A wire strike due to failure to maintain proper altitude, and improper visual lookout by the pilot-in-command.

Full narrative: **CHI94LA161**

On May 12, 1994, about 1230 central daylight time, a Bell 206B helicopter, N49585, sustained substantial damage when it struck a power line and crashed near Winnebago, Illinois. Neither the airline transport certificated pilot nor the single passenger aboard the helicopter were injured. The business flight originated at Rockford, Illinois, about 1215, with an intended destination of Galena, Illinois. No flight plan was filed, and visual meteorological conditions prevailed at the time. The pilot-rated passenger who was seated in the right seat was flying the helicopter when it departed Rockford. He stated the purpose of the flight was to follow some cars to Galena. He said he was flying at 1200 feet following highway 20 westbound. After the helicopter cleared the Rockford Regional Airport's airspace, the passenger stated the pilot took control of the helicopter and descended to about 30 feet above the road while following the cars. He said the helicopter was below the tree line. He stated the pilot pulled the helicopter up sharply when wires were seen in their flight path. The helicopter struck one of the wires. The pilot made an autorotation to a field north of the highway. The helicopter rolled over after landing.

10. NTSB Identification: **CHI94LA191.**

14 CFR Part 137: Agricultural

Accident occurred Thursday, June 23, 1994 in WATERTOWN, SD

Aircraft: HILLER HU-12E, registration: N330CW

Injuries: 1 Fatal.

While maneuvering during aerial application the helicopter impacted a transmission wire and the terrain. A subsequent examination of the helicopter revealed no pre-existent anomalies. Post mortem examination of the pilot revealed no physical impairment and toxicological examination of specimens from pilot were negative for drugs screened.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain a visual lookout. A factor associated with the accident was the power lines.

11. NTSB Identification: **CHI94LA276.**

14 CFR Part 137: Agricultural

Accident occurred Thursday, August 11, 1994 in SARGEANT, MN

Aircraft: BELL 47G3B1, registration: N64292

Injuries: 1 Uninjured.

The pilot reported he had just completed an aerial application spray run with the helicopter, and was maneuvering to start another run. He turned the helicopter to miss a guy wire, and in the

process inadvertently allowed the main rotor blades to strike a transmission wire. He was able to maintain partial control of the helicopter, and made a forced landing in a nearby field.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance from a transmission wire during an agricultural spray run. A factor in the accident is the transmission wire.

12. NTSB Identification: **MIA94LA216.**

14 CFR Part 137: Agricultural

Accident occurred Friday, September 23, 1994 in MOORE HAVEN, FL

Aircraft: BELL 47G-2A, registration: N30JJ

Injuries: 1 Uninjured.

The pilot stated he was making a swath run to the north over an orange grove. He was aware that power lines paralleled the swath run to the north, and additional power lines crossed the end of the swath run from east to west. Upon reaching the end of the swath run, the helicopter collided with the wires separating the tail rotor from the helicopter. The helicopter spun to the right, collided with the terrain, and was destroyed by a post crash fire.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot-in-command's failure to maintain a visual lookout while maneuvering on a swath run, resulting in an in-flight collision with wires, and subsequent in-flight collision with terrain.

13. NTSB Identification: **CHI95LA026.**

14 CFR Part 91: General Aviation

Accident occurred Wednesday, October 26, 1994 in INVER GROVE HTS, MN

Probable Cause Approval Date: 2/24/95

Aircraft: BELL 206B3, registration: N505KS

Injuries: 4 Serious, 1 Minor.

The helicopter struck transmission wires that ran perpendicular to its flight path, crashed and then caught fire. Witnesses reported seeing the helicopter flying low over a recently completed area of road construction, climb to pass over a 32' high intersecting bridge, and then descend again. The helicopter struck wires which were approximately 30' agl. The pilot stated he was giving non-revenue sight-seeing rides to construction personnel who had been working on the highway project. He said he had made one previous round trip pass along the highway at approximately 75-200'. He said he made the second, accident pass lower to scout for landing sites to load future passengers. He indicated in an interview that he did not see the wires until just prior to impact.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's improper altitude and inadequate visual lookout.

14. NTSB Identification: **MIA95FA018.**

14 CFR Part 91: General Aviation

Accident occurred Friday, November 04, 1994 in PERRY, FL

Aircraft: Below BO-105S, registration: N911LF

Injuries: 2 Fatal, 1 Serious.

The surviving passenger reported that the helicopter pilot had stated over the intercom that he was going to 'break in the new passenger with a real ride.' he then descended to low level, high speed flight. Shortly thereafter, the dispatcher called. The pilot climbed to give a position report, then dove back to low level flight. Soon thereafter, the helicopter struck a power line, went out of control, and crashed. Ground witnesses reported that they also saw the helicopter at low altitude and high speed before it struck the power line.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Failure of the pilot to maintain sufficient clearance from the power line, while buzzing (at low altitude).

1995

1. NTSB Identification: **LAX95FA079.**

Nonscheduled 14 CFR Part 135: Air Taxi & Commuter

Accident occurred Saturday, January 14, 1995 in LOS ANGELES, CA

Probable Cause Approval Date: 2/27/96

Aircraft: BELL 206B, registration: N2209P

Injuries: 2 Fatal, 2 Serious.

The pilot requested and received a special vfr clearance out of the class c airspace and proceeded southbound from the Burbank airport. The airport prevailing weather was 300 ft broken; visibility 2-1/2 mi with fog and light rain. The helicopter continued southbound until it collided with high voltage transmission wires about 150 ft agl. Radar data showed that the helicopter did not climb more than 300 ft above the ground after departure. Ground witnesses reported that due the prevailing rain showers, cloud obscuration, and a 1/4-mi visibility, the helicopter was barely distinguishable. The helicopter became entangled with the second set of wires until the main rotor assembly separated and then it plunged to the ground. The pilot did not obtain a weather briefing from the fss, nor file a flight plan. He did receive the current atis before departing.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's continued vfr flight into instrument meteorological conditions. Factors which contributed to the accident were: the pilot's and operator's failure to follow their established dispatch procedures, the pilot's poor judgment in initiating the flight, and the existing weather conditions.

2. NTSB Identification: **LAX95LA113.**

14 CFR Part 91: General Aviation

Accident occurred Monday, February 20, 1995 in SONOMA, CA

Probable Cause Approval Date: 5/18/95

Aircraft: BELL 47G-5, registration: N1309X

Injuries: 1 Serious.

The pilot reported that while performing a preflight inspection he observed moisture (dew) present on the bubble of his helicopter. He did not have towels, so he attempted to wipe the bubble clean using his hands. The pilot further reported that he observed bystanders approaching, so he decided to take off away from their position, and he flew into telephone wires. The pilot also reported that the sun was in front of him which also restricted his flight visibility.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain an adequate visual lookout for obstructions during initial climb. Factors which contributed to the accident were the pilot's inadequate preflight inspection, and his decision to fly with an inadequately cleaned bubble which partially obstructed his vision. Sun glare was an additional factor in the accident.

3. NTSB Identification: **SEA95FA064.**

14 CFR Part 91: General Aviation

Accident occurred Tuesday, March 07, 1995 in LAKECREEK, OR

Probable Cause Approval Date: 1/29/96

Aircraft: McDonnell Douglas 369E, registration: N59HS

Injuries: 1 Fatal.

The pilot was on a local practice flight. There were no witnesses to the accident. The wreckage was located almost directly beneath transmission lines, the lowest which was no more than 26 feet agl. Wreckage distribution indicated a slow velocity or hover condition at the time of the accident. The lower vertical stabilizer stinger tube was found imbedded in the soil alongside a gouge made by the tail rotor impacting the ground. The bottom wire was severed when one of the main rotor blades striking the ground separated and impacted the wire during its free flight.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain adequate clearance from the surrounding terrain. A factor was the transmission lines.

4. NTSB Identification: **FTW95FA151.**

14 CFR Part 91: General Aviation

Accident occurred Saturday, April 01, 1995 in FLOWER MOUND, TX

Probable Cause Approval Date: 10/19/95

Aircraft: BELL 206L-1, registration: N701EC

Injuries: 1 Fatal, 2 Serious, 4 Minor.

With winds from the south at 10-15 knots, the helicopter departed to the north, and the pilot had difficulty maintaining the helicopter in a climb attitude. During a right turn to avoid trees and houses, the pilot observed wires, and climbed in an attempt to clear the wires. However, the top wire was struck by the bottom aft portion of the left skid. During the night precautionary landing to a large field the pilot determined he had 'stabilized' the helicopter on an east heading and forward movement was stopped. During the touchdown with lateral movement, the helicopter rolled over and came to rest on its right side. The helicopter was at an estimated gross weight of 4,120 pounds at the time of the accident. Maximum allowable gross weight was 4,150 pounds. The pilot's currency for carrying passengers at night expired on March 11, 1995. A successful engine run was accomplished in a test cell after the accident.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's improper wind evaluation, and improper touchdown procedure, resulting in dynamic rollover of the helicopter. Factors were the tailwind, dark night, and the lack of recent experience at night.

5. NTSB Identification: **FTW95FA181.**

14 CFR Part 91: General Aviation

Accident occurred Tuesday, April 25, 1995 in ARDMORE, OK

Probable Cause Approval Date: 11/30/95

Aircraft: BELL 47D1, registration: N2202C

Injuries: 2 Fatal.

While on a local training flight, preparing the private pilot student for his commercial certificate check flight, the helicopter descended into a clearing. During departure from this site, the helicopter struck the static line of a power transmission array which crossed the area. The helicopter impacted in a vertical descent approximately 600 feet beyond the transmission line.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Inflight collision with a power transmission array static line when the flight instructor and dual (private pilot) student failed to maintain adequate visual lookout.

6. NTSB Identification: **SEA95LA112.**

14 CFR Part 137: Agricultural

Accident occurred Sunday, June 04, 1995 in CALDWELL, ID

Probable Cause Approval Date: 12/19/95

Aircraft: HUGHES 269B, registration: N9474F

Injuries: 1 Minor.

The pilot stated that he was returning from aerial application operations when he elected to look over the next field he was going to spray. He said his intent was to fly around a house on the west side of the field and then drop down to fly parallel to the power lines oriented east-west between two fields. As he banked around the house and flew east into the sun, he did not see the house's power pole and associated service line. The rotorcraft impacted the service line approximately 20 feet agl and impacted the ground 150 feet further east.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance from power lines. Factors include sun glare encountered when he turned into the sun.

7. NTSB Identification: **SEA95LA139.**

14 CFR Part 91: General Aviation

Accident occurred Tuesday, July 04, 1995 in ORTING, WA

Probable Cause Approval Date: 1/29/96

Aircraft: HUGHES 369HS, registration: N9196F

Injuries: 3 Serious.

The helicopter pilot was giving scenic rides, and elected to make a landing approach to a sand bar in the middle of a river. He stated that he scanned for wires at 300 feet elevation and saw nothing. He made a turn and slow approach to the sand bar. At about 10 feet height and 20 mph, he struck a cable used for an overhead trolley for crossing the river.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to see and avoid the cable.

8. NTSB Identification: **ATL95LA145.**

14 CFR Part 137: Agricultural

Accident occurred Monday, July 31, 1995 in MONTROSE, GA

Probable Cause Approval Date: 1/16/96
Aircraft: BELL 47G2, registration: N6145C
Injuries: 1 Uninjured.

The pilot stated that he was making a low level observation of the field prior to beginning spray operations. He said that he did not observe the power lines in the field, until it was too late to avoid hitting them. The helicopter struck the power lines and crashed into the field.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate preflight planning and visual lookout.

9. NTSB Identification: **LAX95FA313.**

14 CFR Part 91: General Aviation

Accident occurred Tuesday, August 29, 1995 in JOHNSONDALE, CA

Probable Cause Approval Date: 2/27/96

Aircraft: Bell 206-L1, registration: N3886J

Injuries: 2 Fatal.

The helicopter was engaged in filming operations for a video production company and made three passes along a river. On the third pass it flew down the river at an altitude between 50 and 100 feet and struck electrical transmission lines which span the river. After wire impact, the aircraft continued in the same direction, shaking and spinning to the right before final ground impact. Witnesses said that the wires were difficult to see because of foliage on the canyon walls. The helicopter was not equipped with wire cutters.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain an adequate obstacle clearance altitude while operating at a very low level. The aircraft's lack of wire cutters was a factor in this accident.

10. NTSB Identification: **FTW96FA060.**

14 CFR Part 133: Rotorcraft Ext. Load

Accident occurred Tuesday, December 05, 1995 in THIBODAUX, LA

Probable Cause Approval Date: 11/11/96

Aircraft: McDonnell Douglas 369E, registration: N16089

Injuries: 1 Fatal, 1 Minor.

The helicopter was hovering at 55 feet agl, parallel to a power line cable, facing east-southeast. The wind was from 200 to 210 degrees at 5 to 10 knots. The rotation plane of the tail rotor blades was about 38 inches from the nearest wire. A crew member, held by a safety harness, was working from the left side of the helicopter installing an overhead ground wire in roller blocks. The crew member's work platform was about 4 inches from the overhead ground wire when, as the pilot described, 'the cyclic suddenly moved to the left and maybe slightly forward. (The

helicopter) immediately started moving to the left and into the pole and line.’ The pilot further stated that he was ‘trying to stop the cyclic’ and move it to the right; however, ‘cyclic movement to the right had a restriction,’ and the ‘helicopter struck the pole and/or the shield wire, pivoted to the left and up, over the shield wire,’ and ‘began to spin.’ It impacted the ground, fire erupted, and the helicopter came to rest inverted. The pilot escaped the fire, but the crew member sustained fatal injuries. Investigation revealed the helicopter’s center-of-gravity was left-lateral (-2.67 inches), the limit was -3.00 inches, and about 25% of right cyclic travel was available to the pilot. A gouge mark was found on the side of the power pole matching the helicopters work platform. No preexisting cracks or discontinuities were found in unburned flight controls, although most of the controls were consumed by fire.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Failure of the pilot to maintain clearance from the power line and utility pole. The gusty/crosswind (weather) condition was a related factor.

1996

1. NTSB Identification: LAX96TA186.

14 CFR Part 91: General Aviation

Accident occurred Tuesday, April 30, 1996 in YUMA, AZ

Probable Cause Approval Date: 12/20/96

Aircraft: Hughes 369, registration: N5062Q

Injuries: 1 Uninjured.

The pilot was on a night visual surveillance operation in an area that was familiar to him. During a turn to the right at low altitude, the helicopter collided with transmission power lines. No visual or mechanical problems were reported to have occurred before the accident.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Failure of the pilot to maintain altitude and/or clearance from obstacles, while maneuvering a low altitude at night. Factors relating to the accident were: darkness and the lack of visual cues.

2. NTSB Identification: SEA96LA106.

14 CFR Part 91: General Aviation

Accident occurred Friday, May 31, 1996 in AROCK, OR

Probable Cause Approval Date: 8/20/96

Aircraft: Hughes 369HS, registration: N444GJ

Injuries: 1 Uninjured.

While flying at approximately 40 to 50 feet above ground level and 100 knots, the helicopter struck a power line. The pilot stated to state troopers after the accident that following the wire strike, ‘he had side to side control but did not have up and down control.’ The pilot stated on his

accident report that he performed ‘an emergency landing in rough terrain with substantial resulting damage.’ He reported that he had not seen the wire the helicopter had struck.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot’s failure to see and avoid the transmission wire. A factor was the low altitude flight.

3. NTSB Identification: **CHI96LA223.**

14 CFR Part 137: Agricultural

Accident occurred Sunday, June 30, 1996 in MANDAN, ND

Probable Cause Approval Date: 9/19/96

Aircraft: Bell TH-13T, registration: N96161

Injuries: 1 Uninjured.

The pilot was spot spraying pasture land with pesticide. He turned into the sun heading east to follow a ravine. The pilot stated the sun was glaring off the bubble and he was unable to see the power lines until he was too close. When the pilot did see the power lines he ‘pulled back and to the left to avoid them.’ The helicopter’s lower outside cabin struck the power lines and the helicopter settled to the ground tail first.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot’s failure to maintain clearance from known transmission lines. A factor relating to this accident was the sun glare, which hindered the pilot’s ability to see the transmission lines.

4. NTSB Identification: **NYC96LA145.**

14 CFR Part 91: General Aviation

Accident occurred Monday, July 08, 1996 in CARVER, MA

Probable Cause Approval Date: 2/1/97

Aircraft: Bell 47G-5, registration: N8591F

Injuries: 1 Minor.

The helicopter collided with power lines after the pilot completed an aerial spray run of a cranberry bog. According to the pilot, ‘...As I was departing the bog, I saw wires directly in front of me. I pulled back on the cyclic and raised the collective to try to fly over the wires. I cleared the wires initially, but could not recover from the maneuver before contacting the ground. The wind was behind me, and when at the top of the pull-up, I realized I couldn’t fly out of it, and did a right 180 degree pedal turn, and lowered the nose to dive into the wind, I hit the ground in a level attitude before I could complete the maneuver.’

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual look out for obstacles, which resulted in a collision with wires and the ground.

5. NTSB Identification: **ATL96LA106.**

14 CFR Part 91: General Aviation

Accident occurred Tuesday, July 09, 1996 in BARTOW, FL

Probable Cause Approval Date: 12/23/1996

Aircraft: Bell 47G, registration: N6356

Injuries: 2 Minor.

The purpose of the flight was to survey alligator nests along a canal. According to the pilot, they had been flying low (50 to 100 feet), at approximately 35 miles per hour, along the canal when the passenger warned him of utility lines crossing their intended route of flight. As the pilot executed a quick stop maneuver to avoid a collision with the utility lines, the tail rotor assembly collided with the ground. No mechanical problems were reported. The pilot also stated that a better scanning technique, and a slightly higher altitude may have prevented this accident.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout, and his failure to maintain ground clearance, while maneuvering to avoid a collision with a utility line.

6. NTSB Identification: **MIA96LA200.**

14 CFR Part 137: Agricultural

Accident occurred Saturday, August 03, 1996 in BARTON, AL

Probable Cause Approval Date: 6/30/1997

Aircraft: Bell 206B III, registration: N5015T

Injuries: 1 Fatal.

According to the operator of the helicopter, the purpose of the flight was to defoliate an area of vegetation near power lines by spraying chemicals. The loader of the chemicals indicated that when the flight was due to return for refueling, he observed smoke near where the helicopter was spraying. He then called 911 and reported the crash. Investigation revealed that one of the main rotor blades had contacted a power line that was 97 feet above ground level. The helicopter then descended and impacted the ground nose low and rolled onto its right side where it came to rest. Impact damage to the cockpit from the main rotor blades was noted. Examination of the airframe and engine revealed no evidence of pre-impact failure or malfunction. There were no known witnesses to the accident.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Failure of the pilot to see-and/or-avoid the obstruction (unmarked power line), while en route between the area that was being treated and the refueling location. The power line and lack of visual cues at dusk were related factors.

7. NTSB Identification: **SEA96TA213.**

14 CFR Public Use

Accident occurred Friday, September 13, 1996 in ST REGIS, MT

Probable Cause Approval Date: 8/21/97

Aircraft: Bell 206B-3, registration: N47MA

Injuries: 1 Uninjured.

The helicopter sustained substantial damage when it struck wires during a fire suppression activity for the U.S. Forest Service. The pilot reported that his water bucket malfunctioned on his seventh load, while performing fire suppression, and he was unable to drop its water. On his way back to the helibase, he diverted from a direct return. He reported that he descended and circled with the intention of putting his bucket down on an abandoned railroad grade to tip it over and empty it. An eyewitness advised that the pilot appeared to be descending and circling to fill his bucket in a pond just across the railroad grade. About 80 feet above the pond, the helicopter struck a power line with the main rotor blades, severing three conductors of a main distribution line. About 80 feet further west along the power line, the main rotor blades severed the messenger wire in two places, about 12 feet apart. The helicopter remained controllable and the pilot continued a right turn, descending to a landing on the railroad grade.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Failure of the pilot to maintain clearance from electrical transmission lines. The proximity of transmission lines was a related factor.

8. NTSB Identification: **CHI97LA016.**

14 CFR Part 133: Rotorcraft Ext. Load

Accident occurred Monday, October 28, 1996 in VESTABURG, MI

Probable Cause Approval Date: 6/30/97

Aircraft: Hughes 369, registration: N9251f

Injuries: 1 Fatal.

The pilot had just dropped off a load of Christmas trees, and was relocating the helicopter from the north side of a field to the south side when the rotor blades of the helicopter contacted power lines. One witness reported that he heard no abnormal engine noises coming from the helicopter, before the accident. Another witness reported that the pilot appeared to duck just before the helicopter contacted the wires. An on-scene investigation of the airframe and engine did not reveal any abnormalities.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Failure of the pilot to maintain clearance with the wires.

1997

1. NTSB Identification: SEA97LA072.

14 CFR Part 137: Agricultural

Accident occurred Friday, March 14, 1997 in GLIDE, OR

Probable Cause Approval Date: 5/30/97

Aircraft: Hiller UH-12E, registration: N545HA

Injuries: 1 Minor.

While maneuvering his helicopter to finish off the aerial application of chemicals on a field of coniferous trees, the pilot accidentally flew into a power transmission line that ran across the center of the field. According to the pilot, he knew the power line was there, but he had trouble seeing it because of the ambient lighting conditions caused by the overcast sky.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Failure of the pilot to maintain clearance from a power transmission line. Factors relating to the accident included ambient light conditions, which made the power line hard to see.

2. NTSB Identification: FTW97LA131.

14 CFR Part 137: Agricultural

Accident occurred Wednesday, March 19, 1997 in DONNA, TX

Probable Cause Approval Date: 2/2/98

Aircraft: Hiller UH-12E, registration: N136HA

Injuries: 1 Serious.

The helicopter impacted a set of north-south aligned power lines at the mid point between two poles during an aerial application flight. The helicopter came to rest on its side in an onion field approximately 400 feet east from the point of impact with the wires. Authorities reported that wires were found wrapped around the helicopter's tail rotor assembly. According to the FAA inspector, the helicopter approached the dark green onion field to be sprayed from the east, while flying over a freshly plowed field which exhibited a light tan/sandy shade of color. The FAA inspector added that the poles and the power lines that the helicopter impacted with lay directly between light and dark colored fields. A completed NTSB Form 6120.1/2 was not received from the pilot/operator of the helicopter.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance with the power lines during an aerial application flight. A factor was the power lines.

3. NTSB Identification: **CHI97GA166.**

14 CFR Part 91: General Aviation

Accident occurred Wednesday, June 11, 1997 in CEDAR RAPIDS, IA

Probable Cause Approval Date: 2/28/00

Aircraft: Hughes 269A-1, registration: N1020U

Injuries: 2 Serious.

After refueling, the pilot departed north from a helipad with an observer aboard. The helicopter overflew a 50 foot building located 141 feet from the pad. The helicopter started to shudder over the building and shuddered again when it crossed a power line located 292 feet from the pad. The observer reported the helicopter did a right, flat turn. The helicopter impacted the top crossbeam of a power line pole, then impacted the ground in a right skid down, nose low attitude. A fire erupted. The pilot was initially pinned in the wreckage, but the observer & a truck driver, who arrived at the scene, were able to extricate the pilot. Investigation revealed evidence of continuity in the flight controls and engine, but the magnetos were fire damaged & could not be tested. Performance calculations indicated that power required for a 50' hover out of ground effect (HOGE) would have been 154 HP; power available should have been 173 HP. The local airport's (Aviation Routine Weather Report) METAR winds indicated 100 degrees at 7 knots. The wind sock at the helicopter pad was not functional. For takeoff, the pilot also had the option to depart the helipad on a heading of 140 degrees, or to depart on a heading of 320 degrees after back taxiing about 150 feet for additional takeoff distance. The pilot received serious burns & head injuries. He was wearing a polyester based police uniform & no flight helmet or gloves. The observer was wearing a Nomex flight suit and boots, but no helmet or gloves.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Loss of engine power due to undetermined reason(s). Related factors included the obstructions (building, utility pole, and transmission wires); and the lack of a functional windsock, due to inadequate facility maintenance by the operator.

4. NTSB Identification: **NYC97LA119.**

14 CFR Part 91: General Aviation

Accident occurred Friday, June 13, 1997 in SHARON, VT

Probable Cause Approval Date: 2/2/98

Aircraft: Enstrom F-280C, registration: N5700J

Injuries: 2 Minor.

The pilot and passenger departed on a local flight to land in a school yard to display the helicopter. After takeoff from the departure airport, the pilot over flew the school, then

established a long final approach to the school yard. After crossing an interstate overpass, the pilot descended over a river. The helicopter struck wires that extended across the river, about 100 feet above the water, approximately 3/4 of a mile west of the intended school landing area. The helicopter came to rest in 2 feet of water. The pilot listed 429 hours of total flight experience, of which 193 were in helicopters, and 152 hours of helicopter pilot-in-command experience. The pilot did not provide experience in make and model, but listed 1.3 hours of helicopter experience during the previous 90 days.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's improper decision to descend and fly at 100 feet over a river and his failure to maintain adequate obstacle clearance, which resulted in the in-flight collision with wires.

5. NTSB Identification: **ATL97LA121.**

14 CFR Part 137: Agricultural

Accident occurred Monday, August 11, 1997 in HOLCOMB, MS

Probable Cause Approval Date: 2/2/1998

Aircraft: Bell 47-D1, registration: N908B

Injuries: 1 Uninjured.

The pilot stated the cotton field he was going to spray with insecticide was lined with utility lines. He circled the field '2 or 3 times to locate obstructions', and began spraying. After finishing about half the field, he struck a utility line that was 'hidden by the surrounding trees'. The nose pitched up, and the utility line wrapped around the helicopter's mast. The helicopter then rotated 150 to 160 degrees to the left, and it settled to the ground in a 'hard landing'.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The failure of the pilot to adequately see and avoid all obstructions while doing aerial application work.

6. NTSB Identification: **ATL97LA139.**

14 CFR Part 91: General Aviation

Accident occurred Saturday, September 20, 1997 in MCGEE, MS

Probable Cause Approval Date: 6/26/98

Aircraft: Bell 47G-2, registration: N90485

Injuries: 3 Uninjured.

According to the pilot, he was circling over the house of one of the passengers in about a 50 degree bank angle, when the engine lost power. He stated he immediately executed an autorotation and headed for a hay field. As he turned past trees, the pilot noticed a utility pole and wires. He maneuvered to climb over the obstructions, but the tail boom struck the wires, the controls shuddered, and the helicopter banked to the left. The pilot stated that he leveled off

about 20 feet above the ground, then landed in the hay field. Post accident investigation showed minimal fuel in the tanks.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Fuel starvation, while in maneuvering flight, due to the pilot's improper planning/decision.

7. NTSB Identification: **CHI98LA021.**

14 CFR Part 91: General Aviation

Accident occurred Tuesday, October 14, 1997 in GRAND FORKS, ND

Probable Cause Approval Date: 2/2/98

Aircraft: Schweizer 269C, registration: N557DC

Injuries: 1 Uninjured.

The pilot stated he knew he was low on fuel during the last leg of a cross country flight. The low fuel light illuminated when he was 9.5 miles from the destination airport. The pilot elected to make a precautionary landing. The light went off during the landing descent. The pilot continued the descent at which time he felt a yaw to the right. Suspecting an engine failure, he initiated a 'hovering autorotation' only to discover he still had engine power. He reported he regained control of the helicopter and continued the landing. It was later determined that the helicopter contacted an electrical wire which ran across a nearby road.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate preflight planning which resulted in a low fuel state, and his inability to see the wire which the helicopter contacted. Factors associated to the accident were the precautionary landing, the dark night conditions, and the wire which was contacted.

8. NTSB Identification: **SEA98LA020.**

14 CFR Part 91: General Aviation

Accident occurred Friday, December 05, 1997 in BIG TIMBER, MT

Probable Cause Approval Date: 5/4/98

Aircraft: Schramm HELICYCLE, registration: N3275Q

Injuries: 1 Minor.

The pilot reported that during a high speed fly-by to demonstrate the helicopter to prospective investors, he became distracted by a low engine coolant temperature. The pilot stated that he did not follow his intended flight path and did not see the power lines until the last moment. The pilot rolled the helicopter to a near 90 degree angle and the main rotor blades collided with and cut the transmission wires. The helicopter subsequently crashed in snow on level terrain.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance from power lines. The pilot's diverted attention and transmission wires were factors.

9. NTSB Identification: **FTW98FA068.**

Nonscheduled 14 CFR Part 135: Air Taxi & Commuter

Accident occurred Sunday, December 14, 1997 in LITTLETON, CO

Probable Cause Approval Date: 8/20/99

Aircraft: Bell 407, registration: N771AL

Injuries: 4 Fatal.

On takeoff from an automobile accident site, with the patient on board, the air ambulance flight made a climbing right turn and flew into power lines. Witness marks on the helicopter provided evidence the helicopter struck the transmission line from below and impacted the ground in an inverted attitude below and to the west of the lines. Light conditions were a dark night with emergency response, construction, and emergency response vehicle lights illuminating the landing site area. The existence of the power lines was unknown to the fire rescue on-scene commander and the light conditions prevented the pilot from seeing anything outside the lighted area. The unmarked power lines were 622 feet apart and oriented northeast/southwest. The southern tower was 106 feet high and the northern tower 83.5 feet high. The towers and lines did not meet obstruction-marking criteria and were not marked. In addition, they were not depicted on sectional or topographic maps. Company policy, promulgated through documents and training, provided landing zone departure procedures which instructed the pilot to climb straight ahead in a near vertical climb to a minimum of 300 feet agl before turning. The horizontal distance from the helicopter's takeoff position to the power line was approximately 630 feet based on global positioning system (GPS) measurement.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inability to maintain adequate visual lookout due to the lighting conditions and his failure to follow company procedures for departure from a landing zone. Factors were dark night conditions, bright lights in the landing zone which prevented vision beyond the zone, and the power line existence was not available on charts to either the pilot or ground personnel.

1998

1. NTSB Identification: **LAX98TA123.**

14 CFR Part 91: General Aviation

Accident occurred Thursday, March 19, 1998 in SANTA CLARITA, CA

Probable Cause Approval Date: 2/15/01

Aircraft: Bell 206B, registration: N3186L

Injuries: 1 Uninjured.

The pilot reported that he was making a normal approach to a dry riverbed on a southwesterly heading directly into the sun. He reported that ‘moments before I hit the wires, I saw them and made an evasive maneuver to avoid them.’ He then clipped the wire with the main rotor blades and as he attempted to turn away, he clipped the tail rotor. The pilot stated that he then flew the helicopter to the ground and made ground contact in a level attitude. The helicopter landed hard and rolled over onto its right side. The series of wires were at a measured height of 39 feet agl and spanned lengthwise approximately 1,200 feet between poles or other markings. The sun and moon position information for the time of the accident showed the sun’s position to be at 4.6 degrees above the horizon. The sun’s azimuth was at 252 degrees. Official sunset that evening was at 1808.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The failure of the pilot to maintain adequate clearance with the wires. Additional factors in this accident are the position of the sun at that time of the day, which made it difficult to see the wires, and the lack of markings or poles for that series of wires.

3. NTSB Identification: **LAX98FA149.**

14 CFR Part 91: General Aviation

Accident occurred Friday, May 01, 1998 in IRWINDALE, CA

Probable Cause Approval Date: 2/15/01

Aircraft: Robinson R22, registration: N8365D

Injuries: 1 Fatal, 1 Serious.

The 10-hour student pilot reported that they had performed several autorotations and normal approaches to sites chosen by the instructor. He was flying the helicopter and the instructor was following on the controls. They were performing a normal landing approach when both he and the flight instructor were startled to see electrical power transmission lines in front of them. The instructor took control of the helicopter and he recalled flying under one group of power lines that he viewed high on the windshield. The instructor then made a pull-up and the rotor impacted a second group of wires and the helicopter fell approximately 60 feet to the ground landing on its left side. The student reported there were no mechanical problems with the aircraft prior to impacting the wires. The operator reported that the instructor flew in this practice area almost daily and was well aware of the presence of the power lines. The student was Japan and spoke limited English.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The failure of the pilot to observe in a timely manner and maintain clearance from electrical power transmission wires and her improper maneuver to avoid the obstruction.

4. NTSB Identification: **FTW98FA238.**

14 CFR Part 91: General Aviation

Accident occurred Sunday, May 24, 1998 in BIXBY, OK

Probable Cause Approval Date: 7/2/99
Aircraft: Bell 47G, registration: N9954F
Injuries: 1 Fatal, 1 Serious.

Witnesses reported observing the helicopter flying 'slow,' at an altitude below 100 feet agl, from east to west along the Arkansas River. The helicopter 'struck power lines' that spanned the river, descended vertically, and impacted a sandbar. The witnesses also reported that the engine 'sounded okay and it continued to run' until ground contact. The passenger reported that 'when they saw the power line tower supporting the cables that cross the river at the bridge on Memorial Boulevard, they talked and decided they would turn around and go back to Haskell.' The passenger stated he didn't see the other power line, which cross the river prior to the bridge, or remember striking them. The unmarked power line was an estimated 60 to 75 feet agl. The three lower wires of the power line were observed to be frayed. Linear scratching and dull gray metal transfers were found on sections of one wooden main rotor blade's leading edge and underside. The forward portion of the center vertical console also exhibited linear scratching. Continuity was established to all flight controls.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance from the power lines.

5. NTSB Identification: **ATL98FA080.**

Nonscheduled 14 CFR Part 135: Air Taxi & Commuter
Accident occurred Monday, May 25, 1998 in INDIAN TRAIL, NC
Probable Cause Approval Date: 2/16/01
Aircraft: Bell 206L-3, registration: N96CW
Injuries: 5 Fatal.

According to US Helicopters, Inc., the pilot was conducting passenger transport from the Charlotte Motor Speedway to various destinations in the Charlotte area. The pilot was on his last trip of the day, and departed the Speedway with four passengers on board destined for the Monroe Airport. Prior to departing the Speedway, the pilot informed a co-worker that weather at the time was VFR with 3 miles visibility. According to the co-worker, the pilot had last reported that he was proceeding east along highway 74, about 0025. Witnesses, in the immediate area, said they observed the helicopter flying low, in fog, with its lights on. The report from the Monroe ASOS (Automatic Surface Observation System) located on Monroe Airport was 300 feet overcast sky condition, 1.75 miles visibility in mist. At about 0032 the helicopters skids contacted a high-tension static ground wire about 150 feet above the ground.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain altitude while operating in adverse weather. A contributing factor was the incoming fog and high tension static wire.

6. NTSB Identification: **SEA98FA084.**

14 CFR Part 133: Rotorcraft Ext. Load

Accident occurred Tuesday, June 02, 1998 in SHOSHONE, ID

Probable Cause Approval Date: 1/10/00

Aircraft: McDonnell Douglas 369FF, registration: N16031

Injuries: 1 Fatal, 1 Serious.

Witnesses reported that the helicopter had just released from positioning a fiber optic cable on top of a power pole. An external line is hung over the left landing skid, forward of the front leg, and a shoe is used to cradle the cable to lift and position it in place for permanent attachment. A lineman was on the pole and in the process of permanently attaching the cable to the pole when the pilot maneuvered the helicopter away and behind the lineman about five feet. Another lineman was standing on the left side landing skid and was then going to install vibration dampers on the cable. The lineman on the pole stated that everything was normal when he heard what sounded like a clicking sound or a sound like a card in a spoked wheel. The lineman on the pole stated that he knew that the helicopter was in the wires and saw pieces of the helicopter flying. The lineman ducked down on the pole, and when he looked up again, the helicopter had already gone through the transmission wires and was laying on its right side on the ground. Impact signatures of a cable strike were found on both tailrotor blades. The cable that the helicopter was positioned next to was severed. Further inspection of the severed cable noted that 19 of the 22 strands that make up the fiber optic cable received varying amounts of mechanical damage prior to failure. During the post-crash wreckage documentation and inspection, no evidence was found to indicate a mechanical failure or malfunction.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Failure to maintain clearance from wires. A transmission wire was a factor.

7. NTSB Identification: **CHI98LA198.**

14 CFR Part 137: Agricultural

Accident occurred Wednesday, June 10, 1998 in LE CENTER, MN

Probable Cause Approval Date: 5/19/99

Aircraft: Bell 47G, registration: N73284

Injuries: 1 Serious.

The pilot was spraying along a creek bed when the main rotor/transmission assembly contacted a wire, which was at an altitude of about 20 feet above the terrain. The helicopter then descended to impact with the terrain.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance with the wire. A factor associated with the accident was the wire, which the helicopter contacted.

8. NTSB Identification: **CHI98LA239.**

14 CFR Part 91: General Aviation

Accident occurred Thursday, July 02, 1998 in CASSVILLE, MO

Probable Cause Approval Date: 2/15/01

Aircraft: Robinson R-44, registration: N8329B

Injuries: 2 Minor.

The pilot and his passenger were enroute to their destination when they became aware that they were approaching a line of thunderstorms from behind. The pilot decided to make a precautionary landing due to the convective weather in the area and wait for the line of thunderstorms to move further from their route. During approach to the landing area, the aircraft struck a power line, approximately 35' above ground level (agl), and the pilot executed a run-on landing. The aircraft impacted the ground resulting in substantial damage to the landing skids, rotor blades, and tail boom. The pilot stated that he was aware of the thunderstorms from watching a television weather broadcast, but thought the line of storms had moved past his route of flight when he had made his departure. There were no Flight Service Station (FSS) or Direct User Access Terminal System (Duats) pilot briefings given for the aircraft in question. The pilot stated that there were no aircraft mechanical problems related to the accident.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot in command's inadequate preflight planning/preparation and weather evaluation that resulted in flight into adverse weather conditions. Factors to the accident were a preflight briefing service not being used and the transmission wire.

9. NTSB Identification: **LAX98LA225.**

14 CFR Part 137: Agricultural

Accident occurred Tuesday, July 07, 1998 in SALINAS, CA

Probable Cause Approval Date: 2/16/2001

Aircraft: Bell 47G-5, registration: N7914S

Injuries: 1 Minor.

The pilot was spraying a field approximately 10 feet agl parallel to telephone lines. The main rotor blades clipped the telephone lines and the helicopter descended into the ground. The skids became embedded in a row of irrigation pipes and the aircraft nosed over and came to rest inverted. The pilot reported that there were no mechanical malfunctions with the aircraft prior to the accident.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The failure of the pilot to maintain clearance with the telephone lines.

10. NTSB Identification: **NYC99LA004.**

14 CFR Part 91: General Aviation

Accident occurred Monday, October 05, 1998 in BOW, NH
Probable Cause Approval Date: 1/28/2000
Aircraft: Enstrom F280, registration: N8618N
Injuries: 1 Minor.

The pilot of the helicopter was practicing touch and go landings from a private heliport he owned. During the approach, the helicopter's tail boom struck a 330 foot tall guyed meteorological equipment tower, which was located about 1/2 miles from the heliport. The helicopter then descended and impacted the ground, where it was consumed by a post crash fire. Examination of the wreckage did not reveal evidence of any pre-impact abnormalities. The pilot said 'strong wind gusts' pushed the helicopter into the tower, which he did not see because it was on his 'blind side.' The weather reported at an airport about 5 miles northeast of the accident site was: sky clear; visibility 10 statute miles; winds from 350 degrees at 13 knots, with 20 knot gusts.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout and his failure to maintain adequate obstacle clearance, which resulted in an in-flight collision with a tower. A factor in this accident was the gusty wind conditions.

11. NTSB Identification: **CHI99LA026.**

14 CFR Part 91: General Aviation

Accident occurred Friday, November 06, 1998 in CLINTON, MN

Probable Cause Approval Date: 2/16/01

Aircraft: Tomschin MINI 500, registration: N316AZ

Injuries: 1 Uninjured.

The individual who piloted the helicopter said that he was flying the helicopter and everything was working fine. As he looked inside at one of the gauges, he felt a strong tug on the helicopter. The non-pilot said that he knew right away that he had hit some high wires. He tried to keep the helicopter from crashing. The non-pilot said that he felt the wires break and he landed the helicopter the best that he could. It landed upright on the skids. Examination of the wreckage revealed no anomalies. The non-pilot did not possess a pilot certificate or a current medical certificate. A review of his pilot logbook showed that he had 23 total flying hours in helicopters.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The non-pilot's failure to maintain clearance from the power lines. Factors contributing to this accident were the non-pilot's lack of total experience and the power lines.

12. NTSB Identification: **SEA99LA016.**

Nonscheduled 14 CFR Part 135: Air Taxi & Commuter

Accident occurred Sunday, November 29, 1998 in IDAHO CITY, ID
Probable Cause Approval Date: 1/11/00
Aircraft: McDonnell Douglas MD-900, registration: N977LF
Injuries: 4 Uninjured.

The McDonnell Douglas MD-900 medevac helicopter was dispatched to a car accident at a site characterized by high terrain and high trees. Prior to landing, the pilot requested information about wires and was advised by ground personnel that 'there were none.' Subsequent to landing, the pilot examined the landing site and proposed departure route for wires, and reportedly observed none. The departure from the site was conducted under dusk to dark night conditions. While climbing out vertically due to the narrow canyon conditions at the site, the helicopter struck unmarked transmission lines approximately 150 feet above ground. The pilot then determined that the helicopter was controllable and displayed no unusual flight characteristics, and chose to proceed to his destination. Post-flight examination revealed crazing of the windscreen and damage to four of the five main rotor blades requiring major repair/replacement.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot-in-command's not obtaining/maintaining clearance with the unmarked transmission lines. Contributing factors were environmental (dusk) conditions, the transmission lines, and both the pilot-in-command and the ground personnel not identifying the existence of the hazardous condition (high wires).

13. NTSB Identification: **DEN99FA024.**

14 CFR Part 91: General Aviation

Accident occurred Friday, December 04, 1998 in DEMING, NM

Probable Cause Approval Date: 3/31/00

Aircraft: Robinson R-22 BETA II, registration: N8340J

Injuries: 1 Fatal.

The pilot had been herding cattle with his helicopter and was returning home, when the helicopter impacted an electrical transmission wire, 25 feet 3 inches above the ground. The wire was oriented 085-265 degrees, and the pilot's flight path was 220 degrees. At the time of the accident, the sun's altitude was 18 degrees above the horizon, and its azimuth was 133 degrees east of north.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance of the transmission wire. Factors were the transmission wire, and the glaring sunlight condition.

14. NTSB Identification: **SEA99LA019.**

14 CFR Part 91: General Aviation

Accident occurred Sunday, December 06, 1998 in CARNATION, WA

Probable Cause Approval Date: 1/11/00
Aircraft: Robinson R-22B, registration: N2304W
Injuries: 2 Uninjured.

The pilot reported that while doing a low pass over a relative's farm, he struck a wire that was approximately 50 feet above ground level. He also reported that a combination of clouds and the sun made the wires 'virtually invisible' until the helicopter struck them. He reported that after striking the wire, the helicopter started to shake violently and he initiated a forced landing. During the forced landing the helicopter landed hard in approximately two feet of water.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance with a wire. Related factors were the pilot's performance of a low pass, a transmission wire, and difficulty encountered by the pilot in detecting the wire visually.

1999

1. NTSB Identification: **FTW99LA080**.
Nonscheduled 14 CFR Part 135: Air Taxi & Commuter
Accident occurred Saturday, February 13, 1999 in HOCKLEY, TX
Probable Cause Approval Date: 4/25/01
Aircraft: Eurocopter BK 117 B-1, registration: N220HH
Injuries: 5 Uninjured.

The helicopter impacted power lines while departing from an automobile accident scene. The helicopter was part of a two aircraft team dispatched to the scene of the automobile accident. During the landing approach, the pilot noticed the power lines running parallel to the road; however, he did not consider them to be an unusual hazard at the time. After the passengers were loaded into the helicopter, the pilot took off, drifted toward the wires, and impacted the power lines. The pilot then landed the helicopter in an adjacent field. The pilot stated that at the time the helicopter impacted the wires 'the sun was shining directly into the aircraft' and that 'trash was blowing around.' Another helicopter was dispatched to the scene of the accident to transport the patients to the hospital.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance with the power lines. A factor was the sun glare reducing the pilot's visibility.

2. NTSB Identification: **ANC99TA058**.
The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)
14 CFR Part 133: Rotorcraft Ext. Load
Accident occurred Wednesday, May 05, 1999 in WRANGELL, AK

Probable Cause Approval Date: 11/30/2000
Aircraft: Bell UH-1B, registration: N97HM
Injuries: 1 Fatal, 2 Uninjured.

A restricted category Bell UH-1B helicopter was hovering near high voltage wires at a construction site, performing external load lift operations with a 110 feet long steel cable. The construction project was under the direction of the Alaska Energy Authority, a State of Alaska corporation. The State of Alaska construction project manager reported the electrical wires were energized, and the wires were configured to de-energize if shorted. The pilot had extensive external load experience, but had about 1 hour in the accident helicopter make and model. He said he was not aware the electrical wires were energized. The chief pilot was occupying the right seat, and said he was providing 'guidance' during the flight. The chief pilot said he was aware the wires were hot. Just after the long line was hooked to a load of steel beams on the ground, the cable touched the overhead electrical wire, and electrocuted one ground member standing on the load. The construction project operations manager said that the electrical short, caused when the cable touched the wire, was insufficient to trip the electrical power off. The helicopter company's external load manual includes the following: 'The chief pilot will brief all involved personnel concerning procedures for each operation; the flight crew consists (normally) of one pilot; the use of a hand signalman, separate from the ground crew, shall be assigned no other duties during the operation; the pilot may elect to use a continuous visual observation method, wherein he is directly observing the load by looking out the window, out the door, or by use of mirrors. In this case, release and/or signalmen need not be utilized.' The manual also includes: 'Radio contact between the pilot and the hook-up man is highly desirable, and the presence of a radioman in no way alleviates the need for the hand signalman. A signalman should be present at all times in the event of a radio failure. If the pilot is able to observe the hook-up operation by using a skid-mounted mirror, and VHF two-way radio communications are maintained between the pilot and the hook-up man, a signalman is not required.' During the accident, direct radio communication between the ground crew and the pilot was not maintained, and a signalman was not utilized.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot-in-command's failure to maintain sufficient distance from a transmission wire, arcing of the transmission wire, the failure of company personnel to utilize a nonconducting cable, and an inadequate procedure utilized by the construction project manager to ensure adequate fault protection on an energized transmission wire. Factors in the accident were a failure of the helicopter operator to maintain sufficient standards, including flight and ground crew coordination, and a failure to maintain radio communication between the pilot and ground crew.

3. NTSB Identification: **NYC99FA136.**

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Tuesday, June 08, 1999 in ASHCAMP, KY

Probable Cause Approval Date: 12/4/00

Aircraft: American Eurocopter AS-350B, registration: N35AG

Injuries: 1 Fatal.

After dropping off passengers at a mining site, the helicopter was observed climbing in a shallow nose down attitude, heading north, when it impacted two electrical wires. The helicopter then descended and impacted on a road between vertical walls of a previously mined area, where it was consumed by a post-crash fire. Examination of the wreckage did not reveal any evidence of a pre-impact malfunction. Examination of the main rotor blades revealed several scrape marks and gouges consistent with a wire strike. Visibility reported at a nearby airport was 10 statute miles, and a witness to the accident said the wind was 'calm,' and visibility was 'good.'

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual look out which resulted in an in-flight collision with wires.

4. NTSB Identification: **NYC99FA157.**

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Wednesday, June 23, 1999 in HURRICANE, WV

Probable Cause Approval Date: 9/1/00

Aircraft: Robinson R-22, registration: N9070F

Injuries: 1 Fatal.

A witness observed the helicopter at approximately 200 feet above ground level (AGL) and then descend to approximately 60 feet AGL. The witness stated that the helicopter was making a 'popping noise,' and wobbling back and forth, and side to side for about 30 seconds. The witness also stated that he could see the helicopter's main rotor blades slowing down. The helicopter then 'nose dived' towards the ground. The helicopter impacted in a dry creek bed and came to rest on it's left side. One main rotor bladed was found curved upward and contained blue and white paint transfer. It should be noted that the helicopter tail boom is painted blue and white. A 12,000 volt electrical wire system was located approximately 37 feet above the main wreckage and one of the wires had been severed. The helicopter had been operated for about 1 hour since an annual inspection had been performed 5 days prior to the accident; about 70 hours since December 1994; and about 2,070 hours since it was last overhauled in 1992. The helicopter was fueled with automotive gasoline. A supplemental type certificate (STC) for the use of automotive gasoline for the accident helicopter was available; however, examination of the helicopter's maintenance records did not reveal that an STC had been obtained for the use of automotive gasoline. The engine was test run and it operated satisfactorily. Examination of the wreckage did not reveal any pre-impact malfunctions of the airframe or engine. Review of the FAA 'Carburetor Icing Probability Chart' placed the reported temperature and dew point in the 'serious icing at glide power' area. Additionally, examination of the engine low oil pressure light bulb filament from the annunciator panel revealed some elongation of the filament.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

A loss of engine power for undetermined reasons. Contributing to the accident was the pilot's failure to maintain rotor rpm and the transmission wires.

5. NTSB Identification: **CHI99LA248.**

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Friday, July 23, 1999 in SPRING GREEN, WI

Probable Cause Approval Date: 5/12/00

Aircraft: Robinson R22, registration: N2313D

Injuries: 1 Uninjured.

The helicopter was being used to pollinate a cornfield at the time of the accident. The pilot stated, in a written report, that he had '... made about three to four turns near the wires at the east end of the field before striking the wire....' The helicopter subsequently impacted the terrain. Post accident examination of the helicopter revealed no preexisting anomalies.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilots failure to maintain clearance with the wire. A factor was the wire.

6. NTSB Identification: **LAX99TA299.**

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 133: Rotorcraft Ext. Load

Accident occurred Thursday, September 09, 1999 in BAKERSFIELD, CA

Probable Cause Approval Date: 5/9/01

Aircraft: Bell B212, registration: N212AR

Injuries: 1 Minor.

While engaged in fire fighting water-dropping operations, the helicopter impacted high tension power transmission wires and fell to the ground under marginal control. The pilot and helicopter were reassigned from another nearby base on the morning of the accident and, at the time of the wire strike, the pilot was engaged in his first operational sortie in the new area. Prior to takeoff the pilot had been briefed about wire hazards in the area. A topographical map that was used in the briefing showed high power transmission wires, including the set the pilot later impacted, as red lines. After takeoff, the pilot proceeded to the fire area and made an initial drop on the fire. It was while returning to the dip site to refill that the wire strike occurred. The pilot reported that as he approached the dip site at 250 - 300 feet agl, he was aware of a power transmission tower high on the mountain to his right, well above him. He was also aware of another tower to his left on the valley floor below and an electrical powerhouse on the valley floor nearly in front of him. He thought that the wires from both the tower on his right and the tower on his left went to the powerhouse and were beneath him. In fact, the wires were strung directly from the tower above him, on the right, to the lower tower, on his left, and crossed his flight path at the helicopter's

altitude. Visual meteorological conditions prevailed and smoke was not present in the area of the accident. Flights flown after the accident in like conditions of daylight and visibility showed the wires could not be visually detected until the helicopter was ‘extremely close to the wires.’

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The failure of the pilot-in-command to maintain adequate visual surveillance to see and avoid power transmission wires known to be in the area.

7. NTSB Identification: **DEN99LA163**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Saturday, September 18, 1999 in TUCUMCARI, NM

Probable Cause Approval Date: 12/4/2000

Aircraft: Robinson R22A, registration: N8497Y

Injuries: 1 Uninjured.

Shortly after takeoff, the helicopter collided with powerlines. The pilot said he did not see the powerlines because they blended in with the brush and background terrain.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot’s inadequate visual lookout. A factor was a reduced visual detection due to background vegetation and terrain.

DEN99LA163-On September 18, 1999, approximately 1330 mountain daylight time, a Robinson R22A, N8497Y, registered to and operated by Hunts Hashknife Helicopters, Inc., was substantially damaged when it collided with powerlines shortly after taking off from a field 20 miles northwest of Tucumcari, New Mexico. The commercial pilot, the sole occupant aboard, was not injured. Visual meteorological conditions prevailed, and no flight plan had been filed for the business flight being conducted under Title 14 CFR Part 91.

According to the pilot’s accident report, he had been herding cattle on the Clabber Hill Ranch for about four hours when he took a lunch break. When he returned, he preflighted the helicopter, then took off into the wind in a northerly direction. After traveling 100 to 150 yards at an altitude of 30 feet and at an airspeed of 30 knots, the helicopter collided with powerlines. The pilot said he did not see the powerlines because they blended in with the brush and background terrain. Asked how this accident could have been prevented, the pilot wrote: “A better recon[naissance] of area before T/O [takeoff].”

8. NTSB Identification: **LAX99LA319**.

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 137: Agricultural

Accident occurred Saturday, September 18, 1999 in SALINAS, CA

Probable Cause Approval Date: 5/9/01
Aircraft: Bell OH58A, registration: N5800K
Injuries: 1 Uninjured.

The pilot was performing low level aerial application work. Wires ran perpendicular to his flight path at the end of a crop row and a berm was located just in front of the wires. The pilot planned to fly under the wires. As he flew under the wires he heard a loud noise to his rear and the helicopter began to rotate clockwise. He increased pitch on the collective and climbed to approximately 100 feet. He could not control the rotation and completed an autorotation to a hard landing. A ground witness saw the helicopter's tail contact the berm. The tail rotor blades were fractured and separated, and, the tail rotor drive shaft was fractured midway between the aft short shaft and the tail rotor gearbox. The fracture exhibited torsional overload signatures angled aft along a 45-degree plane from the bottom to the top of the shaft. The torsional twist was in a clockwise direction as viewed from the rear. The tail rotor drive shaft normally rotates clockwise as viewed from the rear. No preimpact malfunctions were identified with the tail rotor gearbox or pitch control.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain an adequate clearance from all ground obstacles during a low altitude aerial application flight.

9. NTSB Identification: **NYC99GA234**.

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Wednesday, September 22, 1999 in RANDOLPH, NY

Probable Cause Approval Date: 8/3/00

Aircraft: Bell 206L-1, registration: N17SP

Injuries: 2 Serious.

The pilot was conducting a drug eradication mission. He was flying in a valley, toward the sun, approximately 200 feet above ground level, when the helicopter struck utility wires. The towers, which supported the wires, were below the tree line. The wires were depicted on the current Detroit Sectional Aeronautical Chart.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain visual separation from the wires. A factor was sun glare.

10. NTSB Identification: **DEN99LA171**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Saturday, September 25, 1999 in ST. GEORGE, UT

Probable Cause Approval Date: 12/4/2000

Aircraft: Robinson R22, registration: N8360J
Injuries: 1 Uninjured.

The private pilot, who held an airplane single-engine land rating, was practicing maneuvers in preparation for taking the private pilot-helicopter practical test. He decided to practice 'quick stops,' and flew to an uninhabited area. The pilot wrote, 'I was practicing the part where the helicopter is leveled out after the flare to slow down and just before you go to a hover. I knew there was a power line in the area, but I thought I was 200 yards away from it.' As he transitioned from a hover to forward flight, he saw the power line 120 feet ahead. He attempted to fly over the line, but snagged it with the skids. The helicopter fell 100 feet, landing on its right side.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout. Factors included the pilot concentrating on the maneuver being practiced to such an extent that he was inattentive to outside surroundings, and the sun glare.

11. NTSB Identification: **LAX00LA027**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 137: Agricultural

Accident occurred Thursday, October 28, 1999 in CASTROVILLE, CA

Probable Cause Approval Date: 5/17/2001

Aircraft: Hiller UH-12E, registration: N5374V

Injuries: 1 Serious.

The pilot had been spraying a field and altered his course to move away from telephone repair personnel who were working on a pole located near the field he intended to spray. While flying between 25 and 30 feet above the ground, the pilot diverted his attention toward the global positioning satellite receiver in which he intended to mark his new spray position. While proceeding over the field he looked up and observed a power line directly in front of his helicopter. With insufficient time to turn, the helicopter collided with the power line. Thereafter, the pilot lost control and the helicopter impacted the underlying field.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout and diverted attention.

12. NTSB Identification: **SEA00TA013**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Public Use

Accident occurred Tuesday, November 02, 1999 in STITES, ID

Probable Cause Approval Date: 5/16/2001

Aircraft: Hiller UH-12E, registration: N5388V

Injuries: 2 Serious, 1 Uninjured.

During a low-altitude fish survey, the helicopter experienced a separation of a control rotor while leveling off from a climb to about 400 feet above ground level (AGL). The pilot initiated an emergency descent but, due to severely reduced cyclic controllability resulting from the separation, was unable to avoid power lines in the aircraft's emergency descent flight path. The helicopter struck the power lines about 50 feet AGL and fell to the ground, landing hard but upright. Post-accident examination disclosed a fatigue failure in the cuff which retains the control rotor blade. The fatigue originated on two opposite sides of a retaining bolt hole that appeared to have been unevenly hand chamfered or deburred during original manufacture of the cuff, with gouging and sharp-bottomed dents visible at the origins. However, while a company mechanic had signed off an Airworthiness Directive (AD) requiring recurring inspection of the cuff about two months/56 flight hours before the accident, post-accident examination disclosed evidence indicative of inadequate inspection and maintenance of the assembly, including: old dried grease between the cuff and control rotor blade spar, large areas of the spar missing required paint with associated corrosion areas, and zinc chromate primer in corrosion pits. The FAA-approved Hiller service bulletin referenced by the AD contains procedures for inspection of spar tube retention bolt holes for 'elongation, corrosion, burrs, pitting or fretting' and associated repair procedures, but does not contain any instructions to inspect or repair bolt holes in the control rotor cuff for those same conditions.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Inadequate inspection of the control rotor cuff by a company mechanic and subsequent fatigue fracture of the cuff, resulting in an inflight separation of the control rotor blade. Factors contributing to the accident were: inadequate quality control during manufacture; insufficiently defined manufacturer's inspection and repair procedures; inadequate FAA approval of the manufacturer's inspection and repair procedures; power lines in the helicopter's emergency descent flight path; and reduced aircraft controllability following the control rotor separation.

2000

1. NTSB Identification: LAX00LA077.

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 137: Agricultural

Accident occurred Wednesday, January 26, 2000 in FIVE POINTS, CA

Probable Cause Approval Date: 7/2/01

Aircraft: Hiller UH-12E, registration: N68024

Injuries: 1 Uninjured.

The pilot took off from a loading truck for the second time with the intention of spraying a nearby field. En route, he flew over a road and maneuvered beneath a telephone line that was suspended between 25 and 30 feet above the ground. The helicopter's tail rotor contacted the line and he lost control. The helicopter spun around and impacted the ground.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate clearance while maneuvering beneath a telephone line.

2. NTSB Identification: **MIA00LA095**.

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Sunday, February 20, 2000 in DELRAY, FL

Probable Cause Approval Date: 3/2/01

Aircraft: Aerospatiale SA341G, registration: N2LN

Injuries: 1 Uninjured.

The pilot had approached the field from the west, and came to a stop about halfway into the field, about 6 to 8 feet above the ground, turned 90 degrees to the north, stopped, and started a turn to the west. The helicopter hesitated to turn, started to turn east, drifted north, hooked a barred wire fence with the right side skid, and lost control.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

A collision with a fence while at a hover, which resulted in the helicopter rolling over.

3. NTSB Identification: **LAX00LA107**.

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 137: Agricultural

Accident occurred Monday, February 21, 2000 in BYRON, CA

Probable Cause Approval Date: 10/2/01

Aircraft: Hiller H-12E, registration: N61PC

Injuries: 1 Minor.

The pilot collided with wires and impacted terrain while maneuvering during a morning aerial application flight. The pilot indicated that the accident could have been prevented had he performed a better reconnaissance of the area, avoided distractions, and approached the wires with the sun at his back.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout while maneuvering in proximity to wires. A contributing factor was the sun glare, which reduced the wire's conspicuity.

4. NTSB Identification: **LAX00LA124**.

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 137: Agricultural

Accident occurred Sunday, March 12, 2000 in VACAVILLE, CA

Probable Cause Approval Date: 7/17/01
Aircraft: Bell 47G, registration: N9763Z
Injuries: 1 Minor.

The pilot was flying low while applying chemicals to a field. He completed spraying approximately half of the field, when he collided with wires that he did not see. He extricated himself from the helicopter, which subsequently caught fire.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows: Failure of the pilot to see wires and maintain clearance while flying at a low altitude.

5. NTSB Identification: **SEA00FA061.**

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Sunday, April 02, 2000 in STANWOOD, WA

Probable Cause Approval Date: 11/30/00

Aircraft: Bell 47G-3B-1, registration: N3377H

Injuries: 1 Fatal, 1 Serious, 1 Minor.

The pilot and two passengers were engaged in a sightseeing flight eastbound over a river in the Bell 47G helicopter when they heard a 'clunk,' the engine began to over speed, and rotor RPM began to decay. The pilot executed an autorotation to a nearby field. Just prior to touchdown, the helicopter snagged the wires of two low profile, four-foot high electrical fences which he did not see. The helicopter then rolled/yawed to the right and made a hard landing, coming to rest on its right side. Post-crash examination of the engine and transmission revealed no mechanical malfunctions. However, the oil jet (a threaded, hollow plug which screwed into the forward end of the engine crankshaft) was found lying loose beneath the clutch housing. The interior surfaces of the clutch housing displayed a large amount of oil. The clutch assembly was found to be without mechanical disparities and within normal wear limits. The release of the oil jet would have allowed engine oil to flow through the 3/8 inch threaded orifice into the lower transmission and clutch housing at a significantly higher rate than through the small diameter orifice in the end of the oil jet, resulting in disengagement of the clutch. The orifice in the jet was intended to allow a mist or light spray of oil to reach the lower mast bearing for lubrication purposes.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The disengagement of the oil jet fitting from its threaded receptacle at the forward end of the engine crankshaft. This resulted in excessive oil within the clutch assembly, the subsequent slipping of the clutch, and ultimately the disengagement of the rotor drive system from the engine. Contributing factors were the pilot's not maintaining clearance from the electric fences, which were also hidden objects against the grass landing surface.

6. NTSB Identification: **DEN00FA082.**

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Monday, May 01, 2000 in BLOOMFIELD, NM
Probable Cause Approval Date: 8/21/01
Aircraft: McDonnell Douglas 369E, registration: N1606K
Injuries: 2 Fatal.

The helicopter had been used for fiber optic cable installation support operations earlier that day. The helicopter landed next to a company fuel truck at a job site approximately 20 miles south-southeast of Farmington, New Mexico, and approximately 12 miles west-southwest of the accident site. There the helicopter was refueled. The pilot told the driver he and his passenger were returning to Four Corners Regional Airport in Farmington. Shortly after it departed, an oilfield worker, investigating the source of a smoke plume, found the burning wreckage of the helicopter and notified authorities. A severed static line was found nearby. The utility company estimated the height of the static line, at the point where it was severed, to be 39 feet. The power lines were estimated to be 35 feet above the ground. A toxicological screen revealed the presence of tetrahydrocannabinol (marijuana) and tetrahydrocannabinol carboxylic acid (primary inactive metabolite of marijuana) in blood, lung, and bile.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's intentional buzzing (low level flying), and his failure to maintain clearance with the static wire. A factor was his physical impairment by a contraindicated drug controlled substance.

7. NTSB Identification: **MIA00LA145.**

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Saturday, May 06, 2000 in METTER, GA

Probable Cause Approval Date: 12/4/00

Aircraft: Hiller UH-12C, registration: N80584

Injuries: 1 Minor.

The pilot stated that he was flying his helicopter and he struck a power line. He said that the wire strike destroyed the glass bubble and he thought that was the only damage, so he tried to return to the airport. As he approached the airport for landing, the pilot said he was unable to control the engine rpm, which had stuck on a high setting, and he could not perform a normal autorotation. He landed the helicopter with high vertical and forward speeds, and the helicopter received substantial damage.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain an adequate lookout resulting in a collision with a transmission wire that resulted in a forced landing and substantial damage to the helicopter.

8. NTSB Identification: **SEA00LA092.**

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 137: Agricultural

Accident occurred Thursday, May 25, 2000 in BUHL, ID

Probable Cause Approval Date: 5/9/01

Aircraft: Sikorsky S-58, registration: N2253A

Injuries: 1 Serious.

The pilot reported that while en route to a field for the aerial application, he was distracted by a radio call from another pilot. The pilot looked down at a map to verify a field location, and when he looked back up, he did not see the power lines that he knew were along his flight path and had flown over on previous flights. After colliding with those power lines, the helicopter pitched nearly straight up, leveled slightly, and then fell to the ground in a tail low attitude. A post-crash fire consumed the helicopter. The pilot reported that there were water drops on the windshield, which was dirty, and the sky was overcast, reducing his visibility substantially.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout, and his failure to maintain adequate clearance from the power lines. The pilot's diverted attention, a dirty windshield, power lines, and light rain were factors.

9. NTSB Identification: **IAD00LA065.**

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Sunday, July 23, 2000 in CIRCLEVILLE, OH

Probable Cause Approval Date: 12/18/2001

Aircraft: Rotorway EXEC 90, registration: N651GE

Injuries: 1 Serious, 1 Minor.

The helicopter collided with a utility pole shortly after take-off from a confined area on private property. According to witnesses, the helicopter hovered for approximately five minutes before making a climbing left hand turn over buildings that were adjacent to the take-off area. As the pilot attempted to clear the buildings, the helicopter's rotor rpm decreased and there was no forward airspeed. The helicopter began to shake and the pilot made a descending left hand turn and impacted the utility pole and wires. Examination of the helicopter revealed there were no mechanical malfunctions. The pilot flew helicopters in the military, but did not possess any Federal Aviation Administration flight certificates.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Pilot's improper decision to depart a confined area with two people onboard, which resulted in a loss of rotor RPM and collision with a utility pole and wires.

10. NTSB Identification: **LAX00LA280**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 137: Agricultural

Accident occurred Friday, July 28, 2000 in KING CITY, CA

Probable Cause Approval Date: 11/1/2001

Aircraft: Bell 47G-5, registration: N7885S

Injuries: 1 Uninjured.

The pilot of the agricultural application helicopter took off at dawn and was en route to the spraying location beneath a 300-foot overcast cloud ceiling with 1/4 to 1/2-mile flight visibility. The helicopter flew into a fog bank and the pilot lost visual contact with the ground. He lowered the collective control and descended toward the ground to regain visual reference; however, the tail rotor contacted power transmission wires before he regained visual contact. He then lowered the collective further and reduced engine power to regain directional control and the helicopter made a hard impact with the ground in an upright attitude.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's intentional flight into adverse weather, which resulted in loss of visual reference and flight into power transmission wires and terrain.

11. NTSB Identification: **LAX00LA326**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 137: Agricultural

Accident occurred Wednesday, August 30, 2000 in SALINAS, CA

Probable Cause Approval Date: 7/17/2001

Aircraft: Bell 206B-3, registration: N207EH

Injuries: 1 Uninjured.

The pilot of the agricultural application helicopter completed chemical application at one site and then proceeded to a second application site. While setting up to begin application at the second site, the helicopter struck 12KV electrical power transmission wires without the pilot ever seeing them. He landed the helicopter and observed that the rotor pitch change links were damaged. The pilot attributed the accident to improper reconnaissance of the area prior to starting the application.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual surveillance of the worksite to see and avoid power transmission wires.

12. NTSB Identification: **MIA00LA257**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 137: Agricultural

Accident occurred Friday, September 01, 2000 in CANTON, MS
Probable Cause Approval Date: 5/17/2001
Aircraft: Bell 47G-3B-1, registration: N53SP
Injuries: 1 Serious.

The pilot stated he had a wire strike which he believes led to an in-flight fire. He landed the helicopter upright and fire consumed the helicopter.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout which resulted in the helicopter colliding with power lines, catching fire, and being consumed by fire after landing.

MIA00LA257—On September 1, 2000, about 0935 central daylight time, a Bell 47G-3B-1, N53SP, registered to an individual, crashed while on a Title 14 CFR Part 137 aerial application flight. Visual meteorological conditions prevailed at the time and no flight plan was filed. The helicopter received substantial damage and the commercial-rated pilot received serious injuries. The flight originated from the local area about 0900.

The pilot stated he had a wire strike, which he believes led to an in-flight fire. The helicopter was subsequently landed standing upright. By this time the helicopter was engulfed in flames. He exited the helicopter and watched it burn.

13. NTSB Identification: **LAX00LA328**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Thursday, September 07, 2000 in RANCHO MURIETA, CA

Probable Cause Approval Date: 11/1/2001

Aircraft: Hughes 269C, registration: N50638

Injuries: 1 Fatal.

During cruise the helicopter collided with power lines and was destroyed in the post-impact fire. The purpose of the flight was to herd cattle at one of the ranches. The helicopter was discovered when the local fire department was notified of a fire and downed power lines in the vicinity of the accident. Prior to arrival, the local fire department was not aware that there had been an aircraft accident. When they arrived on scene they observed the helicopter in the middle of the fire. In 1993 the pilot was involved in a similar accident. He was herding cattle when the helicopter struck power lines and crashed.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout during cruise, which subsequently led to a wire strike.

LAX00LA328-On September 7, 2000, at 1020 hours Pacific daylight time, a Hughes 269C, N50638, collided with power lines and then impacted the ground in a pasture near Rancho Murrieta, California. The helicopter, owned and operated by the pilot under the provisions of 14 CFR Part 91, was destroyed in the collision sequence and postimpact fire. The private pilot, the sole occupant, was fatally injured. Visual meteorological conditions prevailed for the personal flight, and no flight plan was filed. The flight originated from a private strip about 0900 to herd cattle at one of the ranch sites.

According to a Federal Aviation Administration (FAA) inspector, about 1028, the local fire department was notified of a fire and downed power lines in the vicinity of the accident. They did not know that there had been an aircraft accident. When they arrived on-scene they observed the helicopter in the middle of the fire.

The FAA further reported that in January 1993, the pilot was involved in a similar accident where he was rounding up a herd of cattle on his property. The helicopter struck power lines, and crashed.

WITNESS INFORMATION

A deputy from the Sacramento County Sheriff's Department interviewed the spouse of the pilot. She stated that about 0900 she went for a run while her husband departed in his helicopter to herd cattle at the "Boys Ranch." She expected him home about noon. When she returned to the house about 0930, an individual at the residence told her that there was smoke on the hill. She attempted to call the pilot on his cell phone several times, but received no answer.

At that point, she heard the fire engine sirens. When she arrived on scene, she stated that the helicopter belonged to the pilot.

PERSONNEL INFORMATION

The pilot's logbooks were not available for review by the Safety Board.

Review of the FAA Airman Certification records disclosed that the pilot held a private pilot certificate with ratings for airplane single engine land (ASEL) issued on February 17, 1946. He received additional aircraft ratings for ASEL instrument On March 16, 1959, and a rotorcraft-helicopter rating on January 14, 1966. On December 27, 1969, he received an additional rating for airplane multiengine land - limited to center thrust.

Review of the FAA Medical Certification records revealed that the pilot held a third-class medical issued on May 26, 1999, with limitations for vision. At that time he reported his flight time as over 10,000 hours, with 70 hours accrued in the last 6 months. The Safety Board investigator estimated the pilot's total flight time, over 11,000 hours, from information gathered on his medical applications from the preceding years.

AIRCRAFT INFORMATION

The helicopter airframe, engine, and maintenance logbooks were unavailable for review by the Safety Board.

MEDICAL AND PATHOLOGICAL INFORMATION

The County of Sacramento Coroner's Office conducted an autopsy on the pilot on September 8, 2000. A toxicological analysis was performed by the FAA Civil Aeromedical Institute, Oklahoma City, Oklahoma, from samples obtained during the autopsy. The results of the analysis were negative for carbon monoxide, cyanide, ethanol and drugs.

ADDITIONAL INFORMATION

According to the coroner's investigation report of the accident, the Sacramento Fire Department responded to a 911 call made by the pilot's wife, reporting smoke on the family property. The firemen found the pilot and the burned helicopter wreckage as they extinguished the fire. Severed power lines were found 60 feet northwest of the decedent that were connected to a power pole about 40 feet northwest of the severed ends of the wires. The coroner's office concluded that the helicopter had collided with the wires, severing them, resulting in the grass fire that burned the helicopter wreckage.

14. NTSB Identification: **FTW01FA021**.

The docket is stored in the Docket Management System (DMS). Please contact Public Inquiries
14 CFR Part 91: General Aviation

Accident occurred Thursday, November 16, 2000 in HOUSTON, TX

Probable Cause Approval Date: 8/26/2002

Aircraft: Eurocopter AS350B2, registration: N126TV

Injuries: 1 Fatal.

The turbine powered helicopter was on a 29 nautical mile night flight over a city. Two law enforcement officers, located about two blocks northeast of the accident site, reported observing the helicopter "flying at a very low altitude" northbound. The officers walked around the building to a parking lot where they met another officer. All three officers heard the helicopter fly over the parking lot in a southwest direction. The officers looked for the helicopter, but they could not see it due to the poor visibility. When the helicopter came into view, it was "banked to the right" traveling in a westerly direction. The helicopter continued in a downward direction, and then a "huge fireball" was observed. The helicopter struck wires, a power pole and an above ground gas meter. An electrical transformer exploded, and the helicopter was consumed by the ensuing fire. The destination airport had IFR weather conditions at the time of departure. Witnesses estimated that at the time of the accident, there was an overcast ceiling of about 300-400 feet. No record was found of any preflight weather briefing obtained by the pilot. No pre-impact anomalies were observed during an examination of the airframe and engine.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain obstacle clearance while maneuvering, which resulted in an in-flight collision with objects. Contributing factors were the dark night and low ceilings.

HISTORY OF FLIGHT

On November 16, 2000, approximately 2155 central standard time, a Eurocopter AS350B2 helicopter, N126TV, was destroyed following impact with wires and terrain while maneuvering in the River Oaks section of Houston, Texas. The Fox 26 News helicopter was owned and operated by Helicopter Services, Inc., of Spring, Texas. The airline transport pilot, sole occupant, sustained fatal injuries. Dark night instrument meteorological conditions prevailed at the accident site, and a flight plan was not filed for the 14 Code of Federal Regulations Part 91 positioning flight. The flight originated from the William P. Hobby Airport (HOU), at 2145, and was destined for the David Wayne Hooks Memorial Airport (DWH), Spring, Texas, located 29 nautical miles northwest of HOU.

Two law enforcement officers, who were coming out of the Chuy's Restaurant, located about two blocks northeast of the accident site, reported observing the helicopter "flying at a very low altitude" northbound along Kirby Drive. The officers walked around the restaurant to the parking lot where they met another officer. All three officers heard the helicopter fly over the parking lot in a southwestern direction. The officers looked for the helicopter, but they could not see it due to the poor visibility. When the helicopter came into view, it was "banked to the right" traveling in a westerly direction and paralleling Westheimer Road. The helicopter continued in a downward direction, and then a "huge fireball" was observed.

A witness, who resided approximately two blocks east-southeast of the accident site, reported that he heard the helicopter as it flew past his house from east to west at about 25 feet higher than his house. The helicopter was so loud that it shook his house. He further reported that the engine sounded like it was producing full power, as though the helicopter was taking off. He commented that the engine was not sputtering.

A witness at the Lizzard's Pub initially heard a roaring sound, and ran outside to see what it was. Once outside he realized that it was a helicopter and it was "coming in just over the street in front of Li[z]ard's Pub looking like it was going to crash into the houses and trees across the street;" however, "the pilot pulled up enough to avoid them. It seemed like he was trying to make it to the Lutheran Church parking lot. After avoiding the trees, he caught the power line[s] and dropped to the ground."

After the helicopter struck the wires, it struck a power pole and impacted an above ground gas meter located next to a beauty salon on the north side of Elm Street at Bammel Lane. An electrical transformer exploded, and the helicopter was consumed by the ensuing fire. The beauty salon was damaged by the fire, and several business structures were damaged by flying debris.

PERSONNEL INFORMATION

According to FAA records, the pilot was issued an airline transport pilot certificate on January 20, 1997, for multiengine land airplanes. He also held a commercial certificate for airplane single-engine land and rotorcraft-helicopter with a helicopter instrument rating. On April 27, 2000, the pilot completed initial AS350 helicopter ground and flight training, which was administered by American Eurocopter, Grand Prairie, Texas. The pilot was issued a flight instructor certificate for rotorcraft-helicopter on September 18, 2000. There were no restrictions or limitations listed on the pilot's FAA second class medical certificate issued on October 17, 2000. On the application for this medical certificate, the pilot reported having accumulated a total of 5,000 flight hours, of which 350 hours were in the previous six months. The pilot also held an airframe and powerplant mechanic certificate.

A review of the pilot's flight logbook revealed that on June 11, 2000, he completed a biennial flight review in a Cessna 172 airplane, and on August 10, 2000, he completed an instrument proficiency flight in a Hughes 369HS helicopter. The logbook also revealed that as of September 14, 2000, the pilot had logged a total flight time of 5,241.3 hours, of which 4,674.3 hours were in helicopters and 232.9 hours were logged in the same make and model as the accident helicopter. The pilot had also logged 279.3 hours in night conditions, 165.4 hours in simulated instrument conditions, and 45.0 hours of actual instrument conditions.

AIRCRAFT INFORMATION

The 1996-model Eurocopter AS350B2 helicopter (S/N 2944) had a three-bladed main rotor system, a two-bladed tail rotor, and was powered by a Turbomeca Arriel 1D1 turboshaft engine (S/N 9447), rated at 732-horsepower.

A review of the maintenance records revealed that the helicopter's engine (2,870.9 hours total time since new) was removed for overhaul on November 18, 1999, and another engine (S/N 9665) was installed. The helicopter underwent its most recent annual inspection on December 4, 1999, at a total aircraft time of 2,903.6 hours. On February 14, 2000, the original engine (S/N 9447) was reinstalled in the helicopter at 3,125.2 hours total aircraft time. The last 100-hour inspection was completed on November 4, 2000, at a total aircraft time of 3,973.9 hours and an engine total time of 3,719.6 hours. The following maintenance was also completed on November 4, 2000: landing light replaced; the aft baggage door hinge attachment repaired; hydraulic and air conditioner drive belts replaced; main rotor fore and aft hydraulic servo, main rotor lateral hydraulic servo, and tail rotor control hydraulic servo replaced with overhauled servos. Additionally the following Airworthiness Directives (ADs) were complied with: AD 98-24-35, separation of spherical bearings; AD 2000-10-10, failure of cross beam; and AD 86-15-10(R1), inspection of main rotor star arms and main gearbox suspension bar as per Eurocopter Service Bulletin 01-17A.

METEOROLOGICAL INFORMATION

At 2153, the weather observation facility at HOU, located 9 miles southeast of the accident site, reported wind 010 degrees at 10 knots, visibility 8 statute miles, ceiling broken at 1,100 feet,

overcast sky at 2,300 feet, temperature 17 degrees C, dew point temperature 16 degrees C, and altimeter 30.00 inches of mercury.

At 2211, HOU reported wind 020 degrees at 10 knots, visibility 8 statute miles, ceiling broken at 1,100 feet, overcast sky at 2,300 feet, temperature 17 degrees C, dew point temperature 15 degrees C, and altimeter 29.99 inches of mercury.

At 2153, the weather observation facility at the George Bush Intercontinental Airport (IAH), located 15 miles north-northeast of the accident site, reported wind 350 degrees at 6 knots, visibility 1/2 statute mile in mist, ceiling overcast at 300 feet, temperature 14 degrees C, dew point temperature 13 degrees C, and altimeter 30.02 inches of mercury.

At 2153, the weather observation facility at DWH, located 20 miles north-northwest of the accident site, reported wind variable at 5 knots, visibility 3 statute miles in mist, ceiling overcast at 400 feet, temperature 13 degrees C, dew point temperature 12 degrees C, and altimeter 30.01 inches of mercury.

At 2204, DWH reported wind variable at 5 knots, visibility 3 statute miles in mist, ceiling overcast at 200 feet, temperature 12 degrees C, dew point temperature 12 degrees C, and altimeter 30.02 inches of Mercury.

At 2200, the Channel 2 remote weather sensor at the Lamar High School, located on Westheimer Road about a quarter mile west of the accident site, reported a temperature of 63 degrees F, a dew point temperature of 63 degrees F, and a relative humidity of 100 percent with no rain. Witnesses estimated that at the time of the accident, there was an overcast ceiling of about 300-400 feet. No record was found of any preflight weather briefing obtained by the pilot.

WRECKAGE IMPACT INFORMATION

The accident site location was on the south side of a hair salon at the northeast corner of Bammel Lane and Earl Street, in the River Oaks section of Houston. An above ground gas meter located next to this building was ruptured resulting in a natural gas leak. Power lines that ran parallel to Bammel Lane were down; however, the wires were repaired prior to the arrival of the NTSB investigator-in-charge (IIC). A utility/light pole on Earl Street next to the hair salon had three pieces separated from it. Two pieces were found in a garden area on the east side of the hair salon, and the top piece was found in the street next to the aircraft wreckage. The wreckage distribution continued east along Earl Street for 150 feet beyond the main wreckage. Pieces of the main rotor blades were found on the street and in the building across the street from the main wreckage. A main rotor blade weight traveled through this building and struck the building on the other side.

The helicopter's cabin floor, instrument panel and aft fuselage were consumed by the fire. The fuel flow control lever was found in the flight position, the rotor brake application lever was in the "off" or not applied position, and the emergency fuel shut-off lever was in the open position. Both the fore and aft landing gear cross-tubes were separated at the point where they attach to

the airframe. Both skid tubes were separated forward of the front cross-tube attachment point. Flight control continuity could not be established due to the impact and fire damage.

The engine remained attached to the engine deck, and was damaged by the fire. Engine rotation could not be confirmed due to molten metal in the axial compressor inlet. All electrical lines were burnt, and the external components displayed various stages of melting.

The main rotor gearbox was laying horizontally next to a retaining wall. The transmission support platform was consumed by fire. The main gearbox input shaft was separated just aft of the input pinion. All three main rotor blades were attached to the sleeves at the root by both blade retention pins. The fibers of the main rotor head sleeves were thermally damaged, and the star-flex arms were broken and ground down to the central part of the star-flex. One of the main rotor blades came to rest against the utility pole. The blade tip had fanning of the internal rovings. The trailing edge and skin were consumed by fire, and the stainless steel leading edge was separated from the blade.

The tail boom forward of the tail rotor gearbox to the fuselage junction, tail rotor drive shaft, control tube and horizontal stabilizer were all consumed by fire. Power transmission lines were entangled in the aft most portion of the tail section, consisting of the vertical fin and tail rotor. The tail skid was separated from the lower vertical fin. The lower vertical fin was displaced 90 degrees to the right and one blade of the tail rotor was embedded in the fin. The opposite blade of the tail rotor had fire damage.

The intermediate drive shaft was separated from the engine and the tail rotor drive shaft. The forward end was separated with 45 degree fracture surfaces, and it had rotational scratches around the shaft tube.

The engine was removed from the wreckage and transported to the Turbomeca facility in Grand Prairie, Texas, for further examination. The helicopter wreckage was moved to Air Salvage of Dallas, Lancaster, Texas.

MEDICAL AND PATHOLOGICAL INFORMATION

On August 21, 2000, the Office of the Medical Examiner of Harris County in Houston, Texas, performed an autopsy of the pilot. There was no evidence found of any preexisting disease that could have contributed to the accident.

Toxicological testing was performed by the FAA Civil Aeromedical Institute's (CAMI) Forensic Toxicology and Accident Research Center at Oklahoma City, Oklahoma. The toxicological tests were negative for alcohol, cyanide, carbon monoxide, and drugs.

TESTS AND RESEARCH

An examination of the Arriel 1D1 turboshaft engine (S/N 9447) was conducted at the Turbomeca facility on April 18, 2001, under the supervision of the NTSB IIC. The engine external surfaces and components displayed thermal damage and corrosion. As the modules were separated, drive

train continuity was established throughout each module. Examination of the oil filter revealed no visible particles, and evidence of oil lubrication was present in each module. Disassembly of the rear bearing and labyrinth seals revealed no anomalies. Rotational scoring was observed at the air inlet, the compressor rotors, 1st and 2nd stage turbines, free turbine, and the reduction gearbox. Ashes and debris were found throughout the air path of the engine.

ADDITIONAL DATA

The helicopter wreckage was released to the owner's representative on May 4, 2001.

2001

1. NTSB Identification: **FTW01LA076**.

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Saturday, March 10, 2001 in Alvarado, TX

Probable Cause Approval Date: 7/30/01

Aircraft: Robinson R22, registration: N4009W

Injuries: 2 Uninjured.

According to the pilot, he flew to an area on his property where he and his passenger planned to test some equipment. The equipment was not related to the helicopter. He stated that the helicopter was in a 2-foot hover beneath a marked static wire that was 30 feet agl. He noticed that the wire began coming closer to the helicopter and initiated a descent; however, the wire continued to descend with the helicopter. Subsequently, the wire contacted the main rotor blades, and the helicopter landed without further incident. The damage to the main rotor blades required their replacement.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance with a marked static wire.

2. NTSB Identification: **LAX01TA119**.

14 CFR Public Use

Accident occurred Saturday, March 17, 2001 in Hayward, CA

Aircraft: Eurocopter France AS-350-B2, registration: N996PD

Injuries: 3 Uninjured.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On March 17, 2001, at 2134 hours Pacific standard time, a Eurocopter AS-350-B2, N996PD, was substantially damaged during an emergency autorotation descent and impact with electrical power transmission lines following loss of engine power at Hayward, California. The airline transport certificated pilot and two passengers were not injured. The local area, law enforcement

flight was operated as a public-use aircraft under 14 CFR Part 91 by the East Bay Regional Park District. The helicopter departed from the Hayward Executive airport at 1955. Visual meteorological conditions prevailed and no flight plan was filed.

Following loss of engine power, the helicopter autorotated to a dark, open lot; however, during the descent the helicopter's tail boom was partially severed by impact with a residential power transmission wire.

3. NTSB Identification: **FTW01LA109**.

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Friday, April 27, 2001 in Nacogdoches, TX

Probable Cause Approval Date: 9/19/01

Aircraft: Hughes 269B, registration: N9508F

Injuries: 1 Minor.

The helicopter was parked on a trailer between two T-hangars and under a power line. The pilot stated that he cleared the area around the helicopter; however, he did not clear the area directly over the helicopter. The pilot lifted off the trailer and impacted the power line approximately 30 feet above the ground. The pilot mentioned that at the time of the accident, "the sun was at an angle and intensity so that the wires were not visible." He also stated that the wires were not marked with red balls. The power line wrapped around the main rotor mast and partially separated one of the main rotor blades. The helicopter then entered an uncontrolled descent and impacted the ground.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance with the wires during takeoff. Contributory factors were the sun glare and the unmarked wires.

4. NTSB Identification: **NYC01LA131**.

The docket is stored in the Docket Management System (DMS). Please contact Public Inquiries

14 CFR Part 91: General Aviation

Accident occurred Monday, May 28, 2001 in Fairfield, KY

Probable Cause Approval Date: 8/13/2001

Aircraft: Hughes 269C, registration: N9660F

Injuries: 1 Minor, 1 Uninjured.

According to the pilot, he initially overflew the field, and looked for power lines and transmission poles. He noticed one pole, but his attention was diverted, and didn't notice any other poles or power lines. The pilot made his approach, brought the helicopter into a hover, and hovered for about 1 minute. The pilot then looked for obstacles in his departure path, but didn't see any. He initiated the takeoff, and during the departure, the helicopter struck a power line. The pilot then performed an autorotation to the ground.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout during takeoff, and his inadequate reconnoiter of the area prior to takeoff.

5. NTSB Identification: **CHI01LA243**.

The docket is stored on NTSB microfiche number **DMS**.

14 CFR Part 137: Agricultural

Accident occurred Thursday, July 26, 2001 in Wheeler, WI

Probable Cause Approval Date: 4/1/03

Aircraft: Bell 47G-2, registration: N986B

Injuries: 1 Fatal.

While maneuvering during an aerial application flight, the helicopter impacted a power transmission line and subsequently impacted the terrain. The pre-impact height of the power transmission line was approximated to be 42 feet. The tailboom assembly, including the tail-rotor, was found approximately 125 feet from the main wreckage. No anomalies were found during the post-accident inspection that could be associated with any pre-impact condition.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot not maintaining altitude/clearance from the power transmission line. A factor to the accident was the power transmission line.

6. NTSB Identification: **LAX01LA276**.

The docket is stored on NTSB microfiche number **DMS**.

14 CFR Part 137: Agricultural

Accident occurred Saturday, August 11, 2001 in Strathmore, CA

Probable Cause Approval Date: 10/23/02

Aircraft: Bell 47G-4A, registration: N4262Y

Injuries: 1 Minor.

During the aerial application flight, the pilot completed a spray run and was returning to the truck when he flew into a wire in the middle of the field, at 15 feet above the ground. Thereafter, he lost control of the helicopter and it crashed coming to rest on its right side. Prior to the mishap, the pilot had observed poles in the area, but had not observed the line that he collided with during the low altitude pass. No mechanical malfunctions or failures associated with the operation of the helicopter were indicated.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout while maneuvering during an aerial application flight.

7. NTSB Identification: **ATL02FA003**.

The docket is stored on NTSB microfiche number **DMS**.

14 CFR Part 91: General Aviation

Accident occurred Monday, October 22, 2001 in N. Wilkesboro, NC

Probable Cause Approval Date: 4/15/03

Aircraft: Bell 206B, registration: N8104J

Injuries: 2 Fatal.

The helicopter collided with power lines in cruise flight approximately 130 feet above the ground, then collided with the ground and burst into flames. Power line cable 3/4-inch in diameter was found wrapped several times around the transmission mast, and the helicopter was not equipped with a Wire Strike Protection System. Examination of the airframe and powerplant revealed no evidence of mechanical malfunction. It was observed that the rising terrain to the west of the accident site cast a shadow over the power lines at the time of the accident.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain visual lookout and clearance above obstacles, which resulted in a collision with power lines and subsequent loss of control and collision with terrain.

8. NTSB Identification: **FTW02FA028**.

The docket is stored in the (offline) NTSB Imaging System.

14 CFR Part 91: General Aviation

Accident occurred Saturday, November 03, 2001 in Seagoville, TX

Probable Cause Approval Date: 2/20/02

Aircraft: Robinson R22, registration: N127RB

Injuries: 1 Fatal, 1 Serious.

The pilot-rated student receiving instruction stated that the objective of the flight lesson was to work on confined area and pinnacle landings. The student stated that he had practiced a number of confined area landings in the local area and along a river. The student added that following his last landing/takeoff, the flight instructor took over flying to give him a break. The flight instructor flew the helicopter north of the last few landing areas to review their lesson. The flight instructor turned the helicopter south and flew along the river instructing the student and commenting on the various landing areas. The student stated that he was looking over his right shoulder at one of the previous landing areas, and looked forward to see wires in front of the helicopter. The student exclaimed, "wires" and saw the instructor pull up on the collective and left on the cyclic. The helicopter pitched up and rolled to the left; subsequently impacting trees and terrain along the left side of the river. Examination of the accident site revealed that there was a set of three unmarked wires; one which remained hanging across the river, and two others that were laying on the west bank of the river. The helicopter came to rest on its left side among trees approximately 100 yards from the wires. The wire that remained hanging across the river was approximately 40 feet above the river, and was below the tops of the trees along the banks. Examination of the helicopter revealed that the mast cowling displayed two marks and tears perpendicular to the mast.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The flight instructor's failure to maintain clearance with wires while maneuvering along a river.

9. NTSB Identification: **FTW02LA038**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Saturday, November 17, 2001 in Richmond, TX

Probable Cause Approval Date: 8/26/2002

Aircraft: Hughes 269C, registration: N9294F

Injuries: 1 Serious, 1 Uninjured.

The private pilot, who was not helicopter rated, was attempting to land the helicopter near a friend's house when the main rotor blades contacted power lines. The helicopter landed hard and came to rest upright in a grass field. The tailboom was severed by the main rotor blades, the main rotor blades were bent and fractured, and the skids were spread up and outward, level with the bottom of the cabin section.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance from the power line while landing.

10. NTSB Identification: **MIA02FA026**.

The docket is stored on NTSB microfiche number **DMS**.

14 CFR Part 91: General Aviation

Accident occurred Thursday, November 22, 2001 in Tallassee, AL

Probable Cause Approval Date: 6/18/02

Aircraft: Enstrom 280FX, registration: N280XF

Injuries: 2 Fatal, 1 Serious.

The pilot stated he keeps the helicopter at his residence. On the day of the accident he flew to his sister's house. After dinner, he departed his sister's house, which is located about 5 miles from the accident site, with the 2 passengers. They flew around the town of Tallassee, and he then entered on the downwind leg for runway 13 at Reeves Airport. He turned on base over the Tallapoosa River, and was flying to the south. He observed a glimmer and remembers seeing power lines. The next thing he remembers is being in the river. Postcrash examination of the helicopter showed it had collided with an unmarked power transmission line, which drooped below the tree level on the river banks, to a point about 75 feet about the river. The collision occurred about midpoint in the river and the wire rapped around the main rotor mast. The main rotor system separated from the helicopter and the helicopter crashed into the river about 500 feet south of the power lines. Postcrash examination of the helicopter and engine showed no evidence of precrash failure or malfunction of the helicopter structure, flight controls, or engine. Toxicology tests performed on specimens obtained from the pilot after admission to a hospital were negative for ethanol and drugs.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows: The failure of the pilot to maintain a safe altitude above terrain and maintain a visual lookout resulting in the helicopter colliding with power transmission lines and crashing into a river. A factor in the accident was the power transmission lines not being marked.

11. NTSB Identification: **CHI02FA049.**

The docket is stored on NTSB microfiche number **DMS.**

14 CFR Part 91: General Aviation

Accident occurred Wednesday, December 12, 2001 in Waukesha, WI

Probable Cause Approval Date: 5/13/03

Aircraft: Robinson R44, registration: N7007F

Injuries: 1 Fatal, 1 Serious, 1 Minor.

The helicopter, while in cruise flight, was destroyed when it impacted a static power line, a vehicle and terrain. The pilot asked local ATC to fly in controlled airspace and was told to remain outside due to present IFR conditions. Those weather conditions were 1 1/2 statute miles visibility, drizzle, and overcast skies at 400 feet. A witness stated that he “was driving and saw a red light over what seemed like the median a few 100 ft. in the air. The light rose almost straight upward maybe another 200 ft and then began corkscrewing downward.” The helicopter is placarded, “THIS ROTOCRAFT APPROVED FOR DAY AND NIGHT VFR [visual flight rules] OPERATIONS.” An on-scene investigation revealed no pre-impact anomalies. The fiberglass chin portion of the front right side of the cabin had a linear tear. The right side forward and aft cabin doors had a linear scratch across them. The helicopter color scheme was blue, white, and red. A power line contractor stated, “I inspected the helicopter crash site at I-43, on December 14, 2001. I inspected the static wire span, hands on, and found some plastic and fiberglass shavings. I also found three different color paints, mainly blue, very little yellow and a tiny bit of red. ... The locations of apparent contact points on the shield wire was an area 35 - 40 feet just North of mid-span.” A power line employee calculated the wire was about “146’ over the roadway.” Robinson Safety Notice SN-26 stated, “NIGHT FLIGHT PLUS BAD WEATHER CAN BE DEADLY ... When it is dark, the pilot cannot see wires or the bottom of clouds, nor low hanging scud or fog.” A Flight For Life Pilot stated that a request was received for “Aeromedical transport from an accident on [Highway] 164 and [Interstate] -43 by the Waukesha Co. Sheriff’s Dept. I determined weather conditions were not acceptable so the flight request was denied.”

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot’s continued flight into adverse weather and not maintaining altitude/clearance from the static line during cruise flight. Factors were the static wire, the darkness of night, the low ceiling, and the vehicle.

12. NTSB Identification: **DEN02GA016.**

The docket is stored on NTSB microfiche number **DMS.**

14 CFR Public Use

Accident occurred Thursday, December 27, 2001 in Park City, UT
Probable Cause Approval Date: 1/16/03
Aircraft: Hughes 369E, registration: N280SP
Injuries: 3 Fatal.

The helicopter had been contracted by the State to relocate moose to an area where they would be less hazardous to traffic. After the helicopter herded a moose off a frozen reservoir and back towards the shoreline, the pilot turned and flew into five power lines. The helicopter nosed over, and fell 80 feet in a near-inverted attitude to the surface of the frozen reservoir. It broke through the ice, sank, and then floated back to the surface. A portion of the tail boom remained entangled in the wires. Witnesses said the visibility was 1 mile in fog. An examination of the wreckage revealed no anomalies.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout, resulting in an in-flight collision with power lines. Contributing factors were the fog and the power lines.

2002

1. NTSB Identification: LAX02LA090.

14 CFR Part 91: General Aviation

Accident occurred Friday, February 22, 2002 in Paso Robles, CA

Aircraft: Young Mini-500, registration: N500JY

Injuries: 1 Minor.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On February 22, 2002, about 1335 hours Pacific standard time, a Young Mini-500, N500JY, collided with power lines during initial climb from a clearing about 4 miles southeast of Paso Robles, California. The helicopter was substantially damaged, and the airline transport certificated pilot received minor injuries. Visual meteorological conditions prevailed, and no flight plan was filed. The personal flight was performed under 14 CFR Part 91, and was originating at the time.

The pilot reported to the National Transportation Safety Board investigator that he did not observe the power lines during initial climb. There were no mechanical malfunctions or failures with his helicopter.

2. NTSB Identification: ATL02LA102.

The docket is stored on NTSB microfiche number **DMS**.

14 CFR Part 137: Agricultural

Accident occurred Tuesday, May 21, 2002 in Marion, AL

Probable Cause Approval Date: 8/26/03

Aircraft: Bell 47G, registration: N72MU
Injuries: 1 Uninjured.

According to the pilot, while spraying the edge of a lake, he lost visual contact with the nearby power line, and was unable to reacquire visual contact. The helicopter struck the power line as the pilot maneuvered the helicopter for the spray operation.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain visual lookout while conducting an aerial application maneuver. A factor was the transmission line.

3. NTSB Identification: **SEA02FA085.**

The docket is stored on NTSB microfiche number **DMS.**

14 CFR Part 91: General Aviation

Accident occurred Thursday, May 23, 2002 in Merlin, OR

Probable Cause Approval Date: 4/18/03

Aircraft: Robinson R-22 Mariner, registration: N2322Y

Injuries: 2 Fatal.

Witnesses reported observing the helicopter traveling over the river at an altitude of about 50-100 feet above the water when it collided with an unmarked telephone line support cable. One of the witnesses reported that the engine rpm did not change until the helicopter collided with the cable. After striking the cable, the engine rpm slowed, but did not stop. The helicopter subsequently collided with the ground along the river's edge and came to rest partially submerged along the bank. The width of the river at the accident site was approximately 75 yards wide. About 300 feet upstream of the main wreckage, two cables running perpendicular to the river were located. One of the two cables was broken and in the water. The other cable was intact, but not taut, and displayed a considerable droop. One end of the 1/8 in diameter cables was attached to a power pole near a restaurant. The other end traveled to the opposite side of the river and over upsloping terrain.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Clearance from a cable running perpendicular to a river was not maintained during low level cruise flight. A cable was a factor.

4. NTSB Identification: **ATL02LA128.**

The docket is stored on NTSB microfiche number **DMS.**

14 CFR Part 137: Agricultural

Accident occurred Monday, June 24, 2002 in La Belle, FL

Probable Cause Approval Date: 4/15/03

Aircraft: Bell 47G-2A, registration: N8486E

Injuries: 1 Minor.

The pilot was executing swath runs to apply herbicide solutions to weed plants. While finishing with the second load of spray, the pilot maneuvered to turn the helicopter around and struck unmarked power lines approximately 75 to 100 feet above the ground. The pilot then lost control of the helicopter, and it came down on its side and impacted trees. The pilot reported no mechanical malfunction. Examination of the wreckage revealed the main rotor system was damaged, the tail boom was separated, the canopy was shattered, and one skid was separated.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain visual lookout while maneuvering during an aerial application, which resulted in an in-flight collision with power lines and uncontrolled descent into terrain.

5. NTSB Identification: **DEN02FA065**.

The docket is stored on NTSB microfiche number **DMS**.

14 CFR Part 91: General Aviation

Accident occurred Thursday, June 27, 2002 in Raton, NM

Probable Cause Approval Date: 9/30/03

Aircraft: Bell 206BIII, registration: N2779B

Injuries: 2 Fatal.

The pilot was flying a power line inspection patrol for possible maintenance needs when the helicopter struck power lines. The mission was flown at 40 to 50 knots, on the right side of the wires, with the main rotor a "few" feet above the highest wire, but not over-lapping the wire. This permitted the observer, sitting in the left seat, to have an optimum view. Two 3/8 inch in diameter galvanized steel static cables (without associated transmission wires) joined the northbound galvanized steel static cables (with associated transmission cables) on a 30 degree angle. The accident occurred at 0758, when the sun was at approximately 37 degree altitude above the horizon, and its azimuth was 87 degrees east of north (there were no clouds in the sky).

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance of the static wire. Factors were the static wire, and the glaring sunlight condition.

6. NTSB Identification: **LAX02LA218**.

The docket is stored in the Docket Management System (DMS). Please contact Public Inquiries

14 CFR Part 91: General Aviation

Accident occurred Sunday, July 07, 2002 in Compton, CA

Aircraft: Bell 47G-2, registration: N2483B

Injuries: 2 Uninjured.

On July 7, 2002, about 1145 Pacific daylight time, a Bell 47G-2, N2483B, experienced a partial loss of engine power during cruise flight and collided with power lines during a forced landing near Compton, California. The pilot/owner was operating the helicopter under the provisions of

14 CFR Part 91. The pilot and one passenger were not injured; the helicopter sustained substantial damage. Visual meteorological conditions prevailed, and a flight plan had not been filed. The personal local flight originated at the Compton/Woodley Airport about 1100.

LAX02LA218—On July 7, 2002, about 1145 Pacific daylight time, a Bell 47G-2, N2483B, experienced a partial loss of engine power during cruise flight and collided with power lines during a forced landing near Compton, California. The pilot/owner was operating the helicopter under the provisions of 14 CFR Part 91. The pilot and one passenger were not injured; the helicopter sustained substantial damage. Visual meteorological conditions prevailed, and a flight plan had not been filed. The personal local flight originated at the Compton/Woodley Airport about 1100.

In a written statement, the pilot reported that about 45 minutes after departure, the helicopter was about 1,000 feet above ground level (agl), and moving in an easterly direction with an airspeed of 70 knots. He felt a “severe” vibration and noted a drop in the helicopter’s rotor rpm. As the vibrations continued, he manipulated the flight controls in an effort to maintain a controlled descent. While searching for a suitable landing area, he verified that the engine rpm indicated zero. About 200 feet agl he noticed that power lines were in the helicopter’s path, and turned the helicopter in a unsuccessful effort to avoid them and an accompanying pole. The helicopter came to rest in a dirt field on the corner of the 91 freeway and Alondra Blvd.

During a telephone interview with a National Transportation Safety Board investigator, the brother of the pilot, a mechanic with inspection authorization (IA) who regularly worked on N2483B, examined the helicopter after the accident. He stated that a fan belt used in the integral system for cooling the engine had either broken or come loose. As a result, the belt wrapped around the pulley, which caused the transmission to drag. The pilot autorotated the helicopter into power lines and impacted terrain.

The IA further noted that the engine ran fine after the accident, and the fuel system was free of particulates and contaminants. He said that he completed the annual inspection for the helicopter about 14 hours prior to the accident, at which time he believed that he examined the belts. He further stated the helicopter was stored outside, in a corrosive environment.

7. NTSB Identification: **CHI02FA189**.

The docket is stored on NTSB microfiche number **DMS**.

14 CFR Part 91: General Aviation

Accident occurred Wednesday, July 10, 2002 in Brookville, IN

Probable Cause Approval Date: 11/25/03

Aircraft: Sikorsky S-58ET, registration: N580US

Injuries: 1 Fatal, 2 Serious.

The helicopter was flying over a lake at a low altitude when it struck power transmission lines, lost control and impacted the lake. The pilot stated that he checked his sectional and was aware of power transmission lines to the east but was not aware of any power transmission lines to the west. The pilot stated that he saw the power transmission lines and attempted to pull up to clear the power transmission lines. The pilot stated that the helicopter was running alright and

everything appeared to be operating okay. The power transmission lines that were struck measured 124 feet above the water.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's intentional low altitude flight and his failure to maintain clearance from power transmission lines. Factors to the accident were the power transmission lines followed by the inability to control the aircraft after the collision with power transmission lines.

8. NTSB Identification: **LAX02LA262.**

14 CFR Part 137: Agricultural

Accident occurred Saturday, August 24, 2002 in Oasis, CA

Aircraft: Bell 47G-2, registration: N8478H

Injuries: 1 Serious.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On August 24, 2002, at 1843 Pacific daylight time, a Bell 47G-2, N8478H, collided with power lines during aerial application maneuvering for a local citrus nursery near Oasis, California. The helicopter, operated by Salton Sea Air Services under the provisions of 14 CFR Part 137 as an agricultural crop dusting operation, sustained substantial damage. The commercial pilot, the sole occupant, sustained serious injuries. Visual meteorological conditions prevailed for the local area flight, and no flight plan had been filed. The helicopter departed from a private strip near the accident site, and was scheduled to terminate at the private strip.

9. NTSB Identification: **CHI02LA256.**

The docket is stored on NTSB microfiche number **DMS.**

14 CFR Part 91: General Aviation

Accident occurred Sunday, August 25, 2002 in COOPERSVILLE, MI

Probable Cause Approval Date: 4/18/03

Aircraft: Enstrom 280C, registration: N51689

Injuries: 1 Serious, 1 Uninjured.

The helicopter sustained substantial damage when it hit a transmission wire during cruise flight and impacted into a river. The passenger reported they were flying over the river on a westerly heading and the sun was in their eyes. She reported the helicopter was "running great" prior to the helicopter hitting the transmission wires. Witnesses reported seeing the helicopter flying approximately 70 feet over the river. The two transmission wires were approximately 70 feet in height.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance from the transmission wires. Additional factors were the transmission wires and the sun glare.

10. NTSB Identification: **DEN02LA101.**

The docket is stored on NTSB microfiche number **DMS.**

14 CFR Part 91: General Aviation

Accident occurred Friday, August 30, 2002 in Canon City, CO

Probable Cause Approval Date: 4/1/03

Aircraft: Bell 206L-III, registration: N43GA

Injuries: 1 Serious.

The pilot said that he had been flying down in the canyon, and had come up to the surface to return to his helipad. He said that the helicopter's mast struck a wire, and severed the main rotor pitch change tubes disabling the aircraft. The pilot said that the helicopter came down vertically (20 to 30 feet) breaking the left skid, crushing the fuselage, separating the tail boom, and separating portions of both main rotor blades.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance of a static wire, and the subsequent loss of aircraft control due to the main rotor pitch change tubes being severed.

11. NTSB Identification: **FTW02LA264.**

14 CFR Part 137: Agricultural

Accident occurred Wednesday, September 25, 2002 in Edmondson, AR

Aircraft: Bell 47G-2, registration: N5193B

Injuries: 1 Fatal.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On September 25, 2002, at 1412 central daylight time, a Bell 47G-2 agricultural helicopter, N5193B, was destroyed when it impacted a wire and terrain while maneuvering near Edmondson, Arkansas. The helicopter was registered to and operated by Ag Copters, Inc. of Jupiter, Florida. The commercial pilot, sole occupant, was fatally injured. Visual meteorological conditions prevailed, and a flight plan was not filed for the 14 Code of Federal Regulations Part 137 boll weevil eradication flight. The local flight originated from a staging field near Edmondson, at 1404.

The operator reported that the pilot had completed spraying a cotton field, which was located approximately 3/8 of a mile from the staging field. As the helicopter was returning to the staging area, one of its main rotor blades impacted a wire as the pilot attempted to fly under a set of high

voltage power lines. A main rotor blade separated from the main rotor system, and the top assembly of the main transmission with the other main rotor blade separated from the aircraft. The helicopter impacted the ground inverted, and an ensuing fire consumed the cockpit area.

12. NTSB Identification: **FTW02LA266**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Thursday, September 26, 2002 in Freer, TX

Probable Cause Approval Date: 4/23/2003

Aircraft: Robinson R22 Beta, registration: N888MH

Injuries: 2 Uninjured.

The pilot was herding cattle flying from the east “right into the sun, in sideward flight” when the helicopter struck a 25-foot high power line. The helicopter began shaking violently and yawed hard to the left, when the pilot rolled off throttle and lowered the collective to autorotate. The helicopter then made a three-quarter turn to the right before hitting flat on its skids and rolling over on its left side.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot’s failure to maintain clearance with the power lines while maneuvering. A factor was the sun glare.

FTW02LA266—On September 26, 2002, at 0830 central daylight time, a Robinson R22 Beta helicopter, N888MH, was substantially damaged upon collision with power lines and subsequent impact with terrain near Freer, Texas. The aircraft was registered to and operated by Mesquite Helicopter Service, Inc., of Alice, Texas. The commercial pilot and his passenger were not injured. Visual meteorological conditions prevailed, and a flight plan was not filed for the 14 CFR Part 91 flight. The local flight departed from ranch headquarters near Freer at 0745.

According to the Pilot/Operator Accident Report (NTSB form 6120.1/2), and in a telephone conversation with the NTSB investigator-in-charge, the pilot reported that he was using the helicopter to “gather” cattle in a pasture and move them into pens. The pilot stated that he had completed gathering cattle from the first pasture with the owner of the ranch on board, who then instructed him to take one of his farm hands to gather cattle from the second pasture. The pilot reported that he started gathering cattle in the second pasture, flying north and south along the west fence. “The pens were in the southeast corner, so I planned on taking the cows to the east fence and pushing them south to the pens.” The pilot reported that the cattle were moving good, but “I noticed one had stayed back near a pond, so I got low to push the cow out of the thicket to get her up to the heard.” The pilot stated that he was now flying east, “directly into the sun, in sideward flight” when he struck a 25-foot high power line. The pilot further stated “the helicopter began shaking violently, and there was a lot of grinding noise.” The pilot reported that after the helicopter yawed to the right “hard”, he rolled off throttle and lowered the collective to autorotate. The helicopter made a three-quarter rotation to the right, hit flat on its skids, and

subsequently rolled over on its left side. The pilot and his passenger exited the helicopter uninjured, and there was no post-impact fire.

The pilot reported that damage to the helicopter included both main rotor blades being destroyed, and approximately 1 foot of the aft tail boom, including the tail rotor, had separated.

13. NTSB Identification: **LAX03LA027**.

14 CFR Part 91: General Aviation

Accident occurred Sunday, November 10, 2002 in Kingman, AZ

Aircraft: Aerospatiale AS350B, registration: N909WA

Injuries: 2 Minor, 1 Uninjured.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On November 10, 2002, about 1155 hours mountain standard time, an Aerospatiale AS350B, N909WA, collided with a transmission line and impacted the terrain near Kingman, Arizona. The pilot was operating the helicopter under the provisions of 14 CFR Part 91. Two passengers sustained minor injuries and the pilot was not injured. The helicopter sustained substantial damage. The local flight departed Kingman airport about 15 minutes earlier that day to shoot an aerial photographic sequence. Day visual meteorological conditions prevailed, and no flight plan had been filed.

The pilot reported that he was filming a motor home for the “Ripley’s Believe It or Not” television series. The helicopter was crabbing sideways, paralleling highway 66 as it impacted the transmission line. Both he and another crewmember had noticed the transmission line just before the impact. By then one rotor blade had struck, sending the helicopter into a descent. There were no mechanical or weather issues.

14. NTSB Identification: **ANC03LA015**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Friday, November 15, 2002 in Kingman, AZ

Probable Cause Approval Date: 11/25/2003

Aircraft: Bell 206B, registration: N16962

Injuries: 1 Fatal.

The private pilot was making a cross country flight in the helicopter in visual meteorological conditions. A sergeant for the sheriff’s office said his office received a cellular telephone call from a motorist, advising of the helicopter accident. He said when he arrived at the accident site, he saw a debris field about 50 yards long perpendicular to a line of power poles. He said the poles were about 60 feet high, and two power lines were stretched between each pole, with the top line about 4 feet above the lower line. He said the site was in a fairly remote area of the desert, and that the power lines terminated at a ranch several miles from the accident site. He said the lower power line appeared to have been cut by the helicopter between two of the poles, and the top power line was intact. The sergeant said the owner of the ranch at the end of the

power line reported a power failure about 1630. An FAA aviation safety inspector, who responded to the accident site, said the wreckage was scattered along a path about 50 yards long in the direction of the helicopter's destination. He said it appeared the helicopter, on a general heading of south, crossed perpendicular to a road and power lines, and impacted the ground about 50 yards south of the power lines. He said there was no large impact crater, and that all the major components of the helicopter were located at the accident site. He said the helicopter came to rest on its left side. The main rotor system was intact, and one main rotor blade had little or no damage. The second main rotor blade exhibited impact damage and striations starting about 4 feet from the hub on the leading edge, which he said were consistent with cutting the power line. The second blade also had span-wise flex folding along the trailing edge.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain altitude/clearance from obstacles during cruise flight, which resulted in the helicopter striking a transmission line, and subsequently the ground.

15. NTSB Identification: **DEN03LA018.**

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Friday, November 22, 2002 in Morrison, CO

Probable Cause Approval Date: 4/18/2003

Aircraft: Enstrom F-28C, registration: N552CS

Injuries: 1 Minor, 1 Uninjured.

The pilot said his helicopter was approaching a landing area, located just east of a restaurant, from the south, in night visual meteorological conditions. During the approach, the pilot could not see the lighted flag on top of the restaurant, thus he could not determine the wind direction or velocity for landing. He executed a go around and began maneuvering so that he could approach the landing area from the east. The pilot said that at the "northern most point of the go around, a tail rotor strike was felt." The tail rotor struck telephone lines along the north side of a road. The pilot immediately put the helicopter down hard into a ditch alongside the road, breaking the left skid, crushing the right skid and fuselage upward, bending and twisting the main rotor blades, and bending the tail rotor blades. An examination of the helicopter's systems revealed no anomalies.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot not maintaining clearance from the telephone lines during landing. Factors contributing to the accident were the pilot not being able to see the telephone lines, the low altitude, and the dark night.

16. NTSB Identification: **LAX03FA054**

14 CFR Part 91: General Aviation

Accident occurred Monday, December 23, 2002 in Dolan Springs, AZ

Aircraft: Robinson R22 Beta, registration: N888KB
Injuries: 2 Fatal.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On December 23, 2002, at 1137 mountain standard time, a Robinson R22 Beta, N888KB, collided with power lines and impacted desert terrain near Dolan Springs, Arizona. The helicopter was operated by the pilot/owner under 14 CFR Part 91. The private pilot and one passenger sustained fatal injuries. The helicopter was destroyed. Visual meteorological conditions prevailed, and no flight plan was filed. The flight originated from Las Vegas, Nevada, at an unknown time.

According to a witness who was driving southbound on I-93, at milepost 38.5, about 30 miles north of Kingman, Arizona, he saw the helicopter flying over his lane southbound along the highway when it struck power lines.

Power company linemen reported that wires/cables are required to be a minimum of 30 feet above ground level.

2003

1. NTSB Identification: NYC03LA087.

The docket is stored on NTSB microfiche number **DMS**.

14 CFR Part 91: General Aviation

Accident occurred Sunday, April 20, 2003 in Waterford, PA

Aircraft: Robinson R-22B, registration: N7192M

Injuries: 1 Uninjured.

On April 20, 2003, about 1545 eastern daylight time, a Robinson R-22B, N7192M, was substantially damaged when it impacted terrain while landing in an open field near Waterford, Pennsylvania. The certified private pilot was not injured. Visual meteorological conditions prevailed for the personal flight that originated from the Beaver County Airport (BVI), Beaver Falls, Pennsylvania. A flight plan was not filed, and the flight was conducted under 14 CFR Part 91.

2. NTSB Identification: LAX03LA177.

14 CFR Part 91: General Aviation

Accident occurred Sunday, June 01, 2003 in North Las Vegas, NV

Aircraft: Robinson R22 Beta, registration: N991RW

Injuries: 1 Uninjured.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On June 1, 2003, about 1120 Pacific daylight time, a Robinson R22 Beta, N991RW, collided with a wire while maneuvering near North Las Vegas, Nevada. Silver State Helicopters was operating the helicopter under the provisions of 14 CFR Part 91. The private pilot, the sole occupant, was not injured; the helicopter sustained substantial damage. The local instructional flight departed North Las Vegas Airport (VGT) about 1100. Day visual meteorological conditions prevailed, and no flight plan had been filed.

In a phone conversation with the Safety Board investigator-in-charge (IIC), the pilot stated he was practicing high reconnaissance operations for a pinnacle approach. He was on his third pattern around the pinnacle when the helicopter collided with a wire that was strung from a pole to the side of a mountain. The wire wrapped around the main rotor swash plate and the pilot entered an autorotation onto a hillside. The tail rotor and boom were damaged upon touchdown. The pilot estimated his altitude was 400 feet above ground level (agl) when the collision occurred.

3. NTSB Identification: **CHI03LA182.**

The docket is stored on NTSB microfiche number **DMS.**

14 CFR Part 137: Agricultural

Accident occurred Wednesday, June 25, 2003 in Dexter, MO

Aircraft: Robinson R-22 Beta, registration: N933CB

Injuries: 1 Fatal.

HISTORY OF FLIGHT

On June 25, 2003, at 1002 central daylight time, a Robinson R-22 Beta, N933CB, operated by Show-Me Helicopters, was destroyed during a post-impact fire following an in-flight collision with wires and terrain near Dexter, Missouri. Visual meteorological conditions prevailed at the time of the accident. The commercial pilot sustained fatal injuries. The 14 CFR Part 137 aerial application flight was not operating on a flight plan. The local flight departed from Dexter Municipal Airport (DXE), Dexter, Missouri, at 0917.

4. NTSB Identification: **CHI03LA210.**

The docket is stored on NTSB microfiche number **DMS.**

14 CFR Part 137: Agricultural

Accident occurred Tuesday, July 15, 2003 in Cleveland, MN

Aircraft: Bell 47G-5, registration: N7925J

Injuries: 1 Serious.

On July 15, 2003, about 0730 central daylight time, a Bell 47G-5 helicopter, N7925J, piloted by a commercial pilot, was destroyed on impact with a transmission wire and terrain near Cleveland, Minnesota. Visual meteorological conditions prevailed at the time of the accident. The 14 CFR Part 137 aerial application flight was not operating on a flight plan. The pilot sustained serious injuries. The flight departed from a private airstrip near Cleveland, Minnesota, at 0725.

5. NTSB Identification: **LAX03CA250**.

The docket is stored on NTSB microfiche number **DMS**.

14 CFR Part 137: Agricultural

Accident occurred Wednesday, July 30, 2003 in Tulare, CA

Probable Cause Approval Date: 11/25/03

Aircraft: Texas Helicopter OH-13E-M74, registration: N51852

Injuries: 1 Minor.

The helicopter collided with power lines during an aerial application. The pilot was on his nineteenth pass over the field, traveling eastbound. Power lines were located on the east and west side of the road. There was a pole about 75 feet tall, and the top 6 feet contained three wires. The top wire, a black colored insulator wire, was located 3 feet from the top of the pole. The pilot located the outbox on the pole and determined he would fly above the box to clear all of the wires. As he flew over the lines, the helicopter impacted the insulator wire about 1/2 foot above the cockpit floor. The helicopter slid along the wire and then the wire broke from the insulator at the next pole. The poles were placed about 300 feet apart. As the helicopter impacted the ground, the left skid hit first, followed by the main rotor.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance with the wires due to an inadequate visual lookout.

6. NTSB Identification: **FTW03LA197**.

The docket is stored on NTSB microfiche number **DMS**.

14 CFR Part 91: General Aviation

Accident occurred Tuesday, August 19, 2003 in Mason, TX

Aircraft: Bell 206B, registration: N9877Z

Injuries: 3 Minor.

On August 19, 2003, about 1945 central daylight time, a Bell 206B helicopter, N9877Z, registered to and operated by Crystal Finger Corp DBA of Liberty Hill, Texas, sustained substantial damage when it impacted power lines and the ground while maneuvering near Mason, Texas. The airline transport pilot and two passengers received minor injuries. Visual meteorological conditions prevailed, and a flight plan was not filed for the 14 Code of Federal Regulations Part 91 aerial photography flight. The flight originated from Burnet Municipal Airport-Kate Craddock Field (BMQ), near Burnet, Texas, approximately 1630, with an intermediate stop at a local field site.

The highway, we came upon the second set of wires before I thought we should have. With the sun in my eyes, I did not see them until maybe a second before we impacted it." After striking the wire, the pilot added, the helicopter descended in a slight nose low attitude and impacted the highway, then skidded off the road into a ditch.

An examination of the helicopter by an FAA inspector, who responded to the accident site, revealed that “the helicopter caught fire after it came to a stop, due to the exhaust pipe being on the grass, and was destroyed.”

7. NTSB Identification: **LAX03CA284.**

The docket is stored on NTSB microfiche number **DMS.**

14 CFR Part 137: Agricultural

Accident occurred Tuesday, September 09, 2003 in Kekaha, HI

Probable Cause Approval Date: 11/25/03

Aircraft: Hiller UH12E, registration: N9792C

Injuries: 1 Uninjured.

The helicopter collided with power lines during aerial application operations. The pilot was returning to the service truck for another load [of chemicals]. At the top of a ridge, approximately 500 feet mean sea level, there were two power lines of which he was unaware. During a descent at 60 knots, the helicopter impacted the top wire “about the middle of the bubble.” As a result, it pitched forward and the main rotor blade cut the wire and tail boom off in sequence. The helicopter began spinning to the right and the pilot performed an autorotation.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot’s failure to maintain clearance with the wires due to an inadequate visual lookout.

8. NTSB Identification: **LAX03CA285.**

The docket is stored on NTSB microfiche number **DMS.**

14 CFR Part 137: Agricultural

Accident occurred Saturday, September 13, 2003 in Greenfield, CA

Aircraft: Bell 47G-5, registration: N7060J

Injuries: 1 Uninjured.

On September 13, 2003, about 0830 Pacific daylight time, a Bell 47G-5 restricted category helicopter, N7060J, collided with power lines during an aerial application near Greenfield, California. SoilServ, Inc., was operating the helicopter under the provisions of 14 CFR Part 137. The commercial pilot, the sole occupant, was not injured; the helicopter sustained substantial damage. Visual meteorological conditions prevailed and no flight plan had been filed. The flight departed from the local area about 0823. The primary wreckage was at 36 degrees 19.726 minutes north latitude and 121 degrees 13.279 minutes west longitude.

9. NTSB Identification: **SEA04LA005.**

14 CFR Part 91: General Aviation

Accident occurred Tuesday, October 14, 2003 in Swisshome, OR

Aircraft: Bell 206B, registration: N86W

Injuries: 2 Fatal.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On October 14, 2003, about 1045 Pacific daylight time, a Bell 206B, N86W, registered to and operated by Weyerhaeuser Company as a 14 CFR Part 91 reconnaissance flight for the Oregon State Department of Forestry, collided with a power line strung across the Siuslaw River, near Swisshome, Oregon. Visual meteorological conditions prevailed at the accident site. The helicopter was substantially damaged. The airline transport pilot and passenger were fatally injured. The flight departed from Eugene, Oregon, about 30 minutes prior to the accident.

Department of Forestry personnel reported that the helicopter was rented from Weyerhaeuser for the purpose of accomplishing a reconnaissance of the area to find water holes for future aerial dip sites in support of fire fighting activities.

Witnesses near the accident site reported that the helicopter was flying in a westerly direction over the river when it struck one of four wires that were strung across the river. The lower neutral line was severed. The remaining three higher power lines were not damaged. The wires traveled between rising terrain on the south side of the river to a mill site on the north side in the valley. The estimated height of the wires at the point of collision was approximately 250 to 300 feet above the water level. The width of the river was estimated to be 200 yards across.

The helicopter came to rest in the river below the lines. The neutral line was entangled around the helicopter.

10. NTSB Identification: **CHI04CA020**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Friday, October 24, 2003 in Cushing, MN

Probable Cause Approval Date: 6/2/2004

Aircraft: Shapowal Rotorway Exec 90, registration: N442DS

Injuries: 1 Minor.

The amateur-built helicopter was substantially damaged during an in-flight collision with a static wire, and subsequently the terrain, during an approach for a precautionary landing. The pilot reported that he delayed his planned flight due to high winds. He stated that once the winds had died down, he departed for what should have been a 10 minute flight. However, after takeoff he reported that he made a wrong turn and became disoriented. While attempting to orient himself, the pilot "determined that [he] no longer had enough light to fly." He selected a location for a precautionary landing. He stated that he did not see the power lines on short final due to the poor lighting conditions. He reported that the helicopter "hit [the] power line at low speed and was thrown back and down on [its] left side." The pilot stated there were no malfunctions with the aircraft or engine prior to the accident.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

Selection of an unsuitable landing area by the pilot due to the static wire across the approach path. Contributing factors were the pilot's disorientation, the static wire and the low light (dusk) conditions.

CHI04CA020—On October 24, 2003, at 1830 central daylight time, an amateur-built Shapowal Rotorway Exec 90 helicopter, N442DS, piloted by a private pilot, was substantially damaged during an in-flight collision with a static wire, and subsequently the terrain, during an approach for a precautionary landing near Cushing, Minnesota. Visual meteorological conditions prevailed at the time of the accident. The personal flight was being conducted under 14 CFR Part 91 and was not on a flight plan. The pilot reported minor injuries. The flight departed a farm 9 miles northwest of Motley, Minnesota, at 1610, with an intended destination of the pilot's residence 3 miles southwest of Pillager, Minnesota.

On his written statement, the pilot reported that he delayed his planned flight due to high winds earlier in the day. He stated that once the winds had died down, he departed for what should have been a 10 minute flight. He noted that after departure, he "turned north instead of south" and "after a few minutes [he] determined [he] was going the wrong direction." He subsequently located Motley, however he "missed the left (east) turn on County 28 south of Motley."

At that point, the pilot "determined that [he] no longer had enough light to fly." He stated that he selected a location for a precautionary landing. He reported that he did not see the power lines on short final due to the poor lighting conditions. He stated that the helicopter "hit [the] power line at low speed and was thrown back and down on [its] left side."

The pilot stated there were no malfunctions with the aircraft or engine prior to the accident.

11. NTSB Identification: **LAX03CA285**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)
14 CFR Part 137: Agricultural

Accident occurred Saturday, September 13, 2003 in Greenfield, CA

Probable Cause Approval Date: 2/5/2004

Aircraft: Bell 47G-5, registration: N7060J

Injuries: 1 Uninjured.

The helicopter collided with power lines during an aerial application. As the pilot was lining up the helicopter in the corner of the lot, the helicopter descended into a wire. The wire wrapped around the mast and control linkages and the helicopter began pitching in an unusual manner. He attempted to level off; however, the controls were unresponsive and the helicopter collided with the ground.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance with the wires due to an inadequate visual lookout.

LAX03CA285—On September 13, 2003, about 0830 Pacific daylight time, a Bell 47G-5 restricted category helicopter, N7060J, collided with power lines during an aerial application near Greenfield, California. SoilServ, Inc., was operating the helicopter under the provisions of 14 CFR Part 137. The commercial pilot, the sole occupant, was not injured; the helicopter sustained substantial damage. Visual meteorological conditions prevailed and no flight plan had been filed. The flight departed from the local area about 0823. The primary wreckage was at 36 degrees 19.726 minutes north latitude and 121 degrees 13.279 minutes west longitude.

The pilot reported in a written statement that he was en route to the first field. As he was lining up the helicopter in the corner of the lot, the helicopter descended into a wire that was located outside the boundaries of the field. The helicopter began pitching in an unusual manner. After attempting to level off, he realized the controls were unresponsive and the helicopter collided with the ground. A later inspection by the pilot revealed that the wire had wrapped around the mast and control linkages.

12. NTSB Identification: **FTW04LA046**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Saturday, December 20, 2003 in Henryetta, OK

Probable Cause Approval Date: 6/2/2004

Aircraft: Bell 206B, registration: N62HF

Injuries: 3 Uninjured.

The private pilot was attempting to land in a field near a local automobile dealership when his tail boom became entangled in a guy wire. The pilot reported making two close, left-hand patterns around the area to select the best landing site. After a site was determined to be safe, he made an additional short downwind, base and final steep approach into the wind. The pilot further reported that he was aware of the power lines, but did not see the light-gray colored wire that ran between them. After making several attempts to maintain a level attitude, the pilot gently lowered the nose of the helicopter onto the ground and rested it on the front of the skids, with the tail still snagged in the wire.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual look out and failure to maintain clearance from guy wire while maneuvering for landing.

FTW04LA046—On December 20, 2003, at 1100 central standard time, a Bell 206B helicopter, N62HF, was substantially damaged when the tail boom struck a guy-wire while on short approach to a field in Henryetta, Oklahoma. The private pilot and the two passengers were not

injured. The helicopter was registered to and operated by Cayman Helicopters, LLC. Visual meteorological conditions prevailed and no flight plan was filed for the personal flight that originated at the Arlington Municipal Airport (GKY), Arlington, Texas, about 0930, and conducted under 14 Code of Federal Regulations Part 91.

In a written statement, the pilot stated that he was attempting to land in a field adjacent to an automobile dealership. He made two close, left-hand patterns around the area to select the best landing site. After a site was determined to be safe, the pilot made an additional short, downwind base and final steep approach into the wind. The approach was made over the power lines and between two poles, which supported the wires. The pilot reported that he was aware of the power lines, but did not see the light-gray colored wire that ran between them.

The pilot made a slow approach to the site, but the lower vertical stabilizer caught the wire, cut into it about 10-inches, and destroyed both tail rotor blades. He said the tail boom became firmly attached to the wire, which enabled the helicopter to go into a dynamic “spin” or a level descent for landing. After making several attempts to maintain a level attitude, the pilot gently lowered the nose of the helicopter onto the ground and rested it on the front of the skids, with the tail still snagged in the wire. The right skid fractured.

The pilot made a normal engine shut down of the engine and each occupant exited the helicopter.

A Federal Aviation Administration (FAA) Inspector, who traveled to the accident site, performed an examination of the helicopter. According to the inspector, the helicopter struck the wire on the aft portion of the tail, just forward of the lower vertical stabilizer, and cut into it about 10-inches. Both tail rotor blades were damaged, and there was a hole in one of the main rotor blades, about 14-inches from the butt of the blade.

The pilot reported a total of 563 flight hours, of which 347 hours were in make and model.

Weather reported at Okmulgee Regional Airport (OKM), Okmulgee, Oklahoma, at 1053, was reported as wind from 190 degrees at 9 knots, visibility 10 statute miles, and clear skies.

12. NTSB Identification: **LAX03CA285**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 137: Agricultural

Accident occurred Saturday, September 13, 2003 in Greenfield, CA

Probable Cause Approval Date: 2/5/2004

Aircraft: Bell 47G-5, registration: N7060J

Injuries: 1 Uninjured.

The helicopter collided with power lines during an aerial application. As the pilot was lining up the helicopter in the corner of the lot, the helicopter descended into a wire. The wire wrapped around the mast and control linkages and the helicopter began pitching in an unusual manner. He attempted to level off; however, the controls were unresponsive and the helicopter collided with the ground.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's failure to maintain clearance with the wires due to an inadequate visual lookout.

LAX03CA285—On September 13, 2003, about 0830 Pacific daylight time, a Bell 47G-5 restricted category helicopter, N7060J, collided with power lines during an aerial application near Greenfield, California. SoilServ, Inc., was operating the helicopter under the provisions of 14 CFR Part 137. The commercial pilot, the sole occupant, was not injured; the helicopter sustained substantial damage. Visual meteorological conditions prevailed and no flight plan had been filed. The flight departed from the local area about 0823. The primary wreckage was at 36 degrees 19.726 minutes north latitude and 121 degrees 13.279 minutes west longitude.

The pilot reported in a written statement that he was en route to the first field. As he was lining up the helicopter in the corner of the lot, the helicopter descended into a wire that was located outside the boundaries of the field. The helicopter began pitching in an unusual manner. After attempting to level off, he realized the controls were unresponsive and the helicopter collided with the ground. A later inspection by the pilot revealed that the wire had wrapped around the mast and control linkages.

2004

1. NTSB Identification: CHI04LA079.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Saturday, February 28, 2004 in Burlington, WI

Probable Cause Approval Date: 9/1/2004

Aircraft: Robinson R44, registration: N7184G

Injuries: 2 Uninjured.

The helicopter sustained substantial damage when it impacted the ground after contacting a power line and pole during takeoff. The pilot's accident report stated, "I cleared the area did a slow vertical liftoff and a left pedal turn. I was instantly in the wires which were [approximately] 10-12 [feet] north of depot and [approximately] 14-15 [feet] high. Obviously I didn't see the wires and have never seen wires that close to a fuel depot. ... The tail rotor got in the wires first and actually 'reeled' me backwards into the pole. Then the main rotor made contact. Then we hit the ground. It took me a few seconds to kill the engine as we were being bounced around so violently." His safety recommendation was, "The wires should at the very least been marked or identified in some way. (sign, placard) Most importantly they shouldn't have been so close to fuel depot 15-20 [feet] or so low. They should have been underground."

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

The pilot's inadequate visual lookout and his failure to obtain/maintain clearance from the transmission wire during the takeoff. Factors contributing to the accident were the transmission wire and the pole.

CHI04LA079—On February 28, 2004, about 1200 central standard time, a Robinson R44 helicopter, N7184G, sustained substantial damage when it impacted the ground, after contacting a power line, while departing Burlington Municipal Airport (BUU), near Burlington, Wisconsin. Visual Meteorological Conditions prevailed at the time of the accident. The personal flight was operating under the provisions of 14 CFR Part 91 without a flight plan. The pilot and passenger reported no injuries. The flight's destination was the Grand Geneva Resort Airport (C02), near Lake Geneva, Wisconsin.

The flight departed from Ann Arbor Municipal Airport (ARB), near Ann Arbor, Michigan, and landed at C02. C02 did not have fuel service. The pilot flew to BUU for fuel for the return flight to ARB that day. The pilot's accident report stated: I flew into Burlington from the south directly to the fuel depot. There was a fixed wing aircraft at the south of the depot (not fueling) so I wanted to stay as far left as I could because of rotor wash. I landed the craft near the north end of depot for same reason. After receiving fuel, did my preflight and started the aircraft. I cleared the area did a slow vertical liftoff and a left pedal turn. I was instantly in the wires which were [approximately] 10-12 [feet] north of depot and [approximately] 14-15 [feet] high. Obviously I didn't see the wires and have never seen wires that close to a fuel depot. ... The tail rotor got in the wires first and actually 'reeled' me backwards into the pole. Then the main rotor made contact. Then we hit the ground. It took me a few seconds to kill the engine as we were being bounced around so violently.

The pilot did not indicate any mechanical malfunctions in reference to the flight on his report. His safety recommendation was: The wires should at the very least been marked or identified in some way. (sign, placard) Most importantly they shouldn't have been so close to fuel depot 15-20 [feet] or so low. They should have been underground. This was a very dangerous set-up.

2. NTSB Identification: **LAX04TA202**

14 CFR Public Use

Accident occurred Monday, May 03, 2004 in Bakersfield, CA

Aircraft: Bell OH-58A+, registration: N397E

Injuries: 2 Uninjured.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On May 3, 2004, at 2330 Pacific daylight time, a Bell OH-58A+, N397E, lost engine power during a turn and made a forced landing on a residential street near the Bakersfield Junior College, Bakersfield, California. The Kern County Sheriff's Department operated the helicopter under the provisions of 14 CFR Part 91 as a public-use flight. The pilot flying (PF), a

commercial helicopter rated pilot, and the commercial helicopter rated tactical flight officer were not injured. Visual meteorological conditions prevailed for the local area surveillance flight, and a company visual flight rules (VFR) flight plan had been filed. The flight departed the Meadow's Field Airport (BFL), Bakersfield, about 2115. The flight was scheduled to terminate at BFL.

The Safety Board investigator-in-charge (IIC) interviewed both pilots. According to both pilots, the first flight of the night lasted 2 hours, with no discrepancies noted. They indicated that after the first flight, they went to have the helicopter refueled; however, the fuel truck ran dry after 20 gallons had been pumped onboard. While the deputies were on break, the operator refilled the fuel truck. Prior to the accident flight, the fuel truck operator pumped an additional 24 gallons onboard the helicopter.

The accident occurred about 1 hour 15 minutes into the flight. The pilots received a call regarding a stolen car about 2 miles from their current position. The PF made a 180-degree turn to respond to the call. Halfway through the turn, both pilots heard a "big boom" and the helicopter shuddered. The PF leveled the helicopter and assessed the situation. He made a decision to land in a nearby parking lot. En route to the parking lot, about 30 seconds later, they heard another loud boom followed by the engine out audio and warning lights.

Both pilots indicated that the airspeed was 60 knots, and they were about 500 feet above ground level (agl). During the descent to the parking lot, the PF noted that the helicopter was not descending as fast as he had initially thought, and they were going to overfly the landing site. The PF initiated a climb over trees, and then attempted to land on a residential street. During the autorotation, the skids and tail rotor struck wires. The PF stated that the rpm's bled off fast, and the helicopter landed hard from 10 feet agl.

3. NTSB Identification: **SEA04LA102**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)
14 CFR Part 91: General Aviation
Accident occurred Tuesday, June 08, 2004 in Prosser, WA
Aircraft: Bell 206B, registration: N213SD
Injuries: 2 Uninjured.

On June 8, 2004, at 1850 Pacific daylight time, a Bell 206B helicopter, N213SD, was substantially damaged after impacting power lines while maneuvering near Prosser, Washington. The commercial pilot and his sole passenger were not injured. The helicopter, registered to Heliworks Inc., of Pensacola, Florida, was being operated in accordance with 14 CFR Part 91. Visual meteorological conditions prevailed at the time of the accident, and a flight plan was not filed. The helicopter had departed the Tri-Cities Airport, Pasco, Washington, at approximately 1800.

SEA04LA102—On June 8, 2004, at 1850 Pacific daylight time, a Bell 206B helicopter, N213SD, was substantially damaged after impacting power lines while maneuvering near Prosser, Washington. The commercial pilot and his sole passenger were not injured. The helicopter, registered to Heliworks Inc., of Pensacola, Florida, was being operated in accordance

with 14 CFR Part 91. Visual meteorological conditions prevailed at the time of the accident, and a flight plan was not filed. The helicopter had departed the Tri-Cities Airport, Pasco, Washington, at approximately 1800.

In a telephone interview with the NTSB investigator-in-charge (IIC), and according to the Pilot/Operator Aircraft Accident Report (NTSB form 6120.1/2), the pilot reported that while conducting cherry drying operations he made a right turn and caught the tail rotor in a power line. The pilot further reported, "...about 30 seconds later a vibration occurred. I pulled collective to attempt a landing on a road, [and] as I pulled collective the ship immediately swung to the right and the main rotor struck a power line." The pilot stated that he then banked away from the power line and "seemed" to gain some control. "I saw an opening in the orchard and headed for [it]. The ship came to rest upright between the trees."

The pilot reported damage to the helicopter included the transmission being separated from the airframe and the tail rotor and tail rotor assembly being damaged. The pilot also reported to the IIC that no anomalies existed with the helicopter prior to the accident, which would have precluded normal operations.

4. NTSB Identification: **FTW04FA167.**

14 CFR Part 91: General Aviation

Accident occurred Saturday, June 26, 2004 in Cushing, OK

Aircraft: Bell 206B, registration: N27TV

Injuries: 2 Fatal, 3 Serious.

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected when the final report has been completed.

On June 26, 2004, approximately 2045 central daylight time, a Bell 206B single-engine helicopter, N27TV, was destroyed when it impacted the water following an in-flight collision with power lines while maneuvering near Cushing, Oklahoma. The commercial pilot and a passenger sustained fatal injuries, and three passengers were seriously injured. The helicopter was owned and operated by Interstate Helicopters, Inc., of Oklahoma City, Oklahoma. Visual meteorological conditions prevailed, and no flight plan was filed for the Title 14 Code of Federal Regulations Part 91 sightseeing flight. The local flight departed the Elks Lodge, Cushing, Oklahoma, approximately 2015.

According to the operator, the helicopter was chartered by a private individual to provide sightseeing rides to guests at a birthday party near Cushing. Prior to the accident flight, the pilot had completed 4 or 5 previous flights around the town of Cushing. Approximately 2030, the operator's safety officer, who was located at the helicopter's departure point, contacted the owner of Interstate Helicopters Inc., and stated the helicopter was overdue from a flight. Approximately 2100, the safety officer was notified by personnel from the Cushing airport of a downed aircraft in the Cimarron River, approximately 5 miles north of Cushing.

A witness, who was fishing with his son in a boat in the Cimarron River, reported they started fishing approximately 1830. A few minutes prior to the accident, the witness moved his boat

under a bridge due to an isolated rain shower in the area. At 2045, the witness heard a crashing sound, then a observed a large splash in the water and flying debris. At 2050, unable to obtain a clear signal with his cellular telephone, the witness contacted a relative who then notified the police about a crashed helicopter in the middle of the Cimarron River. Approximately 15 minutes after the accident, rescue personnel arrived near the accident site. Rescue personnel located three individuals hanging on to the accident helicopter. The witness did not see or hear the helicopter on any other flights prior to the accident.

The main wreckage was located at 36 degrees 03:067 minutes North latitude, and 98 degrees 45:142 minutes West longitude. The helicopter wreckage was located in the middle of the Cimarron River in approximately 4 to 5 feet of water. The fuselage came to rest inverted and was 90 percent submerged. The tail boom and main rotor system were separated from the fuselage.

Examination of the accident site revealed the helicopter impacted and severed three power lines approximately 200-300 yards from the main wreckage. The power lines, which were not marked, crossed the Cimarron River and were approximately 30 to 40 feet above the river. The helicopter's direction of flight over the river was established to be from east to west.

5. NTSB Identification: **NYC04CA166**.

The docket is stored in the Docket Management System (DMS). Please contact [Public Inquiries](#)

14 CFR Part 91: General Aviation

Accident occurred Sunday, July 11, 2004 in Beverly, MA

Aircraft: Robinson R-44 II, registration: N277MC

Injuries: 2 Uninjured.

On July 11, 2004, about 1430 eastern daylight time, a Robinson R-44 II, N277MC, was substantially damaged when it struck wires while lifting off from the Beverly Municipal Airport (BVY), Beverly, Massachusetts. The certificated private pilot and passenger were not injured. Visual meteorological conditions prevailed for the local personal flight. A flight plan was not filed, and the flight was conducted under 14 CFR Part 91.

NYC04CA166—On July 11, 2004, about 1430 eastern daylight time, a Robinson R-44 II, N277MC, was substantially damaged when it struck wires while lifting off from the Beverly Municipal Airport (BVY), Beverly, Massachusetts. The certificated private pilot and passenger were not injured. Visual meteorological conditions prevailed for the local personal flight. A flight plan was not filed, and the flight was conducted under 14 CFR Part 91.

According to the pilot, after a local flight over the ocean, he elected to land the helicopter near a fresh water hose at the airport, where the helicopter could be rinsed off. Once on the ground, with the engine running, the passenger exited the helicopter and proceeded to spray water on the fuselage and rotor blades. The passenger then re-boarded the helicopter, and the pilot added collective to hover taxi from the area. As the helicopter rose from the ground, the main rotor blades struck transmission wires which were directly above the helicopter. The pilot immediately set the helicopter back on the ground and secured the engine.

According to a representative at a fixed based operator (FBO) at BVY, where the helicopter was based, all helicopter operations were restricted to a designated takeoff/landing area on the ramp. All helicopters based at the FBO were required to use a dolly to move from the hangar area to the designated helicopter takeoff/landing area, and air taxis were prohibited in the ramp area.

APPENDIX C—EXTRACTS FROM MARKING OF WIRES AND TOWERS RECOMMENDATIONS

The Marking of Wires and Towers (MOWAT) Work Group was established in April 2001, under the auspices of the Controlled Flight Into Terrain Joint Safety Implementation Team (JSIT), for the purpose of “establishing a national criteria for the standardization and expansion of requirements for enhancing the visibility and detection of wires, towers and associated support structures.”

The membership of the MOWAT Work Group consisted of a cross-section of aviation and utilities industries experts. These individuals reflect considerable expertise in general aviation operations in and around the “wire environment”, specifically within the utilities industry, and of the requirements for the effective marking of wires, towers and structures:

Richard M. Wright, Jr., Helicopter Association International (HAI), Co-Chair
Steve Isaacs, FAA (AFS-820), Co-Chair
Jim Clark, President, Clark Helicopters
Bob Culver, Salt River Project
John Eckman, Institute of Electrical and Electronics Engineers (IEEE)
Bob Feerst, President, Utilities Aviation Specialists, Inc.
David Mitchell, Manager of Transmission Lines, Alabama Power Company.

The MOWAT Work Group reviewed 14 CFR Part 77 and Advisory Circular (AC) 70/7460-1K, “*Obstruction Marking and Lighting*,” as well as the training given to GA pilots to heighten their awareness of the hazards within an obstacle-rich environment. The two recommendations of the Group are as follows:

C.1 Recommended Change to FAR Part 77

Marking of Wires and Towers (MOWAT) Work Group

Recommended Change to FAR Part 77

FAR § 77.15 Construction or Alteration Not Requiring Notice, states:

“No person is required to notify the Administrator for any of the following construction or alteration:

- (a) Any object that would be shielded by existing structures of a permanent and substantial character or by natural terrain or topographic features of equal or greater height, **and** would be located in the congested area of a city, town, or settlement where it is evident beyond all reasonable doubt that the structure so shielded will not adversely affect safety in air navigation.
- (b) Any antenna structure of 20 feet or less in height except one that would increase the height of another antenna structure.

(c) Any air navigation facility, airport visual approach or landing aid, aircraft arresting device, or meteorological device, of a type approved by the Administrator, or an appropriate military service on military airports, the location and height of which is fixed by its functional purpose.

(d) Any construction or alteration for which notice is required by any other FAA regulation.”

Recommendation: Where FAR §77.15(a), reads, “...equal or greater height, **and** would be located...”, change the word “and” to “or”.

Discussion: By this wording of Part 77.15(a), only those obstructions that are shielded “and” located in a congested area would be exempt from the notification requirement as delineated in Part 77. The original intent was for shielded objects regardless of their location to be exempted from the notification requirement. Therefore, the word “or” would be better suited in this application.

The problem as currently worded is that utility companies read Part 77 and its associated Advisory Circular and recognize that some of the power lines in question may be masked or shielded by terrain but are not located in a congested area. Therefore, these must be reported to the FAA. In practice, the FAA receives these reports, and without consultation or inspection, routinely “recommends” that the utility company mark the wires/structures involved. The “recommendation” becomes a de-facto order as interpreted by the utility company’s legal department; to do otherwise exposes the utility company to unnecessary liability should an incident occur.

The unfortunate consequence is that utilities are forced either to spend large amounts of money to install unneeded markers or mark nothing at all. In reality, with limited resources to allot to the marking of wires and structures, utility companies have been trending toward the latter. It would better serve the interest of aviation safety by extending the same provisions allowed in congested areas to areas that are not congested but where wires and structures are similarly “masked”. This change would offer greater inducement to obstruction owners to mark the true hazards, thus enhancing safety.

C.2 Recommended Changes To Practical Test Standards (PTS)

Marking of Wires and Towers (MOWAT) Work Group

Recommended Changes to Practical Test Standards

It is recommended that the Practical Test Standards (PTS) be modified to include hazard awareness training with regard to flying in the low level hazard (LLH) environment, to include wires, towers and other associated support structures. This training should apply to the following:

Private and Commercial Pilot, Single –Engine, Multi-Engine - Land and Sea airplanes (FAA-S-8081-14AS and FAA-S-8081-12B, dated August 1, 2002), and Private and Commercial Pilot – Rotorcraft (FAA-S-8081-HD, dated April 1,1996).

Add separate lettered items to Section I – Preflight Preparation for the above listed PTS’s.

- For the Private & Commercial Pilot, Single-Engine and Multi-Engine Land and Sea, Airplane: Add new letter “K”.
- For the Private & Commercial Pilot, Rotorcraft/Helicopter: Add new letter “T”.

For these new sections, insert the following:

- Reference: “A guide to Avoiding Wire Strikes” (AOPA Air Safety Foundation publication P008), AOPA Air Safety Foundation Video “Wire Strikes” 6/7/95, and FAR 91.3

Objective – To determine that the applicant has knowledge of the elements related to the avoidance of wire strike accidents by explaining:

1. Wire Marking Considerations
2. Wire Recognition
3. Wire Strike Avoidance
4. Vigilance