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Data Show Same U.S. Fatal-accident Rate for Single-turbine and Twin-turbine Helicopters

Statistics for 1993 through 1997 show a relatively low accident rate for U.S.-registered twin-turbine helicopters. Nevertheless, almost half of the accidents were fatal, and 70 percent of the accidents involved pilot error.

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U.S. National Transportation Safety Board (NTSB) data show that U.S.-registered twin-turbine helicopters were involved in 48 accidents in 1993 through 1997 (Table 1, page 2). NTSB accident data, U.S. Federal Aviation Administration (FAA) flight-activity estimates[1] for 1993 through 1996 and the author's estimate of flight activity in 1997 (an average of FAA flight-activity estimates for the previous four years) show that the helicopters flew 1,637,500 flight hours and were involved in 2.93 accidents per 100,000 flight hours.

Figure 1 (page 5) shows that the twin-turbine-helicopter accident rate was lower than the accident rates of general aviation aircraft (fixed-wing and rotary-wing aircraft involved in pleasure flying, business travel, corporate travel, training and other operations that are not governed by U.S. Federal Aviation Regulations Part 121 or Part 135), single-turbine helicopters and air-taxi aircraft (those involved in on-demand Part 135 operations).

Almost half (48 percent) of the twin-turbine-helicopter accidents were fatal. Twin-turbine helicopters were involved in 23 fatal accidents, or 1.4 fatal accidents per 100,000 flight hours. Figure 2 (page 5) shows that the twin-turbine-helicopter fatal-accident rate was lower than the fatal-accident rate of general aviation aircraft, equal to the fatal-accident rate of single-turbine helicopters and higher than the fatal-accident rate of air-taxi aircraft.

Two nonfatal twin-turbine helicopter accidents involved serious injuries, five involved minor injuries, and 18 involved no injuries.

Seventeen different helicopter makes and models were involved in the accidents. Twenty-seven helicopters were destroyed, 20 were substantially damaged and one was not damaged.

All of the accidents occurred in the United States.

NTSB final reports were available on Jan. 1, 1999, for 43 of the 48 twin-turbine helicopter accidents; only preliminary reports were available for five accidents. The final reports show that pilot error was a probable cause of 30 (70 percent) of the 43 accidents (Figure 3, page 5).

The average total flight time among the 30 pilots-in-command (PICs) involved in the pilot-error accidents was 8,190 hours. The average flight time among all 48 PICs was 9,190 hours, with flight times ranging from 1,300 hours to 20,459 hours; 20 pilots had 10,000 flight hours or more.

Among the 30 PICs involved in pilot-error accidents, 17 had airline transport pilot (ATP) certificates, and 13 had

(continued on page 5)

Table 1
U.S. Twin-turbine Helicopter Accidents, 1993–1997

Date	Location[1]	Aircraft Type	PIC Certificate	PIC Total Time/Time in Type (hours)	Aircraft Damage	Injuries
Feb. 19, 1993	Lincoln Park, New Jersey	Agusta A-109-A2	ATP	10,141/264	substantial	none
The pilot misjudged clearance while taxiing, and the rotor blades struck a hangar.						
May 25, 1993	Lafayette, Louisiana	MBB BK-117-A3	ATP	16,268/21	substantial	none
Lateral cyclic-control-rod movement was restricted because of improper installation of the rod by maintenance personnel.						
July 14, 1993	Hortense, Georgia	Sikorsky S-70A	ATP	7,751/1,395	destroyed	4 fatal
U.S. Customs Service helicopter was flying at high speed over a river when it struck unmarked wires at 82 feet.						
Sept. 10, 1993	Ogden, Utah	Aerospatiale AS-365N	ATP	9,066/233	destroyed	1 fatal; 2 serious; 3 minor
The helicopter was flying at 60 knots to 70 knots during an aerial-photography flight over water when it struck the surface of the water.						
Dec. 3, 1993	Cameron, Louisiana	Bell 412	ATP	11,766/2,165	destroyed	4 minor
While approaching a heliport in fog and haze, the pilot flying (copilot) was unable to maintain visual contact with lights at the landing site. The helicopter struck the ground 900 feet (275 meters) from the landing site.						
Jan. 6, 1994	Clearwater, Oregon	MBB BO-105S	ATP	10,001/146	destroyed	3 minor
The helicopter struck power lines while flying at 50 feet along a canal during an aerial survey. Sun glare restricted visibility.						
Jan. 28, 1994	San Jose, California	Sikorsky S-58T	ATP	7,000/1,500	destroyed	1 fatal
The helicopter was hovering 100 feet above a 13-story building during an external-load operation when it lost engine power because of fuel starvation.						
Feb. 21, 1994	Walnut Creek, California	Sikorsky S-58T	ATP	6,270/1,250	destroyed	3 fatal
The helicopter's engines lost power because of fuel contamination by water. The pilot attempted to extend the autorotative glide to avoid houses. This resulted in low rotor speed and loss of control.						
April 22, 1994	Bluefield, West Virginia	Bell 412	ATP	4,095/969	destroyed	4 fatal
The helicopter struck mountainous terrain while being vectored by ATC for an ILS approach. Contributing factors were adverse weather conditions and failure of ATC to provide adequate vectors.						
June 30, 1994	Newport, Rhode Island	Sikorsky S-76B	ATP	10,000/2,000	substantial	none
The helicopter was being flown at 500 feet when the left helical gear in the main transmission failed. The crew deployed emergency floats and ditched the helicopter.						
Aug. 19, 1994	Albert Lea, Minnesota	Bell 230	ATP	10,727/206	substantial	none
The pilot conducted a steep, downwind approach at low airspeed. The helicopter settled with power and landed hard.						
Sept. 1, 1994	Libby, Montana	Sikorsky S-64	commercial	13,500/1,800	destroyed	2 minor
Rotor speed decreased and the helicopter settled into a lake during a maintenance test flight. Weight and balance limits were exceeded because of a false indication of water quantity in an external fire-retardant tank. The external-load-jettison system failed to operate.						
Sept. 27, 1994	Mesa, Arizona	MD 520N	commercial	8,239/3,066	destroyed	1 fatal; 1 serious
The helicopter was flying chase for an MD AH-64D at night when they collided. The MD-520N struck the ground. The AH-64D was substantially damaged but was landed without further incident. Inadequate radio coordination may have been a factor.						
Oct. 15, 1994	Jonesville, Virginia	Aerospatiale AS-355	commercial	1,300/NA	destroyed	1 fatal
During a day VFR flight in a valley, the helicopter struck unmarked power lines at 200 feet.[2]						
Nov. 4, 1994	Perry, Florida	MBB BO-105	ATP	9,234/1,123	destroyed	2 fatal; 1 serious
According to a passenger, the pilot said that he was going to "break in the new passenger with a real ride." The pilot flew the helicopter to a low altitude, where it struck a power line at high speed and then struck the ground.						
Nov. 8, 1994	Cameron, Louisiana	Sikorsky S-76A	ATP	15,000/1,036	destroyed	1 fatal; 2 minor
The crew was flying VFR after conducting a Copter VOR/DME approach in IMC at night over the Gulf of Mexico. Neither pilot was aware that the helicopter was descending until it struck the water.						
Dec. 1, 1994	Ann Arbor, Michigan	Agusta A-109	commercial	5,000/200	destroyed	3 fatal
After one engine lost power, the pilot inadvertently secured the other (operating) engine. The pilot was unable to maintain a successful autorotation. Rotor speed was very low when the helicopter struck the ground. The cause of the engine failure was not determined.						
Dec. 3, 1994	St. Petersburg, Florida	Sikorsky S-70	ATP	10,000/585	substantial	none
The helicopter was being taxied between two hangars when the main-rotor blades struck a hangar.						

Table 1
U.S. Twin-turbine Helicopter Accidents, 1993–1997 *(continued)*

Date	Location[1]	Aircraft Type	PIC Certificate	PIC Total Time/Time in Type (hours)	Aircraft Damage	Injuries
Jan. 9, 1995	Glendale, Arizona	Kaman H-43	commercial	11,000/952	substantial	none
The pilot made an emergency landing in a field after the rotor blades struck tree branches during an aerial-application flight.						
Jan. 18, 1995	Jackson, Pennsylvania	Agusta A-109	commercial	11,000/250	destroyed	3 fatal
The pilot completed a nonprecision instrument approach at night in IMC and proceeded VFR to a helipad. The pilot experienced spatial disorientation, and the helicopter struck the ground in a near-vertical attitude.						
Jan. 23, 1995	Gulf of Mexico	MBB BO-105	ATP	8,609/3,814	substantial	none
The pilot did not remove a tie-down from the right rear skid before attempting to lift off from a platform. The helicopter pitched up, rolled right and came to rest on the platform.						
Feb. 13, 1995	Marblemount, Washington	Sikorsky S-58T	commercial	11,389/3,139	substantial	1 serious
The helicopter was being flown in logging operations when the main-rotor drive shaft failed because of fatigue damage. Altitude and airspeed were not adequate for a successful autorotation.						
March 17, 1995	Portland, Oregon	Bell 230	ATP	7,600/80	substantial	none
The helicopter was landing at a heliport when the tail rotor struck a perimeter fence.						
May 31, 1995	Lost Hills, California	Aerospatiale AS-355	commercial	7,691/80	substantial	none
The pilot experienced spatial disorientation during a VFR approach on a dark night. The helicopter landed hard and rolled over.						
Aug. 8, 1995	Daggett, California	Aerospatiale AS-355	ATP	12,242/183	substantial	none
The helicopter experienced ground resonance (destructive vibration induced by rotor-blade oscillation) during liftoff when the Starflex arm failed because of fatigue damage.						
Aug. 26, 1995	Emigrant Gap, California	Sikorsky S-64	ATP	11,400/240	destroyed	none
After experiencing a right-engine compressor stall, the crew failed to coordinate the timely jettisoning of an external load of logs. The helicopter struck trees during the emergency landing.						
Sept. 11, 1995	Winslow, Washington	Agusta A-109	commercial	3,056/51	destroyed	3 fatal
The helicopter struck the glassy surface of water while flying at night in weather conditions that included fog and low ceilings.						
Sept. 14, 1995	Houston, Texas	MBB BO-105	ATP	4,992/217	destroyed	none
A main-transmission component failed and an engine-fire-warning light illuminated during cruise at 800 feet. The pilot landed the helicopter in a parking lot. Both engines had foreign-object damage, and the tail boom was detached partially by fire damage.						
Sept. 19, 1995	Irvine, California	Bell 206 L-1[3]	ATP	3,200/700	destroyed	1 fatal
The helicopter struck a ridge when the pilot descended into IMC without an IFR clearance. The helicopter was not authorized for IFR flight.						
Oct. 26, 1995	League City, Texas	MBB BO-105	commercial	4,378/11	destroyed	2 fatal
The helicopter struck the ground out of control 15 minutes after departing for a repositioning flight in IMC on a dark night. The pilot had not obtained a weather briefing or obtained an IFR clearance.						
Feb. 10, 1996	Gulf of Mexico	MBB BO-105	commercial	11,288/5,731	destroyed	2 fatal
The helicopter was flying at a high airspeed and in a near-level pitch attitude when it struck water six miles (11 kilometers) from the destination, an offshore platform where fog intermittently obscured visibility.						
June 18, 1996	Pagosa Springs, Colorado	Bell 212	commercial	8,800/150	destroyed	2 minor
While proceeding up-slope and downwind with an external load, the helicopter settled when its performance limits were exceeded for hover out of ground effect.						
June 21, 1996	Sabine Pass, Texas	MBB BO-105	ATP	20,459/664	destroyed	4 fatal
While flying to an offshore platform, the pilot made a normal position report 38 miles (70 kilometers) from the destination. The helicopter subsequently struck the water. The main-rotor-transmission sun gear had failed.						
July 1, 1996	Newport, Oregon	Agusta A-109	commercial	4,001/1,143	substantial	none
The left main gear collapsed during an attempted landing in gusting wind.						
July 5, 1996	Lakewood, New Jersey	Aerospatiale AS-332-L	ATP	15,500/500	substantial	none
While waiting to take off, the pilots felt control stiffness, saw electrical-system warning lights and smelled smoke. They secured the engines and activated the engine fire extinguishers. The fire had erupted in the area of the lateral hydraulic servo.						

Table 1
U.S. Twin-turbine Helicopter Accidents, 1993–1997 *(continued)*

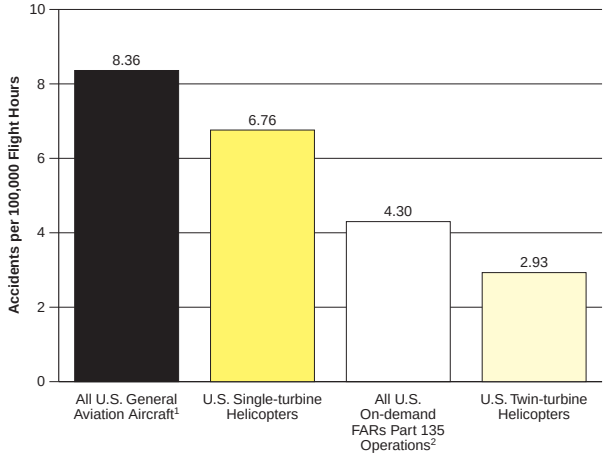
Date	Location[1]	Aircraft Type	PIC Certificate	PIC Total Time/Time in Type (hours)	Aircraft Damage	Injuries
July 13, 1996	Ketchikan, Alaska	Sikorsky S-64	commercial	7,985/500	destroyed	1 fatal; 1 serious
The helicopter was lifting an external load of logs weighing 18,000 pounds (8,165 kilograms) when a tail-rotor bearing failed. The helicopter struck steep terrain.						
Sept. 6, 1996	Flamingo, Florida	Agusta A-109	ATP	6,800/100	substantial	none
The pilot secured an engine when its oil pressure decreased during a VFR night flight. The transmission-chip detector light illuminated approximately two minutes thereafter. The pilot made a precautionary landing on an unlit parking lot.						
Oct. 4, 1996	Canby, Oregon	Boeing Vertol 107	ATP	14,778/8,880	destroyed	3 fatal
The helicopter struck the ground out of control during a maintenance check flight. Noninstallation of a cotter pin in a clevis bolt had caused a flight-control disconnection.						
Oct. 10, 1996	Cameron, Louisiana	MBB BO-105	ATP	NA	destroyed	1 fatal
The helicopter struck terrain four miles (seven kilometers) from the departure point on a dark night in VMC.[2]						
Nov. 23, 1996	Taos, New Mexico	Aerospatiale AS-355	commercial	2,163/741	substantial	none
During a search-and-rescue mission, the helicopter was hovering and had part of a skid resting on a boulder. A wind gust caused the helicopter to yaw right, and the tail rotor struck a rock. The pilot secured the engines and landed the helicopter.						
Dec. 12, 1996	Penn Yan, New York	MBB BO-105	commercial	4,470/70	destroyed	3 fatal
The helicopter was departing on a medical-evacuation flight on a dark night with low ceilings. The pilot's attention was diverted to the GPS navigation receiver when the helicopter struck rising terrain about 1.1 miles (two kilometers) from the departure point.						
March 5, 1997	Washington, Pennsylvania	Aerospatiale AS-355F	commercial	3,320/36	substantial	1 minor
The helicopter began to roll left after liftoff. The pilot attempted to correct the roll, but the helicopter did not respond and the main rotor blades struck the ground. The master-flight-control servo did not meet the manufacturer's specifications.						
March 14, 1997	Lena, Louisiana	MBB BO-105S	commercial	7,179/3,958	destroyed	1 fatal; 1 serious
The pilot was flying the helicopter 500 feet above a highway on a dark night. The ceiling was about 600 feet. The pilot slowed the helicopter to 70 knots to keep pace with highway vehicles. He then lost control of the helicopter because of spatial disorientation.						
April 15, 1997	New York, New York	Eurocopter BK-117-B2	ATP	9,400/3,900	destroyed	1 fatal; 2 serious; 1 minor
The helicopter lifted off vertically and was in transition to forward flight when the copilot heard a noise. The helicopter then rotated to the right and descended into a river.[2]						
April 30, 1997	Kane, Pennsylvania	MBB BK-117-A1	ATP	4,600/190	substantial	none
The helicopter struck the ground while landing at a hospital in VMC.[2] The helicopter may have settled with power.						
May 21, 1997	Indianapolis, Indiana	Aerospatiale AS-365N	ATP	17,000/500	none	1 fatal
After landing, the pilot shut down the engines and applied the rotor brake. A passenger deplaned and was struck and was killed by a main-rotor blade. Gusting winds were a contributing factor.						
July 18, 1997	Page, Arizona	Sikorsky S-58T	ATP	9,996/4,750	substantial	none
The helicopter was being flown in an external-load operation when the pilot heard an explosion. The engines lost power, and the helicopter landed hard.[2]						
Sept. 22, 1997	Patterson, Louisiana	Sikorsky S-76A	ATP	13,199/4,123	substantial	2 serious
The pilot flying (copilot) did not maintain a positive rate of climb while taking off at night in fog. The PIC was adjusting instrument lighting and did not realize that the helicopter was descending.						

ATC = air traffic control
ATP = airline transport pilot
DME = distance measuring equipment
GPS = global positioning system
IFR = instrument flight rules
ILS = instrument landing system
IMC = instrument meteorological conditions
MBB = Messerchmitt-Bolkow-Blohm
MD = McDonnell Douglas
NA = not available
PIC = pilot-in-command
VFR = visual flight rules
VMC = visual meteorological conditions
VOR = very-high-frequency omnidirectional radio

Notes: 1. All accidents occurred in the United States; 2. Information is based on a preliminary accident report by the U.S. National Transportation Safety Board (NTSB); 3. The helicopter was a prototype twin-engine conversion.

Sources: Joel S. Harris and NTSB

Aircraft Accident-rate Comparison, 1993–1997



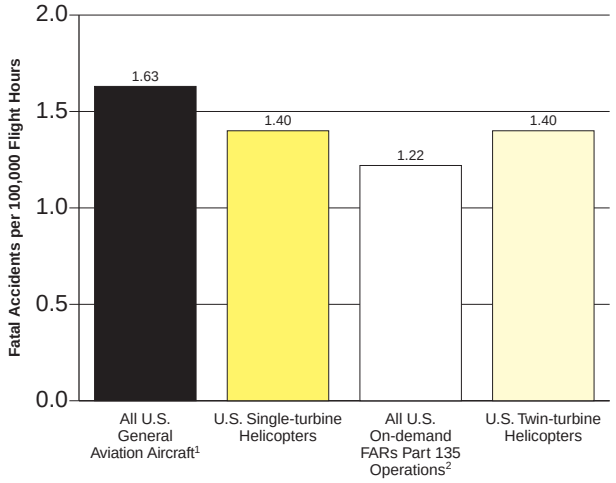
FARs = U.S. Federal Aviation Regulations

Notes: 1. The U.S. National Transportation Safety Board (NTSB) defines general aviation aircraft as U.S.-registered aircraft (airplanes and rotorcraft) that do not conduct air-carrier revenue operations under FARs Part 121 or Part 135; 2. On-demand FARs Part 135 operations include unscheduled revenue operations by rotorcraft and by airplanes with 30 or fewer passenger seats and a payload capacity of 7,500 pounds (3,402 kilograms) or less; and scheduled passenger-carrying revenue operations of less than five round-trip flights per week by rotorcraft and by nonturbojet airplanes with nine or fewer passenger seats and a payload capacity of 7,500 pounds or less.

Source: Joel S. Harris, based on U.S. Federal Aviation Administration data and NTSB data

Figure 1

Aircraft Fatal-accident Rate Comparison, 1993–1997



FARs = U.S. Federal Aviation Regulations

Notes: 1. The U.S. National Transportation Safety Board (NTSB) defines general aviation aircraft as U.S.-registered aircraft (airplanes and rotorcraft) that do not conduct air-carrier revenue operations under FARs Part 121 or Part 135; 2. On-demand FARs Part 135 operations include unscheduled revenue operations by rotorcraft and by airplanes with 30 or fewer passenger seats and a payload capacity of 7,500 pounds (3,402 kilograms) or less; and scheduled passenger-carrying revenue operations of less than five round-trip flights per week by rotorcraft and by nonturbojet airplanes with nine or fewer passenger seats and a payload capacity of 7,500 pounds or less.

Source: Joel S. Harris, based on U.S. Federal Aviation Administration data and NTSB data

Figure 2

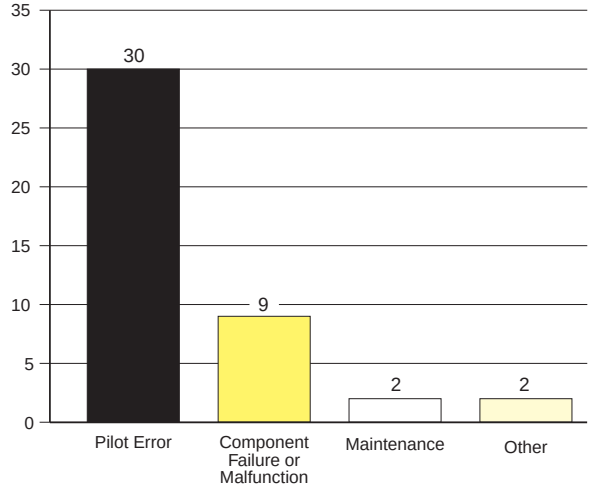
commercial pilot certificates. Overall, 30 of the 48 PICs had ATP certificates, and 18 had commercial pilot certificates. All the pilots had current medical certificates.

Nearly half (13) of the pilot-error accidents occurred when visibility was reduced by instrument meteorological conditions (IMC), marginal visual meteorological conditions (caused by fog, haze and/or low ceilings) and/or low-light conditions (night). Only three of the 13 flights were being operated under instrument flight rules (IFR).

One reduced-visibility accident occurred on the night of Sept. 19, 1995. The pilot had conducted flight demonstrations of a prototype twin-engine version of a Bell 206 L-1 LongRanger II and was returning the helicopter to John Wayne–Orange County Airport in Santa Ana, California.

The aircraft was not certified for flight in IMC. It had one very-high-frequency navigation/communication radio that provided one selected function (either navigation or communication) at a time. The aircraft also had a Loran-C (long-range navigation system) receiver that was placarded for use only for visual flight rules (VFR) flight.

Probable Causes of U.S. Twin-turbine Helicopter Accidents, 1993–1997



Source: Joel S. Harris, based on U.S. Federal Aviation Administration data and U.S. National Transportation Safety Board data

Figure 3

At 2229 local time, the pilot radioed the air traffic control (ATC) tower at El Toro U.S. Marine Corps Air Station (MCAS), approximately seven nautical miles (13 kilometers) east of the destination. The pilot said that his aircraft was at 3,000 feet, inbound to John Wayne–Orange County Airport. He requested the El Toro weather. The controller said that the weather observation 30 minutes earlier was scattered clouds at 500 feet and broken ceilings at 700 feet and at 1,000 feet. The controller did not report the surface visibility.

Forty-one seconds later, the pilot said that he was 10 miles (19 kilometers) east of El Toro at 2,000 feet. He said that the cloud deck below the aircraft appeared to be "pretty solid." He said, "I need to look for a hole." The controller advised the pilot to stay north of El Toro MCAS to get below the overcast. The controller assigned the flight a transponder code and said that the helicopter was in radar contact.

The pilot asked the controller to confirm that the helicopter was flying toward Lake Irvine, approximately six miles (11 kilometers) north of El Toro MCAS. The controller said that the helicopter was "coming up on Lake Irvine now, sir."

The pilot then requested a left turn toward a reservoir. The controller suggested a heading of "about 170 [degrees]."

Forty-nine seconds later, the pilot said, "Is it OK to descend here?"

The controller said, "Just fine. Descend right there, sir."

The pilot said, "What is my minimum altitude here?"

The controller said, "Stand by." The controller received no response to further radio calls to the pilot. The last recorded radar position showed the aircraft at an altitude of 1,300 feet.

Accident investigators found imprints of the helicopter's landing skids at the top of a 1,250-foot (381-meter) ridge. They determined that the helicopter struck the ridge top, became airborne again and traveled approximately 350 feet (107 meters) before striking down-sloping terrain. The aircraft was destroyed, and the pilot was killed.

Investigators calculated that approximately 32 gallons (121 liters) of fuel were aboard the aircraft when the accident occurred, and that the helicopter used 44 gallons (167 liters) of fuel per hour in cruise flight.

The NTSB report[2] said that the probable causes of the accident were "the pilot's intentional VFR flight into IMC … , [the pilot's] failure to maintain an adequate terrain-clearance altitude, and the … controller's improper use of ATC procedures/technique." The report said that contributing factors were "the helicopter's low fuel state and lack of required equipment for IFR flight."

The NTSB reports show that, besides the 13 pilot-error accidents involving reduced visibility, the pilot-error accidents also involved controlled flight into terrain (a factor in six of the 30 accidents), main-rotor strikes or tail-rotor strikes (five), spatial disorientation (three), wire strikes (three), fuel starvation or contamination (two), hard landings (two), weight and balance (two), securing the wrong engine after an engine failure (one), and failure to remove a tie-down prior to liftoff (one). (Some accidents involved more than one factor.)

Fourteen of the 48 accident aircraft were flown by two pilots. Lack of crew coordination was cited as a factor in one NTSB report.[3] The accident involved a Sikorsky S-64 Skycrane that collided with trees and terrain while being flown in aerial logging operations in California on Aug. 26, 1995.

After picking up a sling load of logs weighing approximately 14,000 pounds (6,350 kilograms), the crew flew the helicopter toward a landing zone on a mountain slope where they were to deposit the logs. The crew heard an explosion (NTSB said that the sound was caused by an engine compressor stall), and the aircraft pitched up and rolled right.

The PIC began to experience control difficulties. The crew then attempted to land the helicopter in an area approximately one mile (1.9 kilometers) down the mountain slope. The PIC believed that the copilot had used the electric cargo-hook-release system to release the sling load. The copilot believed that the PIC had released the sling load. Nevertheless, neither pilot had released the sling load. The sling load was not released until the cargo hook struck rocky terrain and opened. The main-rotor blades contacted trees, and the helicopter touched down in a shallow stream and rolled approximately 105 degrees onto its left side. The pilots were not injured.

The NTSB report said that the PIC later attempted to recover the accident aircraft with another S-64 helicopter. While flying from the accident site with the accident aircraft in a sling, the pilot encountered conditions that necessitated jettisoning the load. The accident aircraft was destroyed when it was dropped.

Component Problems Caused 11 Accidents

NTSB reports show that component failure or component malfunction was a probable cause of nine twin-turbine helicopter accidents, and that improper maintenance was a probable cause of two accidents. Among the 11 accidents, four involved main-rotor transmissions or main-rotor drive shafts; four involved flight controls or flight-control servos; one involved an engine; one involved a tail-rotor-drive system; and one involved a main-rotor head.

An example of an accident attributed by NTSB to component failure occurred on June 21, 1996. A Messerschmitt-Bolkow-Blohm BO-105 was being flown to an oil-drilling platform in

the Gulf of Mexico, 90 miles (167 kilometers) south of Sabine Pass, Texas. The pilot radioed company dispatch that he was 38 miles (70 kilometers) from the destination. No further radio transmissions were heard from the pilot.

Wreckage of the aircraft was found in the Gulf of Mexico. The NTSB report[4] said, "Structural deformations of the airframe revealed that the helicopter impacted the water vertically in a high rate of descent." Examination of the main-rotor transmission revealed that the sun gear had failed, disconnecting the main-rotor system from the engines.

An example of an accident attributed by NTSB to improper maintenance occurred on Oct. 4, 1996, in Oregon. Approximately 37 minutes after a Boeing Vertol 107 took off for a maintenance-check flight, witnesses saw the tandem-rotor helicopter maneuver erratically, tumble out of control and strike the ground. The two pilots and one passenger were killed.

Investigators determined that the flight-control system had become disconnected because the wrong type of bell crank had been installed. The bell crank (a lever with a fulcrum and two arms) was too large to allow a cotter pin to be inserted in the bolt that attaches the bell crank to a clevis (a U-shaped component with bolt holes in its arms).

The NTSB report[5] said, "Metallurgical examination of the bolt revealed evidence that a nut had been applied to the threaded end, but there was no evidence that a cotter pin had been inserted." Without a cotter pin to keep the nut in position, the nut separated from the bolt, and then the bolt separated from the bell crank and clevis.

Passenger Killed by Main-rotor Blade

On May 21, 1997, the pilot of an Aerospatiale AS-365N Dauphin transported two passengers to a corporate ramp at Indianapolis (Indiana) International Airport. The NTSB report[6] quoted the pilot as saying, "I landed, taxied in, shut down the engines and … applied the rotor brake. My passengers were deplaning from the right side of the helicopter with the help of line personnel. [One passenger] walked forward of the helicopter and turned left into the tip path plane of the rotor system. The passenger was struck in the left temple by a main-rotor blade."

The report said that the probable cause of the fatal accident was the passenger's "inadequate visual lookout." The report said that gusting wind was a factor. Surface wind velocity was 14 knots (26 kilometers per hour), gusting to 21 knots (39 kilometers per hour). "The static flex clearance of the helicopter blade was determined to decrease at increased wind velocities," said the report.

Midair Collision Occurred at Night

On Sept. 27, 1994, two helicopters collided during a VFR, night flight in Arizona. The NTSB report[7] said that a McDonnell Douglas MD-520N was being flown as a chase aircraft for a McDonnell Douglas AH-64D Longbow Apache helicopter when the collision occurred.

The MD-520N struck the ground. The pilot was killed, and a passenger was seriously injured. The AH-64D was substantially damaged but was landed without further incident.♦

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5. NTSB accident report SEA97FA001.
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About the Author

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

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