



Aviation Investigation Final Report

Location:	Chicago, Illinois	Accident Number:	CHI06GA174
Date & Time:	June 30, 2006, 12:00 Local	Registration:	N681FD
Aircraft:	Bell UH-1H	Aircraft Damage:	Substantial
Defining Event:		Injuries:	3 Minor, 1 None
Flight Conducted Under:	Public aircraft		

Analysis

The public-use helicopter was responding to an emergency when it had a vibration and yawed to the right during cruise flight. It subsequently had a loss of tail rotor thrust. The pilot reduced engine power and made an autorotation to a park along the lakeshore. During landing flare, the helicopter yawed left as the pilot increased collective prior to touchdown. He stated that the touchdown "seemed smooth" and was made on the aft-portion of the skids, but as the helicopter slowed the left yaw tendency increased. The helicopter rolled over and came to rest inverted at the completion of the run-on landing. Examination of the helicopter revealed that the number-one tail rotor driveshaft hanger assembly had separated, resulting in a discontinuity of the tail rotor driveshaft. The machine bolt that held the assembly together was not installed with the required cotter pin. Further examination of the hanger assembly revealed that the splined areas did not contain grease. The remaining tail rotor driveshaft hanger bearings were properly greased and assembled. The mechanic who worked on the helicopter reported that due to other workload items, the previous tail rotor driveshaft inspection was interrupted several times before he was able to complete all of the required tasks. To avoid inter-mixing the driveshaft components, he temporarily reassembled the hanger assemblies before working on other projects. His intention was to disassemble each hanger bearing when he had the opportunity to complete the inspection. The mechanic stated that he must have forgotten to disassemble, inspect, and grease the number one hanger assembly. At the time of the accident, the number one hanger assembly had accumulated about 33 hours since the inspection.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:
The in-flight separation of a tail rotor driveshaft hanger bearing due to inadequate maintenance performed by maintenance personnel. Contributing to the accident was the inability to maintain directional control due to the lack of tail rotor thrust.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: CRUISE - NORMAL

Findings

1. (C) MISC ROTORCRAFT - SEPARATION
2. (C) MAINTENANCE, INSPECTION - INADEQUATE - COMPANY MAINTENANCE PERSONNEL

Occurrence #2: FORCED LANDING
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings

3. AUTOROTATION - PERFORMED - PILOT IN COMMAND

Occurrence #3: ROLL OVER
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings

4. (F) DIRECTIONAL CONTROL - NOT POSSIBLE

Factual Information

HISTORY OF FLIGHT

On June 30, 2006, at 1200 central daylight time, a Bell UH-1H helicopter, N681FD, operated by the City of Chicago Fire Department, was substantially damaged during a forced landing after experiencing a loss of tail rotor thrust while in cruise flight over Chicago, Illinois. Visual meteorological conditions prevailed at the time of the accident. The public-use flight was operating under the provisions of 14 Code of Federal Regulations (CFR) Part 91. The pilot-in-command (PIC) and two passengers (rescue divers) sustained minor injuries. The second-in-command (SIC), the remaining occupant, was not injured. The local area flight departed from the Chicago Fire Department Air Sea Rescue Heliport (LL35), Chicago, Illinois.

At 1143, the flight crew was dispatched to the scene of a drowning victim in Lake Michigan. At 1150, the pilot performed an uneventful departure and proceeded northbound over Lake Michigan toward the location of the drowning. While in cruise flight at 1,200 feet mean sea level (msl), the helicopter "experienced a vibration and a slight yaw of the nose to the right." The pilot did not notice any anomalies after scanning the instrument panel. The helicopter then experienced another set of vibrations and experienced additional yawing to the right. The pilot reported that his "suspicions of tail rotor failure were being confirmed" and he elected to head for an open area along the lakeshore as a precaution. A few moments later, the helicopter again experienced more vibrations and yawed about 45-degrees to the right.

The pilot reduced engine power, which "seemed to reduce the yaw angle somewhat" and then performed an autorotation to the open area ahead of the helicopter. During landing flare the helicopter yawed left as the pilot increased collective prior to touchdown. He stated that the touchdown "seemed smooth" and was made on the aft-portion of the skids, but as the helicopter slowed the left yaw tendency increased. When the helicopter had almost stopped, the pilot "sensed that the [helicopter] was tipping over slowly on its right side" and it subsequently rolled inverted.

PERSONNEL INFORMATION

Pilot-in-Command (PIC)

According to Federal Aviation Administration (FAA) records, the PIC of N681FD, age 52, held a commercial certificate with rotorcraft-helicopter, airplane single-engine land, airplane multiengine land, and instrument airplane ratings. The PIC was also a certified flight instructor for single-engine and multi-engine land airplanes. The PIC's last aviation medical examination was completed on May 27, 2006, when he was issued a second-class medical certificate with the limitation "shall possess glasses that correct for near vision."

According to fire department information, the PIC had accumulated 1,814 hours total flight time. He had flown 781 hours in rotorcraft, 783 hours in single-engine airplanes and 250 hours in multiengine airplanes. He had accumulated 740 hours as PIC in rotorcraft. The PIC had flown 200 hours in a Bell UH-1H helicopter. His last flight review was completed on January 26, 2006, in a Bell 412EP Level D Simulator at Flight Safety International.

Second-in-Command (SIC)

According to FAA records, the SIC of N681FD, age 50, held a commercial certificate with rotorcraft-helicopter and airplane single-engine land ratings. The airplane single-engine land rating was limited to private pilot privileges. The SIC's last aviation medical examination was completed on June 19, 2006, when he was issued a second-class medical certificate with no restrictions or waivers.

According to fire department information, the SIC had accumulated 329 hours total flight time. He had flown 196 hours in rotorcraft and 133 hours in single-engine airplanes. He had accumulated 30 hours as PIC in rotorcraft. The SIC had flown 3 hours in a Bell UH-1H helicopter. His last flight review was completed on April 13, 2006, in a Bell 206B-3 helicopter.

AIRCRAFT INFORMATION

The 1965 Bell UH-1H helicopter, serial number 65-10101, manufacturer ship number 5145, was a military surplus aircraft. In 1995, the Chicago Fire Department acquired the helicopter from the Illinois National Guard after it was retired from military service. The helicopter had a two-bladed main rotor system and was powered by a single 1,250 horsepower Honeywell T53-L-13BA turbo shaft engine. The accident helicopter was configured to accommodate a pilot and seven passengers. The helicopter's maximum gross weight was 9,500 lbs. The helicopter was approved for single-pilot operations. At the time of the accident, the airframe had accumulated about 5,278 hours and the engine had accumulated about 2,511 hours. The helicopter had accumulated about six hours since the last maintenance inspection, which was completed on June 27, 2006.

METEOROLOGICAL INFORMATION

The closest weather reporting facility was at the Chicago Midway International Airport (MDW), about 7.2 nautical miles west-southwest of the main wreckage. The airport was equipped with an automated surface observing system (ASOS). At 1153 central daylight time, the MDW ASOS reported the following weather conditions: Wind 220 degrees true at 8 knots; visibility 10 statute miles; few clouds at 12,000 feet above ground level (agl) and scattered clouds at 20,000 feet agl; temperature 27 degrees Celsius; dew point 13 degrees Celsius; altimeter setting 30.07 inches of mercury.

FLIGHT RECORDERS

The accident helicopter was not equipped, nor was it required to be equipped, with a cockpit voice recorder or flight data recorder.

WRECKAGE AND IMPACT INFORMATION

The helicopter landed in a park area along the Lake Michigan shoreline. There were four ground scars in the turf preceding the main wreckage. These ground scars were consistent with the helicopter's ground track during landing. The ground scars curved from a northerly to northwesterly heading and collectively measured about 65 feet long. The helicopter was inverted, laying on its roof structure. Both the main transmission and its rotor system separated from the fuselage and were lying next to the cabin. A main rotor blade tip was found about 460 feet southwest of the main wreckage. The tailboom assembly remained attached to the cabin structure and the tail rotor remained attached to its gear box. The tail rotor system did not have any noticeable blade damage.

Examination of the helicopter revealed that the number-one tail rotor driveshaft hanger assembly (p/n 204-040-600-11) had separated, resulting in a discontinuity of the tail rotor driveshaft. The machine bolt (p/n AN4-30) that held the assembly together was not installed with the required cotter pin (p/n MS24665-155). Further examination of the hanger assembly revealed that the splined areas did not contain grease. The remaining tail rotor driveshaft hanger bearings were properly greased and assembled.

SURVIVAL ASPECTS

The accident helicopter was commonly used to patrol Chicago's Lake Michigan shoreline during search and rescue operations. During these operations, two rescue divers would accompany the flightcrew during flight. The cabin seating provided for the divers did not accommodate their self-contained underwater breathing apparatus (SCUBA) air tanks. In order to facilitate getting the rescue divers on-scene as soon as possible, the divers wore their SCUBA air tanks while in flight. While the helicopter was patrolling the lakeshore or enroute to an emergency, the rescue divers would sit on the forward edge of their respective seats due to the interference of their air tanks. As a result, the rescue divers would not be fully seated in their seats and could not use their supplied lap belts. Both rescue divers reported minor injuries from being unrestrained in the cabin during the accident landing.

A majority of the accident aircraft's missions were performed over Lake Michigan. The helicopter was not equipped with skid-mounted emergency inflatable floats. Although flight crew personnel were equipped with personal floatation devices (PFD), they were not provided helicopter emergency egress devices (HEEDs). A HEED provides compressed air for emergency breathing while evacuating from submerged aircraft. Although personnel had previously received training covering evacuation and ditching procedures, the recurrent instruction did not include underwater egress training.

ADDITIONAL INFORMATION

According to the fire department mechanic who maintained the accident helicopter, he began a scheduled inspection of the tail rotor driveshaft components on December 19, 2005. He reported that due to other workload items, it was necessary for the inspection to be interrupted several times before he was able to complete all of the required tasks. To avoid inter-mixing the driveshaft components, he temporarily reassembled the hanger assemblies before working on other projects. His intention was to disassemble each hanger bearing when he had the opportunity to complete the inspection. The mechanic stated that he must have forgotten to disassemble, inspect, and grease the number one hanger assembly. At the time of the accident, the number one hanger assembly had accumulated about 33 hours since the inspection.

In response to the accident investigation, the City of Chicago Fire Department incorporated several changes to enhance their safety of operations. Maintenance procedures and quality checks were implemented to ensure critical maintenance items were completed as per maintenance instructions. Specifically, maintenance personnel are now required to complete multi-procedural tasks prior to beginning work on new projects. Additionally, all critical maintenance items now require an additional person to verify the work completed before the aircraft is returned to service.

Also in response to the accident investigation, all of the Chicago Fire Department helicopters were configured with cabin seats that accommodate the rescue divers' SCUBA tanks and equipment. These cabin seats allow the divers to properly use the helicopter's safety restraint systems. Additionally, the primary search and rescue helicopter was configured with skid-mounted emergency inflatable floats. Flight crew personnel are now required to complete recurrent evacuation and ditching instruction that includes underwater egress training. During calendar year 2008, all flight crew personnel will begin carrying a 2-liter HEED air supply bottle as a part of their required safety equipment.

Pilot Information

Certificate:	Commercial; Flight instructor	Age:	52, Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine	Toxicology Performed:	No
Medical Certification:	Class 2 With waivers/limitations	Last FAA Medical Exam:	May 1, 2006
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	January 1, 2006
Flight Time:	1814 hours (Total, all aircraft), 200 hours (Total, this make and model), 1753 hours (Pilot In Command, all aircraft), 20 hours (Last 90 days, all aircraft), 5 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

Co-pilot Information

Certificate:	Commercial; Private	Age:	50, Male
Airplane Rating(s):	Single-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	
Instrument Rating(s):	None	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 2 Without waivers/limitations	Last FAA Medical Exam:	June 1, 2006
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	April 1, 2006
Flight Time:	329 hours (Total, all aircraft), 3 hours (Total, this make and model), 32 hours (Last 90 days, all aircraft), 2 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	Registration:	N681FD
Model/Series:	UH-1H	Aircraft Category:	Helicopter
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:		Serial Number:	65-10101
Landing Gear Type:	Skid	Seats:	8
Date/Type of Last Inspection:	June 1, 2006 AAIP	Certified Max Gross Wt.:	9500 lbs
Time Since Last Inspection:	6 Hrs	Engines:	1 Turbo shaft
Airframe Total Time:	5278 Hrs at time of accident	Engine Manufacturer:	Honeywell International Inc.
ELT:	Installed, activated, did not aid in locating accident	Engine Model/Series:	T53-L-13BA
Registered Owner:	City of Chicago Fire Department	Rated Power:	1250 Horsepower
Operator:		Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	MDW, 620 ft msl	Distance from Accident Site:	7 Nautical Miles
Observation Time:	11:53 Local	Direction from Accident Site:	248°
Lowest Cloud Condition:	Few / 12000 ft AGL	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	8 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	220°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.06 inches Hg	Temperature/Dew Point:	27°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Chicago, IL (LL35)	Type of Flight Plan Filed:	Company VFR
Destination:	Chicago, IL (LL35)	Type of Clearance:	None
Departure Time:	11:50 Local	Type of Airspace:	

Wreckage and Impact Information

Crew Injuries:	1 Minor, 1 None	Aircraft Damage:	Substantial
Passenger Injuries:	2 Minor	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	3 Minor, 1 None	Latitude, Longitude:	41.838054,-87.603332

Administrative Information

Investigator In Charge (IIC):	Fox, Andrew
Additional Participating Persons:	Edmond G Pottle; Federal Aviation Administration - DuPage FSDO; West Chicago, IL Harry E Vergis; City of Chicago Fire Department - Air Sea Rescue; Chicago, IL David C Dosker; Bell Helicopter; Fort Worth, TX
Original Publish Date:	March 31, 2008
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=64038

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).