



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Maplewood, Minnesota	Accident Number:	CEN13FA357
Date & Time:	June 19, 2013, 08:12 Local	Registration:	N5024N
Aircraft:	Bell 47G-3B-1	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	1 Fatal
Flight Conducted Under:	Part 137: Agricultural		

Analysis

The helicopter had completed aerial applications at two designated locations without incident. Recorded GPS data and witness information indicated that the helicopter then travelled north at a low altitude to another location. Witnesses observed the helicopter rolling or banking left and descending. The helicopter subsequently impacted a residential garage and terrain. A postimpact fire destroyed the helicopter's forward section and a majority of its control system components. An examination of the helicopter and its systems revealed no malfunctions or failures that would have precluded normal operations. The helicopter was below the allowable maximum gross weight. The reason of the loss of helicopter control could not be determined.

Probable Cause and Findings

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

The loss of helicopter control for reasons that could not be determined because an examination of the helicopter and its systems revealed no malfunctions or failures that would have precluded normal operation.

Findings

Aircraft	(general) - Not attained/maintained
Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

Maneuvering-low-alt flying	Loss of control in flight (Defining event)
Maneuvering-low-alt flying	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On June 19, 2013, at 0812 central daylight time, a Bell 47G-3B-1 single-engine helicopter, N5024N, impacted a residential garage while maneuvering near Maplewood, Minnesota. The commercial pilot, who was the sole occupant, sustained fatal injuries. The helicopter was destroyed by impact and post-crash fire. The helicopter was registered to and operated by Scott's Helicopter Services, Inc., Le Sueur, Minnesota, under the provisions of 14 Code of Federal Regulations Part 137 as an aerial application flight. Visual meteorological conditions prevailed for the flight, which operated without a flight plan. The flight originated from a remote staging area at 0755.

According to the operator and global positioning system data, the helicopter departed Flying Cloud Airport, Minneapolis, Minnesota, at 0716, and flew to a remote staging area near Maplewood to be loaded with a mosquito control dry chemical. The helicopter was loaded with 640 pounds of dry chemical and departed the staging area. Based on a map provided by the operator, the pilot was planning to apply chemical to four designated areas. The GPS data showed the helicopter maneuvered around two of the designated areas, consistent with chemical application, and was then transitioning to the north-northeast. While flying north-northeast, the helicopter maintained a level altitude of approximately 200-300 feet above ground level. For the last 30 seconds of the flight, the GPS data showed the groundspeed gradually increased from 49 knots to 67 knots. The last recorded GPS position showed the helicopter at 300 feet above ground level, a groundspeed of 67 knots, on a heading of 15 degrees, and located approximately 400 feet south of the accident location.

A witness observed the helicopter applying the chemical at one of the designated areas, which was located just south of the staging area. The helicopter was then observed to depart that location. Additional witnesses, who were located near the accident location, observed the helicopter traveling south to north near the accident. Prior to the accident, the helicopter was observed to lose altitude, turn or roll to the left, and descend. Witnesses then lost sight of the helicopter behind some residential houses.

PERSONNEL INFORMATION

The pilot held a commercial pilot certificate with rototcraft-helicopter and instrument helicopter ratings. The pilot's most recent second class medical certificate was issued on December 11, 2012, with no restrictions or limitations. The pilot's most recent flight review was completed by Scott's Helicopter Services, Inc., on April 23, 2013.

According to the operator and pilot records, the pilot had accumulated approximately 2,794 flight hours, of which 2,778 hours were in helicopters, and 332 hours in the make and model of the accident helicopter.

The pilot had previously worked for Scott's Helicopter Services, Inc., from April to October in 2009 conducting mosquito control, pipeline patrol, and electronic news gathering (ENG) operations. From December 2009 until April 2013, the pilot was employed in the helicopter emergency medical services (HEMS) industry. The pilot returned to Scott's Helicopter Services, Inc., in April 2013, and since returning, the pilot had flown approximately 100 flight hours in the make and model accident helicopter performing mosquito control operations.

According to members of the pilot's family, the pilot was in excellent health and physical condition. In the days preceding the accident, the pilot was well rested and had no medical or health issues.

According to another company pilot, who interacted with the accident pilot on the morning of the accident, the accident pilot arrived at the Flying Cloud hangar approximately 0620. The accident pilot made some coffee, checked the weather, and both pilots preflighted their helicopters. After departure from the Flying Cloud airport, the other company pilot had no further communication with the accident pilot.

AIRCRAFT INFORMATION

The accident helicopter was a Bell 47G-3B-1 helicopter, serial number 6601, and equipped with a Rolls Royce 250-C10D turboshaft engine per a supplemental type certificate. The helicopter was issued a special airworthiness certificate in the restricted category for the purpose of Agricultural and Pest Control on April 19, 1991, and registered to the owner on June 10, 1994.

According to the aircraft records and information obtained from the operator, the most recent annual and 100-hour inspections were completed on December 14, 2012, at a total airframe time of 5,340.3 hours and a total engine time of 2,948.8 hours. In addition, the 200-, 300-, and 400-hour airframe inspections and 200-, 300- engine inspections were completed at that date.

METEOROLOGICAL INFORMATION

At 0753, the Saint Paul Downtown Airport, Saint Paul, Minnesota, automated surface observing system, located 4 miles southwest of the accident site, reported the wind from 140 degrees at 8 knots, visibility 10 miles, sky clear, temperature 18 degrees Celsius, dew point 13 degrees Celsius, and an altimeter of 30.07 inches of Mercury.

RADAR AND COMMUNICATIONS INFORMATION

There was no recorded radar or communications information regarding the accident helicopter or pilot.

WRECKAGE AND IMPACT INFORMATION

The helicopter impacted a residential garage, came to rest on its left side on a measured magnetic heading of 275 degree, and the cockpit and fuselage were consumed by post-impact fire. Helicopter debris, which consisted of windscreen and miscellaneous fiberglass sections, was distributed in an area

surrounding the helicopter approximately 100 feet in diameter. Ground scars were noted under the helicopter and other impact marks, consistent with the main rotor blades were noted on the residential concrete driveway and garage roof. The residential garage was partially consumed by fire.

Both main rotor blades remained attached to the hub and displayed leading edge crush damage, bending, twisting, and blade fragmentation. Mechanical continuity was confirmed from the engine, through the transmission and main rotor blades. The tail rotor drive shaft was disconnected from the engine. The main rotor pitch links were intact; however, continuity could not be established from the cockpit controls as multiple control tubes and linkage were consumed by fire. The main rotor clutch assembly was intact, and engaged and disengaged with no anomalies noted.

The tailboom remained partially attached to the fuselage. The tail rotor drive system was bent and distorted, and continuity could not be established due to separated drive system components. The damage to the tail rotor system was consistent with impact damage. The tail rotor blades remained attached to the hub and gearbox. One tail rotor blade was bent span-wise approximately 45 degrees near the blade grip and one blade was bent 90 degrees at the grip. Mechanical continuity was confirmed to the tail rotor blades through the gearbox and pitch control assembly. The tail rotor pitch control cables were found separated, and the separations displayed broomstraw features consistent with tensile overload.

The engine remained partially attached to the fuselage and displayed thermal damage. The left engine mounts were both fractured, and the right engine mounts were bent and fractured. The engine exhibited damage to the left side. The exhaust collector and associated ductwork were crushed. The engine fuel spray nozzle was removed to facilitate borescope examination of the gas-generator turbine. Inspection revealed no evidence of turbine distress, erosion, or failure. Metal splatter was noted on the 1st stage turbine nozzle shield. The fuel spray nozzle was disassembled and the internal screen was clear of debris. The upper magnetic chip detector was removed and inspected. The chip detector was clear of debris. The lower magnetic chip detector was removed and inspected. The chip detector showed a small amount of metallic paste and carbonized oil, and was free of metallic debris. The engine oil filter was removed. The filter contained some carbonized oil and was free of metallic debris. The engine was removed for further examination.

The fuel tanks remained partially attached to the fuselage and displayed thermal damage. The helicopter landing skids were bent, deformed, and fragmented. The chemical hopper assemblies were separated, fragmented, and partially consumed by fire.

The helicopter flight and engine instruments were consumed by fire and no recognizable information was able to be determined. Annunciator panel light bulbs were removed and examined. The bulbs displayed no filament stretch. The collective throttle was found in the open position. The cockpit seats and restraints were consumed by fire.

A portable global positioning system (GPS) and AG-NAV GPS unit were located in the wreckage and sent to the NTSB Vehicle Recorders Laboratory, Washington, DC, for examination and data extraction.

MEDICAL AND PATHOLOGICAL INFORMATION

On June 19, 2013, at the Ramsey County Office of the Medical Examiner, St. Paul, Minnesota, an autopsy was performed on the pilot.

Toxicological analysis of specimens of the pilot was performed at the FAA Toxicology and Accident Research Laboratory, Oklahoma City, Oklahoma. Samples were tested for cyanide, ethanol, volatiles, and drugs. None were found to be present. Carbon monoxide test could not be performed due to insufficient specimen for analysis.

TEST AND RESEARCH

AG-NAV GPS Unit

The AG-NAV GPS unit was examined by the NTSB Vehicle Recorder Laboratory. The unit is a GPS navigation system designed for aerial applications. The unit contains a 6.5 inch LCD display with data logging features. The system is designed to interface with other GPS engines and AG-NAV products, such as, Automatic Flow Controller and Variable Rate Application for aerial applications. The device can also interface with FAA tower obstacle data to show the pilot nearby obstacles on its moving map and will provide the pilot with warnings of incoming obstacles with messages and aural alerts.

An exterior examination revealed the AG-NAV unit sustained major fire damage. An interior examination revealed the CF card that contained the flight log data was melted to the unit and could not be recovered.

Garmin GPSMAP 296 Unit

The Garmin GPSMAP 296 is a hand-portable GPS unit equipped with a detachable antenna, a 256 color display, built-in base map, and an internal Jeppesen aviation database. The unit is capable of storing date, route of flight, and flight time information for up to 50 individual flights in the form of a flight log. A detailed track log, including latitude, longitude, date, time, and GPS altitude information for an unspecified number of points, is stored within the unit whenever the receiver has a lock on the GPS navigation signal.

An exterior examination revealed the unit sustained minor impact damage to the casing. The unit powered on normally, and the data was extracted using the manufacturer's recommended procedures. The data extracted from the unit included 3 sessions all from the accident day, and consisted of 279 total data points. The accident flight was recorded starting at 0755:24 and ending at 0812:01, which consisted of 179 data points. The flight from Flying Cloud Airport to the remote staging field was recorded starting at 0716:28 and ending at 0744:51.

Engine Examination

On November 5, 2013, at the facilities of Rolls Royce, the engine was examined and disassembled under the supervision of the NTSB. Representatives from the Federal Aviation Administration, Scott's Helicopter Service, Inc., and Rolls Royce were also present during the examination. Examination of the 1st stage compressor blades showed foreign object damage with tearing and bending noted in the direction opposite of normal compressor rotation. The compressor could not be rotated due to the melting and deformation of the polymer lining within the compressor case halves. Due to damage to the pneumatic tubing, an air pressure check of the engine control systems could not be completed. The fuel control unit's mounting lugs and drive shaft were fractured. The stub remnant of the drive shaft could be rotated by hand. A microscope examination of the fractured drive shaft showed the drive shaft fractured in linear overload. The engine-driven fuel pump was removed and inspected. The fuel pump drive shaft

was rotated by hand. Metal splatters were noted on the 1st stage turbine nozzle shield, which was consistent with impact damage to the compressor. The gas generator turbine was rotated by hand, with no evidence of binding or drag from either the bearings or blade tip rub. The power turbine shaft to pinion gear coupling exhibited a 2-3 mm bulge at its midpoint, consistent with rotational contact and frictional heating between the coupling and inner shaft. The contact was consistent with the bending movement of the turbine during impact. Rotational witness marks were noted within the 4th stage turbine air seal. The turbine-to-compressor coupling exhibited circumferential scoring on the outer surface. The compressor diffuser scroll was removed and the front diffuser was examined. The front diffuser exhibited rotational scoring consistent with being contacted by the centrifugal compressor rotor during engine operation.

Weight and Balance

Review of the helicopter's most recent weight and balance form revealed it had a useful load of 1,061 lbs. The pilot weighed approximately 163 lbs. The estimated fuel on board was 35 gallons, and estimated chemical was 600 lbs. The weight of the pilot, fuel, and chemical would result in the helicopter being about 54 lbs less than the maximum gross weight of 2,950 lbs.

Pilot Information

Certificate:	Commercial	Age:	44
Airplane Rating(s):	None	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	4-point
Instrument Rating(s):	Helicopter	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 2 Without waivers/limitations	Last FAA Medical Exam:	December 11, 2012
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	April 23, 2013
Flight Time:	(Estimated) 2794 hours (Total, all aircraft), 332 hours (Total, this make and model), 2600 hours (Pilot In Command, all aircraft), 100 hours (Last 90 days, all aircraft), 75 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	Registration:	N5024N
Model/Series:	47G-3B-1	Aircraft Category:	Helicopter
Year of Manufacture:		Amateur Built:	
Airworthiness Certificate:	Restricted (Special)	Serial Number:	6601
Landing Gear Type:	High skid	Seats:	1
Date/Type of Last Inspection:	December 14, 2012 Annual	Certified Max Gross Wt.:	2950 lbs
Time Since Last Inspection:		Engines:	1 Turbo shaft
Airframe Total Time:	5340 Hrs as of last inspection	Engine Manufacturer:	Rolls Royce
ELT:	Not installed	Engine Model/Series:	250C10D
Registered Owner:	SCOTTS HELICOPTER SERVICES INC	Rated Power:	
Operator:	SCOTTS HELICOPTER SERVICES INC	Operating Certificate(s) Held:	Agricultural aircraft (137)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	STP	Distance from Accident Site:	4 Nautical Miles
Observation Time:	07:53 Local	Direction from Accident Site:	210°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	8 knots /	Turbulence Type Forecast/Actual:	/ None
Wind Direction:	140°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.06 inches Hg	Temperature/Dew Point:	18°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Maplewood, MN	Type of Flight Plan Filed:	None
Destination:	Maplewood, MN	Type of Clearance:	None
Departure Time:	07:55 Local	Type of Airspace:	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:		Aircraft Fire:	On-ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal	Latitude, Longitude:	44.967224,-92.986114(est)

Administrative Information

Investigator In Charge (IIC):	Sauer, Aaron
Additional Participating Persons:	David R Nelson; Federal Aviation Administration; Minneapolis, MN Don Maguire; Scott's - Bell 47, INC; Le Sueur, MN
Original Publish Date:	March 24, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=87232

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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](#).