Aviation Investigation Final Report

Location:	Northport, Alabama	**Accident Number:**	ERA14FA396
Date & Time:	August 19, 2014, 11:00 Local	**Registration:**	N444RS
Aircraft:	McDonnell Douglas Helicopter 369E	**Aircraft Damage:**	Substantial
Defining Event:	Unknown or undetermined	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

The pilot and passenger were inspecting a span of high-tension powerlines for damage after a recent storm. Recorded data showed that the helicopter departed and proceeded along the left side of the span at an altitude roughly consistent with the height of the suspended wires. The helicopter's last recorded position was about 400 ft laterally and about 25 ft below the point where it ultimately contacted and severed the uppermost wire of the span, which was about 150 ft above ground level. The severed wire was located on the right side of the span, whereas the helicopter was flying on the left. The helicopter's ground track transitioned from left to right and back across the span near transmission towers earlier during the flight; however, there were no transmission towers located in the immediate vicinity of the accident site. Portions of the wreckage came to rest directly below the severed wire, and oriented along a debris path to the right of and along the helicopter's previous direction of travel. Examination of the wreckage revealed no evidence of any mechanical malfunctions or failures before the helicopter contacted the wire.

Probable Cause and Findings

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

An inadvertent collision with a utility wire for reasons that could not be determined from recorded data and examination of the helicopter and accident site.

Findings

Not determined	(general) - Unknown/Not determined
Environmental issues	Wire - Not specified

Factual Information

History of Flight

Maneuvering-low-alt flying	Unknown or undetermined (Defining event)
Maneuvering-low-alt flying	Collision with terr/obj (non-CFIT)

On August 19, 2014, about 1100 central daylight time, a McDonnell Douglas 369E, N444RS, owned and operated by Rotorworks LLC, was substantially damaged when it impacted a utility wire and terrain while maneuvering near Northport, Alabama. The commercial pilot and the passenger were fatally injured. Visual meteorological conditions prevailed, and a company flight plan was filed for the local flight, which originated from Tuscaloosa Regional Airport (TCL), Tuscaloosa, Alabama, about 1034. The aerial observation flight was conducted under the provisions of 14 Code of Federal Regulations Part 91.

According to the operator, on the morning of the accident flight, the pilot was requested to relocate the helicopter from Mobile, Alabama, to Tuscaloosa. Once in Tuscaloosa, the pilot fueled the helicopter and picked up the passenger/observer before departing on the accident flight; the purpose of which was to inspect a span of high-tension power lines for damage from a storm that had passed through the area the previous night.

About 1025, the pilot submitted a company flight plan via email, and according to satellite tracking data, departed TCL about 1034. The helicopter's location, altitude, groundspeed, and direction of travel were subsequently reported to the operator every 5 minutes, as it initially flew east, intercepted the powerline span to be inspected, and then proceeded north along the span. The helicopter's final position, as reported by the satellite tracking data, was recorded at 1100, at a GPS altitude of 457 feet, a groundspeed of 32 knots, and a track of 27 degrees true. At that time, the helicopter was positioned over the western edge of the easement through which the powerlines ran.

About 1130, the power company contacted the operator and reported an additional fault with the transmission lines the accident helicopter was tasked with inspecting, and believed that the fault may be associated with the helicopter. The operator subsequently began a search for the helicopter and provided its last known position to local law enforcement. The accident site was located by air about 1/4-mile northeast of helicopter's last reported position.

Pilot Information

Certificate:	Commercial; Private	**Age:**	51,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	January 21, 2014
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 10, 2014
Flight Time:	13500 hours (Total, all aircraft), 1500 hours (Total, this make and model), 13000 hours (Pilot In Command, all aircraft), 160 hours (Last 90 days, all aircraft), 64 hours (Last 30 days, all aircraft), 7 hours (Last 24 hours, all aircraft)		

According to Federal Aviation Administration (FAA) airman records, the pilot, age 51, held a commercial pilot certificate with ratings for rotorcraft-helicopter, airplane multiengine land, instrument airplane, and instrument helicopter. He also held a private pilot certificate with a rating for airplane single engine land. The pilot was issued an FAA first-class medical certificate on January 21, 2014 with no waivers or limitations. According to the operator, he had accumulated 13,500 total hours of flight experience, of which 12,860 were in rotorcraft. He had accumulated 160 total hours of experience in the 90 days preceding the accident, and overall had accumulated 1,500 hours of experience in the accident helicopter make and model. He completed his most recent flight review in February 2014.

Aircraft and Owner/Operator Information

Aircraft Make:	McDonnell Douglas Helicopter	**Registration:**	N444RS
Model/Series:	369E	**Aircraft Category:**	Helicopter
Year of Manufacture:	1990	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	0441E
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	August 4, 2014 Annual	**Certified Max Gross Wt.:**	3000 lbs
Time Since Last Inspection:	60 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	3824 Hrs at time of accident	**Engine Manufacturer:**	Allison
ELT:	C91A installed, activated, did not aid in locating accident	**Engine Model/Series:**	250-C20B
Registered Owner:	ROTORWORKS LLC	**Rated Power:**	420 Horsepower
Operator:	ROTORWORKS LLC	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	R96A

According to FAA airworthiness records, the accident helicopter was manufactured in 1990, and was powered by a Rolls-Royce 250-C20B turboshaft engine. A review of the helicopter's maintenance records revealed that its most recent annual/100-hour inspection was completed on August 4, 2014, and at that time the helicopter had accumulated 3,765 total hours. The helicopter had accumulated 59 hours since its most recent inspection.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KTCL,186 ft msl	**Distance from Accident Site:**	18 Nautical Miles
Observation Time:	15:53 Local	**Direction from Accident Site:**	219°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.96 inches Hg	**Temperature/Dew Point:**	30°C / 22°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Tuscaloosa, AL (TCL)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Tuscaloosa, AL (TCL)	**Type of Clearance:**	None
Departure Time:	10:30 Local	**Type of Airspace:**	

The 1053 weather conditions reported at TCL, located about 18 nautical miles southwest of the accident site, included wind from 260 degrees at 5 knots, 10 statute miles visibility, a temperature of 30 degrees C, a dew point of 22 degrees C, and an altimeter setting of 29.97 inches of mercury.

At the time of the accident, the sun's angle was about 57 degrees above the horizon at an azimuth of about 122 degrees.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	33.45111,-87.387496

The accident site was located along the eastern edge of the powerline easement, which was oriented roughly north-south along uneven terrain in a shallow valley between two transmission towers. The transmission towers were identified as 81 and 82, and were located north and south of the accident site, respectively. A 6-gauge, 3-strand aluminum shield wire about 0.35 inches in diameter, which spanned between the two towers on their eastern side, was severed about 775 feet north of tower 82. The shield wire's estimated height above ground level at that point along the span was about 150 feet. The remaining fiber optic cable and three power transmission phase cables appeared undamaged.

The helicopter fuselage came to rest inverted within a creek bed, just outside and east of the easement, in

a forested area. The helicopter's static mast, main rotor hub, and four of the five main rotor blades were separated from the fuselage, along with the aft portion of the tailboom. The remaining main rotor blade separated from the main rotor hub at the strap pack. The main rotor blades exhibited extensive damage which varied in severity and included fractures, gouges, bent spars, cord-wise wrinkling, leading/ trailing edge damage, bending, separation and indications of a wire strike. All of the separated components were located within about 90 feet of the fuselage, and in the general vicinity of the severed shield wire, with the aft portion of the tailboom coming to rest nearly directly below the break point of the shield wire. The wreckage displayed no evidence of a pre- or post-impact fire.

The helicopter exhibited extensive damage to the main airframe structural members, static mast support structure and center beam. The static mast was separated at the mast base by fractures near the mast base attachment points. The forward fuselage, including the door and canopy frames, cockpit, and instrument panel were also damaged. All of the canopy windscreens were broken. The cockpit compartment was compromised from ground impact. Both sides of the cockpit and cabin floors were crushed, bent and distorted. Examination of the cockpit seat belts and shoulder harnesses revealed that they functioned normally. All cockpit and cabin doors were installed, and a single set of flight controls was installed at the pilot's position in the left front seat. The pilot was wearing a helmet.

The aft boom fairing exhibited crushed, dented and torn exterior skin surfaces. The air inlet fairing was separated near its mounting base, and exhibited relatively uniform separation surfaces on both of the separated portions. The tailboom was fractured into three pieces, with the first fractured near fuselage station (FS) 200, in the area of the FS 197 mounting frame, with no apparent damage to the mounting bolts. The second section was fractured around FS 258, and exhibited concave depressions consistent in size with the main rotor profile. The third section contained the tail rotor gearbox, tail rotor assembly, vertical and horizontal stabilizers. The horizontal stabilizer and vertical stabilizers sustained various degrees of impact damage to the frame structures, leading edges and exterior skin surfaces. There was no visible indication that the shield wire made contact with the tailboom, empennage, tail rotor, or either of the helicopter's two installed wire strike protection devices.

The main transmission rotated freely, contained oil, and the chip detectors were inspected and found clean of magnetic particles. Drive continuity from the transmission to the tail rotor output pinion was present. The main rotor transmission mounting points had visible damage to the main transmission housing mounting bores and mounting studs. The main rotor transmission output splines and mating splines on the main rotor driveshaft were visibly damaged from the separation of the main rotor static mast. The engine-to-transmission drive shaft had fractured in apparent overload. The shaft fractured immediately forward of the aft flexible coupling. The coupling exhibited bending damage, but remained intact. The over-running clutch operated normally. The oil cooler blower assembly mounting bracket and scroll was impact-damaged.

The tail rotor gearbox and tail rotor assembly appeared undamaged. The gearbox was mounted securely to the FS 281 frame, contained oil, and rotated freely. There were no metallic chips on the chip detector. The tail rotor swashplate rotated smoothly. The tail rotor driveshaft fractures corresponded to the damaged tailboom. Both the forward and aft tail rotor driveshaft couplings appeared undamaged. The tail rotor blades, pitch links, hub, fork, fork bolt and elastomeric teetering bearings appeared undamaged.

There were fractures, bends and distortion throughout the flight controls. Control continuity was verified for the collective, cyclic and tail rotor controls with all control discontinuities displaying impact-related damage consistent with overload separation. The pilot's cockpit controls and under the seat routed controls were extensively damaged. The lateral and longitudinal actuators were removed and inspected. Both actuator shafts were found near the approximate mid-points of their travel. Damage and fractures to the upper controls including the control rods, pitch links, rotating and stationary swashplates displayed signatures consistent with overload separation.

The engine remained inside its cowling and all but the right forward engine mounts were fractured. The engine compressor exhibited foreign object damage consistent with ingestion of small, hard-body and soft-body foreign objects during engine operation. Wood debris, pine needles and leaves were ingested deep into the compressor. Most compressor blades exhibited leading edge impact marks and bending in the opposite direction of normal engine rotation. Borescope inspection of the compressor revealed no evidence of blade/vane failure or release. The composite liner within the compressor was intact and exhibited no evidence of erosion or blade tip rub. Rotation of the compressor (N1) was smooth, with some binding caused by ingested evergreen and hardwood debris. N1 continuity was established from the compressor through the gearbox to the starter/generator. Rotation of the power turbine (N2) was also smooth, with no binding or unusual noise. Continuity from N2 to the power output shaft was established.

Due to extensive airframe damage, control continuity could not be established from the collective and twist grip to the engine. However, both the fuel control unit and power turbine governor were undamaged. The control arms for both units moved freely, with no binding or abnormal resistance. The airframe-mounted fuel cutoff valve was in the OPEN position. Due to cockpit damage, the valve could not be closed from the cockpit. The valve control arm was disconnected from the cockpit control cable, and then moved to the SHUT position. The valve operated easily, with no unusual binding. The fuel supply line to the fuel-flow totalizer was removed; the line contained approximately 2 teaspoons of fuel, which was clean and bright with no observable particulate matter. The fuel line from the totalizer to the fuel spray nozzle was removed and contained approximately 1 teaspoon of clean fuel. The fuel spray nozzle was removed and examined; the spray face displayed normal carbon sooting and was otherwise unremarkable. The nozzle was disassembled, revealing the internal finger filter. The filter was free of debris.

Removal of the fuel spray nozzle allowed access to visually examine the gas generator turbine and combustion sections via borescope. Borescope inspection of the gas-generator turbine revealed no evidence of operational damage or failure, nor evidence of thermal damage or erosion. The 1st stage turbine blades appeared to be in good condition, with no impact marks or thermal erosion. Manual rotation of the compressor resulted in corresponding rotation of the gas generator turbine. The combustion section exhibited no evidence of abnormal combustion, streaking, or asymmetric flame pattern. The combustion liner was intact, with no signs of cracking or degradation. Borescope inspection of the power turbine revealed no evidence of operational failure or malfunction. The bleed valve was checked by hand for proper operation, and operated smoothly by hand, with no lateral play of the poppet valve.

Oil was present in the engine's auxiliary gearbox and the airframe-mounted oil reservoir. The oil was clean with no abnormal odor, entrained water, or observable particulate matter. Both the upper and

lower magnetic chip detectors were absent of ferrous metal. The engine-mounted oil filter was removed and examined. No contamination of the filter was present and the oil within the filter bowl was clean. The airframe-mounted oil filter was equipped with a pop-up style bypass indicator. The indicator was not in bypass.

Medical and Pathological Information

An autopsy was performed on the pilot by the Alabama Department of Forensic Sciences, Montgomery, Alabama. The medical examiner determined that the cause of death was multiple blunt force injuries.

Toxicological testing performed by the FAA's Civil Aerospace Medical Institute found no trace of ethanol or other drugs present in the samples submitted for the pilot.

Additional Information

A handheld GPS receiver was recovered from the wreckage and forwarded to the NTSB Vehicle Recorder Laboratory for examination and data recovery. The unit sustained major impact damage to the screen and casing. The memory chip was located after an interior inspection and a chip-level recovery was performed. The data were successfully obtained from the memory chip. The accident flight was identified by 181 data points spanning between 1030:46 and 1100:46, with one data point recorded every 10 seconds.

According to the data, the helicopter departed from TCL at 1034 and proceeded east before intercepting the north/south oriented powerline span about 1040, and proceeding north. The helicopter maintained approximate GPS groundspeeds between 30 and 60 knots, GPS altitudes between 300 and 700 feet, and generally flew on the west (left) side of the powerlines. The ground track briefly slowed and transitioned to the east (right) of the powerlines on two occasions, about 1047 and 1058. Both of the transitions occurred roughly at points along the powerlines where transmission towers were present. At 1100:26, the calculated GPS groundspeed was 32 knots, and the GPS altitude was 467 feet, or about 120 feet agl. The next recorded position, at 1100:36, placed the helicopter at 33 knots GPS groundspeed, 522 feet GPS altitude, and about 125 feet agl. The final recorded position, at 1100:46, recorded a GPS groundspeed of 32 knots, 537 feet GPS altitude, or about 164 feet agl. This position was roughly 410 feet north of transmission tower 82. The helicopter's tail rotor was recovered about 400 feet northeast of the final recorded GPS position.

Figure 1 – Accident Site Diagram Depicting GPS Flight Path and Helicopter Wreckage

Administrative Information

Investigator In Charge (IIC):	Diaz, Dennis
Additional Participating Persons:	Clay Perkins; FAA/FSDO; Birmingham, AL John Hobby; MD Helicopters, Inc.; Mesa, AZ Jack Johnson; Rolls-Royce Engines; Indianapolis, IN Mark Caffrey; RotorWorks, LLC; Hiram, GA Paul Reese; RotorWorks, LLC; Hiram, GA Adrian Booth; Boeing Helicopters; Mesa, AZ Joan Gregoire; MD Helicopters; Mesa, AZ
Original Publish Date:	September 22, 2016
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=89911