Aviation Investigation Final Report

Location:	Noxen, Pennsylvania	**Accident Number:**	ERA13FA336
Date & Time:	July 27, 2013, 22:20 Local	**Registration:**	N646AG
Aircraft:	Robinson R66	**Aircraft Damage:**	Destroyed
Defining Event:	VFR encounter with IMC	**Injuries:**	5 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The flight departed under visual flight rules (VFR) and then obtained VFR flight following before proceeding in a southeasterly direction. About 28 minutes after takeoff, while flying about 3,000 feet mean sea level over a sparsely populated and heavily wooded area with few ground reference lights, the flight likely encountered light rain. The pilot flew south of a wind turbine, initiated an approximate 180-degree left turn with 300 feet altitude loss, then began following a dirt road associated with the wind turbines. After completion of the turn he advised the controller, "...we're inadvertent IMC [instrument meteorological conditions], reversing..." and asked for a heading to the nearest airport. The controller asked the pilot if he wanted a vector to the nearest airport and also if the flight was in IMC, but there was no reply. The controller provided a heading for a vector to a nearby airport but the pilot did not respond. The flight continued in the same orientation following the course reversal, flying past another wind turbine before turning right; the controller again advised the pilot of the direction to the nearest airport. The pilot immediately responded that he was, "...having trouble maintaining control here." The controller informed the pilot that the nearest airport was heading 068 degrees and 8 miles away, and the recorded radar data indicates the pilot flew a north-northeasterly heading with changes in altitude noted. The comments from the pilot followed by the maneuvering (changes in altitude and heading) were consistent with the known effects of spatial disorientation. Radio and radar contact were lost; the helicopter descended on an east-northeasterly heading into trees and terrain in a heavily wooded area away from any nearby wind turbines.

Postaccident examination of the helicopter revealed extensive impact damage, although there was no evidence of a preimpact failure with the flight controls, drive line, or structure. The engine was found to operate normally and data downloaded from the engine monitoring unit indicates no evidence of preimpact failure or malfunction.

While there was no record of an official preflight weather briefing before departure, a text message from the non-instrument rated pilot to his brother approximately 1 hour before departure stating, "...Waiting out weather to fly back to [Ocean City, MD] tonight" indicates that to some extent he was aware of the

weather. Had the pilot obtained an official preflight weather briefing for the intended VFR flight, the briefing specialist likely would have advised him against VFR flight due to IMC (ceiling less than 1,000 feet and visibility less than 3 miles) and mountain obscuration that were forecast to exist in the accident area.

Although the left seat occupant was a student pilot, it is unlikely the pilot-in-command was giving him instruction during the accident flight. While operation of a helicopter with decreased ceiling and visibility can be safely performed, the environmental conditions in the accident site area consisting of a sparsely populated heavily wooded area with few ground reference lights and no illumination from the moon were indicators that VFR flight should not have continued.

Probable Cause and Findings

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

The pilot's decision to continue VFR flight into night instrument meteorological conditions, which resulted in spatial disorientation and a loss of control.

Findings

Personnel issues	Decision making/judgment - Pilot
Personnel issues	Spatial disorientation - Pilot
Personnel issues	Aircraft control - Pilot
Aircraft	(general) - Not attained/maintained
Environmental issues	Dark - Decision related to condition
Environmental issues	Low ceiling - Decision related to condition

Factual Information

History of Flight

Enroute-cruise	VFR encounter with IMC (Defining event)
Maneuvering-low-alt flying	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On July 27, 2013, about 2220 eastern daylight time, a Robinson Helicopter Company R66 helicopter N646AG, operated by a private individual, collided with trees and terrain near Noxen, Pennsylvania. Instrument meteorological conditions prevailed in the area at the time and no flight plan was filed for the 14 Code of Federal Regulations (CFR) Part 91 personal flight from Tri-Cities Airport (CZG), Endicott, New York, to Jake Arner Memorial Airport (22N), Lehighton, Pennsylvania. The helicopter was destroyed and the commercial-rated pilot and 4 passengers were fatally injured. The flight originated from CZG about 2151.

The flight departed VFR, and at 2153, the non-instrument rated pilot contacted Binghamton Approach Control and advised the controller that the flight had just departed CZG, and was requesting visual flight rules (VFR) flight following. The controller provided the altimeter setting (30.00 inches of Mercury) and asked the pilot the destination and requested altitude, to which he replied 22N, and 3,000 feet msl.

A discrete transponder code was assigned (4606), and the flight was radar identified 3 miles southwest of CZG. The flight proceeded in a southwesterly direction flying about 3,000 feet until about 2157, then turned to a south-southeasterly heading while flying between 2,600 and 3,000 feet msl.

At 2204, air traffic control communications were transferred to Wilkes-Barre Approach Control; the pilot established contact with that facility advising the controller that the flight was level at 3,000 feet msl. The Wilkes-Barre Approach controller acknowledged the transmission, and issued an altimeter setting of 30.00 inches of Mercury. While in contact with that facility the flight proceeded in a southeasterly direction with altitude and slight heading changes until about 2219, at which time recorded radar reflects a left turn to a northwesterly direction. Correlation of the radar targets from recordings of the Wilkes-Barre airport surveillance radar with locations of wind turbines in the area revealed that between 2218:55, and 2219:00, the helicopter flew west of the B-26 wind turbine, and continued in a southeasterly direction, then when turning to a northwesterly direction about 2219:19, the pilot flew just south of the B-21 wind turbine. The radar targets depict the flight path above and adjacent to a road associated with the wind turbines while turning to a northwesterly direction; no determination could be made whether the pilot had visual contact with the road. At 2219:40, while just east of the B-16 wind turbine, the pilot advised the controller, "we're inadvertent IMC, reversing ah, can you give us a heading to the nearest airport, please."

The controller asked the pilot if he wanted a heading to the nearest airport and if the flight was in IFR conditions but the pilot did not respond to that transmission. The radar data reflects that the helicopter continued in a northwesterly direction until 2219:53. About 6 seconds later, the controller instructed the pilot to fly heading 068 degrees for vectors to an airport, to which he replied 5 seconds later "6 alpha golf having trouble maintaining control here." The helicopter at that time was located about 1,105 feet east-southeast of the previous radar target 10 seconds earlier, and had descended from 2,800 to 2,600 feet msl.

The radar data from Wilkes-Barre Approach reflects that between 2220:03 and 2220:17, the flight proceeded in a northeasterly heading with some altitude deviation noted. The controller then asked the pilot, "helicopter 6AG ah you having trouble maintaining altitude sir", to which the pilot immediately replied, "Affirmative 6AG." The radar data reflected that between 2220:17, and 2220:27, the helicopter descended from 2,600 to 2,300 feet, though the coordinates remained unchanged. Radio and radar contact were lost. The pilot of a nearby airline flight attempted to communicate with the pilot at 2221, but there was no reply.

The helicopter crashed on privately owned wooded land leased to an energy company; there were no known witnesses to the accident that occurred during a dark night.

A 406 MHz emergency locator transmitter (ELT) signal was received at the Air Force Rescue Coordination Center (AFRCC) at 2224, and the Pennsylvania State Police and State Emergency Operations Center were notified. A search was initiated, but adverse weather (heavy fog) caused the search to be called off in the early morning hours. The search resumed several hours later when the weather conditions improved; the wreckage was located on July 28, 2013, about 1350.

PERSONNEL INFORMATION

The pilot seated in the right seat, age 30, held a commercial pilot certificate with rotorcraft helicopter rating issued January 19, 2012. He also held a certified flight instructor certificate with rotorcraft helicopter rating issued February 25, 2012. He was issued a first class medical certificate with no limitations on April 30, 2012. On the application for his last medical certificate he listed a total time of 350 hours.

His 2nd pilot logbook contained entries from the first dated February 12, 2013, to the last dated July 21, 2013. He carried forward a total flight time of 952 hours, 14.5 hours simulated instrument time, and 6.0 hours turbine powered rotorcraft helicopter, though the make and model helicopter was not specified. Including his carry forward time he logged a total time of approximately 1,328 hours, of which 1,274 hours were as pilot-in-command. He did not log any simulated or actual instrument flight time in the 2nd pilot logbook. Excluding the unlogged flights after July 21, 2013, he logged a total of approximately 92 hours night flight time, of which approximately 5 hours were in the previous 90 days, and 0.3 hour, or 18 minutes was logged in the previous 30 days. The last logged night flight occurred on July 16, 2013, and was flown in a Robinson R22.

Further review of his 2nd logbook revealed an entry dated July 19, 2013 indicating his attendance of a R66 helicopter pilot safety course at the manufacturer's facility. A total of approximately 1 hour was logged in the R66 helicopter.

Documents provided by Robinson Helicopter Company associated with the pilot/flight instructor safety course revealed that on the application dated June 28, 2013, he listed in part having accrued 1,306 hours total helicopter hours, and 6 hours in R66 helicopters. Ground training was conducted July 15 through July 18, 2013, and on July 19, 2013, an approximately 1.0 hour flight was conducted in an R66 helicopter. On the "Instructor/Pilot Evaluation" form for training conducted in the R66, the instructor indicated his proficiency was above average in "Knowledge" with a comment indicating, "Well studied on systems." He was marked average for the remainder of the maneuvers, and a comment in the General Comments section indicated, "Flew well – no problems noted. Taking delivery of R-66 today." In addition, he was approved to transition other pilot's in Robinson R66 helicopters.

Following completion of the pilot/flight instructor safety course at the manufacturer's facility, he and another pilot flew the helicopter during the course of several flights over a 3 day period from California to Hampton Roads Executive Airport (PVG), Norfolk, Virginia. While the pilot logged the time (approximately 19.6 hours) as dual received and pilot-in-command, the other individual who flew with him and who is a certified flight instructor reported flying the helicopter 7.4 hours. He also indicated he did not give the accident pilot any flight instruction during any of the flights, and further, he did not sign his pilot logbook indicating he had given him flight instruction. The individual who flew with the accident pilot reported there were no discrepancies with the helicopter, and all systems worked OK with no squawks noted. After an uneventful arrival in Virginia at PVG, the other pilot departed, and the accident pilot flew the helicopter to Ocean City Municipal Airport (OXB), Ocean City, Maryland; the flight duration was logged to be approximately 1 hour, and there were no further logged flights in the accident helicopter.

Data downloaded from the Engine Monitoring Unit (EMU) correlated with unlogged flights in the pilot's pilot logbook revealed he accrued approximately 7 hours, bringing his total time to 1,335 hours. On the accident date including the accident flight, the helicopter was operated on 6 flights totaling approximately 6 hours.

The occupant seated in the left front seat was issued a student pilot medical certificate on February 19, 2013, with a restriction to wear corrective lenses. On the application for the medical certificate he listed 10 hours flight time.

AIRCRAFT INFORMATION

The helicopter was manufactured by Robinson Helicopter Company in 2013, under a production certificate issued on October 25, 2010, and designated serial number 0409. It was equipped with a Rolls-Royce 250-C300/A1 engine rated for 270 horsepower for takeoff limited to 5 minutes or 224 horsepower continuous. The helicopter was equipped with 5 seats.

The helicopter was approved for VFR operations day and night. VFR operation at night is permitted only when landing, navigation, instrument, and anti-collision lights are operational. Section 2 of the Pilot's Operating Handbook and FAA Approved Rotorcraft Flight Manual indicates that in "Kinds of Operating Limitations" that orientation during night flight must be maintained by visual reference to ground objects illuminated solely by lights on the ground or adequate celestial illumination.

Review of the airframe and engine logbooks revealed no entries other than those associated with production of the airframe or engine.

According to the hour meter, the elapsed time since manufacture at the time of the accident was 33.08 hours, while the engine monitoring unit indicates a total engine run time of approximately 28 hours, and 18 engine starts.

METEOROLOGICAL INFORMATION

There was no record with Lockheed Martin AFSS, or either DUAT vendor (CSC or DTC) that the pilot obtained a preflight weather briefing before departure.

Airmet Sierra Update 6, for IFR conditions issued by National Weather Service (NWS) at 1645, and valid until 2300, bordered the immediate vicinity of the accident site. The Airmet indicated that between 2000 and 2300, and continuing beyond 2300 to 0500 the next day, ceilings below 1,000 feet and visibilities below 3 miles with precipitation and mist were forecast. The Airmet for mountain obscuration, which extended over the route and the accident site, indicated that between 1700 and 2000, and continuing beyond 2300 to 0500 the next day, clouds, precipitation, and mist were forecast.

The NWS Weather Depiction Chart for 1800 EDT depicted an area of instrument flight rule (IFR) conditions over eastern Pennsylvania by a shaded contour line due to visibility 2 miles in thunderstorms and moderate rain, which was surrounding by an area of marginal visual flight rule (MVFR) conditions by an unshaded contour line. Multiple stations across western Pennsylvania and New York reported rain and thunderstorms with MVFR conditions.

A surface observation taken from Binghamton Regional Airport (BGM), Binghamton, NY, at 2142, or approximately 9 minutes before the flight departed indicates the wind was from 190 degrees at 8 knots, the visibility was 2.5 miles with moderate rain and mist, broken clouds existed at 600 feet and 1,400 feet, and overcast clouds existed at 7,000 feet. The temperature and dew point were 19 and 18 degrees Celsius, respectively, and the altimeter setting was 29.99 inches of Mercury (inHg).

At 2045, or approximately 1 hour 6 minutes before the flight departed, the Area Forecast (FA) issued by the National Weather Service Aviation Weather Center indicated that for eastern Pennsylvania, expected broken clouds at 3,500 feet layered to 25,000 feet, with widely scattered thunderstorms and light rain, with cumulonimbus tops to 38,000 feet.

At 2054, or approximately 1 hour before the flight departed, the pilot sent a text message to his brother indicating, "…Waiting out weather to fly back to [Ocean City, MD] tonight." At the same time, a surface observation from the Wilkes-Barre/Scranton International Airport (AVP), Scranton, PA, located approximately 18 miles east-southeast of the accident site reported wind from 220 degrees at 4 knots, 10 miles visibility with light rain, scattered clouds at 7,000 feet, broken clouds at 8,000 feet, and overcast clouds at 10,000 feet. The temperature and dew point were 22 and 18 degrees Celsius, respectively, and the altimeter setting was 30.00 in Hg.

At 2100, or approximately 51 minutes before the flight departed, the Weather Depiction Chart depicted a larger area of MVFR conditions extending over across western and central New York and northern Pennsylvania along and ahead of the approaching frontal system. The accident site was located in the area of MVFR conditions. Visual flight rule (VFR) conditions were depicted across southern Pennsylvania into Maryland, with the station models depicted overcast sky coverage.

The GOES-13 infrared satellite imagery for 2202 and 2232 EDT respectively with a standard MB temperature enhance curve applied to highlight the higher and colder cloud tops typically associated with convective activity. The images depict an extensive area of low clouds over the region with a north-to-south band of enhanced clouds moving over the route of flight at the time of the accident, with the radiative cloud top temperatures corresponding to cloud tops between 29,000 and 33,500 feet.

The closest Weather Surveillance Radar-1988, Doppler (WSR-88D) to the accident site was from the NWS Binghamton (KBGM) located approximately 46 miles north of the accident site, at an elevation of 1,606 feet. Based on the radar height calculations, the 0.5 degree elevation scan depicted the conditions encompassing the altitude between 3,230 and 7,860 feet over the accident site, with the floor just above the helicopters altitude. The KBGM 0.5 degree base reflectivity image at 2220 EDT depicts the accident site area with light reflectivity values of 15 to 20 dBZ, and several high reflectivity echoes on the range of 50 dBZ east of the general route of flight associated with embedded thunderstorms with one of the cells immediately north of Wilkes-Barre/Scranton International Airport (AVP), which was reporting IFR conditions in heavy rain at the time.

A remote automated weather station RAWS located about 24 miles northwest of the accident site reported at 2201, or approximately 19 minutes before the accident, that the wind was calm, the temperature and dew point were 67 and 66 degrees Fahrenheit, respectively, and the relative humidity was 95 percent.

A surface observation taken from AVP at 2221, or approximately 1 minute after the accident indicates the wind was variable at 4 knots, the visibility was 1.25 miles with heavy rain and mist, runway 04 visual range (RVR) 4,000 variable 6,000 feet, a few clouds at 600 feet, broken clouds at 1200 feet, and overcast clouds at 4,900 feet. The temperature and dew point were 19 and 18 degrees Celsius, respectively, and the altimeter setting was 30.00 inHg.

A RAWS located approximately 15 miles north-northeast of the accident site reported at 2229, or approximately 9 minutes after the accident, that the wind was calm, the temperature and dew point were 66 and 62 degrees Fahrenheit, respectively, the relative humidity was 88 percent, and rain was being recorded at the time of the observation.

Based on the approximate location of the accident, sunset occurred at 2025, and the end of civil twilight occurred at 2056. The Sun and the Moon were more than 15 degrees below the horizon and provided no illumination.

FLIGHT RECORDERS

The helicopter was equipped with an Engine Monitoring Unit (EMU) that is a digital recording device mounted behind the right rear seatback panel. The EMU records and retains data consisting of total engine run time, an engine start counter (whenever N1 exceeds 30 percent and Measured Gas Temperature (MGT) is at least 343 degrees Celsius), and exceedances for N1, N1 run limit, N2 transient, N2 run limit, Torque Meter Oil Pressure (TMOP) transient, TMOP exceedance, TMOP run limit, MGT transient start- up mode, MGT start-up mode, MGT run limit start up, MGT transient run mode, MGT run mode, MGT run limit run mode, and torque. The EMU also records and retains data consisting of flight history (date, engine start time and duration), and in 1 second increments N1 and N2 speeds in percent, TMOP psi, and MGT in Fahrenheit.

Data downloaded from the revealed that the accident flight and 17 previous flights were recorded; 1 entry totaling 4 seconds on July 19, 2013 was noted but was not attributed to a flight. There were no recorded exceedances for any of the flights. Data associated with the accident flight totaled approximately 37 minutes 35 seconds; an approximate 14 second gap of data was noted between 0222:32 and 0222:46 Universal Coordinated Time (UTC), or between 2222:32 and 2222:46 local EMU time.

Review of the recorded data associated with the accident flight revealed that slight variation to N2 below 100 percent was noted for about 6 minutes 49 seconds after the first recorded data point, or until 0152:00.500 (2152:00.500 local), at which time the N2 (equivalent to main rotor speed), and TMOP were recorded to be consistently above 100 percent and 50 psi, respectively. The recorded N2 readings were nearly constant with slight changes for the next 29 minutes 17 seconds, or until 0221:17.312 (2221:17.312), while the TMOP readings were nearly constant with slight changes notes between 0152:00.500 (2152:00.500 local) and 0220:40.312 (2220:40.312), at which time the TMOP began to decrease. Changes to recorded TMOP occurred from then until 0222:46.937 (2222:46.937 hours local), which was the last recorded data point. A copy of the recorded data associated with the accident flight downloaded from the EMU is contained in the NTSB public docket.

WRECKAGE AND IMPACT INFORMATION

The helicopter crashed in a heavy wooded area owned by several family members, who leased the land to an energy company which installed 88 wind turbines. According to the site manager, on the date and time of the accident, the wind turbines were down for maintenance and Notice to Airman # 07/025 was disseminated indicating the wind turbines were not illuminated. The site manager also advised that there was no damage to any of the wind turbines, and they do not have any cameras or recording equipment on them.

Examination of the accident site revealed damage to trees at decreasing heights and debris along an energy path oriented on a magnetic heading of 074 degrees. Major parts of the helicopter consisting of the main rotor assembly, mast, transmission, tail rotor assembly, and horizontal and vertical stabilizers were separated from the helicopter and located along the energy path southwest of the resting portion of the main wreckage. Numerous cockpit and cabin furnishings as well as cockpit and cabin doors, landing gear pieces, and personal effects were also located along the energy path. There was no smell of fuel at the accident site, and no evidence of fire. The accident site was not located near any wind turbines.

Further inspection of the accident site revealed the farthest identified impacted trees were located at 41.4546 degrees North latitude and 076.0926 degrees West longitude. The trees were nearly aligned and perpendicular to the energy path and were about 16 feet apart. When viewed from that location towards the resting point of the main wreckage, the tree to the left was damaged at an estimated height of 55 feet above ground level (agl), while the tree to the right was damaged 45.12 feet agl (measured using Theodolite App). A distance of 59.05 feet existed between the estimated impact point in the creek bed and the tree that was fractured 45.12 feet agl, while the calculated angle between the two points was 27.5 degrees.

The main portion of the wreckage consisting of the fuselage was inverted near the base of 2 trees adjacent to a creek; the wreckage was located at 41.4547 degrees North latitude and 076.0923 degrees West longitude. It came to rest on a magnetic heading of 040 degrees magnetic. The fuel tank was

drained following recovery of the wreckage and found to contain 54 gallons of jet fuel; no contaminants were noted. A small amount of a liquid with the appearance and odor of Jet A fuel was drained from the fuel line to the fuel pump when the line was detached from the fuel pump. No breaches of the fuel system were noted, and there was no evidence of fuel spillage on the ground.

The airframe was almost completely destroyed. The main rotor and gearbox were detached from the airframe, with the mast fairing remaining attached to the mast tube. The mast fairing exhibited a large dent on the trailing edge, which corresponded to the bent mast tube and main rotor mast. The rear fuselage was intact and the rear cowling was attached. The tailcone was bent and wrapped around the left side of the airframe. The tailcone was separated in the approximate center of the 5th bay. The remaining 2 ½ bays were intact, but detached from the empennage. There was a large dent on the upper surface of the aft 2 bays. The empennage was intact. The lower vertical stabilizer was bent approximately 90 degrees rearward, and there was a circular shaped dent at the intersection between the lower vertical and horizontal stabilizers. The dent contained wood debris and bark scrapings. The tail rotor visual guard was fractured at the front of the lower vertical stabilizer. The forward end remained attached to the tailcone and the aft portion was attached to the lower vertical stabilizer.

Inspection of the flight controls revealed numerous fractures; however, there was no evidence of preimpact failure or malfunction. Inspection of the driveline revealed no evidence of preimpact failure or malfunction.

Examination of the firewall revealed it was deformed in several places and rotational scoring from the engine output shaft at the firewall penetration point was noted. The fuel cut-off valve was in a forward, or off position, and the control cable was detached from the control arm. The control cable sheath was secure in the retention clamps. The cable end was not visible protruding from the end of the sheath, and the sheath exhibited stretching and separation of the coils between the engine and the control in the cabin.

The cockpit was fragmented, and flight and engine instruments were located along the energy path. Additionally, the instrument panel was separated. All of the removable controls were installed. The collective was in a full up position, and the friction slider was straight and was fractured at the lower end. The pilot's throttle twist grip was in the "on" or "flight position."

Inspection of the separated instrument panel revealed it contained the airspeed indicator, faceplate of the turn coordinator, and directional gyro. The housing of the turn coordinator was separated from the panel, and was accounted for at the accident site. The annunciator panel contains LED type lights; therefore, no determination could be made as to whether there were any annunciations at the time of the accident.

Inspection of the engine and engine compartment revealed the throttle valve on the engine right side was in a rearward, or 'flight' position, and the control cable was detached from the control arm. The control cable sheath was secure in the retention clamps. The cable end was not visible protruding from the end of the sheath, and the sheath exhibited stretching and separation of the coils between the engine and the control in the cabin. The power turbine governor (PTG) needle was in a position between 30 and 40, and the control cable and linkage was intact and secure. The PTG 'beep' control actuator when tested by hand. The F642-1 shaft was separated at the flex couplings at both ends. At the engine end, 1 flexplate ear was torn and one F906-1 yoke arm was torn. At the main rotor gearbox (MRGB) end, assembly was intact and in place. The sprag clutch unit locked and free-wheeled normally the flexplate arms were torn

on opposite sides, and one MRGB input yoke arm was separated from both the flexplate and the input "shaft".

Main rotor blade SN 0950 exhibited a fractured spar was broken at approximately 6 feet from the coning bolt, and the tip of the blade was detached, but accounted for at the accident site. The blade skin/honeycomb was damaged at tip. There was a gentle upward bend over the inboard 6 feet of the blade, and again for the outboard 4 feet of blade. Wood was embedded in the spar of the blade at the tip. Some minor dents and one tear were visible on the lower skin. 2 small pieces of the removable tip cap were located. The spindle tusk was intact.

Main rotor blade SN 0954 "exhibited a 90 degree downward bend approximately 90 inches from coning bolt, with a partial spar fracture, and spar separated at 160 inches from coning bolt. Skin/honeycomb portion detached from spar at separation, and was not located. The outboard approximate 36 inches of main rotor blade was later accounted for; the spindle tusk was intact. A report concerning the separated outboard section of main rotor blade is contained in the NTSB public docket.

Examination of the engine revealed it exhibited little visible damage. The output shaft/sprag clutch assembly exhibited significant damage. The engine which was secure in its mount points was removed, and sent to the manufacturer's facility, where with FAA oversight, it was placed in a test cell and found to operate normally. The report from the manufacturer and statement from the FAA inspector that witnessed the engine run are contained in the NTSB public docket.

MEDICAL AND PATHOLOGICAL INFORMATION

Postmortem examinations of the pilot and left seat occupant were performed by Forensic Associates of NEPA, Clarks Summit, Pennsylvania. The cause of death for both was listed as multiple traumatic injuries.

External examinations only were performed on the remaining occupants. The cause of death for all was listed as multiple traumatic injuries.

Forensic toxicology was performed on specimens of the pilot and left seat occupant by the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The toxicology report for the pilot stated the results were negative for carbon monoxide, volatiles, and tested drugs, while testing for cyanide was not performed.

The toxicology report for the left seat occupant stated the results were negative for volatiles and tested drugs, while the specimens were unsuitable for carbon monoxide testing; testing for cyanide was not performed.

TESTS AND RESEARCH

The first uncorrelated radar target at 2151:34, was located at 42 degrees 04 seconds 23.88 seconds North latitude and 076 degrees 06 minutes 23.40 seconds West longitude, or about 0.42 nautical miles from the center of a ramp at the departure airport. Review of the EMU recorded data revealed the estimated takeoff was at EMU time 0152:00.500 (2152:00.500). No determination could be made as to how the helicopter proceeded between the EMU time estimated at takeoff and the first uncorrelated radar target.

Correlation of the EMU data with the transmissions from the pilot and the radar data indicates that the changes to the TMOP from the near steady state condition after takeoff occurred about 4 seconds after the pilot advised the controller that the flight was inadvertent IMC, which also was at a point when changes in heading and altitude were noted.

ADDITIONAL DATA AND INFORMATION

Weight and Balance Data

At the time of manufacture, the basic empty weight was 1,346.2 pounds and the empty weight moment was 146392. No modifications were recorded in the maintenance records between the time of manufacture and the accident flight.

Baggage and personal effects that were found either in bags in the baggage compartment, on the ground adjacent to the main wreckage, or loose at the accident site were recovered and secured at a facility of the Pennsylvania State Police. The items that were wet were air dried, and the weight of all items was determined to be 159.5 pounds.

Weight and balance calculations were performed using the empty weight of the helicopter (1,346.2 pounds), the weight of the pilot and left front seat occupant per the Coroner (140 and 170 pounds), respectively. The weights of the rear seat occupants from left to right also reported by the coroner were 127, 33, and 190 pounds, respectively. Additionally, the calculations included the weight of the luggage (159.5 pounds), and full usable fuel amount of 493.1 pounds. The calculations determined that at the moment of engine start, the gross weight was 2,658.8 pounds.

According to the helicopter type certificate data sheet, the design gross weight is 2,700 pounds.

Spatial Disorientation

According to Advisory Circular (AC) 60-4A titled, "Pilot's Spatial Disorientation," surface references and the natural horizon may become obscured even though visibility may be above VFR minimums and that an inability to perceive the natural horizon or surface references is common during flights over water, at night, in sparsely populated areas, and in low-visibility conditions.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	30
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	Helicopter	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	April 30, 2012
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	January 19, 2012
Flight Time:	(Estimated) 1335 hours (Total, all aircraft), 35 hours (Total, this make and model), 1281 hours (Pilot In Command, all aircraft), 221 hours (Last 90 days, all aircraft), 49 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Robinson	**Registration:**	N646AG
Model/Series:	R66	**Aircraft Category:**	Helicopter
Year of Manufacture:	2013	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	0409
Landing Gear Type:	Skid	**Seats:**	5
Date/Type of Last Inspection:		**Certified Max Gross Wt.:**	2700 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo shaft
Airframe Total Time:	33 Hrs at time of accident	**Engine Manufacturer:**	Rolls-Royce
ELT:	C126 installed, activated, aided in locating accident	**Engine Model/Series:**	250-C300/A1
Registered Owner:	Sale Reported	**Rated Power:**	270 Horsepower
Operator:	David E. Jenny	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	AVP,2165 ft msl	**Distance from Accident Site:**	14 Nautical Miles
Observation Time:	22:21 Local	**Direction from Accident Site:**	131°
Lowest Cloud Condition:	Few / 600 ft AGL	**Visibility**	1 miles
Lowest Ceiling:	Broken / 1200 ft AGL	**Visibility (RVR):**	5000 ft
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/ Unknown
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/ Unknown
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	19°C / 18°C
Precipitation and Obscuration:	N/A - None - Mist		
Departure Point:	Endicott, NY (CZG)	**Type of Flight Plan Filed:**	None
Destination:	Lehighton, PA (22N)	**Type of Clearance:**	VFR flight following
Departure Time:	21:51 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	4 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	5 Fatal	**Latitude, Longitude:**	41.454723,-76.092224

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	Harry Soudas; FAA/FSDO; Allentown, PA Les Thompson; FAA FSDO; Indianapolis, IN Ken Martin; Robinson Helicopter Company; Torrance, CA Jack Johnson; Rolls-Royce Corporation; Indianapolis, IN
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Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=87589