Aviation Investigation Final Report

Location:	Monticello, Georgia	**Accident Number:**	ERA21FA362
Date & Time:	September 15, 2021, 20:46 Local	**Registration:**	N888DV
Aircraft:	ROBINSON HELICOPTER CO R66	**Aircraft Damage:**	Destroyed
Defining Event:	VFR encounter with IMC	**Injuries:**	3 Fatal
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled		

Analysis

The pilot, who was also the owner of the company, and a pilot-rated passenger were transporting a revenue-paying passenger on a chartered helicopter flight. The flight began on the morning of the accident with an approximately 200 nautical-mile flight to their destination before returning several hours later under visual flight rules. During the return trip, they stopped at an airport to refuel. About halfway through the subsequent flight, they encountered moderate to heavy rain showers. The passenger sent a text message to his spouse stating they landed in a field because “bad storms popped up” and they were waiting for it to blow over before resuming their flight. The message included a photograph that showed a grass field, gray skies, and rain on the helicopter’s window.

According to recorded flight track data, after departing the field, the pilot made a series of meandering track changes before proceeding to a nearby small airport where they stayed for about 5 minutes. Weather data indicated that after takeoff, the helicopter remained in areas of low ceilings and rain for the remainder of the flight. By this point in the flight, the sun had set and the end of civil twilight had passed. The helicopter subsequently passed 5 miles west of a city, then passed 2 miles east of a large powerplant before entering a large national wildlife refuge, a remote area covered with dense forest.

Shortly thereafter, the helicopter made a series of shallow left and right track changes. During the last 25 seconds of the flight, the helicopter entered a rapidly descending right turn and descended to ground impact. The calculated rate of descend reached nearly 4,000 feet per minute during the descent. The fragmentation of the wreckage and damage to surrounding trees revealed that the helicopter was in a 90° right bank as it came through the trees and impacted terrain.

Postaccident examination of the airframe, flight control system components, transmission, rotor system, and engine revealed no evidence of any preimpact mechanical malfunctions or failures that would have precluded normal operation. The helicopter was certified for operation in visual meteorological conditions (both day and night) and was not certified for operation in instrument meteorological conditions. While the helicopter was equipped with modern avionics that included tools like synthetic vision, as well as an autopilot system, the pilot's proficiency in the use of the systems could not be determined based on available information.

Some or all the ethanol detected by postmortem toxicological testing in the pilot's tissue may have been from sources other than consumption. It is unlikely that ethanol or impairment was a factor in the accident.

The weather conditions at the time of and preceding the accident consisted of low ceilings, low visibility, and rain with marginal visual meteorological conditions expected through most of the area. Once the helicopter passed the city and powerplant that contained ground reference lighting, and entered the national forest, the dark night conditions and sparse lighting along the flightpath would have made it even more difficult for the pilot to recognize and recover from a loss of control due to spatial disorientation. Based on the wreckage distribution, which was consistent with a high-energy impact, coupled with the known low visibility present at the time of the accident, it is likely that the pilot experienced spatial disorientation and lost control of the helicopter.

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 the visual flight rules flight into deteriorating weather conditions during a dark night and over unlit terrain, which resulted in spatial disorientation and a subsequent loss of helicopter control.

Findings

Personnel issues	Spatial disorientation - Pilot
Environmental issues	Low visibility - Effect on personnel
Environmental issues	Dark - Effect on personnel

Factual Information

History of Flight

Enroute	VFR encounter with IMC (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On September 15, 2021, at 2046 eastern daylight time, a Robinson R66 helicopter, N888DV, was destroyed when it was involved in an accident at the Oconee National Forest, near Monticello, Georgia. The commercial pilot, the pilot-rated passenger, and one other passenger sustained fatal injuries. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 135 on-demand charter flight.

The pilot, who was the owner of the company, and a pilot-rated passenger, a part time company employee, were transporting a revenue passenger to southern Georgia and north Florida for personal business. The spouse of the passenger confirmed that the passenger chartered the flight to "look at properties" in the area and was supposed to return later that evening.

The flight originated at Fulton County Executive Airport/Charlie Brown Field (FTY) Atlanta, Georgia, about 0700 and proceeded south, making a stop in Reidsville, Georgia, before continuing to Finlayson Farm Airport (9FL8) Greenville, Florida, where they landed and stayed for several hours before departing on the return flight under visual flight rules.

During the return trip, they landed at Thomasville Regional Airport (TVI), Thomasville, Georgia, where they refueled with 40 gallons of fuel. Automatic dependent surveillance–broadcast (ADS–B) data indicated the flight departed TVI at 1840, then proceeded on a northerly track for about 80 nautical miles near the town of Andersonville, Georgia. At 1937, the passenger's spouse sent a text message her husband and asked him, "What's your ETA to home?" He responded with a photograph taken with his mobile device and stated "Approx 9:30, bad storm pop up had to land in field. It's blowing over now." The photograph showed a grass field, gray skies and rain on the helicopter's window (figure 1).

After departing the field to the west, the helicopter proceeded north and followed a powerline right-of-way for about 4 nautical miles (nm) before reversing course and following the same right-of-way south for about 3 nm. The helicopter then turned left on a southeast track for about 15 nm before making a left turn to the northeast where they made an approach and landing to Perry-Houston County Airport (PXE) Perry, Georgia about 2015.

Five minutes later, the helicopter continued to the north, following a six-lane divided highway (Interstate 75); it passed 5 miles west of downtown Macon, Georgia, then about 10 minutes

later passed about 2 miles east of a large powerplant shortly before entering the Piedmont National Wildlife Refuge, a remote area covered with dense forest. The passenger sent a second series of text messages to his spouse during this en route portion of the flight and included a screen shot of the weather radar and their location (figure 1).

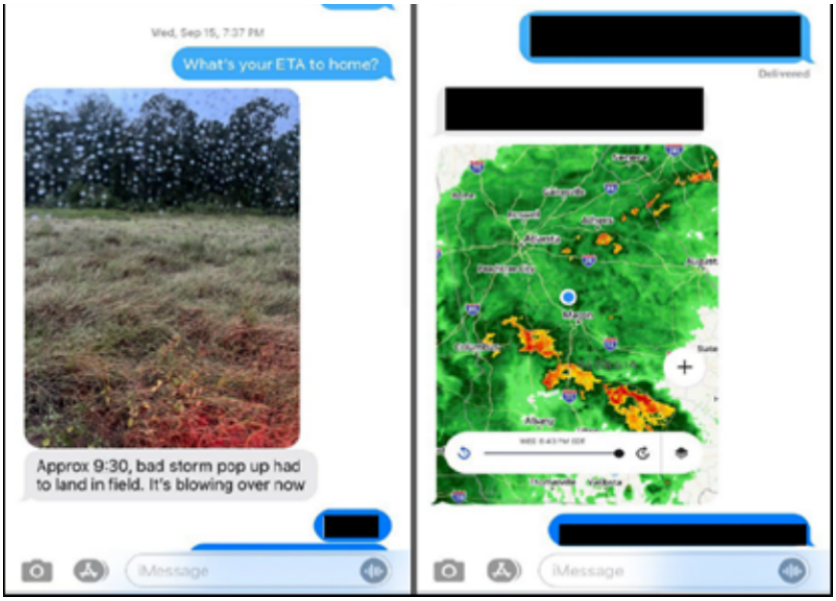

Figure 1 – Screen captures of mobile telephone messages from the passenger. These included a photo of the weather about 1937 and a weather radar composite image (right).

About 2043, the helicopter made a series of left and right track changes (figure 2), then during the last 25 seconds of the flight, when the helicopter was at 1,650 ft above mean sea level , it entered a rapidly descending right turn where the vertical speed decreased steadily from level flight to a nearly 4,000 ft per minute descent; at 2046, the ADS-B signal was lost. The helicopter collided with trees and hilly terrain at an elevation of 570 ft. A witness south of the accident site reported hearing a low-flying helicopter and stated that at the time it was “very rainy.”

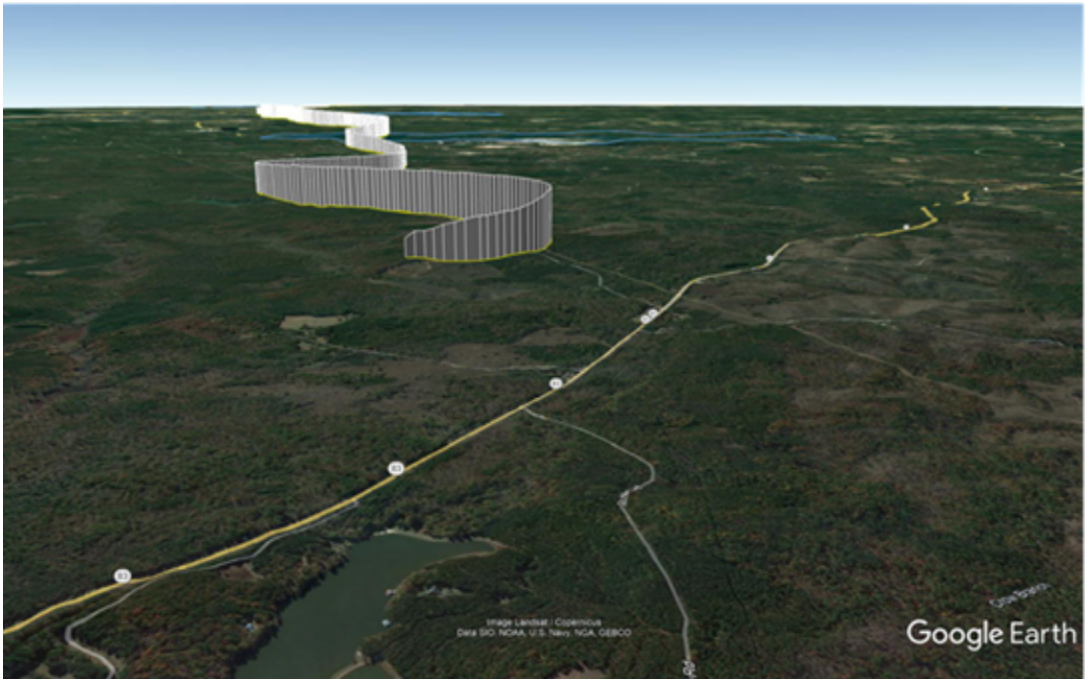

Figure 2 - Orthographic image of helicopter flight path (white overlay), looking south.

An additional background witness, who was also the mechanic and a helicopter pilot, stated that the operator, Atlanta Helicopters Inc, used a Robinson R-44 for charter operations, and at the time of the flight, that helicopter was down for maintenance. The owner had used the "new" R-66 for the accident flight. The owner had acquired the helicopter several months before. The witness further stated that the pilot-rated passenger was a relatively "low time" helicopter pilot with several hundred hours and likely accompanying the pilot to get some extra turbine flight experience.

AIRCRAFT INFORMATION

The helicopter was equipped with a Garmin GDU 1060L 10-inch display and a GTN 750xi with GPS Navigation and Com; the Garmin GDU 1060L was a 10.6" horizontal format display that could accommodate Primary Flight Display (PFD) information and a multifunction display (MFD) side by side within the same unit. The display was pilot-selectable for PFD or PFD/MFD presentation, and was equipped with Helicopter Synthetic Vision, which would create a graphic display of the terrain in front of the helicopter based on a geographic database. It was driven by the Garmin GTN 750xi GPS/NAV/COMM/MFD, which performed the basic functions of GPS and VOR navigation, as well as a communication radio. The combination of the two components could display maps, weather, traffic, airport information, and synthesized terrain in various configurations.

In addition, a HeliSAS autopilot was installed. The HeliSAS autopilot system in the accident helicopter was primarily a Stability Augmentation System (SAS), which would maintain a steady helicopter attitude by applying corrective inputs to the cyclic. The autopilot would not

provide any collective or pedal inputs. Additional modes of operation could provide heading hold, altitude hold, and navigation functionality. Control inputs from the autopilot system were felt as a light cyclic centering force. The autopilot sensed helicopter attitude using a combination of sensors in the flight control computer and the onboard attitude source. The computer then sent signals to the servomotors which were connected to the bottom of the cyclic in the control tunnel.

The helicopter was not certified for operation under instrument flight rules and was only certified for day/night visual flight rules operation.

According to the operator's operations specifications (D085) section a. "The certificate holder is authorized to conduct operations under 14 CFR Part 135 using the aircraft identified on this operations specification," registration number N206TJ, which was a Robinson R-44-II.

METEROLOGICAL INFORMATION

The recorded weather conditions at Covington Municipal Airport (CVC), Atlanta, Georgia, located about 27 miles north of the accident site at an elevation of 820 ft included, wind from 090° at 5 knots, 5 statute miles visibility, moderate rain, scattered clouds at 500 ft, broken 2,300 ft, and overcast at 11,000 ft, temperature 20° C, dewpoint 20° C; and an altimeter setting of 30.02 inches of mercury.

The recorded weather conditions at Thomaston-Upson County Airport (OPN), Thomaston, GA, about 28 miles southwest of the accident site at an elevation of 798 ft included wind from 070° at 4 knots, 10 statute miles visibility, moderate drizzle, overcast 500 ft, temperature 21° C, dewpoint 21° C, and an altimeter setting of 30.00 inches of mercury.

The recorded weather conditions at Middle Georgia Regional Airport (MCN), Macon, GA, located about 28 miles south of the accident site at an elevation of 354 ft included wind from 060° at 7 knots, 10 statute miles visibility, light rain, few clouds 4,500 ft, broken clouds 8,500 ft, overcast 9,000 ft, temperature 22° C, dewpoint 22° C, and an altimeter setting of 29.97 inches of mercury.

The closest National Weather Service (NWS) Weather Surveillance Doppler Radar (WSR-88D) was located at Atlanta Regional Airport-Falcon Field (FFC) Atlanta, Georgia about 42 miles north-northwest of the accident site. The FFC 0.5° base reflectivity image for 2047 with the flight track overlaid is included as figure 3. The base reflectivity inset image depicted echoes of 20 to 37 dBZ along the flight track, and the accident site located about 4 miles from an isolated cell with maximum echo intensity of 53 dBZ. The echo was moving northward at a velocity of around 15 knots. No lightning was depicted with the echo or within 25 miles of the accident site between 2000 and 2100.

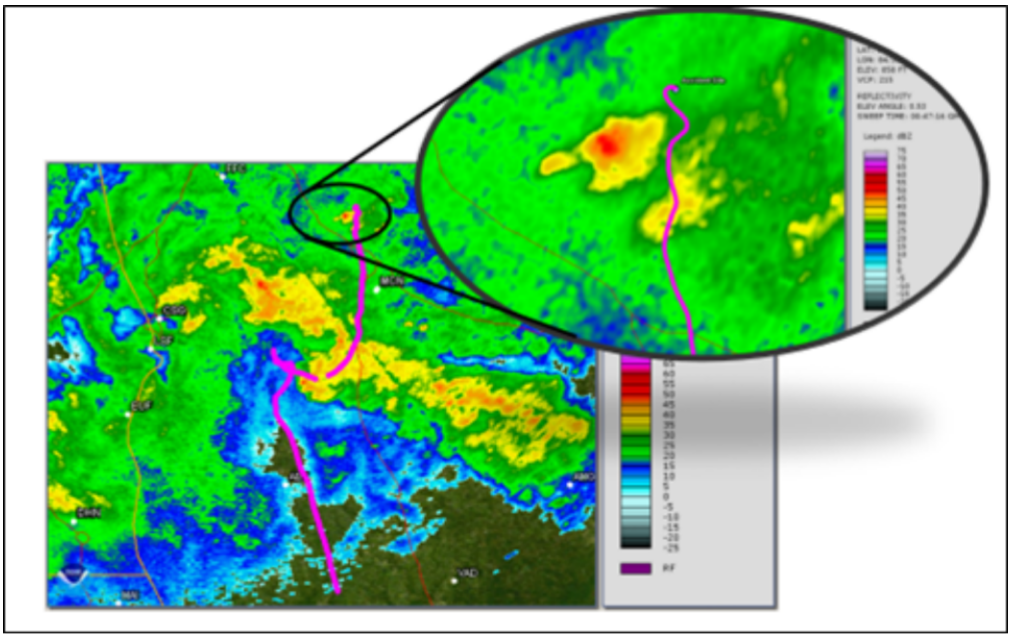

Figure 3 - Doppler radar base reflectivity image for 2047 with flight track overlaid (magenta).

The MCN terminal aerodrome forecast (TAF) current at the time of departure was an amended forecast issued at 1550. The forecast period from 1800 through 0100 on September 16 expected marginal visual flight rules (MVFR) conditions to prevail, with wind from 070° at 5 knots, visibility 6 miles in light rain and mist, ceiling broken at 1,500 ft above ground level (agl). Instrument meteorological conditions were forecast at MCN after 0100 on September 16th. The next scheduled TAF was issued at 1923 and was current at the time of the accident.

The MCN TAF continued to expect MVFR conditions to prevail with wind variable at 5 knots, visibility 6 miles or more in moderate rain, ceiling broken at 2,500 ft agl, and overcast at 10,000 ft. During a temporary period between 2000 and 2200, a of visibility 4 miles in mist, scattered clouds at 900 ft agl, and ceiling broken at 2,500 ft agl.

The United States Naval Observatory's documented the astronomical conditions for the accident site coordinates, on the day of the accident. The sunset was at 1941 and the end of civil twilight was at 2005, 41 minutes before the accident. Moonrise was at 1633. At the time of the accident the sun was approximately -15° below the horizon at an azimuth of 282°, and the moon was 29° above the horizon at an azimuth of 168°, with the phase a waxing gibbous with 73% of the moon's disk illuminated.

No flight plan had been filed and there was no record found indicating that the pilot received a preflight weather briefing; however, it could not be determined if the pilot obtained weather information using other sources.

WRECKAGE AND IMPACT INFORMATION

The helicopter entered the trees on a heading of about 145°. It impacted the trees at a steep downward, right bank angle based on damage to surrounding trees before impacting the

terrain, which left a 2-ft deep by 6-ft-wide crater. Several trees contained vertical and horizontal branch removal and the bark was scraped from trees prior to the primary impact point. The debris field extended for approximately 150 ft along a generally southeasterly path through the densely wooded and hilly terrain. All major components of the helicopter were located within the area. Smaller debris was widely scattered along the debris field in a fan-like pattern.

During the impact, a 24-inch tip of 1 main rotor blade separated and was found about 75 ft from the main wreckage. The main rotor blades were impact-damaged but remained attached to the hub at their respective positions. The transmission and mast separated from the fuselage. The cockpit and cabin were severely damaged by impact forces and postimpact fire. The main rotor gearbox was separated from the airframe. The mast fairing remained attached to the main rotor mast and was heavily distorted on the leading edge. The aft bulkhead casting was fractured, and the empennage was detached from both the tail cone and the tail rotor gearbox. The main rotor gearbox was broken open and the tail rotor output gear nose bearing housing was broken loose. Amber colored oil was visible in places in the gearbox. Rotation of the input shaft produced movement of the tail rotor output shaft and the main rotor shaft, but movement was limited due to the fractured housing, internal damage, and a bend in the main rotor driveshaft. There were broken tree branches and pine needles inside the main rotor head, and pine needles in one blade's pitch change housing boot. There was very slight scoring on the main rotor hub just inboard of the pitch change housing.

The main rotor gearbox output flex coupling was mostly intact, but the fan shaft was separated at the yoke. The tail rotor driveshaft hanger bearing had been exposed to fire, was detached from the tail cone, and the bearing rotated with a ratchet feel. The tail rotor driveshaft was separated in several places. The friction linkage was detached from the tail cone, and the friction at the pivots felt normal. The aft flex coupling appeared undamaged. The tail rotor gearbox was detached from the aft tail cone casting/bulkhead. The tail rotor gearbox was intact and free to rotate at least one full turn and contained amber oil. The tail rotor output shaft and hub appeared to be undamaged. The tail rotor blades were largely intact and had some minor damage and bending.

The flight control system was severely damaged by fire and impact forces and continuity was traced through breaks and the control tubes that could be identified. There was no evidence of pre-impact failures or malfunctions to the control system.

The engine monitoring unit (EMU) was located in the wreckage. It had been exposed to post crash fire and the internal board and components were melted or reduced to ash. No data from the EMU could be retrieved.

The engine remained within the general wreckage of the engine bay and had been exposed to a postimpact fire. The engine exhaust cowling was crushed tightly around the engine. Hand rotation of the compressor was smooth but did not result in rotation of the N1 drive train. Removal and examination of the compressor revealed signatures of engine operation during impact. The fuel spray nozzles exhibited normal carbon coating. All turbine blades were intact

and exhibited no evidence of leading-edge impact or thermal distress. Examination of the combustion chamber and gas generator turbine revealed no damage or anomalies. The accessory gearbox revealed no preimpact damage or anomaly. The engine controls were damaged by impact forces but revealed no other damage or anomaly; the control arms remained attached and moved freely.

There was no evidence of engine fire, failure, or malfunction prior to impact. All evidence found was consistent with normal engine operation. Examination of the recovered airframe, flight control system components, transmission, rotor system and engine revealed no preimpact mechanical malfunctions or anomalies that would have precluded normal operation.

MEDICAL AND PATHOLOGICAL INFORMATION

The Georgia Bureau of Investigation, Division of Forensic Sciences performed an autopsy of the pilot's remains. According to the autopsy report, the cause of death was multiple generalized blunt impact injuries, and the manner of death was accident.

The FAA Forensic Sciences Laboratory performed toxicological testing of postmortem specimens from the pilot. Ethanol was detected at 0.019 g/dL in muscle tissue but was not detected in kidney tissue. No other drugs were detected in muscle. No blood was available for testing.

ADDITIONAL INFORMATION

According to FAA Advisory Circular 60-4A, "Pilot's Spatial Disorientation," Surface references and the natural horizon may at times become obscured, although visibility may be above visual flight rule minimums. Lack of natural horizon or surface reference is common on overwater flights, at night, and especially at night in extremely sparsely populated areas or in low-visibility conditions. A sloping cloud formation, an obscured horizon, a dark scene spread with ground lights and stars, and certain geometric patterns of ground lights can provide inaccurate visual information for aligning the aircraft correctly with the actual horizon. The disoriented pilot may place the aircraft in a dangerous attitude.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	42,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	5-point
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Helicopter; Instrument helicopter	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	October 2, 2020
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 3, 2021
Flight Time:	(Estimated) 6000 hours (Total, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Pilot-rated passenger Information

Certificate:	Commercial	**Age:**	46,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	5-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	December 8, 2020
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 383 hours (Total, all aircraft)		

Passenger Information

Certificate:		**Age:**	40,Male
Airplane Rating(s):		**Seat Occupied:**	Rear
Other Aircraft Rating(s):		**Restraint Used:**	Unknown
Instrument Rating(s):		**Second Pilot Present:**	Yes
Instructor Rating(s):		**Toxicology Performed:**	
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	ROBINSON HELICOPTER CO	**Registration:**	N888DV
Model/Series:	R66	**Aircraft Category:**	Helicopter
Year of Manufacture:	2020	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	1000
Landing Gear Type:	Skid	**Seats:**	5
Date/Type of Last Inspection:	July 23, 2021 Annual	**Certified Max Gross Wt.:**	2600 lbs
Time Since Last Inspection:		**Engines:**	1 Turbo shaft
Airframe Total Time:	201.52 Hrs as of last inspection	**Engine Manufacturer:**	Rolls Royce
ELT:	C126 installed, activated, aided in locating accident	**Engine Model/Series:**	RR300-A1
Registered Owner:	Atlanta Helicopters	**Rated Power:**	300 Horsepower
Operator:	Atlanta Helicopters LLC	**Operating Certificate(s) Held:**	On-demand air taxi (135)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	6A2,959 ft msl	**Distance from Accident Site:**	26 Nautical Miles
Observation Time:	20:35 Local	**Direction from Accident Site:**	277°
Lowest Cloud Condition:		**Visibility**	7 miles
Lowest Ceiling:	Broken / 300 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	50°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	20°C / 20°C
Precipitation and Obscuration:			
Departure Point:	Thomasville, GA (TVI)	**Type of Flight Plan Filed:**	None
Destination:	Atlanta, GA (FTY)	**Type of Clearance:**	None
Departure Time:	18:40 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	2 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	33.176346,-83.769253

Preventing Similar Accidents

Reduced Visual References Require Vigilance (SA-020)

The Problem

About two-thirds of general aviation accidents that occur in reduced visibility weather conditions are fatal. The accidents can involve pilot spatial disorientation or controlled flight into terrain. Even in visual weather conditions, flights at night over areas with limited ground lighting (which provides few visual ground references) can be challenging.

What can you do?

- Obtain an official preflight weather briefing, and use all appropriate sources of weather information to make timely in-flight decisions. Other weather sources and in-cockpit weather equipment can supplement official information.
- Refuse to allow external pressures, such as the desire to save time or money or the fear of disappointing passengers, to influence you to attempt or continue a flight in conditions in which you are not comfortable.
- Be honest with yourself about your skill limitations. Plan ahead with cancellation or diversion alternatives. Brief passengers about the alternatives before the flight.
- Seek training to ensure that you are proficient and fully understand the features and limitations of the equipment in your aircraft, particularly how to use all features of the avionics, autopilot systems, and weather information resources.

- Don’t allow a situation to become dangerous before deciding to act. Be honest with air traffic controllers about your situation, and explain it to them if you need help.
- Remember that, when flying at night, even visual weather conditions can be challenging. Remote areas with limited ground lighting provide limited visual references cues for pilots, which can be disorienting or render rising terrain visually imperceptible. When planning a night VFR flight, use topographic references to familiarize yourself with surrounding terrain. Consider following instrument procedures if you are instrument rated or avoiding areas with limited ground lighting (such as remote or mountainous areas) if you are not.
- Manage distractions: Many accidents result when a pilot is distracted momentarily from the primary task of flying.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-020.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Mccarter, Lawrence
Additional Participating Persons:	John Pless; FAA/FSDO; Atlanta, GA Jack Johnson; Rolls Royce; Indianapolis, IN Ken Martin; Robinson Helicopters; CA
Original Publish Date:	August 15, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=103882