Aviation Investigation Final Report

Location:	Brainerd, Minnesota	**Accident Number:**	CEN19FA185
Date & Time:	June 28, 2019, 00:40 Local	**Registration:**	N11NM
Aircraft:	Agusta A109	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal, 1 Serious
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled - Air Medical (Discretionary)		

Analysis

The crew of the helicopter air ambulance flight was approaching the airport for landing in dark night instrument meteorological conditions (IMC) after delivering a patient to the hospital. The reported weather conditions about the time the pilot initiated the instrument landing system (ILS) approach included 1/2-mile visibility with haze, which then deteriorated to 1/4 mile, which was within the operator's approved visibility approach minimums. The paramedic onboard reported that he saw the runway environment through a thin layer of fog as the helicopter descended toward the decision height (DH) of 200 ft above ground level during the approach.

After descending below the DH, with a power setting below 30% torque, the helicopter's pitch attitude increased from -3° (nose-down) to +20° (nose-up), its airspeed decreased from 100 to 50 knots, and the pilot declared a missed approach, likely due to a loss of visual contact with the runway environment. The pilot's increased collective input and the helicopter's decreasing airspeed resulted in an increase in torque, and the helicopter entered a right rotational yaw that accelerated into a spin. The helicopter subsequently impacted terrain near the runway.

The dark night conditions at the rural airport resulted in little to no visual references during the pilot's transition to landing and the attempted missed approach. It is likely that the pilot became spatially disoriented, which led to the excessive pitch attitude, slow airspeed, his failure to recognize and arrest the right yaw, and the subsequent loss of control.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's spatial disorientation during an instrument approach in dark night instrument meteorological conditions, which resulted in a loss of control and subsequent impact with terrain.

Findings

Personnel issues	Spatial disorientation - Pilot
Personnel issues	Aircraft control - Pilot
Environmental issues	Dark - Effect on operation
Environmental issues	Fog - Effect on operation
Aircraft	Airspeed - Not attained/maintained

Factual Information

History of Flight

Approach-IFR missed approach	Loss of control in flight (Defining event)

On June 28, 2019, about 0040 central daylight time, an Agusta Spa A109S helicopter, N11NM, was substantially damaged when it was involved in an accident at Brainerd Lakes Regional Airport (BRD), near Brainerd Lakes, Minnesota. The pilot and flight nurse were fatally injured, and the flight paramedic was seriously injured. The helicopter was operated by North Memorial Healthcare as a Title 14 C*ode of Federal Regulations* Part 135 helicopter air ambulance flight.

The flight was returning to BRD after delivering a patient to North Memorial Heliport (MY77), Robbinsdale, Minnesota. An onboard Appareo Vision 1000 device recorded flight data, cockpit imagery, and audio of the flight. The helicopter departed MY77 at 2348, and the pilot received an instrument flight rules clearance from air traffic control (ATC) to climb to 6,000 ft mean sea level (msl) and fly direct to BRD.

At 2356, while holding an iPad, the pilot stated on intercom to the paramedic and/or flight nurse that visibility at BRD was "1 mile, looks good." The pilot requested the instrument landing system runway 23 (ILS RWY 23) approach and informed the controller that he had obtained the current weather at BRD.

At 0028, the pilot selected the BRD automated surface observing system (ASOS) frequency. The ASOS transmission included a ceiling of 200 ft above ground level (agl) and 1/4-mile visibility with fog. The controller cleared the helicopter for the ILS RWY 23 approach. Shortly thereafter, the ASOS-transmitted weather included 1/2-mile visibility with haze, and the pilot stated "awesome, 1/2 we're legal" on the intercom. The pilot subsequently activated the runway lights.

At 0034:35, the helicopter began a descent on the ILS glideslope with the autopilot coupled. About 5 seconds later, the pilot appeared to turn on the helicopter's landing light and/or search light.

At 0036:30, the helicopter passed the final approach fix (5.3 miles from Runway 23) at 93 knots.

At 0036:37, the ASOS-transmitted weather included 1/4-mile visibility with haze and a sky condition of 200 ft vertical visibility.

After arriving at the ILS decision height, the pilot selected the altitude hold mode on the flight director and about 1 second later, decoupled the autopilot (pitch and roll steering modes). The radar altimeter read 130 ft agl. Over the next 14 seconds, with a power setting below 30% torque, the helicopter's pitch increased from -3° (nose-down) to +20° (nose-up) and the radar altimeter increased to 230 ft agl. As airspeed decreased below 50 knots, the pilot selected vertical speed, and heading modes on the flight director. The helicopter's power increased rapidly through 40% torque and the airspeed decreased

through 25 knots. Based on a GPS groundspeed of 40 knots, the airborne tailwind was about 15 knots.

At 0039:38, the pilot announced a go-around. The helicopter's power increased past 80% torque, and the airspeed was 0 knots. The flight instruments indicated that the helicopter had entered a right rotational yaw and the radar altimeter read 300 ft agl. The helicopter's right yaw continued to increase; the power setting rose above 110% torque and the airspeed remained near 0 knots.

The last recorded information, at 0039:57, indicated that the helicopter was about 100 ft agl. The power setting was below 30% torque and the pilot had selected the "ALT" (altitude hold) button on the flight director.

Recorded images of the approach and attempted go-around did not provide a view of the runway environment or weather conditions.

Following the accident, the flight paramedic (seated in the left forward seat) recalled that the runway lights and surface were visible below a thin fog layer during the approach. As the helicopter approached the runway, he noticed clouds to the side and recalled the pilot stating that the weather conditions were foggy and that a go-around was needed. The helicopter subsequently spun to the right and impacted the ground.

Pilot Information

Certificate:	Commercial	**Age:**	44,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
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:**	January 10, 2019
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	March 12, 2019
Flight Time:	3376 hours (Total, all aircraft), 533 hours (Total, this make and model), 2294 hours (Pilot In Command, all aircraft), 38 hours (Last 90 days, all aircraft), 11 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

Passenger Information

Certificate:	None	**Age:**	58,Female
Airplane Rating(s):	None	**Seat Occupied:**	Rear
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	None	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Passenger Information

Certificate:	None	**Age:**	42,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	None	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

The pilot's most recent Part 135 competency/proficiency check occurred on March 12, 2019. During the 90 days before the accident, the pilot logged 27 landings at night, 16 instrument approaches, 1 flight hour of actual instrument time, and 57 hours of simulated instrument time. The pilot's total actual instrument time flown was 41 hours.

Aircraft and Owner/Operator Information

Aircraft Make:	Agusta	**Registration:**	N11NM
Model/Series:	A109 S	**Aircraft Category:**	Helicopter
Year of Manufacture:	2008	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	22075
Landing Gear Type:	Retractable - Tricycle	**Seats:**	5
Date/Type of Last Inspection:	June 18, 2019 AAIP	**Certified Max Gross Wt.:**	7000 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo shaft
Airframe Total Time:	2723 Hrs at time of accident	**Engine Manufacturer:**	Pratt & Whitney Canada
ELT:	Not installed	**Engine Model/Series:**	PW207C
Registered Owner:	North Memorial Healthcare	**Rated Power:**	750 Horsepower
Operator:	North Memorial Healthcare	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	S6GA

The helicopter was equipped with a 2-axis autopilot for lateral (roll) and longitudinal (pitch) control. The autopilot provided for limited yaw dampening, but no yaw control. Minimum airspeed to comply with IFR handling quality requirements for the helicopter was 55 knots.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	KBRD,1221 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	00:18 Local	**Direction from Accident Site:**	312°
Lowest Cloud Condition:	Unknown	**Visibility**	0.25 miles
Lowest Ceiling:	Broken / 200 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	50°	**Turbulence Severity Forecast/Actual:**	N/A / Light
Altimeter Setting:	30.07 inches Hg	**Temperature/Dew Point:**	19°C / 16°C
Precipitation and Obscuration:	Moderate - None - Haze		
Departure Point:	Robbinsdale, MN (MY77)	**Type of Flight Plan Filed:**	IFR
Destination:	Brainerd, MN (BRD)	**Type of Clearance:**	IFR
Departure Time:	23:48 Local	**Type of Airspace:**	Class E

BRD was located in a rural area with few ground lights, and there was no moon illumination at the time of the accident. Airport personnel stated that several lakes near BRD would often generate patchy fog

and visibility could vary significantly at different locations on the airport.

The BRD ASOS was located about 600 ft left of runway 23 and about 1,200 ft from the runway threshold. BRD did not have equipment to measure runway visual range (RVR) for the touchdown zone.

At the time of the accident, the ASOS reported wind from 040° at 5 knots, 1/4 statute mile visibility, haze, vertical visibility of 200 ft agl, temperature of 19°C and a dew point temperature of 17°C.

The terminal aerodrome forecast (TAF) valid for BRD about the accident time included wind from 020° at 4 knots, 1 1/2 statute miles visibility, haze, and a clear sky. An AIRMET advisory for instrument flight rules (IFR) conditions was valid at the accident time.

Airport Information

Airport:	Brainerd Lakes Rgnl BRD	**Runway Surface Type:**	Concrete
Airport Elevation:	1232 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	23	**IFR Approach:**	ILS
Runway Length/Width:	6512 ft / 150 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	2 Fatal, 1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 Fatal, 1 Serious	**Latitude, Longitude:**	46.403331,-94.128334

The helicopter impacted a grassy area south of runway 23 and came to rest upright and nearly intact on a heading of 074°. The main fuselage and tail boom exhibited crushing consistent with a high-velocity vertical descent and impact. (See Figure 1.) The helicopter was upright and nearly intact, with no movement from the initial impact point. There was no evidence of a postcrash fire. The ground adjacent to the wreckage was soaked with fuel and the smell of fuel was present at the accident site.

Figure 1. View of Helicopter at Accident Site

Examination of the helicopter and review of recorded flight information revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.

Medical and Pathological Information

An autopsy was performed on the pilot and flight nurse by the Ramsey County Medical Examiner, St. Paul, Minnesota. The cause of death was multiple traumatic injuries.

The Federal Aviation Administration (FAA) Forensic Sciences Laboratory performed toxicological testing on the pilot. The tests were negative for all screened-for drugs, carbon monoxide, and alcohol.

Survival Aspects

The FAA Civil Aerospace Medical Institute (CAMI) reviewed the helicopter's seats, restraints, and helmet specifications and the effects of the impact with terrain at a high vertical velocity. No anomalies were noted.

The operator's communication center first attempted radio contact with the helicopter crew about 15 minutes after the accident and the paramedic made a mayday radio transmission about 22 minutes after the accident. Emergency response personnel located the helicopter about 41 minutes after the accident. The low-visibility weather conditions contributed to the delayed arrival of first responders.

The FAA did not require that the operator have an operational control center (OCC). Following the accident, the operator made communication center training and process improvements, including timely identification of an aircraft potentially in distress.

Additional Information

Spatial Disorientation

The FAA's Airplane Flying Handbook (FAA-H-8083-3B) describes some hazards associated with flying when the ground or horizon are obscured. The handbook states, in part, the following:

The vestibular sense (motion sensing by the inner ear) in particular can and will confuse the pilot. Because of inertia, the sensory areas of the inner ear cannot detect slight changes in airplane attitude, nor can they accurately sense attitude changes that occur at a uniform rate over a period of time. On the other hand, false sensations are often generated, leading the pilot to believe the attitude of the airplane has changed when, in fact, it has not. These false sensations result in the pilot experiencing spatial disorientation.

FAA Instrument Approach Guidance

FAA guidance for helicopter instrument approaches allows a reduction of the Category A visibility by half, but in no case less than 1⁄4 statute mile or 1,200 ft runway visual range (RVR). The approach can be initiated at any speed up to the highest approach category authorized; however, the speed on the final approach segment must be reduced to the Category A speed of less than 90 knots before the missed approach point in order to apply the visibility reduction.

Operator Training and Guidance

The operator's flight training and currency programs were all conducted inflight, as the only A109

simulator was based in Italy. Following a September 2016 accident that involved a loss of control during a missed approach in night IMC conditions, the operator started construction of a flight training device (FTD) for instrument procedures using an actual A109S cockpit. The FTD was not yet certified or in use at the time of the accident.

Following the accident, the operator increased the minimum weather conditions required for their pilots to conduct an instrument approach to a cloud ceiling of 400 ft agl and 1 mile visibility.

Administrative Information

Investigator In Charge (IIC):	Folkerts, Michael
Additional Participating Persons:	Edward Martin; Flight Standards District Office; Minneapolis, MN Scott Tyrrell; FAA Rotorcraft Standards Branch; Fort Worth, TX Joshua Jones; North Memorial Health; Crystal, MN Marc Hamilton; Transportation Safety Board of Canada; Ottawa Mikael Amura; Italian Civil Aviation Authority; San Marino
Original Publish Date:	November 19, 2020
Last Revision Date:	
Investigation Class:	Class 2
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=99715