Aviation Investigation Final Report

Location:	Carthage, Illinois	**Accident Number:**	CEN23LA350
Date & Time:	August 6, 2023, 01:07 Local	**Registration:**	N288AE
Aircraft:	Bell 206	**Aircraft Damage:**	Substantial
Defining Event:	Collision during takeoff/land	**Injuries:**	3 None
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled - Air Medical (Medical emergency)		

Analysis

The air medical helicopter was dispatched to a remote area to pick up a patient in night visual meteorological conditions. While enroute, the aircrew received received a landing zone (LZ) brief that included information that a wire fence was located on the south side of the road.

Upon approach to the LZ, the pilot and the flight nurse transitioned to and used night vision goggles (NVGs). The pilot performed both high and low reconnaissance and the aircrew verified that there were no poles or wires present. The flight nurse reported that she observed the fence on the south side of the road during this time; however, she thought the fence was farther away than it was.

The pilot maneuvered the helicopter to a 10-ft hover over the road; the aircrew identified the wire fence on the south side of the road and noted that there were ditches on both sides of the road. The pilot initiated a right pedal turn and he planned to land so that the cabin door was oriented toward the accident scene. As the helicopter touched down, the pilot heard a “pop” noise and he felt feedback in the tail rotor pedals. The pilot realized the tail rotor system impacted the wire fence; he lowered the collective immediately and performed an emergency shutdown. The helicopter sustained substantial damage to the vertical stabilizer, the tail boom, the tail rotor driveshaft, and the two tail rotor blades.

At the time of the accident, the moon was bright with 73% of its disk illuminated and it was at a relative angle of 25° above the horizon. According to NVG training references, terrain interpretation is generally more difficult when the moon is low on the horizon due to the lower light level and the shadows caused by the low angle. is the pilot likely had difficulty viewing the fence while using NVGs due to the lower light level and the presence of shadows.

It is likely that, during the landing, the aircrew misjudged the distance of the wire fence due to the reduced distance estimation and depth perception while using NVGs.

Probable Cause and Findings

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

A collision with a fence during landing due to the crew's reduced distance estimation and depth perception while using night vision goggles. Contributing to the accident was the low moon angle, which made viewing the fence more challenging.

Findings

Personnel issues	Perception - Pilot
Personnel issues	Monitoring environment - Pilot
Personnel issues	Identification/recognition - Pilot
Environmental issues	Fence/fence post - Effect on equipment
Environmental issues	Fence/fence post - Awareness of condition
Environmental issues	Fence/fence post - Contributed to outcome
Environmental issues	Dark - Effect on operation

Factual Information

History of Flight

Landing	Off-field or emergency landing
Landing	Collision during takeoff/land (Defining event)
Post-impact	Evacuation

On August 6, 2023, about 0107 central daylight time, a Bell 206 L-3 helicopter, N288AE, sustained substantial damage when it was involved in an accident near Carthage, Illinois. The pilot, the flight nurse, and the flight medic were not injured. The helicopter was operated as a Title 14 *Code of Federal Regulations (CFR)* Part 135 air ambulance flight.

The crew (consisting of the pilot in the front right seat, the flight nurse in the rear left seat, and the flight medic in the rear right seat) were dispatched to pick up a patient from a remote area. The pilot completed the flight risk assessment just before the flight, with a low risk score, and accepted the flight. The operator's operations control specialist also reviewed and acknowledged the completed flight risk assessment.

The helicopter departed from the Southeast Iowa Regional Medical Center, Fort Madison, Iowa, at 0051. While enroute, the aircrew received an LZ brief that included information that the intended LZ was an east-to-west running dirt and gravel road with no wires; a wire fence was located on the south side of the road and corn fields were on the north and south sides of the road. Night visual meteorological conditions prevailed at the LZ and marking lights were placed on it. All of the helicopter's external light sources were on for the approach and the landing.

Upon approach to the LZ, the pilot and the flight nurse transitioned to and used NVGs. The flight medic was unaided and was not using NVGs. The pilot used the NVG-compatible searchlight to aid in scanning the LZ and the surrounding area for obstacles. The helicopter approached the LZ from the northwest and performed a high reconnaissance about 700 ft agl in a left orbit, confirming the LZ brief received from the fire department. The helicopter approached the LZ from north to south, perpendicular to the road. During the descent the aircrew performed a low reconnaissance, verified that there were no poles or wires present, and established visual contact with the fire department. The flight nurse reported that she observed the fence on the south side of the road during this time; however, she thought fence was farther away than it was.

The pilot maneuvered the helicopter to a hover about 10 ft over the road; the aircrew identified the wire fence on the south side of the road and noted that there were ditches on both sides of the road. The pilot initiated a right-pedal turn and he planned to land so the cabin door was

oriented toward the accident scene. This intended landing position would also provide visual contact with the fire department personnel entering and departing under the main rotor system and aid in patient loading.

The heading of the helicopter was 310° when the pilot initiated the descent toward the road. As the helicopter touched down, the pilot heard a "pop" and felt feedback in the tail rotor pedals. The pilot realized the tail rotor system impacted the wire fence; he lowered the collective immediately and performed an emergency shutdown. The helicopter came to rest upright on a heading of about 360°, perpendicular to the road and not the intended landing direction. The three aircrew members egressed the helicopter without further incident. The helicopter sustained substantial damage to the vertical stabilizer, tail boom, tail rotor driveshaft, and two tail rotor blades.

At the time of the accident the moon was at a relative angle of 25° above the horizon and at an azimuth of 106°, with 73% of its disk illuminated. The moon had risen at 2311 on the previous day and set at 1155 on the accident day. The operator's risk assessment program did not include information about moon altitude and brightness; however, this data is captured and analyzed on the operator's daily crew briefing form.

The operator reported there were no preimpact mechanical malfunctions or failures with the airframe or engine that would have precluded normal operation.

The operator's 14 *CFR* Part 135 NVG training program included information about moon angle, distance estimation, and depth perception. However, it did not include information about shadows, construction, terrain density, and vegetation. After the accident and at the suggestion of the NTSB investigator-in-charge, the operator updated their 14 *CFR* Part 135 NVG training program to include these additional areas regarding terrain interpretation.

While not a required training reference for civilian aircrews, the U.S. Army has published Training Circular 3-04.4 Fundamentals of Flight, released in July 2022. This document discusses various topics used in the U.S. Army NVG training program. This document discusses distance estimation and depth perception and states in part:

Distance estimation and depth perception are closely related. Distance estimation relates to determining distance to objects, while depth perception primarily refers to the relationship of objects to each other. The quality of both is affected by ambient light, type, and quality of NVG, degree of contrast in the field of view, and viewer's experience utilizing monocular cues. Objects tend to appear further away than they actually are.

Reduction in visual acuity negatively influences distance estimation because we expect objects that are less distinct in detail to be farther than ones that possess sharp detail.

This document further discusses moon angle when using NVGs and states in part:

Moon angle has the same effect as the angle of the sun regarding ambient light levels. The position of the moon should be considered during each phase of aviation operations. However, the angle of the moon would have the most impact of LZ selection and landing direction.

A low-angle moon may be beneficial in areas with little terrain relief. Terrain interpretation is generally more difficult when the moon is low on the horizon. This is due to the lower light level and the shadows caused by the low angle. However, when the moon is low on the horizon, terrain features or objects on the skyline may be more recognizable.

The Federal Aviation Administration does not provide reference material for NVG operations for the public regarding topics such as NVG operating characteristics, terrain interpretation, and operational considerations.

Pilot Information

Certificate:	Commercial	**Age:**	54,Male
Airplane Rating(s):	Single-engine land	**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 With waivers/limitations	**Last FAA Medical Exam:**	February 10, 2023
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	October 10, 2022
Flight Time:	(Estimated) 4142 hours (Total, all aircraft), 3324 hours (Total, this make and model), 3925 hours (Pilot In Command, all aircraft), 66.5 hours (Last 90 days, all aircraft), 18.6 hours (Last 30 days, all aircraft), 3.3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N288AE
Model/Series:	206 L3	**Aircraft Category:**	Helicopter
Year of Manufacture:	1989	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	51327
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	July 22, 2023 AAIP	**Certified Max Gross Wt.:**	4450 lbs
Time Since Last Inspection:	22.9 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	17364.5 Hrs at time of accident	**Engine Manufacturer:**	Allison
ELT:	C126 installed, not activated	**Engine Model/Series:**	250-C30
Registered Owner:	Air Evac EMS, Inc.	**Rated Power:**	650 Horsepower
Operator:	Air Evac EMS, Inc.	**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:	Air Evac Lifeteam	**Operator Designator Code:**	EVCA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night/bright
Observation Facility, Elevation:	KEOK,671 ft msl	**Distance from Accident Site:**	18 Nautical Miles
Observation Time:	00:55 Local	**Direction from Accident Site:**	281°
Lowest Cloud Condition:	Few / 4500 ft AGL	**Visibility**	8 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:		**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.93 inches Hg	**Temperature/Dew Point:**	19°C / 19°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Fort Madison, IA	**Type of Flight Plan Filed:**	Company VFR
Destination:	Carthage, IL	**Type of Clearance:**	None
Departure Time:	00:51 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	3 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	N/A	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	40.370691,-91.052192(est)

Administrative Information

Investigator In Charge (IIC):	Hodges, Michael
Additional Participating Persons:	Alex Taylor; FAA Springfield FSDO; Springfield, IL Helen Tsai (Accredited Representative); Transportation Safety Board of Canada; Gatineau, OF Gary Howe (Technical Advisor); Bell Flight; Fort Worth, TX Tony Bonham; Air Evac Lifeteam; O'Fallon, MO
Original Publish Date:	June 5, 2024
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=192809