Aviation Investigation Final Report

Location:	Mosby, Montana	**Accident Number:**	WPR19LA194
Date & Time:	July 13, 2019, 14:30 Local	**Registration:**	N3078G
Aircraft:	Bell 47G 3B 1	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	2 Serious, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

The pilot had refueled the helicopter, bringing the total fuel on board to about 58 gallons, and departed with two passengers for a 15-mile flight to a private ranch. After arriving at the destination, the pilot circled the area and determined the wind direction. He established a normal approach path into the wind to land near a building. While about 30 to 40 feet above ground level, the helicopter entered an uncommanded yaw to the right. Despite the pilot's control inputs, which included application of full left pedal, the helicopter continued to yaw to the right. The pilot attempted to recover and applied forward cyclic to gain airspeed to go-around. The helicopter continued to yaw right and ascended above the building as described by the two passengers and a witness located near the building. During the recovery attempt, the pilot recalled initially lowering the collective when the yaw first occurred, but did not recall raising or lowering it again. The pilot lost control of the helicopter, which subsequently impacted the ground in a silage pit about 250 feet north of the intended landing area.

An engine test run and airframe examination revealed no mechanical failures or malfunctions with the helicopter that would have precluded normal operation.

During the approach, the helicopter was operating in a high-power demand condition due to high density altitude, high gross weight, and while near the out-of-ground effect boundary and at a slow airspeed. These conditions reduced the amount of yaw control effectiveness available to counter an uncommanded right yaw. Additionally, the pilot's selected approach path placed the helicopter on the leeward side of a building and likely exposed the helicopter to disturbed air that disrupted the airflow entering the main rotor and tail rotor and initiated the uncommanded right yaw/loss of tail rotor effectiveness.

During the recovery attempt, the pilot likely increased the collective while applying full left pedal, which resulted in the ascent described by the passengers and witness. The added power

from the increased collective would also have resulted in an increased right yaw rate 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 failure to account for environmental conditions conducive to a loss of tail rotor effectiveness, which resulted in a loss of tail rotor effectiveness and subsequent loss of control. Contributing to the accident was the pilot's inappropriate application of power during the recovery.

Findings

Personnel issues	Aircraft control - Pilot
Aircraft	Prop/rotor parameters - Not attained/maintained
Personnel issues	Knowledge of meteorologic cond - Pilot

Factual Information

History of Flight

Landing	Loss of tail rotor effectiveness
Landing	Loss of control in flight (Defining event)
Landing	Collision with terr/obj (non-CFIT)

On July 13, 2019, about 1430 mountain daylight time, a Bell 47G-3B-1 helicopter, N3078G, was substantially damaged when it was involved in an accident near Mosby, Montana. The pilot and one passenger received serious injuries; one passenger received minor injuries. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 aerial observation flight.

Before departing on the 15-mile flight, the pilot fueled the helicopter, bringing the total fuel quantity to about 58 gallons. After arriving at the destination, the pilot circled the landing area to determine the wind conditions. Concluding that the wind was light and from the west, he entered a normal approach into the wind to land near the building where the helicopter would be stored following the flight. During the approach, the helicopter entered an uncommanded yaw to the right. Despite the pilot's control inputs, which included full left pedal application, the helicopter continued to yaw to the right. He attempted to recover by applying forward cyclic control to gain airspeed and then perform a go-around. The pilot recalled lowering the collective control when the event first started, but did not recall if he raised or lowered the collective control during the go-around attempt. He stated that the controls felt like they were ineffective and that the helicopter descended straight down and impacted the ground hard.

One passenger stated that the helicopter pitched from side to side and then the tail came around twice. He stated that the pilot tried to climb and as the helicopter was going up, it was still spinning. The other passenger recalled that they were approaching the building and the helicopter swung to the right and started to ascend above the building. A witness located near the building reported that the helicopter approached from the east and looked normal until it was about 30 to 40 ft above the ground. He said that the helicopter turned right, then left, and back to the right before it ascended and flew directly over his position. The witness photographed the helicopter as it began to yaw to the right. (see Figure 1.)

Figure 1. Photograph of the helicopter as it began the uncommanded right yaw. Photo courtesy of a witness.

The helicopter came to rest in a level attitude in a silage pit located about 250 ft north of the intended landing area, at an elevation of 2,856 ft above mean sea level (msl). All major components were found in the small debris area around the helicopter.

Postaccident examination of the airframe revealed no preaccident mechanical malfunctions or failures with the helicopter that would have precluded normal operation. The engine was examined and test run at a Rolls-Royce authorized service facility and operated normally, with no mechanical malfunctions or failures that would have precluded normal operation.

A review of the pilot's training records revealed that he had recorded about 1,092 hours of flight experience in reciprocating engine helicopters. According to the operator, after the pilot was hired, he began training to operate the turbine-powered Bell 47G-3B-1. He received 18 hours of ground instruction, 4 hours of flight training, and an additional 6 hours of solo flight time in the helicopter. He accrued an additional 15.5 flight hours during the aerial observation flights before the accident.

An automated weather reporting station located at Lewiston Municipal Airport, about 84 miles west of the accident site, reported wind from 080° at 7 knots, 10 statute miles visibility, clear sky condition, temperature 31°C, dew point temperature 12°C, and an altimeter setting of 30.00 inches of mercury. The calculated density altitude for the accident site about the time of the accident was about 5,406 ft msl.

A weather reporting station located about 5 miles northeast of the accident site reported wind from 160° at 7 knots, temperature 31°C, dewpoint temperature 15°C.

The Federal Aviation Administration Helicopter Flying Handbook (FAA-H-8083-21B) states the following regarding loss of tail rotor effectiveness (LTE), also referred to as "uncontrolled right yaw":

LTE is a condition that occurs when the flow of air through a tail rotor is altered in some way, by altering the angle or speed at which the air passes through the rotating blades of the tail rotor disk.

To help reduce the onset of LTE, follow these steps:

Avoid OGE [out of ground effect] *operations and high-power demand situations below airspeeds of 30 knots at low altitudes.*

A loss of translational lift results in an unexpected high-power demand and an increased antitorque requirement.

Be aware that if a considerable amount of left pedal is being maintained, a sufficient amount of left pedal may not be available to counteract an unanticipated right yaw.

Be alert to changing wind conditions, which may be experienced when flying along ridge lines and around buildings.

Recovery technique (Uncontrolled Right Yaw). If a sudden unanticipated right yaw occurs, the following recovery technique should be performed. Apply full left pedal. Simultaneously, apply forward cyclic control to increase speed. If altitude permits, reduce power… If the

rotation cannot be stopped and ground contact is imminent, an autorotation may be the best course of action.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	31,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	4-point
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	Helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	February 27, 2019
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 1125 hours (Total, all aircraft), 36 hours (Total, this make and model), 1037 hours (Pilot In Command, all aircraft)		

Passenger Information

Certificate:		**Age:**	Female
Airplane Rating(s):		**Seat Occupied:**	Center
Other Aircraft Rating(s):		**Restraint Used:**	4-point
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Passenger Information

Certificate:		**Age:**	Male
Airplane Rating(s):		**Seat Occupied:**	Right
Other Aircraft Rating(s):		**Restraint Used:**	4-point
Instrument Rating(s):		**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	No
Medical Certification:		**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N3078G
Model/Series:	47G 3B 1	**Aircraft Category:**	Helicopter
Year of Manufacture:	1964	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	2925
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	April 16, 2019 Annual	**Certified Max Gross Wt.:**	2950 lbs
Time Since Last Inspection:	450.9 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	7328.1 Hrs	**Engine Manufacturer:**	Rolls-Royce
ELT:	Installed, not activated	**Engine Model/Series:**	250-C20B
Registered Owner:	On file	**Rated Power:**	420 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	Rotorcraft external load (133), Commuter air carrier (135), Agricultural aircraft (137)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LWT,2854 ft msl	**Distance from Accident Site:**	5 Nautical Miles
Observation Time:	14:22 Local	**Direction from Accident Site:**	59°
Lowest Cloud Condition:	Unknown	**Visibility**	10 miles
Lowest Ceiling:	Unknown	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	160°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	31.1°C / 15°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Benzien, MT	**Type of Flight Plan Filed:**	Company VFR
Destination:	Mosby, MT	**Type of Clearance:**	None
Departure Time:	14:07 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Serious, 1 Minor	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	2 Serious, 1 Minor	**Latitude, Longitude:**	47.040832,-107.66055(est)

Administrative Information

Investigator In Charge (IIC):	Salazar, Fabian
Additional Participating Persons:	Luke Waters; Helena FSDO; Helena, MT Jon-Adam Michael; Rolls-Royse Corporation; Indianapolis, IN
Original Publish Date:	April 1, 2022
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=99890

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