Aviation Investigation Final Report

Location:	Balch Camp, California	**Accident Number:**	WPR23LA338
Date & Time:	September 10, 2023, 13:45 Local	**Registration:**	N873HL
Aircraft:	Bell 212	**Aircraft Damage:**	Destroyed
Defining Event:	Low altitude operation/event	**Injuries:**	1 Serious
Flight Conducted Under:	Part 133: Rotorcraft ext. load		

Analysis

The pilot was conducting aerial firefighting with a helicopter equipped with a water reservoir that, when released, would discharge a maximum of 375 gallons of water. The pilot had completed eight water drops at altitudes of 6,000 to 7,000 ft mean sea level (msl) before flying to an area with an elevation of about 8,000 ft msl. He first flew to the water reservoir, where he deployed the snorkel and activated the pump to fill the onboard water tank. The pilot was initially unable to open the water tank doors, but was subsequently successful after he cycled the tank power switch. He then reactivated the water pump and loaded water into the tank until he observed engine torque increase to about 75% - 78%, which equated to anywhere between 90-180 gallons of water. He then flew to and orbited the fire area, which was about 8,000 ft msl and surrounded by 100-ft-tall pine trees, and started his approach from a slightly higher elevation; however, he noticed that the helicopter required more power than normal to maintain altitude. When the pilot slowed the helicopter, he felt that he was still using more power than normally required and decided to jettison the water load. After two unsuccessful attempts to release the load by depressing the drop switch, he increased power and began a turn towards a meadow when he heard the low rotor rpm horn annunciate. The main rotor then contacted a tree and the helicopter descended rapidly to the ground, where it was destroyed by a post-crash fire.

Postaccident examination of the airframe and engine was incomplete due to fragmentation and thermal damage from the post-crash fire; however, the examination revealed no evidence of a mechanical failure or malfunction.

The pilot computed the allowable payload at a pressure altitude that was 2,000 ft less than where the accident drop occurred. This calculation was for the beginning of the workday; an updated load calculation was not performed, as the pilot would typically take on less water to

accommodate environmental changes. The actual load calculations that factored in the helicopter's remaining fuel quantity, altitude, and temperature at the accident site indicate that the helicopter was likely closer to 10,160 lbs total weight, 160 lbs over the helicopter weight limit for the conditions. With no evidence of a mechanical anomaly, it is likely that the pilot was unable to maintain altitude due to the weight of the helicopter and the altitude when he made the left turn and was slowing down. When he increased collective control during the turn, the low rotor rpm horn annunciated as the helicopter was operating at its maximum performance. The reduction in rotor speed resulted in a loss of lift, which resulted in a descent into trees.

During two water pickups on the day of the accident, the pilot observed that the water pump required additional effort before it shut off. The pilot was also unable to open the water tank doors when he refilled the tank before the accident. He used the emergency jettison function by turning off the master switch to cycle the water tank doors. Despite multiple malfunctions, the pilot still chose to continue the flight. When he decided to abort the water drop at the fire location, the pilot experienced a similar issue with the tank doors not opening with the doors open switch. However, the pilot likely did not have enough time to attempt an emergency jettison, which would have reduced gross weight and allowed him to maintain altitude.

There were no historical maintenance records that showed abnormal performance of the water release system on the accident helicopter.

Probable Cause and Findings

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

The pilot's inadequate performance planning for the operation that resulted in an excessive gross weight for the operating conditions, leading to a loss of altitude during maneuvering and contact with trees. Contributing to the accident was the pilot's decision to continue the flight despite a series of malfunctions with the water deployment system, and his subsequent inability to jettison the load, preventing a successful recovery from the loss of altitude.

Findings

Personnel issues	Performance calculations - Pilot
Personnel issues	Decision making/judgment - Pilot
Environmental issues	High density altitude - Decision related to condition
Aircraft	(general) - Malfunction

Factual Information

History of Flight

Maneuvering-low-alt flying	Low altitude operation/event (Defining event)

On September 10, 2023, about 1345 Pacific daylight time, a Bell 212 helicopter, N873HL, was destroyed when it was involved in an accident near Balch Camp, California. The pilot was seriously injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 133 firefighting flight.

The flight was operated by Rogers Helicopters Inc. under contract with the United States Forest Service.

The helicopter was equipped with a Simplex 304 Fire Attack System, composed of a 375-gallon belly-mounted tank, a hover refill pump, and cockpit controls for dispensing the tank's contents. According to the pilot, he successfully completed eight water drops at altitudes between 6,000 ft and 7,000 ft msl and then returned to his departure airport in Sanger, California, to refuel. The pilot noted that during two separate water pickups that day the pump continued to run after he filled his tank and withdrew the snorkel from the water; however, the pump ceased running after he jostled the switch. At 1315, he departed towards Pine Flat Reservoir to pick up his first load of water at a site about 2,000 ft msl. After he reached the reservoir, the pilot hovered over the water, deployed the snorkel and activated the pump as prescribed by the operating procedure, but immediately noticed that water was spilling from the tank. The pilot disengaged the pump and activated the water tank doors, but did not observe any movement. After he climbed to about 20 ft above the water, he observed the doors move after he cycled the tank power switch on the center console. Subsequently, he reengaged the pump and performed a successful test opening of the tank doors. He ran the pump until he loaded the desired amount of water and then proceeded to the fire area.

The fire was located between 7,000 ft and 8,000 ft msl, surrounded by 100-ft-tall pine trees. During a subsequent orbit of the area the pilot decided to approach the fire from higher terrain. As he approached the fire area he noticed that the helicopter required more power than expected. Although he was not initially concerned, he decided to approach the fire from a direction that would ensure a downhill escape. The pilot then slowed the helicopter; however, he felt that the helicopter still required more power than he expected and decided to jettison the water load. The pilot depressed the drop switch twice, but the water tank doors did not open. The pilot then elected to fly towards a meadow, but when he increased collective control and began the turn the low rotor rpm horn activated and the main rotor contacted a tree. He

immediately applied aft cyclic control as the helicopter rapidly descended before it impacted the ground and a post-crash fire ensued.

The helicopter was destroyed by post-crash fire, which consumed the majority of its airframe and components. The main drive shaft to the input quill (between the combining gearbox and the main transmission) were intact but exhibited thermal damage. Circumferential scoring was observed through the input drive shaft tube adjacent to both splined ends. The main rotor blades did not display any evidence of a preimpact failure.

The tail rotor drive shaft was mostly consumed by post-crash fire. A portion of the tail rotor drive shaft remained attached to the intermediate gearbox. Continuity of the drive was confirmed through the intermediate gearbox and rotation of the tail rotor resulted in a corresponding rotation of the tail rotor gearbox input pinion.

Continuity of the flight control system could not be established due to significant fragmentation and post-crash fire.

Both engines had separated from the airframe and were subsequently examined at the engine manufacturer's facility with oversight from the National Transportation Safety Board (NTSB). Neither engine exhibited any evidence of a preimpact mechanical anomaly that would have precluded their normal operation.

The pilot completed a load calculation before the accident flight, which had the date and time of September 9, 2023, 0930 for the mission "initial attack fire." The load calculation performance reference was for Bell 212HP helicopters equipped with the Boundary Layer Research FastFin (BLR FF), which was installed on the accident helicopter in 2018. The BLR FF incorporates physical changes to the vertical fin and adds tail boom strakes to improve aerodynamic efficiency during hover. A rotorcraft flight manual supplement (RFMS) for helicopters equipped with the BLR FF contains revised performance charts. The total calculated helicopter weight with equipment, personnel and fuel was 8,642 lbs and the jettisonable allowable payload for hovering out of ground effect (HOGE) was 1,858 lbs. The pilot also listed the "actual payload" as 1,858 lbs.

The pilot estimated that he had about ¼ to ½ tank of water (about 90-180 gallons) onboard at the time of the accident. He remarked that he estimated water quantity by observing the amount of engine torque required to maintain rotor speed at his desired altitude. Once he reached about 75% and 78% torque he discontinued the water collection. The pilot reported that an updated load calculation was not completed and that he took on less water instead to accommodate for the higher altitude at his destination.

An NTSB computation determined a total helicopter weight, without payload, of 8,741 lbs based on a helicopter-equipped weight of 7,141 lbs, a flight crew weight of 200 lbs, and a fuel weight of 1,400 lbs at water collection. Performance calculations were completed at a pressure altitude of 2,000 ft and a temperature of 30° C, the estimated dipping altitude and temperature at the time the pilot refilled his water tank. According to the helicopter

manufacturer, at 75% and 78% torque, the hover in ground effect (HIGE) weight at pickup was 9,965 lbs and 10,280 lb, respectively. The water payload at pickup was calculated at 1,224 lbs at 75% torque and 1,539 lbs at 78% torque. The operating weight at the accident site was computed using this calculated water payload at pickup, along with a pressure altitude of 8,000 ft and a temperature of 20° C, and an estimated total fuel consumption of 120 lbs. At 75% torque the helicopter operating weight would have been 9,845 lbs and at 78% torque the weight would have been 10,160 lbs.

According to the BLR FF HOGE charts, based on the pressure altitude of 8,000 ft and a temperature of 20° C, the helicopter weight limit was 10,000 lbs.

According to the pilot, before the accident flight he had been notified by Air Attack that he would need to perform a water drop over another spot fire. The pilot had sufficient power margin while operating at higher altitudes all day and didn't feel he needed to recalculate his load before completing this drop.

According to the flight manual supplement,

"The Simplex Fire Attack System is used on the Bell 205A-1, 205B, 212, 412 and 412EP helicopters series for the purpose of fighting fires. The tank system is filled via ground fill or either a 3" standard hover refill pump or optional 5" hover refill pump. The 5" hover pump offers decreased fill times in comparison to the 3" standard hover refill pump. Simplex Fire Attack System allow for independent filling, unloading, and delivery of fire retardant and/or water."

The supplement also contains delivery instructions that require the operator to "pull and hold the DOORS OPEN switch aft the cyclic control box." The doors close once the switch is released. A note states that the DOORS OPEN switch must be in the open position to ensure a full release of the water load.

For an emergency jettison the instructions state,

"In the event of an aircraft emergency or if difficulty is experienced in controlling the helicopter, the water load should be dumped immediately using the DOORS OPEN switch on the CCB [cyclic control box]. *The pilot should hold the door open for a minimum of 3-5 seconds and visually check that the load has been dumped. If the doors fail to open turn off MASTER switch on CDB* [cockpit display box], *the doors will remain open until the MASTER switch is turned ON.*

There were no historical maintenance records that showed abnormal performance of the Simplex system on the accident helicopter.

Pilot Information

Certificate:	Commercial; Military	**Age:**	52,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	
Instructor Rating(s):	Airplane single-engine; Helicopter	**Toxicology Performed:**	
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	September 15, 2022
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	June 1, 2023
Flight Time:	4700 hours (Total, all aircraft), 1800 hours (Total, this make and model), 3000 hours (Pilot In Command, all aircraft), 19 hours (Last 90 days, all aircraft), 2.6 hours (Last 30 days, all aircraft), 1.6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N873HL
Model/Series:	212	**Aircraft Category:**	Helicopter
Year of Manufacture:	1978	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	30873
Landing Gear Type:	Skid	**Seats:**	11
Date/Type of Last Inspection:	September 4, 2023 Continuous airworthiness	**Certified Max Gross Wt.:**	11200 lbs
Time Since Last Inspection:	6 Hrs	**Engines:**	2 Turbo shaft
Airframe Total Time:	13429 Hrs	**Engine Manufacturer:**	PWC
ELT:	C126 installed, not activated	**Engine Model/Series:**	PT6T-3B
Registered Owner:	ROGERS ROBIN M	**Rated Power:**	800
Operator:	ROGERS ROBIN M	**Operating Certificate(s) Held:**	Rotorcraft external load (133), Agricultural aircraft (137)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KFAT,334 ft msl	**Distance from Accident Site:**	34 Nautical Miles
Observation Time:	13:53 Local	**Direction from Accident Site:**	251°
Lowest Cloud Condition:	Few / 15000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:		**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	260°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.99 inches Hg	**Temperature/Dew Point:**	34°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Sanger Heliport, CA (PRIV)	**Type of Flight Plan Filed:**	
Destination:	Sanger Heliport, CA (PRIV)	**Type of Clearance:**	None
Departure Time:	13:00 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Destroyed
Passenger Injuries:	N/A	**Aircraft Fire:**	On-ground
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Serious	**Latitude, Longitude:**	36.963822,-119.05102

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Helen Tsai; Transportation Safety Bureau of Canada John Jensen; Federal Aviation Administration; Fresno, CA Gary Howe; Bell Helicopter (Textron); Fort Worth, TX Lea Weinkauf; United States Forest Service; McClellan, CA Merryn Spielman; Pratt & Whitney Canada; Longueuil, OF
Original Publish Date:	April 2, 2025
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=193040