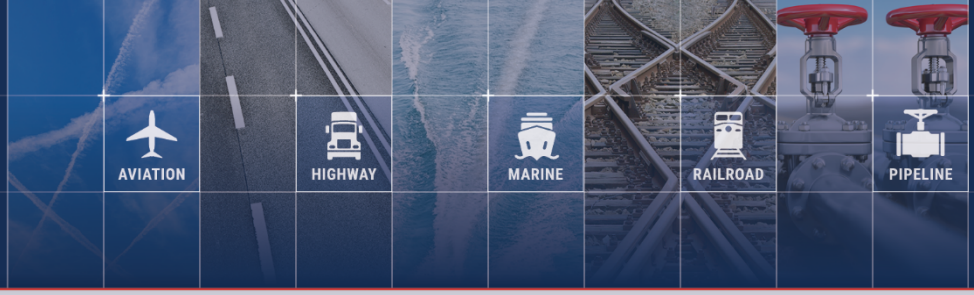

Aviation Investigation Final Report

Location:	Bountiful, Utah	**Accident Number:**	WPR14LA113
Date & Time:	February 5, 2014, 14:30 Local	**Registration:**	N3211N
Aircraft:	Bell 206	**Aircraft Damage:**	Substantial
Defining Event:	Dynamic rollover	**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The helicopter-rated private pilot was receiving instruction to obtain his commercial helicopter certificate. He and the flight instructor were practicing landings and takeoffs at a snow-covered remote landing zone (LZ) in mountainous terrain. They completed one successful landing and takeoff, and, after a second uneventful landing, the helicopter sat on the snow for a few minutes before the instructor initiated the next takeoff. Just after engine power application, the right forward skid sank into the snow, and the instructor was unable to prevent the ensuing dynamic rollover. The helicopter came to rest on its right side on top of the snow.

The area located just forward and to the right of the helicopter was covered with snow less than 6 inches thick, and grass protruded through the snow, which likely led the pilots to assume that this was a representative depth for the snow on the entire LZ. However, although the snow surface was essentially level, the terrain underlying the snow was not level, and the helicopter had landed on snow that was about 2 ft deep. The instructor was not qualified by the school to conduct operations on deep snow, and the helicopter was not equipped to land on snow deeper than about 6 inches. The pilots did not report any pre-existing mechanical deficiencies or failures, and examination of the helicopter did not reveal evidence of any pre-existing mechanical deficiencies.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilots' inaccurate assessment of the snow depth on the landing zone, which resulted in a landing on snow deeper than that for which the helicopter was equipped and led to dynamic rollover.

Findings

Personnel issues	Decision making/judgment - Flight crew
Environmental issues	Snow/slush/ice covered surface - Effect on operation

Factual Information

History of Flight

Standing-engine(s) operating	Dynamic rollover (Defining event)

HISTORY OF FLIGHT

On February 5, 2014, about 1430 mountain standard time, a Bell 206B helicopter, N3211N, was substantially damaged when it rolled onto its right side during the initial phase of an attempted takeoff from a remote landing zone (LZ) near Bountiful, Utah. Neither the flight instructor nor the pilot under instruction was injured. The instructional flight was conducted under the provisions of Title 14 Code of Federal Regulations Part 91. The helicopter was operated by the Salt Lake City Utah division of Upper Limit Aviation, which was a Part 141 certificated training facility. Visual meteorological conditions prevailed, and no Federal Aviation Administration (FAA) flight plan was filed for the flight.

According to both pilots, a portion of the flight was being used to practice operations from a snow-covered LZ, which was located in mountainous terrain at an elevation several thousand feet above that of the school's base airport. The pilots had already completed one landing and takeoff at the LZ. After the second landing, which was uneventful, the helicopter sat on the snow for a few minutes before the pilots initiated the next takeoff. Winds at the LZ were light, and the helicopter nose was pointed into the wind. Just after engine power application, the right forward skid sank into the snow, and the pilots were unable to prevent the ensuing rollover.

Flight Instructor

According to the flight instructor, he held commercial pilot and flight instructor certificates, with ratings for airplane single engine, helicopter, instrument helicopter, and helicopter instructor. He had approximately 1,550 total hours of flight experience, including about 750 hours in the accident helicopter make and model. His most recent flight review was completed in January 2014.

According to the operator's Chief Safety Officer, in order for an instructor to conduct instruction in operations on snow more than 6 inches deep, the operator's policy required that the helicopter must be appropriately equipped, and the instructor must have received specific training from the chief flight instructor. The instructor had not received the required training.

Pilot Under Instruction

According to the pilot under instruction, he held a private pilot certificate with ratings for helicopter and instrument helicopter. He had approximately 244 total hours of flight experience, including about 72 hours in the accident helicopter make and model. The pilot was enrolled in the operator's course for a commercial helicopter certificate, and the accident flight was in support of that course work.

AIRCRAFT INFORMATION

FAA information indicated that the helicopter was manufactured in 1984, and was equipped with a Rolls-Royce (Allison) 250-C20 series turboshaft engine. The helicopter was equipped with "tundra pads" mounted near the rear landing skid crosstube. According to the operator, tundra pads are smaller than the "bear paws" intended for use in deep snow, but were suitable for operations on limited (less than about 6 inches) depths of snow.

WRECKAGE AND IMPACT INFORMATION

Neither NTSB nor FAA personnel traveled to the accident site. According to information provided by the operator, the helicopter came to rest on its right side, on top of the snow. The two-blade main rotor assembly had separated from the helicopter, and both blades were extensively damaged. The right landing skid tube forward of the forward crosstube was bent about 45 degrees up and inboard. According to operator personnel, damage to the main rotor blades and the tail boom was consistent with one or both blades striking the tail boom at some point during the rollover.

Examination of site photographs provided by the operator showed that the overall LZ area within an approximate 100-foot diameter circle was snow-covered, and that the snow surface was essentially level. However, due to variations in the underlying terrain, the snow depth was not uniform. The area located about 15 feet forward and to the right of the helicopter was covered with snow less than 6 inches deep, and grass protruded through the snow. The snow beneath and to the right of the helicopter was about 2 feet deep. Site examination by company personnel indicated that the helicopter had landed on an area of snow that consisted of a soft layer of snow that was about 5 to 6 inches thick, which overlaid a crust of firmer snow that was on top of a base of about 12 to 18 inches of more soft snow.

The helicopter was recovered from the LZ the day after the accident, and was examined by FAA inspectors. The pilots did not report, and the FAA inspectors did not observe, any indications of any pre-existing mechanical deficiencies or failures.

ADDITIONAL INFORMATION

The FAA Rotorcraft Flying Handbook contained the following information regarding dynamic rollover:

- A helicopter is susceptible to a lateral rolling tendency, called dynamic rollover, when lifting off the surface. For dynamic rollover to occur, some factor has to first cause the helicopter to roll or pivot around a skid, or landing gear wheel, until its critical rollover angle is reached. Then, beyond this point, main rotor thrust continues the roll and recovery is impossible. If the critical rollover angle is exceeded, the helicopter rolls on its side regardless of the cyclic corrections made.

- Dynamic rollover begins when the helicopter starts to pivot around its skid or wheel. This can occur for a variety of reasons, including….if the gear is stuck in ice, soft asphalt, or mud.

- Once started, dynamic rollover cannot be stopped by application of opposite cyclic control alone.

- The following conditions are most critical for helicopters with counter-clockwise rotor rotation:
1. right side skid/wheel down, since translating tendency adds to the rollover force.

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	31
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	3-point
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	October 17, 2013
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	January 27, 2014
Flight Time:	1550 hours (Total, all aircraft), 750 hours (Total, this make and model), 1400 hours (Pilot In Command, all aircraft), 200 hours (Last 90 days, all aircraft), 80 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Pilot Information

Certificate:	Private	**Age:**	34
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	3-point
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	June 27, 2013
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	244 hours (Total, all aircraft), 72 hours (Total, this make and model), 127 hours (Pilot In Command, all aircraft), 11 hours (Last 90 days, all aircraft), 9 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N3211N
Model/Series:	206 B	**Aircraft Category:**	Helicopter
Year of Manufacture:	1984	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	3808
Landing Gear Type:	Skid	**Seats:**	5
Date/Type of Last Inspection:	January 4, 2014 100 hour	**Certified Max Gross Wt.:**	3200 lbs
Time Since Last Inspection:	41 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	20087 Hrs	**Engine Manufacturer:**	Rolls Royce
ELT:	C126 installed, not activated	**Engine Model/Series:**	250 C20B
Registered Owner:	Mark Lancaster	**Rated Power:**	420 Horsepower
Operator:	Upper Limit Aviation	**Operating Certificate(s) Held:**	Rotorcraft external load (133), On-demand air taxi (135), Agricultural aircraft (137), Pilot school (141)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	SLC	**Distance from Accident Site:**	9 Nautical Miles
Observation Time:	14:53 Local	**Direction from Accident Site:**	219°
Lowest Cloud Condition:	Few	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	310°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.01 inches Hg	**Temperature/Dew Point:**	0°C / -11°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Salt Lake City, UT (SLC)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Salt Lake City, UT (SLC)	**Type of Clearance:**	None
Departure Time:	13:27 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	40.877777,-111.821662(est)

Administrative Information

Investigator In Charge (IIC):	Huhn, Michael
Additional Participating Persons:	David Odekirk; FAA FSDO; Salt Lake City, UT
Original Publish Date:	November 5, 2015
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=88776