Aviation Investigation Final Report

Location:	Chugiak, Alaska	**Accident Number:**	ANC14FA030
Date & Time:	May 28, 2014, 14:33 Local	**Registration:**	N392GP
Aircraft:	ROBINSON HELICOPTER COMPANY R44 II	**Aircraft Damage:**	Destroyed
Defining Event:	External load event (Rotorcraft)	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 133: Rotorcraft ext. load		

Analysis

This report was revised on November 29, 2017. Please see the docket for this accident to view the original report.

The accident flight was one of several recent practice external-load flights that the pilot had been conducting with a 150-ft long-line and weighted barrel. The helicopter approached the airport from the north and then hovered over the approach end of runway 20R. At the time, two airplanes were in the airport traffic pattern for runway 20R, another was in the airport vicinity, and a fourth was departing from runway 2R toward the hovering helicopter. One witness reported hearing the accident pilot attempt to communicate with the departing northbound airplane, but no response was heard, and the airplane passed close to the helicopter. After the northbound airplane passed by, the helicopter moved to its normal landing area on the east ramp, and the accident pilot responded to another pilot's query as to his intentions by stating that he was landing. Immediately after the pilot's response, the helicopter suddenly pitched up, rolled left, and descended to the ground.

Examination of the helicopter revealed no evidence of preimpact mechanical anomalies with the airframe, systems, or powerplant. Damage to the main rotor and associated ground scars and wreckage distribution were consistent with the rotor system operating at normal rpm during the impact sequence. Damage to the helicopter and the location of the main rotor ground scar were consistent with the helicopter having collided with the ground in an extreme left roll. The long-line remained attached to the barrel but was not attached to the helicopter's cargo hook, and the disconnected end was near the main wreckage. The relative orientation of the long-line and the main wreckage indicated that the line was still attached to the helicopter when the helicopter moved laterally at some point; however, no known witness observed when or how smoothly the line and load were released.

Maneuvering a helicopter to land during external load operations requires precision in both helicopter control and timing of load release. Although the accident pilot's workload was increased by the demands

of maintaining traffic separation and communicating on the radio in the busy, nontowered airport environment, there was no evidence to suggest that such an operation was beyond his skill level, particularly given his recent practice. The accident pilot was based at BCV and, in the 2 weeks before the accident, had conducted seven flights (including the accident flight) with a 150-foot long-line in the accident helicopter; in the preceding 90 days, the pilot had flown almost 60 hours, most of which involved autorotations, hover maneuvers, and long-line practice.

The pilot's autopsy identified severe coronary artery disease with greater than 75% stenosis in two main arteries. In addition, scarring in the left ventricle was identified, which indicated that the pilot had experienced a previous heart attack. Although the pilot had sought and received in recent years medical care that included cardiac testing, there is no evidence that his previous heart attack was ever diagnosed (research has shown that the tests are not always accurate). Given the presence of two severely stenotic lesions in two main arteries and the presence of scarring from a previous heart attack, the accident pilot's likelihood for experiencing another acute cardiac event (such as a new heart attack, anginal symptoms, or an acute arrhythmia) was inevitable. An acute cardiac event would likely cause symptoms ranging in severity from impairing (such as chest pain and shortness of breath or palpitations) to incapacitating (fainting from low blood pressure or sudden cardiac death). Further, such an event occurring immediately before impact would likely leave no identifiable evidence on autopsy. Considering the precision required while maneuvering to land with an external load, any level of impairment could result in catastrophic consequences; therefore, the pilot likely experienced a sudden, acute cardiac event that adversely affected his performance.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's loss of control of the helicopter due to impairment or incapacitation from a sudden, acute cardiac event.

Findings

Personnel issues	Aircraft control - Pilot
Personnel issues	Predisposing condition - Pilot
Personnel issues	Cardiovascular - Pilot

Factual Information

History of Flight

Maneuvering	External load event (Rotorcraft) (Defining event)

On May 28, 2014, at 1433 Alaska daylight time, a Robinson R44 Raven II helicopter, N392GP, collided with the ground and caught fire while maneuvering for landing during an external-load flight at Birchwood Airport (BCV), Chugiak, Alaska. The commercial pilot was fatally injured, and the helicopter was destroyed by the ground impact and postimpact fire. The flight was operated by Global Positioning Services, Inc., under the provisions of 14 *Code of Federal Regulations* Part 133 with no flight plan filed. Visual meteorological conditions prevailed. The local flight departed BCV about 1315.

According to the operator's representative, the pilot had been conducting practice flights with a 150-ft long-line attached to a fluid-filled, 55-gallon barrel in preparation for an upcoming project. Satellite flight-following data provided by the operator (the helicopter was equipped with a Latitude Technologies system that recorded data in 2-minute intervals) showed that the entire flight remained within 5 nautical miles (nm) of the airport, maneuvering near the airport and northeast along the coast of Knik Arm.

Several witnesses at the airport said that they saw the helicopter flying on the day of the accident with the barrel suspended beneath it by the long-line. One witness, who was a pilot flying his airplane near the airport with a passenger, said that he heard the accident pilot provide position reports over the airport common traffic advisory frequency (CTAF) about every half mile, beginning from about 5 miles out as the helicopter approached BCV from the north. When the helicopter arrived at the airport, the witness observed it hover over the approach end of runway 20R (the longer of the airport's two parallel runways). The witness recalled that, in addition to his airplane, one airplane was flying on the downwind leg of the traffic pattern for runway 20R, a second airplane was flying southbound east of the highway, and a third airplane was departing from runway 2R (the shorter parallel runway). The witness said that he heard the accident pilot communicate over the CTAF to the departing airplane several times, "Did you hear me?" but there was no response from the pilot of the departing airplane. Both the witness in the airplane and another on the ground said that the departing airplane appeared to pass close to the hovering helicopter as the airplane headed north and left the area.

The witness in the airplane intended to land on runway 20R, so he maneuvered his airplane to wait for the helicopter to clear the runway. As the helicopter transitioned east toward the ramp where it normally landed, he asked the helicopter pilot over the CTAF his intentions. The witness reported that the helicopter pilot responded, "landing," then there was a "click" over the radio, and the helicopter suddenly pitched nose-up, rolled over to the left, descended, and crashed. The passenger in the witness' airplane said that the helicopter pitched "way nose up," rolled left, then descended near vertically to the ground. The passenger witness demonstrated the movement with his hand, illustrating that the helicopter's motion was sudden, and its left roll was extreme before it descended straight down to the ground.

Multiple witnesses on the ground reported hearing "pop" or "bang" noises, and one reported "two cracks and a loud boom." None of these witnesses had the helicopter in view when they heard the noises, and no known witnesses saw in detail the relative positions of the helicopter, its long-line, and the load during the accident sequence. One ground witness, who was in a hangar adjacent to the accident site, reported that the helicopter's engine made a high-pitch sound followed by two loud "bang" noises that came a few seconds apart. When he looked to see what made the sound, he saw the helicopter on the ground in flames with the smoke blowing toward the hangar.

Pilot Information

Certificate:	Commercial	**Age:**	62,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Unknown
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	April 1, 2014
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	July 1, 2013
Flight Time:	2174 hours (Total, all aircraft), 2061.3 hours (Pilot In Command, all aircraft), 59.5 hours (Last 90 days, all aircraft), 25 hours (Last 30 days, all aircraft)		

The pilot held a commercial pilot certificate with a rating for rotorcraft helicopter. He held a second-class Federal Aviation Administration (FAA) airman medical certificate issued April 1, 2014, with the limitation "must wear corrective lenses." The pilot's logbook recorded that his most recent flight review, as required by Special Federal Aviation Regulation 73, Section 2(c)(2) and (3), was completed in the Robinson R-44 on July 1, 2013.

According to the pilot's logbook, as of May 23, 2014, the pilot had accumulated 2,174 hours total flight time, including 2,061.3 hours pilot-in-command (PIC) time, all of which was in helicopters. All of the pilot's flight time recorded in the logbook (which was the second book of two and began with an entry dated April 30, 2010, and 656.5 total flight hours) was accumulated in Robinson R-44 helicopters (primarily, the accident helicopter). The pilot completed a Robinson Helicopter Company pilot safety course and R-44 flight training in November 2008.

In the 90 days before the accident, the pilot had accumulated 59.5 hours, and his logbook indicated that most of these flights involved proficiency practice such as autorotations, hover maneuvers, and flights with a 50-, 100-, or 150-ft long-line. The pilot had conducted seven flights (including the accident flight) with a 150-foot long-line in the accident helicopter in the 2 weeks before the accident.

According to the pilot's spouse, the day of the accident was a normal day for the pilot. She said that he typically slept about 8 hours per night, had gone to bed before 2300 the night before the accident, and had awakened about 0630 that morning, which was typical for him. She could recall nothing abnormal about his schedule or sleep in the days before the accident. She noted that he was interested in being proficient with the long-line because he had an upcoming project that would involve lowering an all-

terrain-vehicle (ATV) to a site, and he wanted to make sure he would not damage the ATV in the process. She said that the pilot had been researching the way that the barrel swings, even studying at home how a weighted string reacts to motion. She described his interest in the long-line training and research as excitement, not concern or apprehension.

The pilot's spouse described that the pilot was very dedicated to keeping in shape and staying healthy and that he exercised regularly. She said that he had no recent health concerns other than mild cold- or pollen-related symptoms within the past 6 weeks, but the symptoms had cleared.

In response to questions, the pilot's spouse stated that her husband did not have a cardiologist, only a primary care physician. She recalled that the pilot had some kind of heart-related "scare" perhaps 3 or 4 years before the accident and that the primary care physician performed testing on the pilot at that time. She recalled that some of the tests performed may have been subject to misreading and had to be done again or followed by other tests, but she could not recall specifics. She described that the pilot had regular follow-up screenings from his primary physician.

Aircraft and Owner/Operator Information

Aircraft Make:	ROBINSON HELICOPTER COMPANY	**Registration:**	N392GP
Model/Series:	R44 II	**Aircraft Category:**	Helicopter
Year of Manufacture:	2006	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	11238
Landing Gear Type:	N/A; Skid	**Seats:**	
Date/Type of Last Inspection:	March 14, 2014	**Certified Max Gross Wt.:**	2500 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	2320.2 Hrs as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:		**Engine Model/Series:**	IO-540 SER
Registered Owner:	GLOBAL POSITIONING SERVICES INC	**Rated Power:**	0 Horsepower
Operator:	GLOBAL POSITIONING SERVICES INC	**Operating Certificate(s) Held:**	Rotorcraft external load (133)

The helicopter was equipped with a Lycoming IO-540-AE1A5 engine. According to inspection and maintenance records, the most recent engine log entry, dated March 14, 2014, documented a 50-hour inspection, oil and filter change, oil screen check, and Hobbs meter replacement; the engine time since overhaul was recorded as 120.2 hours. The most recent airframe log entry, dated May 12, 2014, documented the installation of new position lights and the adjustment of the left helipod brackets; the airframe total time was documented as 2,339.4 hours.

The records indicated that the engine was overhauled to factory new limits on April 26, 2013, at an

engine total time of 2,200 hours. A maintenance record dated June 18, 2013, recorded that the overhauled engine was installed at an airframe total time of 2166.8 hours; other maintenance recorded on that date included the overhaul of the Onboard Systems International cargo hook, model 528-023-01.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	BCV	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:		**Direction from Accident Site:**	0°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Broken / 7000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	300°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.1 inches Hg	**Temperature/Dew Point:**	14°C / 6°C
Precipitation and Obscuration:			
Departure Point:	Chugiak, AK (BCV)	**Type of Flight Plan Filed:**	None
Destination:	Chugiak, AK (BCV)	**Type of Clearance:**	Unknown
Departure Time:		**Type of Airspace:**	Class E

The closest official weather observation station was located at BCV. At 1416, BCV reported, in part, that the wind was from 300° at 3 knots, visibility was 10 miles, the sky condition was clear, the temperature was 57° F, and the dew point was 43° F.

A review of FAA weather camera images for BCV revealed that, for all camera views (northeast, northwest, south, and southeast), images taken about the time of accident (from about 7 minutes before to about 1 minute after) showed that clouds were present at the airport with no visibility restrictions below them. Rising terrain 11 miles south and 6 miles northeast, as well as a 4,400-ft mean sea level peak 7.5 miles southeast of the airport, were identifiable in the images. (Note: None of the cameras captured any detailed image of the accident helicopter.)

Airport Information

Airport:	Birchwood PABV	**Runway Surface Type:**	
Airport Elevation:	83 ft msl	**Runway Surface Condition:**	Dry
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

BCV, elevation 83 ft msl, was located 2 miles northwest of Chugiak, Alaska. BCV was a nontowered airport with a 4,010 ft x 100 ft asphalt runway (2L/20R) and an 1,800 ft x 50 ft runway (2R/20L). The CTAF was 123.0 MHz.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	61.417778,-149.500839

Initial examination of the helicopter at the accident site revealed that the fuselage came to rest on its left side on a gravel area south of the paved airport ramp, and most of the cockpit and cabin structures were consumed by fire. The engine and skids were on the ground near the fuselage and showed thermal damage. The tailcone and tail rotor were primarily intact and on the ground aft of the burned fuselage, which was generally oriented facing northwest. A linear scar was adjacent to the burned fuselage; the length of the scar was consistent with the length of a main rotor blade. The main rotor gearbox and mast assembly with the main rotor hub attached was found separated on the ground an estimated 100 ft north of fuselage and engine, at the edge of the paved ramp and adjacent to a separated taxiway light. One main rotor blade was separated outboard of the hub near the blade root, and the other main rotor blade was attached in its entirety and damaged. All separated pieces of main rotor blade were located at the accident site.

The barrel with which the pilot had been practicing was found on its side in the grass adjacent to the airport ramp. (A witness reported that the pilot typically lowered the barrel such that it remained upright.) The barrel, a 55-gallon steel drum, was about three-quarters filled (estimated) with water. The long-line was attached to the barrel, and the other end was not attached to the helicopter's cargo hook. The line extended on the ground from the barrel generally southwest toward the main wreckage and was looped on the ground adjacent to the main wreckage; the end of the line was on the ground about 20 ft southwest of the main wreckage. Visual examination of the ramp area, barrel, and line revealed no scrape, drag, or contact marks that could be identified as uniquely associated with the accident. (The ramp area had multiple scrape marks, most of which were presumably from winter snow removal activity, and the barrel had multiple scrape marks in several areas.)

Examination of the long-line revealed it consisted of three 50-foot sections of 3/8-inch braided nylon rope, each of which included a 1/2-inch rope thimble spliced at each end. The ropes were connected together by aluminum carabiners with locking gates. The barrel end of the long-line was attached to a hook through two aluminum carabiners with locking gates and a swivel adapter between them. The hook was attached to a barrel harness, which was secured around the barrel. The helicopter end of the long-line terminated at the 1/2-inch rope thimble with no ring or other rigging structure attached.

Postaccident examination of the wreckage at a recovery facility revealed that the upper and left sides of the airframe sustained extensive impact damage. The main rotor drive shaft was crushed and bent about 15° at the teeter stop. The three D212-1 hydraulic servos (forward right, forward left, and aft servo) for the main rotor flight controls were removed from the wreckage and retained for further examination.

One main rotor blade was attached to the root and fractured in two places with its fractured segments attached by the trailing edge doublers. The separated surfaces were angular and jagged, and the blade was bowed upward about 6 ft outboard of the hub, and the outboard 6 ft were bent forward in the direction of rotation. The leading edge had many small dents with coarse scuff marks running chordwise along the entire blade. There was a large puncture in the blade afterbody from the upper skin into the lower skin. The other main rotor blade was separated near the root, and the separations were angular and jagged. Both the inboard side and the outboard side of the disconnect had corresponding coarse scuff marks running mostly chordwise on the upper skin. This blade was bent forward in the direction of rotation at mid-span, and the afterbody in the same area was fractured from the trailing edge toward the spar at a slight angle. The surfaces of the fractured skins were angular and jagged. The leading edge of the upper skin at the tip had coarse scuff marks running chordwise, and the trailing edge was deformed.

The tailcone sustained thermal damage at the forward end and was separated from the upper frame at the thermally damaged area. The intermediate flex coupling was mostly consumed by fire along with the forward end of the tail rotor driveshaft. The tail rotor driveshaft was bowed slightly. The tail rotor driveshaft damper bearing rotated smoothly, and the hanger bracket functioned freely. The aft flex coupling was undamaged. The tail rotor gearbox input gear and cartridge was separated from the tail rotor gearbox housing and remained attached to the bulkhead. The surface of the separation was angular and jagged. The input gear rotated smoothly and had no damage to the teeth. The output gear was undamaged. The output shaft was bent. Oil, blue in color, was present around the gearbox. The tail rotor hub and both blades had coarse scuff marks on their outboard surfaces. One tail rotor blade was slightly deformed along the trailing edge, and the other had a dent in the leading edge.

The landing gear sustained only thermal damage. The rear cross tube, both rear elbows, and most of the forward cross tube were consumed by fire. The bottom surface of the tail skid had a fresh scrape mark.

The clutch strut was found attached at one end to the frame assembly and was retained for further examination.

Examination of the engine revealed extensive thermal damage. All of the accessories were partially or fully consumed by fire, and both oil coolers and the oil sump were consumed by fire. The crankshaft could be rotated, and valve continuity was established. Compression (thumb check) was observed on the Nos. 1, 2, 4, 5, and 6 cylinders. During the check, debris blew out the intake for the No. 3 cylinder, and examination revealed the No. 3 intake tube had been displaced. The oil pump turned freely. The spark plugs showed normal wear. The oil filter element and oil strainer showed no metallic debris.

The operating components of the cargo hook were found separated from each other with some pieces fragmented and encased in molten metal. Damage precluded any functional testing. The pilot's cyclic grip with the cargo hook release button mount was thermally damaged.

Medical and Pathological Information

The State of Alaska Medical Examiner's Office, Anchorage, Alaska, performed an autopsy on the pilot. The report listed the pilot's cause of death as "multiple blunt force injuries" and noted that the thermal

injuries were sustained postmortem.

The autopsy report also noted focal areas of greater than 75% atherosclerotic stenosis in both the mid left anterior descending coronary artery and the distal right coronary artery; the other coronary arteries showed scattered calcific atherosclerosis without significant stenosis. Focal white scarring was identified in the posterior left ventricle consistent with a remote myocardial infarct (heart attack). Microscopic evaluation of the heart identified the area as "confluent fibrosis consistent with remote infarct."

The FAA Bioaeronautical Sciences Research Laboratory in Oklahoma City, Oklahoma, performed forensic toxicology on specimens from the pilot. The report stated that no carbon monoxide was detected in the blood, no ethanol was detected in the vitreous, and 33.4 (ug/ml, ug/g) salicylate was detected in the urine. (Salicylate is a metabolite of aspirin.)

Medical History

Review of the medical records from the pilot's primary care physician found that, in March 2011, a coronary calcium score test was ordered to evaluate the pilot's risk of coronary artery disease. The result was a total coronary artery calcium score of 919, which included 361 in the right coronary and 335 in the left anterior descending. (According to the record, a total score over 400 indicates a very high likelihood of significant atherosclerosis in at least one main coronary artery.) The pilot subsequently underwent a stress test on March 25, 2011, and exercised to 14.9 metabolic equivalents of task without symptoms. The electrocardiogram (ECG) portion of the test demonstrated some non-diagnostic ST segment depression inferiorly at peak heart rate and during the post-exercise recovery period. (The ST segment is the section of an ECG between the end of the S wave and the beginning of the T wave.) A note from the physician in the record suggested that this was a thallium stress test, but the record contained no radiology report.

According to the records, on March 6, 2012, the pilot's blood pressure was 142/80. On April 30, 2013, the pilot underwent a physical examination that was unremarkable. A letter from the physician to the pilot described an elevated glucose level, but the record contained no laboratory results that specified the glucose level.

A research study published in 2012 found that the sensitivity for stress testing for significant stenosis is 77%, even when the person reaches maximal exertion and with the addition of nuclear imaging (a thallium stress test). (Source: Al Aloul et al. 2012. "Utility of nuclear stress imaging for detecting coronary artery bypass graft disease." BMC Cardiovascular Disorders, 12:62.)

Tests and Research

Hydraulic Servos for Main Rotor Flight Controls

Visual examination of the three D212-1 hydraulic servos (forward right, forward left, and aft servo) at the Robinson Helicopter factory revealed nominal impact-related damage. The fluid inlet screen for each servo was clear, and the hardware torque stripe on each was unbroken. All three servos were fitted with

factory fluid fittings and supply and discharge hoses and were connected to a factory hydraulic test bench for functional testing. The testing revealed that all three servos functioned within limits with no anomalies noted.

Clutch Strut

Examination of the clutch strut under magnification in the NTSB Materials Laboratory showed linear scrape damage across one side of the strut fittings at one end.

Administrative Information

Investigator In Charge (IIC):	Gagne, Catherine
Additional Participating Persons:	Anthony Bockelman; FAA - FSDO; Anchorage, AK Thom Webster; Robinson Helicopter; Torrance, CA Mark Platt; Lycoming Engines; Van Nuys, CA
Original Publish Date:	August 9, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=89299