Aviation Investigation Final Report

Location:	Kailua, Hawaii	**Accident Number:**	WPR19FA123
Date & Time:	April 29, 2019, 09:10 Local	**Registration:**	N808NV
Aircraft:	Robinson R44	**Aircraft Damage:**	Destroyed
Defining Event:	Inflight upset	**Injuries:**	3 Fatal
Flight Conducted Under:	Part 135: Air taxi & commuter - Non-scheduled - Sightseeing		

Analysis

The pilot and two passengers departed on a helicopter tour flight around the island. Air traffic control radar and communications information indicated that the flight encountered deteriorating visibility conditions enroute. About this time, the helicopter slowed from about 108 knots (kts) to about 92 kts and initiated a turn. Shortly thereafter, radar data then indicated a rapid descent from an altitude about 1,700 ft above ground level. Witnesses near the accident site reported hearing the helicopter in the clouds and reported that it sounded as if it was very low. They then described the sound of metal hitting metal and saw pieces of the helicopter falling from the sky.

Postaccident examination of the airframe revealed that the forward left roof and floor/chin exhibited damage consistent with contact from a main rotor blade. One main rotor blade exhibited a spanwise dent which displayed equally spaced score marks consistent with the row of screws in the windshield bow. The outboard portion of one of the main rotor blades, along with left fuselage and left side cabin components, were found early in the debris path. The main rotor drive shaft was bent about 20° above the swashplate. Arc-shaped scoring was observed on both sides of the main rotor hub adjacent to the pitch horns. Both teeter stops were crushed, and the driveshaft was dented. The droop stop bolt at the nut was sheared but remained in place. Examination of the engine revealed no anomalies and the evidence indicated that the engine was operating at the time of the accident.

The accident helicopter was equipped with a two-bladed, semirigid rotor system. This design is susceptible to excessive rotor blade flapping, during periods of low-G's or the pilot's improper application of control inputs. Excessive rotor blade flapping can result in main rotor contact with the fuselage. A manufacturer safety notice stated, in part, that, when flying in turbulence, the helicopter should be slowed below a normal cruise speed to around 60 to 70 kts.

Review of weather information for the area of the accident site around the time of the accident revealed a warm, moist environment that supported heavy rain showers that could produce unexpected strong

downdrafts, reduced visibilities, wet microburst, and outflow wind conditions. At the time of the accident, weather surveillance radar reflectivity values indicated a descending core of 20 to 30 dBZ values descending towards the surface from above the accident site. The accident flight likely encountered this downdraft or outflow boundary, reduced visibilities, and rapidly changing and unexpected wind conditions. Which likely caused a low-G condition, excessive main rotor flapping, and an in-flight breakup when the main rotor contacted the cabin area.

Probable Cause and Findings

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

The helicopter's encounter with a strong downdraft or outflow boundary while operating at a higher than recommended airspeed in turbulence which resulted in a low-G condition, excessive main rotor flapping, and an in-flight breakup when the main rotor contacted the cabin area.

Findings

Aircraft	Main rotor blade system - Capability exceeded
Personnel issues	Aircraft control - Pilot
Environmental issues	Convective turbulence - Effect on operation
Environmental issues	(general) - Effect on operation
Aircraft	Airspeed - Not specified

Factual Information

History of Flight

Maneuvering	Windshear or thunderstorm
Maneuvering	Inflight upset (Defining event)
Maneuvering	Aircraft structural failure
Maneuvering	Loss of control in flight

On April 29, 2019, about 0910 Hawaii-Aleutian standard time, a Robinson R-44 helicopter, N808NV, was destroyed when it was involved in an accident near Kailua, Hawaii. The commercial pilot and two passengers were fatally injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 135 air tour flight.

The accident helicopter and another of the operator's helicopters departed from Daniel K. Inouye International Airport (HNL), Honolulu, Hawaii, about 0854 for an island tour. Radar, ADS-B, and Federal Aviation Administration (FAA) air traffic control (ATC) data indicated that the helicopters flew east along the south shore of the island. They then turned to the northwest; at 0907:58, the pilot of the accident helicopter reported that he was over Bellows Air Force Base requesting a northwest transition. The controller approved the transition, and about 13 seconds later, the second helicopter pilot made the same request. About 1 minute later, the controller asked the two helicopters, "How is the weather looking over Kailua right now?" The second helicopter pilot reported that the weather was "still VFR, but it's getting a little bit harder to see"; that helicopter subsequently turned toward the water. About 10 seconds later, the pilot of the accident helicopter, who was further inland and approaching Kailua, contacted the controller and stated that he wanted to alter his course in the same manner. The controller approved and informed both pilots to maintain flight at or above 600 ft. The accident helicopter started a right turn toward the water at a ground speed of about 108 knots and acknowledged the altitude assignment. There were no further transmissions from the accident helicopter.

The accident helicopter continued toward the water for about 1/2 nautical mile (nm) before it made a left turn further inland over Kailua and its ground speed decreased from about 108 knots to 104 knots. Shortly thereafter, the helicopter's ground speed started to decrease to about 100 knots, and it made a gradual right turn parallel to a roadway; its ground speed continued to decrease to about 92 knots. About 0.19 mile from the accident site, the helicopter was at 1,700 ft above ground level (agl) when it entered an abrupt descent and track information ended about 0.11 mile from the accident site. The last data point indicated that the helicopter was about 1,425 ft agl with a vertical descent rate of 7,360 ft per minute. At the time of the accident, the second helicopter was about 2.5 miles to the southeast over the water. That pilot did not witness the accident and the helicopter continued its flight uneventfully to HNL.

A witness reported that she was standing outside when she heard the accident helicopter flying overhead; it sounded very low and loud. She looked up but did not see the helicopter due to heavy cloud cover, and she assumed that the helicopter was either inside of or on top of the clouds. About 10 seconds

later, she heard what sounded like metal hitting metal, followed by the sound of ripping metal. One second later, she saw a piece of the main rotor blade below the clouds. The piece spiraled down on an angle, in kind of an "elliptical pattern." She never saw the helicopter.

Other witnesses reported that they heard the helicopter overhead but did not look up until they heard an odd noise followed by a loud metallic bang. One witness reported that when he looked up, the helicopter pitched forward, tilted to one side, and entered a nosedive. He also observed a piece of the rotor blade detach and fall away from the helicopter. He noted that nothing was moving, and there were no helicopter noises; it seemed like the helicopter stopped in midair and started to freefall. The helicopter impacted the street and a post-crash fire ensued.

A security camera near the accident site showed overcast skies. The helicopter could be heard approaching followed by a loud crashing sound. Shortly thereafter, the helicopter could be seen falling through the frame. The helicopter appeared to be in a freefall on its side; one main rotor blade was completely stopped, and the second blade was not visible. The tail boom was bent at about a 90° angle and extended upward.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	28,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	3-point
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	Helicopter; Instrument helicopter	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	October 3, 2018
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	April 19, 2019
Flight Time:	540 hours (Total, all aircraft), 340 hours (Total, this make and model), 470 hours (Pilot In Command, all aircraft), 135 hours (Last 90 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

The operator reported that the pilot was hired by the company about 2 1/2 weeks before the accident. The pilot completed company training for Part 135 operations on April 19, 2019, then completed one week of tour-specific training. He began taking passengers on tours about 3 days before the accident. The accident flight was the pilot's first flight on the day of the accident.

Aircraft and Owner/Operator Information

Aircraft Make:	Robinson	**Registration:**	N808NV
Model/Series:	R44	**Aircraft Category:**	Helicopter
Year of Manufacture:	2000	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	0926
Landing Gear Type:	Skid	**Seats:**	4
Date/Type of Last Inspection:	April 21, 2019 100 hour	**Certified Max Gross Wt.:**	2400 lbs
Time Since Last Inspection:	39 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	6242 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	C126 installed, not activated	**Engine Model/Series:**	O-540
Registered Owner:	United Helicopter Leasing LLC	**Rated Power:**	260 Horsepower
Operator:	Novictor Aviation LLC	**Operating Certificate(s) Held:**	Commuter air carrier (135)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PHNG,23 ft msl	**Distance from Accident Site:**	3 Nautical Miles
Observation Time:	08:57 Local	**Direction from Accident Site:**	345°
Lowest Cloud Condition:	Clear	**Visibility**	4 miles
Lowest Ceiling:	Broken / 1800 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	8 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	30°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	29.98 inches Hg	**Temperature/Dew Point:**	24°C / 20°C
Precipitation and Obscuration:	Light - None - Rain		
Departure Point:	Honolulu, HI (HNL)	**Type of Flight Plan Filed:**	Company VFR
Destination:	Honolulu, HI (HNL)	**Type of Clearance:**	None
Departure Time:	09:10 Local	**Type of Airspace:**	

The Pacific Surface Analysis for 0800 indicated a surface trough located over the northwestern Hawaiian Islands in the vicinity of the accident site. Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. With the trade winds and mountainous terrain, there was sufficient moisture and lift for rain shower and thunderstorm formation. The station model near the accident site depicted an east wind of 20 knots.

At 0800, a Global Data Assimilation System sounding for the accident site indicated a conditionally unstable environment from the surface through 12,500 ft mean sea level (msl). If rain showers or thunderstorms formed in this environment, the sounding indicated that the strongest wind speed possible at the surface from any downdraft or outflow wind was 37 knots. The sounding also indicated a favorable environment for a downdraft, outflow boundary, or gust front from rain showers or thunderstorms which can create an environment favorable for unexpected changes in wind direction and speed. There were no indications of additional low-level wind shear or clear-air turbulence from the surface through 14,000 ft msl.

Satellite imagery depicted a band of cumuliform clouds located above the accident site at the accident time. The cloud cover and cumuliform bands were moving from east to west in the low-level wind flow. In addition, weather surveillance radar indicated light to moderate intensity echoes above the accident site at the time of the accident and along the helicopter's flightpath. The rain shower activity was expanding in area coverage with time. The weather surveillance radar reflectivity values indicated a descending core of 20 to 30 dBZ values descending towards the surface between 0907 and 0915 from above the accident site.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	2 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal	**Latitude, Longitude:**	21.403333,-157.76445(est)

The wreckage came to rest in a residential area. The debris field was about 1/4-mile long and extended along a heading of about 009° magnetic. The first identified pieces of debris were a piece of plexiglass and carpet. Directly northeast of the first identified pieces of debris, and slightly out of the main debris path, was the outboard third of one main rotor blade, which came to rest in a fence. Following the first identified pieces of debris along the debris path was a large area of scattered left side airframe and cockpit components followed by other items from the cabin area and the main fuel tank, which was separated from the airframe and located about 70 yards south of the main wreckage.

The helicopter came to rest on its left side on a roadway and a large portion of the forward left side fuselage was not present at the main wreckage. The remaining portions of the left side of the helicopter exhibited damage consistent with contact from the main rotor blade. The left cabin seats exhibited damage outboard to inboard. The left corner of the instrument console was bent inward toward the passenger compartment. The aft cabin, main rotor driveshaft and assembly, and engine exhibited postimpact fire damage. The main rotor blades remained attached to the main rotor hub and exhibited extensive damage. The blue main rotor blade was bent 90° about midspan.

The tail boom remained attached to the fuselage; the forward portion of the tail boom exhibited areas of crush damage. The horizontal and vertical stabilizers were mostly intact and exhibited some crush damage. The tail skid tube was not damaged. The tail rotor assembly remained attached to the airframe and was relatively undamaged; the tail rotor blades exhibited limited, non-rotational, impact-related damage.

During a postaccident examination of the airframe, the tail rotor and main rotor flight controls were visually traced and mostly present. All of the fractured surfaces were consistent with overload. The main rotor driveshaft was seized and would not rotate by hand; it was bent about a 20° angle above the swashplate. Arc-shaped scoring was observed on both sides of the main rotor hub adjacent to the pitch horns. Both teeter stops were crushed, and the driveshaft was dented. The droop stop bolt at the nut end was sheared but remained in place. The main rotor blades were removed from the hub and examined. The afterbody of the blue blade exhibited damage consistent with the shape of the left skid toe. The red main rotor blade was bent near the hub, and about one-third of the outboard tip was fracture-separated and found earlier in the wreckage debris path. Slightly inboard from about halfway, on the lower side of the red blade, was a spanwise dent that extended about 45 inches. Within the dent were equally spaced score marks consistent with the row of screws in the windshield bow.

The upper sheave of the drivetrain exhibited rotational scoring on the forward face along with scoring on nearby support tubes. Three of the V-belts were fracture-separated consistent with overload; one remained intact but was no longer seated in its groove. The tail rotor driveshaft exhibited three breaks throughout. A small section was separated and not present; there was no apparent twisting at the fracture points.

The vertical firewall exhibited severe impact damage to its left and lower sides. The cooling fan exhibited rotational scoring on its aft face, and the lower half of the cooling fan was flat at the 6 o'clock position. The oil cooler exhibited an approximate 1-inch-deep indentation from the starter ring gear; the indentation exhibited both grinding and teeth impression marks.

Postaccident examination of the engine did not reveal any anomalies that would have precluded normal operation.

Medical and Pathological Information

An autopsy of the pilot was performed by the Department of the Medical Examiner, City and County of Honolulu, Hawaii. The cause of death was multiple blunt force injuries.

Toxicology testing performed at the FAA Forensic Sciences Laboratory was negative for carbon monoxide, ethanol, and tested-for drugs.

Additional Information

The accident helicopter was equipped with a semirigid rotor system. The FAA Helicopter Flying Handbook states, in part: *this system usually has two blades that are rigidly mounted to the main rotor hub. The main rotor hub is free to tilt with respect to the main rotor shaft on what is known as a teetering or flapping hinge. If [rotor] flapping exceeds the design value, the static stop will contact the mast...This contact must be avoided at all costs.*

Helicopters rely on positive G to provide much or all of their response to pilot control inputs. Low-G conditions can be catastrophic for two-bladed helicopters. Turbulence and severe downdrafts can also cause a low-G condition, and when combined with high airspeed, may lead to the static stop impacting the mast. The accident sequence may be extremely rapid, and the energy and inertia in the rotor system can sever the mast or allow rotor blades to strike the tail or other portions of the helicopter."

Robinson Safety Notice SN-32, "High Winds or Turbulence," states that a pilot's improper application of control inputs in response to turbulence can increase the likelihood of a mast bumping accident. It recommends that pilots reduce airspeed below normal cruise speed to 60-70 knots in significant turbulence, and states that pilots should allow for momentary airspeed, heading, altitude, and rpm excursions during flight in turbulent conditions and use gentle control inputs to restore the helicopter to level flight in order to avoid overcontrolling.

Administrative Information

Investigator In Charge (IIC):	Link, Samantha
Additional Participating Persons:	Thom Webster; Robinson Helicopters; Torrance, CA Troy Helgenson; Lycoming Engines; Williamsport, PA Nicole Vandelaar; Novictor Aviation LLC; Honolulu, HI Spencer Leonard; Federal Aviation Administration; Honolulu, HI
Original Publish Date:	May 27, 2021
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=99337