



National Transportation Safety Board Aviation Accident Final Report

Location:	Borrego Springs, California	Accident Number:	WPR18LA133
Date & Time:	April 30, 2018, 13:30 Local	Registration:	N423ML
Aircraft:	ROBINSON HELICOPTER COMPANY R44 II	Aircraft Damage:	Substantial
Defining Event:	Off-field or emergency landing	Injuries:	1 Minor, 3 None
Flight Conducted Under:	Part 91: General aviation - Business		

Analysis

The pilot of a Robinson Helicopter Company R44 II reported that, after takeoff, he heard a “light thump” and that the helicopter yawed from left to right. Shortly thereafter, the clutch light illuminated; 5 seconds later, the low rotor rpm light illuminated, and the low rotor warning horn sounded. The pilot performed an autorotation by fully lowering the collective and applying aft cyclic to load the main rotor blade system and maintain the airspeed. During the autorotation, the low rotor rpm horn and light continued, and the clutch light went out. The rotor rpm then increased to 100%, and the warning light and horn extinguished. The pilot continued the landing, however while descending through an altitude of 50 ft agl, the wind switched from a headwind to a tailwind, and the low rotor rpm light and horn annunciated again. Due to the helicopter’s low altitude, he was not able to maneuver back into the wind to land. As the helicopter settled through 5 ft agl, it weathervaned, bringing the nose to the left. The pilot used full collective just before touchdown and the helicopter landed hard on its skids on uneven sandy terrain and came to rest on its right side.

The Robinson Helicopter Company R44 II pilot’s operating handbook stated that a drive system failure would be indicated by the low rotor rpm horn and possibly an unusual noise or a yaw to the right or left, all of which the pilot reported. Thus, the available evidence for this investigation indicated that the likely cause of the accident was a drive system loss of power.

The handbook also stated that, if the clutch light illuminates during flight and does not extinguish within 10 seconds, “land immediately if there are other indications of drive system failure” and advised that, under those circumstances, the drive system should be inspected for a possible malfunction. However, postaccident examination of the helicopter revealed no mechanical malfunctions or anomalies that would have precluded normal operation of the drive system. As a result, the National Transportation Safety Board was unable to determine, from the available evidence, why the drive system loss of power occurred.

Probable Cause and Findings

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

The loss of the helicopter’s drive system for reasons that could not be determined from the available evidence, which led to an autorotation that resulted in a hard landing and rollover on uneven sandy terrain.

Findings

Not determined	(general) - Unknown/Not determined
Aircraft	Rotor/drive indicating system - Unknown/Not determined
Environmental issues	Sloped/uneven terrain - Effect on operation

Factual Information

On April 30, 2018, about 1330 Pacific daylight time, a Robinson Helicopter Company (RHC) R44 II, N423ML, was substantially damaged when it was involved in an accident near Borrego Springs, California. One passenger received minor injuries, and the pilot and two passengers were not injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 business flight.

The helicopter departed earlier in the day from Palm Springs International Airport (PSP), Palm Springs, California, to drop off the passengers at a golf club in Borrego Springs. The flight was uneventful. At 1230, the pilot received a telephone call from someone at the golf course, indicating that the passengers were ready to be picked up for the return flight to PSP. The pilot then asked about the wind at the golf course and was told that the wind was between 4 and 5 knots.

The pilot reported that, during the flight to pick up the passengers, he “experienced strong winds” as the helicopter traveled over mountainous terrain. The pilot landed the helicopter at the golf course and performed a shutdown.

Before takeoff, the pilot noted the wind direction as well as the increase in wind velocity. The helicopter departed toward the east and then turned toward the northwest. The pilot reported maintaining an airspeed of 70 knots and making a “slow [and] steady” climb to 2,500 ft above ground level (agl).

About 10 minutes later, the pilot heard a “light thump” accompanied by a small yaw of the helicopter from left to right; he initially thought that the thump was wind induced. Shortly thereafter, the clutch light illuminated, and the pilot began the 10-second countdown, as noted by the clutch light procedure in the RHC pilot’s operating handbook, to determine if the light would extinguish on its own or another action would need to be taken. Five seconds into the countdown, the low rotor rpm warning light illuminated, and the low rotor warning horn annunciated.

The pilot stated that he lowered the collective fully and applied aft cyclic to load the main rotor blade system to help maintain a safe rotor rpm and the 70-knot airspeed. He then rolled off the throttle and continued with the autorotation. The low rotor rpm horn and light continued, but the clutch light extinguished. The pilot stated that rotor rpm increased to 100%, and the warning light and horn extinguished. The pilot then chose a forced landing site that was free of obstacles but had uneven and sandy terrain, and he maneuvered the helicopter so that it would be landing into the wind.

While the pilot was descending the helicopter at an altitude of 50 ft agl, the wind switched from a headwind to a tailwind, and the low rotor rpm light and horn annunciated again. The pilot reported that, due to the helicopter’s low altitude, he was not able to maneuver back into the wind to land. He rolled on the throttle and applied a cyclic flare to decrease the rate of descent and airspeed. The pilot stated that he began to level the helicopter for landing at 10 ft agl and

that, as the helicopter settled through 5 ft agl, it weathervaned, bringing the nose to the left. The pilot used full collective just before touchdown and landed on both skids before the helicopter rolled onto its right side.

AIRCRAFT INFORMATION

The RHC R44II pilot's operating handbook noted the following about the clutch light:

Clutch light may come on momentarily during run-ups or during flight to retension belts as they warm-up and stretch slightly. This is normal. If, however, the light flickers or comes on in flight and does not go out within 10 seconds, pull CLUTCH circuit breaker and land as soon as practical. Reduce power and land immediately if there are other indications of drive system failure (be prepared to enter autorotation). Have drive system inspected for a possible malfunction.

The RHC R44II pilot's operating handbook noted the following about Low RPM:

Indicates rotor speed below 97% RPM. To restore RPM, immediately lower collective, roll throttle on and, in forward flight, apply aft cyclic. Light is disabled when collective is full down.

The RHC R44II pilot's operating handbook stated the following general information about a power failure:

A power failure can be caused by either an engine or drive system failure and will usually be indicated by the low RPM horn.... A drive system failure may be indicated by an unusual noise or vibration, nose right or left yaw, or decreasing rotor RPM while engine RPM is increasing.

In case of a power failure, immediately lower collective to enter autorotation and reduce airspeed to power-off V_{ne} [never exceed speed] or below.

The handbook cautioned that "aft cyclic is required when collective is lowered at high airspeed" and "do not apply aft cyclic during touchdown or ground slide to prevent possible blade strike to tail cone."

WRECKAGE AND IMPACT INFORMATION

A passenger provided photographs of the helicopter after the accident. The photographs showed that the landing gear remained attached to the helicopter but had spread in an outward direction. The main rotor blades were in the wreckage debris adjacent to the main rotor mast, which was in its normal position. The tail section came to rest forward of the main wreckage along with the tail rotor assembly, the horizontal and vertical stabilizers, and the tail rotor guard.

Postaccident examination of the drive system found that the belt tension actuator was undamaged and extended about 1.3 inches between the scissor mounts. The upper and lower support bearings rotated smoothly by hand. The upper sheave rotated smoothly on the shaft when moved by hand in a clockwise (looking forward) direction and was locked on the shaft when moved in a counterclockwise direction. The forward flex coupling was secure and undamaged.

The main rotor gearbox was undamaged. Dark blue oil was visible in the sight gauge. The mast tube and driveshaft were straight. The main rotor was rotated by hand more than 360° with no anomalies, confirming continuity from input yoke to the driveshaft.

One main rotor blade was bowed downward slightly near the root and bent downward and aft (opposite the direction of rotation) near the tip. Inboard of the blade tip, the spar was bent upward about 90°, and the upper and lower skins were separated with multiple dents and creases throughout. Scuff marks appeared along the leading edge of the outboard section of blade.

The other main rotor was bent downward near the root and had partially separated. Outboard of the root, the blade was bent upward about 30°, causing the lower skin to separate chordwise. Both the upper and lower skins had multiple dents and creases throughout. Scuff marks appeared along the leading edge of the outboard section of blade. Inboard of the blade tip, the spar was bent downward about 25°, separating the spar and skins in the area; the spar was also bent aft (opposite the direction of rotation). The intermediate flex coupling was mostly undamaged. The frame tube adjacent to the flex coupling had deep score marks and dents in the direction of rotation of the flex coupling.

The tail rotor driveshaft was bent and disconnected forward of the damper bearing. The damper bearing rotated smoothly by hand. The damper bearing support arm was bent, but the friction in the arm was normal. The tail rotor driveshaft was also disconnected forward of the aft flex coupling, consistent with damage to the tailcone. The surrounding areas were twisted in the direction of normal rotation from the forward end. The aft flex coupling was undamaged.

The tail rotor gearbox was partially separated from the aft tailcone bulkhead with disconnects in the bulkhead and the gearbox mounting flanges. Blue oil was visible in the sight gauge. The input yoke was rotated by hand more than 360° with no anomalies, confirming continuity from the input yoke to the output shaft. Both tail rotor blades sustained impact damage to their tips and leading edges, causing the blades to bend and deform. One tail rotor blade was missing 6 inches of its tip. The other tail rotor blade was missing the forward half of its tip cap.

The postaccident examination of the helicopter found no mechanical malfunctions or anomalies that would have precluded normal operation.

History of Flight

Landing	Off-field or emergency landing (Defining event)
Landing	Hard landing

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	Age:	53, Male
Airplane Rating(s):	Single-engine land; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	3-point
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Helicopter; Instrument airplane	Toxicology Performed:	No
Medical Certification:	Class 1 Without waivers/limitations	Last FAA Medical Exam:	January 2, 2018
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	August 16, 2017
Flight Time:	5551 hours (Total, all aircraft), 610 hours (Total, this make and model), 4266 hours (Pilot In Command, all aircraft), 180 hours (Last 90 days, all aircraft), 67 hours (Last 30 days, all aircraft)		

Passenger Information

Certificate:		Age:	Male
Airplane Rating(s):		Seat Occupied:	Left
Other Aircraft Rating(s):		Restraint Used:	3-point
Instrument Rating(s):		Second Pilot Present:	No
Instructor Rating(s):		Toxicology Performed:	
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:	Left
Other Aircraft Rating(s):		Restraint Used:	3-point
Instrument Rating(s):		Second Pilot Present:	No
Instructor Rating(s):		Toxicology Performed:	
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:	3-point
Instrument Rating(s):	Second Pilot Present:	No
Instructor Rating(s):	Toxicology Performed:	
Medical Certification:	Last FAA Medical Exam:	
Occupational Pilot: No	Last Flight Review or Equivalent:	
Flight Time:		

Aircraft and Owner/Operator Information

Aircraft Make:	ROBINSON HELICOPTER COMPANY	Registration:	N423ML
Model/Series:	R44 II II	Aircraft Category:	Helicopter
Year of Manufacture:	2013	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	13453
Landing Gear Type:	N/A; Skid	Seats:	4
Date/Type of Last Inspection:	April 27, 2018 100 hour	Certified Max Gross Wt.:	2500 lbs
Time Since Last Inspection:	6.16 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	941.66 Hrs at time of accident	Engine Manufacturer:	LYCOMING
ELT:	C91A installed, activated, aided in locating accident	Engine Model/Series:	IO-540-AE1A5
Registered Owner:		Rated Power:	245 Horsepower
Operator:		Operating Certificate(s) Held:	On-demand air taxi (135)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KTRM,0 ft msl	Distance from Accident Site:	25 Nautical Miles
Observation Time:	13:52 Local	Direction from Accident Site:	13°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	/ 15 knots	Turbulence Type Forecast/Actual:	None / None
Wind Direction:		Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	29.77 inches Hg	Temperature/Dew Point:	28° C / 3° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Borrego Springs, CA	Type of Flight Plan Filed:	None
Destination:	Palm Springs, CA (TRM)	Type of Clearance:	None
Departure Time:	13:50 Local	Type of Airspace:	Class G

Airport Information

Airport:	PALM SPRINGS INTL PSP	Runway Surface Type:	
Airport Elevation:	476 ft msl	Runway Surface Condition:	Dry
Runway Used:		IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	Forced landing;Precautionary landing

Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Substantial
Passenger Injuries:	1 Minor, 2 None	Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	1 Minor, 3 None	Latitude, Longitude:	33.220275,-116.27666(est)

Administrative Information

Investigator In Charge (IIC):	Cornejo, Tealeye		
Additional Participating Persons:	Christopher Thomas; Federal Aviation Administration; San Diego, CA Thom Webster; Robinson Helicopter Company; Torrance, CA		
Original Publish Date:	July 19, 2022	Investigation Class:	3
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=97157		

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