



National Transportation Safety Board Aviation Accident Final Report

Location:	Hillsboro, Oregon	Accident Number:	WPR20LA119
Date & Time:	April 6, 2020, 14:10 Local	Registration:	N725GT
Aircraft:	Robinson R44	Aircraft Damage:	Substantial
Defining Event:	Loss of engine power (total)	Injuries:	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

During takeoff, about 30 to 40 ft above ground level, the pilot heard a loud "bang," followed by the illumination of the low rotor RPM light and the sound of the low rotor horn. In response, he lowered the collective and performed an autorotation on the paved taxiway. As a result of the hard impact, the skids spread, and the tailboom received substantial damage.

A postaccident examination of the engine revealed that the fuel servo induction air inlet duct was partially collapsed. The inner rubberized fabric liner of the duct had partially delaminated and separated from the outer rubberized fabric, obstructing the interior volume of the duct. Further examination of the duct revealed two different contaminants that prevented co-curing of the inner and outer layers. One contaminant was similar to a water-based mold release agent used by the manufacturer at the manufacturing plant. The other contaminant consisted of low-carbon steel, likely from the mandrel used as a form for assembling the duct.

Because there is no mechanical support structure for the inner layer inside the tube, the inner layer relies on the co-curing with the outer layer and the adhesive bond with the helical wire to resist the force it encounters when the duct is placed under negative pressure. Because the inner layer was not bonded to the outer layer, the inner layer could not withstand the negative pressure and the inner layer was pulled into the internal volume of the duct, causing it to collapse, starving the engine of air, and resulting in the loss of engine power.

About a year prior to this accident, the helicopter manufacturer issued Service Bulletin (SB)-97 after a similar accident occurred. SB-97 required all inlet duct tubes installed on R44 II helicopters with serial numbers 14248 through 14286 (except 14269) to be inspected for indications of layer separation. Three months later, the Federal Aviation Administration (FAA) issued Airworthiness Directive (AD)-2019-12-18, mandated compliance with SB-97. Because SB-97 did not cover all inlet duct tubes in the R44 II fleet, as a follow up, the helicopter manufacturer issued SB-100, which expanded the inspection to essentially all R44 II helicopters up to aircraft serial number 14314. The inspection was to be completed in the next

100 flight hours or by August 31, 2019, whichever came first. At the time of the accident, neither SB-97 nor AD-2019-12-18 were applicable for the accident helicopter (serial number 14213). Conversely, SB-100 was applicable to the accident helicopter; however, there was no indication in the maintenance records for the helicopter indicating SB-100 had been performed. It could not be determined whether the aircraft owner did not comply with SB-100, or the visual examination and crinkle test were not adequate to detect the layer separation.

As a result of this accident, the FAA issued AD-2020-18-08, which superseded AD-2019-12-18 and expanded the serial number range of R44 II helicopters and subject inlet duct tubes requiring inspection.

Probable Cause and Findings

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

The total loss of engine power during takeoff due to the delamination of the fuel servo induction air inlet duct tube.

Findings

Aircraft	(general) - Damaged/degraded
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Factual Information

On April 6, 2020, about 1410 Pacific daylight time, a Robinson R44 Raven II helicopter, N725GT, was substantially damaged when it was involved in an accident near Portland, Oregon. The pilot was not injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 flight.

The pilot reported that, during takeoff, about 30 to 40 ft above ground level, he heard a loud "bang," followed by the illumination of the low rotor RPM light and the sound of the low rotor horn. In response, he lowered the collective and performed an autorotation on the paved taxiway. As a result of the hard impact, the skids spread, and the tailboom received substantial damage.

Initial examination of the engine revealed that the fuel servo induction air inlet duct was partially collapsed. The inner rubberized fabric liner of the duct had partially delaminated and separated from the outer rubberized fabric, obstructing the interior volume of the duct.

The duct was retained, and further examined. The outer layer of the duct appeared normal with no damage or anomalies. The inner layer had several areas of what appeared to be bubbles. The bubbles were .5 -.75 inch wide and varied in length running down the length of the duct. The duct was flexed 90° and a distinct crinkle sound was heard and again as it was straightened.

The duct was installed on the fuel control unit of an exemplar R44 and was then bent 90° and secured to the airbox. The engine was started, and the power was gradually increased to 102 percent; the collective was raised to 20 inches of manifold air pressure (MAP). The engine ran smoothly with no anomalies for 74 seconds, then the MAP fluctuated slightly and within one more second it increased as the engine stalled. From inside the cockpit a cough sound (after fire) was heard.

The cowling was removed, and the hose was unclamped from the airbox. The hose was pulled away from the airbox just enough to see the inside of the hose, reducing the bend in the hose from 90° to approximately 75°. Examination of the inner layer revealed bubbles that had reduced the inside diameter of the duct significantly.

The air intake duct tube was sent to the NTSB Materials Laboratory for further examination. The tube was dissected to examine the condition of the internal surfaces of the inner and outer layers and the steel wire. Visual examination of the internal surfaces indicated that there were few, if any, areas where the inner and outer layers had apparently co-cured to one another. As the outer layer was peeled back, it appeared to be bonded primarily to the helical wire. Examination of the exposed wire surfaces indicated that there were areas where the silicone rubber separated in a cohesive manner, leaving remnants of rubber on the wire. Conversely, in some areas the separation occurred at the rubber/wire interface, consistent with either no bond or a weak bond between the rubber and the wire. The outer and inner layers had not co-cured to one another as indicated by the smooth appearance of the internal surfaces. The inner and outer layer internal surfaces were examined with the aid of a binocular stereomicroscope and two unidentified substances were observed. One substance consisted of discrete spots of

gray particulates, distributed at random across the internal surfaces. The second friable translucent substance was observed in some areas, typically in steel wire impressions in the rubber layer and adjacent tented regions.

The chemical composition of the gray particulates was examined with the aid of a scanning electron microscope (SEM) equipped with an energy dispersive x-ray spectrometer (EDS). The spectrum of the gray particulate sample consisted primarily of iron (Fe) with traces of manganese (Mn), consistent with the composition of a low carbon steel. The second spectrum exhibited primarily aluminum (Al), silicon (Si), and calcium (Ca) with traces of iron (Fe), consistent with primarily silicate minerals. No traces of bromine, lead, aluminum, or calcium were observed on the intralayer gray particulate sample.

The friable translucent substance was analyzed and was similar to that of a water-based mold release agent used by the manufacturer. A spectral search using an online library of reference spectra returned matches for silicone-based materials.

A similar accident occurred on April 4, 2019 (NTSB accident number ERA19FA142). Following this accident, Robinson Helicopter Company issued Service Bulletin SB-97 on April 11, 2019. SB-97 required all inlet duct tubes installed on R44 II helicopters with serial numbers 14248 through 14286 (except 14269) to be inspected for indications of layer separation. On July 5, 2019, the Federal Aviation Administration (FAA) issued AD-2019-12-18, which made compliance with SB-97 mandatory. Because SB-97 did not cover all inlet duct tubes in the R44 II fleet, as a follow up, Robinson Helicopter Company issued SB-100 on July 3, 2019. SB-100 expanded the inspection to essentially all R44 II helicopters up to aircraft serial number 14314. The inspection was to be completed in the next 100 flight hours or by August 31, 2019, whichever came first.

The serial number for the accident that occurred on April 6, 2020 (N725GT) was 14213; it was not subject to the inspections recommended in SB-97 or required in AD-2019-12-18. However, SB-100 did apply to the helicopter. Examination of the maintenance records for the helicopter made no mention of the inspection recommended in SB-100.

As a result of this accident, Robinson Helicopter Company issued a Safety Alert on June 17, 2020, urging operators to ensure compliance with SB-100. Additionally, the FAA issued AD-2020-18-08 (effective on August 27, 2020), which superseded AD-2019-12-18 and expanded the serial number range of R44 II helicopters and subject inlet duct tubes requiring inspection.

History of Flight

Takeoff	Loss of engine power (total) (Defining event)
Autorotation	Hard landing

Pilot Information

Certificate:	Airline transport; Commercial; Private	Age:	54, Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land; Multi-engine sea	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	Toxicology Performed:	No
Medical Certification:	Class 3 Without waivers/limitations	Last FAA Medical Exam:	September 28, 2018
Occupational Pilot:	No	Last Flight Review or Equivalent:	December 4, 2019
Flight Time:	(Estimated) 11000 hours (Total, all aircraft), 150 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Robinson	Registration:	N725GT
Model/Series:	R44 II	Aircraft Category:	Helicopter
Year of Manufacture:	2018	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	14213
Landing Gear Type:	N/A; Skid	Seats:	4
Date/Type of Last Inspection:	July 2, 2019 100 hour	Certified Max Gross Wt.:	2500 lbs
Time Since Last Inspection:		Engines:	1 Reciprocating
Airframe Total Time:	250.88 Hrs at time of accident	Engine Manufacturer:	Lycoming
ELT:	C126 installed, activated, did not aid in locating accident	Engine Model/Series:	IO-540-AE1A5
Registered Owner:		Rated Power:	290 Horsepower
Operator:		Operating Certificate(s) Held:	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KHIO, 204 ft msl	Distance from Accident Site:	0 Nautical Miles
Observation Time:	14:00 Local	Direction from Accident Site:	134°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	4 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	270°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.95 inches Hg	Temperature/Dew Point:	18° C / 6° C
Precipitation and Obscuration:			
Departure Point:	Hillsboro, OR (HIO)	Type of Flight Plan Filed:	None
Destination:	Warren, OR	Type of Clearance:	VFR
Departure Time:	14:10 Local	Type of Airspace:	Class D

Airport Information

Airport:	PORTLAND-HILLSBORO HIO	Runway Surface Type:	Asphalt
Airport Elevation:	207 ft msl	Runway Surface Condition:	Dry
Runway Used:		IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	Aircraft Damage:	Substantial
Passenger Injuries:		Aircraft Fire:	None
Ground Injuries:		Aircraft Explosion:	None
Total Injuries:	1 None	Latitude, Longitude:	45.542221, -122.950836(est)

Administrative Information

Investigator In Charge (IIC):	Smith, Maja		
Additional Participating Persons:	Timothy Gunther; FSDO; Hillsboro, OR Thom Webster; Robinson Helicopter Company; Torrance, CA Steve Boyce; Aero Air, LLC		
Original Publish Date:	June 21, 2022	Investigation Class:	3
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=101150		

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).