



Aviation Investigation Final Report

Location:	Valdez, Alaska	Accident Number:	ANC16LA010
Date & Time:	December 16, 2015, 09:42 Local	Registration:	N255VS
Aircraft:	ROBINSON HELICOPTER COMPANY R44 II	Aircraft Damage:	Substantial
Defining Event:	Loss of engine power (total)	Injuries:	3 None
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

The commercial pilot was departing on a power line patrol flight in the helicopter. After liftoff, the pilot hovered the helicopter about 10 ft above ground level (agl) before commencing a left turn, accelerating to about 25 knots, and initiating a climb. As the helicopter climbed through about 20 ft agl, the engine experienced a total loss of power. The pilot performed an autorotation, but the helicopter landed hard, resulting in substantial damage to the fuselage, skids and tail boom.

Review of the accident helicopter's maintenance records revealed that the fuel injection servo had been repaired and reinstalled about 2 hours before the accident flight. During postaccident examination of the fuel injection servo assembly, small amounts of a white, greasy substance were discovered in the servo assembly. The greasy substance, later identified as DuPont Krytox, is a lubricant used in small amounts and specific locations, during reassembly after overhaul or maintenance of the fuel injection servo assembly.

Inspection of a fuel injection servo from a different helicopter that had been overhauled by the same maintenance facility revealed similar contamination. A representative from the maintenance facility stated that about 6 months before the accident, they had begun using Dupont Krytox, an approved lubricant, but did not realize that it was being used in excess and in locations not approved per the maintenance/service manual.

Due to the improper and excessive use of assembly lubricant and the lack of engine anomalies, it is likely that the lubricant contaminated the fuel injection servo, causing a disruption in fuel flow, which resulted in a total loss of engine power.

Probable Cause and Findings

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

The overhaul facility's improper and excessive use of an approved lubricant during overhaul of the fuel injection servo, which resulted in a disruption of fuel flow and a total loss of engine power.

Findings

Aircraft	Fuel distribution - Incorrect service/maintenance
Personnel issues	Repair - Maintenance personnel
Personnel issues	Knowledge of procedures - Maintenance personnel

Factual Information

History of Flight

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

On December 16, 2015, about 0942 Alaska standard time, N255VS, a Robinson R44 II helicopter, sustained substantial damage during a forced landing following a total loss of engine power during takeoff from the Valdez Airport, Valdez, Alaska. The commercial pilot and two passengers were not injured. The helicopter was registered to and operated by Vertical Solutions, LLC, under the provisions of 14 Code of Federal Regulations Part 91 as a power line patrol flight. Visual meteorological conditions prevailed and an FAA flight plan had been filed. The flight departed Valdez Airport about 0938.

During an on-scene interview with the National Transportation Safety Board (NTSB) Investigator-in-Charge (IIC) on December 18, 2015 the pilot stated that he had computed the weight and balance, and performed a preflight inspection prior to pushing the helicopter out of the hangar. After the passengers boarded the helicopter, and the passenger safety briefing was completed, the engine was started and allowed to warm up for about 5 minutes, and all ground run-up checks of the engine were satisfactory. He stated that after liftoff he hovered the helicopter about 10 feet above ground level (AGL), before commencing a left turn, accelerating to about 25 knots and initiating a climb. As the helicopter climbed through about 20 feet AGL all engine power was lost. He entered an autorotation but the helicopter landed hard, sustaining substantial damage to the fuselage, skids and tail boom.

The helicopter was equipped with a reciprocating Lycoming IO-540-AE1A5 series engine, equipped with a AVStar RSA-10-AD1 fuel injection servo.

On December 18, 2015, an engine examination was performed by the NTSB IIC. No anomalies, contamination, or evidence of malfunction was found in any of the engine accessories, but the fuel injection servo was removed for further examination and testing. The cylinders, pistons, valve train, crankshaft, and other internal components were all without evidence of anomaly or malfunction.

Both magnetos were removed from the engine and the coupling was rotated. When the coupling was rotated, strong blue spark was produced from each terminal, in rotational order.

A review of the helicopter's maintenance records revealed that the fuel injection servo had been repaired on December 9, 2015 by Alaskan Aircraft Engines Inc., Anchorage, Alaska, and had been reinstalled on the helicopter about 2.1 hours prior to the accident flight.

On January 14, an NTSB investigator and a representative from AVStar Fuel Systems, Inc. examined the fuel injection servo at the facilities of AVStar Fuel Systems, Inc. in Jupiter, Florida. The fuel servo was placed on the test bench, and all test points were within serviceable limits using AVStar Service Bulletin AFS-AB12 "Service Limits for AVStar Fuel Servos" with the exception of the adjusted idle flow with adjustment wheel centered. The adjusted idle flow with fuel wheel centered should be

between 14 – 15 pounds per hour (lb/hr), and was found to be at 16.4 lb/hr, but this is considered a field adjustment.

Disassembly inspection revealed a very small amount of white contamination ranging in size from small specs to about 0.10 of an inch. The contamination was present on the fuel diaphragm, the fuel area adjacent to the regulator valve seat, mixture control valve, mixture control plate, and the bore of the valve train opening. In addition, the interior of the mixture control assembly adjacent to the mixture control stem bushing exhibited evidence of lubricant material consistent with DuPont Krytox.

On January 19, the NTSB IIC along with another NTSB investigator, and two FAA aviation safety inspectors visited the facilities of Alaskan Aircraft Engines Inc. in Anchorage, and disassembled a recently overhauled fuel injection servo. The inspection revealed excessive amounts of a white grease like substance throughout the fuel injection servo, consistent with the white contamination noted in the servo removed from the accident helicopter. A representative from Alaskan Aircraft Engines stated that about 6 months prior they had switched assembly lubricants to Dupont Krytox, an approved lubricant, but due to the investigation, realized it was being used in excess and in locations not approved per the maintenance manual.

Dupont describes Krytox 240 series greases in part: "As white, buttery greases based on perfluoropolyether (PFPE) oils. These synthetic fluorinated lubricants are used in extreme conditions such as continuous high temperatures up to 300°C (572°F) and higher temperatures for shorter periods, depending on product grade limits. Chemically inert and safe for use around hazardous chemicals, these lubricants are nonflammable and are safe for use in oxygen service."

A review of the AVStar Servo Fuel Injector Overhaul and Repair Manual for the RSA-10-AD1 fuel injection servo assembly lists four places where DuPont Krytox is to be used during assembly states, in part:

"LAPPING THE VALVE-LOWER IDLE, SHAFT-IDLE VALVE, AND THE PLATE-MIXTURE CONTROL

Before reassembly with mating parts, very lightly apply DuPont Krytox to one mating surface.

CAUTION! Do not allow any amount of Krytox to enter a hole, a slot or reach any edge of the part to which it has been applied.

Carefully remove any Krytox.

SERVO ASSEMBLY

Apply DuPont Krytox to the lever assembly-mixture control. Apply carefully to the space between the lever stop and the packing-preformed.

NOTE! Remove excess Krytox with P-D-680, Acetone or MEK, as needed.

Apply DuPont Krutox grease to the idle valve shaft outboard of the packing-preformed.

NOTE! Remove excess Krytox with P-D-680, Acetone or MEK, as needed.

Apply a light coat of Krytox on the concave side of seal-servo. Place the seal-servo stem over the bullet with the concave side up. Press seal down on diaphragm stem. Remove all traces of lubricant from the bullet and the stem."

On January 19, 2016 Alaskan Aircraft Engines issued a Service Advisory that stated, in part: "Beginning in June of 2015 Alaskan Aircraft Engines purchased and began use of an approved assembly lube it had not used previously. This lube was used in excess and in locations not required by the manufacturer's service manual. We believe this has the potential to cause a fuel distribution problem." A complete copy of the Service Advisory is included in the public docket for this accident.

The closest weather reporting facility is Valdez Airport. At 0936, an aviation routine weather report (METAR) at Valdez, Alaska, reported in part: wind, calm; visibility, 10 statute miles; sky condition, broken clouds 7,000 feet, overcast 8,000 feet; temperature, 21 degrees F; dew point 21 degrees F; altimeter, 29.97 inHG.

Additional Information

Before this accident investigation was completed (and before the results of the component examinations were known) another Robinson R44 II helicopter experienced a similar event involving a fuel injection servo overhauled by the same repair facility that resulted in a total loss of engine power. See NTSB ANC16IA013 for more information about that incident.

Pilot Information

Certificate:	Commercial; Flight instructor	Age:	24, Male
Airplane Rating(s):	None	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	5-point
Instrument Rating(s):	Helicopter	Second Pilot Present:	No
Instructor Rating(s):	Helicopter; Instrument helicopter	Toxicology Performed:	No
Medical Certification:	Class 2 With waivers/limitations	Last FAA Medical Exam:	June 12, 2015
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	May 29, 2015
Flight Time:	1468 hours (Total, all aircraft), 1020 hours (Total, this make and model), 1394 hours (Pilot In Command, all aircraft), 70 hours (Last 90 days, all aircraft), 15 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	ROBINSON HELICOPTER COMPANY	Registration:	N255VS
Model/Series:	R44 II	Aircraft Category:	Helicopter
Year of Manufacture:	2014	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	13685
Landing Gear Type:	N/A; Skid	Seats:	4
Date/Type of Last Inspection:	September 11, 2015 100 hour	Certified Max Gross Wt.:	
Time Since Last Inspection:		Engines:	1 Reciprocating
Airframe Total Time:	766.2 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:	VERTICAL SOLUTIONS LLC	Rated Power:	245 Horsepower
Operator:	VERTICAL SOLUTIONS LLC	Operating Certificate(s) Held:	Rotorcraft external load (133), On-demand air taxi (135), Certificate of authorization or waiver (COA)

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	PAVD	Distance from Accident Site:	
Observation Time:	09:36 Local	Direction from Accident Site:	
Lowest Cloud Condition:		Visibility	10 miles
Lowest Ceiling:	Broken / 7000 ft AGL	Visibility (RVR):	
Wind Speed/Gusts:	/	Turbulence Type Forecast/Actual:	/
Wind Direction:		Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.96 inches Hg	Temperature/Dew Point:	-6°C / -6°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Valdez, AK (VDZ)	Type of Flight Plan Filed:	VFR
Destination:	Valdez, AK (VDZ)	Type of Clearance:	None
Departure Time:		Type of Airspace:	Class E

Airport Information

Airport:	VALDEZ PIONEER FIELD VDZ	Runway Surface Type:	Asphalt
Airport Elevation:	121 ft msl	Runway Surface Condition:	Ice;Snow
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:	2 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	3 None	Latitude, Longitude:	61.134166,-146.24472(est)

Administrative Information

Investigator In Charge (IIC):	Banning, David
Additional Participating Persons:	Hugh Youngers ; Federal Aviation Administration; Anchorage , AK Mike Williams; Vertical Solutions; Valdez, AK Ronald Weaver; AVStar fuel systems, Inc.; Jupiter, FL
Original Publish Date:	March 6, 2017
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=92463

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).