



National Transportation Safety Board Aviation Accident Data Summary

Location:	Greenville, VA	Accident Number:	ERA09LA317
Date & Time:	06/02/2009, 1110 EDT	Registration:	N8356F
Aircraft:	HUGHES 369D	Injuries:	1 Serious
Flight Conducted Under:	Part 133: Rotorcraft Ext. Load		

Analysis

Following completion of aerial tree cutting near power lines, the pilot returned to the designated landing zone and, while maneuvering for landing after placing the saw on the ground, the engine experienced a loss of power. The pilot attempted to perform an autorotative landing but landed hard, causing substantial damage to the helicopter.

Postaccident inspection of the engine revealed one airfoil of the fourth-stage power turbine wheel fractured near the hub due to high-cycle fatigue that initiated on the pressure side of the airfoil at the trailing edge. No surface defects were noted along the root fillet radius adjacent to the fracture initiation region. The enhanced fourth-stage power turbine wheel was manufactured in October 2006, installed into the turbine assembly, operated for 1,769 hours, then removed for a 1,750-hour inspection. The fourth-stage power turbine wheel remained installed in the turbine assembly at the completion of the inspection, and the turbine assembly was reinstalled onto the engine. At the time of failure, the wheel had accumulated approximately 2,690 hours since new and approximately 921 hours since the last 1,750-hour inspection was performed.

Since 2005, there have been four other fatigue failures of an airfoil of an enhanced fourth-stage turbine wheel. All other failures initiated at the trailing edge near the hub. In December 2006, Rolls-Royce developed an engine alert bulletin (CEB-A-1400) alerting owners and operators of the accident make and model engine to avoid steady state N₂ speed between 75 to 88 percent above 85 shaft horsepower (shp). Additionally, Rolls-Royce reported that their research of failures of airfoils of the fourth stage power turbine revealed the possibility of a higher stress state in the airfoil at the trailing edge root than originally modeled. The stress, which occurs during engine start, results from thermal differentials in the airfoil geometry that produce a residual stress at the trailing edge root that can lead to a fatigue crack. Once a crack occurs, it can propagate in high-cycle fatigue followed by overload failure if the engine is operated in a steady state in the N₂ speed avoidance range (75 to 88 percent N₂) above 85 shp, as specified in CEB-A-1400.

Flight Events

Maneuvering-low-alt flying - Loss of engine power (total)
Landing-flare/touchdown - Hard landing

Probable Cause

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The inadequate design of the fourth-stage turbine wheel, resulting in the fatigue failure of one airfoil and a subsequent loss of engine power.

Findings

Aircraft-Aircraft power plant-Engine (turbine/turboprop)-Turbine section-Design - C
Aircraft-Aircraft power plant-Engine (turbine/turboprop)-Turbine section-Failure

Pilot Information

Certificate:	Commercial	Age:	41
Airplane Rating(s):	None	Instrument Rating(s):	None
Other Aircraft Rating(s):	Helicopter	Instructor Rating(s):	None
Flight Time:	8676 hours (Total, all aircraft), 7780 hours (Total, this make and model), 8610 hours (Pilot In Command, all aircraft), 105 hours (Last 90 days, all aircraft), 32 hours (Last 30 days, all aircraft), 7 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	HUGHES	Registration:	N8356F
Model/Series:	369D	Engines:	1 Turbo Shaft
Operator:	Aerial Solutions, Inc.	Engine Manufacturer:	Allison
Air Carrier Operating Certificate:		Engine Model/Series:	250-C20B
Flight Conducted Under:	Part 133: Rotorcraft Ext. Load		

Meteorological Information and Flight Plan

Observation Facility, Elevation:	SHD, 1201 ft msl	Weather Information Source:	Weather Observation Facility
Conditions at Accident Site:	Visual Conditions	Lowest Ceiling:	None
Condition of Light:	Day	Wind Speed/Gusts, Direction:	7 knots, 190°
Temperature:	29° C / 21° C	Visibility	10 Miles
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Greenville, VA	Destination:	Greenville, VA

Wreckage and Impact Information

Crew Injuries:	1 Serious	Aircraft Damage:	Substantial
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None

Administrative Information

Investigator In Charge (IIC):	Timothy W Monville	Adopted Date:	07/18/2011
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=73952		

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