



# National Transportation Safety Board Aviation Accident Final Report

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<b>Location:</b>	Susanville, California	<b>Accident Number:</b>	WPR20LA007
<b>Date &amp; Time:</b>	October 13, 2019, 17:00 Local	<b>Registration:</b>	N131HA
<b>Aircraft:</b>	Hiller UH 12E	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Loss of engine power (partial)	<b>Injuries:</b>	1 Minor
<b>Flight Conducted Under:</b>	Part 137: Agricultural		

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## Analysis

While operating over steep, logged forest terrain, the helicopter experienced multiple compressor stalls followed by a partial loss of power. The pilot attempted to regain engine power; however, once he determined that was not possible, he initiated a forced landing on the sloping terrain. The main rotor blades impacted terrain and the helicopter rolled over onto its left side, which resulted in substantial damage to main rotor system, fuselage, and the tail boom.

A postaccident examination of the engine revealed damage to the stage 1, 2, and 3 turbine wheels, which exhibited cracks that were consistent with multiple over-temperature operations and a hot start event. Additionally, examination of the turbine outlet temperature gauge revealed errors that registered higher than the test temperature and are most likely not causal to the over temperature and hot start events. Review of maintenance documents revealed no indication of any previous hot start events or over temperature operations.

## Probable Cause and Findings

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

A partial loss of engine power due to multiple overtemperature events and a hot start event, which resulted in thermally damaged internal components of the engine. Contributing to the accident was the lack of suitable terrain on which to perform the forced landing.

## Findings

Aircraft	Turbine section - Damaged/degraded
Environmental issues	Mountainous/hilly terrain - Contributed to outcome

## Factual Information

On October 13, 2019, about 1700 Pacific daylight time, a Hiller UH-12E helicopter, N131HA, was substantially damaged when it was involved in an accident near Susanville, California. The pilot sustained minor injuries. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 137 aerial application flight.

The pilot stated that he was finishing an aerial application in a remote area that featured steep logged forest terrain when the helicopter experienced two loud compressor stalls, along with a slight yaw to the left. The pilot decreased engine power and turned the helicopter downslope, to allow the engine to recover; however, continuous compressor stalls began, and engine rpm decayed. The pilot continued to fly downhill in an attempt to recover engine speed; however, once he realized that was not possible, he turned the helicopter uphill and applied collective pitch to cushion the landing. The main rotor blades struck terrain and the helicopter rolled onto its left side. The pilot stated the engine was still running when he exited the helicopter.

Postaccident examination of the recovered airframe revealed no mechanical malfunctions or failures that would have precluded normal operations. Examination of the recovered engine revealed that the stage 4 turbine wheel would not rotate with moderate hand force, and small metallic debris was found in the exhaust plenum.

The engine was removed and subsequently shipped to a Rolls Royce facility for further examination. Disassembly of the engine revealed that the stage 1 turbine wheel exhibited thermal damage with about 50% of the blade length absent, and a crack extending into the web was observed. The stage 1 nozzle and the stage 1 nozzle shield both exhibited a soot coating. The stage 2 turbine wheel exhibited thermal damage with about 25% of the blade length absent. Both stage 1 and stage 2 nozzles exhibited thermal damage with metal splatter and dirt throughout the gas path, including the stage 3 and 4 nozzles and their respective wheels. The stage 3 turbine wheel exhibited a crack in the outer rim. The stage 3 nozzle displayed no visible damage. The stage 4 nozzle exhibited flaking metal in the stage 3 blade track. The stage 4 turbine wheel exhibited no visible damage.

The stage 1 and stage 2 turbine wheels and nozzles were further examined by the Rolls-Royce Corporation Materials Laboratory. The examination revealed that the stage 1 turbine wheel crack extended radially inboard from the rim into the web and was about 1.12 inches in length. The crack initiation point exhibited signatures consistent with thermal fatigue and transitioned to an interdendritic fracture, which is consistent with an over-temperature operation. The fracture also exhibited two distinct regions, which is consistent with having formed from two separate over-temperature events. Further examination of the stage 1 turbine wheel exhibited 31 visually apparent cracks on the trailing edge side of the wheel rim and cracks in between every airfoil on the leading-edge side of the wheel rim, consistent with an over temperature event during startup operation.

Examination of the turbine outlet temperature gauge using a calibrated test set revealed that the gauge indicated inaccurate values higher than the test temperature applied to the gauge. Examination of the engine thermocouple using a calibrated test set revealed a resistance of 0.57 ohm. According to the Rolls-Royce M250-C20 series operations and maintenance document, which states in part, for harness part number 23034926, the acceptable internal resistance is, 0.50 to 0.60 ohm at room temperature.

Examination of the helicopter maintenance logbooks revealed that the most recent 100-hour inspection was performed on September 26, 2019, at 68.2 tachometer time, 12078.4 aircraft total time. No defects were noted within the logbook entry. Additional maintenance documents revealed the turbine section had been repaired on September 9, 2014, due to low power and high operating temperatures. No entries regarding any previous hot starts or over-temperature operations were noted in the maintenance logbooks.

### History of Flight

<b>Maneuvering-low-alt flying</b>	Loss of engine power (partial) (Defining event)
<b>Landing-flare/touchdown</b>	Roll over

### Pilot Information

<b>Certificate:</b>	Commercial	<b>Age:</b>	67, Male
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	Helicopter	<b>Restraint Used:</b>	4-point
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 2 With waivers/limitations	<b>Last FAA Medical Exam:</b>	July 11, 2019
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	(Estimated) 25000 hours (Total, all aircraft), 10000 hours (Total, this make and model), 25000 hours (Pilot In Command, all aircraft), 58 hours (Last 90 days, all aircraft), 23 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Hiller	<b>Registration:</b>	N131HA
<b>Model/Series:</b>	UH 12E	<b>Aircraft Category:</b>	Helicopter
<b>Year of Manufacture:</b>	1975	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Restricted (Special)	<b>Serial Number:</b>	HA3031
<b>Landing Gear Type:</b>	Skid	<b>Seats:</b>	3
<b>Date/Type of Last Inspection:</b>	September 26, 2019 100 hour	<b>Certified Max Gross Wt.:</b>	3100 lbs
<b>Time Since Last Inspection:</b>	10.5 Hrs	<b>Engines:</b>	1 Turbo shaft
<b>Airframe Total Time:</b>	12078 Hrs	<b>Engine Manufacturer:</b>	Rolls-Royce
<b>ELT:</b>	Not installed	<b>Engine Model/Series:</b>	250-C20B
<b>Registered Owner:</b>		<b>Rated Power:</b>	420 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	Agricultural aircraft (137)
<b>Operator Does Business As:</b>	Western Helicopter Services	<b>Operator Designator Code:</b>	

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	KSVE, 4149 ft msl	<b>Distance from Accident Site:</b>	16 Nautical Miles
<b>Observation Time:</b>	16:55 Local	<b>Direction from Accident Site:</b>	132°
<b>Lowest Cloud Condition:</b>	Clear	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	10 knots /	<b>Turbulence Type Forecast/Actual:</b>	None / None
<b>Wind Direction:</b>	260°	<b>Turbulence Severity Forecast/Actual:</b>	N/A / N/A
<b>Altimeter Setting:</b>	29.9 inches Hg	<b>Temperature/Dew Point:</b>	19° C / -9° C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Susanville, CA	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Susanville, CA	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	07:00 Local	<b>Type of Airspace:</b>	Class G

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Minor	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>		<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>		<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	1 Minor	<b>Latitude, Longitude:</b>	40.55611,-120.83916(est)

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Salazar, Fabian		
<b>Additional Participating Persons:</b>	Donald F Morgan; Reno FSDO; Reno, NV Dave Riser; Rolls-Royce Engines; Indianapolis, IN		
<b>Original Publish Date:</b>	June 3, 2022	<b>Investigation Class:</b>	3
<b>Note:</b>	The NTSB did not travel to the scene of this accident.		
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=100433">https://data.nts.gov/Docket?ProjectID=100433</a>		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

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](#).