



Rolls-Royce

Engine Investigation Report

Rolls-Royce Corporation

**Model 250-C20C
Engine AE 405105**



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Air Safety Investigations**

**Accident date: 16 April 2019
Investigation date: 23 April 2019
Engine Test date: 16 July 2019**

**Omaha Police Department
Omaha, Nebraska
N109PD**

Background

On 16 April 2019, a Bell OH-58A, registration N109PD, was significantly damaged during an auto-rotative landing following a loss of power while conducting police patrols near Omaha, Nebraska. The pilot and passenger were not injured.

The NTSB directed the operator to recover the aircraft to their operations base.

On 23 April 2019, representatives from the FAA, Omaha PD and Rolls-Royce gathered at Omaha PD's hangar to examine the aircraft.

This report presents the observations made during the investigation.

Accident Flight

The helicopter was being used for routine aerial police patrol when the accident occurred.

Significant to the investigation:

For several months prior to the accident flight, maintenance personnel had been troubleshooting an issue where, following flight during the prescribed 2-minute cool-down period, the engine would flameout. This happened several times, prompting maintenance personnel to remove the engine-driven fuel pump and Fuel Control Unit (FCU) and ship them to Keystone Turbine Services for bench testing. Testing revealed no operational deficiencies and the units were returned to Omaha PD. The units were subsequently installed and the helicopter operated without any further instances of engine flameout during cool-down for ~30 flight hours prior to the accident flight.

Flight crews felt comfortable with continued operation of the aircraft in spite of a root cause for the flameout issue not being identified. This decision was based on the aircraft's history of having no in-flight performance issues, and the flame-out issue being confined to the 2-minute cool-down period.

On the day of the accident flight, the helicopter was reportedly fueled from Omaha PD's usual source, which was subsequently tested and found satisfactory. The helicopter then took off and was in cruise flight when the pilot noted a change in engine sound. Shortly afterwards, the pilot noted main rotor RPM dropping and the Engine Out warning sounded. The pilot made an auto-rotation landing to an open field, but the tail boom was severed by the main rotor during touchdown. After landing, the engine continued to run at ~35% until the pilot shut the engine down. There were no injuries or additional damage.

Aircraft Information

Model	Bell OH-58A
Serial Number	71-20455
Registration Number	N109PD
Airframe Total Time	13,510.5 Hours

Engine Information

Engine Model	Allison 250-C20C
Rating:	420 HP
Serial Number	AE-405105
Engine Total Hours	8298.2 Hours

Aircraft Examination

The aircraft was presented for examination at the Omaha PD hangar.

The airframe exhibited no significant damage other than the severed tail boom. Representatives from Bell were not present, so only a cursory inspection of the airframe was conducted. Control continuity was established from the collective twist grip to the engine. Controls were cycled fully from stop to stop, with no unusual resistance or excessive travel noted during the control movements. The fuel cutoff valve cycled normally. All engine controls operated smoothly and appropriately.

Engine Examination

The engine mounts were intact with no apparent deformity. The engine exhibited no evidence of having been damaged during the accident.

Both N1 and N2 rotors could be rotated by hand. Rotation was smooth and quiet. Continuity from the power turbine to the power output shaft and tail rotor output shaft was established.

All engine B-nuts and fittings were checked by hand for proper torque. All were found to be at least hand tight. There was no evidence of fuel or oil leakage and the engine compartment appeared to be in good order.

The bleed valve was checked by hand for proper operation. The valve operated smoothly with no lateral play of the poppet valve.

Both the upper and lower Magnetic Chip Detectors (MCDs) were left in-place for later examination.

Rolls-Royce recommended, and the parties agreed, to remove the engine and ship it to Rolls-Royce's Authorized Maintenance Center (AMC) in Lafayette, Louisiana for detailed examination and testing. An engine shipping container was delivered to the operator and the operator removed the engine from the airframe and delivered it to Lafayette for examination.

Engine Examination

On 16 July 2019, the subject engine was examined at Rolls-Royce's AMC in Lafayette, Louisiana under the auspices of the Federal Aviation Administration.

The shipping container was opened and the engine appeared to be in the same general condition as when it was examined in Omaha.

The engine was hoisted by overhead crane and placed into a rollover stand for further examination.

50 PSI air was applied to the Pc pneumatic line in order to check the pneumatic system for leaks. A soap solution was applied to all fittings and connections and lines. No leakage was detected.

The upper and lower MCDs were removed and examined. Both were found to be free of ferrous debris.

After examination by an AMC mechanic, the engine was considered acceptable to run on the production test cell.

The engine successfully started, ran and shut down. The engine successfully completed ground-idle, flight-idle, max-continuous-power and take-off power runs, in addition to “wave-off” max-power increases. When corrected for standard atmospheric conditions, the engine yielded performance 9.3% above new-production standards at takeoff power (spec: 420 horsepower. Observed: 459 horsepower) and 2.4% above new-production standards at normal cruise (Spec: 370 horsepower. Observed 379 horsepower). The engine responded normally to all power demands without surging or hesitation.

Following the engine run, the performance results were forwarded to the NTSB Investigator in Charge, who subsequently released the engine to be returned to the operator.

Engine Maintenance and Records

Component	Serial Number	Part Number	TSO	Total Time
Engine	AE-405105		2857.0	8298.2
Gearbox	AG-405105	6879863	2857.0	UNK
Compressor	AC-17650	6890570	2857.0	8298.2
Turbine	AT-17466	6898739	2857.0	8298.2
PTG	BR37803	23065122	2857.0	UNK
FCU	BR52372	23070607	2857.0	UNK
Fuel Pump	T100239	6899253	2857.0	UNK
Bleed Valve	FF45464	23053176	2857.0	UNK
Fuel Nozzle	AG97180	23077068	2857.0	UNK

Summary of Findings

There was no evidence of engine fire, failure or malfunction. The engine performed satisfactorily on the test cell. The reported loss of power could not be repeated. All available evidence is consistent with the engine being capable of producing take-off power and responding to throttle inputs.