NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

Feb 9, 2011

ENGINE EXAMINATION REPORT

WPR12MA034

This document contains 12 embedded photos.

A. ACCIDENT

Location: Pukoo (Island of Molokai), Hawaii

Date: November 10, 2011

Time: 1214 Hawaiian standard time

Aircraft: Eurocopter EC 130 B4, N11QV

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C. SUMMARY

On November 10, 2011, about 1214 Hawaiian standard time, a Eurocopter EC 130 B4, N11QV, collided with mountainous terrain near Pukoo (Island of Molokai), Hawaii. The commercial pilot and four passengers were fatally injured. The helicopter was registered to Nevada Helicopters Leasing, Henderson, Nevada, and operated by Blue Hawaiian Helicopters, Maui, Hawaii. The flight was operated under the provisions of 14 Code of Federal Regulations Part 135. Visual meteorological conditions prevailed and a company flight plan was filed for the local air tour flight. The flight originated from the Kahului Airport (PHOG), Maui about 1144.

The Turbomeca Arriel 2B turboshaft engine (serial no. 23067) was removed from the helicopter and shipped to Turbomeca's Grand Prairie, Texas, facility for disassembly and examination which commenced on February 9, 2012. The disassembly revealed no evidence of a preimpact mechanical malfunction or deficiency that would have precluded normal operations.

D. DETAILS OF THE INVESTIGATION

1.0 Engine Information

The helicopter was equipped with a Turbomeca Arriel 2B1 turbo shaft engine; the engine consists of 5 modules; an axial compressor, gas generator, power turbine, reduction gearbox and power transmission that drives the helicopter's rotor assemblies. The engine is rated at 730 (maximum continuous) horsepower and is equipped with a dual channel Engine Electronic Control Unit (EECU). The EECU incorporates an integrated third channel backup in the event of an EECU failure.

2.0 Examination

The engine was enclosed in a sealed shipping container and opened in the presence of the Powerplants Group. The engine was removed from the container; heavy soot and extensive thermal damage was noted to the 5 individual modules. A majority of the electronic accessories and associated wiring was damaged and melted away. There were no indications of a case rupture or uncontainment. A boroscope examination of the gas generator was performed and showed the presence of foreign material, consistent with dirt seen at the accident site, in the high pressure turbine inlet.

Figure 1 – As received sealed shipping container

Figure 2 - As received engine assembly

Module M01 – Freewheel and Power Transmission Shaft - Accessory Gearbox

The gearbox was intact; however, impact and thermal damage was noted throughout. Boroscope examination of the internal casing showed that the gears were intact with evidence of residual oil. No foreign debris of gear damage was noted.

The freewheel shaft and power shaft were removed. The freewheel shaft showed twist in the clockwise direction (viewed from the aft of the engine) just before the tail rotor drive shaft connection point. A representative from the engine manufacturer indicated that the observed twist was consistent with sudden stoppage of the tail rotor with continued engine drive. The power shaft showed thermal damage at the mid section and rotational scarring on the aft section. The area of the rotational scarring on the shaft is consistent with the area of damage on the external linking tube.

Figure 3 - The freewheel shaft (top) and power transmission shaft (bottom)

Note: When viewed from the aft position forward, the power transmission shaft rotate in a clockwise direction.

Module M02 – Axial Compressor

The compressor case, inlet cone and compressor wheel and associated blades were in place. Impact related damage, case deformation and heat distortion were noted to the assembly.

Compressor blade tip curl, opposite direction of rotation, was noted. The assembly would not rotate and foreign material (dirt) was noted inside the compressor casing.

Figure 4 - Module M02 – Axial compressor

Module M03 – Gas Generator (High Pressure Turbine)

The gas generator was intact; however, impact related damage and case deformation was noted. Disassembly of the gas generator revealed that the splined portion of the centrifugal compressor was fractured. The fracture features were consistent with over stress separation. Rotational scoring was noted to the centrifugal compressor and adjacent compressor cover. The combustion chamber was intact; deformation consistent with impact was noted. Mud/dirt and organic debris was observed in the combustion chamber. The centrifugal injection wheel was intact and appeared to be clear of debris. The turbine wheel was removed. The blades were intact and no anomalies were noted.

Figure 5 - Centrifugal compressor cover

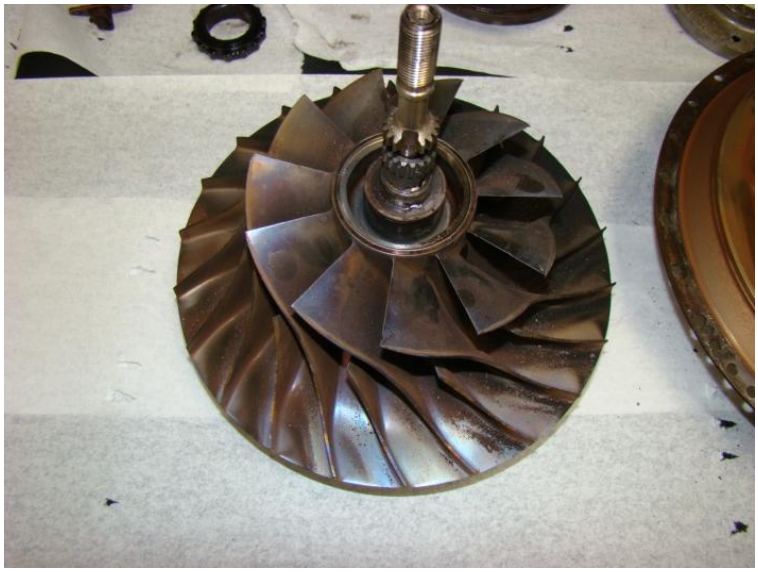

Figure 6 – Centrifugal compressor

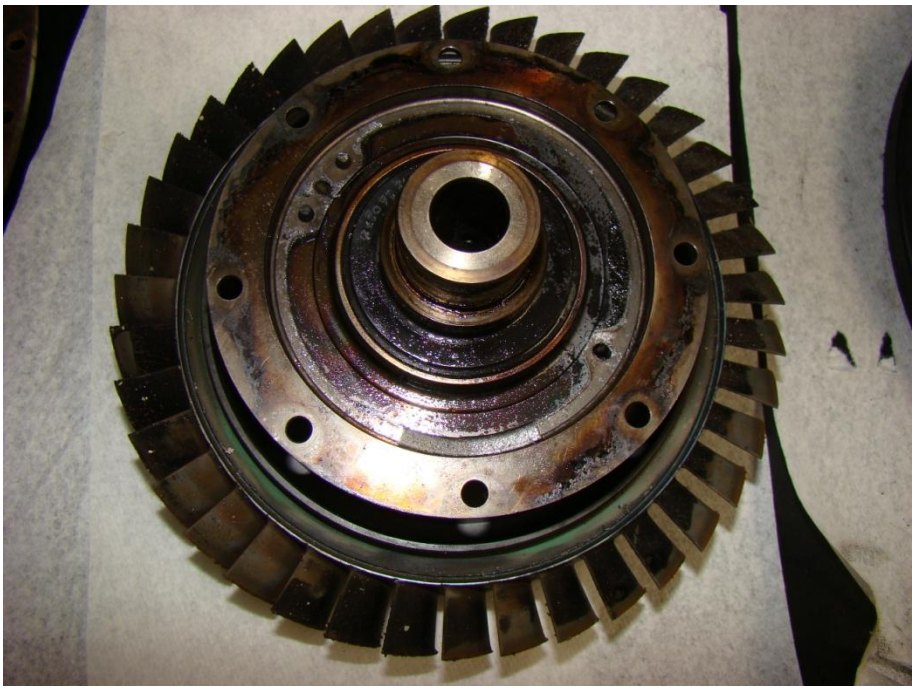

Figure 7 –Gas generator turbine wheel

Module M04 - Power Turbine

The power turbine section was removed and examined. The power turbine wheel was intact and rotated freely. The turbine wheel was in place and secured within the bearings. The power turbine blades were in place and undamaged. The power turbine casing and containment ring were intact and undamaged.

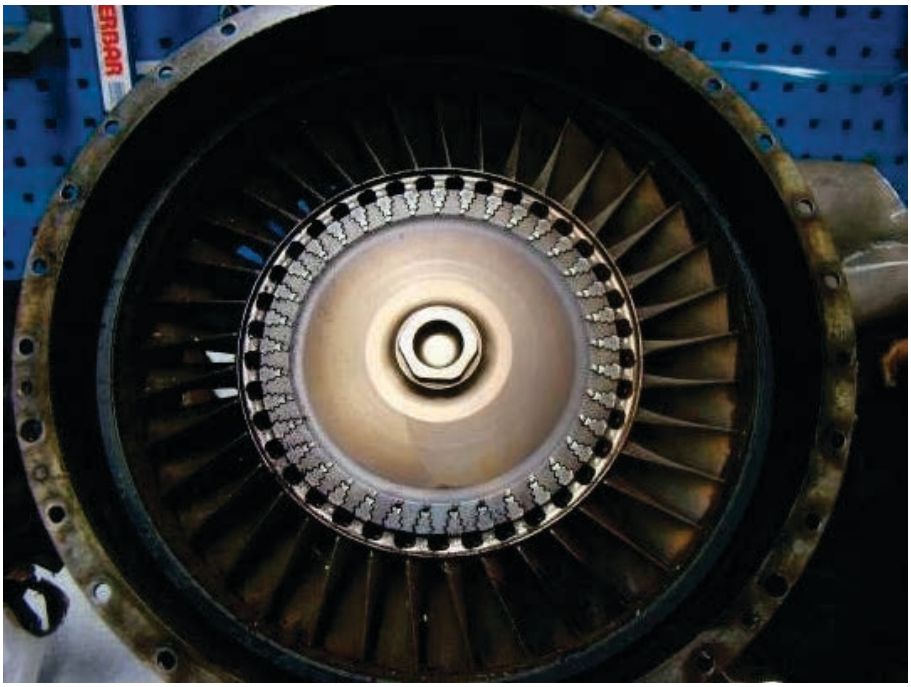

Figure 8 - Module M04 power turbine wheel

Module M05 - Reduction gearbox

The reduction gearbox was removed from the engine. The N2 drive gear was in place and the gear assembly rotated freely and no binding was noted. The splined nut, which attaches the power turbine to the reduction gearbox, was misaligned about 2 mm (in a torqueing direction) with its reference point on the inlet pinion. According to the manufacturer, the misalignment represents approximately 513 foot pounds of torque applied to the splined nut pinion coupling. This reference point is established by the manufacturer to determine sudden stoppage of main rotor blades when the engine is producing power.

Figure 9 - Splined nut pinion coupling, 2 mm displacement

Fuel metering unit

The fuel pump/metering unit (hydro mechanical unit) was in place, however, sustained extensive thermal and impact related damage. Postaccident functional testing of the unit was not possible due to the damage. The emergency backup control auxiliary unit (EBCAU) was removed and the unit was dissembled. Disassembly of the unit revealed that the emergency throttle keyed shaft (which actuates the emergency throttle) was in the 12 o'clock position, which, according to the manufacturer, equates to the neutral or closed position. It was the consensus of the group that the fuel control unit was not in emergency mode during the accident sequence.

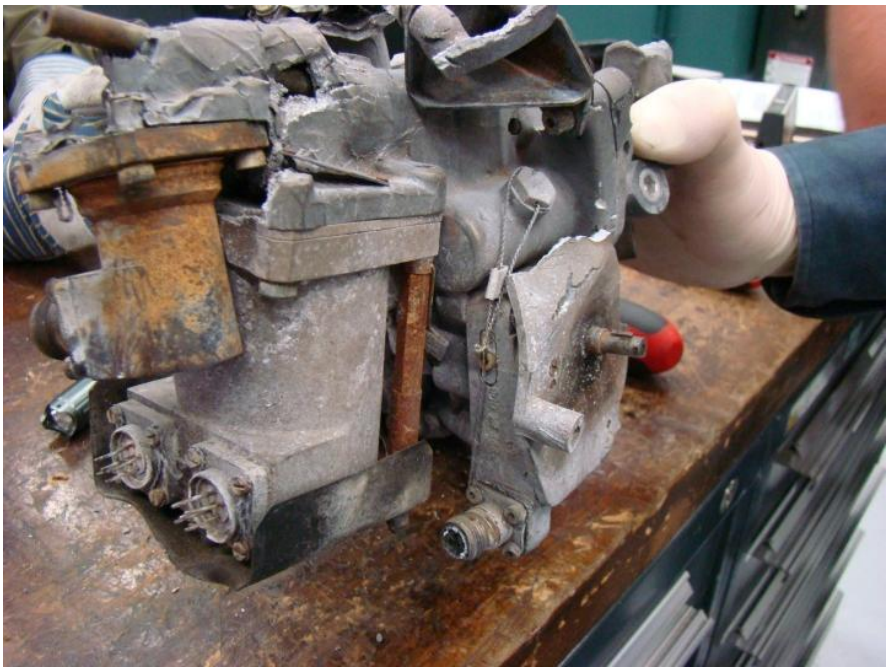

Figure 10 - Fuel metering unit (HMU)

Figure 11 - Emergency backup control shaft - found in the 12 O'clock (closed / neutral) position

Engine Electronic Control Unit (EECU), also referred to as the Digital Engine Control Unit (DECU), was located with the main wreckage. The unit sustained extensive thermal and impact related damage during the accident sequence and postaccident functional testing was not possible.

Figure 12 - Digital Engine Control Unit (DECU)