



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

February 15, 2022

AIRFRAME & ENGINE EXAMINATION SUMMARY

WPR21FA270

This document contains 27 embedded photos.

A. ACCIDENT

Location:	Monterey, California
Date:	July 13, 2021
Aircraft:	Cessna 421C, N687SW
NTSB Investigator-in-Charge:	Eric M. Gutierrez

B. PARTICIPANTS

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C. DETAILS OF THE INVESTIGATION

1.0 Airframe Examination

Examination of the recovered wreckage revealed that the cockpit, fuselage structure was mostly destroyed by thermal and impact damage. Both engines, engine mounts, engine nacelles, nose landing gear, instrument panel, cockpit, flight controls, and seats were separated, exhibited thermal and impact damaged throughout. Multiple instruments were separated from the instrument panel and exhibited thermal and impact damaged. One instrument, which was heavily impact damaged, contained a gyro gimble. Rotational scoring and impact damage was observed on the gimble.

Flight control continuity was unable to be established due to multiple separations, impact and thermal damage. The cockpit flight controls were separated and exhibited thermal and impact damage throughout. The rudder pedals were observed in the cockpit area with heavy impact and thermal damage. All areas of separation were consistent with overload or were cut by recovery personnel.



Figure 1: View of airplane cockpit area with impact and thermal damage. (Photo courtesy of Textron Aviation)



Figure 2: View of various airplane instruments with impact and thermal damage. (Photo courtesy of the NTSB)



Figure 3: View of unknown instrument with impact and thermal damage. (Photo courtesy of the NTSB)



Figure 4: View of unknown instrument gyro gimble with rotational scoring and impact damage. (Photo courtesy of the NTSB)

The cockpit switch/circuit breaker panel was separated and exhibited thermal and impact damage.



Figure 5: View of airplane cockpit switch/circuit breaker panel with impact and thermal damage. (Photo courtesy of the NTSB)

The left wing was separated from the fuselage at the wing root. The left wing was fragmented into multiple pieces with varying degrees of thermal and impact damage. The outboard section of the left wing was mostly destroyed. An approximate 3 ft section of leading edge, with fuel cap attached exhibited thermal damage. The portion that remained attached to the center section was bent, buckled, and torn throughout. The left aileron and outboard portion of the wing structure were separated. The left wing flap remained partially attached via their mounts, thermal and impact damaged was observed throughout. The left main landing gear was separated from the wing attachment point. The landing gear actuator remained attached via its mount.



Figure 6: View of left wing with impact and thermal damage. (Photo courtesy of the NTSB)

The right wing separated from the fuselage at the wing root. The right wing had various portions of the wing structure separated and exhibited thermal and impact damage throughout. An approximate 5 ft section of leading edge with fuel cap attached exhibited impact damage. The portion that remained attached to the center section was thermal damaged, bent, buckled, and torn throughout. The right aileron was separated and was mostly intact, however, bent and buckled throughout. The right flap separated, had thermal damage about mid span, was bent and buckled throughout. The right main landing gear was separated from the wing attachment points.



Figure 7: View of right wing with impact and thermal damage. (Photo courtesy of the NTSB)

The empennage was separated from the fuselage. The vertical stabilizer was separated from the empennage, exhibited thermal damage, crushing and bending throughout. The rudder remained attached to the vertical stabilizer via its attachment points and exhibited thermal damage, crushing, and bending throughout. The left and right horizontal stabilizers were separated from the empennage and mostly destroyed. The left and right elevators were separated from the horizontal stabilizers and mostly destroyed.



Figure 8: View of empennage with impact and thermal damage. (Photo courtesy of the NTSB)

The cabin heater assembly was separated and exhibited impact damage to the external casing. Using a lighted borescope, the heater assembly was examined internally. No evidence of any soot or discoloration was observed internally.



Figure 9: View of airplane heater assembly with impact and thermal damage. (Photo courtesy of Textron Aviation)

2.0 Engine (s) Examination

Left Engine: Continental

Engine Model Number: GTSIO-520-N (2)

Serial Number: 610066

Examination of the recovered engine revealed that the engine was separated from the engine mount, impact and thermal damage was observed throughout. The propeller and propeller flange separated from the quill shaft. The intake and exhaust were separated. The intercooler was separated and impact damaged. The oil sump was mostly separated and not completely observed within the recovered wreckage.



Figure 10: Front view of left engine with impact and thermal damage. (Photo courtesy of the NTSB)

All six cylinders remained attached and exhibited varying degrees of impact and thermal damage. The exhaust rocker box covers, rocker arms, and portions of the cylinder heads were separated from the No. 2, 4, and 6 cylinders. The exhaust rocker box cover, rocker arm, and portions of the cylinder head were separated from the No. 1 cylinder. The intake rocker box cover, rocker arm, and portions of the cylinder head were separated from the No. 5 cylinder. The No. 2, 4 and 6 cylinder exhaust and intake valves springs were separated. The rocker box covers were removed from the No. 1, 3 and 5 cylinders, the intake and exhaust rocker arms were intact and oil coated. The push rod tubes and push rods were separated from the No. 1, 2, 4, and 6 cylinders. The upper spark plugs were removed, and all six cylinders were examined internally using a lighted borescope. The No. 3 cylinder was filled dirt and debris, the remaining cylinders exhibited a normal amount of combustion deposits was observed within the combustion dome of each cylinder and piston face. The crankshaft was rotated by hand using a hand tool connected to the starter adapter. Rotational continuity was established throughout the engine and valve train. Due to the extensive damage to all cylinders, thumb compression and suction was not obtained.



Figure 11: View of left engine cylinders 2, 4, and 6. (Photo courtesy of the NTSB)



Figure 12: View of left engine cylinders 1, 3, and 5. (Photo courtesy of the NTSB)

The top spark plugs were removed from the 1, 3 and 5 cylinders. The bottom spark plug was removed from the No. 2 cylinder. All spark plugs were massive electrode type. All sparkplugs had a debris and

corrosion within electrode area. All of spark plugs exhibited signatures consistent with worn-normal when compared to the Champion Check-A-Plug comparison chart.

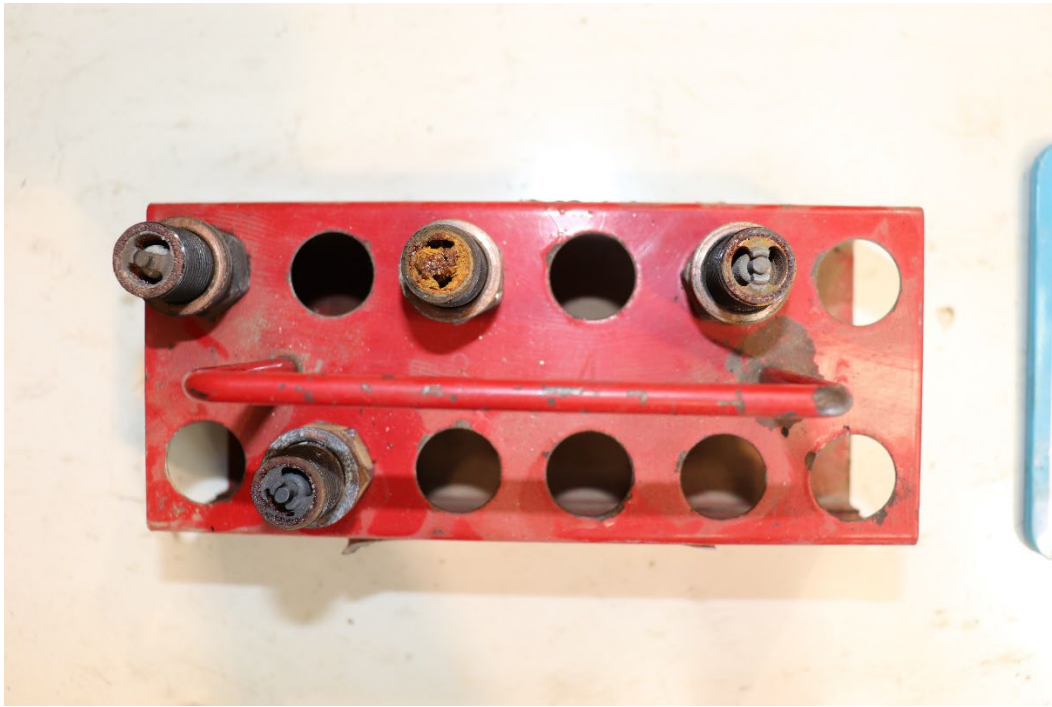


Figure 13: View of left engine spark plugs. (Photo courtesy of the NTSB)

The fuel manifold valve was separated and exhibited impact damage. All fuel injector lines exhibited impact damage. The fuel manifold valve was disassembled. The internal spring and diaphragm were intact. Various amounts of debris and corrosion was observed within the fuel screen and plunger.



Figure 14: View of left engine fuel manifold valve. (Photo courtesy of the NTSB)

The No. 2, 4 and 6 cylinder fuel injector nozzles were separated and not located. The No. 1, 3, and 5 cylinder fuel injector nozzles remained attached to the cylinder and were impact damaged.

The left and right magnetos were separated. Due to impact damage a functional test was not able to be conducted.



Figure 15: View of left engine magnetos. (Photo courtesy of the NTSB)

The left engine turbo was separated, exhibited impact and thermal damage. The impeller blades on the turbine and compressor side were impact and thermal damaged. The turbo would not rotate, impact damage and corrosion were observed within the impeller.



Figure 16: View of left engine turbo. (Photo courtesy of the NTSB)

The waste gate remained attached to the turbo assembly and exhibited impact damage. The waste gate valve moved freely when rotated by hand using a handtool.



Figure 17: View of left engine waste gate. (Photo courtesy of the NTSB)

The left engine vacuum pump was separated, exhibited impact and thermal damage. The vacuum pump was disassembled. The rotor and veins were fragmented. The vacuum pump drive was impact damaged. The vacuum drive shaft was intact and undamaged.



Figure 18: View of left engine vacuum pump. (Photo courtesy of the NTSB)

The left engine oil pump was separated, exhibited impact and thermal damage. The oil pump was disassembled and free of debris. The oil pump drive shaft rotated freely when rotated by hand.



Figure 19: View of left engine oil pump. (Photo courtesy of the NTSB)

Right Engine: Continental

Engine Model Number: GTSIO-520-N (2)

Serial Number: 808275-R

Examination of the recovered engine revealed that the engine was separated from the engine mount, impact and thermal damage was observed throughout. The quill shaft along with a section of the crank and crank case separated from the engine. The intake separated and fragmented. The intercooler was separated, exhibited impact damage throughout. The oil sump was separated and not observed within the recovered wreckage.



Figure 20: Front view of right engine with impact damage. (Photo courtesy of the NTSB)

All six cylinders remained attached and exhibited varying degrees of impact and thermal damage. The exhaust rocker box covers, and rocker arms were separated from the No. 5 and 6 cylinders. The rocker box covers were removed from remaining cylinders, the intake and exhaust rocker arms were intact and oil coated. The upper spark plugs were removed, and all six cylinders were examined internally using a lighted borescope. All cylinders exhibited a normal amount of combustion deposits was observed within the combustion dome of each cylinder and piston face. The crankshaft was rotated by hand using a hand tool connected to the crank shaft. Rotational continuity was established throughout the engine and valve train. Due to the damage to the cylinders, thumb compression and suction was not obtained.

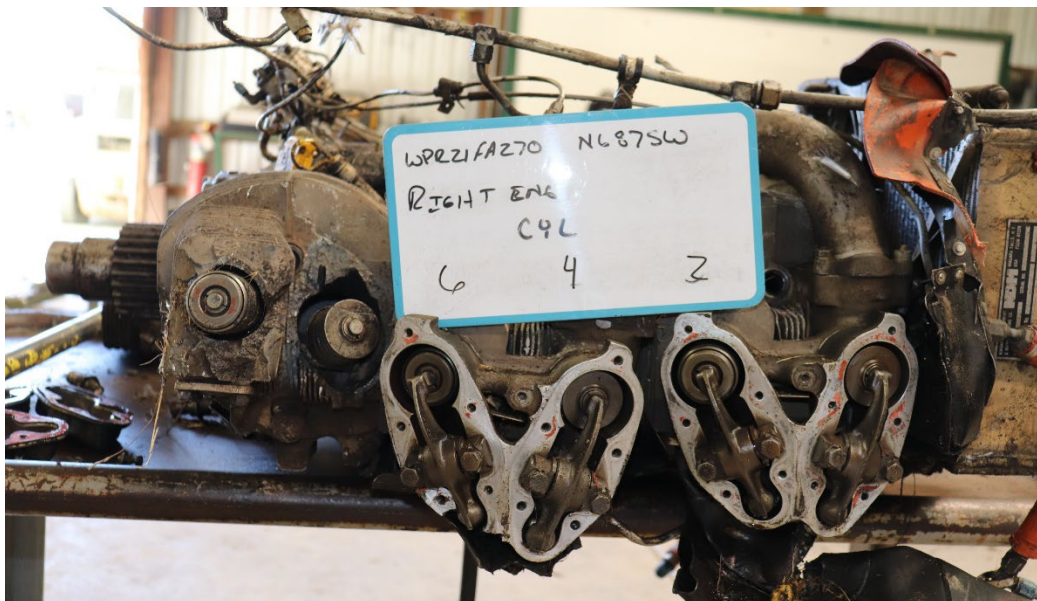


Figure 21: View of right engine cylinders 6, 4, and 2. (Photo courtesy of the NTSB)



Figure 22: View of right engine cylinders 1, 3, and 5. (Photo courtesy of the NTSB)

The top spark plugs were removed from the engine, and they were the massive electrode type. All sparkplugs had a grey deposits within the electrode area. All of spark plugs exhibited signatures consistent with worn-normal when compared to the Champion Check-A-Plug comparison chart.



Figure 23: View of right engine spark plugs. (Photo courtesy of the NTSB)

The left and right magnetos were separated. Due to impact damage a functional test was not able to be conducted.



Figure 24: View of right engine magnetos. (Photo courtesy of the NTSB)

The right engine turbo was separated, exhibited impact damage. The impeller blades on the turbine side were impact damaged. The impeller blades on the compressor side were intact and undamaged. The turbo rotated freely by hand.

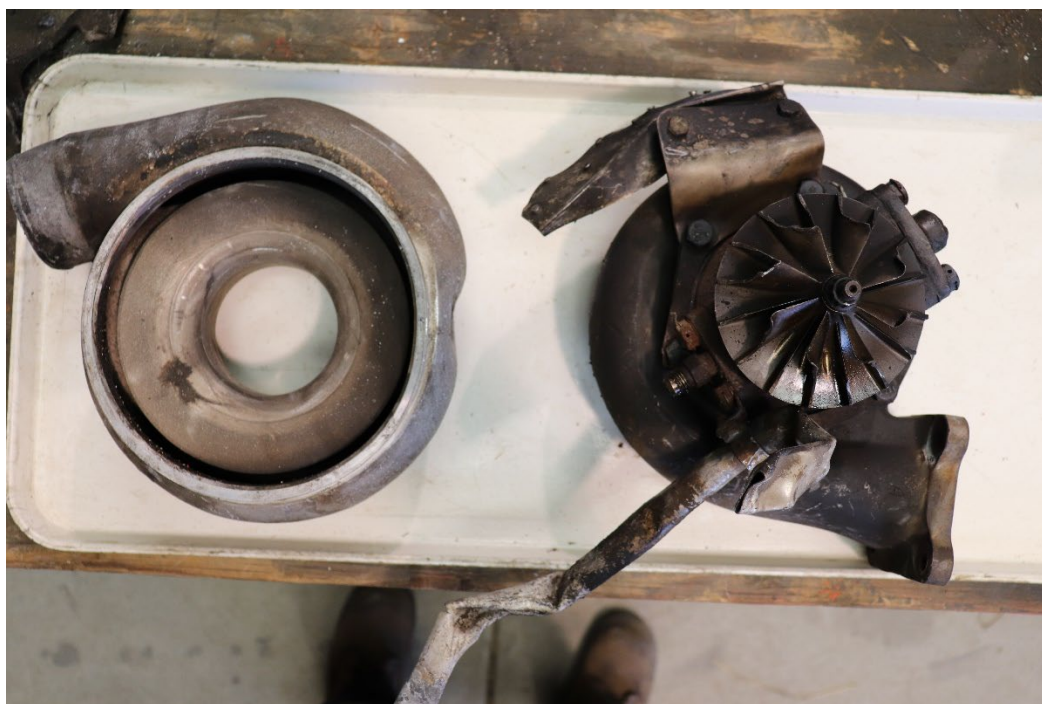


Figure 25: View of right engine turbo. (Photo courtesy of the NTSB)

The right engine vacuum pump was separated and exhibited impact and thermal damage. The cap was partially separated. The rotor and veins were fragmented. The vacuum pump drive was separated. The drive pins were intact and undamaged.

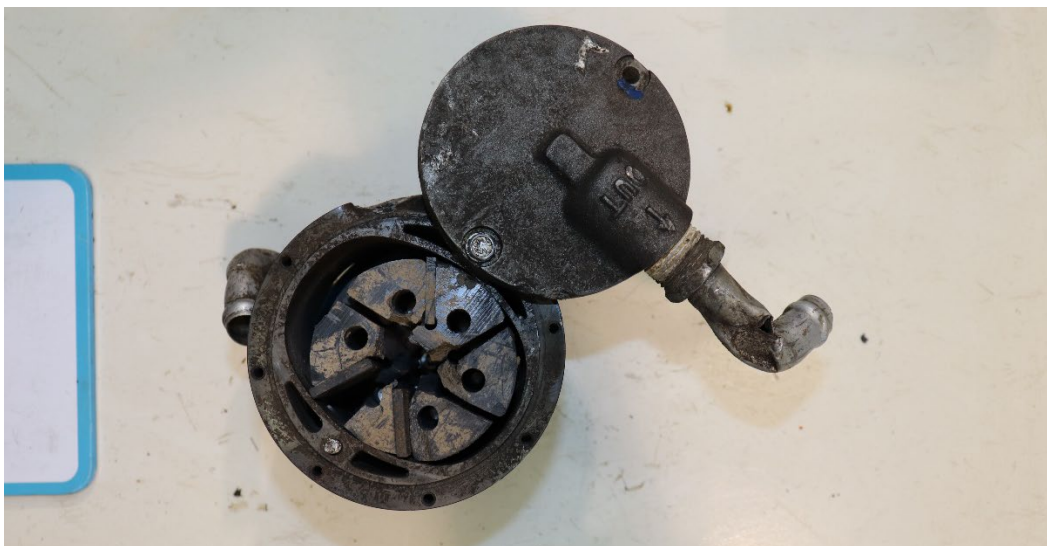


Figure 26: View of right engine vacuum pump. (Photo courtesy of the NTSB)

The right engine oil pump was separated, exhibited impact and thermal damage. The oil pump was disassembled and free of debris. The oil pump drive shaft rotated freely when rotated by hand.



Figure 27: View of right engine oil pump. (Photo courtesy of the NTSB)

The exhaust was separated and exhibited crushing throughout.

3.0 Propeller (s) Examination

The engine was equipped with two, three blade McCauley propellers. Both propeller hubs separated from the reduction gearbox. Due to the damage correlated to the engine and propeller hubs, propeller blades A–C are likely the right engine propellers and propeller blades D–F are likely the left engine propellers.

Propeller blade A exhibited bending aft near the tip, with polishing of the blade face along with chordwise striations on the cambered side of the blade. Propeller blade B exhibited bending aft about mid span with polishing of the blade face along with unidirectional striations on the cambered side of the blade.

Propeller blade C exhibited bending aft near the tip, with polishing of the blade face along with chordwise striations on the cambered side of the blade.

Propeller blade D exhibited impact damage on the trailing edge near mid span, with aft bending near the tip and polishing of the blade face along with chordwise striations on the cambered side of the blade.

Propeller blade E remained attached to the propeller hub, exhibited S bending about mid span with polishing of the blade face along with unidirectional striations on the cambered side of the blade.

Propeller blade F exhibited bending aft about mid span with polishing of the blade face along with unidirectional striations on the cambered side of the blade.

Submitted by: Eric M. Gutierrez