



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

October 4, 2021

AIRFRAME AND ENGINE EXAMINATION

WPR22FA001

This document contains 10 embedded photos.

A. ACCIDENT

Location:	Chandler, Arizona
Date:	October 1, 2021
Aircraft:	Piper, PA28-181, N2868H \
	Robinson, R22, N412TL
NTSB Investigator-in-Charge:	Eric M. Gutierrez

B. PARTICIPANTS

Eric M. Gutierrez
Air Safety Investigator
National Transportation Safety Board
Federal Way, Washington

Dennis Hogenson
Deputy Regional Chief – Western Pacific Region
National Transportation Safety Board
Federal Way, Washington

Michael G. Moyer
Aviation Safety Inspector
Federal Aviation Administration
Scottsdale, Arizona

Hannah Warren
Engineering Department
Robinson Helicopter Company
Torrance, California

C. SUMMARY

- Examination of the recovered airplane airframe and engine revealed no anomalies that would have precluded normal operation and the production of power.
- Due to extensive impact damage and post-crash fire a functional examination of the helicopter airframe and engine was limited.

D. DETAILS OF THE INVESTIGATION

1.0 Airplane Airframe Examination

Both wings were removed from the airframe by the recovery company to facilitate transportation and storage. Examination of the airframe revealed that the nose landing wheel and tire, and the left landing gear assembly were separated from the airframe. Additionally, the recovery personnel drained about 30 gallons of fuel from the left and right fuel tanks to facilitate recovery.

The fuel selector lever was in the off position and the master switch was off. The observed hobbs meter time was 1887.9 hours.



Figure 1: front view of airplane during exam

Throttle and mixture control continuity was established from the cockpit controls to the fuel carburetor and moved from stop to stop when actuated by hand.

A visual inspection was conducted of the fuel system. Continuity was established from the fuel tanks throughout the fuel system to the carburetor.

The nose landing gear wheel assembly was separated from the strut fork assembly. The tire was cut near the center diameter, from tread to tread, consistent with main rotor impact. Impact damage, constant with main rotor blade contact was observed to the outer diameter of the tire rim assembly. Impact damage consistent with main rotor blade contact was noted to the nose landing gear oleo strut assembly. The nose landing gear fork casting was fractured near the upper attachment point; the left-side and right-side forks separated from the casting.



Figure 2: view nose landing gear wheel assembly

The left main landing gear was separated from the airplane at the wing spar attachment. The left landing gear strut fairing was partially separated from the wing. The landing gear strut fairing had impact damage near the bottom section, consistent with main rotor impact. The tire was cut, about 9 inches in length on the tread, consistent with main rotor impact. A small piece of main rotor blade was imbedded in the upper brake bleeder valve seat.

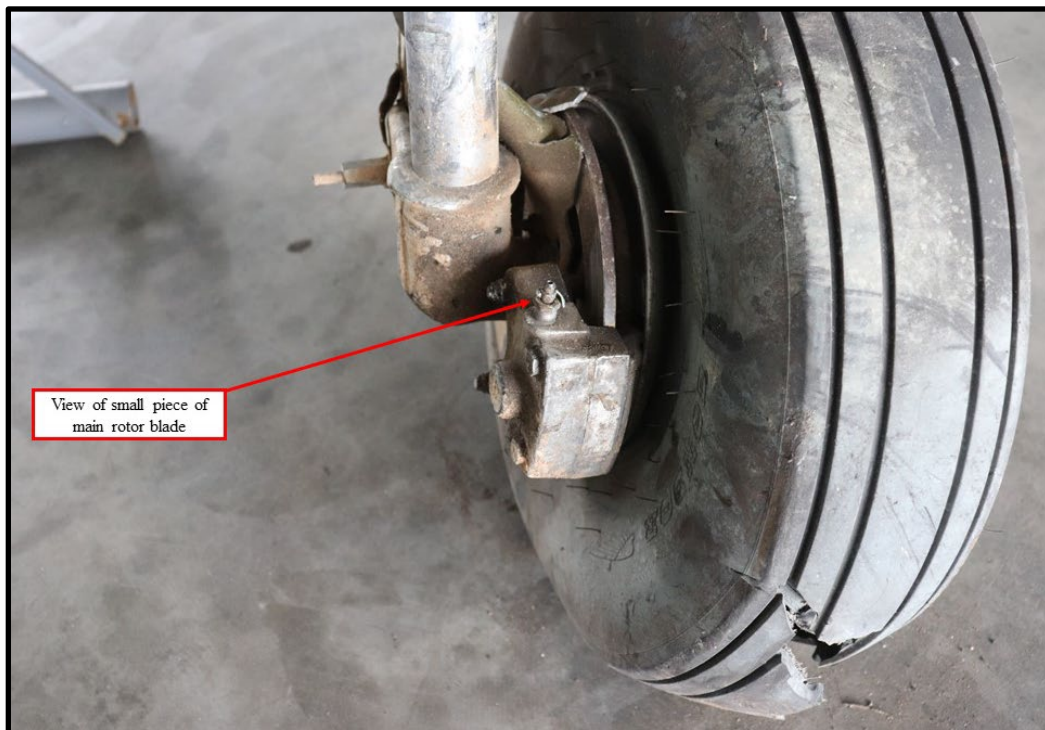


Figure 3: view left main landing gear

The right main landing gear remained attached to the right wing. Impact damage was noted on the right main landing gear strut fairing from the aft section to the landing gear. The chromed inter cylinder of the landing gear had impact damage, consistent with main rotor impact.



Figure 4: view right main landing gear

Examination of the airplane fuselage undercarriage revealed crushing and jagged tearing measuring about 18 inches in length on the hat channel, along the longitudinal axes near the wing root.



Figure 5: view airplane fuselage undercarriage

2.0 Airplane Engine Examination

Engine Manufacturer: Lycoming

Engine Model Number: O-360-4AM

Engine Serial Number: L-36779-39

Examination of the recovered engine revealed that the engine remained attached to the engine mounts. All four cylinders and all engine accessories remained attached. All fuel and oil lines remained attached to their corresponding attachment points and were tight. No evidence of any mechanical damage was observed to the engine crankcase.

The exhaust system remained secure to the cylinders. No evidence of any exhaust leaks around the cylinder attach points were observed.

The airplane was equipped with a 2 blade, fixed pitch propeller. Both propeller blades remained attached to the propeller hub. Propeller blade A was bent about 90° aft, about 6 inches from the propeller tip, consistent with runway impact.



Figure 6: view of airplane propeller blade A

Propeller blade B remained attached to the propeller hub. A yellow paint mark about 4 inches in length, near the propeller tip on the cord side. The propeller was bent about 90° forward, about 9 inches from the propeller tip.



Figure 7: view of airplane propeller blade B

3.0 Helicopter Airframe Examination

Flight control continuity was not established due to multiple separations and thermal damage. The tail rotor pedal assembly was impact and thermal damaged. The right-side pedals were thermal and impact damaged. The left side pedals were installed, impact and thermal damaged.

The cyclic was impact and thermal damaged. The removable cyclic was installed. The left side of the cyclic grip weldment was separated near the center post. The right side of the cyclic grip weldment remained attached to the center post. The push-pull tube assemblies were thermal and impact damaged throughout.

The collective control stick assembly was impact and thermal damaged throughout. The pilot's side was identified; however the position of the collective could not be determined due to extensive impact and thermal damage.

The tail cone remained attached to the upper tube frame and rotated 180°. The tail cone had thermal damage from the tail cone attachment to about mid span. The tail cone had a partial separation 18 inch from the tail cone attachment and bending throughout consistent with impact damage.

The empennage was separated from the aft tail cone bulkhead. The lower vertical stabilizer had crushing and bending throughout consisting with impact damage. The horizontal stabilizer was bent about 4 inch from the vertical stabilizer consisting with impact damage.

The tail rotor remained attached to the tail rotor gearbox; however, the tail rotor gearbox was fracture separated from the tail cone. The pitch change bearing moved freely with no binding. Tail rotor blade serial number 10368 was bent about 30° toward the trailing edge constant with impact damage.

The right landing gear skid was impact and thermal damaged. The right skid toe was separated forward of the right forward strut. The left skid was impact and thermal damaged. The left skid strut was bent aft and partially separated.

4.0 Helicopter Engine Examination

Engine Manufacturer: Lycoming

Engine Model Number: O-360-J2A

Engine Serial Number: L-39564-36A

Examination of the recovered engine revealed that the engine remained attached to the engine mounts. Extensive thermal damage was noted throughout the engine. All four cylinders remained attached.

Impact damage was noted on all rocker box covers except, on the number 2 cylinder. Thermal damage was observed on all rocker box covers. All rocker box covers were removed. The intake and exhaust rocker arms were intact and oil coated. Thermal and impact damage was noted to the number 1 and 3 cylinder intake and exhaust valve springs. The number 2 and 4 intake and exhaust valve springs were in place and visually appeared to be undamaged. The upper spark

plugs were removed, and all four cylinders were examined internally using a lighted borescope. A normal amount of combustion deposits was observed within the combustion dome of each cylinder and piston face. All of the intake and exhaust valves were unremarkable. The crankshaft was rotated by hand from the cooling fan. Rotational continuity was established throughout the engine and valve train. Thumb compression and suction was obtained on the number 2 and 4 cylinders. Due to thermal and impact damage to the 1 and 3 cylinder, thumb compression and suction was not obtained.



Figure 8: view of right side of helicopter engine



Figure 9: view of left side of helicopter engine



Figure 10: view of helicopter engine spark plugs

Impact and thermal damage was observed throughout the main rotor system. The main rotor gearbox remained attached to the upper tube frame. The main rotor gearbox was fractured and thermal damaged throughout. The main rotor mast remained attached to the main rotor gearbox and was thermal damaged. The rotor hub assembly components exhibited varying degrees of visible damage consistent with sudden stoppage from impact with terrain. The swashplate remained attached to the main rotor mast. Both main

rotor blades remained attached to the main rotor hub but were destroyed. The pitch link of main rotor blade "A" was fracture separated near the rod end connection to the pitch change horn, consistent with impact damage. Blade "A" was fractured approximately 31 inches from the blade root. A separated section of the spar of blade "A" about 76 inches in length was bent down about mid span. An approximately 41 inch section of blade was found 330 feet north of the main wreckage location. The spar was dented in near the fractured end consistent with impact, and the body of the blade was crushed towards the trailing edge near the fractured end. A portion of the tip cover remained attached to the blade section. There were black transfer marks on the upper skin of the blade section near the tip and an arc shaped scuff mark extending from near the tip of the blade towards the trailing edge and inboard approximately 16 inches. The fracture surface of the spar of the 41 inch section of blade matched the fracture surface of the spar of blade "A".

The pitch link of main rotor blade "B" remained attached to the swashplate and the pitch change horn of the blade. Blade "B" was fractured approximately 75 inches from the blade root and was bent down and toward the trailing edge. A 51 inch section of main rotor blade was located about 122 feet west of the main wreckage. The blade section was bent at approximately a 60° angle with the lower surface of the blade on the inside of the bend. There were multiple punctures on the lower skin of the blade and one circular puncture mark on the upper surface of the blade near the bend of the spar. The fracture surface of the 51 inch bent section of blade matched the fracture surface of the spar of blade "B". Multiple smaller pieces of main rotor skin and honeycomb were located in the debris field. Four pieces of blade recovered from the debris field, including a large 22 inch skin section, were matched based on fracture surface shape to the 51 inch section of blade and reconstructed the outboard section of the blade. No spar was recovered from the most outboard section of blade "B". The approximately 22 inch length piece of blade skin was identified as the upper surface of the tip of the blade based on the paint scheme and the pattern of bonding adhesive on the skin.

The exhaust manifold remained secured and attach to the cylinders. Thermal and impact damage was noted throughout.

The engine left magneto remained attached to the engine, thermal and impact damage was noted throughout. The engine right magneto drive remained attached to the engine accessories case; the remainder of the magneto was separated.

Impact and thermal damage were noted to the carburetor. The carburetor remained attached to the engine. The throttle arm was intact, undamaged, and moved freely from stop to stop, with corresponding movement of the throttle plate.

Submitted by: Eric M. Gutierrez