

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



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WRECKAGE EXAMINATION SUMMARY

January 12, 2022

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A. ACCIDENT

Location: Cosby, Tennessee
Date: December 29, 2021
Time: 1425 EST
1925 UTC
Helicopter: N544SC, Robinson Helicopter Company R-44 II

B. WRECKAGE EXAMINATION SUMMARY

Participants:

NTSB IIC	Peter Wentz National Transportation Safety Board Washington, DC
Party Coordinator	Neal Thorne Federal Aviation Administration Nashville, Tennessee
Party Coordinator	Thom Webster Robinson Helicopter Company Torrence, California
Party Coordinator	James Childers Lycoming Engines Williamsport, Pennsylvania

C. SUMMARY

On December 29, 2021, at 1425 eastern standard time, a Robinson R-44 II, N544SC, was substantially damaged when it was involved in an accident near Cosby, Tennessee. The commercial pilot received serious injuries and the passenger was fatally injured. The helicopter was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

D. DETAILS OF THE EXAMINATION

1.0 General

On December 30 and 31, 2021, an examination of the main wreckage and the accident location were performed. Present for the examinations were Peter Wentz (NTSB), Neal Thorne (FAA) and Thom Webster (RHC).

Due to inclement weather, the wreckage was recovered several days later and transported to AMF Aviation in Springfield, Tennessee, where it was secured.

On January 12, 2022, a detailed examination of the wreckage was performed at the AMF facilities. Present for this examination were Neal Thorne (FAA), Mike Childers (Lycoming) and Thom Webster (RHC). Details of both examinations are in the following pages.

The wreckage came to rest on steep, wooded terrain at coordinates 35.773248, -83.279198 on a heading of 210°. There was no fire. All structural components of the helicopter were located within the wreckage debris field. The accident site elevation was about 1,960 ft msl.

2.0 Cabin Examination

The floor of the cabin structure was deformed upward, more severely at the nose. A tree trunk pierced thru the belly, up between the aft seats and protruded out the aft right door.

The upper console was separated from the lower console and tethered by wires. The lower console was deformed and crushed rearward.

The pilot's cyclic grip was disconnected from the crossbar. The surface of the disconnect was angular and jagged. The left side cyclic control was installed. The collective was positioned approximately mid-travel. The removable collective and tail rotor pedals were recovered on the aft left floor. The pilot's tail rotor pedals were positioned with the left pedal forward.

The front right seat structure was severely deformed. The front left seat structure was moderately deformed. Both aft seat structures were severely deformed and the seat backs/bulkhead was folded over the seat bottoms.

The front right seat belt buckle was unlatched (reportedly, the other three were buckled).

Personal items recovered consisted of two backpacks, two suitcases, extra headsets and the pilot's flight bag with his logbook.

3.0 Fuel System Examination

The main fuel tank sustained impact damage to the forward end of the outer shell, but the bladder was not compromised. The filler cap remained secure on the filler neck. The main fuel tank appeared to be half full of 100LL aviation fuel, blue in color with proper aroma. No water was present in the sample taken.

The auxiliary fuel tank sustained impact damage to the forward end of the outer shell, but the bladder was not compromised. The filler cap remained secure on the filler neck.

The auxiliary fuel tank appeared to be full of 100LL aviation fuel, blue in color with proper aroma. No water was present in the sample taken.

The fuel lines and hoses remained secure to their fittings.

The fuel tank vent tubes were separated from the rollover valves. The tubes and hoses were clear when blown through. The rollover valves operated properly.

The gascolator sustained impact damage. The bowl contained no fuel. The screen was clean. The fuel shutoff knob was mostly in the on position. The connecting rod was damaged.

4.0 Powerplant Controls Examination

The fuel mixture control knob was in the full rich position. The fuel mixture guard was hanging on the console. The fuel mixture arm on the fuel control unit was in the cutoff position. The control wire sheathing was secure in the mounting clamps. The control wire sheathing was stretched due to impact damage.

The throttle grip was in a fully open position as was the throttle valve in the fuel control unit.

The governor switch was in the on position.

5.0 Powerplant Examination

An examination of the engine was performed at the aircraft salvage facility. The aircraft was removed from a trailer and placed on the floor in a hangar. The engine mount and structural tubing aft of the firewall were impact-damaged. The engine-driven fuel pump overboard drain line fitting was impact-separated from the pump. The fuel strainer was impact-damaged. The fuel strainer screen was absent of debris.

The fuselage was suspended from a lift. The upper spark plugs were removed and the engine crankshaft was rotated by turning the cooling fan. Continuity of the crankshaft to the rear gears and to the valve train was confirmed. The interiors of the cylinders were viewed using a lighted borescope and no damage to the pistons or valves was noted.

The fuel strainer was bypassed using locally-sourced hoses and fittings. An external fuel source was plumbed to the aircraft fuel system and serviced with aviation gasoline. An external battery was connected to the aircraft starter and to the airframe electric fuel pump. When the electric fuel pump was energized, fuel leaked around the fuel injector servo throttle shaft and the attempt to run the engine was abandoned. Closer examination of the throttle shaft revealed that it was bent consistent with contact with the aircraft firewall during the accident sequence.

All of the sparkplugs and the rocker covers were removed. The aircraft engine oil pressure gage was energized using an external battery and the engine crankshaft was rotated by energizing the engine starter motor. The oil pressure gage indicated about 60 PSI.

The fuel injector servo remained attached to the engine and was impact-damaged. The servo was removed and partially disassembled. The rubber diaphragms were observed intact. The servo fuel inlet screen was unobstructed.

The fuel flow divider remained attached to the engine. No damage was noted and it was not removed. The two-piece fuel injector nozzles were unobstructed.

The engine-driven fuel pump remained attached to the engine. No damage was noted and it was not removed.

Both magnetos remained attached to the engine and no damage was noted. Both were removed and each produced spark from all ignition towers when rotated by hand.

The spark plug electrodes exhibited gray coloration and normal wear condition when compared to a Champion Check-A-Plug chart. The electrodes of the #2 top, #6 top, #2 bottom, #4 bottom and #6 bottom spark plugs were oil-soaked.

The engine oil dipstick indicated about 5 quarts of oil in the engine oil sump. No oil was observed on the exterior of the engine. The oil suction screen was absent of debris. The oil filter media was absent of metallic debris.

6.0 Drive System Examination

The grooves in the lower and upper sheaves appeared to have normal wear. The V-belts remained in their grooves on the lower sheave and were positioned one groove forward on the upper sheave. The V-belts appeared to have no abnormal wear. The belt tension actuator was bent at the screw tube and the overtravel activation cable was fully extended. The extension distance between the scissor mounts was approximately 1.3".

The lower and upper actuator support bearings rotated smoothly by hand.

The upper sheave rotated smoothly on the clutch shaft when moved by hand in a clockwise direction (looking forward) and locked on the shaft when moved in a counterclockwise direction.

The forward flex coupling was undamaged.

The main rotor gearbox was undamaged and remained secure to the upper frame. Oil, blue in color, was visible in the sight gauge. The mast tube and driveshaft remained straight. The main rotor was rotated by hand more than 360° with no anomalies in the gearbox, confirming continuity from the upper sheave to the main rotor.

The main rotor hub had no contact marks from the main rotor blade spindle boots.

Both elastomeric teeter stops were dented across the centers with no damage to their brackets. The droop stops and tusks appeared to be undamaged.

Main rotor blade serial number 12234 was bent upward approximately 45° about 8 feet out from the hub and had several chordwise creases throughout. A 3' section of the tip was disconnected. The surface of the disconnect was angular and jagged with a portion of afterbody (skin and honeycomb) was pulled away from the spar, leaving an equal amount of adhesive on both surfaces.

Main rotor blade serial number 12227 was bent upward approximately 90° about 5 feet out from the hub and was bowed upward slightly throughout the mid-section. A 5' section of the tip was disconnected. The surface of the disconnect was angular and jagged.

Both ears of the clutch shaft yoke of the intermediate flex coupling were bent and disconnected. The surface of the disconnect was angular and jagged. The flex plate was also bent.

The tail rotor driveshaft was recovered separated from the tailcone and had a disconnect near the aft end. The surface of the disconnect was angular and jagged with one side flattened and folded over. The tail rotor driveshaft damper bearing rotated smoothly by hand and remained in place on the shaft, but the housing was separated.

The support bracket was disconnected from the bulkhead. The surface of the disconnect was angular and jagged. The friction link was bent slightly, but still moved smoothly with normal resistance.

The flex plate of the aft flex coupling was disconnected from the tail rotor gearbox input yoke. The surface of the disconnects were angular and jagged and the plate along with the yoke arms were bent.

The tail rotor gearbox mounting flanges bolts were secure, but one of the flanges was disconnected and one was bent coinciding with damage to the bulkhead casting. The surface of the disconnects were angular, jagged, and flat gray in color. The input yoke rotated smoothly by hand more than 360° of the tail rotor with no anomalies confirming continuity throughout the gearbox. Oil, blue in color, was visible in the sight gauge. The chip detector was clear of any debris. The output shaft remained straight.

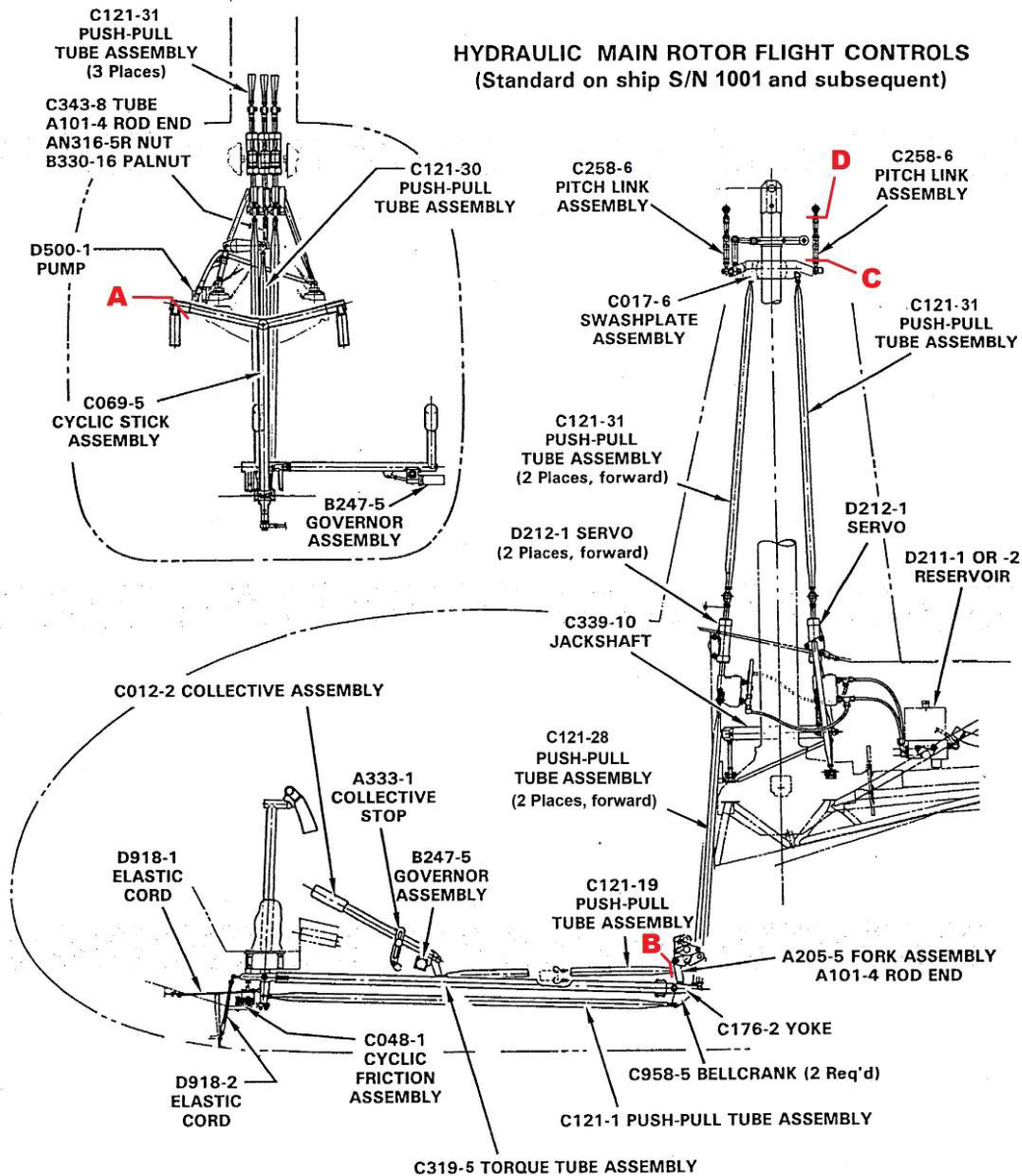
Both tail rotor blades were separated at the root. The surface of the separations were angular and jagged. Tail rotor blade serial number 10548 had a 2", round shaped dent in the leading edge near the tip. Tail rotor blade serial number 10549 had several dents in the leading edge and the tip section was separated.

7.0 Flight Controls Examination

The flight control system had discontinuities at the locations indicated on the diagrams on pages 10 and 11. The disconnects are shown individually in the photographs that follow. No evidence of pre-impact failures of the flight control system was found. The center section of pitch link between disconnects C and D was not recovered.

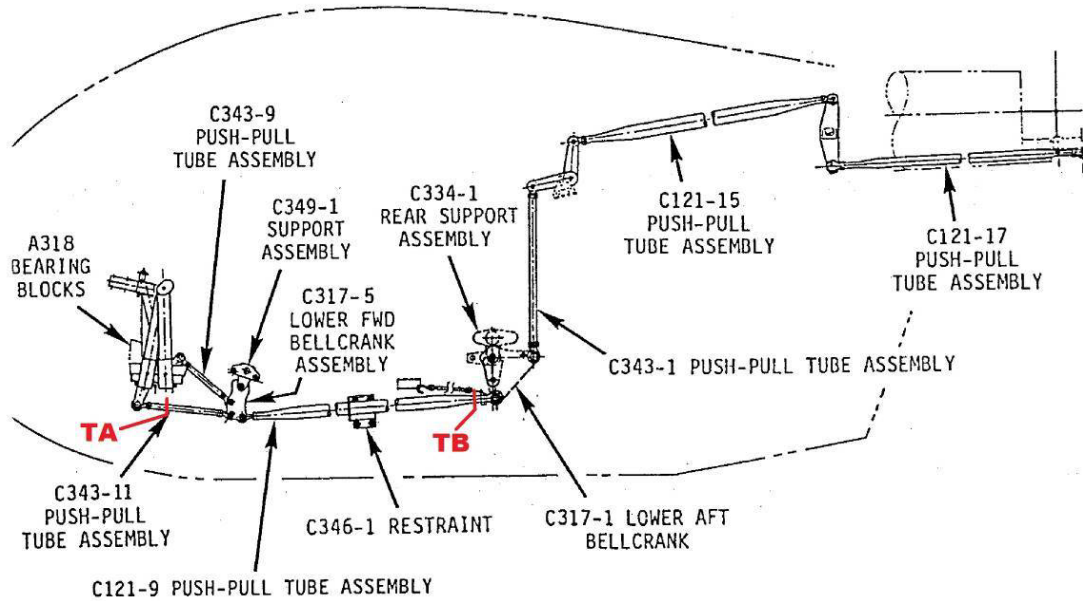
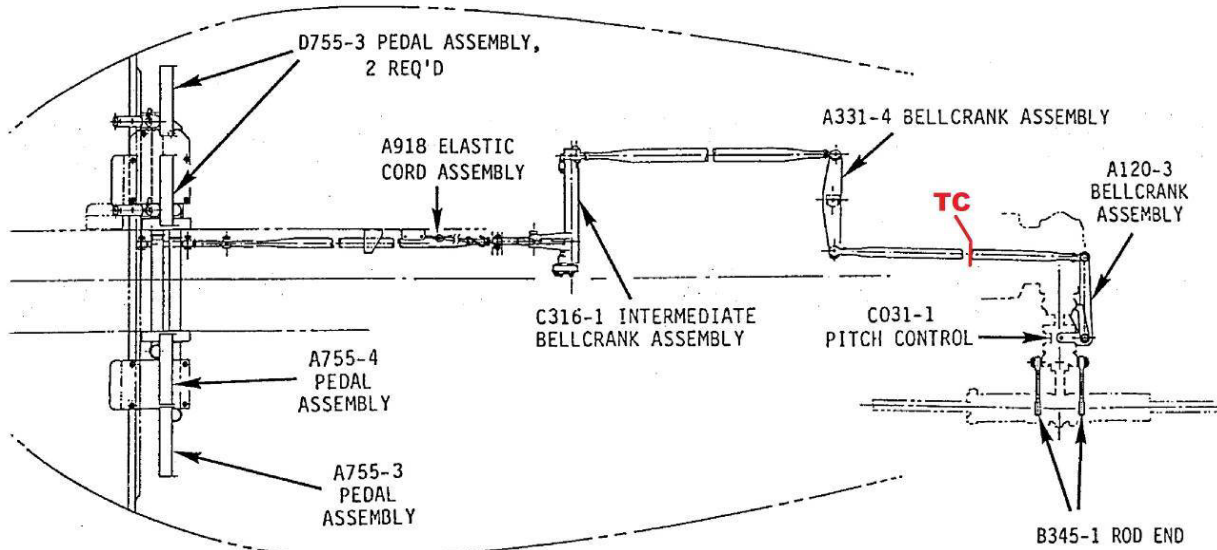
The hydraulic servos were manipulated by hand through their full motion with no anomalies.

The tail rotor pitch change slider was free to slide along the tail rotor gearbox output shaft.



TAIL ROTOR CONTROL SYSTEM

N544SC



8.0 Airframe Examination

The fuselage and cowlings sustained impact damage with the belly and chin being deformed upward and aft. The door frames were distorted. Three doors remained attached to the cabin, the aft left door was separated. The windshields were shattered.

The lower frames were bent slightly.

The horizontal and vertical firewalls were distorted and wrinkled.

The upper frame had only slight bending of the lower tubes.

The forward end of the tailcone remained attached to the upper frame. Most of tailcone bay 6 was not located in the debris field although the strobe light and sections of the tail rotor guard were recovered in the immediate area. Tailcone bay 7 was separated from bay 6 at the bulkhead leaving the rivets sheared.

The empennage remained attached to the aft bulkhead. The bulkhead was partially disconnected across the center. The surface of the disconnect was rough and matte gray in color. The lower portion of the disconnected bulkhead was partially separated from bay 7. The lower vertical stabilizer was bent and folded up to the left with multiple dents and creases on the leading and trailing edges. The upper vertical and horizontal stabilizers had minor dents to their leading and trailing edges.

9.0 Landing Gear Examination

The forward cross tube was straight and remained in place although both elbow mounts were bent/deformed rotating the struts rearward 30-40°.

The left skid was disconnected at both strut mounts.

The aft cross tube was folded slightly aft and upward at the right elbow. Both elbows were separated from their mounts. Both elbows remained secure on the cross tube.

The right skid was disconnected at the forward strut and partially disconnect at the aft strut. The toe section of the right skid was not recovered.

Submitted by:

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Air Safety Investigator