



The National Transportation Safety Board

Office of Aviation Safety
Central Region
Memorandum for the Record
Airframe Examination
Findings
CEN21LA084
Colorado City, Texas
December 10, 2020

Summary

The helicopter wreckage was located on relatively flat rural terrain, and the debris field was about 400-yards long. The first pieces of wreckage were identified as fragments of the left landing skid and forward skid strut. About 30-yards forward of the strut, fragments of a main rotor blade skin were found. The main wreckage, consisting of the cabin, main rotor assembly, and tail boom and rotor assembly were found about 400-yards from the left landing gear skid and strut fragments. There was no evidence of an in-flight collision with fixed obstacles.

The wreckage debris pattern was consistent with an in-flight break-up at low altitude. A tail rotor driveshaft segment was found twisted and fractured forward of the aft flex coupling. The fracture and twist were consistent with a sudden stoppage. The tail rotor gearbox rotated by hand more than 360-degrees with no anomalies. The tail rotor blades exhibited minor dents on the outer skins, with no damage to the leading edges. The tail rotor pitch control operated properly. The main rotor blades exhibited impact damage near mid-span, and damage to the leading edge of the spars, which separated sections of skin and honeycomb.

The nose of the cabin showed impact damage consistent with main rotor blade contact prior to ground impact. Paint transfer marks on the damaged portions of the main rotor blades, and the left side of the landing gear strut were consistent with the shape of a main rotor blade spar. There was paint transfer in the damaged areas of both main rotor blades. The main and tail rotor flight controls had several fractures. The surfaces of the fractures were angular and jagged, consistent with overload. The tail rotor pedals were found jammed with the left pedal forward.

Other than impact damages and separations, flight control continuity was established from the cockpit throughout all flight controls to the main rotor head and tail rotor assembly.

The main rotor blade fragments were examined and there was no evidence of pre-impact delamination. All main rotor blade damage was consistent with impact forces. The tail rotor blade's damage was consistent with impact forces.

No pre-impact structural anomalies were found.

Details

Cockpit and Cabin

The cabin structure sustained severe impact damage. The upper instrument console was separated from the cabin and the tachometer was separated from the panel. The Engine indicator appeared normal. The Rotor

indicator floated up and down depending on rotation of the gauge. The lower console and keel panels were severely deformed and/or crushed.

Removable flight controls were installed. Both cyclic grips remained on the cross tube, but the right side of the cross tube was smashed and disconnected near the pivot. The pedals were positioned with the left pedal forward. The left pedal on the right side was disconnected at the upper 90° joint. The right pedal on the left side was bent and deformed.

The collective friction slider was fractured near the center with the upper portion remaining on the friction hardware.

Both front seat supports were crushed downward, and the seat cushions were separated. The rear seat supports were severely distorted, and the cushions were separated.

The front and aft right seat belts were unbuckled. The front left seat belt was buckled and cut by first responders. The aft left seat belt was not accessible due to structural damage. The three accessible inertia reels operated properly.

AIRFRAME

The airframe sustained severe impact damage. The fuselage was unrecognizable. The horizontal and vertical firewalls were severely deformed. The lower frames were bent. The upper frame was saw cut forward of the upper sheave during recovery.

The belly was compressed upward into the floor and seat structure. The nose and windshield bow were crushed into the cabin area with a dent appearing to match the shape and size of the leading edge of the main rotor blade. The dented area had black paint transfer marks.

The two right side doors were undamaged. The two left side doors sustained impact damage. The right front door/windshield frame was disconnected near the top. The edge of the disconnect was dented with black paint transfer marks. The surface of the disconnect was angular and jagged. The front right portion of the chin/door/windshield frame was separated.

The tail cone remained attached to the upper frame. Tail cone bays 1 and 2 were crushed and dented mostly on the top and right side. Tail cone bays 3 through 7 were undamaged.

The empennage remained attached to the tail cone bulkhead. The lower vertical stabilizer was crushed upward and folded to the left. The upper vertical and the horizontal stabilizers sustained impact damage to their trailing edges. The tail rotor guard was disconnected at the forward end and at the aft end. The surface of the disconnects were angular and jagged. The tail skid was separated from the lower stabilizer.

LANDING GEAR

The landing gear was separated from the airframe and had several disconnects. The surface of all the disconnects were angular and jagged. The right-side skid was disconnected into several pieces at the forward strut. The aft strut appeared undamaged and remained secure to the skid.

The aft cross tube was straight. It was separated from the right elbow. The retaining bolt was sheared off with the center portion remaining in the cross tube.

The aft left strut was disconnected near the center. The area on both sides of the disconnect was flattened and the forward surface had black scuff marks running diagonally across the disconnect. The left skid was disconnected at the forward and aft strut mounts.

The forward left strut was smashed below the center. The forward surface had black and yellow scuff marks running diagonally across the smashed area. The forward cross tube was straight. It was separated from the left elbow. The retaining bolt was sheared off with the center portion remaining in the cross tube. There were several evenly spaced gouge marks on the aft surface, 3.5" apart. The forward right strut appeared undamaged.

FLIGHT CONTROLS

The flight control system had some discontinuities due to impact damage. No evidence of pre-impact failures of the flight control system was found. The tail rotor pitch change slider was free to slide along the tail rotor gearbox output shaft. Continuity from the cockpit to all flight control surfaces and interfaces was established.

POWERPLANT CONTROLS

The fuel mixture control knob was found in the full rich position although the shaft was bent nearly 90°. The fuel mixture arm on the carburetor was in the full rich position. The return spring was slightly deformed. The control wire was separated from the airbox mount and the mixture arm hardware, which remained secure.

The carburetor heat control knob was unlocked and raised 1.4" (50% of travel). The control wire sheath was no longer secure in the clamp on the airbox. The control wire remained secure on the slider valve. The slider valve was approximately 90% open (heat on).

FUEL SYSTEM

Both fuel tanks were separated from the airframe, their shells dented and deformed, and their bladders compromised.

The main fuel tank filler cap was recovered separate from the tank and both tangs were bent. It did not have the aluminum reinforcement. The outlet and crossover hoses were separated from their fittings. The finger screen was clear. The main fuel tank rollover valve and hose remained secure. The crossover vent hose was separated from the tube.

The auxiliary fuel tank filler cap was secure on its filler neck, and had an aluminum reinforcement. The crossover hose remained secure. The finger screen was clear. The auxiliary fuel tank rollover valve was separated from the hose, the hose remained secure on the tube. The crossover hose was separated from the tube.

The upper vent lines were distorted. Both lines were clear when blown through.

The gascolator bowl was clean and retained about 1 teaspoon of liquid, blue in color and had the aroma of aviation 100LL. The gascolator screen was clear.

DRIVELINE

The grooves in the lower sheave had slight steps appeared to be worn through the layer of primer. The upper sheave grooves were unremarkable. 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. All four V-belts were looped around the intermediate flex coupling. The belts had areas of damage, but the friction surfaces appeared to have normal wear. The belt tension actuator was disconnected from the upper bearing and the screw tube was disconnected. The surface of the disconnects were angular and jagged. The extension distance of the actuator appeared to be 1.3" measured between the scissor mounts. Both actuator support bearings rotated freely and smoothly. The lower actuator support bearing brackets remained secure to the remaining portions of scroll.

The forward flex coupling was distorted and disconnected from the main rotor gearbox input yoke. The surface of the disconnects were angular and jagged.

The main rotor gearbox remained secure to its upper frame. No oil was visible in the gearbox sight gauge, but residual oil, blue in color, was present around the rotor hub area. The mast tube was straight. The main rotor driveshaft was bent at the swashplate. The main rotor driveshaft was rotated by hand more than 360° of the driveshaft rotation with no anomalies confirming continuity from the input yoke through the driveshaft.

Both elastomeric teeter stops were deformed, and their brackets bent across their centers. Each droop stop remained secure with slight deformation of the tusks. The hub had arc shaped score marks adjacent to the main rotor blade pitch horns.

Main rotor blade serial number 5901 sustained significant impact damage bending the spar mid-span, tip downward and forward in the direction of rotation and separating most of the skin from the spar. Adhesive remained on both the spar and skin surfaces. The blade was disconnected near the root. The surface of the disconnect was angular and jagged and the area around the disconnect was flattened.

Main rotor blade serial number 6031 sustained significant impact damage disconnecting the spar mid-span and separating approximately 2' of the skin from the spar in that area. Adhesive remained on both the spar and skin surfaces. The surface of the disconnect was angular and jagged and the area around the disconnect was flattened. The blade was bent downward slightly near the root. The blade was cut near the root during recovery.

The intermediate flex coupling was bent and folded over on itself. The yokes and the adjacent frame tube had score marks running in the direction of rotation.

The tail rotor driveshaft was folded downward near the intermediate flex coupling and bowed throughout its length. It was disconnected near the aft flex coupling. The ends of the shaft at the disconnect were twisted in the direction of rotation of the shaft. The tail rotor driveshaft damper bearing rotated smoothly by hand. The damper pivot arm was bent but moved freely with a slight drag.

The aft flex coupling was bent slightly.

The tail rotor gearbox remained secure to the bulkhead. The output shaft was rotated more than 360° and the tail rotors rotated with no anomalies. The output shaft was straight. Oil, blue in color, was visible in the sight gauge.

The tail rotor blades sustained minor scrapes and scratches.

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