



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

March 22, 2021

Airframe and Engine Exam

WPR20LA130

This document contains 8 embedded photos.

A. ACCIDENT

Location: Mesa, AZ.
Date: April 24, 2020
Aircraft: N3276T, Bell, UH-1H
NTSB Investigator-in-Charge: Samantha Link

B. EXAMINATION

On March 22, 2021, the helicopter's airframe and engine were examined at the Air Transport Recovery facility. The following personnel were present:

Fabian Salazar
ASI, WPR
NTSB

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ASI, WPR
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Marlin Kruse
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C. SIGNIFICANT FINDINGS

- Main rotor assembly had separated from the mast and displayed damage consistent with a mast bumping event.
- The tailboom displayed fracture separation in an area just aft of the synchronized elevators and damage consistent with main rotor contact.
- The 90° gearbox and tail rotor assembly were not present for this examination. (The Federal Aviation Administration removed them during an initial examination and shipped them to the NTSB materials laboratory.) The top of the vertical stabilizer was present and retained one of the 90° gearbox mounting bolts. The other mounting bolts had also been previously sent to the NTSB Materials Laboratory.
- The top section of the vertical stabilizer was removed and prepared for shipment to the NTSB materials lab.
- The 90° gearbox pinion gear was shipped to the NTSB lab.
- The intermediate (42° gearbox) remained attached to the tailboom, and appeared normal, with no anomalies noted.

D. AIRFRAME EXAMINATION

Overall Observations

- Extensive crush damage was observed on the lower left side of the helicopter, with the most severe damage concentrated at the left-pilot's station.
- The helicopter was at rest in about a 45° left angle.

- The left pilot's door remained attached at the hinges and was damaged. The door had engine performance gauges installed and a bubble window. The bubble window was shattered. Due to the crush damage, the gauges were inaccessible.
- The left cargo door separated from the helicopter but was recovered.
- The landing gear cross tubes were displaced or push aft. Both skid tubes separated from the cross tubes at the saddles. The cross tubes were cut for the recovery.
- The left side of the fuselage was inaccessible due to the crush damage and the helicopters tendency to rest on its left side.
- The nose of the helicopter was crushed from the bottom and to the aft.
- The battery access door was absent, exposing the area behind the instrument panel. There were two battery connection terminals, but both batteries were absent.
- The two windshields remained attached to the front of the fuselage and were shattered.
- The roof above the pilot's stations was damaged and the two greenhouse windows were shattered.
- The roof area forward of the main rotor system was damaged and fractured away from the roof areas to the left and right of the main rotor system.
- The roof area to the left of the main rotor system was damaged and displaced to the left, over the cargo door area.
- The transmission was fractured from the mounts and laid left, over the left roof top area.
- The right-side pilot's door was absent but recovered.
- The right-side cargo door remained attached to the fuselage.
- The right-side jump door remained attached to the fuselage.
- The lower portion of the nose area, containing the chin bubbles was fractured and appeared absent, exposing the right-side pilot's area.
- The right-side pilot's seat remained attached to the floor mounts.
- The left-side pilot's seat remained attached to the floor.
- The tail boom had been removed at the mount for recovery.
- The tailboom displayed minor damage from the mounting surface back to the area just in front of the synchronized elevators.
- The tailboom displayed a major fracture and separation just aft of the synchronized elevators.
- The fractured and separated tailboom section had a data plate that read "Global Helicopter Technology Inc, FAA-PMA S/N: 920"
- The fractured and separated section of tailboom had a second data plate that read: "FAST FIN P/N: FF205-101A, S/N: 12199 / 69-15911."
- The tail boom stinger was remained attached to the tailboom and was bent upwards to the tail cone.
- Sheet metal at the tailboom area just aft of the synchronized elevators was bent inwards on the left side of the tailboom and outward at the right side of the tail boom, consistent with main rotor blade contact in a clockwise direction.
- The right-side synchronized elevator displayed damage and a fracture separation of the tip, along with about 4 inches of the sync elevator, all consistent with contact from a main rotor blade.
- The left sync elevator displayed damage at the tip in an upward direction consistent with contact with terrain.
- The forward transmission cover separated from the roof top but was recovered

- The engine nacelle remained attached to the rooftop area and displayed damage. The tail cone housing remained attached to the rooftop area and displayed damage.
- An ACK Technologies ELT, model no: E-04 ELT was among the wreckage items.
- An On Board Systems cargo hook was installed in the helicopter, Part number 528-020-03.

Landing Gear

All landing gear components were accounted for. Both skids separated from the cross tubes. One skid remained intact and displayed damage at the cross tube mounting saddles. The other skid was fractured about 24 inches from the forward tip. The rear cross tube saddle area was missing. The rear tip of the skid remained attached at the skid shoe.

Both the fore and aft cross tubes were damaged and cut for recovery. The forward cross tube remained attached to the helicopter by the left mount. The forward cross tube was displaced aft. The cross tube was cut on the left and right sides of the helicopter for recovery.

The aft cross tube remained attached to the helicopter at the left mount. The aft cross tube was displaced aft. The cross tube was cut on the left and right side for recovery.

Cockpit Area

The forward section of the fuselage containing the left and right pilot's station displayed extensive damage. The floor of the cabin area was separated from the upper section of fuselage. The nose area, above the chin bubbles, had separated from the lower section of the fuselage. The nose section above the chin bubbles remained attached to the windshield and roof top adjacent to the greenhouse windows remained secure. The rooftop area, aft of the greenhouse windows, crushed downwards into the cabin area down to the top of the left-side pilot's seat.

The instrument panel remained attached to the cabin and displayed some damage. There were two Hobbs meters in the cabin. One was mounted to the instrument panel and read: 228.1 hours. The other Hobbs meter was mounted to the center console and read: 89.8.

Right Pilot's station

The right pilot's station seating area remained intact. The right-side cabin area including the right door was missing. The windshield remained attached but was shattered. The right-side collective was fractured in half, just above the collective friction. The right-side collective throttle and collective control head separated but remained attached to the lower collective by aluminum tubing. The throttle position was undetermined. The right-side cyclic remained attached to the floor. The right-side pedals remained attached to the floor. The right-side manual cargo release pedal fractured and separated from the floor mount. The torque tube running to the left-side cargo release pedal was bent and twisted. The right-side pilot's seat remained attached to the cockpit floor.

Left Pilot's Station

The left pilot's station area was greatly compromised. The area above the chin bubbles had distorted and crushed upwards. The left-side floor had crushed upwards. The left-side pilot's door remained attached to the fuselage and displayed extensive damage. The left-side door was modified to contain engine instruments. Instrument indications were unable to be observed due to damage to the door. The left-side collective remained attached to the floor. The throttle position was undetermined. The left-side cyclic control remained attached to

the floor. The left-side pedals were extensively damaged and destroyed by the accident. The left side pilot's seat remained attached to the cockpit floor.

1.0 Flight Control Continuity:

The right seat cyclic control was confirmed from cyclic control stick to the mid-cabin floor area. Several control tubes were fractured and separated at the mid-cabin floor. The right forward (longitudinal) hydraulic servo to the push-pull tube was confirmed. Continuity was unable to be established from the mid-cabin floor to the end of the push-pull tube attached to the longitudinal hydraulic servo due to airframe deformation.

Continuity from the mid-cabin floor to the left forward (lateral) hydraulic servo could not be confirmed due to airframe deformation.

The left seat collective control was confirmed from the collective control stick to the mid-cabin floor. Continuity could not be established from mid-cabin floor to the hydraulic servo due to airframe deformation.

Tail Rotor Continuity. Tail rotor control continuity was established from the right-side pedals to the silent chain located at the end of the control cables. The 90° gearbox and tail rotor assembly were absent. There were several breaks in the system consistent with the accident and recovery efforts. A detailed description of the tail rotor control continuity check follows.

Tail rotor continuity was established from the right tail rotor pedals to a fractured push pull tube, located just aft of the right pilot's seat. Continuity was then established from the fracture in the push-pull tube to the tail rotor hydraulic servo. The tail boom was removed for recovery, and the push-pull tube from the tail rotor hydraulic servo was disconnected at the servo. Continuity was established from the disconnected push-pull tube to the tail rotor control cable bell crank. The push-pull tube to bell crank bracket was fractured. The tail rotor control cables (2 each) remained connected to the bell crank. The cables ran to, and were fracture separated, at the major tail boom break and separation point about 12 ft 6 inches from the tailboom root. The opposite end of the cables ran from the major fracture of the tailboom to the vertical stabilizer and retained to the chain. The chain was fractured and separated about half length.

Tail rotor drive shaft continuity

All hangar bearings remained attached to the tailboom and fuselage and were normal in appearance.

- The drive shaft running from the transmission to the short shaft was separated at the transmission end and the short shaft end.
- The short shaft remained attached to the fuselage at both hangar bearings, appeared thermally damaged but rotated freely.
- The drive shaft after the short shaft (A-tube) remained attached at both hangar bearings, displayed minor damage, and rotated freely.
- The next driveshaft (B-tube) remained attached to both hangar bearings, rotated freely, and displayed minor damage.
- The next driveshaft (C-Tube) fractured and separated about 10 inches from the forward hangar bearing near the area of major tailboom fracture.
- The drive shaft from the intermediate gearbox to the 90° gearbox separated, and was fractured about 35.5'
- There were three fragments of drive shaft recovered that were unable to be identified. Given how similar they were, investigators labeled them "??", "???", and "???" for the purpose of this investigation.
 - "Drive shaft ?" - was 35.5 inches long and revealed torsional twisting with separation.

- “Drive shaft ??” - was 35.5 inches long and revealed torsional twisting with separation.
- “Drive shaft ???” - was an end to a drive shaft and is about 15 inches long.
- The intermediate gearbox remained attached to the tailboom. It contained clear oil that was visible to the mid-level point in the sight gauge. The four mounting bolts were in place and the gearbox appeared secure. Safety wire remained attached to the mounting bolts and had anti-chafing plastic installed over the wire.

Main Rotor System

The main rotor system separated from the helicopter at the mast. A contact mark from the red blade stop was present at the mast, and the mast was dented into a D-shape. Both of which are features consistent with a mast-bumping event.

The stabilizer bar remained attached to the main rotor system and appeared bent on one end. Both main rotor pitch horns separated from the blade grips and the mounting hardware was absent.

The Red blade displayed a fracture and separation at about 26 inches from the tip. There were multiple deep gouges at the stainless-steel leading edge, and multiple scrapes running along the span of the blade. A large span-wise fracture ran from the root of the blade in between the blade grip and the drag brace and outboard for about 4 ft. The blade remained attached to the hub at the blade grip and drag brace.

The white blade separated from the main rotor system about 5 ft from the blade grip. The composite blade was heavily fractured spanwise from the root to the fracture and separation point. The remaining blade portion displayed major span-wise fractures running from the fracture at the root end to the tip. The tip remained attached to the blade. The entire leading edge was coated with dirt, consistent with a distinguishable ground gouge at the accident site.

E. ENGINE EXAM

The engine was examined by an ASI from Honeywell Aerospace and an ASI in training from Honeywell Aerospace. Below are highlights from the engine exam:

- T53-L-703. Serial number: LE-12505Z
- Remained attached to the fuselage.
- K-flex separated from the front of the engine
- The engine moved toward the left side of the fuselage
- Metal spray was observed on the suction side of 2nd stage PT stator vanes
- No damage to leading or trailing edge of the 2nd stage PT rotor blades
- PT rotated freely.
- Continuity through the planetary reduction gear to the K-flex coupling was established.
- No penetration of the compressor cases or turbine plenum
- Compressor N1 and N2 rotated freely
- Damage to the 1st stage compressor rotor blades. Leading edge damage.
- A wire was found at the leading edge of the inlet guide vanes.
- Unable to get to the fuel control.
- No slap marks were observed on the engine gauges.

F. PHOTOGRAPHS



Photo 1. N276T front left view.



Photo 2. Front view.



Photo 3. N3276T Front right view.



Figure 4. N3276T Right-side view.



Photo 6. Vertical stabilizer without the 90° gearbox or tail rotor assembly.



Photo 5. Tailboom left-side view.



Photo 7. The white main rotor blade, top view.

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Photo 8. The red main rotor blade, underside view.

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Submitted by Fabian Salazar