



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

December 15, 2014

AIRFRAME AND ENGINE EXAMINATION SUMMARY

WPR15FA051

This document contains 11 embedded photos.

A. ACCIDENT

Location:	North Salt Lake, Utah
Date:	December 2, 2014
Aircraft:	Robinson R44 II, N3234U
NTSB Investigator-in-Charge:	Andrew Swick

B. SUMMARY

On December 2, 2014, about 1400 mountain standard time, a Robinson R44 II helicopter, N3234U, impacted a two-story building while maneuvering near Skypark Airport (BTF), Bountiful, Utah. The commercial pilot-rated mechanic and passenger were fatally injured. The helicopter was substantially damaged. The helicopter was registered to Native Range Capture Services, Inc., Elko, Nevada and operated by Native Range Inc, Ventura, California. The local flight was conducted under the provisions of 14 Code of Federal Regulations Part 91 as a post-maintenance flight. Visual meteorological conditions prevailed for the flight, and no flight plan was filed. The flight departed from BTF shortly before the accident.

Witnesses, who were in the area of the accident site, reportedly heard popping sounds then saw the main rotor and empennage separate from the helicopter as the helicopter flew overhead. Several of the witnesses then saw the helicopter tumble in flight and impact the top of a building. The main rotor blade and empennage impacted the ground a few hundred feet from the impacted building.

Security camera video footage from a nearby business captured the helicopter in the air shortly after the separation of the main rotor and empennage separation.

C. DETAILS OF THE INVESTIGATION

1.0 Airframe Examination

Examination of the recovered wreckage was conducted on December 15, 2015, at the facilities of Air Transport in Phoenix, Arizona, by representatives from Robinson Helicopter Company, Lycoming Engines, and an Federal Aviation Administration (FAA) inspector, under the supervision of the National Transportation Safety Board (NTSB) investigator-in-charge (IIC).

The main rotors, tail rotor section and tail rotor drive shaft separated from the main wreckage during the accident sequence.



Figure 1-Main Wreckage

The main wreckage, consisting of the cabin area and a five-foot section of the tailboom, had impact and thermal damage. The left side of the cabin was crushed inward towards the center, and the right side near the firewall was crushed inward. The rear seat area had minor thermal damage.



Figure 2-Main Wreckage

The top side of the airframe had several disconnects and separations and was bent to the right side. The tail cone separated aft of the number seven bay, and number 4, 5 and 6 separated into several sections consistent with a main rotor strike. The left side of the number 1, 2 and 3 tail cone bays were flattened inward. The empennage separated from the main wreckage and had minor damage.



Figure 3-Drive Train

The v-belts remained attached to the upper sheave and was split between the vees. The belts had thermal damage. The sprag clutch was examined and operated normally. The intermediate flex plate was distorted.

The upper sheave forward and aft faces had rotational scoring around the entire circumference. The engine mounting tubes adjacent to the forward face had scoring running in the direction of rotation of the upper sheave. The clutch centering strut had rotational scoring on its forward face adjacent to the aft of the upper sheave running in the direction of rotation. The oil cooler had rotational scoring adjacent to the starter ring gear. The alternator cooling fan was distorted around its entire circumference.



Figure 4-Main Rotor Drive Shaft

The main rotor gear (MRG) box separated at the gearbox housing. The MRG mast tube fractured near its midsection. The MRG drive shaft was bent below the swashplate and bent and separated at the teeter stop.

The empennage was fractured about 32 inches from the forward tail gearbox mount. The tail rotor gear box rotated freely by hand and no anomalies noted. The tail rotor blades sustained minor impact damage.



Figure 5-Tailrotor Drive Shaft

The tail rotor driveshaft exhibited an impact about 4 inches from the empennage separation. The curvature of the impact mark was consistent with the curvature of the main rotor blade leading edge. The tail rotor drive shaft separated in four places. The tail rotor blades exhibited signatures consistent with low rotor RPM at ground impact.

The fuel tanks remained attached to the airframe. The crossover hose fitting at the main tank separated. The fuel vent hoses pulled apart from vent lines fittings. The hoses and lines were clear of debris. Both fuel tank skins sustained impact damage and the bladders remained intact. Both fuel caps remained secured to the filler neck.

The cabin area was crushed and distorted. All circuit breakers were down and in. Removable flight controls were not installed. The fuel mixture knob was found in the full rich position and could not be moved by hand. The fuel control unit mixture arm was in the full rich position and the control rod was secure. The throttle control was near the idle position. Both forward seats were crushed inward and slightly forward. Both seat backs were folded aft along with all door frames. The aft seat structure was crushed inward. Both firewalls were severely deformed. The airframe nose was crushed inward and the windshield was shattered. The upper instrument console separated from the lower instrument console. First responders cut the left forward seat belts. The right forward seat belts were unbuckled. The rear seat belt assemblies sustained thermal damage; and the right side was buckled and the left side was stowed. The warning lights were pulled from the instrument console and the elements revealed:

- Oil Pressure-coil tight
- Engine Fire-coil tight
- Alt-two small sections of the coil stretched
- Aux Fuel Pump-coil had small stretch, distorted
- Fuel Filter-coil had small stretch, distorted
- Brake-coil was tight and deformed
- Gov off-coil stretched
- Clutch-tight, coil broken
- MR Temp-tight, coil distorted
- MR Chip-tight, coil distorted
- Starter on-coil tight/stretched
- TR Chip- coil tight/broken
- Low Fuel-coil tight
- Low RPM-coil tight, coil deformed
- Carbon Monoxide-damaged

The flight controls had several disconnects between the cyclic/collective and swashplate. All fractures had overload signatures, angular and jagged. The tail rotor flight controls had several disconnects from the pedals to the tail rotor and all separations had overload signatures.



Figure 6-Main Rotor Blade (Red Blade Serial Number 4406)

The red blade remained attached to the main rotor hub. The separated sections of the outboard end were found in the debris field. The tip cap was broken with the attachment bolts still integral to the main rotor blade. The blade tip and about 43 inches of the leading edge spar, was found near the beginning of the debris field. Two afterbody sections measuring about 45 inches in length, separated the tip. Gray paint transfer marks, about 2 inches wide and 4 inches long, were observed on the upper surface at about 25 inches from the tip. The blade spar was bent forward about 15 degrees beginning at about 54 inches from the tip. The leading edge was damaged about 4 feet from the hub. Red transfer marks on the leading edge were found about 42 inches from the center of rotation of the blade. The pitch horn separated from the blade grip and the fractured surface was consistent with overload. Thread imprints were observed above the pitch change link upper rod end. The pitch change link remained attached to the pitch change horn and had multiple bends. The blade droop stop was bent downward and remained attached to the grip.



Figure 7-Main Rotor Blade (Blue Blade, Serial Number 4402)

The blue blade remained attached to the main rotor hub. The tip cap separated from the blade and was found in the main wreckage. The blade spar was continuous from the inboard to the outboard end. The blade afterbody was fractured from the spar to the tip end to about 72 inches inboard. The spar was bent opposite the direction of rotation about 72 inches from the tip end, bent about 15 degrees aft. The blade afterbody wrinkled aft of the spar attachment area from the tip end to 96 inches inboard of the tip end.



Figure 8-Blue Blade and Impact Damage

The blue blade had impact marks on the leading edge, observed about 20 inches from the center of rotation. The curvature of the impact marks was consistent with the curvature of damage on the blue blade's pitch horn. The pitch horn was fractured at the blade grip, and the fracture surface was consistent with overload. Thread imprints were observed on the pitch horn above the pitch change link upper rod end. The droop stop was bent downward but remained integral to the grip. The pitch change horn was recovered in the debris field. The upper rod end remained attached to the pitch change horn but was fractured at the threads beneath the upper rod end bearing. The midsection of the pitch change link was recovered loose, but was fractured at the pitch change link barrel. The lower section of the pitch change link remained attached to the swashplate. The threads adjacent to the lower rod end were bent.

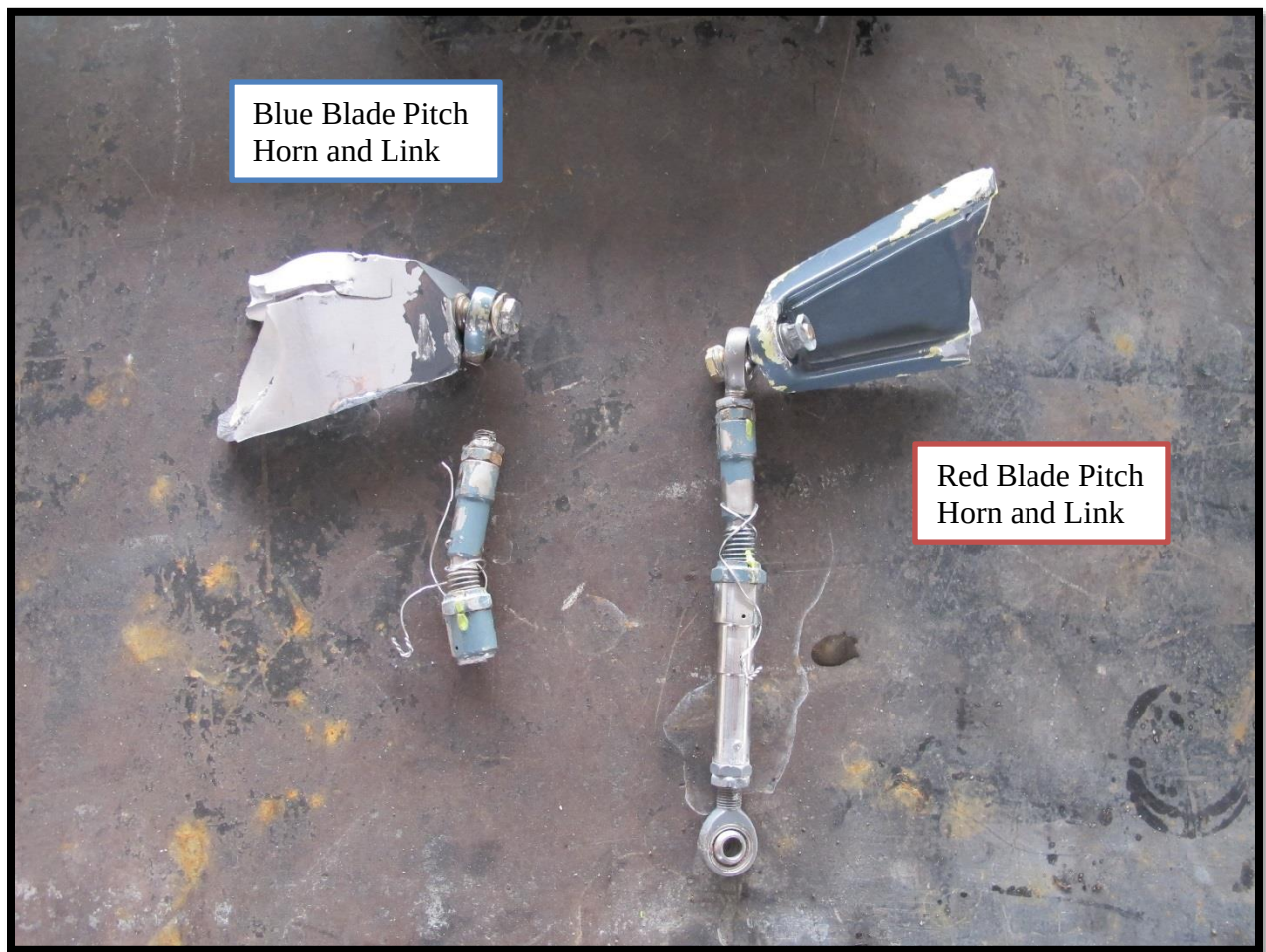


Figure 9-Pitch Horns and Pitch Change Links

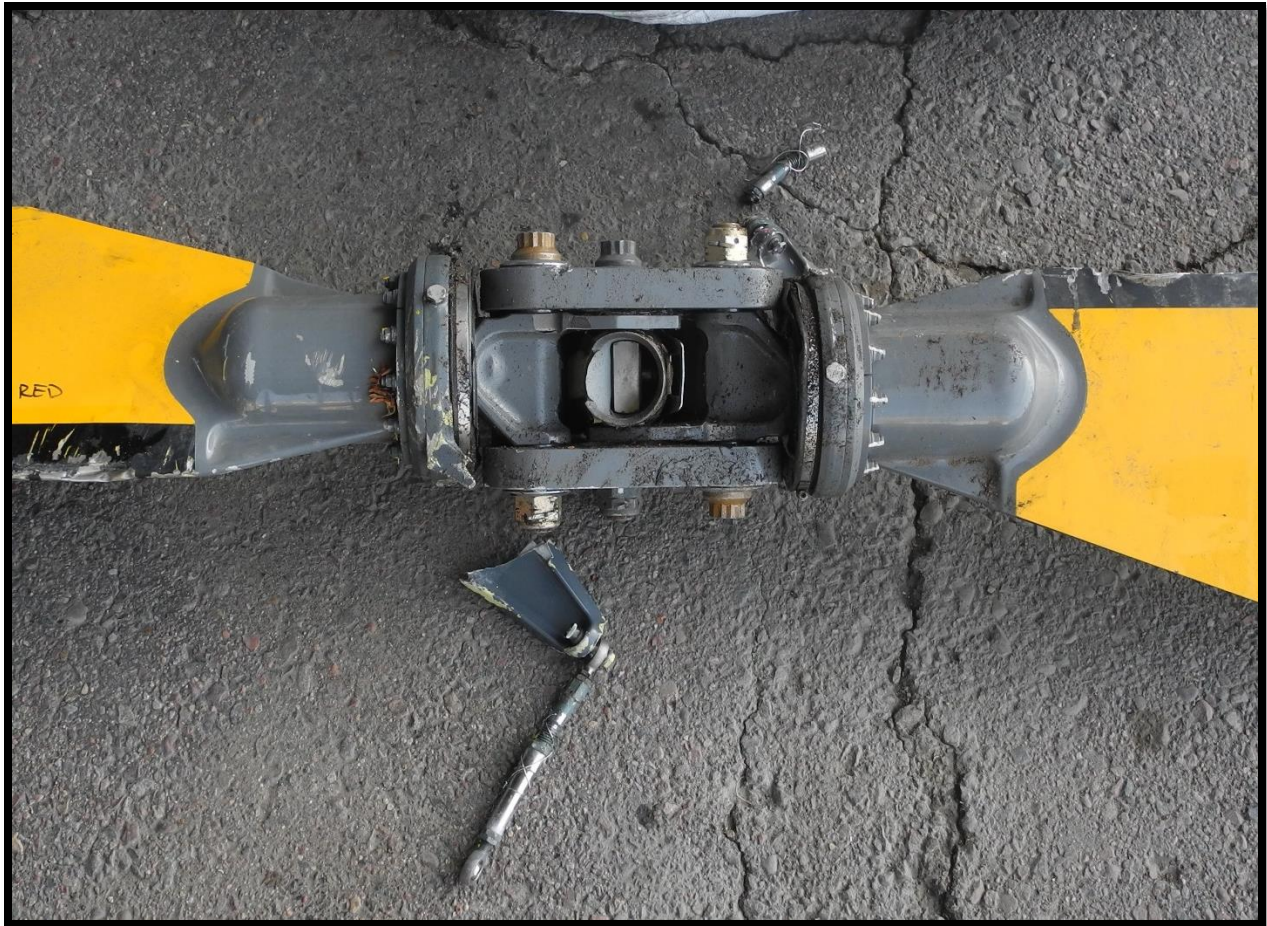


Figure 10-Main Rotor Hub and Blades

The main rotor hub hardware including the bolts, shims, nuts and safeties remained intact. The hub exhibited impact marks of the blue blade grip contacting the hub consistent with flapping exceedance. Similar impact marks of less severity were observed on the red blade grip side. A small upper section of the main rotor mast remained attached to the hub via the teetering bolt. The small upper section separated a few inches below the hub and was severely bent inward on the side of the red blade spindle. Coarse thread imprints were found on the lower edge of the hub immediately beneath the red blade coning bolt, consistent with a pitch change link. On the upper surface of the hub, adjacent to the teetering bolt on the red blade side, an impact mark was consistent with the impact from a pitch change rod link end bearing.

The swashplate red blade pitch change link bolt hole exhibited dark surface markings on the outboard edge and about midway down the bore. Thread impact marks were found on the swashplate adjacent to the lower rod end bearing of the blue blade pitch change link attachment location.



Figure 11-Landing Gear Skids

The landing skids were fractured in multiple locations. The aft crosstube separated from the main wreckage. The forward crosstube remained attached to the main cabin. Both the forward left and aft left struts were bent aftward.

The main rotor blades (both inboard sections), hub, upper mast section, upper drive shaft section, droop stops (2), yoke, pitch change links (2), main rotor blade pitch change horns (2), and swashplate were sent to NTSB headquarters for further examination. See the Materials Laboratory Factual Report in the docket for this accident for further information.

During the wreckage examination, the microchips from the MicroVib unit were not found.

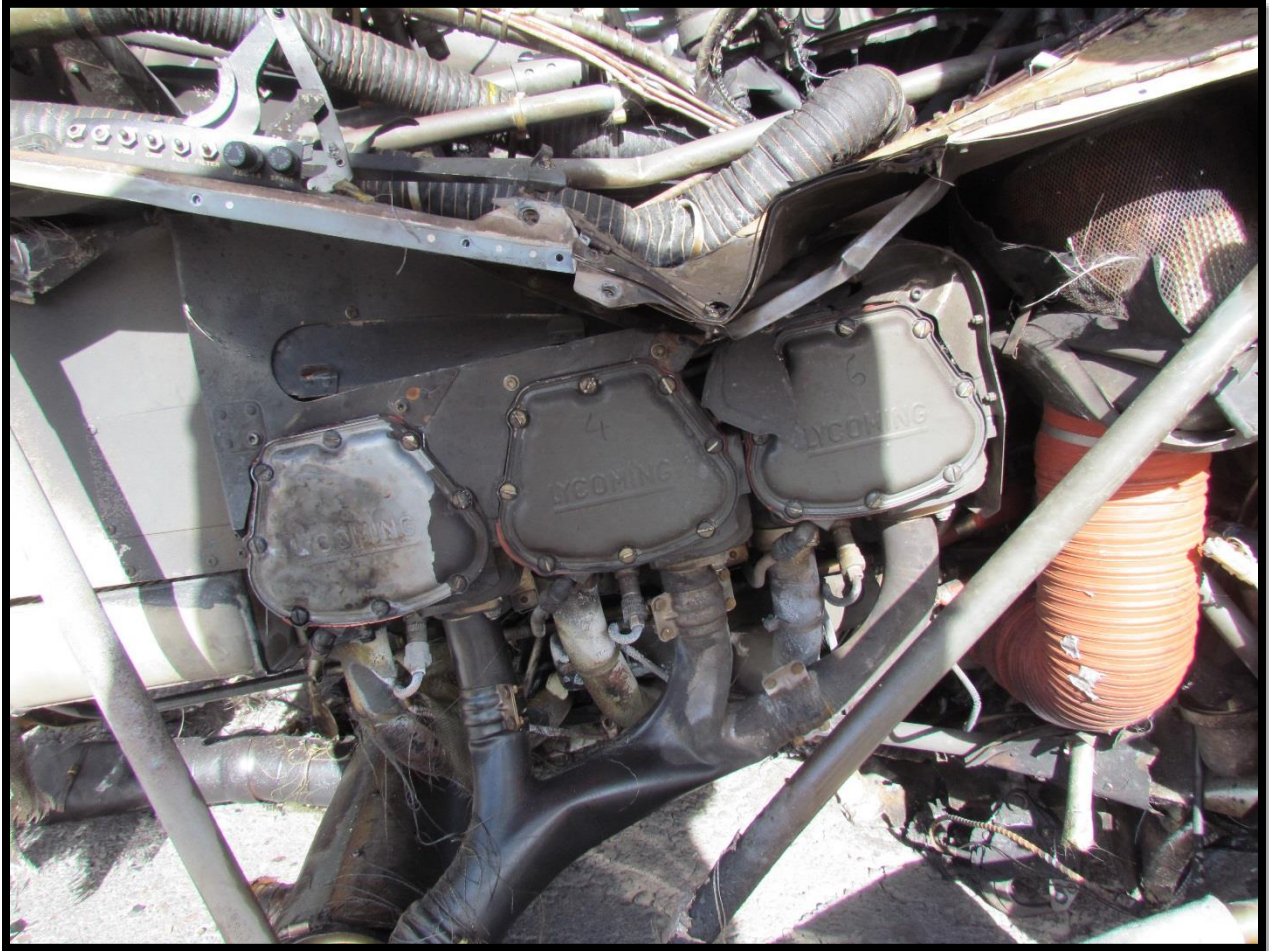


Figure 12-Engine

2.0 Engine Examination

The engine remained attached to the fuselage and thermal damage was noted to the wiring harness and ignition leads. The engine was covered in a sooty residue. The firewall had impact damage and the fuel pump had impact damage to its housing. The magneto ignition leads had impact damage near the distributor cap and thermal damage near the cylinders. The lower sparkplugs were removed and revealed normal wear conditions and light gray deposits. Two of the spark plugs were saturated in oil. The crankshaft was rotated by hand and cylinder compression was obtained. The ignition leads were cut near the thermal damage and spark was obtained from all leads during crankshaft rotation. The magnetos were not removed during the examination. Rotational scoring was evident on the fan wheel assembly. The starter ring gear separated from the flywheel. The oil pickup screen was removed and was clear of debris. The exhaust assembly was crushed upwards.

Submitted by: Andrew Swick