



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

# Aviation Investigation Final Report

<b>Location:</b>	Orlando, Florida	<b>Accident Number:</b>	ERA15FA164
<b>Date &amp; Time:</b>	March 22, 2015, 14:30 Local	<b>Registration:</b>	N30242
<b>Aircraft:</b>	ROBINSON HELICOPTER COMPANY R44 II	<b>Aircraft Damage:</b>	Destroyed
<b>Defining Event:</b>	Loss of control in flight	<b>Injuries:</b>	3 Fatal
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

## Analysis

Approximately 5 minutes after the pilot departed he told air traffic control that he wanted to return to the airport, but did not specify a reason. The pilot was unable to make it back to the airport and collided with trees, powerlines, and a residence. Post-accident examination of the helicopter found that the lower swashplate left forward attachment ear had no rod end hardware present. A review of the helicopter's maintenance logbook revealed there were no entries regarding the repairs to the main rotor system; however, the helicopter's journey log revealed that several flight tests had been conducted due to a track and balance issue with the main rotor blades. According the mechanic who performed the most recent maintenance to the swashplate, he did utilize the manufacturer's maintenance manual; however, he did not complete the work and the chief mechanic later completed the job. The chief mechanic did not make any entries into the logbook because he "forgot."

The inflight loss of control was most likely caused by the detachment of the left front push-pull tube from the lower swashplate due to the liberation of the attachment bolt. The cause of the bolt liberation could not be conclusively determined because the attachment hardware could not be recovered.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: An inflight loss of control due to the likely detachment of the forward left servo control tube upper rod end attachment bolt.

## Findings

Aircraft	Rotorcraft servo system - Malfunction
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## Factual Information

### History of Flight

<b>Enroute-cruise</b>	Loss of control in flight (Defining event)
<b>Uncontrolled descent</b>	Collision with terr/obj (non-CFIT)

On March 22, 2015, about 1430 eastern daylight time, a Robinson Helicopter Company R44 II, N30242, impacted a two-story residence while maneuvering near Orlando, Florida. The private pilot and the two passengers were fatally injured, and the helicopter was destroyed. The helicopter was registered to a private individual and operated by HQ Aviation. The local flight was conducted under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed and no flight plan was filed for the personal flight, which departed from Executive Airport (ORL), Orlando, Florida, shortly before the accident.

A review of voice transcriptions obtained from the Federal Aviation Administration revealed that the pilot contacted the ORL air traffic control tower to request his takeoff clearance. The pilot received a clearance, for a downtown departure leaving from the operator's helipad. Approximately 5 minutes later the pilot contacted the control tower and stated that he wanted to return to the operator's ramp. There were no other transmissions made by the pilot.

Multiple witnesses reported hearing a loud helicopter flying low, which caught their attention. As they looked in the direction of the sound they observed the helicopter descending into a tree. One witness watched the helicopter's main rotor blades break apart as it descended through the trees. The helicopter subsequently impacted a power line transformer before colliding with the residence and erupted in flames. The witnesses called the local authorities and attempted to extinguish the fire.

### Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	48, Male
<b>Airplane Rating(s):</b>	None	<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>	Helicopter	<b>Restraint Used:</b>	Unknown
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 3 Without waivers/limitations	<b>Last FAA Medical Exam:</b>	September 6, 2013
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	August 9, 2014
<b>Flight Time:</b>	(Estimated) 124 hours (Total, all aircraft), 23 hours (Total, this make and model), 28 hours (Pilot In Command, all aircraft)		

## Passenger Information

Certificate:	Age:	Female
Airplane Rating(s):	Seat Occupied:	Unknown
Other Aircraft Rating(s):	Restraint Used:	Unknown
Instrument Rating(s):	Second Pilot Present:	No
Instructor Rating(s):	Toxicology Performed:	No
Medical Certification:	Last FAA Medical Exam:	
Occupational Pilot: No	Last Flight Review or Equivalent:	
Flight Time:		

## Passenger Information

Certificate:	Age:	Male
Airplane Rating(s):	Seat Occupied:	Unknown
Other Aircraft Rating(s):	Restraint Used:	Unknown
Instrument Rating(s):	Second Pilot Present:	No
Instructor Rating(s):	Toxicology Performed:	No
Medical Certification:	Last FAA Medical Exam:	
Occupational Pilot: No	Last Flight Review or Equivalent:	
Flight Time:		

The pilot, age 48, held a private pilot certificate with a rating for rotorcraft-helicopter. A review of his logbook revealed he had a total flight experience of 124 hours, including 13 hours during the last 6 months. The pilot possessed a third-class medical certificate dated September 6, 2013, with no limitations or restrictions. Further examination of the pilot's logbook revealed he was signed off on August 9, 2014 for the special federal aviation regulation (SFAR) No. 73, which required him to have special training to operate the Robinson R-44.

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	ROBINSON HELICOPTER COMPANY	<b>Registration:</b>	N30242
<b>Model/Series:</b>	R44 II	<b>Aircraft Category:</b>	Helicopter
<b>Year of Manufacture:</b>	2007	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	11784
<b>Landing Gear Type:</b>	N/A; Skid	<b>Seats:</b>	4
<b>Date/Type of Last Inspection:</b>	December 28, 2014 100 hour	<b>Certified Max Gross Wt.:</b>	2500 lbs
<b>Time Since Last Inspection:</b>	81 Hrs	<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	1267.5 Hrs as of last inspection	<b>Engine Manufacturer:</b>	LYCOMING
<b>ELT:</b>	C91 installed, not activated	<b>Engine Model/Series:</b>	IO-540-AE1A5
<b>Registered Owner:</b>	On file	<b>Rated Power:</b>	235 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	None

The helicopter was a Robinson Helicopter Company model R44 II that was manufactured in 2007. It was powered by a Continental IO-540-AE1A5 engine, rated at 235 horsepower. The Hobbs meter was destroyed and per the journey log the last known recorded airframe total time was 1,267.5 hours on the day of the accident flight. The last annual inspection of the airframe and engine occurred on October 31, 2014, at an airframe total time of 1,092.1. The last recorded 100 hour inspection noted under discrepancies "rotated TR pitch links" on December 28, 2014, at an airframe total time of 1,186.1 hours. This was also the last maintenance entry made in the airframe logbook.

Though no recent maintenance entries were noted in the helicopter maintenance logbook, there were entries in its journey log (flight log of every flight) that several maintenance flights were conducted in support of attempts to track and balance the main rotor blades. The maintenance flights were identified by (MX or MTX) in the journey log. The first flight was conducted by another pilot on March 1, 2015, and the pilot stated that the MX flight was conducted for a track and balance of the main rotor blades. The next MX flight was conducted on March 6, 2015 and March 11, 2015, by another pilot who stated the flight was conducted for a track and balance of the main rotor blades. The last MX flight was conducted on March 15, 2015, and was signed off by the operator to show that the work was completed.

In a telephone interview, the mechanic who performed the most recent track and balance of the rotor blades stated he performed the job in accordance with the R44 Maintenance Manual section 10.230, the tail rotor in accordance with section 10.240 and the fan in accordance with section 6.240. He said that he did not complete the work and the chief mechanic later completed the job. The chief mechanic stated that he was not clear where the previous mechanic had finished the previous day. Further interviews with the chief mechanic, revealed that he performed the last check and reading of the track and balance of the main rotor blades. He also mentioned that he replaced the belt tensioning actuator gear motor on March 10, 2015, but "forgot" to make all of the entries in the helicopter's maintenance logbooks.

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	ORL, 113 ft msl	<b>Distance from Accident Site:</b>	3 Nautical Miles
<b>Observation Time:</b>	14:53 Local	<b>Direction from Accident Site:</b>	282°
<b>Lowest Cloud Condition:</b>	Few / 4900 ft AGL	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	10 knots /	<b>Turbulence Type Forecast/Actual:</b>	/ None
<b>Wind Direction:</b>	240°	<b>Turbulence Severity Forecast/Actual:</b>	/ N/A
<b>Altimeter Setting:</b>	29.94 inches Hg	<b>Temperature/Dew Point:</b>	30°C / 18°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Orlando, FL (ORL )	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Orlando, FL (ORL )	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	14:25 Local	<b>Type of Airspace:</b>	Class C

The recorded weather at ORL, at 1453, included winds from 240 degrees at 10 knots; 10 statute miles visibility, few clouds at 4,900, temperature 30 degrees Celsius (C), dew point temperature 18 degrees C, and an altimeter setting of 29.94 inches of mercury.

## Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Fatal	<b>Aircraft Damage:</b>	Destroyed
<b>Passenger Injuries:</b>	2 Fatal	<b>Aircraft Fire:</b>	On-ground
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	On-ground
<b>Total Injuries:</b>	3 Fatal	<b>Latitude, Longitude:</b>	28.556943,-81.389167

Examination of the accident site revealed that the helicopter came to rest on the top floor of a two-story residence, about 3 miles northwest of ORL, and on a 360 degree magnetic heading. The wreckage debris field was about 50 yards in circumference. All flight control surfaces were located at the accident site. Examination of the wreckage revealed that a post-impact fire was concentrated within the second story of the building where the helicopter came to rest. A postcrash fire had consumed a majority of the wreckage. The main rotor mast, head, and gearbox were found separated from the main wreckage and within the debris field.

Examination of the cockpit and cabin section revealed that the instrument console was destroyed by impact forces and fire. The collective and anti-torque pedals were found within the wreckage. The

mixture was found within the wreckage in the full rich position and impact damaged. Examination of the flight control system revealed that it was fire and impact damaged. At the lower swashplate, the left forward attachment ear had no rod end hardware present, and could not be located. The rod end was present at the top of the left push pull tube, which was found within the wreckage.

The swashplate and push pull tube with the attached rod end were sent to the NTSB Materials Laboratory for further examination. The examination of the lower swashplate attachment lug bolt holes were examined for indications of damage or deformation. The side of the lug that butted up against the rod end was referred to as the "rod end-side" of the lug and the other side was referred to as the "opposite side." The rod end-side of the front left push-pull tube attachment lug exhibited an outward deformation along the outer lower portion of the bolt hole. There were no other notable features on the front left lug nor were there any signs of deformation on any of the other lugs.

Examination of the hydraulic control servos revealed that they were intact and the two forward servos had bends in their shafts and could not be moved. The aft servo piston was free to move when force was applied. The tail rotor pitch change slider was free to slide along the tail rotor gearbox output shaft.

Examination of the driveline revealed that the drive belts were completely burned away but displayed belt residue in the grooves of the upper and lower sheaves. The belt tension actuator was fractured between the anti-rotation scissors. The upper and lower actuator bearing were fire damaged. The lower bearing did not rotate when force was applied. The upper bearing rotated but dragged when force was applied. The sprag clutch was fire damaged and did not rotate. The forward flex coupling, main rotor gearbox input arm and main rotor gearbox was fractured. Further examination of the main rotor gearbox revealed that it was fire damaged. The main rotor gear box did not rotate and the mast tube was fractured. The main rotor shaft was bent and fractured. The droop stops and droop stop tusk were intact and in place. There was scoring on the main rotor hub just inboard of the pitch change housings.

Both main rotor blades were accounted for at the crash site. One main rotor blade was intact and impact damaged. The rotor blade was bent downward and approximately 33 inches from the coning bolt and the spar was fractured. The blade was distorted over the span of the blade and scored on the lower surface.

The opposite main rotor blade was fractured and scored on the lower surface. Examination revealed it was bent upward from the coning bolt and approximately 12 inches further outboard bent downward. The spar was fractured in two areas on the rotor blade; 70 and 104 inches from the coning bolt. The blade spar had a forward bend at the outboard separation. A section of the skin and honeycomb separated from the spar at the bend. The main rotor blade was sent to the NTSB Material Laboratory for further examination, and examined for indications of fatigue failure. The pieces consisted of an approximately 95-inch long section of blade from the outboard tip to a fracture through the spar at the inboard end and a smaller piece of the blade consisting of the trailing edge, upper and lower skins, and honeycomb core. The small piece was separated from the rest of the blade by a chordwise fracture approximately 80 inch from the blade tip and a longitudinal fracture that proceeded inboard just aft of the spar. The deformation and fracture features on the blade were visually examined. The blade exhibited an aft bend that extended from the blade tip to the approximate position of the chordwise fracture, buckling of the upper and lower skins, and a comparatively severe forward bend at the inboard end. The fracture at the inboard end of the spar was located at a circular hole in the spar and exhibited 45° inclined fracture surfaces, consistent with an overstress fracture. No evidence of fatigue was

observed.

The intermediate flex coupling was intact but impact damaged. The tail rotor driveshaft was separated a few inches forward of the tail rotor driveshaft damper. The tail rotor driveshaft damper bearing was fire and impact damaged and was not free to rotate. The friction linkage was intact, but separated from the tail cone and the linkage pivots were fire damaged.

The tail boom was separated from the main fuselage, and displayed fire damage. The tail rotor control tube was fractured at the fuselage, and remained attached to the tail rotor gearbox. The vertical fin and horizontal stabilizer were impact damaged and remained attached to the tail boom. The tail rotor blades were undamaged and remained intact to the gearbox. The aft flex coupling was intact. The tail rotor gearbox was intact and free to rotate, and contained blue oil.

Examination of the fuel system revealed that it was fire and impact damaged. The main fuel tank was not recovered. The auxiliary tank was distorted and the fuel cap was not recovered. The fuel tanks were not bladder-style tanks and were ruptured. The main fuel tank flexible outlet line was breached, but intact on the fuel valve. The fuel valve was in place and in the partially closed position. The gascolator was intact and was removed for examination and no debris was found in the fuel screen. The remaining fuel lines were fire damaged, but the fittings remained.

Examination of the engine revealed that when rotated by the cooling fan, continuity to the rear gears and valve train was confirmed. Compression and suction were observed on all four cylinders. Further examination of the engine revealed that the bottom of the sump was fire damaged and the fuel servo was not observed or recovered. The flow divider was intact and the fuel injector nozzles were removed and examined. The fuel injector nozzles were unobstructed. The engine driven fuel pump remained attached to the engine and was impact damaged. Examination of the magnetos revealed that they both remained attached to the engine. The left magneto was impact damaged, but when rotated by hand it sparked on all towers. The right magneto was fire damage and did not rotate. The top spark plugs were removed and top spark plugs and the electrodes were undamaged. The bottom spark plugs were not removed and examined using a borescope. The bottom spark plug electrodes were undamaged and oil soaked. Examination of the engine did not reveal any anomalies that would have precluded normal operation.

## **Medical and Pathological Information**

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An autopsy was performed on the pilot by the State of Florida District Nine Medical Examiner, Orlando, Florida.

The Federal Aviation Administration's (FAA) Civil Aerospace Medical Institute performed forensic toxicology on specimens from the pilot, with negative results for drugs and alcohol.



## Administrative Information

<b>Investigator In Charge (IIC):</b>	Alleyne, Eric
<b>Additional Participating Persons:</b>	Cherly King; Orlando FSDO; Orlando, FL Mike Childers; Textron Lycoming; Wichita, KS Ken Martin; Robinson; Torrance, CA
<b>Original Publish Date:</b>	August 16, 2016
<b>Last Revision Date:</b>	
<b>Investigation Class:</b>	<a href="#">Class</a>
<b>Note:</b>	The NTSB traveled to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=90900">https://data.nts.gov/Docket?ProjectID=90900</a>

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The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).