



Aviation Investigation Final Report

Location:	Mesa, Arizona	Accident Number:	WPR20LA130
Date & Time:	April 24, 2020, 16:00 Local	Registration:	N3276T
Aircraft:	Bell UH 1H	Aircraft Damage:	Substantial
Defining Event:	Part(s) separation from AC	Injuries:	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

Witnesses reported they observed the helicopter flying low with white smoke emitting from the rear rotor area. Suddenly, the tail rotor separated from the helicopter and landed in a dirt lot below. The helicopter continued northeast as it started to spin and impacted the ground.

Postaccident examination of the engine revealed no preimpact anomalies. The top of the vertical stabilizer, tail rotor assembly, tail rotor gearbox, input quill assembly, and mounting studs were examined. Progressive crack growth was noted on the mounting studs within the tail rotor gearbox housing. The fracture surfaces were relatively rough, consistent with low-cycle fatigue or cyclic overstress crack growth under relatively high cyclic stresses. Additionally, multiple layers of primer, paint, and sealant were observed on the input quill assembly, including paint on the flange clamping surface where it had mated to the vertical stabilizer. Paint was also observed on the vertical stabilizer support casting where it had mated to the input quill as well as the washers for the tail rotor gearbox attachment hardware. In 2012, the gearbox was removed from another helicopter, repaired, painted, and installed on the accident helicopter. There was no other information regarding the installation.

In January 2019, the helicopter was painted and photographs that were taken during this process indicated that the tail boom, tail rotor gearbox, and tail rotor assembly remained installed during the painting process. In addition, the tail rotor assembly and tail rotor gearbox were masked. Therefore, the paint found on the contact mounting surfaces was likely applied during the gearbox installation in 2012; however, the maintenance logs did not provide detailed information of the painting process.

In April 2019, the tail rotor gearbox was removed from the vertical stabilizer for a corrosion inspection; no defects were noted in the maintenance logs. A retorque and/or torque stabilization check was not completed after the gearbox was installed, nor was it required to be according to applicable technical manuals.

The presence of paint on the contact surfaces between the tail rotor gearbox and vertical stabilizer can lead to excessive relaxation of clamping forces due to compressive creep deformation of the paint. Therefore, the improper application of paint on the contact surfaces, which would have been disturbed during the last tail rotor gearbox removal about 39 flight hours prior to the accident, was likely a factor in the eventual reduction in clamping force of the tail rotor gearbox installation onto the vertical stabilizer. However, improper torque of the retaining nuts would also affect the clamping force between the tail rotor gearbox and the vertical stabilizer, but it could not be determined if the retaining nuts were properly torqued during the tail rotor gearbox's reinstallation after the corrosion inspection in April 2019. The reduction in clamping force on the installation led to the initiation of fatigue fractures on the attachment studs and subsequent separation of the tail rotor gearbox from the vertical stabilizer in flight. The separation of the tail rotor gearbox resulted in a loss of directional control of the helicopter. Had a retorque and/or torque stabilization check of the gearbox retaining nuts been required, it could have identified the reduction in clamping force of the tail rotor gearbox's installation onto the vertical stabilizer prior to the accident.

The detected levels of oxycodone and its psychoactive metabolite oxymorphone in the pilot's specimen are most consistent with some degree of tolerance to the effects of oxycodone, indicating regular use. Although it is likely that the pilot was impaired to some degree by the effects of oxycodone at the time of the accident, pilot impairment is unlikely to have contributed to the accident circumstances given that the tail rotor assembly separated in flight.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

An in-flight separation of the tail rotor gearbox from the airframe due to fatigue failure of the gearbox attachment studs, resulting in a loss of directional control and subsequent ground impact. Contributing to the accident were 1) the improper application of paint on the clamping surfaces between the tail rotor gearbox and the vertical stabilizer that led to the initiation of fatigue fractures on the gearbox attachment studs and 2) the lack of a requirement to check the torque of the gearbox attachment hardware after installation of a gearbox onto the airframe.

Findings

Personnel issues	Modification/alteration - Maintenance personnel
Aircraft	(general) - Incorrect service/maintenance
Aircraft	Fasteners - Not specified
Aircraft	(general) - Fatigue/wear/corrosion

Factual Information

History of Flight

Enroute	Part(s) separation from AC (Defining event)
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On April 24, 2020, about 1600 mountain standard time, a Bell UH-1H helicopter, N3276T, was substantially damaged when it was involved in an accident in Mesa, Arizona. The pilot was fatally injured, and the second pilot was seriously injured. The helicopter operated as a Title 14 *Code of Federal Regulations (CFR) Part 91* relocation flight.

The surviving pilot stated he does not recall the accident sequence. Witnesses reported they observed the helicopter flying low toward Falcon Field Airport (FFZ), Mesa, Arizona, with white smoke emitting from the tail rotor area. Suddenly, the tail rotor separated from the helicopter and landed in a dirt lot below. The helicopter continued northeast as it started to spin and impacted the ground.

The flight track indicated that the helicopter took off from Jacqueline Cochran Regional Airport (TRM), Palm Springs, California, about 1324 Pacific daylight time and turned eastbound seemingly along Interstate I-10 toward the Phoenix area. The flight track was intermittent due to the helicopter going in and out of coverage for about 2 hours before passing just north of Buckeye Municipal Airport (BXX) Buckeye, Arizona. The helicopter then turned right and tracked southeast for about 10 minutes and turned left traveling east over a mountain chain and continuing until reaching Stellar Airpark (P19), Chandler, Arizona. The helicopter performed one left hand 360° turn just west of the field before continuing across the airport and turning northeast directly toward FFZ. The helicopter continued along that heading until just before crossing Highway 60 when it began to simultaneously descend and lose ground speed. After crossing the highway, it entered a right descending turn until track data were lost about 1556.

Pilot Information

Certificate:	Airline transport; Commercial	Age:	55, Male
Airplane Rating(s):	Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	Unknown
Instrument Rating(s):	Airplane; Helicopter	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 1 With waivers/limitations	Last FAA Medical Exam:	December 16, 2019
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:	(Estimated) 11550 hours (Total, all aircraft)		

Pilot Information

Certificate:	Commercial	Age:	23, Male
Airplane Rating(s):	None	Seat Occupied:	Right
Other Aircraft Rating(s):	Helicopter	Restraint Used:	Unknown
Instrument Rating(s):	Helicopter	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 2 With waivers/limitations	Last FAA Medical Exam:	March 2, 2018
Occupational Pilot:	UNK	Last Flight Review or Equivalent:	March 15, 2019
Flight Time:	714 hours (Total, all aircraft), 32 hours (Total, this make and model), 543 hours (Pilot In Command, all aircraft), 52 hours (Last 90 days, all aircraft), 11 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	Registration:	N3276T
Model/Series:	UH 1H No Series	Aircraft Category:	Helicopter
Year of Manufacture:	1941	Amateur Built:	
Airworthiness Certificate:	Restricted (Special)	Serial Number:	69-15911
Landing Gear Type:	Skid	Seats:	
Date/Type of Last Inspection:	Unknown	Certified Max Gross Wt.:	
Time Since Last Inspection:	3.5 Hrs	Engines:	1 Turbo shaft
Airframe Total Time:	11931 Hrs at time of accident	Engine Manufacturer:	Honeywell
ELT:	C126 installed, activated, did not aid in locating accident	Engine Model/Series:	T53-L-703
Registered Owner:	Bell Asset Management Inc	Rated Power:	
Operator:	Southwest Rotors	Operating Certificate(s) Held:	Rotorcraft external load (133), Agricultural aircraft (137)

According to aircraft records, the accident helicopter's tail rotor gearbox (also known as the 90-degree gearbox) was removed from a different helicopter in September 2012 due to failing serviceability checks caused by metal accumulation. In November 2012, it was repaired by replacing the main input seal, painted, and installed onto the accident helicopter, about 228 flight hours prior to the accident. There was no other information regarding this installation.

In January 2019, the helicopter's tail boom, upper portion of the vertical stabilizer, and elevators were painted. Photographs from this painting activity showed that the tail boom, tail rotor gearbox, and tail rotor assembly remained installed during the painting process. The tail rotor assembly and tail rotor gearbox were masked during the painting process. The fuselage and lower tail boom were painted a white color, and the upper portion of the tail boom was painted black. The vertical stabilizer was painted black on the upper and lower portions, with a blue stripe in the middle. The elevators were removed from the tail boom and painted separately; they were painted a blue color.

In April 2019, about 39 flight hours prior to the accident, the tail rotor gearbox was removed from the vertical stabilizer for a corrosion inspection; no defects were noted in the maintenance logs. The United States Army technical manuals, cited by the type certificate holder for maintenance of this helicopter, do not require a retorquing and/or torque stabilization check of gearbox retaining nuts a certain number of flight hours after installation.

In December 2019, about 7 hours prior to the accident, oil was drained from the tail rotor gearbox due to discoloration and samples were sent for oil analysis. The oil analysis report indicated abnormal copper and aluminum wear particles within the tail rotor gearbox oil.

While no corrective action was recommended at that time, a resample was recommended at the next service interval. The accident occurred before the next oil sample was taken.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	IWA,1384 ft msl	Distance from Accident Site:	9 Nautical Miles
Observation Time:	15:50 Local	Direction from Accident Site:	123°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	6 knots / None	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	280°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	29.85 inches Hg	Temperature/Dew Point:	35°C / 0°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Palm Springs, CA (TRM)	Type of Flight Plan Filed:	None
Destination:	Mesa, AZ (FFZ)	Type of Clearance:	None
Departure Time:		Type of Airspace:	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Substantial
Passenger Injuries:	1 Serious	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Fatal, 1 Serious	Latitude, Longitude:	33.386112,-111.805831(est)

On scene examination by a Federal Aviation Administration inspector indicated that the debris field was about 1/2 mile long, extending along a generally northeast direction. The first identified pieces of debris were fragments of glass, which were consistent with a vertical stabilizer navigation light. About 200 yards further northeast were the tail rotor assembly and the input quill assembly. The rest of the helicopter came to rest about 1/2 mile further northeast in an open, slightly sloped field. The first pieces of debris in the field were the vertical stabilizer and a large portion of the right elevator. Next were two long and narrow ground strikes, consistent with main rotor blade strikes. Immediately following this area was the main wreckage; the helicopter came to rest slightly nose- and left-side low, along a heading of about 49°. The helicopter exhibited upward crushing throughout the cabin and fuselage, most extensively on the left side of the fuselage. The mast and the main transmission were displaced

forward and to the left. The main rotor assembly was fracture separated and located about 20 yards northeast of the main wreckage; it was the last major piece of debris.

Postaccident examination of the helicopter's engine did not reveal any anomalies that would have precluded normal operation. Flight control continuity was mostly established throughout the airframe; some areas were inaccessible due to airframe deformation. The tail boom had been removed for recovery purposes. The vertical stabilizer was fracture-separated, consistent with main rotor blade impact. The tail rotor gearbox was fracture-separated at the attachment studs, and four of the fractured attachment stud pieces were found loose within the vertical stabilizer. A fifth stud piece remained stuck in the vertical stabilizer support casting, and the nut end of the sixth stud piece was not located. The chip detector was removed from the tail rotor gearbox and metallic debris was present. The tail rotor assembly was mostly whole and intact. The linkages and tail rotor blades remained secured in place. The tail rotor blades were damaged at the leading edges near the blade tips and had multiple dents along the span of the blades.

The top of the vertical stabilizer, tail rotor assembly, tail rotor gearbox, input quill assembly, and mounting studs were all packaged and sent to the National Transportation Safety Board materials laboratory for further examination. Progressive crack growth was noted on the mounting studs within the tail rotor gearbox housing. The fracture surfaces were relatively rough, consistent with low-cycle fatigue or cyclic overstress crack growth under relatively high cyclic stresses. Additionally, multiple layers of primer, paint, and sealant were observed on the input quill assembly, including beige-tinted white paint on the flange clamping surface where it had mated to the vertical stabilizer. Beige-tinted white paint was also observed on the vertical stabilizer support casting where it had mated to the input quill as well as the washers for the tail rotor gearbox attachment hardware.

The United States Army Depot Maintenance Work Requirement No. 55-1560-127 contains instructions for painting the tail rotor gearbox. The instructions contain a step to “mask the top part of the outer flange of input quill sleeve and also the entire studs.”

Medical and Pathological Information

Toxicology testing on the deceased pilot performed by NMS Labs at the request of the Maricopa County Medical Examiner identified oxycodone at 140 ng/ml and its psychoactive metabolite oxymorphone at 10 ng/ml in femoral blood.

Oxycodone is an opioid pain medication available by prescription as a Schedule II controlled substance (high potential for addiction and abuse). It is often sold as a combination product with acetaminophen (Tylenol) under the names Percocet, Roxicet, and Endocet. When sold as a solo drug, the most common name is Oxycontin. In all these forms, it carries a boxed warning

about the potential for addiction, abuse, and misuse, and a specific warning that the drug, “may impair the mental or physical abilities needed to perform potentially hazardous activities such as driving a car or operating machinery. Warn patients not to drive or operate dangerous machinery unless they are tolerant to the effects of oxycodone and acetaminophen tablets and know how they will react to the medication.” In novice users, usual drug levels where desired effects are likely but toxic effects are unlikely are between 13 and 99 ng/ml. However, with regular use, patients become tolerated to the effects and may appear to be functioning at much higher blood levels.

In 2013, a FAA hotline complaint was filed against the pilot. He was evaluated by an FAA consultant and diagnosed with cocaine and alcohol dependence, both in remission since November 11, 2014. In 2015, the pilot was evaluated and placed in the Human Intervention Motivational Study program to continue his recovery from alcohol and cocaine addiction. With continued evaluation and treatment, the pilot eventually obtained a special issuance first class medical certificate in December 2016. He remained in this program, which requires periodic evaluations and drug testing, until October 29, 2019. During the pilot’s last medical on December 16, 2019, he reported no other chronic conditions and only reported the use of sildenafil (Viagra).

Administrative Information

Investigator In Charge (IIC):	Link, Samantha
Additional Participating Persons:	Gary Hendrickson; Federal Aviation Administration; Scottsdale, AZ Marlin Kruse; Honeywell Aerospace; Phoenix, AZ
Original Publish Date:	May 3, 2022
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=101204

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

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](#).