Aviation Investigation Factual Report

Location:	Fallbrook, California	**Accident Number:**	LAX06LA161
Date & Time:	May 4, 2006, 09:30 Local	**Registration:**	N2763R
Aircraft:	Bell 206B3	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 Minor
Flight Conducted Under:	Part 137: Agricultural		

Factual Information

HISTORY OF FLIGHT

On May 04, 2006, about 0930 Pacific daylight time, a Bell 206B3, N2763R, collided with trees while conducting an aerial spraying operation near Fallbrook, California. The airline transport pilot (ATP) and a commercial pilot sustained minor injuries. The helicopter, owned and operated by Pacific Rotors, Inc., sustained substantial damage during the crash sequence. The helicopter was operating under the provisions of 14 CFR Part 137. The helicopter departed about 5 minutes prior to the accident from a truck positioned about 2 miles north of Fallbrook. Visual meteorological conditions prevailed for the local area aerial application flight, and a flight plan had not been filed.

The commercial pilot stated that the purpose of the flight was to perform a final rinse load on an avocado orchard they had been spraying that day. The ATP was acting as the safety pilot for insurance purposes while the commercial pilot was acting as pilot-in-command. After finishing with the final load, they began the short return flight back to the truck. The commercial pilot maneuvered the helicopter in a shallow right turn over a steep hill with about 80-percent power. With the helicopter about 20 feet above ground level (agl), and about 5 feet above the treetops, it made an uncommanded yaw. The airline transport pilot took over the controls and maneuvered toward a flat area, and there was a simultaneously loss of rotor revolutions per minute (rpm). The helicopter settled into the trees on a 75-degree slope. The engine was shut off and both pilots egressed the helicopter.

The commercial pilot further noted that the main rotor appeared to cut surrounding trees, which were about 6-inch thick in diameter. He stated that helicopter had over 14 gallons of fuel on board at the time of the accident.

HELICOPTER

The Bell 206B3, serial number 2743, was manufactured in 1979, and had accrued a total time in service of 15,437.5 hours. Several weeks after the accident, the operator presented the helicopter's maintenance records to National Transportation Safety Board investigators for review. The most recent annual inspection was completed on March 03, 2006, 37.5 hours prior to the accident. The Rolls Royce 250-C20B engine, serial number CAE-831537, was last overhauled accomplished on the dates noted for the airframe annual.

According to Bell Helicopter Textron (BHT), an integral part of the helicopter's power train system is the engine to transmission drive shaft, located between the transmission and freewheeling drive. The drive shaft (as installed) is comprised of two identical couplings, which are located on either end of the shaft. The internal components consist of two flanges positioned on the ends of the tubular hollow drive shaft. The assembly requires a retainer ring and packing seal to be positioned against the flange. A drive shaft coupling seal (akin to a rubber boot) is situated against the packing seal, impeding grease from egressing the coupling assembly.

The drive shaft is further comprised of a gear sprocket affixed to the shaft flange via four bolts (bolt heads positioned on the inside of the coupling). The donut-shaped gear has a hollow area in the middle that aligns with the hollow tube situated between the couplings; a slight lip surrounds the hollow area. The outer coupling gear surrounds the drive gear where it was splined, and torque is transmitted. Inside the coupling the assembly is equipped with a shaft centering spring. The spring is positioned in between the lip and the end cap of the coupling (grease retainer plate). A retainer ring and packing seal rest against the back plate.

BHT recommends that the Bell 206B3 engine to transmission drive shaft couplings be hand pack with lubricant (C-015 grease). The application is intended to be over the top of the internal spline teeth and consist of 0.2- to 0.3-inch depth prior to assembly.

The operator's component card record for the engine to transmission drive shaft was reviewed. The record indicated that the drive shaft, part number 206-040-015-103 (serial number A20-01258), had accrued 15,397.6 hours total time in service at the last inspection. That inspection was recorded as completed on March 01, 2006, with the maintenance description labeled as a 600 hours inspection consisting of repacking with grease. The inspection prior to that was recorded as completed on August 01, 2005, marked as 146.4 component hours prior to the last inspection. A review of the airframe logbooks revealed that the helicopter had amassed 489.2 hours over that duration. There was no notation that another drive shaft had ever been installed. The helicopter mechanic with Inspection Authorization (IA) that signed the last inspection had done all pervious maintenance of the component that was listed on the card (a total of eight inspections over the course of about 6 years).

The IA that had signed the logbooks as completing most of the recent maintenance stated that the owner would frequently perform the maintenance under his supervision. The owner recently underwent surgery to remove a brain tumor and was unable to recall the last maintenance he had performed on the helicopter.

TESTS AND RESEARCH

Following recovery, the helicopter was examined under the supervision of a Safety Board investigator at the facilities of Cruiseair Aviation, Ramona, California, on May 23, 2006. Present to the investigation were two Federal Aviation (FAA) inspectors and technical representatives from both Bell Helicopter Textron and Rolls-Royce.

Engine

The engine remained securely attached to the airframe at its three respective attaching points. A visual examination revealed no evidence of damage to the mounting struts securing the engine to the airframe. Investigators additionally found no evidence of foreign object ingestion in the compressor air inlet or first stages of the compressor rotor. Continuity was established in the power turbine drive train between the fourth stage turbine wheel, through the accessory gearbox, to the drive shaft mating flange on the forward side of the freewheeling unit.

Investigators established continuity in the gas producer drive train from the compressor rotor, through the accessory gearbox, to the starter generator; both drive trains turned freely and smoothly. The linkage was intact between both the fuel control and power turbine governor; both sets of linkages moved freely. The fuel, oil, and pneumatic lines on the exterior of the engine were secure, and there was no evidence of pre-existing leaks on the surfaces of the engine. Investigators found two circumferential scars on the tail rotor drive shaft segment in the engine compartment corresponding to the burner drain valve and the pneumatic lines between the governor and fuel control.

Airframe

Investigators established continuity from the cyclic control in cockpit to the stationary swash plate. The collective control rod was separated aft of the far right cyclic servo actuator; the angular fracture surfaces were consistent with that of overload. The remaining control rod was continuous to the mixing unit (aft of the servo deck) and up to the non-rotating swash plate. The remaining section of the rod was affixed to the stationary swash plate. The fuel cell was intact and remained in the aft fuselage structure. The airframe fuel filter was removed and was full of fluid consistent with fuel.

Control continuity was established from the main rotor drive shaft to the tail rotor assembly. The tail rotor hub and blades were intact and remained attached to the 90-degree gearbox. The tail rotor pitch-change mechanism functioned and the 90-degree gearbox was free to rotate. The main transmission remained attached to the airframe. The deck area between the main transmission and engine had a thin layer of dirt and black greasy material covering the structure.

The engine to transmission drive shaft (short shaft) was separated at the forward coupling flange, adjacent to the main transmission. The subject shaft and its two respective spherical splined outer couplings were removed for further examination. There were red and dark brown deposits on the external and internal areas of the drive shaft, mostly at the couplings and flanges, which were similar in appearance to rust. The drive shaft tube had a plate that was affixed to the surface, which appeared to be a data plate; it had several layers of paint on it and no identifying marks could be discerned at that time.

Investigators removed the engine to transmission drive shaft forward coupling from the gear. The retainer ring, packing seal, and drive shaft coupling seal were not attached to the coupling and were dangling loosely on the drive shaft tube. A visual examination of the internal coupling revealed that the teeth were still intact and the inside of the grease retainer plate had a shiny polished appearance revealing its aluminum composition. The surface of the subject plate was heavily scored with numerous indentations. There was no evidence of grease in the coupling, and the entire inside was dry.

Visual examination of the engine to transmission drive shaft forward gear sprocket revealed the gear teeth were not present and appeared to have been flattened or machined flush. The surface where the gear teeth were expected to be was a smooth shinny surface. On the face of the gear sprocket there was a semicircular indentation adjacent to the hollow circle in the middle of the gear. The shape and dimensions of the groove were consistent with that of a partial impression of the spring that is normally inside the coupling and positioned along the lip in the center of the gear. The spring was not found in the coupling.

Investigators removed the engine to transmission drive shaft aft coupling from the aft gear sprocket. A visual examination of the internal coupling revealed that the teeth were intact and a lumpy black substance was inside body of the coupling, which was consistent with used grease. The grease retainer plate and spring were intact. The teeth on the aft gear sprocket were intact and the same black grease was coated along the circumference. There were several pieces of metal material found in the coupling body that were consistent with remnants of a deformed spring.

Engine to Transmission Drive Shaft Examination

The engine to transmission drive shaft and respective couplings were sent to BHT for further testing. Under the auspice of an FAA inspector, the testing was performed on June 28, 2006. Paint was removed from the data plate of the part disclosing that is was part number 206-040-015-103, serial number A20-01258.

The examination revealed that the grease found in the aft coupling was the same grease that is required by BHT. The metal pieces found in the aft coupling were deformed parts of the forward spring that were bent and curled smaller than the outer diameter of the aft spring. Temperature indicator dots were found on the aft coupling, but there was no evidence of the indicators on the forward coupling.

According to the materials laboratory at BHT, the transmission end of the drive shaft showed numerous signs of overheating from lack of lubrication. The hardness values taken after the overheating occurred indicated lower hardness values in the material than would be expected from a drive shaft that had not experienced overheating. On the contrary, the engine end of the drive shaft showed no signs of overheating and the hardness values were within engineering drawing requirements.

ADDITIONAL INFORMATION

The applicable Maintenance Manual for the accident helicopter indicated that every 600-hour or 12-month period (whichever occurs first) the main drive shaft component should be inspected. Specifically, that an inspection of the inner and outer coupling teeth splines should be done to assess if there is any wear or corrosion. Additionally the boot and the shaft should be inspected for damage and corrosion. The bulletin further stated that the inspection should be accomplished concurrently with lubrication requirements.

Pilot Information

Certificate:	Commercial	**Age:**	34,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2	**Last FAA Medical Exam:**	December 1, 2005
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	November 1, 2004
Flight Time:	393 hours (Total, all aircraft), 214 hours (Total, this make and model), 322 hours (Pilot In Command, all aircraft), 57 hours (Last 90 days, all aircraft), 19 hours (Last 30 days, all aircraft)		

Check pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	57,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2	**Last FAA Medical Exam:**	April 1, 2006
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	November 1, 2004
Flight Time:			

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N2763R
Model/Series:	206B3	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	2743
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	March 1, 2006 Annual	**Certified Max Gross Wt.:**	3200 lbs
Time Since Last Inspection:	37.5 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	15437.5 Hrs at time of accident	**Engine Manufacturer:**	Allison
ELT:	Installed, not activated	**Engine Model/Series:**	250-C20B
Registered Owner:	Pacific Rotors, Inc.	**Rated Power:**	420 Horsepower
Operator:		**Operating Certificate(s) Held:**	
Operator Does Business As:		**Operator Designator Code:**	NJDG

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	8 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	2 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	270°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:		**Temperature/Dew Point:**	16°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Fallbrook, CA	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	09:25 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	2 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Minor	**Latitude, Longitude:**	33.433334,-117.25

Administrative Information

Investigator In Charge (IIC):	Keliher, Zoe
Additional Participating Persons:	Steve Vargo; Federal Aviation Administration; San Diego, CA Harold Barrentine; Bell Helicopter Textron; Fort Worth, TX Rick Thorpe; Rolls Royce; Indianapolis, IN
Report Date:	March 21, 2007
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=63637