Aviation Investigation Final Report

Location:	Light, Arkansas	**Accident Number:**	CHI03FA277
Date & Time:	August 21, 2003, 11:00 Local	**Registration:**	N38CD
Aircraft:	Bell TH-13T	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Serious
Flight Conducted Under:	Part 91: General aviation - Positioning		

Analysis

The helicopter sustained substantial damage when it impacted the terrain during a positioning flight. After spraying a field, the pilot landed, refueled, and completed a preflight inspection of the helicopter. The pilot then departed to spray another field. The pilot reported that during the agricultural flight there were no changes in the sound of the transmission or any other part of the helicopter. The helicopter impacted the terrain while in cruise flight and the pilot had no recollection of the accident. The inspection of the helicopter revealed that the transmission failed in-flight. Three worn and deformed lower pinion roller bearings from the lower planetary gear spider assembly were found loose in the transmission. The inner race for that pinion had missing rollers. It was spalled at both the upper row and lower row of its rollers. No spalling was found on the other five inner races from the lower spider assembly and no abnormal wear was found on rollers from the other pinions in the lower spider assembly.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The total failure and seizure of the main rotor transmission while in cruise flight leading to the helicopter's impact with terrain.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: CRUISE

Findings
1. (C) ROTOR DRIVE SYSTEM,MAIN GEARBOX/TRANSMISSION - MALFUNCTION
2. (C) ROTOR DRIVE SYSTEM,MAIN GEARBOX/TRANSMISSION - FAILURE,TOTAL
3. (C) ROTOR DRIVE SYSTEM - SEIZED

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: CRUISE

Findings
4. TERRAIN CONDITION - GROUND

Factual Information

HISTORY OF FLIGHT

On August 21, 2003, around 1100 central daylight time, a Bell TH-13T helicopter, N38CD, sustained substantial damage when it impacted the terrain during a positioning flight. The pilot received serious injuries. The 14 CFR Part 91 positioning flight departed a field near Fontaine, Arkansas, and was en route to another field near Delaplaine, Arkansas. Visual meteorological conditions prevailed at the time of the accident. No flight plan was filed.

The pilot reported that prior to flying to Fontaine, he completed all pre-flights checks and there were no abnormalities. When he flew to Fontaine there were no changes in the sound of the transmission or any other part of the helicopter. At Fontaine he loaded the helicopter with chemicals, as usual, and sprayed a field. After spraying the field, he landed and refueled the helicopter. He reported that he checked the oil level, completed a magneto check, checked the engine's and transmission's oil temperature, and all checks were normal. He departed en route to Delaplaine to spray another field. The pilot reported that he has no recollection of the accident. He reported the helicopter was performing normally and there were no abnormal transmission sounds prior to the accident occurring.

PERSONNEL INFORMATION

The pilot held a commercial pilot certificate with a rotorcraft rating. The pilot was not instrument rated. The pilot was issued a Second Class medical certificate on December 26, 2002, with no limitations or waivers. The pilot reported that he had a total flight time of 1,550 hours. The pilot accumulated approximately 1,329 hours of rotorcraft time, and approximately 840 hours in the Bell TH-13T helicopter.

AIRCRAFT INFORMATION

The accident aircraft was a Bell model TH-13T, serial number 3680, which was manufactured for the U.S. Army as an instrument trainer. According to Bell Helicopter records, TH-13T S/N 3680 was manufactured January 25, 1968 and delivered to the U.S. Army January 26,1968. A Lycoming VO-435 series engine rated at 280 horsepower powered the helicopter. The date the helicopter entered civilian operation was not reported.

According to the aircraft maintenance records, the aircraft had a 1,200-hour inspection on March 1, 1996, in accordance with Bell's Maintenance and Overhaul Manual. All components were removed, and disassembled. The components were inspected by visual inspection, zyglo, magna flux, and x-ray inspection. All worn and out of tolerance parts were replaced. All 1,200-hour components were overhauled and reinstalled on the airframe. The aircraft had

approximately 5,097 total time of service hours at the 1,200-hour inspection.

According to the aircraft maintenance records, the aircraft had a 600-hour inspection on February 22, 2000, in accordance with Bell's Maintenance and Overhaul. The transmission was disconnected and removed to comply with the 600-hour inspection. All items necessary for removal of main transmission were reinstalled and reconnected in reverse order of removal. The oil was drained to check for metal to comply with Airworthiness Directive 62-23-02. No metal was noted. The aircraft had approximately 5,742 total time in service hours at the 600-hour inspection.

The helicopter had an agricultural spray system installed on January 1, 2003. On February 1, 2003, the aircraft was registered to be operated in the Restricted Category for agricultural operations. An annual inspection took place on March 16, 2003. The aircraft had 5,953.1 hours of total time and 1,621 hours indicated on the Hobbs meter at the time of inspection. The helicopter was flown for approximately 70 hours since the last inspection to the time of the accident.

METEOROLOGICAL INFORMATION

A weather observation station, located at Walnut Ridge Regional Airport (ARG), Walnut Ridge, Arkansas, approximately 11 nautical miles northwest from the accident site, recorded the weather conditions at 1055 as:

Winds: 170 degrees at 7 knots
Visibility: 10 statue miles
Ceiling: Clear
Temperature: 30 degrees Celsius
Altimeter: 30.04 inches of Mercury

WRECKAGE AND IMPACT INFORMATION

A Federal Aviation Administration airworthiness inspector from the Little Rock Flight Standards District Office initially examined the aircraft wreckage at the accident site. The wreckage was then sent to the Black River Technical College in Pocahontas, Arkansas. On October 15, 2003, an inspection of the helicopter transmission revealed that the freewheeling unit was jammed and fractured transmission parts were found. On October 29, 2003, an air safety investigator from the NTSB, an operations inspector from the FAA, and a safety investigator from Bell Helicopters examined the helicopter wreckage at the Black River Technical College.

The inspection revealed that the plexiglas bubble that surrounded the cabin was destroyed. The center-frame and cabin were deformed downward. The cabin structure and instrument panel also had downward deformation. The instrument panel was broken from its supporting

structure and was lying forward and parallel to the ground. The pilot seat pan on the left side was found deformed downward to the extent that the forward edge of the pan measured 3.5 inches from the cabin floor. The landing skids were separated from the leg assemblies which connect to the fuselage. The leg assemblies were bent reward toward the tail boom section. The tailboom was recovered in two sections. The first section contained the tail rotor gearbox assembly and tail rotor and was approximately nine feet in length. The remaining section of tailboom remained attached to the center frame and was bent downward approximately 20 degrees. The controls in the cockpit were intact.

The main rotor hub was intact, but the control linkage had fractures. The stabilizer bar and damper assemblies were still mounted on the mast. One of the stabilizer bar tubes was bent downward approximately 40 degrees. Both main rotor blades were removed from the rotor hub. Both main rotor blades were intact and neither had signs of cord-wise scratching, torsional bending, or leading edge damage.

The tailboom was found forward of the tail rotor extension tube. The tail rotor gearbox and tail rotor assembly were still attached to the tailboom extension tube. The tail rotor box exhibited drive continuity. The tail rotor hub was intact. The tail rotor blades did not exhibit any signs of cord-wise scratching, torsional bending, or leading edge damage.

At the conclusion of the wreckage examination, the NTSB directed that the main transmission be shipped to the Bell Helicopter Laboratory in Fort Worth, Texas, for further metallurgical examination.

TESTS AND RESEARCH

On December 2-4, 2003, the transmission components were examined at the Bell Helicopter Field Investigation Laboratory under the supervision of a NTSB aviation safety investigator. The Bell Helicopter Metallurgist stated the following:

"Examination revealed the upper row of lower planetary rollers in one of the lower planetary pinions had become worn and displaced. Six planetary rollers were present in the planet gear upper row and 11 rollers were present in the lower row. Three worn and deformed rollers were found loose in the transmission. The upper face of the pinion and the face of the lower spider that had been adjacent to the pinion were worn and deformed. The condition and/or whereabouts of the other two rollers from the upper row were not determined. No material discrepancies were found in the three worn and deformed rollers found loose in the transmission."

"The inner race for the pinion with missing rollers was spalled at both the upper row and lower row of rollers. No spalling was found on the other five inner races from the lower spider assembly and no abnormal wear was found on rollers from the other pinions in the lower spider."

Teeth on two of the pinions were fractured and two other pinions had fractured from the spider assembly. The fractured tooth on one of the pinions revealed evidence of fatigue cracking. The tooth fragment was found loose in the transmission. The second fractured tooth separation from the pinion was consistent with overstress. The fractured tooth was found loose in the transmission fractured into two pieces. The Bell Helicopter Engineering Laboratories Report number 04703M-10 is in the docket material associated with this case.

ADDITIONAL INFORMATION

The Federal Aviation Administration and Bell Helicopter were parties to this investigation.

Pilot Information

Certificate:	Commercial	**Age:**	26,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	December 26, 2002
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	December 26, 2002
Flight Time:	1550 hours (Total, all aircraft), 840 hours (Total, this make and model), 1550 hours (Pilot In Command, all aircraft), 413 hours (Last 90 days, all aircraft), 62 hours (Last 30 days, all aircraft), 3 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N38CD
Model/Series:	TH-13T	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	3680
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	March 16, 2003 Annual	**Certified Max Gross Wt.:**	2850 lbs
Time Since Last Inspection:	70 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	6005.1 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	Not installed	**Engine Model/Series:**	VO-435 A15 HC
Registered Owner:	Couch Helicopter Services	**Rated Power:**	280 Horsepower
Operator:	SONGER, HARVEY	**Operating Certificate(s) Held:**	
Operator Does Business As:	Couch Helicopter Service	**Operator Designator Code:**	NOSG

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	ARG,273 ft msl	**Distance from Accident Site:**	11 Nautical Miles
Observation Time:	10:55 Local	**Direction from Accident Site:**	315°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.04 inches Hg	**Temperature/Dew Point:**	30°C / 25°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Fontaine, AR	**Type of Flight Plan Filed:**	None
Destination:	Delaplaine, AR	**Type of Clearance:**	Unknown
Departure Time:	10:45 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Serious	**Latitude, Longitude:**	36.116664,-90.75

Administrative Information

Investigator In Charge (IIC):	Silliman, James
Additional Participating Persons:	Michael Wilson; FAA-Little Rock FSDO; Litttle Rock, AK Jack Suttle; Bell Helicopter Textron Inc.; Fort Worth, TX
Original Publish Date:	July 29, 2004
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=57779