National Transportation Safety Board

FACTUAL REPORT AVIATION

NTSB ID: FTW01FA115	Aircraft Registration Number: N917AL
Occurrence Date: 05/04/2001	Most Critical Injury: None
Occurrence Type: Accident	Investigated By: NTSB

Location/Time

Nearest City/Place	State	Zip Code	Local Time	Time Zone	
Vermillion 44	GM	00000	1616	CDT	

Airport Proximity: Off Airport/Airstrip

Distance From Landing Facility:

Aircraft Information Summary

Aircraft Manufacturer	Model/Series	Type of Aircraft
Bell	407	Helicopter

Revenue Sightseeing Flight: No

Air Medical Transport Flight: No

Narrative

Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:

HISTORY OF FLIGHT

On May 4, 2001, at 1616 central daylight time, a Bell 407 single-engine helicopter, N917AL, sustained substantial damage due to a drive shaft component failure while operating off shore in the Gulf of Mexico. The commercial pilot and his passenger were not injured. The helicopter was registered to and operated by Air Logistics LLC, of New Iberia, Louisiana. Visual meteorological conditions prevailed and a company visual flight rules flight plan was filed for the 14 Code of Federal Regulations Part 135 on-demand air taxi flight. The helicopter departed the High Island 368 offshore platform at 1535, and was destined for Intracostal City, Louisiana.

In an interview with the NTSB investigator-in-charge (IIC), the pilot reported that while in cruise flight at 700 feet agl, enroute from High Island 368 to Intracoastal City, a "slight vibration became noticeable." After a few minutes, the vibration became more pronounced, and was accompanied by a noise. During an attempted precautionary landing to an offshore platform, the vibration and noise level increased again, and total engine power was lost. The pilot then initiated an autorotation to the water, deployed the skid floats, and landed safely. After landing, the pilot retarded the throttles, shut off the fuel valve and placed the electrical switches to the OFF position. While the helicopter was being towed in the water, the helicopter rolled over inverted. Examination of the helicopter, after recovery by the operator, revealed that the KAflex engine-to-transmission driveshaft had fractured, and the forward section of the tail rotor driveshaft had separated.

PERSONNEL INFORMATION

The pilot held an airline transport pilot certificate with helicopter, airplane single-engine land and multi-engine land ratings. In addition, he held helicopter and airplane instrument ratings. The pilot was issued a second-class medical certificate on March 8, 2001, with the limitation, "Glasses near and intermediate." His total flight time, as of May 4, 2001, was 15,100 hours, of which 2,800 hours were in the Bell 407. He had flown 166 operational flight hours in the Bell 407 during the 90 days prior to the accident.

AIRCRAFT INFORMATION

Manufactured at Bell Helicopter Textron Canada (BHTC), the Bell model 407 helicopter, S/N 53381, was certified on September 15, 1999, and delivered to Air Logistics L.L.C., of New Iberia, on September 21, 1999, with 14.6 total flight hours. The helicopter was powered by a 630 horsepower turboshaft Rolls Royce Allison 250-C-47B engine, S/N CAE-847417. According to records provided by the operator, the helicopter had accumulated 2,114.2 total flight hours, 1,771 total cycles, and 4,476 total takeoffs at the time of the accident.

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The maintenance records revealed that the fractured KAflex driveshaft, P/N 206-340-300-105, S/N KC734, was last removed and reinstalled on the helicopter on April 10, 2001, at a helicopter time of 1,998 hours. The KAflex driveshaft is often removed when maintenance is performed near the transmission area, pylon mounts, engine, etc. The records indicated that the helicopter's KAflex driveshaft had been removed and reinstalled nine times for both scheduled and unscheduled maintenance prior to accident. The KAflex driveshaft had a total time of 2,114.2 hours and an airworthiness life limit of 5,000 hours.

According to the BHTC maintenance manual, each end of the KAflex driveshaft is comprised of four rectangular flex frames that are attached with bolts to each other and to each end of the shaft. A flange adapter is attached to each flex frame assembly with bolts. One flange adapter bolts to the transmission input adapter, and the other flange adapter bolts to the rotor disk and to the freewheel adapter. The driveshaft turns at 6,317 rpms and transmits the power from the engine to the transmission. The driveshaft is designed to flex to accommodate the misalignment between the engine and transmission that occurs during operation. According to Transport Canada (TC), three incidents involving cracked flex frames on the forward (transmission) end of the driveshaft had previously been reported.

WRECKAGE AND IMPACT INFORMATION

Initial examination of the wreckage was conducted by the NTSB at the operator's base in New Iberia, on May 8, 2001. The helicopter's fuselage and tail boom were predominately intact. The chin bubbles, forward windscreens, and skid gear floats were damaged during recovery. The mast and rotor system were removed from the helicopter prior to the examination and were also substantially damaged during the recovery. The upper cowlings, with the exception of the hydraulic flight control actuators' cowling, were removed prior to the examination. The engine was observed mounted to the airframe and the engine mounts were found to be secure. The steel tail rotor drive shaft had been torsionally separated approximately 2 inches forward of the dynamic balance weight. The tail rotor gearbox case displayed evidence of salt-water corrosion, and the tail rotor hub and blades were securely mounted to the output shaft with no anomalies noted. The cockpit controls were manually manipulated with no anomalies noted, and continuity was established from the cockpit throughout the entire flight control system. The cockpit switch positions were all in their normal shutdown positions, with the exception of the hydraulic system and the avionics master switches, which were ON. The only open circuit breaker was the GPS circuit breaker.

The KAflex driveshaft was found separated from the transmission input side. The anti-flail device was observed separated from the transmission side of the driveshaft. Separated portions of the driveshaft flex frames were found on the roof deck. The roof deck immediately below the transmission end of the driveshaft had been punctured and displayed signatures of rotational scoring and tearing. In addition, the fuel vent line had been punctured. The oil line that connects to the oil manifold for the freewheeling unit had also been severed. The driveshaft and its fractured components, along with the separated forward tail rotor drive shaft, were retained by the NTSB for further examination.

TESTS AND RESEARCH

On May 17, 2001, at the facilities of Bell Helicopter, Hurst, Texas, under the supervision of the NTSB, the KAflex driveshaft and tail rotor driveshaft were examined by Bell engineers. Bell Helicopter's materials laboratory examination of the KAflex driveshaft "revealed fatigue fractures at a bolt hole in the first flex frame at the transmission end of the shaft and fatigue fractures in the end fitting at the transmission end. The primary fracture was a fatigue crack that occurred in a bolt hole where a bolt joined the first flex frame to the center flex frame. All the other fractures were a result of overstress." The driveshaft was determined to be manufactured within engineering specifications.

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Bell Helicopter's materials laboratory report also stated that "the fractured tail rotor driveshaft was a result of torsional overstress. The direction of overstress was consistent with restraint of the driveshaft from the flywheel aft while the forward portion of the shaft was driven in a clockwise direction as viewed looking forward."

ADDITIONAL INFORMATION

Transport Canada issued Airworthiness Directive (AD) CF-2001-24 on June 11, 2001. The AD discussed this accident and three other incidents involving cracked flex frames on the driveshaft. The AD required a one-time visual inspection for any obvious discrepancy of the driveshaft: "(a) within the next 25 hours air time for shafts with more than 1,000 hours, and for shafts with less than 1,000 hours which have been removed or installed since the helicopter was delivered; (b) or within the next 300 hours for shafts with less than 1,000 hours that have never been removed or installed since delivery." The one-time inspection was to be conducted in accordance with Bell Helicopter Alert Service Bulletin (ASB) 407-01-43, dated June 8, 2001. The ASB discussed the possibility of driveshaft failure due to fatigue cracking of the flex frames. The Federal Aviation Administration (FAA) issued AD 2001-13-51, dated June 27, 2001, which addressed the same subject matter as TC's CF-2001-24 AD and utilized the same inspection requirements and intervals.

Transport Canada also issued AD CF-2002-03, effective on February 28, 2002. The AD discussed this accident and the three additional incidents of cracked driveshaft flex frames. The AD stated that: "It has been determined that the KAflex driveshaft on model 407 helicopters is experiencing higher loads than on other helicopter models. Since the KAflex shaft P/N 206-340-3---105 can also be installed on Models 206L-4 and 427, this directive requires a component review to determine if the KAflex shaft was previously installed on Model 407." The corrective actions called for in the AD were:

"Part 1. Models 206L-4 and 427

Review of the Historical Service Record of the KAflex driveshaft to determine if it was ever installed on a Bell Model 407 helicopter:

(a) If the KAflex driveshaft has never been installed on a Bell Model 407 helicopter, then annotate the helicopter log book as follows: P/N 206-340-300-105 KAflex driveshaft has not been installed on a Bell 407. AD CF-2002-03 accomplished;

(b) If the KAflex driveshaft P/N 206-340-300-105 has been previously installed for any length of time on a Bell 407 helicopter, remove from service as per the applicable schedule published in BHTC Alert Service Bulletin 206L-01-123 or 427-01-45, both dated 12 October 2001, or later revisions approved by the Director, Aircraft Certification, Transport Canada."

Part 2. Model 407

Remove shaft P/N 206-340-300-105 as per the compliance schedule provided in BHTC Alert Service Bulletin 407-01-45 Rev "A" dated 21 November 2001, or later revisions approved by the Director, Aircraft Certification, Transport Canada.

The BHTC ASB 407-01-45 was issued to introduce the a new engine-to-transmission driveshaft, P/N 206-340-300-107, with a 1,250-hour overhaul interval and end identification marks. The bulletin requires the removal of driveshafts 206-340-300-105 per a described compliance schedule. The overhauled driveshafts are renumbered and retain an airworthiness life limit of 5,000 hours from new.

At the time of this writing, the FAA has not adopted an AD regarding Transport Canada's AD CF-2002-03.

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The helicopter was released to the owner.

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Occurrence Type: Accident

Landing Facility/Approach Information

Airport Name	Airport ID:	Airport Elevation Ft. MSL	Runway Used	Runway Length	Runway Width

Runway Surface Type: Water

Runway Surface Condition: Unknown

Approach/Arrival Flown: NONE

VFR Approach/Landing: Forced Landing

Aircraft Information

Aircraft Manufacturer	Model/Series	Serial Number
Bell	407	53381

Airworthiness Certificate(s): Normal

Landing Gear Type: Skid

Amateur Built Acft?	Number of Seats:	Certified Max Gross Wt.	Number of Engines:
No	7	5250 LBS	1

Engine Type:	Engine Manufacturer:	Model/Series:	Rated Power:
Turbo Shaft	Rolls Royce Allison	250-C-47B	630 HP

- Aircraft Inspection Information

Type of Last Inspection	Date of Last Inspection	Time Since Last Inspection	Airframe Total Time
AAIP	04/2001	139 Hours	2114.2 Hours

- Emergency Locator Transmitter (ELT) Information

ELT Installed?/Type	ELT Operated?	ELT Aided in Locating Accident Site?
Yes /	No	No

Owner/Operator Information

Registered Aircraft Owner	Street Address	City	State	Zip Code
Air Logistics L.L.C.	4605 Industrial Dr.	New Iberia	LA	70560

Operator of Aircraft	Street Address	City	State	Zip Code
Air Logistics L.L.C.	4605 Industrial Dr.	New Iberia	LA	70560

Operator Does Business As:

Operator Designator Code: ALGL

- Type of U.S. Certificate(s) Held:

Air Carrier Operating Certificate(s): On-demand Air Taxi

Operating Certificate:

Operator Certificate: Aircraft External Load

Regulation Flight Conducted Under: Part 135: Air Taxi & Commuter

Type of Flight Operation Conducted: Non-scheduled; Domestic; Passenger/Cargo

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First Pilot Information

Name	City	State	Date of Birth	Age
On File	On File	On File	On File	51

Sex: M | Seat Occupied: Right | Occupational Pilot? Civilian Pilot | Certificate Number: On File

Certificate(s): Airline Transport

Airplane Rating(s): Multi-engine Land; Single-engine Land

Rotorcraft/Glider/LTA: Helicopter

Instrument Rating(s): Airplane; Helicopter

Instructor Rating(s): None

Current Biennial Flight Review? 03/2001

Medical Cert.: Class 2 | Medical Cert. Status: Valid Medical--w/ waivers/lim. | Date of Last Medical Exam: 03/2001

- Flight Time Matrix	All A/C	This Make and Model	Airplane Single Engine	Airplane Mult-Engine	Night	Instrument Actual	Instrument Simulated	Rotorcraft	Glider	Lighter Than Air
Total Time	15100	2800	285	1970		363				
Pilot In Command(PIC)	14100	2800	248	1140						
Instructor										
Instruction Received										
Last 90 Days	180	166								
Last 30 Days	72	72								
Last 24 Hours	6	6								

Seatbelt Used? Yes | Shoulder Harness Used? Yes | Toxicology Performed? No | Second Pilot? No

Flight Plan/Itinerary

Type of Flight Plan Filed: VFR

Departure Point	State	Airport Identifier	Departure Time	Time Zone
HI-338	GM	368	1535	CDT

Destination	State	Airport Identifier
Intercoastal	LA	7RA

Type of Clearance: Unknown

Type of Airspace: Class G

Weather Information

Source of Wx Information:

Unknown

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Weather Information

WOF ID	Observation Time	Time Zone	WOF Elevation	WOF Distance From Accident Site	Direction From Accident Site
			Ft. MSL	NM	Deg. Mag.

Sky/Lowest Cloud Condition: Clear Ft. AGL | Condition of Light: Day

Lowest Ceiling: None Ft. AGL | Visibility: 10 SM | Altimeter: "Hg

Temperature: 28 °C | Dew Point: °C | Weather Conditions at Accident Site: Visual Conditions

Wind Direction: | Wind Speed: | Wind Gusts:

Visibility (RVR): Ft. | Visibility (RVV) SM |

Precip and/or Obscuration:

Accident Information

Aircraft Damage: Substantial | Aircraft Fire: None | Aircraft Explosion None

- Injury Summary Matrix	Fatal	Serious	Minor	None	TOTAL
First Pilot				1	1
Second Pilot					
Student Pilot					
Flight Instructor					
Check Pilot					
Flight Engineer					
Cabin Attendants					
Other Crew					
Passengers				1	1
- TOTAL ABOARD -				2	2
Other Ground					
- GRAND TOTAL -				2	2

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Administrative Information

Investigator-In-Charge (IIC)

Alexander Lemishko

Additional Persons Participating in This Accident/Incident Investigation:

Mark S Evans
FAA FSDO
Baton Rouge, LA

Mattew Rigsby
Bell Helicopter Textron Canada
Fort Worth, TX

Gary Tucker
Air Logistics, L.L.C.
Lafayette, LA

Jeffery M Post
Kamatics Corporation
Bloomfield, CT