Aviation Safety Investigation Report 199501030

Bell Helicopter Co 214ST

07 April 1995

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Occurrence Number: 199501030 **Occurrence Type:** Accident
Location: 440km WNW Darwin
State: Other **Inv Category:** 3
Date: Friday 07 April 1995
Time: 1155 hours **Time Zone** CST
Highest Injury Level: None

Aircraft Manufacturer: Bell Helicopter Co
Aircraft Model: 214ST
Aircraft Registration: VH-LAT **Serial Number:** 28131
Type of Operation: Charter Cargo
Damage to Aircraft: Substantial
Departure Point: Rig Ocean General ZOCA
Departure Time: 1100 CST
Destination: Darwin NT

Crew Details:

Role	Class of Licence	Hours on Type	Hours Total
Pilot-In-Command	ATPL	700.0	6500
Co-Pilot/1st Officer	ATPL	150.0	6500

Approved for Release: Thursday, January 25, 1996

Circumstances

About 20 minutes after takeoff, while cruising at 3,000 ft and 128 kts with the autopilot engaged, the pilot in command heard or felt a bang which was immediately followed by a high-frequency, high-amplitude vibration. The vibration was such that the crew were unable to read the outboard instruments, both skid balls were fully deflected towards the centreline of the aircraft, and the horizontal situation indicator slaved some 60 degrees off heading and oscillated through 30-40 degrees. The co-pilot reported that the vibration through the cockpit floor made his feet go numb.

The pilot in command altered heading for a return to the rig. All controls appeared to be operating normally and the only warning light to illuminate was the number one elevator light which went out when the system was reset.

Speed was reduced to 60 kts and the aircraft was descended to 200 ft as a precaution in the event of a failure. The change in airspeed and power and the manipulation of the controls did not alter the frequency or level of the vibration.

About 30 minutes later, the vibration stopped as abruptly as it had started. The aircraft felt completely normal and all controls worked normally. The pilot in command increased speed to 100 kts. As the aircraft passed another rig, which was considered to be unsuitable for an emergency landing, it was observed by the rig crew, who reported that everything appeared normal.

About 2 minutes after the vibration stopped, it started again at the same frequency, but at a higher amplitude. A very short time later, the aircraft suddenly yawed to the right and tail rotor control was lost. The pilot in command closed the throttles and the yaw stopped. He then placed the aircraft in an autorotational descent, using cyclic control to counter yaw. The pilot in command reported that the tail rotor controls felt as if they were rubbing against something when he operated them following the tail rotor failure.

During the subsequent flare, as the pilot in command was about to lower the nose and cushion the landing, the aircraft commenced an uncommanded pitch nose-down, even though the pilot in command was still holding full back cyclic control. The pilot in command increased the collective pitch and the co-pilot activated the floats. The aircraft was pitching nose-down and rolling to the right as it touched down on the water. It continued to roll to the right until it was upside down. All doors were opened by the impact. Both pilots left the partly submerged, overturned aircraft by their respective doors and surfaced at about the same time.

The pilots observed that the tailboom, held on the surface by a partially inflated flotation bag, was about 40 m from the main fuselage. The left main fuselage flotation bag was fully inflated. The right bag was inflated except for the centre section.

Both the tail and main fuselage sections subsequently sank in 85 m of water.

A search of the sea bed failed to locate the tail section. The main fuselage section was located, inspected and videotaped using a remotely piloted underwater vehicle.

Inspection of the video and of photographs taken before the fuselage sank indicated that the tailboom broke off approximately 1.5 m aft of the boom attachment bulkhead. The boom appeared to have fractured upwards and then sideways to the right. One main rotor blade had marks indicating a fuselage strike. The other blade was shattered. There was no evidence of failure of the longerons adjacent to the boom attachment bulkhead (a known problem).

No photographs of the tailboom were available.

The helicopter was maintained in accordance with requirements in force at the time of the accident. There was no evidence of pre-existing defects which could have contributed to this occurrence.

Analysis

The vibration was reported by the crew as high frequency and high amplitude indicating that it was most likely associated with tail rotor components rather than engine accessories. Both sets of components rotate at high speed and therefore could induce high frequency vibration. However, it is unlikely that an engine accessory could introduce a high amptitude vibration such as that described by the crew. In addition, the vibration caused the horizontal situation indicator (HSI) to slave off heading. As the compass sensor for the HSI is located in the tailboom this indicates that the vibration was probably centred in that area. The vibration did not vary with power or speed indicating that it was not associated with uneven aerodynamic loading (of the tail rotor). Vibration associated with a previously reported longeron failure was reported as low frequency.

During the period of the initial vibration, and during the break from it, the aircraft controls appeared to respond normally. The pilot lost tail rotor control shortly after the onset of the second period of vibration. The tail rotor drive rotates at a relatively constant speed and the drive components are located inside the fuselage structure. As a result it is likely that vibration associated with these components would remain relatively constant at all power settings and speeds. The one unusual aspect of the failure is that all vibration ceased for a period and flight returned to normal. As the tailboom and tail rotor components were not found, the precise nature of the failure could not be determined. Available information indicates that the vibration was possibly associated with a failure of either the tail rotor drive shaft and/or its mountings or one of the two tail rotor drive gearboxes and/or its mountings.

The damage to the main fuselage in the area of the tailboom fracture and to the main rotor blades indicates that the boom probably failed following contact with the water, during the landing flare, and as a result of a main rotor blade strike. The fact that a tailboom flotation bag partially inflated also indicates that the boom was still attached on touchdown.