

**Aviation Safety Investigation Report
199000089**

Robinson R22M

27 May 1990

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Occurrence Number: 199000089
Location: 200 km NE of Newman WA
Date: 27 May 1990
Highest Injury Level: Fatal
Injuries:

Occurrence Type: Accident
Time: 620

	Fatal	Serious	Minor	None
Crew	1	0	0	0
Ground	0	0	0	-
Passenger	1	0	0	0
Total	2	0	0	0

Aircraft Details: Robinson R22M
Registration: VH-HBS
Serial Number: 722M
Operation Type: Aerial Work
Damage Level: Substantial
Departure Point: Tongolo Creek WA
Departure Time: N/A
Destination: Tongolo Creek WA

Approved for Release: 15th October 1991

Circumstances:

On the morning of the accident the pilot flew the aircraft from a parking area, which was restricted due to vegetation, to a more open area in order to board the passenger and depart for the day's mustering. The aircraft departed the open area and commenced to climb on a westerly heading. At approximately 300 ft and 60 kts the witnesses heard a sharp crack, all engine and rotor noise ceased, and the aircraft was observed descending at a steep angle. The aircraft collided with the ground about 450 m from the witnesses. The occupants were removed from the wreckage by the witnesses before the cockpit area was consumed by a post-impact fire. The on-site investigation determined that one main rotor blade had separated in flight. The helicopter became uncontrollable following the blade separation. The out-of-balance rotor system caused considerable damage to the helicopter before ground impact. The roof of the cockpit was destroyed, both fuel tanks were torn from the fuselage and the tail boom and rotor were cut off. The post-impact fire, fed by residual fuel in the fuel lines and engine oil, consumed what remained of the cockpit area. Subsequent detailed examination determined that the main rotor blade, Serial No. 2961, failed as a result of fatigue crack growth in the root fitting of the blade. No fatigue cracks were found in the other blade, Serial No. 2953, fitted to the helicopter. Fatigue cracking initiated in the counterbore of a hole in the root fitting of the blade. No material abnormalities were present at the initiation sites. Fatigue crack growth was estimated to have occurred over a period of approximately 1100 flights. The blade had been in service for 2257.2 hours, although the retirement life of the blade was 2000 hours. There was evidence to suggest that the clamping force produced by a bolt installed in the hole during bonding was low. It is likely that the clamping force provided by the bolt installed at final assembly was also low. It was considered that the low clamping force was caused by misalignment of the holes in the spar and root fitting and an off-centre and off-axis screw thread. The misalignment caused interference between the spar and the root fitting and the low clamping force caused a change in the load transfer, at the hole, allowing fatigue to develop under normal service loads. The location of the fatigue crack, in the

root area, was covered by a layer of flexible skin which prevented it being detected by the inspection requirements that were in force at the time of the accident. The pilot was under considerable financial pressure and was attempting to earn sufficient funds to purchase new main rotor blades. He had made a practice of recording less than the correct hours in the aircraft documentation and it was likely he was aware that the blades had exceeded their safe life. The pilot apparently had made a conscious decision to overfly the maximum number of permitted hours, possibly based on the knowledge that the blades had been safely tested to twice their approved life. However, had he grounded the aircraft when the blades reached their safe life the accident would not have occurred.

Significant Factors:

The following factors were considered relevant to the development of the accident

1. There were financial pressures which caused the pilot to continue operating the aircraft beyond the mandatory retirement life of some aircraft components.
2. A manufacturing defect occurred which allowed fatigue cracking to develop during the main rotor blade's normally safe life.
3. There was an inflight fatigue failure of one main rotor blade which led to complete loss of control.

Recommendations:

The Bureau of Air Safety Investigation made two recommendations at the preliminary stage of the investigation

1. The Civil Aviation Authority should review the retirement time for Robinson R22 main rotor blades using information based on the true service time of the failed blade.
2. The Civil Aviation Authority should develop and implement an inspection technique for the main rotor blades which will detect progressive fatigue failure in the area of the rib root fitting. The Civil Aviation Authority reduced the service life of all R22 main rotor blades to 1000 hours until an adequate inspection system had been put in place. An adequate inspection system was developed and placed into service. In addition the manufacturer reviewed the manufacturing process and implemented changes to prevent a similar manufacturing defect to the one that was a factor in this accident.