Aviation Safety Investigation Report 199000112

Challenge Rotorcraft

5 April 1990

Readers are advised that the Australian Transport Safety Bureau investigates for the sole purpose of enhancing transport safety. Consequently, Bureau reports are confined to matters of safety significance and may be misleading if used for any other purposes.

Investigations commenced on or before 30 June 2003, including the publication of reports as a result of those investigations, are authorised by the CEO of the Bureau in accordance with Part 2A of the Air Navigation Act 1920.

Investigations commenced after 1 July 2003, including the publication of reports as a result of those investigations, are authorised by the CEO of the Bureau in accordance with the Transport Safety Investigation Act 2003 (TSI Act). Reports released under the TSI Act are not admissible as evidence in any civil or criminal proceedings.

NOTE: All air safety occurrences reported to the ATSB are categorised and recorded. For a detailed explanation on Category definitions please refer to the ATSB website at www.atsb.gov.au.

Occurrence Number: 199000112 **Occurrence Type:** Accident
Location: 12 km north-east Esperence WA
Date: 5 April 1990 **Time:** 1641
Highest Injury Level: Fatal
Injuries:

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

Aircraft Details: Challenge Rotorcraft
Registration: Not Applicable
Serial Number: Not Applicable
Operation Type: Sport Aviation
Damage Level: Substantial
Departure Point: 12 km north-east Esperence WA
Departure Time: 1640
Destination: Not Known

Approved for Release: 30th July 1990

Circumstances:

The aircraft was observed to depart from a farm paddock, climb to approximately 300 feet above ground level and accelerate to cruising speed. Shortly afterwards the engine began to labour, there was a clattering noise a loud metallic bang and then silence. The aircraft was observed to pitch upside down and descend vertically until it collided with the ground. An inspection of the wreckage indicated that the labouring noise was caused when the hydraulic pump actuating cable became entangled in the propeller. The clattering noise was caused by the propeller blades striking the main rotor blades and the loud metallic bang was caused when the main rotor blades struck the rudder assembly. The hydraulic pump was part of a main rotor drive system used to increase main rotor rotational speed prior to take off. All noise ceased when the propeller made solid contact with the main rotor blades and the engine stalled. The main rotor strike on the rudder assembly caused the fibreglass rudder to break up in-flight and pieces of the rudder were found a significant distance downwind from the wreckage. A study of rotorcraft aerodynamics indicates that a sudden application of forward control input is required to create the circumstances which will significantly reverse the airflow through the rotor and cause the main rotor blade to make contact with the propeller and the rudder assembly. The pilot had completed a rotorcraft pilot's course and taken delivery of his aircraft the previous month. Shortly after the aircraft was delivered the pilot made a number of modifications to the hydraulic, fuel and the electrical systems. The pilot did not check any of his modifications with the manufacturer. The pilot had a contract which required the use of the rotorcraft and he was in a hurry to complete preparations for the contract. During the modifications the pilot re-routed an actuating cable running between a hand operated lever, mounted on the control stick, and a hydraulic pump mounted at the rear of the engine and immediately adjacent to the propeller hub. The manufacturer had routed and secured the cable so that there was no unnecessary slack. The re-routing increased the amount of slack in the cable by more than 200 mm and this was sufficient under the right

circumstances, to allow the cable to become entangled with the propeller. Marks and damage to the aircraft and its components indicate that when the aircraft reached its cruising speed, the slack cable at the rear of the aircraft was blown backwards until it was caught by a bolt shank which was part of the propeller hub. The cable became entangled in the propeller which in turn pulled the control stick back towards the pilot. The pilot's natural reaction would have been to apply force to the control stick to push it forward against the rearward force applied by the cable. As the propeller continued to turn with the cable attached, all slack was taken up and the cable failed at both the forward and rear attachment points. The rearwards force on the control stick would have ceased suddenly and the pilot's countering force would have pushed the control stick forward setting up the circumstances necessary to cause the main rotor blade to strike the propeller and rudder. The entire sequence would have taken no more than 2 to 3 seconds.

Significant Factors:

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

1. The pilot made a number of modifications to his aircraft without checking whether or not they affected the safety of the aircraft. This probably occurred because the pilot was anxious to complete preparations for an impending contract.

2. The pilot failed to appreciate the significance of leaving additional slack in the actuating cable when he re-routed it.

3. The hydraulic actuating cable became entangled in the propeller and the ensuing unexpected control forces caused to pilot to lose control of the gyrocopter.

Reccomendations:

1. It is recommended that the Sports Rotorcraft Association incorporate in their design standards, the requirement that only controls necessary for safe in-flight operations be attached to the control stick.