Aviation Safety Investigation Report 199401049

Amateur Built Aircraft
EXEC 90

23 April 1994

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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.

Aviation Safety Investigation Report

199401049

The Bureau did not conduct an on scene investigation of this occurrence. The information presented below was obtained from information supplied to the Bureau.

Occurrence Number: 199401049 **Occurrence Type:** Accident
Location: Berwick
State: VIC **Inv Category:** 4
Date: Saturday 23 April 1994
Time: 1700 hours **Time Zone** EST
Highest Injury Level: None

Aircraft Manufacturer: Amateur Built Aircraft
Aircraft Model: EXEC 90
Aircraft Registration: VH-COC **Serial Number:** V213
Type of Operation: Non-commercial Practice
Damage to Aircraft: Substantial
Departure Point: Berwick VIC
Departure Time:
Destination: Berwick VIC

Crew Details:

Role	Class of Licence	Hours on Type	Hours Total
Pilot-In-Command	Student	34.0	1634

Approved for Release: Wednesday, March 29, 1995

The student helicopter pilot elected to conduct an unsupervised hover practice at Casey Airfield. His total helicopter experience was 27 hours dual and seven hours solo, all in his privately owned Rotorway EXEC 90. The terrain over which the helicopter was hovering was level ground covered by grass about half a metre high. The wind was calm and visibility excellent. The pilot advised that while trying to land, the front of the right skid touched the ground first and the helicopter rolled over onto its side. Damage sustained by the helicopter was consistent with a rollover accident. The rollover probably occurred as the helicopter drifted sideways with the landing skids in the grass.

During wreckage inspection of VH-COC it was discovered that the collective scissor link block was off its mount and that the nuts had been pulled off the two 3/16 bolts which attach the block to its mount. There was concern that had the block pulled free before impact, loss of collective control would have occurred, probably resulting in sudden flat pitch on both main rotor blades. Such loss of control in the hover probably would have caused the helicopter to be slammed onto the ground with more resultant damage than occurred in this rollover accident.

Another wrecked Rotorway EXEC 90, VH-YCP, was examined for comparison. Its scissor link block was still attached but score marks and fretting under the bolt heads were evidence that the block had not been securely attached to the airframe mount. Similar evidence of fretting was subsequently found on VH-COC. On both helicopters the airframe mounts were not flat surfaces. Also, both mounts were coated with paint which could be detrimental to a close tolerance fit. In contrast, the base of the scissor link block was a machined flat surface. When one end of the block was attached with a bolt, the other end of the block was proud of the steel mounting plate by 0.020 inches.

It was discovered that the Civil Aviation Authority (CAA) had required the collective scissor link attachment bracket, originally supplied by the manufacturer, to be replaced by the block of aluminium. A bracket might flex enough during installation to achieve a flush fit with the mounting plate, whereas the aluminium block was inflexible.

Further inspection of Rotorway helicopters discovered that there was no airframe down stop for the collective lever in the cockpit and that the mechanical advantage between the collective lever and the scissor link was 24 to 1. Pushing down on the collective lever placed the two 3/16 bolts in tension. Several 3/16 aircraft bolts were tested in tension to destruction. On average the nuts pulled off the bolts at 2714 ft/lbs. In training, particularly during practise autorotations, it is normal for the pilot (occasionally for both the pilot under instruction plus the instructor) to push down on the collective to ensure flat pitch. The combination of bolts under tension and the non flush fit of the blocks on VH-COC and VH-YCP had caused the blocks to move/work in the past and in time could have caused the bolts to fail.

Significant Factors

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

1. The student pilot conducted an unauthorised solo flight.

2. The pilot probably inadvertently allowed the landing skids to drag through long grass as the helicopter drifted sideways in the hover.

Safety Action

The CAA was immediately informed of the Bureau's findings and concern about the attachment of the collective scissor link block to the airframe. A CAA Airworthiness Surveyor inspected VH-YCP. The Australian agent for the Rotorway kit helicopter was advised verbally of the findings. The CAA approved Australian Rotorway EXEC 90 test pilot and the CAA test pilot were advised of the findings as soon as possible.

Since this accident there has been a Rotorway EXEC 90 incident in which cyclic control became marginal in flight, resulting in a very unsafe condition. This incident exposed that the aircraft type did not comply with the flight characteristics requirements for an amateur built helicopter in Australia. It was found that the friction and adjustment of the slider ball (uniball) was temperature sensitive and had caused binding of the cyclic control system. The instructions provided by the manufacturer to address cyclic binding were not acceptable to the CAA.

The CAA was not made aware of the potential cyclic problem during the application for the amateur built aircraft approval process. Accordingly the CAA has withdrawn Permits to Fly and a Certificate of Airworthiness will not be issued for any helicopter of this type until the matter of the cyclic control is resolved.