ACCIDENT

Aircraft Type and Registration:	Eurocopter AS350B2 Ecureuil, G-VGMG	
No & Type of Engines:	1 Turbomeca Arriel 1D1 turboshaft engine	
Year of Manufacture:	1992 (Serial no: 2668)	
Date & Time (UTC):	11 July 2016 at 1642 hrs	
Location:	Lake Farm, Old Race Course, Bideford, Devon	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Tail boom failed and damage to skids and vertical tail	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	68 years	
Commander's Flying Experience:	6,461 hours (of which 2,189 were on type) Last 90 days - 49 hours Last 28 days - 21 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

Synopsis

During a practice hydraulics-off landing the handling pilot inadvertently tried to land downwind and then pitched up and slowed excessively when he realised this. The helicopter started to yaw so the commander, who was the examiner, took control but experienced a brief freezing of the cyclic, collective and pedals. The helicopter hit the ground heavily, nose down, on the front part of the skids, the tailboom failed and the main rotor struck the vertical fin. The cause of the control freeze could not be identified.

History of the flight

The commander of the flight was an examiner in the left seat and was carrying out an operational proficiency check of a pilot in the right seat (P2 pilot). After a normal departure a practice hydraulic failure was carried out. The examiner initiated this by pressing the 'HYD TEST' pushbutton on the centre console. This causes hydraulic pressure from the pump to be re-circulated to the reservoir and the 'HYD' warning caption to illuminate with associated warning horn. The cyclic and collective controls remain powered via hydraulic accumulators for a sufficient time to allow the helicopter to be decelerated to a safe speed, while pressure to the accumulator of the tail rotor control load compensator is relieved. The P2 pilot carried out the appropriate procedure and reduced the airspeed to below 60 kt. The examiner then deselected 'HYD TEST' to re-pressurise the hydraulic system. The P2 pilot then performed the second part of the test and pressed the 'HYD CUT-OFF' switch on the collective. This

removes hydraulic pressure and accumulator pressure to the cyclic and collective controls, resulting in higher control forces on both the cyclic and collective. The accumulator of the tail rotor control load compensator remains pressurised and will provide continuing pilot load assistance as a function of pedal position.

The examiner confirmed verbally with the P2 pilot that the increased forces were higher than normal and the flight was continued for a 'hydraulics off' landing. As the approach was initiated to the field the examiner was aware that they were approaching to land downwind. The wind was about 10 kt from the west. He prompted the P2 pilot about this and was expecting him to perform a go-around as they were at about 20 to 30 ft agl. However, the P2 pilot responded by pulling back rapidly on the cyclic, causing a pitch-up and for the airspeed to drop below about 20 kt. This induced a yaw to the left so the examiner immediately took control, applied right pedal to counteract the turn and pushed the cyclic forward to correct the excessive nose-up attitude. He recalled that he struggled with the controls and later estimated that the cyclic, collective and pedals had frozen for about 1 to 1.5 seconds. The helicopter continued to yaw left and descended, causing the left skid to lightly touch the ground. According to the examiner the "rotors became extremely violent and almost uncontrollable". Then the right skid lightly touched the ground and the helicopter lurched to the left. The examiner applied right pedal and right cyclic, causing the helicopter to "lurch" 90° to the right and "plunge" to the ground in a slightly nose-down attitude. The helicopter came to a stop with its nose resting on the ground. A rapid shut-down and disembarkation were carried out.

The tailboom had failed below the engine exhaust pipe and was hanging downwards. Only two hydraulic pipes were keeping the tailboom attached to the helicopter. The main rotor blades had struck the top of the vertical fin, although there was no apparent damage to the tail skid at the base of the vertical fin. The skids had fractured at the front cross tube attachment. The ELT had activated automatically and the emergency services made contact but were stood down.

Additional information

No fault investigation was carried out on G-VGMG because the damage to the helicopter was assessed to be beyond economic repair.

The commander had not been expecting the P2 pilot to pitch the helicopter up so suddenly when the P2 pilot realised that they were landing downwind. The commander took control immediately, but the brief apparent freezing of the controls (cyclic, collective and pedals) reduced his ability to bring the helicopter back under control. The commander did not think that the helicopter had suffered any technical fault, and he had experienced a brief freezing of the controls before, but at a greater height so it was not an issue. He did not think that the P2 pilot was resisting him on the controls.

The cyclic/collective control system and the pedal control system are independent, and according to the helicopter manufacturer the probability of having simultaneous freezing of both is "extremely improbable".

The AS350B2 flight manual highlights the following with a caution:

> *'Do not attempt to carry out hydraulic failure hover flight or any low speed maneuver without hydraulic pressure assistance. The intensity and direction of the control feedback forces will change rapidly. This will result in excessive pilot workload, poor aircraft control, and possible loss of control.'*

The accident investigation bureau of France (BEA) and the helicopter manufacturer commented that they were investigating a separate occurrence involving an AS350B3e helicopter. There were two instructor pilots on board and they were carrying out a training flight including practice hydraulic failures. The pilots reported stiff controls (cyclic, collective and pedals) during the hydraulic failure training and even after hydraulic assistance was reapplied. The pilots stated that they had not been on the controls at the same time when the event started. However, this helicopter was fitted with a camera which revealed that both pilots were on the controls at the beginning of the event and their inputs were probably counteracting each other.

It cannot be ascertained whether or not a similar interaction to that in the BEA's investigation took place in G-VGMG.