No: 14/83 **Ref: EW/C 842**

Aircraft type and registration:	Westland Bell Soloy 47G-3B-1 G-BHKD (light single engined helicopter)
Date and time (GMT):	30 July 1983 at 0915 hrs
Location:	Newfield Farm, Ledston, Yorkshire
Type of flight:	Aerial application
Persons on board:	Crew — 1 Passengers — Nil
Injuries:	Crew — 1 (fatal) Passengers — Nil
Nature of damage:	Aircraft destroyed, substantial damage to farm buildings
Commander's Licence:	Commercial Pilot's Licence (New Zealand) with CAA Certificate of Validation
Commander's Age:	31 years
Commander's total flying experience:	4930 hours, fixed wing 1193 hours, rotary wing (168 hours on type)

The pilot's day had started at 0400 hrs and he found, on starting the helicopter's engine that the transmission oil pressure was low. He recalled his tanker driver to the company base by radio and then telephoned the General Manager of the company responsible for the helicopter maintenance to report the fault. The General Manager agreed to contact his engineer stationed in the Yorkshire area as soon as practicable and suggested that there was probably an obstruction in the pressure reducing valve of the transmission oil system. The pilot, assisted by his tanker driver, then removed the valve and found that it was contaminated by small pieces of plastic. Between them they cleaned then refitted the valve and, it is believed, replaced the locking wire. After a 15 minute ground run the pilot declared the aircraft to be serviceable and the tanker driver departed for the rendezvous point for the morning spraying operations. The pilot then telephoned again to the maintenance organisation to report that the fault had been rectified and further remarked that there were two other faults that would need rectification when the engineers arrived for a planned routine maintenance check in two day's time. These were that the damper frame on the rotor head was continuously coming loose so that he was having to tighten the nuts every day and that the collective lever was occasionally becoming stiff as if it was reverting to manual operations. The pilot was advised that he should not be flying the aircraft but he replied that "I can handle it". Both the tightening of the damper frame bolts and the removal of the pressure reducing valve are operations outside of the items of maintenance listed in both the company's operation manual and in the Air Navigation (General) Regulations that may be performed by a pilot under the priveleges of his licence.

At about 0900 hrs the pilot made a rendezvous with his tanker and loaded 80 gals of 'Fubol', a potato fungicide. He was then seen to fly to a nearby farm and to commence spraying. Shortly afterwards the helicopter crashed through the roofs of two barns. There were no witnesses to the accident but the nature of the damage to the barns and to the helicopter showed that it had been descending with a bank angle of about 90°. The evidence of the spray pattern on the crop showed that the pilot had completed one run down the length of the field from north to south and had completed a half of the run in the opposite direction before the spray pattern ceased. From this point the farm buildings lay at 70° to his right hand side at about 250 yards. It is probable that the aircraft had turned to the right and climbed before crashing through the barns in a steep right turn. There was no fire but the pilot died instantly from head injuries.

The examination of the wreckage revealed that there had been a failure in the hydraulic power unit for the lateral cyclic control. The 'wire drive' that positioned the shuttle valve to control the flow of hydraulic fluid to the control jack, in accordance with the pilot's control demands, had fractured. The nature of this failure was such that the fracture faces could butt together to transmit a roll-right demand to the control jack but there was no possibility of transmitting a roll-left demand, nor could a roll-right demand, once initiated, be stopped or reversed. In this situation, it would have been impossible for the pilot to have exerted sufficient sideways force on the cyclic control column to have overridden the power controls. The switch for the hydraulic pump to the power controls is not included with those controls mounted on the pilot's collective or cyclic pitch levers but is on the central instrument panel. This switch was found to be in the 'On' position but it is not known whether the pilot tried to switch it off in an attempt to regain control of the helicopter. It would have been very difficult for him to do so since he was occupying the left hand seat and it would mean that he had to release the collective lever and change the cyclic lever to his left hand before reaching across to the switch with his right hand. However it was later demonstrated when the failure was simulated on an identical aircraft, that with the shuttle

valve failed in the incorrect position, hydraulic fluid would be trapped in the jack thus preventing any movement of the cyclic control to the left.

When the failed unit was examined in greater detail it was found that a plain bearing on the linkage to the wire drive had seized due to overtightening and corrosion. The effect of the seized bearing was to cause the wire drive to bend with each input from the pilot to the lateral cyclic control. Expert metallurgical examination of the fracture face confirmed that the failure was as a result of fatigue caused by bending stresses. It also revealed that neither the material itself nor the surface finish conformed to the specification laid down by the aircraft manufacturer. A recommendation was made to the CAA calling for an immediate examination of similar flying controls. The CAA has issued an Emergency Airworthiness Directive no. 001-09-83. The manufacturer has issued a Service Bulletin no. 47-83-9.

The pilot had been wearing a light shirt, shorts and 'flip-flop' sandals but no protective helmet. While it is recognised that the cockpit of a helicopter can become uncomfortably hot in summer due to the 'greenhouse' effect, this standard of clothing is totally inadequate to provide protection in the event of accident or fire, nor can it protect the skin from the effects of the chemicals used in crop spraying. The lethal injuries sustained by the pilot were a fractured skull with associated brain damage. It is possible that had he worn a protective helmet his injuries might have been less severe and his chances of survival improved.