

Westland Scout AH1, G-BZBD

AAIB Bulletin No: 12/2000 Ref: EW/C2000/08/02 Category: 2.2

Aircraft Type and Registration: Westland Scout AH1, G-BZBD

No & Type of Engines: 1 Rolls-Royce Nimbus MK.10501 turboshaft engine

Year of Manufacture: 1966

Date & Time (UTC): 23 August 2000 at 1418 hrs

Location: Streatly, Berkshire

Type of Flight: Private

Persons on Board: Crew - 1 - Passengers - 2
- (1 pilot's assistant)
- (1 ground handler)

Injuries: Crew - 1 Minor
Passengers - 1 Minor, 1 Serious

Nature of Damage: Helicopter damaged beyond economic repair

Commander's Licence: Private Pilots Licence (Helicopters)

Commander's Age: 49 years

Commander's Flying Experience: 964 hours (232 rotary of which 5.7 were on type)
Last 90 days - 5.7 hours
Last 28 days - 5.7 hours

Information Source: Aircraft Accident Report form submitted by the pilot, wreckage inspection and telephone enquiries

The aircraft involved in this accident was an ex Army Air Corps (AAC) Scout helicopter, but it had recently been sold, refurbished and placed on the Civilian Register. The pilot, who was a part owner of the Scout, had completed his conversion training on the helicopter the day before the accident and planned to ferry it from Thruxton, Hampshire via Halton to its base at Welshpool, mid Wales.

The three people on board comprised the pilot, a pilot's assistant (PA), who was an experienced fixed wing pilot, and a helicopter ground handler. They departed from Thruxton for Halton in the mid-afternoon with the fixed wing pilot (PA) seated in the left front seat. The pilot occupied the normal pilot's position on the right. During the cruise the PA assisted the pilot by making radio

calls and monitoring the navigation. Cruising at 1,500 feet and 90 kt, the flight proceeded uneventfully until severe turbulence was encountered approaching the Chiltern Hills. The helicopter pitched forward and to the right, and almost at the same time the pilot noticed increasing loads on the cyclic pitch control.

Believing that the increased control loads were the result of a hydraulic failure, the pilot switched off the hydraulic system that provides servo assistance to the flying controls. The helicopter immediately and violently pitched down and to the right to the point where the pilot felt that the main rotor blades reached the vertical plane. The control loads were extremely heavy and the pilot considered that his only hope of regaining control of the helicopter was to restore hydraulic power to the flying controls. After some difficulty in locating the switch, the pilot managed to re-establish hydraulic power and immediately the helicopter violently pitched up and to the left. There was a bang followed by a loud mechanical noise and the pilot, realising there had been a serious mechanical failure, entered autorotation descending towards the only available field, which was immediately below him. At about 50 feet above the ground the pilot applied collective pitch control to reduce the rate of descent and cushion the landing. As he did so the helicopter started to rotate in yaw he immediately lowered the collective to stop the rotation and the helicopter hit the ground heavily. The pilot shutdown the engine, and the occupants vacated the helicopter unassisted, although one of them collapsed not far from the wreckage. There was no fire.

Examination of the wreckage

Shortly after the accident, the wreckage was moved from the accident site to a small airstrip in Gloucestershire where an AAIB Inspector examined it and carried out system tests.

The tailboom showed evidence of having been struck by the main rotor blades whilst the helicopter was in flight. These strikes had removed the last horizontal section of the tail rotor drive shaft.

The helicopter had impacted the ground at high vertical velocity with the left skid low. The skid cross-tubes and lower fuselage were severely distorted, and the main rotor blades appeared to have entered the forward left side of the cabin roof. The tailboom was almost completely detached about 12 to 18 inches aft of the tailboom/fuselage joint. The battery had been torn vertically from its mounting in the port side rear fuselage. The hydraulic power switch for the flying controls was found in the OFF position, but witnesses later reported having found the switch ON at the accident site.

Electrical and hydraulic power, from a ground hydraulic rig, were applied to the helicopter. The hydraulic power switch and flying controls functioned normally and the cyclic trim operated correctly from both cyclic sticks. The cyclic trim position was found just forward of the neutral position indicating that a 'hard' cyclic trim runaway had not occurred.

The engine showed no signs of pre-impact damage or obvious signs of internal failure. The engine to main rotor gearbox drive shaft had failed on impact in a way that indicated that the engine was delivering power to the main rotor gearbox at impact.

Aircraft information

The Scout main rotor is servo assisted by three hydraulic servo jacks that are attached to the control runs. In the event of hydraulic failure the linkage is arranged so that full manual control is available. The Aircrew Manual for the Scout describes the helicopter's flying characteristics on

reversion to manual control. At low forward speeds the helicopter tends to pitch up, whereas at speeds above 60 kt the pitch may be either up or down depending on the particular helicopter. In all cases the tendency is for the helicopter to roll to the left and for the control forces to increase significantly. If hydraulic failure is indicated on the standard warning panel the helicopter should be levelled and the speed reduced to 80 kt or less before reverting to manual control.

Pilot's report

In his report the pilot states that he misinterpreted the increased cyclic stick loads for a hydraulic failure and he did not check the HYD caption on the standard warning panel before selecting manual control. The violent manoeuvre and control difficulties that the pilot experienced immediately after switching off the hydraulic power are consistent with manual selection having been accomplished in a manoeuvre above the maximum speed. The subsequent pitch up when hydraulic power was reinstated is consistent with aft pressure being applied to the cyclic when the reinstatement took place. The pilot's report also states his belief that it was upon reinstatement of power controls that the main rotor struck the tail boom and rendered the tail rotor inoperative.

With the tail rotor inoperative the Aircrew Manual recommends that an autorotative landing be accomplished at 'an acceptable run-on speed'. This recommendation is intended to assist directional control during the landing flare. In this accident the pilot cannot recall the speed during autorotation or landing, but it is likely that the uncontrollable yaw during landing was the result of low forward speed aggravated by automatic application of engine power as the collective lever was raised with the engine governor still engaged.

Flight test and research

In view of the pilot's comments regarding an increase in the cyclic control loads, AAIB Inspectors carried out a flight test on a similar helicopter and conducted some other research.

Several options for the increase in cyclic loads were considered. Runaway cyclic trim could have been the cause, and the AAC Flight Safety database records several cases of runaway trim, some of which were intermittent, during Army service. However, the trim functioned normally when tested in the wreckage and the flight test revealed that the trim position found was consistent with that for a 90 kt cruise at 1,500 feet. Runaway trim could have been intermittent and thus undetectable after the event, but the pilot cannot remember trimming the helicopter after he initially lost control and it would seem more likely that the trim position found was that at the start of the incident.

In the absence of any technical malfunction to explain the apparent increase in cyclic loads the investigation considered other possibilities. The PA is adamant that, apart from using the transmit button, he did not at any time interfere with the cyclic control or trim switches, and the investigation found no evidence to the contrary. However, military operators were concerned at the possibility of inadvertent interference with the flying controls when carrying passengers in the front seat, and during AAC service it was common practise to remove the left seat controls when the helicopter was not being used for instructional duties. The investigation therefore considered possible modes of inadvertent interference from the left front seat.

The possibility that the 'coolie hat' trim switch had been inadvertently operated either by hand or perhaps with a map was considered. The PA described using his left index finger to press the transmit button on the front of the cyclic and balancing this with his left thumb on the rear of the stick. The flight test revealed that using this technique it was almost impossible inadvertently to

operate the 'coolie hat' trim switch. The PA was also monitoring the navigation, using a folded map held in his right hand, and occasionally resting it on his lap. It is possible that this map could have lodged under the edge of the trim switch and applied trim but the 'coolie hat' sits above lap level and the geometry is such that this seems unlikely. It was noted, however, that the trim from the left cyclic overrides that of the right and if trim had been applied from the left seat, the pilot would have been unable to make a trim correction until the left trim switch had been released.

The possibility that a map might have impeded movement of the cyclic control was tried during the flight test and it was found that as the cyclic control was pulled back against the map the cyclic loads increased and were very similar to those described by the pilot. However, it appeared unlikely that this situation could have occurred without the left seat occupant being aware of the pressure against the map.

Whilst it was not possible during the test flight to determine whether inadvertent interference with the flight controls from the left front seat had been a factor in this accident, the potential for such interference was apparent.

Conclusion

In his report the pilot assessed the cause of the accident as his misinterpretation of the cause of an increase in cyclic loads followed by inappropriate remedial action (i.e. selecting hydraulic boost off). The pilot's frank assessment clearly illustrates the importance, in general, of conducting a careful evaluation of the situation before taking emergency action.

It has not been possible to determine which, if any, of the possible causes of increased cyclic loads considered during the investigation led the pilot to believe that the helicopter had lost hydraulic power; however, the possibility of an inadvertent input from the controls in the left seat could not be entirely ruled out. It is therefore important that pilots of ex military Scout helicopters are made aware of the potential hazards of the dual controls, especially the override facility of the left cyclic trim switch, and that their passengers are briefed accordingly.