

No: 5/90

Ref: EW/C1145

Category: 2c

Aircraft Type and Registration:

Bell 206B II G-EYEI

No & Type of Engines:

1 Allison 250-C20 turbine engine

Year of Manufacture:

1971

Date and Time (UTC):

24 January 1990 at 1420 hrs

Location:

Giffnock, Glasgow, Strathclyde, Scotland

Type of Flight:

Commercial

Persons on Board:

Crew - 1

Passengers - 3

Injuries:

Crew - 1 serious

Passengers - 1 fatal, 2 serious

Nature of Damage:

Helicopter destroyed

Commander's Licence:

Airline Transport Pilot's Licence (helicopters)

Commander's Age:

47 years

Commander's Total Flying Experience:

7400 hours (of which 1860 were on type)

Information Source:

AAIB Field Investigation

1. The aircraft

A contract between Clyde Helicopters Limited, based at the Glasgow city heliport, and the Strathclyde Police enabled the Police to use a Bolkow 105 helicopter as an extension of their mobile force. To allow for helicopter unserviceability and scheduled servicing, two other helicopters were available; in order of preference, a Bell 206 L Long Ranger and a Bell 206 B II Jet Ranger. The contract stated that the Bolkow was kept for the exclusive use of the Police, as were each of the other two, in turn, as unserviceability occurred. On Wednesday 24 January, the Bolkow was unserviceable and the Long Ranger was grounded awaiting spares and, thus, the Jet Ranger had been allocated to the Police.

2. History of the flight (see attached map)

The original intention of the flight was to observe and report to Police Control upon traffic congestion caused by the inclement weather conditions. Together with the pilot were three police officers who were trained observers, the senior officer occupying the front left seat and the other two officers occupying the rear seats. Before take-off, the task was changed to an attendance at an emergency call which, because of the snowbound roads, was inaccessible to road traffic. However, when the crew were aboard the helicopter, the task was again changed to search for a "getaway" vehicle, following a

robbery in Barrhead.

The weather reported was: Wind 250°/19 kt, variable between 220°-280°, 12 km visibility with 1 okta of cloud cover at 600 feet and 4 oktas at 1200 feet. The temperature was +2°C. A company pilot, who had just landed, reported to the pilot of G-EYEI that the weather was fine except for the strong gusting wind. The weather forecast chart available in the company flight office predicted occasional isolated cumulonimbus cloud giving rain, hail and snow showers throughout the day.

Flights from the heliport have previously to be notified by telephone to the Glasgow Air Traffic Control Centre and this had been done. However, when the task and thus the route was changed, Air Traffic Control (ATC) cleared the flight to operate in the Barrhead area under the Visual Flight Rules (VFR) and not above 1500 feet. In order to comply with this clearance, the pilot was required to maintain visual contact with the ground surface.

The helicopter flew to Barrhead and then progressed southwards to search an area which contains three large reservoirs, known locally as The Dams. From there the flight continued south, towards Newton Mearns, situated on the A77 Ayr road, which runs southwest out of Glasgow. The distance between Barrhead and Newton Mearns is 3 km and The Dams are about midway between them, lying in a bowl surrounded by high ground. The search of this area had continued for several minutes when the helicopter was suddenly engulfed in a severe snow storm. The pilot, who had suffered serious injury during the accident, was unable to recall any details of the flight and so his lack of awareness of the approaching snow storm remains unexplained. However, a misconception that the helicopter was cleared to operate in falling snow for one and a half hours may have contributed to the apparent lack of urgency in his look-out for the snow storm which had been forecast.

Once overtaken by the snowstorm, in order to maintain visual contact with the ground, the pilot was forced to descend. To what height he descended is difficult to define because of variations in the reports of the many witnesses but it is considered likely to have been around 200 feet. The search could not be continued in those weather conditions and consequently, according to the other police pilot and company pilots, the pilot would probably have been looking for a landing area which he knew to be safe. This may have been Rouken Glen Park, which was only a couple of minutes away and had been cleared for helicopter landings.

Severe restriction to both vertical and horizontal visibility caused by the driving snow made geographical orientation very difficult and consequently, when the crew then saw a shopping centre (at Newton Mearns) they initially misidentified it as a similar building in Barrhead. This opinion was probably strengthened by the coincidence of two similar major roads adjacent to the building in each location, one running southwest/northeast and the other running southeast. Believing their position to be Barrhead, they set off along the south easterly road but, a few seconds later, the commander realised that it was not the Barrhead road and so returned to the shopping centre which was then recognised as Newton Mearns.

The pilot then flew north eastwards for about 1 mile over the unpopulated areas and golf course on the

north side of the major road, the A77. The helicopter then crossed the road to pass over another golf course and on towards the Eastwood Toll traffic island, a substantial landmark, and it is suggested by other company pilots that he would then have almost certainly turned left to pass over the traffic island in order to make a precautionary landing in Rouken Glen Park. Furthermore, a direct approach to the park from the south would have not been possible at the height that the helicopter was flying because of the high ground and trees in its southern part.

When about 100 metres from Eastwood Toll the engine failed and the helicopter, in what appeared to be a steep left turn, flew into the side of the fifth storey of a five storey building beside the traffic island and fell to the ground.

Although the exact speed of the helicopter at the time of the engine failure is not known, it was likely to have been fairly slow, being restricted by the lack of forward visibility. This, together with its reported lack of height, makes it probable that the helicopter was, at the time of engine failure, operating within the 'avoid curve'. The avoid curve is an area within the height v speed performance graph, defining a combination of low height and low speed which do not fall within the recommended parameters from which a safe landing can be made following an engine failure. This supposition is supported by the many witnesses who said that the main rotor blades were rotating very slowly at impact.

At impact with the building, the helicopter was descending because of the engine failure, and banked at about 45° to the left. The reason for the left bank cannot be determined. It may have already been established prior to the engine failure, for the purpose of turning towards the adjacent Rouken Glen Park, or, it may have been an emergency turn following the engine failure, to avoid the tall building and make a forced landing on the traffic island. (The concept of using traffic islands for emergency landings in built-up areas had been the subject of discussion within the company.)

3. Impact parameters

The helicopter had struck the southwest face of the building, initially at a height of about 70 ft above street level, with the tip of one of the two main rotor blades. This had been rotating at the time and struck, and severed, a plastic water drain pipe and made a glancing blow on the wooden facing and a concrete lintel just below the edge of the roof. Almost immediately, the vertical fin had contacted the wall at about the same time as a main rotor blade struck and compressed the tail boom and right horizontal stabiliser against the same wall, failing the boom in the process. This caused the aft end, complete with tail rotor and fin, to fall separately to the ground. The general deformation to the tail boom and particular blade showed the main rotor to have been turning only slowly at this time and to have stopped on striking the boom. At about the same time the right side skids and right lower corner of the fuselage struck the wall further down, with some considerable force, causing structural damage to both the building and fuselage.

Analysis of the impact marks on this face of the building and damage to the helicopter showed that it had been descending at a relatively high rate and had been flying in a northeasterly direction into the face

of the building. At the time it was banked to the left by about 40 degrees, in a nose down attitude of about 30 degrees and heading approximately northwest. Once the main impact with the wall had occurred, at a height of around 25 feet, the helicopter fell vertically to the ground on its left side, striking with considerable force the protruding corner of a 4-5 feet high brick wall surrounding a stairway to the building basement. The corner of this wall entered the fuselage through the window of the right rear passenger door, causing severe damage to the integrity of the fuselage structure, particularly to the rear seat/fuel tank. It was not possible to make accurate assessments of the vertical speed of impact with this wall, but there was little doubt that the energy required to so greatly disrupt the helicopter's structure fortuitously reduced the impact loads that would otherwise have been experienced at ground impact. There was no fire, which can be attributed partly to the reported fact that most of the contents of the fuel tank, estimated at approximately 70 gallons of Jet A1, were discharged down the stairwell.

4. Wreckage examination

The wreckage, after an initial examination on site, was removed and transported to the AAIB at Farnborough for a detailed examination. This revealed that the helicopter's structure was complete prior to the impacts and confirmed that the main and tail rotors were rotating slowly at the time.

A strip examination of the engine, conducted at the manufacturer's overhaul base in the UK, its fuel control system and airframe supply, confirmed that the engine had effectively stopped rotating by the time it struck the ground but failed to reveal any technical defect which could have caused the engine to run down in flight. Continuity of drive was present from the power turbine in the engine through to both the tail and main rotor gearboxes and all components were free to rotate. All chip detector plugs were found free from contamination and analysis of oil and fuel samples showed that these were clean and meet the required specification. The helicopter's primary instrumentation, where possible, was calibrated and all defects found were attributable to impact forces. Flying control continuity was assured and a functional test of the three hydraulic control actuators revealed no pre-impact defects.

The aircraft had been fitted with an engine air intake particle separator which had survived the accident with minimal damage. This was examined and found to be in a serviceable condition. There was no evidence that this helicopter had been fitted in recent times with the engine air intake snow deflector kit, reference FMS 18, as there were no relevant attachments in the fairing containing the separator and air intakes. It was established that the engine intake anti-icing valve was in the open position and free to pass compressor delivery air and that the gated selector switch in the cockpit was both serviceable and selected at ON.

As no pre-impact defects were revealed by the investigation the possibility that the engine had run down due to a choking of the air intake path by snow became highly likely.

5. Rules of the Air

The police twin engined Bolkow helicopter had been granted certain exemptions to the rule governing

minimum height at which flight is allowed in such circumstances, but the Bell, being single engined, had not. Thus, the pilot, once engulfed in the snow storm, was confronted by a dilemma. Either he could fly at height, within the snow storm, by reference to only his flight instruments, a method of flight for which this helicopter is not certificated; or, he could descend to a height from which he could maintain visual contact with the ground.

6. The Flight Manual and the Operations Manual

In order for the Bell 206B II to operate safely in conditions of falling snow it needs two items of equipment. These are an engine air intake 'Particle Separator' and a 'Snow Deflector Kit', the requirement for which, and their operational uses, are defined in the approved Flight Manual and its Supplements. However, when the helicopter was first acquired by Clyde Helicopters, the extant revision No 2 of the relevant manual supplement, required only a particle separator to be fitted, providing that a landing must be made after one and a half hours to inspect the separator for snow accretion. In October 1988, following Bell Helicopters' realisation that this was inadequate protection, they issued an approved revision No 3, which stated that a deflector kit must be fitted in conjunction with the particle separator, for safe operation in conditions of falling or blowing snow.

During the updating to Revision 3 (and 4) this new requirement was not noticed, despite the fact that it is stated both in the manual itself and in the supplement. In consequence, the relevant paragraph in the Operations Manual led the company pilots to believe that, with the particle separator alone, the helicopter was capable of flying in falling snow for one and a half hours.

