No: 11/90 **Ref: EW/C1168** **Category: 2b**

Aircraft Type and Registration:	Agusta A109A II, G-PJCB
No & Type of Engines:	Two Allison 250 C20B turboshaft engines
Year of Manufacture:	1989
Date and Time (UTC):	27 June 1990 at 0908 hrs
Location:	Near Rocester, Staffordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 5
Injuries:	Crew - 1 (serious) Passengers - 2 (fatal) 3 (serious)
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Airline Transport Pilots Licence (Helicopter)
Commander's Age:	41 years
Commander's Total Flying Experience:	2630 hours (of which approximately 165 were on type)
Information Source:	AAIB Field Investigation

History of the flight

The flight was part of a customer liaison visit to the factory of the company that owned the helicopter. The helicopter had been hangared overnight at the airfield where it was routinely maintained and, after refuelling and a pre-flight inspection, the helicopter was flown to Blackbushe airport, Surrey where five passengers embarked shortly after 0800 hrs. One passenger was seated in the left front seat adjacent to the pilot. The remaining four were seated in the rear of the cabin with two facing forwards and two facing rearwards. All the passengers wore acoustical headsets and were able to use the intercom facility as well as hear the helicopter's radios.

Take-off from Blackbushe was at 0818 hrs and the flight proceeded directly towards Rocester under Visual Flight Rules at a height of 1500 feet. The pilot contacted ATC agencies at Farnborough, Benson, Coventry and Birmingham before descending towards Rocester shortly before 0900 hrs. Routine reports were made and there was no suggestion of abnormal conditions being encountered.

In the area of Uttoxeter the helicopter was seen to dive towards the ground from its cruising height and head northwards along the River Dove valley in the direction of Rocester. Passengers reported that the helicopter was banked steeply from side to side until it pulled up in an attempt to avoid a set of 11Kv

power lines which were suspended between wooden poles some 35 feet high. Suddenly there was a bang and the helicopter juddered before it continued beyond the power lines whilst climbing to about 100 feet and coming to a high hover some 900 metres north of the power line.

Eyewitnesses saw an object fall from the rear of the helicopter. Others, from a school adjacent to the crash site, described how the helicopter lost forward speed and then rotated about its axis in a nose down attitude for about six times before plunging towards a cornfield where it came to rest. There was no fire and the engines continued to run for a few seconds before stopping due to fuel starvation. Those first on the scene attempted to reassure the surviving pilot and passengers while one of them disconnected the aircraft battery which was still powering some of the electrical systems. One passenger had managed to extricate himself from the wreckage which was lying on its left side at about 45° angle. Another man was then assisted from the wreckage before emergency services arrived to recover the remaining surviving passengers and pilot. They were all taken by ambulance to North Staffordshire Royal Infirmary

Examination of the wreckage

The accident site, shown in Figure 1 covered a distance of 1000 metres. It consisted of flat agricultural land interspersed with trees, hedgerows, farm tracks, overhead telephone and electricity cables and farm buildings. Through the middle of the area ran the River Dove. Approximately 400 metres to the east of the area there was a ridge of high ground which lay in a general north north east to south south west direction. The height of the ridge above the accident area was approximately 190 feet.

Examination of the accident site showed that the helicopter had struck a set of electricity power cables prior to the main body of the helicopter impacting the ground. The power cables were high voltage three phase cables which ran at right angles to the helicopter's flight path and were mounted on wooden poles to a height of approximately 35 feet above the ground. The helicopter struck the cables approximately 26 metres from the cable mounting pole that was situated to the west of the helicopter's flight path. This pole could well have been hidden from the pilot's view by a large tree. The pole to the east of where the helicopter struck the power cables may have been masked from the pilot's view by a large tree in the distance. The cables were of copper construction and coated with a layer of copper oxide which was green in colour. In the area between where the helicopter struck the power cables and the River Dove, which was approximately 400 metres to the north of the power cables, pieces of the helicopter's tail rotor blades, tail rotor drive shaft and the tip section of the left hand synchronized elevator were found. The tail rotor gearbox complete with the tail rotor hub and the remains of the tail rotor blades was found on the southern bank of the river. The main helicopter fuselage came to rest at the edge of a field of standing crop which was situated next to the River Dove. The fuselage impacted the ground whilst rotating in a clockwise direction as viewed from the top, banked to the left by approximately 30°, nose down by approximately 7°, with effectively no forward speed and descending in excess of 500 feet per minute. The main rotor blades struck the ground and broke-up on their initial strike. The rear passenger seat frame was disrupted by the vertical force imparted by one of the passengers which in turn ruptured one of the main fuel tanks. No fire occurred.

A detailed examination of the helicopter's structure and flying control systems was undertaken. It was established that the helicopter struck the power cables initially with its main rotor blades whilst in a climbing left hand turn. This initial cable strike was a glancing impact and may have broken one of the three power cables. A subsequent impact by the rear of the helicopter resulted in the removal of a piece of the left hand synchronized elevator, the tail rotor gearbox and the severance of the remaining power cables. The pieces of all four main rotor blades together with the blade tip fairings were found within the immediate vicinity of the helicopter fuselage which indicated that the main rotor blades had not failed prior to the ground impact. There was no evidence of any structural failure of the helicopter prior to the impact with the power cables. The flying controls were examined in great detail and no evidence was found of a control disconnect or restriction prior to the impact with the power cables. The hydraulic and electrical systems associated with the helicopter's flying control systems were tested, and except for one electrical item were found to function in a satisfactory manner. The "Rectifier flag drive" unit which provided the electrical power supply to the on/off indicator for the No.1 vertical gyro was found to have failed. If this failure had occurred prior to the impact with the power cables there would have been no effect on the control of the helicopter, but it would have given the pilot a warning that one of the two Stabilization Augmentation Systems (SAS) was not available to him. Only one of the two SAS systems was in use at any one time. As a result of the ground impact, disruption and distortion occurred in the helicopter's central avionic bay. This disruption broke a large electrical terminal block in a number of places which caused short circuits to occur. One of the electrical circuits that was routed through this terminal block was the output of the "Rectifier flag drive" unit. It is considered that an impact induced short circuit caused the failure of this unit.

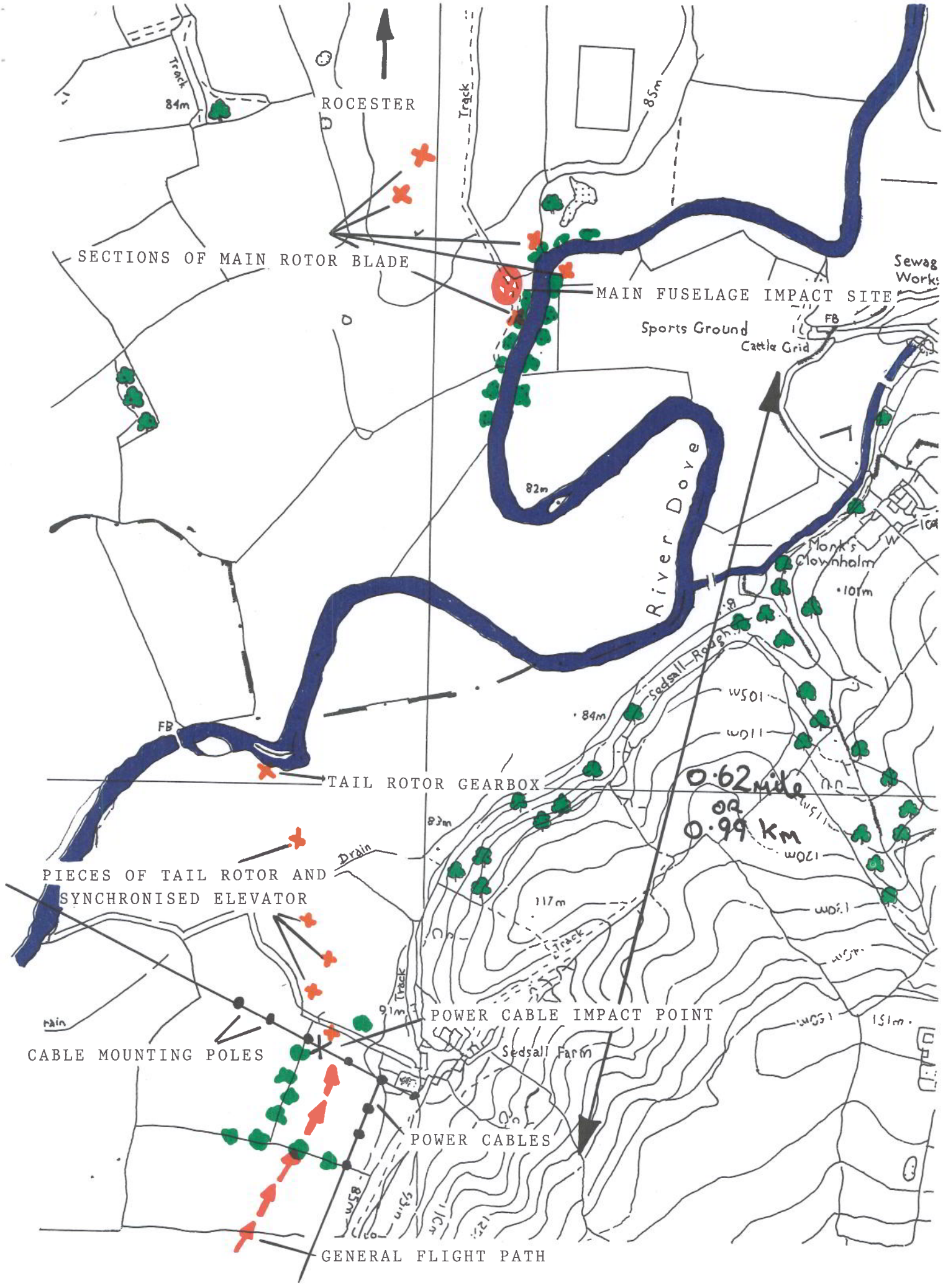

FIGURE 1. ACCIDENT SITE AGUSTA 109 G-PJCB