No: 10/89 **Ref: EW/C1119** **Category: 2c**

Aircraft Type and Registration:	Air Command 532 Commander Elite, G-BOJG
No & Type of Engines:	1 x Rotax 532 piston engine
Year of Manufacture:	1989
Date and Time (UTC):	22 June 1989 at 1150 hrs
Location:	Bredon Hill, Pershore, Worcestershire
Type of Flight:	Private (training)
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (fatal) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence Group A
Commander's Age:	47 years
Commander's Total Flying Experience:	83 hours fixed wing flying and 17 hours on gyroplanes
Information Source:	AAIB Field Investigation

History of the flight

The pilot had flown a fixed wing light aircraft from Coventry Airfield on the day before the accident and had been invited to undertake his qualifying cross-country for a gyroplane PPL on the following day.

He arrived at Coventry airport in the morning towing his dismantled aircraft, and carried out his preparation for the cross-country flight to Long Marston, near Stratford upon Avon, some 16 nm to the south west of Coventry. The weather was CAVOK with light northerly winds and the temperature was +19°C. The pilot then rigged his aircraft for flight and told his instructor that the fuel tanks were full. The primary or main tank contains 4.4 imp gall, and the interconnected auxiliary tanks, mounted on either side of the airframe, contain a total of 5.7 imp gall. The fuel cock may be selected to the primary tank, the auxiliary tank, or to off. A placard next to the fuel selector states that the primary tank should be selected for take-off and landing, and the auxiliary fuel tanks should be used during cruising flight. Fuel consumption is approximately 3½-4 gall an hour depending on engine rpm and airspeed, but it is significantly higher when flying in the circuit.

At 1055 hrs the aircraft took off and completed two circuits and landings before leaving the Coventry circuit and heading south westwards towards Stoneleigh at 1110 hrs. Whilst enroute the aircraft was seen by several witnesses to be flying normally. In the Bredons Norton and Bredon Hill area witnesses saw a gyroplane flying northwards 300 or 400 feet above the ground flying straight and level and remarks were made about the high engine noise level. The engine noise was heard to fade away or stop, and the nose of the gyroplane was seen to pitch down. At least one bang or crack was heard and the rudder was seen to have become detached. A light coloured flash was also noted and is thought to be associated with the disintegration of the propeller. The gyroplane descended very steeply and crashed into a copse of trees. The pilot was killed immediately by the multiple injuries he sustained.There was no fire.

The accident site was 13 nm south west of Long Marston, and although the pilot's portable radio had been pre-set to the Coventry airfield frequency, no calls were received from the aircraft. After having ascertained that the aircraft had not landed and was towards the end of its calculated fuel endurance, the instructor asked Coventry ATC to initiate the overdue procedure and he was then informed of the accident.

Examination of the wreckage

The aircraft had crashed with a high vertical speed through some mature trees on the west facing slopes of Bredon Hill. Its angle of descent was estimated at between 70° and 75° to the horizontal and it was travelling with a low forward speed on a northerly track. As the aircraft passed through the final 50 feet it collided with and broke off several branches of one particular tree. These items came to rest on top of and around the wreckage.

The initial on site examination revealed the wreckage to be complete with the exception of the upper two thirds of the fin and most of the three bladed propeller. The shattered remains of these items were found to the southwest of the impact site, mostly within two hundred metres. A closer wreckage examination, both at the site and later at AAIB Farnborough revealed the following significant points:-

At the time of the impact with the trees, the main rotor had been turning very slowly. The propeller had been turning with some speed but the level of power could not be determined.
Both main rotor blades had been struck by one or more propeller blades and at least one main rotor blade had repeatedly struck the rudder shortly before the impact. This will not occur normally even with the rotor disc tilted backwards as far as it can normally go unless the rotor blades have flexed downwards. This condition is usually associated with a low rotor speed. In autorotative flight the rotor will always turn within the correct speed range so long as positive 'g' loading is maintained. Any reduction from 1g, which can result from pitching the aircraft forward too rapidly, will result in a slowing of the rotor which may result in a dangerous flight condition. Once the rotor speed decay has reached a certain rpm, the situation is irrecoverable.

No fuel was found in the main fuel tank, which is contained within the pilot's seat, or any evidence that fuel had leaked from the intact seat through pipe mounting holes. The fuel for the two-stroke engine on

this machine is a petrol/oil mix in the ratio of 50:1, the oil component usually leaving traces after evaporation of the petrol. The fuel selector valve was found in the main tank position with no evidence apparent that it had been moved there in the impact. Although damaged, both auxillary fuel tanks contained significant quantities of fuel, the analysis of which showed it to be a petrol/oil mix in the ratio of 40:1. Examination of the fuel system failed to reveal any pre-impact defects.

With the exception of the rotor and propeller blade strikes mentioned, all failures of the structure and control systems were consistent with having been caused by impact with the trees and ground.

This autogyro had been issued with a Permit to fly, valid for 1 year, by the Civil Aviation Authority in May 1989 when, according to the aircraft's log book, it was a new aircraft. There were no records of it having flown before this date or of it having suffered any previous damage. One of the conditions of the permit was that no changes should be made to the aircraft's equipment without official approval, but the examination revealed that a poorly engineered (in aeronautical terms) modification had been made to the pitch trim system to enable the trim to be adjusted in flight. Although this system had not failed there was some doubt over the security of attachment of a friction clamp on the mast to which was anchored the lower end of the trim pull down spring. Should this have moved in flight then it would have been possible for an uncommanded forward pitch input to be applied to the system, although the possible effect of such an input is uncertain.

Tests conducted on the engine of a similar autogyro showed that, on the ground, it took approximately 6 seconds for the engine to go from full to zero power, when deliberately run out of fuel, and that the power loss was not sudden. To reinstate power, the fuel selector valve had to be turned through 180°, the system primed by pumping a rubber pump and then pulling on the overhead starter cord if the engine had stopped turning. All of these actions would be likely to detract from sensitive control of the aircraft.