No: 2/86 **Ref: EW/C940/01**

Aircraft type and registration:	Piper 28-180 G-AZVV (light single engined fixed wing aircraft)	
Year of Manufacture:	1972	
Date and time (GMT):	8 November 1985 at about 1635 hrs	
Location:	Drumlanrig Castle, Dumfries	
Type of flight:	Private	
Persons on board:	Crew — 1	Passengers — 1
Injuries:	Crew — Fatal	Passengers — Fatal
Nature of damage:	Aircraft destroyed	
Commander's Licence:	Airline Transport Pilot's Licence and Instrument Rating	
Commander's Age:	53 years	
Commander's Total Flying Experience:	2050 hours (of which 50 hours were on type since January 1983)	
Information Source:	AIB Field Investigation.	

History of the flight

The aircraft, with the pilot as sole occupant, arrived at the Drumlanrig Estate from the Isle of Man (IoM) the day before the accident and landed on the driveway that leads up to the Castle. The aircraft was taxied to a position close to the Castle and parked on a grasss verge.

At about 1300 hrs on the day of the accident the pilot telephoned Ronaldsway Airport (IoM) and discussed the weather conditions to be expected later that day. Sometime after 1600 hrs he boarded his passenger and began his pre-flight checks. During this time he was asked to take some additional baggage with him to the Isle of Man. It was reported that on being told that the baggage weighed about one hundred weight he commented that as he was about one hundred pounds below his maximum take-off weight he would take it.

The aircraft start, warm-up, and power check took between five and ten minutes and nothing unusual was reported by eye-witnesses in the vicinity.

Witness evidence suggested that during the take-off the aircraft, which appeared to be surrounded by a cloud of spray, drifted off to the left of the tarmac driveway and became airborne about a half to three quarters of the way along this road. It was then seen to climb at a shallow angle and "hop over" some power wires that crossed its path. After clearing the wires it was seen to sink down slightly before continuing its shallow climb.

Further on the aircraft clipped the top of a tree on the edge of a small copse which was in its path, and was seen to bank to the right and descend until lost from view.

Weight and balance

Prior to the aircraft's departure the previous day from the Isle of Man it had been refuelled with 59 litres of Avgas 100LL and, as far as could be determined, the aircraft tanks were filled to their capacity of 50 US gallons.

It was calculated that the aircraft consumed 10 US gallons on the journey to the Drumlanrig Estate, where it was not refuelled. From the basic aircraft weight data and actual weights of the occupants and baggage, it was determined that the aircraft was probably slightly above its maximum permitted take-off weight of 2400 pounds. In addition, with all the baggage in the baggage compartment (other than some clothing on the rear seats), the compartment's maximum permitted capacity of 200 pounds was exceeded by about 25 pounds. However, the aircraft's centre of gravity was calculated to be within the permitted range for a take-off weight of 2400 pounds.

Ground Track, Flight Path, and Wreckage Plot

After the start of the take-off (point 'O') the aircraft slowly accelerated along the level road and at the 550 ft point its left main wheel appears to have left the tarmac surface and run along the adjacent soft grass verge. This wheel track deviated from the edge of the 15 ft wide road to a maximum of five feet at the 920 ft point, before adopting a line that brought it back towards the road. (The aircraft's main wheels are spaced ten feet apart). At 1500 feet this track faded out and it is believed that the aircraft became airborne at this point. The aircraft then narrowly missed the power wires 36 feet above road level some 2600 feet from the start of the take-off run. Subsequently it struck a tree, 3450 feet from the start of take-off, at a height of 80 feet above the road level.

The aircraft struck the top of this tree whilst in a right bank causing some damage to the underside of the airframe. No evidence was found of damage to the propeller at this time. About 800 feet further on the aircraft descended to enter a forest at an angle of 20° to the horizontal, some 25 feet below the road level and at a relatively high speed. Its track at this time was 036° Magnetic, it having taken off on a track of 014° Magnetic.

On entry into the forest the left wing was torn off and remained in a tree some forty feet above the ground. The remainder of the aircraft continued forward for 120 feet, whilst rolling and yawing, to be badly broken up by collision with several more trees. There was no fire. The fuselage came to rest, erect, with its firewall hard up against a tree trunk on a heading of 015° Magnetic.

Wreckage examination

The wreckage was examined both on site and later after removal to the AIB facility at RAE Farnborough.

This did not reveal any pre-existing faults in the aircraft structure, flying controls, or systems. It was determined that the engine had been producing a high level of power during the impact. It was also established that the flaps were set at 25° and that the carburettor heat control was set to COLD. Although no fuel remained in the aircraft's tanks, the pipeline, and carburettor were full, with no signs of particle contamination or water.

The aircraft's documentation was also examined and found to be in order.

Weather

A Meteorological Aftercast for the Drumlanrig area gave the following information:

Surface Wind 150/13 kt	Surface Temperature 9—13°C
2000 FT Wind 190/30 kt	Dew Point 10—11°C
Cloud (lowest cloud layer)	3—6/8 Stratus 800 ft locally 500 ft

Surface Visibility. Generally 5—7 km but locally in heavier rain and drizzle 300 m, and less than 100 m in hill fog.

Weather. Virtually continuous precipitation, mainly Rain, Moderate at times, but occasionally Rain and Drizzle. Hill fog patches.

Aircraft performance

There are a number of Aeronautical Information Circulars (AIC's) which are pertinent. In particular, AIC 52/85, "Take-off and Landing Performance of Light Aeroplanes", contains important revised factors that are relevant in an operation of this nature. Using the AIC, the apparent lack of take-off performance of this aircraft may be understood, particularly when applying factors to allow for the effects of a tail wind and soft ground. Additional relevant guidance is contained in AIC 80/84 "Operations from Contaminated Runways". Although the

weather conditions at the time of this accident were highly conducive to carburettor icing, it was considered that this was not a significant factor in this instance. However AIC 1/85 "Carburettor Icing" contains useful information on this subject.

Flight tests carried out subsequent to the accident, on a similar model of aircraft at maximum weight, have shown that with 25° flap the aircraft will climb at approximately 700 fpm at 75 kt indicated air speed (IAS) and 440 fpm at 55 kt IAS. However, the rate of climb reduces towards zero at indicated speeds around 50 kt.

The use of 25° flap is a well known and widely taught short field take-off and obstacle clearance technique for this aircraft. However, take-off performance data for this configuration is not contained in the CAA Approved Flight Manual and the use of the procedure becomes a matter of judgement for the pilot in order to comply with Article 32, para g, of the Air Navigation Order.