AAIB Bulletin No: 2/96 **Ref: EW/C95/8/2** **Category: 1.2**

Aircraft Type and Registration:	Beechcraft Baron 58, G-BAHN	
No & Type of Engines:	2 Continental IO-520-C piston engines	
Year of Manufacture:	1973	
Date & Time (UTC):	11 August 1995 at 0935 hrs	
Location:	Fyfield, near Andover, Hampshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 3
Injuries:	Crew - Fatal	Passengers - Fatal
Nature of Damage:	Aircraft destroyed by impact and fire	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	36 years	
Commander's Flying Experience:	319 hours (of which 34 were on type) Last 90 days - 3 hours Last 28 days - 3 hours	
Information Source:	AAIB Field Investigation	

History of flight

The aircraft had been flown from Thruxton to Bournemouth the previous day; it was flown back to Thruxton on the morning of the accident and arrived at approximately 0830 hours. Both of the pilots involved in these flights recall that there had been no unserviceabilities on the aircraft apart from a minor defect on the ADF equipment.

At Thruxton the aircraft was taken over by the pilot involved in the accident who intended to fly it to Deauville in France and then on to Beaune returning to Thruxton via Deauville on Sunday 13 August 1995. Accompanying the pilot was his wife and two friends, a married couple.

After loading the baggage, the aircraft was taxied to the airfield refuelling pumps where it was refuelled with 178 litres of fuel and was described by the pump attendant as being "full up". After refuelling the pilot and his passengers got into the aircraft with the pilot in the front left-hand seat and his male friend in the front right-hand seat. The rear seating of the Baron is described as "club seating" with four seats arranged in pairs facing each other fore and aft. The pilot's wife sat in the seat which was back to back with his seat and the friend's wife sat diagonally opposite in what was the right-hand rear seat of the aircraft.

Once they were all on board the pilot attempted to start the left engine but was unsuccessful twice so he then started the right engine; this started with no difficulty but it emitted a cloud of exhaust smoke which is not unusual when starting a warm engine. He then recommenced starting the left engine and succeeded on his sixth or seventh attempt. This engine did not produce any visible exhaust smoke. After the second engine start there was a delay of some three minutes whilst the pilot carried out his after-start checklist. The Baron was then taxied to the holding point of Runway 07 to carry out the pre-flight checks.

The weather conditions at the time were recorded as, wind 100˚ less than 5 kt, CAVOK (ie. visibility of 10 km or more, no cloud below 5,000 feet, no cumulo-nimbus cloud and no precipitation), QNH 1020 mb and temperature 26˚C. The aircraft took off on Runway 07 which is 770 x 23 metres of asphalt surface with what is described as a starter extension of 220 x 7 metres. The starter extension was not used for this departure. The takeoff was observed by two pilots in a helicopter that was hovering less than 100 yards from the runway abeam the intersection with Runway 13/31. As G-BAHN passed the mid-point of the runway the forward passenger door, which is on the right side of the aircraft, was seen to open. An attempt was made to close the door and a hand, presumably that of the male passenger was seen to hold the door as the aircraft rotated and climbed away using almost the entire runway length.

G-BAHN then flew straight ahead before turning to the left onto the crosswind leg and passing over St Nicholas' Church in the village of Fyfield. Shortly after takeoff the pilot radioed to Thruxton that a door had come open and that he intended to carry out a low-level circuit in order to land and close it. Aircraft departing Thruxton are required to call Boscombe Down Airfield if they intend to climb more than 800 feet above airfield altitude as they will be entering Boscombe airspace. The aircraft then flew at an altitude of between 200 and 400 feet in a northerly direction over Fyfield. Eyewitnesses report that during this time it steadily lost altitude and that the aircraft's engines were making an unusual noise described as 'spluttering'. The aircraft flew over Fyfield village until it cleared the last house to the north where it appeared to stall, rolled to the left and crashed into a stubble field about 20 metres from the southern fence. All the occupants were fatally injured during the impact and before the aircraft caught fire.

Engineering Investigation

The aircraft had crashed into a field of stubble about 150 feet beyond houses in the village of Fyfield. It had hit the ground about 30˚ nose down and banked to the right. The first contacts had been with the nose and the right engine. The aircraft had then cartwheeled on to its left engine and come to a halt upright 70 feet from its initial impact with some separated items of wreckage lying scattered between it and its impact point. This evidence was consistent with the aircraft being in a stalled or incipient spin condition at impact. The direction of travel at impact had been 350˚M, that is at an angle of 80˚ to left of the runway from which it had taken off. When the aircraft came to rest it had been almost structurally complete though heavily damaged. Then a severe fire had engulfed and destroyed it.

Three bodies were found in the aircraft's cabin; one male in the front left-hand seat, one female in the left side, middle row, rear facing seat and one female in the right side, aft row, forward facing seat. One male body was found lying near to the aircraft but beyond it and still attached to an aircraft seat; this proved to be the body of the front seat passenger. At impact the right wing's main spar had broken in rearward bending at the wing root and near to the front right-hand seat in the cabin. This may have assisted the release of the front passenger's seat and the passenger was thrown out over the aircraft.

The wreckage was severely damaged by fire but examination showed that the aircraft had been intact and complete at the first impact with the landing gear and flaps retracted. No defects other than clear impact and fire damage were found in the flying controls.

The front cabin door was found lying detached and fire damaged in front of the aircraft. The front cabin door is hinged at its front edge and has door locking bolts in its rear edge and its bottom edge and a hook in its top edge. The three latching devices are mechanically linked and operated by an external handle at the trailing edge of the door and an internal handle positioned near the front of the door. The door is closed from inside by pulling it to with an armrest attached to the door and moving the internal handle to the 'LOCKED' position. The hook engages a steel rod in the door frame and the final few degrees of movement of the door handle rotates the hook mechanism through an 'over-centre' movement which locks the hook itself, pulls the hook down on the rod and pulls the door more tightly into contact with the fuselage door frame. If the hook is not fully loaded and locked in the 'over-centred' position or is otherwise not properly engaged, door flexure may allow the other bolts to become disengaged and the door to open. Commonly, an insecure door will open as the aircraft is rotated on takeoff and low pressure develops outside the door. The door locking system was found to be in the correct position for a correctly closed and locked door with the two bolts extended and with the hook in the fully 'over-centred' and 'LOCKED' position. It showed no damage other than that from the fire and impact. It is not known whether the door handle was gripped or moved after the door came open during takeoff or how the system may have moved in the shock of the aircraft's impact with the ground and the door's detachment. The door's latching system, therefore, appears to have been intact but a full assessment of its security could only have been made when the door and aircraft were intact and undamaged in their pre-crash condition.

Because of witness reports that the engine noise sounded rough or abnormal the engines and their controls were examined. No evidence was found of any mechanical defect which would have caused either engine to malfunction though some components had been so badly damaged by fire that their pre-crash condition could not be assessed. Each propeller had sustained sufficient rotational evidence to indicate that there was some power being transmitted at impact and the damage to both was very similar in severity with no sign of any asymmetry of power between the two engines.

The pilot's engine control levers had been destroyed by the fire but the steel cables which connected the control levers to the engine remained. Each cable terminated in a rigid end fitting, a sleeve sliding over a fixed tube. The position of the sleeve on the tube was an indication of the position of the pilot's control lever to which it had been attached. The two sleeves on the propeller control cables were at or very close to the position for maximum propeller and engine speed. The sleeves on the engine throttle cables were at positions which represented partially closed throttles and the sleeves on the mixture cables were both at positions which represented partially weakened mixtures. Any inappropriate weakening of the mixture could have resulted in a greater reduction in power than expected, a loss of airspeed and, if sufficient, rough engine running. This evidence did not allow an accurate assessment of the degree of weakening and, because of the damage suffered by the cables, cannot be taken as completely reliable. However, given that both engines were producing power at impact and no fault was found in their technical examination, though that was limited by fire damage, it may explain witness reports that the engines were running roughly.

Fuel samples from the airfield supply tank were analysed. There was a small quantity of scale and sediment in the sample from the tank filter but otherwise the samples (from filter and nozzle) conformed to AVGAS 100LL specification.

In June of 1995 the aircraft received its three-yearly Star Annual Inspection for renewal of its Certificate of Airworthiness in the Transport (Passenger) Category which was renewed. For the renewal it was also subjected to a standard Civil Aviation Authority test flight. The records in the aircraft's log books showed that, up to the renewal, the aircraft had been maintained to the prescribed schedule (CAA/LAMS/FW/1978/Iss.2). The next 50 hour/62 day inspection was due at 3,152 hours or 28 August 1995. The airframe log book had been completed up to 23 July 1995 when the total operating hours were 3,134.7. The charred remnants of the aircraft's technical documents did not contain the journey record and the only 'Deferred Defects' sheets found were blank.

Aircraft Loading

The aircraft was loaded with a modest amount of baggage distributed between the nose baggage compartment and aft cabin baggage compartment where an inflatable life-raft was also stowed. Aircraft and navigational documents, including four volumes of the Aerad flight guide, were carried in the cabin in the space between the back of the first row of seats and that of the second row, the two rows being back to back. The fire damaged remains of these items were collected and weighed and this information was used in calculating the weight of the aircraft at takeoff.

Weight

Aircraft APS weight from last weighing in 1990	3,656.00 lb
(APS:-Aircraft Prepared for Service, this includes the weight of the airframe, equipment and oil)	
Pilot and passengers total weight (from autopsy estimate)	694.50 lb

Fuel load	994.00 lb
Rear cargo contents (suitcase and dinghy)	39.50 lb
Front cargo contents (clothes and cosmetics)	20.00 lb
Cabin, between seats (manuals and aircraft documents)	5.50 lb
(Bottlang)	5.75 lb
(AERAD 3x 4 lb plus 1 x 5.75 lb)	17.75 lb
TOTAL	5,433.00 lb
MTOW (Maximum Take-off Weight)	5,400.00 lb

Take-off Performance

Power-off stalling speed at weight 5,400 lb	83.5 kt
Take-off safety speed	99.3 kt
TORR (Take-off run required)	2,350 feet
TORA (Take-off run available)	2,526 feet (770 metres).

Medical aspects

The pilot was known to have an irregular heart beat. This had been medically investigated and he had been assessed as fit with this minor variation from the normal. As a result of the post-mortem examination, the pathologist ruled out this condition as a contributory cause whilst conceding that there was a possibility that, under stress, the heartbeat could have become still more irregular. He put this probability at no more than 2%.

Human Factors

The pilot's total flying experience was 319 hours of which he had obtained 140 hours on multi-engine aircraft. This comprised: 10 hours - BN2T twin turboprop Islander; 44 hours - PA-30 Twin Comanche; 52 hours - PA-34 Piper Seneca; and 34 hours - Beechcraft Baron 58. Of the experience gained on the PA-34, 27 hours was achieved in a total of 20 flights during the period from 12 October 1994 to the 23 November 1994. These were training flights for an instrument rating test which he took and passed at the first attempt on the 23 November 1994. On all of these aircraft types he had been given some instruction before flying the aircraft solo apart from the Baron for which there is no record that he was ever given any instruction or dual

familiarisation on the aircraft. As the holder of a Private Pilot's Licence [Group B], he was permitted to fly any multi-engine aircraft of which the maximum total weight authorised does not exceed 5,700 kg and type ratings were not required under licensing regulations.

The Beechcraft Baron is unusual in that the engine controls are grouped in the order, Propellers, Throttles and Mixtures in pairs from left to right, positioned centrally on the instrument panel in front of the pilot as in Figure 1. The conventional layout is, Throttles, Propellers and Mixtures from left to right as in Figure 2. On the latest models of the Baron, the manufacturer has changed the layout to the more conventional one.

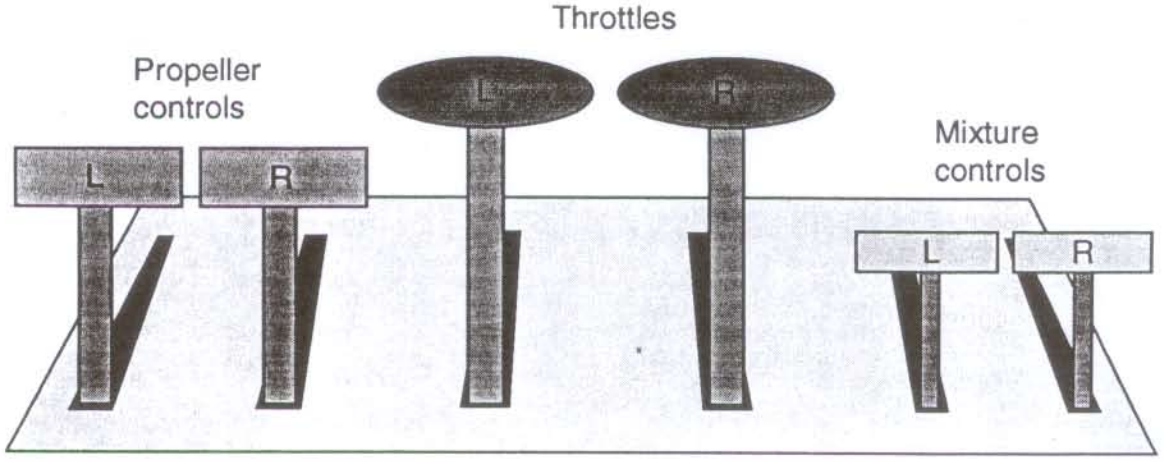

Figure 1: Beechcraft Baron engine control layout

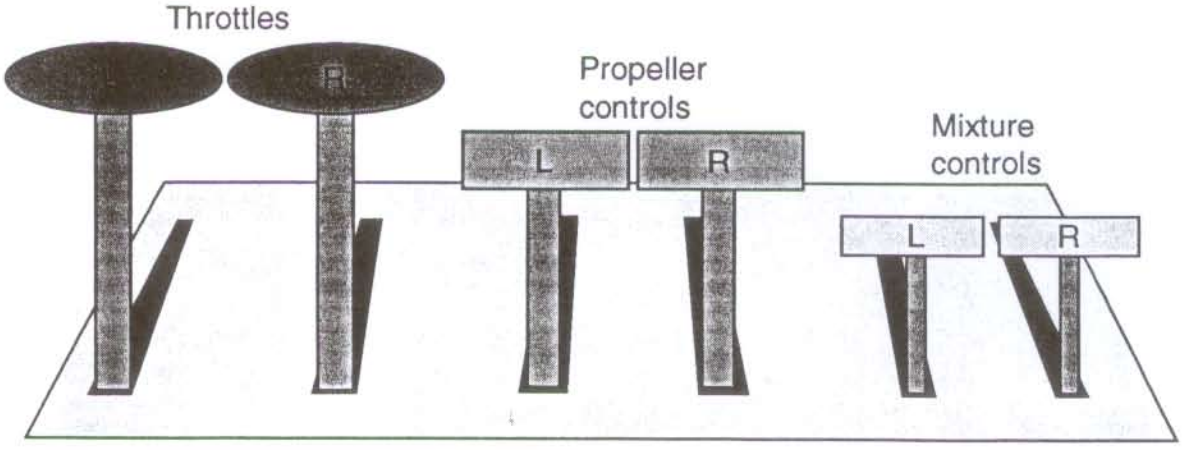

Figure 2: Conventional engine control layout

From examination of the wreckage measurement of the engine control cables indicated that the controls had been at the following positions at impact; propeller levers fully forward, throttles and mixture levers in the mid-position. Because of the damage that the cables had sustained the

mechanical evidence could not be taken as completely reliable but the cables in each pair gave consistent positions even though they had suffered different impact effects from the opposite sides of the aircraft. Thus it is probable that these were the engine control positions at impact.

The combination of throttles and mixture controls at the mid-position is anomalous in that it is a combination that would only ever be demanded under normal conditions when combined with a lower setting of the propeller RPM levers. For example, this would be the procedure adopted when the aircraft reaches the desired cruising altitude. It is more likely that the pilot deliberately throttled back the engines to prevent the aircraft accelerating to too great a speed for the visual circuit in which he planned to return the aircraft to the runway. This power reduction may have been a rapid reaction to the situation caused by the open door whereby the pilot was obliged to change his plans at very short notice and join a left-hand low-level visual circuit. It would be normal procedure to then reduce the propeller RPM to a slightly lower level and, on the conventional lever layout, this would be the two levers to the right of the throttles. On this Baron these levers controlled Mixture and, if they were inadvertently retarded instead of the RPM levers, then the engines would probably have sounded as described by the witnesses.