

**No: 8/91**

**Ref: EW/C91/5/1**

**Category: 1c**

**Aircraft Type and Registration:** Cessna 182Q, G-BMPO

**No & Type of Engines:** 1 Continental O-470-U piston engine fitted with a Mc Cauley constant speed propeller

**Year of Manufacture:** 1979

**Date & Time (UTC):** 15 May 1991 between 1735 and 1740 hrs

**Location:** Llantysilio mountain, near Llangollen, North Wales

**Type of Flight:** Private

**Persons on Board:** Crew - 1 Passengers - 2

**Injuries:** Crew - Fatal Passengers - 2 Fatal

**Nature of Damage:** Aircraft destroyed

**Commander's Licence:** Private Pilot's Licence with IMC and Night ratings.

**Commander's Age:** 59 years

**Commander's Flying Experience:** 533 hours (of which 55 were on type)

**Information Source:** AAIB Field Investigation

### History of the Flight

On the day before the accident the pilot completed two sessions of circuit and VOR tracking practice totalling 2 hours 20 minutes under the supervision of instructors. That evening the aircraft was refuelled with approximately 280 litres of AVGAS 100LL and parked in the open at its home base of Swansea airport in preparation for an early start. At about 0620 hrs on the day of the accident, the aircraft departed Swansea for Tees-side airport where it landed at 0828 hrs. After landing, the pilot entered the flight details into the aircraft's technical and journey logbook; no unserviceabilities were recorded in the logbook or declared to ATC during the flight. The passengers departed for a meeting and the pilot purchased 50 litres of 100LL which was divided equally between the two wing tanks. After replenishment, the bowser operator noted that the fuel level was about one inch below the filler neck in each tank (in all about 270 litres) and the pilot personally checked that the fuel filler caps were correctly seated and that there was sufficient oil in the engine.

At 1510 hrs the pilot booked out for a VFR flight to Swansea lasting 2 hours 15 mins and with an endurance of 5 hours. He gave his intended waypoints as Pole-Hill, RIBEL, Wallasey VOR and Radnor NDB. The aircraft departed Tees-side at 1633 hrs and climbed to FL 40. En-route to Wallasey a service was obtained from RAF Leeming, Pennine Radar, and Warton; each agency was asked for navigational assistance which was given. Near Warton at 1719 hrs the pilot sought and was given clearance to descend to 2000 ft altitude on a QNH of 1028 mb which he read back correctly. (The base of the airway overhead Wallasey VOR is 2000 ft). Approaching Wallasey, the pilot was advised by the Warton controller to squawk 4321 on his transponder and to contact Liverpool since his track was likely to penetrate the airport's special rules zone. Contact was made and shortly afterwards the pilot was asked by Liverpool ATC to call London Information on 124.75 MHz. He contacted the FIS controller at 1727 hrs reporting his position as 6 nm south of Wallasey heading for Radnor at 2000 ft and stated "WE WOULD LIKE TO CLIMB TO FOUR THOUSAND FEET BECAUSE OF THE MOUNTAINS AHEAD". The controller advised him that he knew of no conflicting traffic at that level and asked for an estimated arrival time at Swansea to which the pilot replied "TWO ZERO". That was the last recorded transmission from the aircraft on the FIS frequency and it was made some ten minutes before the accident. Spectral analysis of the sounds made by G-BMPO (ie mechanical noise transmitted by the pilot's microphone whilst he was not speaking) at the end of the penultimate transmission were compared to similar sounds recorded on the earlier flight. It was not possible to determine engine RPM but there were no significant differences between the spectra. A search of other recorded frequencies including 121.5 MHz produced no trace of G-BMPO.

An aftercast of the weather concluded that in the general area there was no precipitation, the visibility was at least 15 km, the freezing level was at 3500 ft and the cloud structure was broken strato-cumulus base 1800 to 2000 ft, tops 4000 ft with broken alto-stratus not below 8000 ft. Local variations in the weather were likely in the hilly areas. Residents in the vicinity of the accident site report that it was a fine evening with no mist or cloud covering the mountain tops, some high cloud and good visibility. Of greater significance was the wind of 360°/33 kts at 2000 ft and a temperature inversion at 6000 ft. The wind, which was at right angles to Llantysilio mountain, coupled with the inversion produced mountain waves which were clearly visible on satellite photographs. These waves were characterised by lenticular shaped clouds and areas of rising and falling air downwind of high ground. The greatest vertical currents were of the order of 700 ft/min at about 7000 ft but moderate to severe turbulence was possible within the lowest 2000 ft of the atmosphere, especially in the lee of the mountains. Meteorological warnings for strong winds, local moderate turbulence below 6000 ft, light to moderate icing and mountain wave activity had been issued and were valid at the time of the accident.

Recorded transponder data including altitude readout were obtained from the Great Dun Fell, Clee Hill and St Anne's radars. The data showed that the aircraft had passed close to the overhead of Wallasey

VOR and had turned onto a sensible track for Radnor whilst at the same time remaining clear of Hawarden airfield. Correlation of the recorded radio and radar data revealed that:

- a. The encoded altitude appeared accurate to within 300 ft.
- b. The aircraft achieved a true airspeed of approximately 115 kt at 2000 ft in the vicinity of Wallasey (ie a sensible and economical cruise speed).
- c. The climb to FL 40 was achieved at an average rate of 450 ft/min and an airspeed of about 110 kt.

The aircraft remained at FL 40 for some 30 seconds with the true airspeed increasing to 130 kt before it commenced a gentle descent and the true airspeed increased further to around 148 kt. The altitude continued to decline and near the overhead of Llandegla, a village about 3 nm north of Llantysilio mountain, the airspeed trend reversed and began to decline slowly but erratically. At about 1730 hrs, two witnesses close to the northern slopes of the mountain were alerted to the presence of an aircraft by unusual engine sounds. Both were indoors at the time; one reports that the engine "kept cutting out" and the other that it was "labouring hard and growling". Both witnesses saw the aircraft clear of cloud, under control and tracking from east to west. These sightings were coherent with the radar data which showed that the aircraft had turned from south on to west along the foot of Llantysilio mountain between the mountain and electricity power lines which follow the valley floor from Llandegla to Bryneglwys. The aircraft then started a gentle but continuous left turn through south onto north-east which took it close to the overhead of Moel Morfydd peak (1802 ft amsl). During this turn the aircraft climbed from 3600 ft to 3900 ft altitude with airspeed decreasing as the aircraft traversed the northern slopes of the mountain. (In this area an increase in altitude could have been caused by orographic lift). Near the peak, as the aircraft tracked south of the ridge line, the altitude began to decrease more rapidly. The last valid radar return was recorded at 1735:32 hrs at a position 800 metres north-east of the impact point with the aircraft heading north east at about 110 kt TAS and at least 3300 ft true altitude (approximately 1800 ft above the impact point).

Several witnesses in the vicinity of the crash site were also alerted to the presence of the aircraft by unusual engine noises. They variously described the sounds as "loud intermittent spluttering", "very rough", "growling at a slow turnover", "rattling" and "unusually noisy". Only two witnesses saw the aircraft in the final few seconds before impact. Both stated that it was flying from east to west across the head of the valley which lies immediately to the north of the village of Rhewl. It appeared to be heading for a dip in the ridge-line and was below the level of Moel Morfydd. Shortly before impact the aircraft began to turn left, possibly through five rotations, before it crashed into the mountain whereupon it broke up and caught fire immediately.

One witness who lived at Valle Crucis (about 2 miles ESE of the impact point and near the river Dee overlooking a hill approximately 1150 ft amsl) attributed an unusual engine noise to a light aircraft which she saw travelling from east to west at extremely low height close to her home at about 6:35 pm (local time). Another witness at Valle Crucis who was indoors also heard but did not see an aircraft with a rough running engine at about 6:30 pm. The hour and minute hands of the pilot's chronograph wristwatch stopped at 6:36 (probably 1736 UTC) but seismographic recorders in the area did not register a local event at or about that time. Consequently, the precise impact time could not be determined but it must have been between 1735:32 (last radar return) and 1740 when the first 999 call was received. It was not possible to establish whether the aircraft seen at Valle Crucis was G-BMPO but the time interval would have been sufficient for the aircraft to fly to the Valle Crucis area and back to the crash site provided that it made good an average groundspeed of at least 90 kt. However, in so doing it would have had to regain or at least maintain an altitude of 1500 ft over a distance of some 2 nm whilst overflying terrain more suited to a forced landing than the upper regions of Llantysilio mountain. Post mortem examination of the occupants indicated that they had all died from multiple injuries. There was no evidence of cabin fire, birdstrike, toxic substances or pre-existing medical condition which may have contributed to the accident. There was no record of either passenger having undertaken any flying training.

### **Impact Parameters**

The aircraft initially contacted the mountain at an altitude of some 1500 ft, approximately 300 metres north east of the Moel Morfydd peak, whilst on a track of 155°M. The profile of the surface at this point was such as to be gently rising, but uneven, along the aircraft's track but sloping down by approximately 25° cross track right to left. It had initially contacted the surface with the nose wheel whilst banked approximately 25° to the left and flying essentially parallel to the surface. The nose wheel skipped along the surface for some 65 ft, with the main wheels clear of the ground, before its collapse was precipitated by a local protrusion. This allowed the propeller to strike the ground, leaving five discernible blade slash marks, following which the propeller and then the engine broke free. Almost immediately, the left wing struck the ground, as the fuselage pitched towards the vertical position, and the aircraft disintegrated. The aircraft's track by this point had reduced to 145°M.

The majority of the wreckage was carried forward at some speed to a point 160 ft from the initial contact with the surface, where the along track slope increased steeply downwards. From this point there was an unobstructed view down a wide valley to the River Dee some 1000 ft below and approximately 2 nm distant. Most of the wreckage tumbled down this slope, the lighter elements coming to rest scattered over this area, the heavier parts, including the engine and fuselage, coming to rest at the base of the steepest section adjacent to wooded areas, a distance of approximately 500

metres from the initial impact. Both wings were badly disrupted in the impact, the fuel tank sections of each fuelling ground fires which eventually spread over several acres of mountainside in three distinct patches.

Analysis of the propeller slash marks suggested that the aircraft's **minimum** likely ground speed, assuming an engine flight idle speed of 1200 RPM, was in the region of 120 kt at the time of impact. Should the engine speed have been higher, then the derived ground speed will be greater in direct proportion. It is likely, from the weather aftercast, that a significant tailwind existed at that time.

### **Wreckage Examination**

The wreckage was recovered to the AAIB at Farnborough where a detailed examination was carried out. Although not all of the aircraft was recovered due to fire effects and the nature of the terrain, it was established that the aircraft had been structurally complete prior to impact and that all the flying controls had been connected and correctly locked. Evidence from damage (or lack of) to the controls in the cockpit suggested that the mixture had been set at full rich, the throttle at maximum power and the propeller to maximum RPM. In addition, the carburettor heat control was found distorted in the 'cold' setting with some evidence to suggest that this was also the flap position in the selector box. The wing flaps selector lever and position indicator in the cockpit had both been distorted in the 'flaps up' position, a position supported by the undamaged condition of the actuator jackscrew in the right wing.

The fuel selector was at the 'both' position and all pipelines that remained in the wreckage were free from obstruction. The fuel strainer was free from contamination but there was, however, some evidence that a small quantity of water had been present in the base of the filter bowl. Both tank filler caps were present.

A complete strip inspection of the engine revealed that no pre-impact failure or seizure of any of the moving parts, cylinders or valves had occurred, all damage seen being attributable to the impact. Oil was present throughout the engine, although the oil tank had been destroyed in the fire, and the oil filter was free from contamination. Not all of the inlet and exhaust ducting and silencer were recovered from the mountain but that which was showed no sign of pre-impact defect. Only the impulse magneto was recovered and this operated satisfactorily on test. Because both magnetos had broken free from the engine gearcase, which itself had broken up, no assessment of ignition timing could be made. The carburettor had detached from the engine and was essentially undamaged and there was evidence of fuel in this unit when first examined on site. A strip examination of the carburettor did not reveal evidence of any pre-impact defects.

The variable pitch propeller had detached from the engine crankshaft flange in the impact, as a result of all the attachment bolts stripping the threads within the propeller boss, and was found lying close to the impact site. The condition of the two propeller blades indicated that, at impact, they had been rotating but not under high power. The propeller hub was strip examined to reveal serious damage within the hub to the pitch change operating mechanism, all of which was attributable to the propeller striking the ground. Symmetrically disposed witness marks, made by the pitch change spigots against the base of the opposite propeller blade, suggested that the propeller pitch was approximately mid way between the fine and coarse limits when it first struck the ground, suggesting that the aircraft had been travelling at a high speed at impact. The pitch governor was seriously damaged in the accident and most of the internal mechanism was missing. No assessment of its state of serviceability could be made.

The maintenance records for the aircraft revealed that the engine and propeller had recently both been stripped for inspection following an incident where the propeller tips came into contact with the ground. Since being repaired and put back into service both units had flown for only some 10 hours prior to the accident.