

No: 9/88

Ref: EW/C1041

Category: 1b

**Aircraft Type and Registration:** Beechcraft Super King Air 200, G-WSJE

**No & Type of Engines:** 2 Pratt & Whitney Canada PT6A-41 turboprop engines

**Year of Manufacture:** 1979

**Date and Time (UTC):** 12 September 1987 at 0435 hrs

**Location:** Rayleigh, Essex

**Type of Flight:** Non-scheduled cargo

**Persons on Board:** Crew - 1                      Passengers - None

**Injuries:** Crew - 1 (Fatal)              Passengers - N/A

**Nature of Damage:** Aircraft destroyed and severe damage to commercial garage

**Commander's Licence**              Commercial Pilot's Licence

**Commander's Age:** 34 years

**Commander's Total Flying Experience:** 4320 hours (of which 50 were on type)

**Information Source:** AAIB Field Investigation

History of the Flight

The aircraft was engaged on overnight movement of newspapers and magazines. It had flown 4 previous short sectors that night and, on the evidence of the pilot who had flown those sectors, it had behaved normally and was fully serviceable when it landed at Southend at 0150 hrs. It was then refuelled and loaded with cargo destined for Bergamo in northern Italy, which brought the aircraft up to its maximum permitted take-off weight. Whilst it was on the ground at Southend, a company ground engineer carried out a visual inspection of the aircraft and a routine check on its electrical system.

At 0223 hrs, as the aircraft left the ramp with a new pilot, there were 5 oktas of stratus cloud at 1000 feet, below 6 oktas of stratocumulus at 2000 feet and light rain was falling. The wind velocity was 240°/19 kts and visibility was better than 10 km. The aircraft was held for several minutes whilst landing traffic cleared the runway and it took off from runway 24 at 0233 hrs. After take-off the aircraft was seen on primary radar from about one mile after take-off and the radar plot showed it to have turned on to the required climb-out heading of 305° and to be flying at a normal airspeed of about 160 kts. No secondary radar trace was seen and thus no height information was available. The radar plot showed that the aircraft maintained a track of about 310° for some two miles when it was seen to turn sharply to the left and drop below radar cover. The last 4 radar points were close together, indicating that the aircraft probably lost airspeed rapidly before it turned to the left.

Witness evidence indicated that the aircraft was much lower than usual as it left the airport and many people were awakened by the noise of the engines. Several witnesses reported hearing the engines running roughly or unevenly and a number reported hearing a sharp crack or bang from the aircraft whilst it was still in the air. Witnesses further along the flight path testified to having seen the aircraft on fire in the air and some of them described how the glow from the aircraft had illuminated their bedrooms through drawn curtains. Those witnesses closest to the crash site described hearing the sound of a diving aircraft immediately before the impact but none of these witnesses heard loud engine noises.

The aircraft crashed on to a commercial garage in a residential area. A fierce fire ensued which burned for more than 2 hours.

### Examination of the Wreckage

At the accident site, it was found that the aircraft had struck the east wall and the roof of the garage and examination of the site and aircraft wreckage showed that the aircraft had been descending on a line of between 35 and 50° below the horizontal, on a heading of between 220 and 240° magnetic. This indicated that the aircraft had performed a steep diving turn through some 75° to the left from the climb-out heading. The impact had caused a high degree of fragmentation of the airframe and the subsequent fierce fire had consumed a large proportion of the wreckage.

The extent of the damage severely limited the scope of the engineering examination. However, it was established that the landing gear and flaps were in their retracted positions and that no major structural failure had occurred to the airframe. On the few portions of the structure which had survived the ground fire there was no evidence of a sustained in-flight fire.

Examination of the propeller assemblies indicated that, although the right-hand propeller appeared to have been at fine pitch and rotating at high revolutions at impact, the left-hand propeller had been rotating much more slowly and appeared to have been at, or close to, its fully feathered position. The firewall shut-off fuel valve for the left-hand engine was found in its closed position, consistent with the action of shutting down this engine at some point prior to the impact. A strip examination of the left-hand engine was conducted and showed no evidence of damage to its rotating assemblies prior to the impact with the garage. The only damage identified on this engine as not being consistent with the impact was a ruptured diaphragm within the low-pressure compressor bleed valve. This rolling diaphragm is designed to hold the compressor bleed valve closed at high power settings and to provide smooth opening of the compressor bleed valve with reduction of compressor discharge pressure.

A review of the CAA's database showed a number of reports of ruptured diaphragms in similar PT6A engines. Some of these had occurred during the take-off and climb phases of flight and the crews had, typically, reported dramatic fluctuations and reductions of indicated engine torque with rapid increases in Interstage Turbine Temperature (ITT), usually requiring the shut-down of that engine.

Inadvertent opening of the bleed valve, such as would occur with rupture of the diaphragm, would be expected to increase the surge margin of the engine. However, some of the previous occurrences included reports of successive bangs or of flames seen at the engine exhausts. 1