

No: 3/90

Ref: EW/C1122

Category: 1b

**Aircraft Type
and Registration:**

Spitfire Mk 5C, G-MKVC

No & Type of Engines:

1 Rolls-Royce Merlin 35/2 piston engine

Year of Manufacture:

1942 (rebuilt 18 November 1988)

Date and Time (UTC):

1 July 1989 at 1757 hrs

Location:

Hartley Wintney, Hampshire

Type of Flight:

Private(pleasure)

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

Commander's Age:

46 years

**Commander's Total
Flying Experience:**

518 hours (of which 101 were on type)

Information Source:

Air Accidents Investigation Branch Field Investigation

Further to the preliminary information contained in AAIB Bulletin 8/89.

The aircraft took-off from its base at Roundwood, Micheldever, Hampshire at about 1730 hrs. From 1739 hrs to 1745 hrs it was in an area between Finchampstead and Crowthorne, Berkshire where it carried out a series of climbing and turning manoeuvres. It departed to the west, carried out an orbit in the Eversley area, and then flew a series of manoeuvres which appeared to be orientated on the Devil's Highway, a Roman road to the west of Stratfield Saye Park.

At 1754 hrs the aircraft began a turn onto an easterly heading. The pilot of a light aircraft logged a Mayday call from G-MKVC at 1755 hrs in which the pilot said that the aircraft had an engine problem and that he was attempting an emergency landing at Blackbushe Airport. At this stage there was no evidence to suggest that the problem presented itself to the pilot as serious enough to necessitate an immediate forced landing. Shortly before 1756 hrs, as the aircraft approached Hartley Wintney, the engine which had started to splutter and misfire was seen to be trailing vapour from one side. About a minute later another Mayday call was made in which the pilot indicated that he was unable to make the airfield and was landing in a field short of Blackbushe. The aircraft, with the propeller stopped, just cleared some high tension cables, banked left at an angle estimated as almost 90° and flew along the wooded perimeter of a field with the left wing

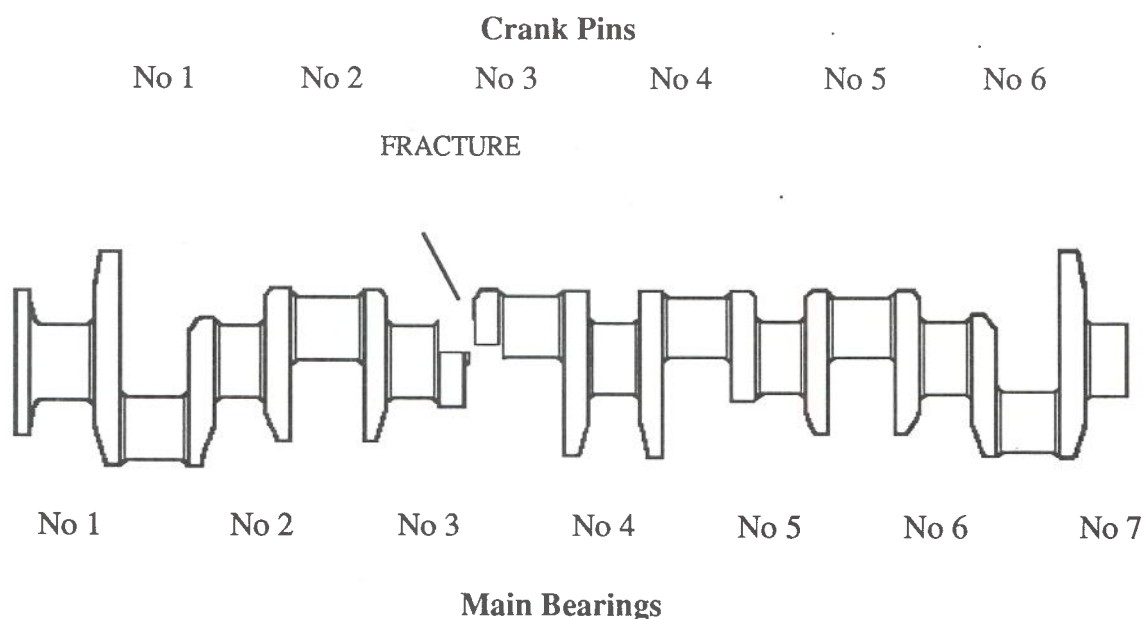
tip only a few feet above the ground. At the last second it rolled out of the turn and struck the ground in a nose-down attitude. It caught fire immediately and the complete centre section was destroyed. The last contact recorded from the Heathrow radar indicated that the accident occurred shortly after 1757 hrs.

The impact had been taken primarily by the engine, which was embedded in the ground at an angle of 22 degrees below the horizontal; the propeller blades had failed in a rearwards direction and had not been under power at impact. The leading edges of both wings had been deformed upwards by the impact and this corresponded to ground marks which indicated that the aircraft had struck with wings approximately level on a heading of 274 °(M).

A fuel fire had destroyed the centre section of the aircraft, leaving the tail section, starboard wing, outer port wing and the engine. The starboard tailplane upper and lower surfaces were contaminated by oil. The canopy had fragmented and a number of fragments had been thrown clear of the fire; some of those recovered from the right hand side were covered in oil on their external surfaces. Although the engine was half buried an oil deposit was observed in the exhaust stub from cylinder 1A, and the fractured end of a plain connecting rod was found lodged outside the crankcase. When the engine was lifted the crankcase was found to be holed on both sides.

The engine had been run for 37 hours since it was rebuilt on behalf of the owner; however its previous history was stated in the logbook as being unknown. During rework the crankshaft journals were reground, hardness tested and crack tested; neither renitriding nor relapping were carried out. New bearing shells were fitted during the rebuild of the engine. No evidence was found to indicate that this work introduced the primary cause of failure of the crankshaft.

The Merlin has 12 cylinders disposed in two blocks mounted on the crankcase at an angle of 60 degrees in the form of an upright V. The connecting rods are in six pairs, plain and forked, working on a one piece, six throw crankshaft supported in seven main bearings within the crankcase.



The engine was removed for strip examination, using the Battle of Britain Memorial Flight facilities at RAF Coningsby, supervised by AAIB and with Rolls Royce assistance, which revealed extensive damage, including:

- A fracture of the crankshaft at the no 3 main journal, extending from the bearing runout radius across the web to the no 3 crankpin.

- Failure of both connecting rods from the no 3 crankpin.

- Complete severance of the crankcase in line with the failed connecting rods.

- Distress to most main bearing shells, which was particularly severe on nos 4 and 5.

- Pulling of most main bearing cap bolts and block holding down studs and severe distortion of the main bearing caps and cylinder block structure around the no 4 bearing position.

Metallurgical and engineering analysis by Rolls Royce at East Kilbride and Derby confirmed that the engine failure had been caused by a crankshaft failure in high cycle fatigue and that the material properties of the crankshaft were within specification. The crankshaft had been exposed to unusual loading in cyclic bending; the deformation required to produce this loading implied a running condition which allowed excessive crankshaft stresses in the area of the no 3 main bearing. The nature of this running condition could not be determined due to the extent of the secondary damage incurred whilst running the engine on after the crankshaft failure.

The post mortem examination of the pilot did not reveal any pre-existing medical condition which would have contributed to the accident.

