Luscombe 8A, G-BSWA, 5 July 1998 at 1852 hrs

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Aircraft Type and Registration:	Luscombe 8A, G-BSWA
No & Type of Engines:	1 Continental A65-8 piston engine
Year of Manufacture:	1946
Date & Time (UTC):	5 July 1998 at 1852 hrs
Location:	Pewsey, Wiltshire
Type of Flight:	Private
Persons on Board:	Crew - 1 - Passengers - 1
Injuries:	Crew - Minor - Passengers - Minor
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence (FAA)
Commander's Age:	40 years
Commander's Flying Experience:	258 hours (of which 162 were on type)
Last 90 days - 19 hours	
	Last 28 days - 6 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further investigation by the AAIB

History of the flight

The aircraft was returning on a direct route from Cranfield to Compton Abbas at an altitude of 2,300 feet on the regional QNH. The pilot had just given his position to the RAF Lyneham Flight Information Service as being 4 nm south-east of Marlborough when he noticed that the engine note had suddenly changed. He remarked on this to his passenger and checked the fuel and ignition settings, in addition to performing a carburettor hot air check.

Shortly after this the engine began to misfire seriously on at least one cylinder and the pilot transmitted a Mayday call to RAF Lyneham, informing them of his intention to make a forced landing in a field; Lyneham passed him their local surface wind of 270 degrees/10 kt, for information. The pilot reduced the airspeed to about 65 kt, the aircraft's best gliding speed, but the engine rough running became more marked and the aircraft began to descend more rapidly.

The pilot identified a field, which was a mile or two ahead and to his left, and which he considered suitable for a forced landing. However his passenger, who was a pilot with a similar amount of powered flying experience, suggested that a field almost immediately below them and to their right was also suitable. The pilot banked the aircraft slightly to the right and saw that the field, which had been cut and was full of scattered bales, had a clear strip along its southern side. He decided to land in this field and flew a little further upwind before turning downwind for a left hand circuit. However as the downwind leg was completed, it became apparent that there was high ground under the base leg and as a result the pilot had to sideslip with the throttle closed, on passing the high ground, in order to position for the field. As the threshold was approached it became apparent that, although the selected field was of suitable length and well aligned into wind, it had a very severe down-slope which it had not been possible to assess from the position the aircraft had been in, almost immediately overhead, when it was selected.

The pilot felt that he would be unable to stop the aircraft before the end of the strip after landing due to the severe downslope. Since the field beyond the strip and another to the left were full of standing crop, and there were the bales to the right, the pilot attempted to gain height and complete a 180° turn to land downwind and up-slope on the selected strip. However during this turn the aircraft stalled and spun to the ground from about 150 to 200 feet agl. Despite their resultant injuries, which were fortunately minor, the pilot and passenger were able to extricate themselves from the wreckage and summon assistance using a mobile telephone.

Engine examination

Subsequent examination of the engine by the AAIB revealed that the No 4 piston and gudgeon pin had both failed catastrophically. Metallurgical examination found that the primary failure had been caused by fatigue fracture of the gudgeon pin between the connecting rod small end and the boss on one side of the piston. The consequent asymmetric loading had resulted in the second piston boss being torn out, with break-up of most of the piston skirt, leaving the small end of the No 4 connecting rod free. The damaged piston had then been pushed up towards the cylinder head, leaving the small end and connecting rod within the cylinder bore.

Gudgeon pin material and manufacture

Metallurgical examination of the gudgeon pin showed that it had been manufactured from a drawn tube of free-machining mild steel. This had manganese sulphide stringer inclusions, running axially, which had acted as initiating sites for multiple fatigue origins. The gudgeon pin bore, which had not been machined, showed evidence of scoring as a result of 'pick-up' on the mandrel which had been used during the tube drawing process at manufacture. Examination of the other three gudgeon pins confirmed that they had also been manufactured from the same drawn material.

Enquiries made of the engine manufacturer established that it no longer supported this old design of engine and had not retained any drawings of the standard of gudgeon pin used during its production. The manufacturer was, however, able to supply a drawing of a later standard of gudgeon pin (of slightly larger diameter) which indicated that the pins should have been manufactured from mild steel bar stock with fully machined bores, rather than drawn tube. The drawing also required the machined pins to be case-hardened and did not indicate that free machining steel was an acceptable material for the manufacture of gudgeon pins. Metallurgical opinion confirmed that free machining steel should not be used in such an application. The core and surface hardness of the gudgeon pins from the engine were compared with the values required on

the drawing supplied and it was found that the pins from the engine had a higher surface hardness and lower core hardness than those specified.

Engine hours

At the time that the aircraft had been imported into the UK, in October 1990, the engine was recorded as having run 201 hours and 20 minutes since complete overhaul, and it had then run some 900 additional hours up to the time of this accident. During its operation in the UK, the engine had been subjected to internal inspections but no reason to change the gudgeon pins had arisen.

Identification of sub-standard gudgeon pins

Gudgeon pins generally appear to have no identifying marks and it is not, therefore, always possible to identify non-approved pins visually when engines are dismantled for internal inspection. It should, however, be possible during such strip inspections to visually check gudgeon pin bores to assess whether they have been machined and, if not, consider whether it would be advisable to have the necessary metallurgical tests performed to establish that they are not made from free machining steel.

Safety action

As a result of these findings, a Draft Safety Recommendation was forwarded to the engine manufacturer recommending that they alert maintenance organisations to visually check the bores of gudgeon pins from such engines during strip inspections to confirm that they had been machined. This Draft Safety Recommendation was also forwarded to the FAA, the Primary Certificating Authority, and the FAA subsequently responded indicating that it intended to publish an article in Advisory Circular 43-16 which will satisfy the intent of the Draft Safety Recommendation, which was therefore withdrawn. The AAIB has contacted both the CAA and PFA on this FAA response, and both organisations have confirmed that they will further publicise AC 43-16.