ACCIDENT

Aircraft Type and Registration:	Fuji FA-200-160, G-FEWG
No & type of Engines:	1 Lycoming O-320-D2A piston engine
Year of Manufacture:	1973
Date & Time (UTC):	22 June 2006 at 1645 hrs
Location:	Near Grantham, Lincs
Type of Flight:	Private
Persons on Board:	Crew 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to propeller
Commander's Licence:	Private Pilot's Licence
Commander's Age:	32 years
Commander's Flying Experience:	613 hours (of which 9 were on type) Last 90 days - 101 hours Last 28 days - 24 hours
Information Source:	AAIB Field Investigation

Synopsis

Following the onset of severe vibration, the pilot carried out a successful forced landing at a military airfield. Examination of the aircraft revealed that the outer six inches of one propeller blade were missing. The failure was associated with the development of a fatigue crack across approximately two thirds of the blade chord. Damage, minor in nature when compared to that typically found on in-service propellers, was identified on the blade leading edge very close to the origin of the crack.

History of the flight

Whilst in a gentle descent, just to the north of Grantham, during the latter stages of a flight from Turweston to Temple Bruer (approximately 2.5 nm NNW of RAF Cranwell), the aircraft was passing 1,900 ft when it suddenly began to shake violently. Suspecting a catastrophic engine failure, the pilot immediately retarded the throttle and mixture controls and initiated a turn into wind, whilst transmitting a MAYDAY call to Cranwell. It was difficult for him to read the engine instruments because of the severe vibration, but, so far as he could tell, the temperatures and pressures were all within normal limits. In light of this, the pilot suspected a propeller problem and decided to shut down the engine and switched off both magnetos. However, the propeller continued to windmill and the shaking and vibration continued.

After completing his turn into wind, with the intention of

landing in a field, the pilot received a call from Cranwell informing him that the airfield at Barkstone Heath was 'in his 2 o'clock'; it was actually behind him at that stage but, upon checking its position visually, he found himself looking straight down Runway 06. He knew that it was some 1,800 m in length and therefore decided to carry out a downwind gliding approach to land on this runway. The approach was carried out without incident, using first-stage flap earlier than normal to compensate for his excess height, and the touchdown was executed at slightly higher indicated air airspeed than normal. Although the brakes were not used during the landing roll, because the pilot was unsure if there had been any damage caused by the vibration, the aircraft came to rest with some 500-600m of runway remaining. Upon vacating the aircraft it became apparent that approximately six inches was missing from the tip of one of the propeller blades. It was subsequently noted that two of the exhaust pipes were loose at their manifold attachments but, in other respects, the aircraft appeared undamaged.

Propeller history

The pilot reported that the aircraft had been serviceable prior to the flight. During his pre-flight inspection of the propeller he saw no signs of cracking and recalled that the leading edges were fairly clean and were certainly not nicked to any large extent.

The maintenance organisation for the aircraft reported that the propeller in question[1] was fitted by an approved organisation as a new component on 11 February 1987, at 4,853 airframe hours, after which the aircraft did not fly until February of the following year. During the next 10 years, the aircraft underwent a series of unexceptional 50 hr, Annual, and Star Annual inspections. The logbook shows no specific reference to the propeller during this period, except for an entry during the 1996 Star Annual inspection at 5,161 hrs, stating '*Attached propeller dynamically balanced to 0.2 IPS*'. In March 1999, with the propeller by that time having accumulated some 673 hours, the aircraft was put into storage. A subsequent logbook entry made during a Star Annual Inspection records that its leading edges had been dressed. The propeller subsequently accumulated a further 43 flying hours up to the time of the failure, making a total of 716 hours since new.

Propeller examination

The condition of the propeller generally, and of the leading edge regions in particular, appeared excellent with very little of the 'stone chip' damage typically seen on propellers which have been in service for some time. The propeller was taken for detailed examination to the AAIB facilities at Farnborough, where the section of the tip containing the fracture was excised. This was then taken to a specialist laboratory for more detailed metallographic examination, including optical and scanning electron microscopy. Here, it was established that the propeller had failed as a result of a fatigue crack, the origin being very close to the leading edge. The crack had propagated across the blade over a distance of approximately two thirds of its chord towards the trailing edge, before the remaining section failed in overload. The characteristics of the crack indicated that it had probably been propagating for a period of time well in excess of the duration of the subject flight.

Examination of the origin region under high magnification revealed a very small flattened area of the outer surface, close to the origin, within which shallow scrape marks were evident. This was consistent with there having been a very small bruise on the leading edge at this location. The size and topography of this feature, in

Footnote

[1] Macauley Pt. No. IC172/MGM 7656 S/N GE006 (Batch No. 120668)

terms of its stress-raising potential, was very small when compared with the damage typically found on in-service propellers. To date, it has not been possible to determine why this apparently trivial damage appears to have initiated a crack in this case. Investigation of the failure, and of the material properties in particular, continues. An addendum will be issued in a future AAIB Bulletin should the underlying cause of the fatigue crack be positively determined.