

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Kolb Twinstar Mk 3 Extra, G-CDFA	
<b>No &amp; Type of Engines:</b>	1 Jabiru 2200A piston engine	
<b>Year of Manufacture:</b>	2004	
<b>Date &amp; Time (UTC):</b>	6 April 2007 at 1500 hrs	
<b>Location:</b>	Trough of Bowland, near Clitheroe, Lancashire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 1
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Propeller missing	
<b>Commander's Licence:</b>	National Private Pilot's Licence	
<b>Commander's Age:</b>	66 years	
<b>Commander's Flying Experience:</b>	105 hours Last 90 days - 13 hours Last 28 days - 4 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and metallurgical examination by the AAIB	

**Synopsis**

The aircraft was in the cruise when the propeller detached. The pilot made a successful forced landing without further damage. Examination showed that the bolts securing the crankshaft extension fitting to the crankshaft had fractured in long-term high-cycle fatigue.

**History of the flight**

The aircraft was on a flight from Rufforth to Rossall Field, Cockerham. Whilst flying straight and level on-track at 2,500 ft, the occupants noticed a rattling sound, but without any vibration. About two minutes later there was a new "mechanical" noise, followed a few seconds later by the abrupt stoppage of the engine.

The pilot was convinced that the engine had seized, so he did not attempt a restart and instead concentrated on finding a field for a forced landing. This was successful and there was no further damage to the aircraft. On vacating the aircraft, the pilot and passenger were surprised to find that the two-bladed wooden propeller was missing, having departed without causing airframe damage.

The aircraft was collected from the field by fellow flying club members using a trailer and the propeller was found 11 days later by a local farmer and despatched to the AAIB for further examination.

## Examination

On the Kolb Twinstar, the engine and propeller act in a 'pusher' configuration. The propeller is mounted on an extension fitting which in turn is bolted to the end of the crankshaft, using six bolts. The propeller does not require removal of the extension fitting when it is installed. The propeller had detached due to failure of the bolts holding the extension fitting to the crankshaft – one was missing completely (see Figure 1). Metallurgical examination showed that the five remaining bolts had fractured in long-term high-cycle bending fatigue. This was caused by progressive slackening of the bolts due to fretting of the holes in the fitting. The six bolts are normally wire locked in pairs and it was noted that the wire locking of two of the pairs had broken due to high-cycle fatigue. Also noted was that the bolts, which are threaded along their entire length, had cut 'threads' into the holes in the fitting. This was considered to have exacerbated the fretting, as may the presence of a relatively high level of surface corrosion on the crankshaft fitting.

The owner of G-CDFA had purchased the aircraft from its original owner in March 2007 and had flown some six hours since then. The original owner, who is also the UK importer of the kits, states that he had flown the aircraft for about 150 hours from new and the engine/propeller combination had performed faultlessly. The bolts securing the extension fitting to the crankshaft were as supplied and specified by the manufacturer and he was not aware of any similar incidents.



**Figure 1**

Detached crankshaft extension showing fatigue fractures of five bolts with sixth missing. (Note surface corrosion)

The AAIB consulted the Popular Flying Association (PFA) concerning the suitability of the bolts and they agreed that it is not good engineering practice to use bolts which are threaded along their entire length in an application such as this. However, the PFA pointed out that this unusual event may be linked to the use of the Jabiru engine in the Kolb Twinstar, as this is the only application employing a pusher installation. A propeller operating in the disturbed air behind a wing is subjected to varying airflow across the propeller disc at every revolution (compared with a tractor layout) with consequent higher stresses on the propeller and its attachments. Consequently, although the PFA advise that they will be requiring replacement of the bolts with items featuring a plain shank, this will initially be limited to Jabiru engines on the Kolb Twinstar unless service experience suggests that other applications experience similar problems. They will also investigate the corrosion protection on the extension fitting.