

ACCIDENT

Aircraft Type and Registration:	Jabiru UL-430, G-BYIM	
No & Type of Engines:	1 Jabiru 2200A piston engine	
Year of Manufacture:	1999 (Serial no: PFA 274A-13397)	
Date & Time (UTC):	12 August 2012 at 1915 hrs	
Location:	Ince Airfield, Liverpool	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Collapsed main undercarriage ¹ and nose leg, damaged propeller and right wing	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	49 years	
Commander's Flying Experience:	377 hours (of which 300 were on type) Last 90 days - 26 hours Last 28 days - 8 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and AAIB enquiries	

Synopsis

The right undercarriage collapsed shortly after the aircraft landed as a result of a nut having pulled off the forward outboard attachment bolt. The nut, which had also bottomed out on the bolt thread, was manufactured from a softer steel alloy than the bolt.

10 to 20 m after touching down, the right main undercarriage, followed by the nose leg, collapsed and the right wingtip and propeller blade struck the ground. At the time of the accident the wind was calm and the grass runway was described as being slightly soft.

History of the flight

The pilot reported that following an uneventful flight of 20 minutes, he made a normal approach and landing on Runway 29 at Ince Airfield. However, approximately

Aircraft description

The Jabiru UL-430 is a high-wing two-seat microlight aircraft equipped with a tricycle undercarriage. The nose undercarriage leg is mounted onto a fibreglass structure,

Footnote

¹ The normal nomenclature used by the AAIB is 'landing gear', however in this report the term 'undercarriage' has been used to reflect the nomenclature used by the aircraft manufacturer.

which is bolted to the engine bulkhead. The main undercarriage consists of separate left and right cantilever spring legs, each of which is secured by one inboard and two outboard 5/16" (AN5) attachment bolts (Figure 1).

G-BYIM was equipped with wheel spats and had the large wheel configuration that weighed approximately 15 kg more than the standard wheel configuration. The aircraft was last weighed on 28 July 2010 when the empty weight was calculated to be 545.8 lb (248 kg). The aircraft was re-sprayed, without first removing the old paint coating, on 16 October 2010 and the last inspection for the Permit to Fly renewal was carried out on 12 November 2011.

The maximum permitted empty weight of the Jabiru UL-430 is 248 kg and the maximum takeoff weight is 430 kg.

Inspection of aircraft

The right cantilever spring leg collapsed as a result of the nut having come off the forward outboard attachment bolt. The rear attachment bolt, which had bent during the accident sequence, was still intact with its nut in place. The inside of the attachment clamp was highly polished, which the UK Jabiru agent advised was unusual. The six undercarriage attachment bolts were all 5/16" bolts.

While the attachment bolts that secure the nose leg mounting structure to the engine bulkhead were still in place, all the bolts had pulled out of the fibreglass mounting resulting in the nose leg detaching from the aircraft.

Following the accident, the aircraft was weighed by the UK Jabiru agent and the empty weight, with no fuel

Outboard attachment bolts
passing through the attachment bracket

Cantilever
spring leg



Figure 1

Undercarriage attachment

and no non-essential items on board, was found to be 276.5 kg. The non-essential items weighed 8 kg.

Detailed examination of failed bolt

Examination of the forward outboard attachment bolt was carried out using a high magnification optical device and a Scanning Electron Microscope. The composition of the bolt and nut were inferred from Energy Dispersive X-ray (EDX) analysis.

The thread on the bolt, which remained intact, contained remnants of the thread from the nut that had been pulled off the bolt. The damage to the thread from the nut was such that it was not possible to establish if the thread had failed as a result of fatigue or overload. The position of the debris on the thread of the bolt, and damage to the cadmium coating on the thread run-out, indicated that

the nut may have bottomed out on the bottom of the bolt thread (Figure 2). Damage to the cadmium coating on the taper at the end of the shank also indicated that there was some contact in this area.

The EDX analysis of the surfaces showed that the bolt had been manufactured from a low alloy steel and was cadmium coated. The nut was found to have been manufactured from a softer steel than that of the bolt. Traces of a polymeric material found in the thread suggest that the nut had a polymeric insert such as nylon.

Undercarriage attachment bolts

In 2003 the Popular Flying Association (PFA) identified a concern that the rear outboard undercarriage attachment bolt might not be sufficiently strong and that the bolts needed to be regularly re-tightened. Consequently, the

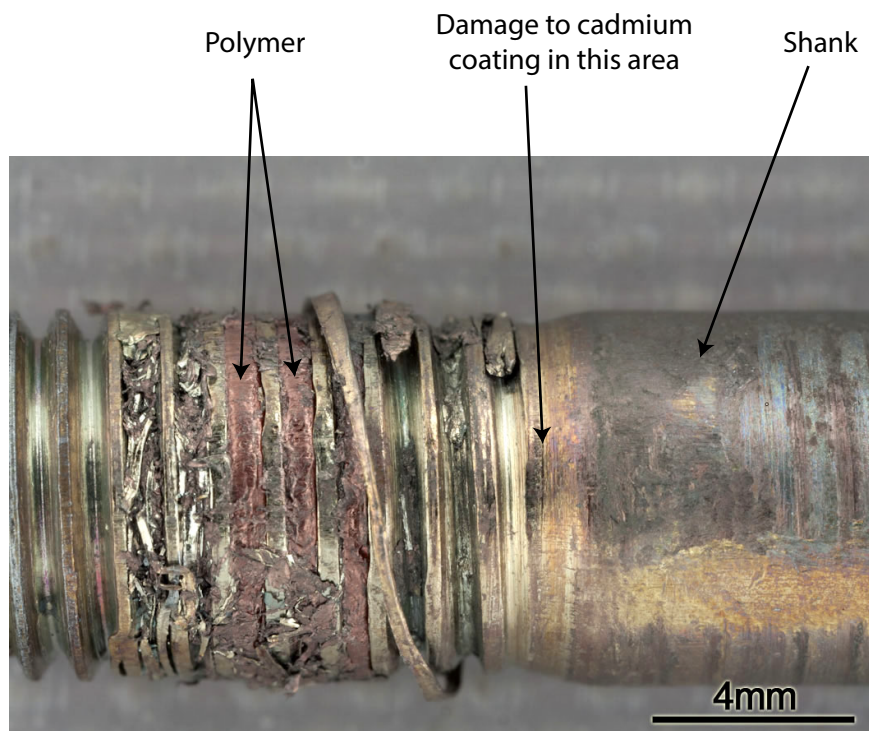


Figure 2

Thread on forward outboard attachment bolt

PFA introduced an optional modification (Mod 10818) to replace the outboard rear 5/16" (AN5) attachment bolt with 3/8" (AN6) bolt and advised their members on the need to check regularly the torque of these bolts. This advice is contained in the LAA Type Acceptance Data Sheet (TADS 274A) for the Jabiru UL-430.

The aircraft manufacturer also introduced two non-mandatory Service Bulletins (SB) relating to the attachment bolts:

Service Bulletin JSB 008-1 was issued on the 31 March 2005 as a result of the failure of the undercarriage attachment bolts on the heavier Jabiru J400 aircraft. The manufacturer recommended that the 5/16" attachment bolts should be replaced with 3/8" bolts on the J400 family of aircraft. To ensure commonality of parts, the large bolts were also permitted to be used on other Jabiru aircraft.

Service Bulletin JSB 025-2 was issued on the 7 May 2009 and recommended a 500-hour life on the undercarriage attachment bolts fitted to all models of the Jabiru aircraft.

The LAA provided information on a number of known issues with the Jabiru undercarriage attachment and advice on how to address these issues in TADS 274A. The TADS states that '*bolts of doubtful quality*' have been found fitted on a Jabiru involved in an accident. It also recommended that owing to variations in the thickness of glass-fibre in the fuselage, the length of the shank on the undercarriage attachment bolts should be checked on assembly to ensure that the nuts do not bottom out at the end of the thread.

Main undercarriage maintenance

A worksheet that was completed during the Permit renewal inspection carried out in August 2010 had an entry '*U/Carriage to fuselage loose*' which was cleared by the entry '*Washers fitted + nuts tightened*'. The LAA inspector, who carried out the inspection, advised that it was the left undercarriage attachment that was loose.

The same inspector carried out a Permit renewal inspection in November 2011 and informed the AAIB that he checked to see if the undercarriage was loose by lifting each wing upwards, in turn, and checking for movement between the cantilever spring leg and the fuselage. He detected no movement in either spring leg.

There was no record in the aircraft log book², provided to the AAIB, of the torque on the undercarriage attachment bolts having been checked or any reference to Service Bulletins JSB 008-1 and JSB 025-2 having been embodied. The owner informed the AAIB that he was unaware of these Service Bulletins and had not seen the TADS for his aircraft.

Safety action

After reviewing the findings of this investigation, and the relevant Jabiru Service Bulletins, the LAA have taken action to:

- Introduce a mandatory life of 500 hours for the undercarriage attachment bolts fitted to all models of Jabiru aircraft.
- Ensure that any 5/16" (AN5) bolts still fitted to the undercarriage on Jabiru aircraft are replaced with 3/8" (AN6) bolts.

Footnote

² The AAIB was provided with the second aircraft log book that contained entries from April 2007 and 399 flying hours.

- Remind owners and inspectors of the need to check regularly the torque of the undercarriage attachment bolts.
- Remind owners and inspectors of the need to reweigh aircraft after they have been painted.

AAIB comment

The investigation determined that the right main undercarriage collapsed as a result of the nut having been pulled off the forward outboard attachment bolt. It was not possible to establish the mode of failure of the thread on the nut, although it was made of a softer steel than that of the bolt.

Previous experience indicates that the loading on the rear outer attachment bolt is greater than the load on the forward bolt and, therefore, in a heavy or over-weight landing the rear attachment bolt would be expected to fail first. In this accident the rear bolt remained intact so the landing force, and weight of the aircraft, were probably not the primary cause of the failure.

The polished surface on the attachment bracket indicated that there had been some relative movement between the spring leg and the bracket. This could be a result of the nut on the attachment bolt becoming loose, or as a consequence of the nut bottoming out such that the clamping force between the spring leg and bracket was insufficient. All of these issues had previously been identified by the LAA who had brought it to the

attention of their inspectors and members through the Jabiru UL-430 TADS.

The owner was surprised by the increase in the weight of his aircraft following the re-spray and did not realise that it exceeded the maximum empty weight limit. He also stated that he was unaware of the need to reweigh his aircraft after it had been painted. Moreover, the inspector who undertook the subsequent Permit renewal inspection stated that he did not realise that the aircraft had been painted since the last time it had been weighed. While the pilot may have operated the aircraft within its maximum takeoff weight, there is a risk in painting control surfaces without first removing the old paint, that the change in weight and balance could increase the risk of control flutter and structural failure.

The LAA had previously taken appropriate action to advise their members and inspectors on a number of issues that might affect the integrity of the undercarriage attachment bolts fitted on Jabiru aircraft. The safety action that the LAA initiated as a result of this accident will reinforce this message and the mandatory use of AN6 bolts should help to reduce the number of failures of the undercarriage in the future. The LAA is also reviewing the circumstances surrounding the painting, weighing and Permit renewal of G-BYIM and will use their findings to inform their members on the necessity to weigh aircraft after they have been painted and the correct procedures to follow.