

ACCIDENT

Aircraft Type and Registration:	Diamond HK 36 TC, G-OSFA	
No & Type of Engines:	1 Rotax 912-A3 piston engine	
Year of Manufacture:	1999	
Date & Time (UTC):	12 June 2006 at 1030 hrs	
Location:	Enstone Airfield, Oxfordshire	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - Nil
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Damaged propeller, nose landing gear leg and nosewheel fork	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	60 years	
Commander's Flying Experience:	89 hours (of which 80 were on type) Last 90 days - 3.6 hours Last 28 days - 0 hours	
Information Source:	AAIB Field Investigation	

Synopsis

Following a normal approach and touchdown a loud scraping noise was heard from the front of the aircraft which was followed by the nosewheel detaching from the nose leg. The metallurgical examination revealed that both the nose landing gear wheel fork arms had failed in overload and that the materials were of the correct specification.

History of the flight

The purpose of the flight was to re-familiarise the pilot with the aircraft type. The pre-flight checks showed no obvious problems and the weather was good with light and variable winds. The first circuit and landing were satisfactory with a normal touchdown. The second circuit,

approach and initial touchdown on the main wheels were normal until the nosewheel was lowered, at which point there was a loud metallic scraping noise from the front of the aircraft and a loss of directional control. The instructor took control and immediately raised the nose and shut down the engine. As the nose of the aircraft settled back down on the runway the nose landing gear failed. The nosewheel was found approximately 150 m from where the aircraft came to rest.

Engineering examination

Initial examination showed that the nosewheel fork had failed at both sides approximately 45 mm forward of the wheel's axle hole in the fork (Figure 1). Metallurgical

examination showed that both fork arms had failed in simple upward bending overload with a small amount of torsion in the right fork arm. This suggested that the left arm failed first, placing a twisting load on the unfailed portion of the right arm. Evidence from the failure surfaces indicated that a crack initiation had occurred from an event prior to that which resulted in the final failure. It was not possible to determine what the two events were or the time between them. There were no pre-existing material defects or damage to either of the fork arms. It was seen from the general appearance of the material surfaces that the fork arms had been sulphuric acid anodised. This could have adversely affected their resistance to surface crack initiation and propagation.

It was noted during the examination of the fork arms that there had been heavy contact between the insides of the arms and the sidewalls of the nosewheel tyre. It was also seen that the nosewheel tyre that was fitted was of a larger size (5.00-4) than that specified (4.00-4). With a

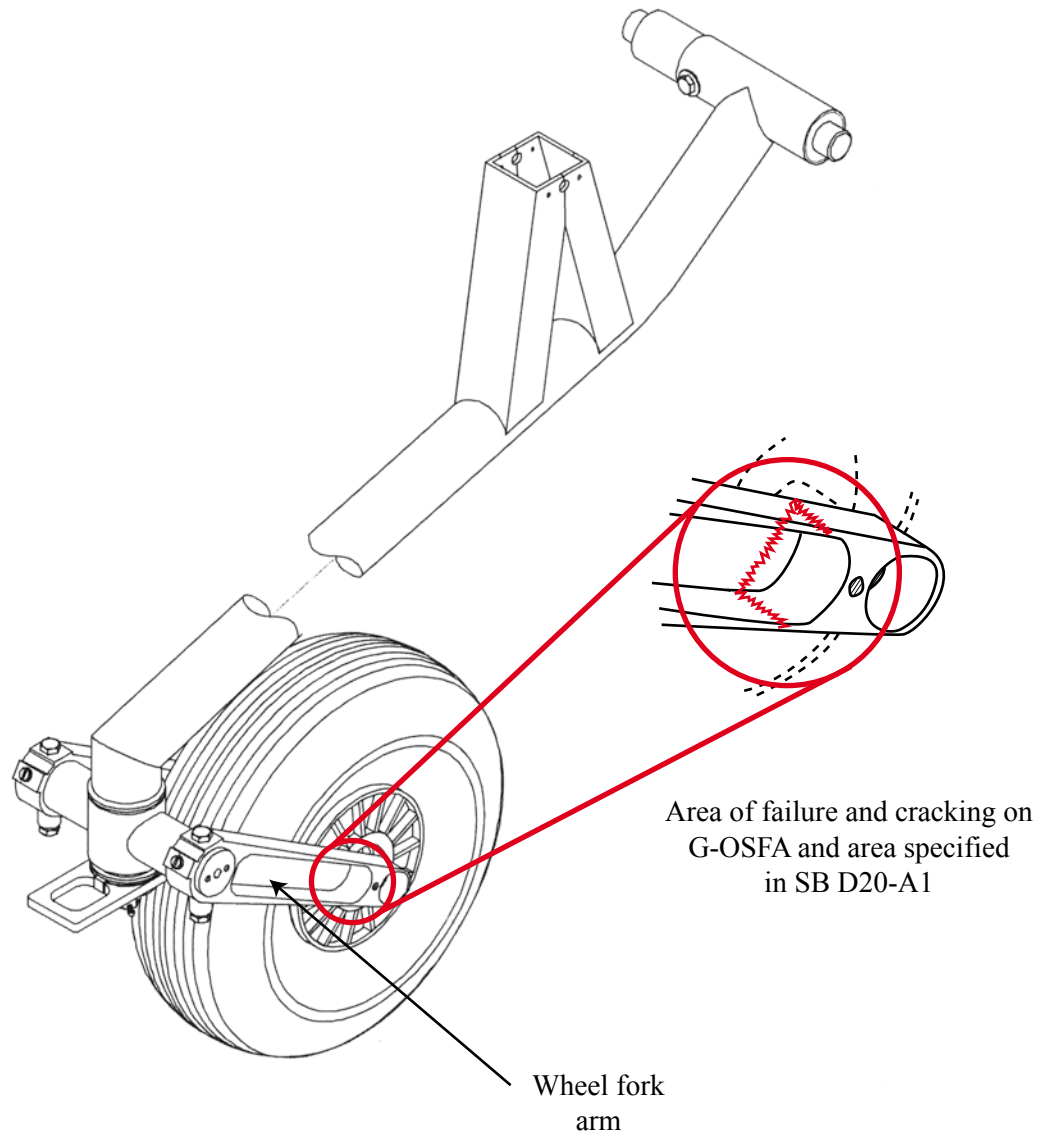


Figure 1 *Adapted from manufacturer's drawing*

Nose Landing Gear

5.00-4 tyre fitted there is a 10 mm clearance between the tyre sidewall and the inside of the nosewheel fork arm whereas with a 4.00-4 tyre there is a 15 mm clearance.

Previous nosewheel fork arm cracking on G-OSFA

In June 2005 the nosewheel fork arms fitted to G-OSFA were found to have cracks in very similar positions to the failures that are the subject of this investigation. These fork arms had been retained by

the operator and were made available to the AAIB, who submitted them for metallurgical examination. Initial examination showed that both fork arms had cracked approximately 45 mm forward of the wheel's axle hole in the fork (Figure 1). Detailed examination showed that both fork arms had cracked in simple upward bending overload. Both fork arm cracks contained fretting products and debris indicating that the cracks had been present for a considerable time and that they had been subjected to a large number of upward cyclic bending loads. These cyclic bending loads had progressed the crack in the right fork arm. There were no pre-existing material defects or damage to either of the fork arms. It was seen from the general appearance of the material surfaces that the fork arms had been sulphuric acid anodised.

As noted on the fork arms involved in the accident, there had been contact between the insides of the arms and the sidewalls of the nosewheel tyre.

Previous accident to G-OSFA

On 15 November 2005 G-OSFA was involved in a landing accident where, as a result of a heavy landing, the nose landing gear leg failed (AAIB Bulletin No 2/2006). The nosewheel fork assembly was inspected, found to be serviceable and fitted to the replacement nose leg.

Manufacturer's inspection requirement

In January 1999 Diamond Aircraft (Canada) issued Service Bulletin (SB) No DA20-32-02 (not mandatory), titled Nose Gear Fork Fatigue, which required the inspection of nose landing gear wheel fork arms fitted to DA20-A1 aircraft for evidence of cracking. The SB states:

General: *As a result of hard landings, cracks have appeared in nose landing gear forks of some aircraft. This service bulletin is divided into two parts. Part 1 addresses an inspection of the nose gear fork. Part 2 addresses modifications required to remove the nose gear fork and replace it with an optional heavy duty fork.*

Compliance: *Compliance with Part 1 of this service bulletin is urgently recommended upon receipt of this bulletin. Compliance with Part 2 is recommended.*

Accomplishment Instructions: *.....Continued inspection every 100 hours in accordance with the Aircraft Maintenance Manual is required.'*

The nose landing gear wheel fork arms fitted to the Diamond HK36-TC aircraft are of very similar design to those fitted to the Diamond DA20-A1. The area of the fatigue cracking that is described in SB No DA20-32-02 is similar to where the cracking occurred in the fork arms of G-OSFA, the aircraft that is the subject of this report.

Safety Recommendations

As a result of the two events that have occurred to G-OSFA and similar events to DA20-A1 aircraft the following safety recommendations are made:

Safety Recommendation 2006-113

It is recommended that Diamond Aircraft Industries, the aircraft manufacturer, issue a service bulletin for HK36-TC aircraft requiring immediate and recurring inspections for cracking of the nose landing gear wheel fork arms.

Safety Recommendation 2006-114

It is recommended that Diamond Aircraft Industries, the aircraft manufacturer, fully appraise the sulphuric acid anodising of the nose landing gear wheel fork arms that are fitted to HK36-TC aircraft for its effect on fatigue crack resistance.

Safety Recommendation 2006-115

It is recommended that the European Air Safety Agency (EASA) review the design, manufacturing and material specifications for Diamond HK36-TC nose landing gear wheel fork arms for their suitability for continued airworthiness.

Further information

The aircraft manufacturer commented that, in their experience, the majority of cracks in the nosewheel fork have been due either to 'shimmy' (although there was no evidence of this in the accident to G-OSFA) or to hard landings. The 'shimmy' is generally attributed to improper friction adjustment of the damper in the nose landing gear.