

ACCIDENT

Aircraft Type and Registration:	DA 40 Diamond Star, G-CBFA	
No & Type of Engines:	1 Lycoming IO-360-M1A piston engine	
Year of Manufacture:	2001 (Serial no: 40.063)	
Date & Time (UTC):	16 July 2016 at 1546 hrs	
Location:	Old Warden Aerodrome, Bedfordshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 2
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Nose landing gear leg, nose wheel, propeller and possible damage to engine	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	42 years	
Commander's Flying Experience:	269 hours (of which 38 were on type) Last 90 days - 26 hours Last 28 days - 21 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The nose gear leg failed whilst the aircraft was taxiing. Detailed examination of the failed leg concluded the failure was due to a fatigue fracture. Because of previous similar failures, this part number nose gear leg was subject to an Airworthiness Directive that required regular inspection for cracks. This inspection had been completed 33 flying hours earlier, with no defect found. Since then the aircraft had been used for basic training, which involved a large number of takeoffs and landings from grass runways.

History of the flight

The pilot of G-CBFA had hired the aircraft from a flying training organisation based at Redhill Aerodrome, which has three grass runways.

The pilot and two passengers had flown to Compton Abbas Airfield before flying to Old Warden Aerodrome, where they had landed on grass Runway 21, which was dry. The pilot reported that the landing was uneventful, but as the aircraft was taxied from the runway towards the parking area, it "felt very sluggish as though taxiing across long grass or soft ground". The aircraft then came to almost a complete stop and the pilot applied engine power, at which point the nose landing gear wheel detached and the aircraft tipped forward. The propeller struck the ground and the engine stopped. The pilot and passengers were uninjured and vacated the aircraft unaided.

The pilot inspected the ground around the aircraft, and could find no cause for the aircraft stopping. The pilot later commented that the aircraft had also felt “slightly unusual” when taxiing on the ground at Compton Abbas, but had assumed that this was due to the grass surface. Subsequently, he considered that this may have been the “first signs” of a problem with the nose gear.

Relevant technical information

In 2005, Airworthiness Directive (AD) A-2005-005 was issued to inspect for cracks on the nose landing gear leg (part number D41-3223-10-00) fitted to DA 40 aircraft. The AD was issued following the failure of the nose gear leg fitted to an aircraft that had been mainly operated on grass runways and for the purposes of training. The AD required that aircraft predominantly (more than 50% of the time) operated on grass runways be inspected at intervals not exceeding 100 flight hours, and those operated for more than 50% of the time from paved runways not more than every 200 flight hours. In 2009, AD A-2005-005 was superseded by AD 2009-0016, which retained the previous inspection limits unless the nose gear leg had been replaced with a modified leg, for which no further inspections were required.

The nose landing gear leg fitted to G-CBFA was part number D41-3223-10-00, and therefore routine inspection was required. As the aircraft was predominantly operated from the grass runways at Redhill Aerodrome, the inspection limit of no more than 100 flight hours was applicable.

Technical examination of the failed nose gear leg

The fracture surfaces were examined by a metallurgical consultant, who concluded that the failure was due to a fatigue fracture which had progressed approximately half way across the part, Figure 1. At this point the nose leg had failed in overload, resulting in separation of the nosewheel assembly.

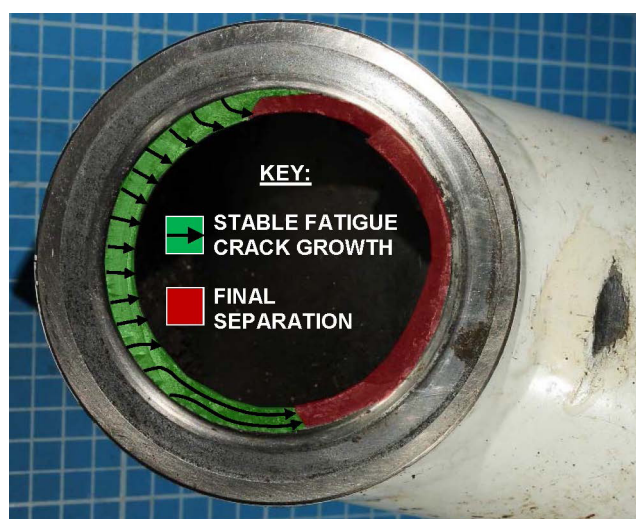


Image courtesy ms4i

Figure 1

Failed part of nose gear leg, view looking up with forward to the left showing fatigued area (green) and crack growth

Photographs of the failed parts were also sent to the aircraft manufacturer. Its materials expert reached similar conclusions, adding:

'It is difficult to tell something about the number of landings, the distance the aircraft has to taxi on ground that a fatigue fracture can propagate as shown in the pictures. It is also possible that the propagation of fatigue or forced fracture was favored by one or more hard landings.'

Relevant maintenance history

The nose gear leg had last been inspected in accordance with AD A-2005-005 on 27 May 2016 and no defect was found. The aircraft had at that time flown 1,558.5 hours. Since then it had been used mainly for basic training and had operated for approximately 33 flight hours, during which it had made 85 takeoffs and landings. These included touch-and-gos; the majority were on grass runways.

Discussion

AD A-2005-005 was issued after failures of a similar nose gear legs and requires regular use of a dye penetrant inspection to identify the formation of cracks. The successful use of dye penetrant relies on thorough cleaning of the part so that the dye is able to penetrate a crack. The inspection is conducted with the leg installed and the area being inspected is greased. Although it is straightforward to remove grease from the general inspection area, it may be more difficult to sufficiently clean the grease from inside a crack to allow the dye to penetrate. However, in this case, there was no evidence that the maintenance organisation had incorrectly carried out the inspection.

It is also possible that the nose gear leg may have been inadvertently subjected to frequent and possibly excessive loads whilst operating from grass runways, particularly in the basic training environment where more time is spent practising takeoffs and landings.

Conclusion

The failure of the leg is similar to previously known failures and the crack occurred in the area highlighted for inspection by AD A-2005-005. The failure occurred 33 flight hours after the last inspection and there was no evidence that the maintenance organisation had incorrectly carried out the inspection.

The potential for unpredictably harsh and abrupt loads when operating from grass runways can have a detrimental effect on landing gear life. The aircraft manufacturer, which is aware of this failure, had previously modified the original nose gear leg design as a result of in service experience. Pre-modified nose gear legs to the original design, similar to this, remain subject to regular inspections under AD A-2005-005.