ACCIDENT

Aircraft Type and Registration:	Cessna Citation 560XL, EC-KPB
No & Type of Engines:	2 Pratt and Whitney PW545C turbofan engines
Year of Manufacture:	2008
Date & Time (UTC):	1 June 2022 at 1420 hrs
Location:	RAF Northolt, South Ruislip, Middlesex
Type of Flight:	Commercial Air Transport
Persons on Board:	Crew - 2 Passengers - 3
Injuries:	Crew - None Passengers - None
Nature of Damage:	Detached nosewheel and fractured nose gear forks
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	48 years
Commander's Flying Experience:	3,800 hours (of which 850 were on type) Last 90 days - 243 hours Last 28 days - 78 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional enquiries with the operator

Synopsis

Whilst taxiing, after landing, the nose landing gear wheel detached from the aircraft. Assessment of the wheel assembly identified that one of the conical bearings within the axle assembly had failed, most likely as a result of corrosion. The cause of the onset of corrosion could not be determined.

History of the flight

Whilst taxiing after a normal landing the crew heard an unusual noise from the aircraft and then felt the front of the aircraft drop.

The nosewheel had detached from the nose landing gear (NLG) leg and came to rest in the grass adjacent to the taxiway, leaving the forks on the NLG resting on the taxiway (Figure 1).

Figure 1

EC-KPB broken NLG fork assembly
(reproduced with permission)

Aircraft information

The Cessna Citation 560XL has a traditional tricycle landing gear. The NLG has a single strut arrangement with a single wheel attached to the fork (Figure 2). The NLG is steerable via the pilot's rudder pedals and is not braked.

The nosewheel assembly on EC-KPB was last replaced in September 2021 and had been fitted for 337 flying hours and 230 cycles. Prior to being fitted, the wheel assembly had been reconditioned in accordance with the manufacturer's component maintenance manual. Grease was applied at the time it was fitted. According to the Aircraft Maintenance Manual (AMM) no maintenance was required to be carried out on the wheel since it was fitted, and none was carried out.

It was not possible to establish whether the bearings were new or re-used when they were fitted during the wheel reconditioning, but they would have been inspected at the time. It is likely that they were of similar usage; however, this could not be confirmed.

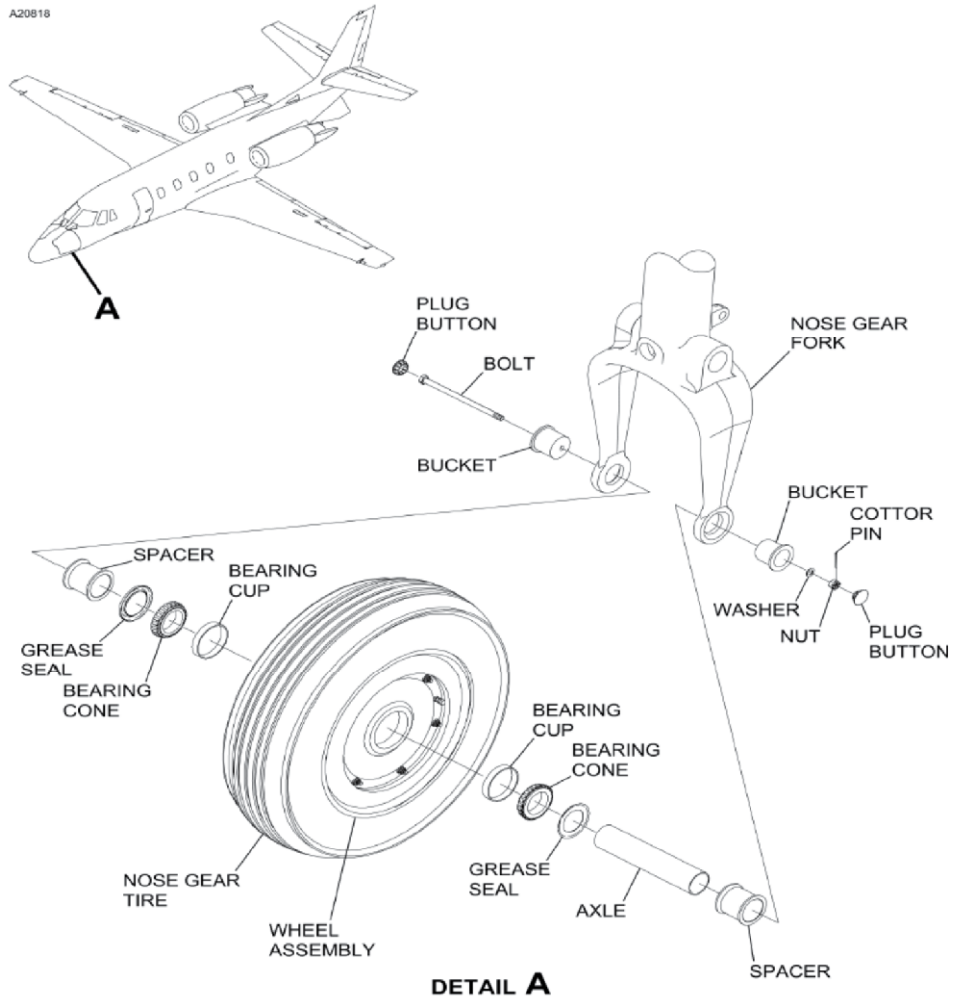

Figure 2

Cessna Citation 560XL NLG arrangement
(reproduced with permission)

Examination of the wheel assembly

One of the conical bearings in the wheel assembly had failed. Due to the extensive damage to the bearing, laboratory examination could not determine the cause of the failure; however, examination of the non-failed bearing identified evidence of multiple lines of material pitting along the length of the rollers and a band of corrosion pitting around the shoulder (Figure 3). Similar indications on the cone (Figure 4) and cup were noted. This was indicative of corrosion pickup between the rollers and races, the linear pitting was particularly indictive of corrosion whilst the bearing was stationary. As both bearings operated in the same environment, it is likely the failed bearing would also have been corroded.

Although only a small amount of grease remained on the failed bearing components, as it had burnt off due to the heat generated during the bearing failure, grease was found within the wheel cavity. This grease type was consistent with the grease approved in the AMM. The grease seal, which protects the bearing from ingress of moisture and dirt from the

outside environment, and is located outboard of the bearing, was damaged during failure of the bearing. It, therefore, could not be determined if the seal was functioning correctly before the bearing failed.

Figure 3

Roller bearings from the non-failed bearing, exhibiting linear and circumferential pitting

Figure 4

Roller bearing cone from the non-failed bearing, exhibiting linear pitting and corrosion around the track shoulder indicating the onset of corrosion

Failure sequence

Examination of the wheel components determined a possible failure sequence as follows:

1. Corrosion pitting in the bearing races caused spalling and then disintegration of the bearing cage.
2. This caused the rollers to skid and due to a combination of frictional heating and loose material the bearing seized, causing the axle to spin on the buckets that support it at each end. This generated more heat.
3. A combination of the heating and sideways loading caused the spacer on the side of the failed bearing to disintegrate.
4. As the spacer failed, the side load caused the axle to migrate towards it, hot working the end of the axle, which was splayed by the bucket, forming a flange.
5. The axle then continued to migrate until it disengaged from the bucket on the non-failed side, snapping the through bolt.
6. The wheel then twisted out of the forks and separated from the aircraft.

Conclusion

The detachment of the NLG wheel resulted from a failure of the conical wheel bearing within the hub. The cause of the bearing failure could not be directly established; however, the non-failed bearing in the wheel assembly exhibited evidence of corrosion. As the bearings operated in the same environment it is possible that the failed bearing was also corroded which is likely to have played a part in its failure sequence. The cause of the onset of corrosion could not be determined.