ACCIDENT

Aircraft Type and Registration:	Grob G115A, G-GPSX
No & Type of Engines:	1 Lycoming O-235-H2C piston engine
Year of Manufacture:	1988 (Serial no: 8040)
Date & Time (UTC):	7 December 2020 at 1420 hrs
Location:	Nottingham City Airport, Nottinghamshire
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Collapsed nosewheel, bent propeller
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	41 years
Commander's Flying Experience:	410 hours (of which 360 were on type) Last 90 days - 130 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional AAIB enquiries

Synopsis

The nose landing gear gas strut piston rod failed under overload during a touch-and-go landing. Three previous occurrences of similar failures on the Grob G115 were due to the incorrect fitment of the sliding tube during maintenance of the nose landing gear. The failure in these cases occurred within days following the maintenance. However, for G-GPSX, the last maintenance that required the dismantling of the nose landing gear was in August 2017. Since then, the aircraft had accumulated about 1,000 hours flying time.

History of the flight

The event occurred on a training flight during which the student was practising exercises 12 and 13 (takeoff and climb to downwind position / circuit, approach and landing). Following the first few touch-and-go landings everything appeared normal, then, during a subsequent circuit, both the instructor and student heard a "cracking" noise. They continued with the exercises and the next touch-and-go landing was uneventful. However, during the following landing the same, but this time louder, "cracking" noise was heard as the student applied full power for the takeoff.

The instructor contacted the Air/Ground radio operator to ask for someone to visually inspect the aircraft on the next approach. The pilot of another aircraft in the circuit then reported that the nosewheel appeared to be "swaying backwards and forwards". On hearing this information, the instructor took control of the aircraft and transmitted a MAYDAY call.

For the landing, the instructor prolonged the flare as much as possible to minimise the nose landing gear contact with the paved runway surface. During the landing rollout, the aircraft derotated onto the upper half of the nose landing gear, with the nosewheel assembly dragging behind, still attached by the scissor torque link (Figure 1), allowing the propeller blades to contact the ground.

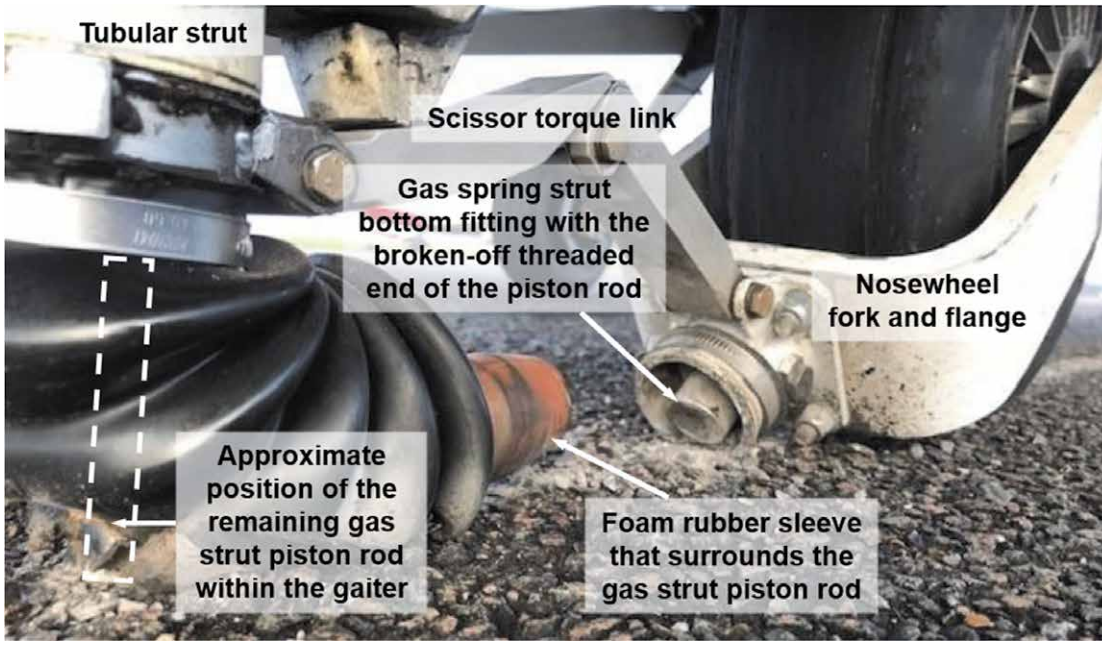

Figure 1

Nose landing gear assembly after landing

Nose landing gear assembly and failure

The nose landing gear assembly consists of a steel housing secured to the airframe, into which fits a tubular strut that is connected to the steering yoke at the top and, via a scissor torque link, to a flange on top of the nosewheel fork assembly. The steel housing is raked forward relative to the fuselage. Inside the tubular strut is a gas spring strut shock absorber. The cylinder end of the gas strut is also connected to the steering yoke, and the piston rod end to the flange on top of the nosewheel fork assembly. A number of these components can be seen in Figure 1.

The piston rod is surrounded by a foam rubber sleeve, with a loose spacer washer at either end of the sleeve, which is housed inside a sliding tube (that slides within the tubular strut). The end of the piston rod is threaded into a bottom fitting. Figure 2 shows these components (from another aircraft) with the sliding tube slid part way up the foam rubber sleeve to expose the piston rod bottom fitting. The bottom fitting and sliding tube both sit inside the flange attached to the nosewheel fork assembly, held in place by a nut and bolt. A black rubber gaiter covering the sliding tube is attached by jubilee clips to the tubular strut and nosewheel fork flange.

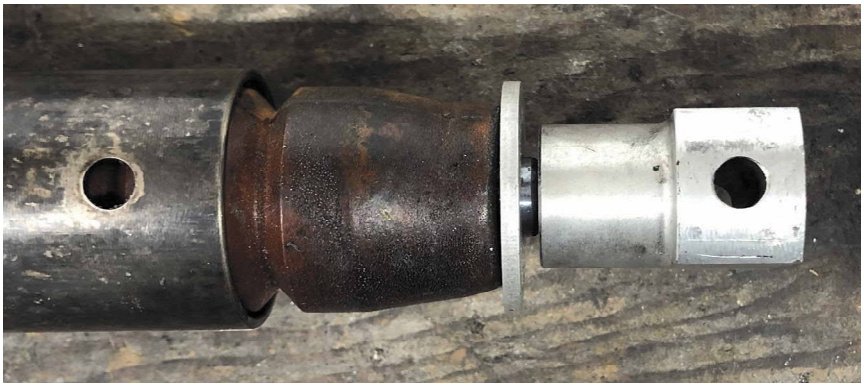

Figure 2

Example sliding tube, gas strut piston rod sleeve and bottom fitting with piston rod just visible as it enters the bottom fitting

The gas strut piston rod is chamfered to the diameter of the thread root at the start of the threaded section (Figure 3).

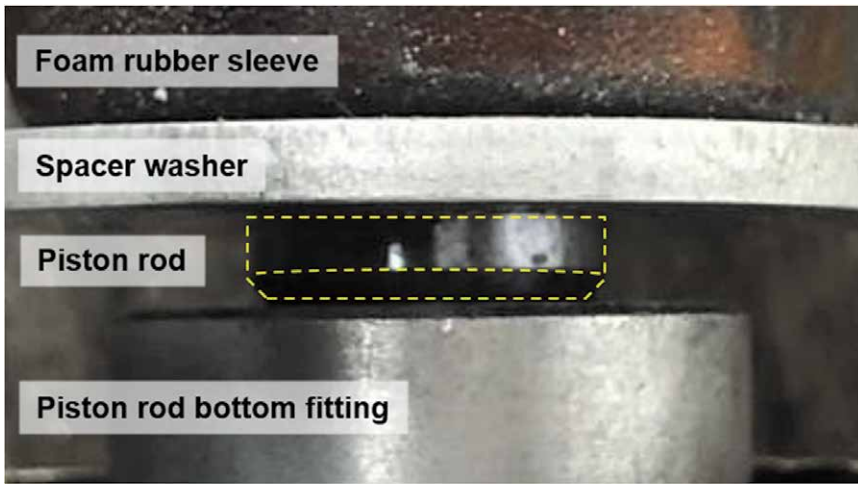

Figure 3

Close-up showing piston rod chamfer at start of threaded portion of the piston rod inside the bottom fitting (the visible part of the piston rod is highlighted)

The bottom fitting from G-GPSX can be seen in Figure 1 which shows that the gas strut piston rod fractured at the start of the threaded section. The sliding tube fell from the aircraft at some point during the last circuit, when the nosewheel assembly would have been swaying from the scissor torque link. The sliding tube was not recovered nor were any fragments of it found trapped between the bottom fitting and bolt in the flange.

Maintenance history

The last maintenance carried out on the aircraft, that required the dismantling of the nose landing gear, was in August 2017 during which the gas spring strut was replaced. Since then, the aircraft had accumulated about 1,000 hours flying time.

Previous occurrences

The AAIB has investigated three previous occurrences of similar nose landing gear leg failures on the Grob G115. In each case, the sliding tube had not been installed properly following maintenance. The first was in February 2003 (G-BVHG - AAIB Bulletin 9/2003) where, following this accident, the maintenance organisation added additional steps and warnings in their procedures about the correct installation of the sliding tube. The second accident occurred in November 2006 (G-BYVZ - AAIB Bulletin 2/2006), which resulted in the maintenance organisation introducing a duplicate inspection requirement to ensure that the flange and sliding tube are correctly assembled. The third accident happened in May 2007 (G-BYWE - AAIB Bulletin 9/2007) after maintenance work to replace the gaiter, during which the maintenance procedure, put in place to check for the correct installation of the sliding tube, was not carried out.

In all three accidents, the failure of the piston rod occurred within days of the incorrect installation of the sliding tube.

Discussion

The sliding tube protects the gas spring strut from any bending loads induced on the nose landing gear during taxiing, takeoff and landing. If the sliding tube migrates upwards out of the flange, the protection is lost, and the bending forces are absorbed by the gas spring strut instead. For the three previous occurrences, the failure of the gas strut happened within days of maintenance work during which the sliding tube had not been secured in place. For this accident, the failure happened after about 1,000 hours flying time after the last time the nose landing gear had been dismantled. It is unlikely, therefore, the sliding tube could have remained in the flange unsecured for so long, had it not been fitted correctly during the maintenance work. Equally, it is not possible to establish how the sliding tube could have failed without leaving any fragments trapped in the flange.

Conclusion

The nose landing gear gas strut piston rod failed under overload during a touch-and-go landing. Previous similar occurrences on other aircraft occurred within days following maintenance on the nose landing gear. However, this aircraft had accumulated about 1,000 flight hours since the last maintenance on the nose landing gear, which would indicate that the maintenance carried out was not a factor in this event. It was not possible to establish the cause of the piston rod failure.