Accident

Aircraft Type and Registration:	Piper PA-28R-200, G-BCPG	
No & Type of Engines:	1 Lycoming IO-360-C1C piston engine	
Year of Manufacture:	1970 (Serial no: 28R-35705)	
Date & Time (UTC):	21 April 2024 at 1220 hrs	
Location:	Teesside International Airport, Durham	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to gear leg, retraction mechanism, mounting brackets, wing spar and upper wing structure	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	49 years	
Commander's Flying Experience:	400 hours (of which 200 were on type) Last 90 days - 0 hours Last 28 days - 0 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

Synopsis

During taxi, the left main landing gear collapsed aft. Inspection of the landing gear installation revealed that the landing gear retainer tube assembly had unscrewed which released one of the gear's two mounting points. The forces encountered by the landing gear leg during the taxi, tore the leg out of the remaining forward mounting point, causing significant damage to the left wheel well, landing gear and wing.

The manufacturer will be updating the aircraft maintenance manual to include a torque setting for the retainer tube bolt in the next revision of the manual.

History of the flight

The pilot had completed a 50 hr check and planned to go for a short local flight. He taxied to hold C of Runway 05 to carry out engine checks, but as he turned left into the wind, he heard a loud thud and the left wing dropped. He shut down the engine, turned off the master switch and, uninjured, vacated the aircraft. External visual inspection confirmed that the left main landing gear had collapsed. Contrary to the pilot's expectation, however, the leg had not folded inwards as it would during a retraction, but instead it was pointing aft (Figure 1).

Figure 1

Left main landing gear collapsed rearwards

Aircraft examination

Main landing gear assembly

The landing gear assembly is attached to the wing spar in the wheel well on the underside of the wing by support fittings and gear support bearings, forward and aft (Figure 2).

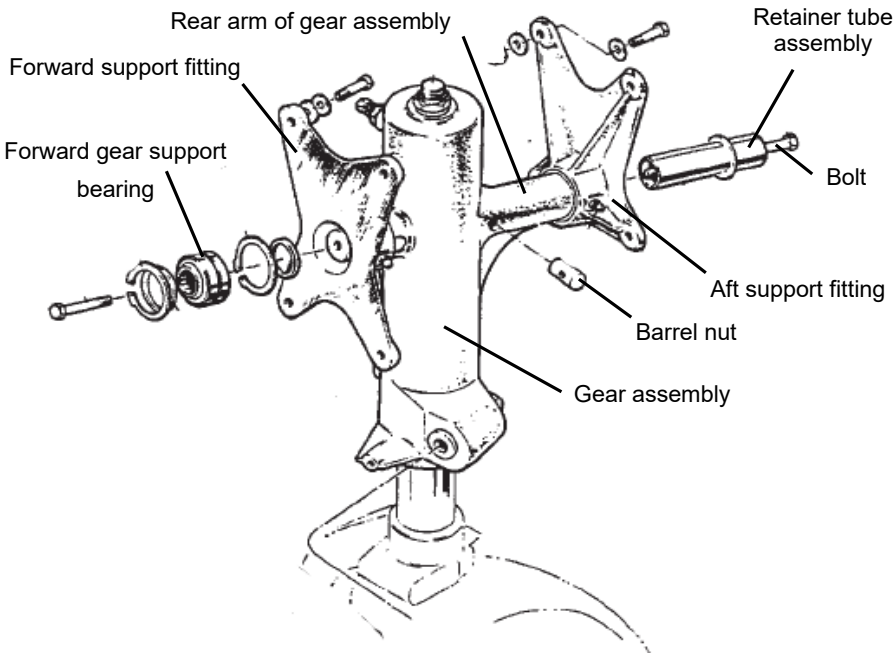


Figure 2

Schematic drawing of upper landing gear assembly

To fit the landing gear, the forward gear support bearing is bolted onto the forward arm of the gear assembly which is then fixed to the forward support fitting using washers and retainer rings[1]. The aft support fitting with the aft gear support bearing installed is then bolted to the rear attachment point in the wheel well under the wing. The retainer tube assembly is inserted into this support fitting via an access hatch on the underside of the wing adjacent to the wheel well. Once the gear is in position, the forward support fitting is bolted in place, attaching the forward arm of the gear assembly to the wing spar. The rear arm of the gear assembly is aligned with the gear support bearing in the aft support fitting, and the retainer tube assembly pushed into rear arm through the access hatch. The tube assembly bolt is then tightened into the barrel nut, fixing the rear arm of the gear assembly in place in the wheel well. Once these actions are complete, the gear assembly can pivot in the wheel well around both arms of the gear assembly, gear support bearings and fittings. The gear side brace assembly (not shown in Figure 2) can then be installed to provide gear retraction.

Examination of damage to the landing gear and wheel well

Inside the left wheel well, the landing gear was found mechanically disconnected from the wing. The forward support fitting was disrupted around the gear support bearing with parts of the bearing missing but some fractured remains still in the bracket (Figure 3). The centre of the forward support fitting was bent away from the wing spar and a hole had been punched through the upper surface of the wing. There were also deep score marks around a circular cut-out in the web of the spar.

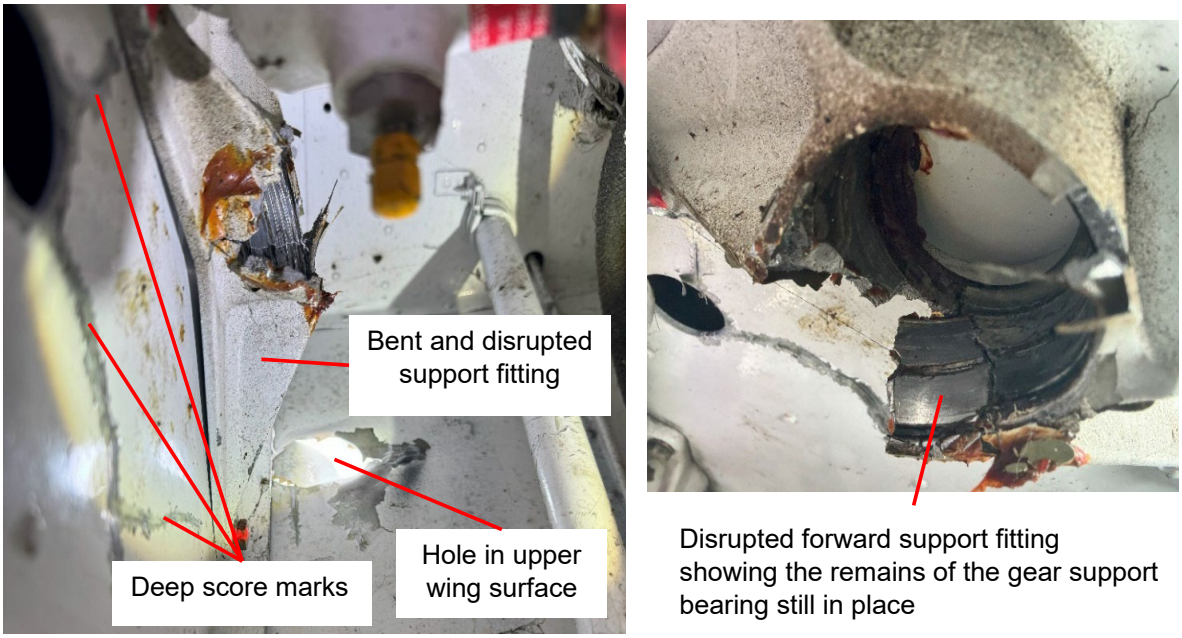


Figure 3

Looking upwards into the wheel bay at the forward support fitting (Left) and the disrupted fitting with the remains of the bearing still in place (Right)

Footnote

[1] This paragraph is only a brief overview of the process. The full installation process can be found in the Piper Cherokee Service Manual 753-586 PA-28-28R-180-200 SM_20210918 Section 7A-25.

The aft support fitting was largely undamaged with the aft gear support bearing intact and still installed in the fitting (Figure 4). The aft arm of the gear assembly was located close to the support fitting but not connected by the retainer tube assembly that would have been fitted during the installation of the landing gear leg. Once the access panel in the lower surface of the wing adjacent to the wheel well was opened, the retainer tube assembly was found loose in the access space. The barrel nut for the tube assembly bolt was still in place in the hole forward of the aft arm of the gear assembly (Figures 2 and 4).

Although the tube assembly showed some signs of wear, the bolt was intact (Figure 5). The thread of the bolt and the barrel nut were also undamaged but with some signs of wear. The barrel nut and tube assembly bolt were screwed back together successfully with no play evident.

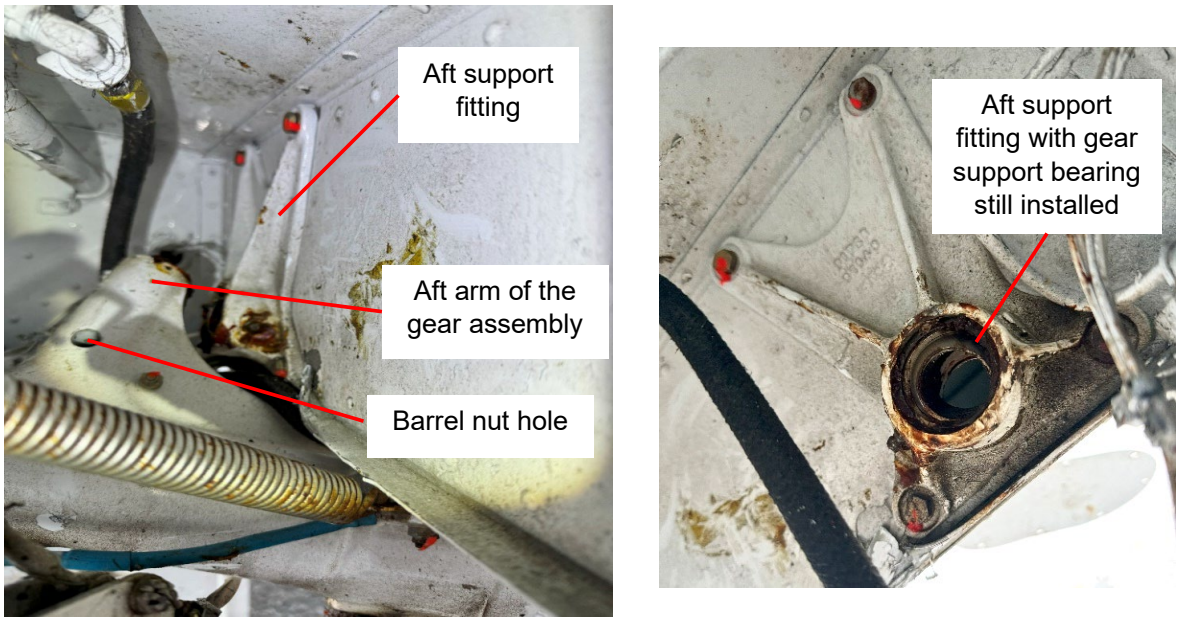


Figure 4

Looking upwards into the wheel bay at the aft support fitting (Left) and the undamaged fitting showing the intact gear support bearing still installed (Right)

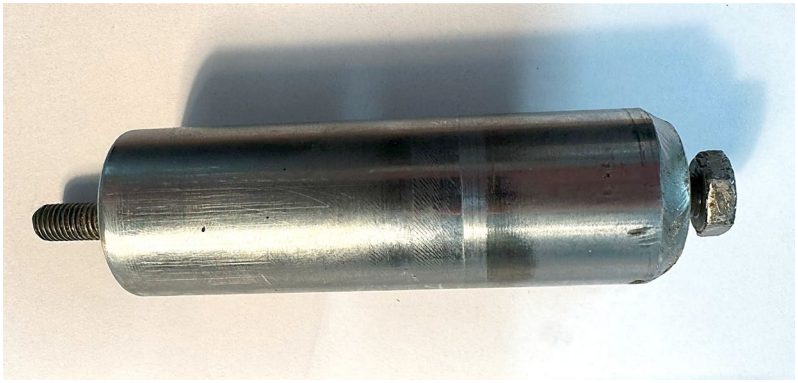
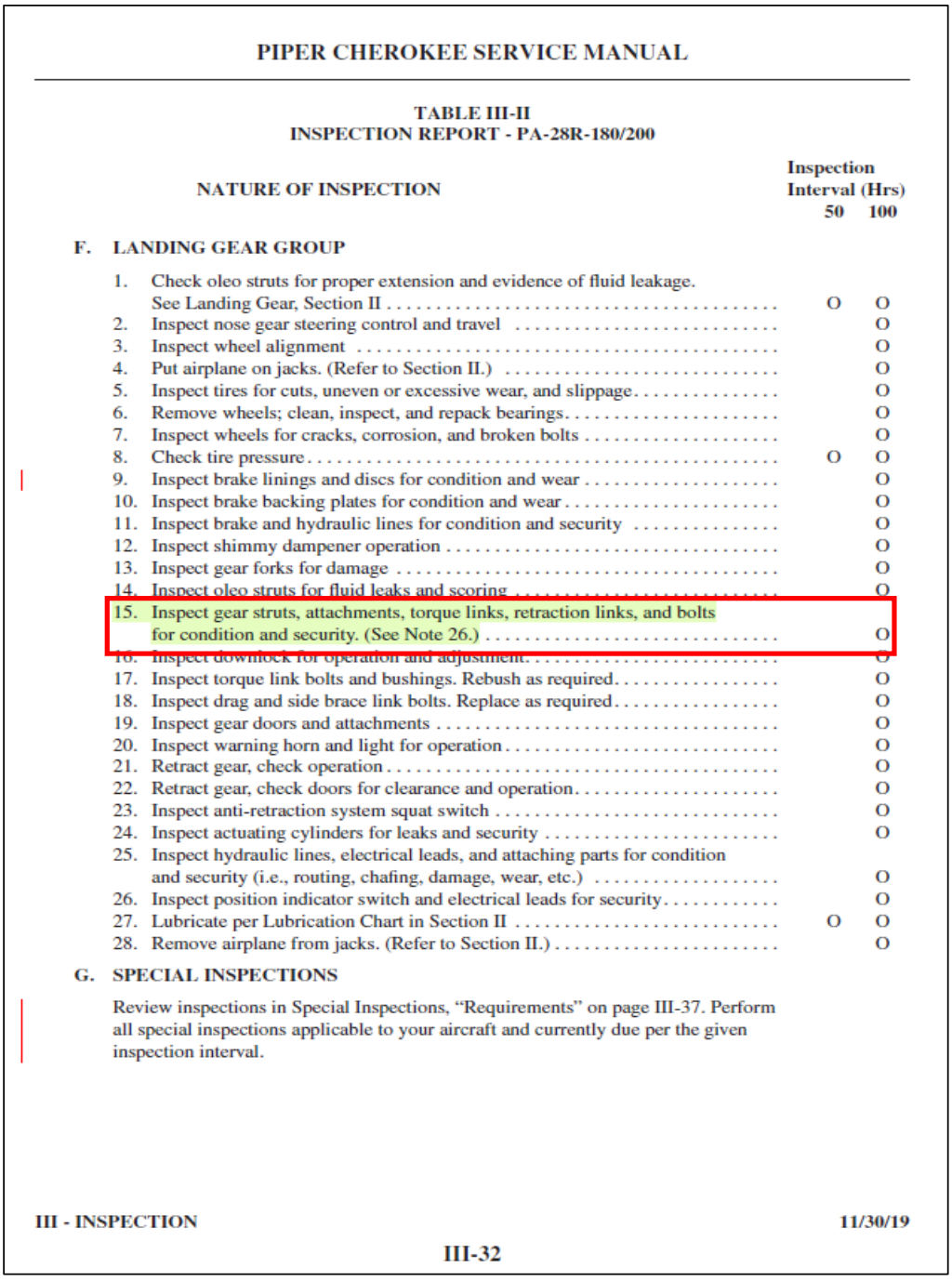


Figure 5

Retainer tube assembly and bolt

Main landing gear maintenance

The left main landing gear had been removed, serviced and re-installed in 2019. Since then, the landing gear had been inspected annually and the work had been carried out by three different maintenance organisations. The inspection instructions stated in the Piper Cherokee Maintenance Manual[2] are shown in Figure 6.



PIPER CHEROKEE SERVICE MANUAL

TABLE III-II
INSPECTION REPORT - PA-28R-180/200

NATURE OF INSPECTION	Inspection Interval (Hrs) 50	100
F. LANDING GEAR GROUP		
1. Check oleo struts for proper extension and evidence of fluid leakage. See Landing Gear, Section II	O	O
2. Inspect nose gear steering control and travel		O
3. Inspect wheel alignment		O
4. Put airplane on jacks. (Refer to Section II.)		O
5. Inspect tires for cuts, uneven or excessive wear, and slippage		O
6. Remove wheels; clean, inspect, and repack bearings		O
7. Inspect wheels for cracks, corrosion, and broken bolts		O
8. Check tire pressure	O	O
9. Inspect brake linings and discs for condition and wear		O
10. Inspect brake backing plates for condition and wear		O
11. Inspect brake and hydraulic lines for condition and security		O
12. Inspect shimmy dampener operation		O
13. Inspect gear forks for damage		O
14. Inspect oleo struts for fluid leaks and scoring		O
15. Inspect gear struts, attachments, torque links, retraction links, and bolts for condition and security. (See Note 26.)		O
16. Inspect downlock for operation and adjustment		O
17. Inspect torque link bolts and bushings. Rebush as required		O
18. Inspect drag and side brace link bolts. Replace as required		O
19. Inspect gear doors and attachments		O
20. Inspect warning horn and light for operation		O
21. Retract gear, check operation		O
22. Retract gear, check doors for clearance and operation		O
23. Inspect anti-retraction system squat switch		O
24. Inspect actuating cylinders for leaks and security		O
25. Inspect hydraulic lines, electrical leads, and attaching parts for condition and security (i.e., routing, chafing, damage, wear, etc.)		O
26. Inspect position indicator switch and electrical leads for security		O
27. Lubricate per Lubrication Chart in Section II	O	O
28. Remove airplane from jacks. (Refer to Section II.)		O
G. SPECIAL INSPECTIONS		
Review inspections in Special Inspections, "Requirements" on page III-37. Perform all special inspections applicable to your aircraft and currently due per the given inspection interval.		

III - INSPECTION 11/30/19

III-32

Figure 6

Piper Cherokee PA-28R-180/200 - 100-hour Inspection Requirements

Footnote

[2] Piper Cherokee Service Manual 753-586 PA-28-28R-180-200 SM_20210918.

The LAA generic maintenance schedule for the Permit to Fly[3], states the following inspection for the landing gear (Figure 7):

Landing Gear		
Inspect landing gear assemblies, shock-absorber struts/units for leaks and correct extension, brake system, brake linings, drums/discs, wheels and tyres.		
Service tyre pressures, hydraulic brake system fluid level.		
Inspect structural members, attachment fittings, pivot points, shock absorbing devices, bungee rubbers, torque links, shimmy dampers, main wheels, nose/tail wheels, bearings, skids, hoses and lines, hydraulic and electric actuators, jacks, struts, wheel fairing. Note: Carry out with weight off the landing gear.		
Operational check of main and parking brake systems.		
Operational check of normal/emergency retraction and extension, locking devices, doors and operating linkages, indicators, warning devices.		
Check hydraulic/pneumatic operating system.		

Figure 7

LAA 12 Month/150-hour generic inspection schedule for landing gear

Analysis

As there was no damage to the thread of the retainer tube assembly bolt, and it screwed back into the barrel nut with no sign of play or damage, it is highly likely the bolt gradually unscrewed due to vibration since re-installation of the landing gear in 2019. Since installation, the landing gear had been inspected annually and by three different organisations. There is no specific check that the tube assembly bolt is secure, therefore, it is possible that the bolt tightness was not checked and gradually became unscrewed over 5 years since installation. This enabled the aft arm of the landing gear to disconnect from the bearing. The landing gear would then only have been held in place by the forward arm, bearing and fitting. The forces applied to the landing gear as the aircraft taxied were sufficient to tear the forward arm of the gear from the fitting and bearing resulting in the landing gear collapse experienced by the pilot and the damage seen in the gear well.

Data searches for accident reports which detail PA-28R landing gear collapses where the retainer tube assembly was causal found no arisings both in the UK and the USA. Following consultation with the aircraft manufacturer, the PA-28R-201 aircraft (which has a similar landing gear arrangement) maintenance manual specifies a torque of 40 – 50 inches lb for the retainer tube bolt. This specification will be incorporated into the PA-28R-180/200 maintenance manual at the next revision.

Footnote

[3] LAA Permit to Fly Generic Maintenance Schedule Form LAA/GMS/12/150 Issue 2 April 2022.

Conclusion

The landing gear collapse that occurred whilst the aircraft was taxiing was likely to have been caused by the left main landing gear retainer tube bolt releasing the aft landing gear arm which allowed the gear to collapse and cause significant damage to the wing. The manufacturer will be issuing an update to include a torque setting for the retainer tube bolt during the next revision of the maintenance manual for this aircraft type.