

SERIOUS INCIDENT

Aircraft Type and Registration:	Cessna F177RG, G-AYSY	
No & Type of Engines:	1 Lycoming IO-360-A1B6 piston engine	
Year of Manufacture:	1971 (Serial no: 26)	
Date & Time (UTC):	7 September 2020 at 1500 hrs	
Location:	Leicester Airport	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Minor)	Passengers - 1 (Minor)
Nature of Damage:	Damage to the nose landing gear, propeller and engine	
Commander's Licence:	Light Aircraft Pilot's Licence	
Commander's Age:	31 years	
Commander's Flying Experience:	105 hours (of which 76 were on type) Last 90 days - 20 hours Last 28 days - 12 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

Returning to Leicester Airport after a flight away from base, the pilot of G-AYSY completed a normal join and circuit to Runway 28. The landing gear was lowered and a check of both the indicator lights and the external mirror showed it to be down and locked. Shortly after landing, as the aircraft reduced speed, the nose landing gear collapsed. Both the pilot and passenger were able to vacate the aircraft and suffered only minor injuries. The cause of the nose gear collapse was not established.

History of the flight

The pilot had completed three circuits at Leicester before meeting up with his passenger for a flight to Newquay via Cardiff before returning to Leicester. The pilot reported no technical issues with the aircraft all day. There was no indication on any of the previous flights or landings that there were any issues with the landing gear and the pilot reported that the extension prior to the landing at Leicester was normal.

Having touched down, the pilot reported that the aircraft began to slow as he expected. The pilot retracted the flaps and as the aircraft speed passed around 40 mph the nose gear collapsed following what he reported as a "metallic sound". The aircraft continued along the runway for approximately 70 metres before coming to a stop, still on its main wheels but with the nose resting on the tarmac. Both the pilot and passenger were able to vacate the

aircraft and suffered only minor injuries. The aircraft suffered damage to the nose landing gear and nose gear doors, propeller and engine. Figure 1 shows the aircraft on the runway.



Figure 1

G-AYSY on the runway at Leicester

Aircraft information

G-AYSY is fitted with a retractable tricycle landing gear. The landing gear is retracted and extended by hydraulic actuators powered by an electrically driven hydraulic power pack. The nose gear has an over-centre mechanical linkage to provide positive up and down locks for the nosewheel. It also has mechanically actuated gear doors that are open if the nose gear is down and closed if it is up. When the over-centre link is made, the hydraulic pressure to the actuator is removed. Proximity microswitches are used to sequence and control the landing gear system. When all three gear legs are down and locked, the electrically driven hydraulic pump is stopped. The green cockpit light illuminates only when all the gear is down and locked, and when the electrically driven hydraulic pump is no longer running.

There are two gear position indicator lights fitted in the cockpit. A green light indicating the gear is down and an amber light indicating the gear is retracted. There is also a mirror fitted to allow inspection of the position of the gear from the cockpit. The indicator lights use a microswitch which must be made in order to ensure the gear is in the selected position before the light will illuminate. The aircraft is also fitted with a warning horn which sounds intermittently when the throttle is retarded below approximately 12 inches of manifold pressure when the gear is up, or not down and locked. The pilot commented that the green extension light illuminated, and the gear extension looked normal in the examination mirror. There was no warning horn during the approach or landing. He has been flying the aircraft for some time, and having experienced a previous landing gear problem, he stated that he is very careful about its operation and indications.

The nose landing gear is fitted with a squat switch which prevents the gear being retracted when the aircraft is on the ground. The squat switch is a 'weight on wheel' switch. Until the squat switch is compressed it is possible to retract the gear, although the main gear is over-centred when down so is unlikely to be able to retract as soon as ground contact is made. The nose gear retracts rearwards.

G-AYSY had previously experienced a gear problem in 2019 which resulted in a landing without the main gear being locked down¹. This was as a result of a failure of a hydraulic pipe within the gear system. The aircraft was repaired and returned to flight.

Aircraft examination

After the landing a bolt was recovered from the runway which was identified as the nose gear centre torque link bolt. This bolt had been in contact with the runway surface after the nose gear collapse and as a result suffered significant damage. The nut from the bolt was also missing. There was also corresponding runway contact damage to the nose gear torque link. These were the only two parts of the nose gear that were found to have sustained damage, and they are shown in Figure 2. Their positions in the nose gear assembly are shown in Figure 3.

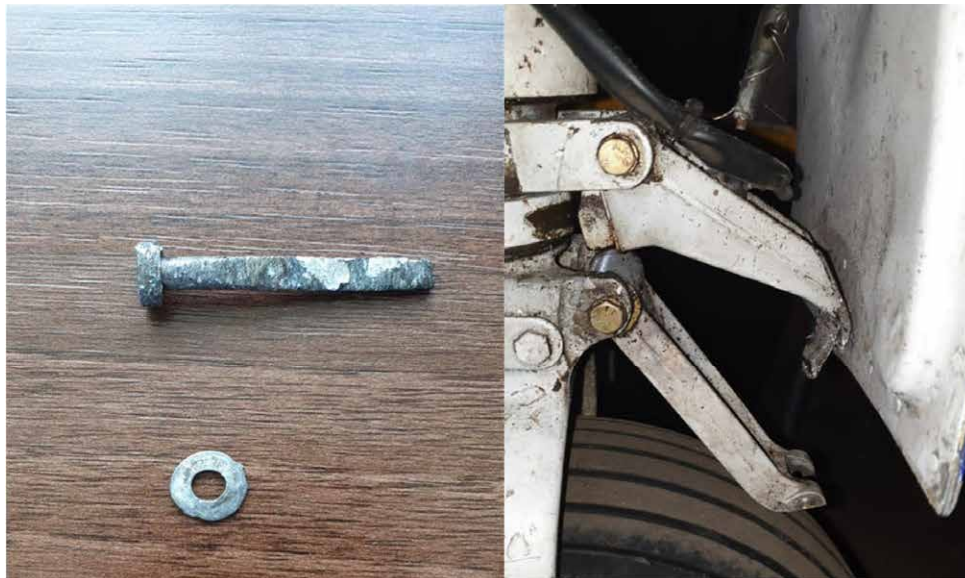
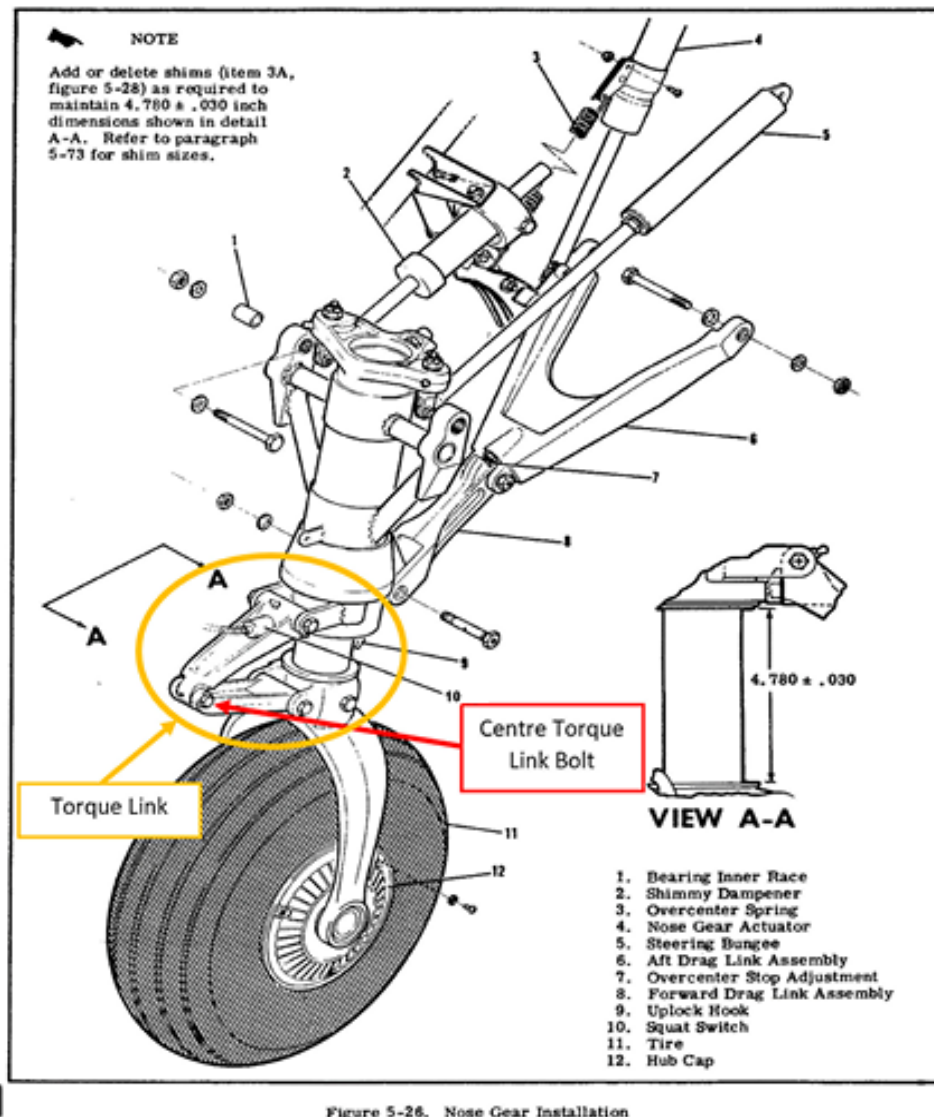


Figure 2

Centre torque link bolt (left) and torque link (right)
(used with permission)

Footnote

¹ <https://www.gov.uk/aaib-reports/aaib-investigation-to-cessna-f177rg-cardinal-rg-g-aysy>
[Accessed May 2021]



5-50 Change 1

Figure 3

Nosewheel diagram from the Maintenance Manual showing the torque link and bolt
(© Textron Aviation)

The aircraft was recovered from the runway and examined by a maintenance organisation. Testing of the individual components of the nose gear found no faults that could have caused the collapse. The retraction and extension system were tested and found to work normally. The maintenance organisation considered that the damage to the torque link bolt and torque link was an artifact of being in contact with the runway after the collapse, rather than contributing to the accident.

Analysis

With no damage to the remaining nosewheel structure it was considered unlikely that the nose gear had collapsed due to a heavy landing or overload. Such a load would have caused significant damage to the drag link assembly as well as the shock strut.

The pilot of G-AYSY had operated the retractable gear without incident or concern on the day of the accident. When he approached Leicester for his final landing of the day, he extended the gear, saw the green downlock indicator light and checked the gear extension in the mirror. After a normal landing, as the aircraft began to slow, the pilot retracted the flaps and shortly afterwards the nose gear collapsed. After a further 70 m, the aircraft came to a halt resting on its nose.

There are two possible scenarios for the retraction of the nose gear. Firstly, had the nose gear not been fully extended, with the over-centre lock not made, then a collapse of the nose gear could have occurred with little or no damage except for those parts in contact with the runway. For the gear down indicator light to illuminate in the cockpit and for the warning horn to be absent, the system must 'believe' that the legs were down and locked. The power pack pump must also no longer be pressurising the system. This can only occur when the microswitches that control the extension circuits are closed. The microswitches are proximity switches, and it is possible that a misalignment in one of these switches caused the extension system to indicate that the nose gear was down and locked when it was not.

Secondly, it is possible that the pilot inadvertently selected the gear to retract when he reached for the flaps after landing. Whilst the nose gear is fitted with a squat switch to prevent retraction on the ground, it may be that the weight was not sufficiently on the nose wheel for the switch to be made, and therefore retraction began. As soon as the over-centre mechanical lock begins to fold, any weight on the nose wheel would assist the retraction. The pilot is sure that he did not inadvertently knock or move the gear handle after landing. Having previous experience of gear problems on this aircraft, the pilot also commented that he was extremely vigilant about its operation.

The nose gear centre torque link bolt was recovered from the runway, which together with the torque link had suffered damage from contact with the runway. These were the only two parts of the nose gear to have been damaged. After the aircraft was recovered to a maintenance facility, the nose gear was checked with no further faults found.

Conclusion

After landing, and as the aircraft slowed on the runway, the nose gear collapsed. The damage found to the centre torque link bolt and the torque link was attributed to being in contact with the runway and was considered unlikely to have been a causal factor in the accident. No other components of the nose gear were found to be faulty and a test of the retraction/extension system worked correctly. Given the lack of further structural damage to the nose gear, it is likely that the nose gear mechanical over-centre lock was not fully extended, either due to a technical fault or because the gear was retracted inadvertently after landing. It was not possible to determine what caused the collapse of the nose gear.