ACCIDENT

Aircraft Type and Registration:	Piper PA-34-200T Seneca II, G-CLUE
No & Type of Engines:	2 Continental Motors Corp TSIO-360-EB piston engines
Year of Manufacture:	1979 (Serial no: 34-7970502)
Date & Time (UTC):	28 July 2013 at 1140 hrs
Location:	Durham Tees Valley Airport
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to left engine, propeller, main landing gear, flap and aileron
Commander's Licence:	Private Pilot's Licence
Commander's Age:	53 years
Commander's Flying Experience:	2,500 hours (of which 200 were on type) Last 90 days - 45 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft was intending to land at a private airstrip but the pilot was unable to obtain a green down-and-locked cockpit indication for the left Main Landing Gear (MLG). He returned to Durham Tees Valley Airport where, despite several attempts, he was still unable to receive confirmation that the gear was locked down. The emergency extension system was used but, during the subsequent landing roll, the left MLG collapsed.

It was found that a combination of factors, including corrosion and a lack of lubrication, had led to stiffness in the downlock mechanism such that it would not lock the gear down fully after free-falling under gravity following emergency extension. The electric pump which supplies hydraulic power under normal gear extension/retraction had burnt out.

History of the flight

Whilst attempting to land at a private airfield some 20 nm from Durham Tees Valley Airport, the pilot found that only the green down-and-locked indicator lights for the right MLG and the nose landing gear illuminated. This indicated that the left MLG had not extended. The pilot recycled the gear selection, but the same indications remained, so he climbed to 2,000 ft to assess the situation. He checked the fuses and swapped the indicator bulbs but the left MLG green down-and-locked light did not illuminate, so he decided to return to Durham.

Upon arrival, he requested a fly-by of the control tower so that they could check the status of the landing gears. He selected gear down again but this time received no green down-and-locked lights at all and could not see the nose gear in the mirror on the left nacelle; this was confirmed visually by the tower who reported that all the gears appeared to be retracted. A further reselection still did not result in any green down-and-locked lights. The pilot then advised the tower that he would deploy the emergency extension on the next approach and asked whether he should land on the grass or the ashphalt runway; he was told to use the runway.

Having performed the emergency extension checklist procedures, the landing gears extended under free-fall and the tower confirmed that all three appeared to be down. However the pilot states that he still had no green down-and-locked lights, but continued the approach, touching down as gently as possible on all three gears at stall speed. As soon as the wheels touched down, he isolated the fuel and electrics but, as he applied gentle braking, he felt the left side of the aircraft slowly sink towards the runway and saw the left propeller make contact with the ground before the aircraft came to a halt.

The two pilots evacuated the aircraft using the normal entry door which had been left ajar as a precaution. The emergency services attended but there was no fire.

Description of MLG extension/retraction system

The PA-34 Seneca uses hydraulic power supplied by a single reversible electric pump/reservoir to raise and lower the landing gear. Normal gear selections are made using a switch on the instrument panel labelled UP and DOWN.

When UP is selected, fluid pressure on the retract side of the pistons acts in that sense and the down line returns fluid to the reservoir. When fully retracted, the gears remain in that position due to hydraulic pressure in the actuator jacks; there are no uplocks.

When a DOWN selection is made, the pump operates in the opposite sense and the up line becomes the return line.

If hydraulic pressure is lost, all three gears should drop under their own weight. In addition to a loss of hydraulic pressure, the gears are designed to free-fall if the emergency extension valve is pulled.

The main gear downlock mechanism comprises a conventional over-centre sidestay, kept in lock by a pair of hooks engaging on a pin (Figure 1). Engagement of the hooks also actuates a microswitch to illuminate the associated down-and-locked green light in the cockpit. Under a normal, powered extension, the final movement of the actuator engages the hooks, but in a free-fall extension, a spring is used to engage the downlock hooks. If any one of the three gears fails to downlock, a gear-unsafe red warning light illuminates.

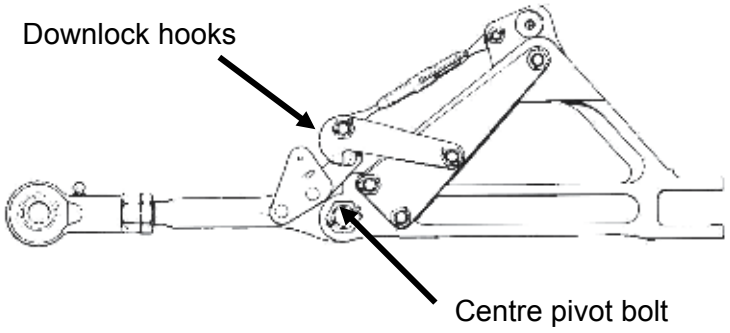

Figure 1

MLG downlock with hooks shown correctly engaged on pin

Examination of the aircraft

Following the accident, during recovery of the aircraft to a hangar, it was observed that the downlock hooks (Figure 1) would not engage and an improvised strut was used to secure the downlock to allow for towing to a hangar. Here the gear was retracted using a hand pump, since the aircraft electro-hydraulic pump also appeared to be inoperative, followed by a free-fall emergency extension. It was found that the nose and right main gears fell under gravity and locked normally but the left gear remained partially 'up' and had to be pulled down manually. The centre pivot bolt (Figure 1) was slightly slackened off and lubrication was applied to the downlock mechanism. Further free-fall extensions were successful inasmuch as the gear dropped fully down under gravity but the downlock hook still did not engage; levering the hook into engagement with a screwdriver was necessary to overcome stiffness caused by corrosion and lack of lubrication.

The inoperative hydraulic pump was also examined; after checking that all solenoids were working, the electric motor was opened for internal inspection. It was found that the brushes had completely burned out and the commutator was excessively worn.

Maintenance requirements

The CAA Light Aircraft Maintenance Programme (LAMP), to which G-CLUE was operated, required a detailed visual inspection of the landing gear components plus a check of the normal and emergency retraction/extension operating system every 150 flying hours. Both the examination and function checks are to be carried out with the aircraft on jacks.

Maintenance history

The aircraft had been at a maintenance organisation for maintenance work and an annual inspection starting in August 2012 at 4,619.5 airframe hours. The work was completed in November 2012. Following some additional rectification, the Airworthiness Review Certificate was signed on 1 March 2013 and it was intended that the aircraft would return to service on that date.

However, upon takeoff, after the maintenance, it was found that the landing gear would not retract, so the aircraft was flown to Blackpool with the gear extended. On arrival the

pilot carried out a touch-and-go, after which the gear retracted. Whilst carrying out some circuits the landing gear appeared to operate normally. The aircraft was then left at a maintenance organisation at Blackpool for additional maintenance, which included an action to address a problem with the '*Undercarriage light on*'. The rectification action recorded by the maintenance organisation was '*Microswitch adjusted, retraction test carried out*'.

The aircraft departed Blackpool on 21 March 2012 and flew for approximately 8 hours 30 minutes until the day of the accident.

Discussion

It is considered that the inability of the left MLG to lock down was the result of two separate factors: the first was the failure of the electro hydraulic pump that prevented normal extension of the landing gear, the second was the inability of the left MLG to fully lock-down under gravity because of overtightness of the pivot bolt in addition to corrosion and lack of lubrication. In the experience of the engineer who examined the aircraft post-accident, intermittent operation of the landing gear is often a symptom of excess wear of the brushes and commutator in the electro-hydraulic pump.