ACCIDENT

Aircraft Type and Registration:	Cessna F177RG Cardinal, G-AZVP
No & Type of Engines:	1 Lycoming IO-360-A1B6D piston engine
Year of Manufacture:	1972
Date & Time (UTC):	25 October 2009 at 1010 hrs
Location:	Derby Aerodrome, Derbyshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Propeller bent, damage to the underside of the front cowling and the landing gear doors
Commander's Licence:	Private Pilot's Licence
Commander's Age:	59 years
Commander's Flying Experience:	756 hours (of which 620 were on type) Last 90 days - 20 hours Last 28 days - 13 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

When the pilot initially lowered the landing gear, the green 'down-and-locked' light did not illuminate; this was due to a misaligned downlock microswitch on the left main landing gear. The pilot operated the emergency hand pump to manually extend the gear, on landing the nose leg collapsed. No other faults were found with the landing gear system and it is possible that during the manual extension there was insufficient pressure applied to fully lock down the nose leg.

History of the flight

After an uneventful flight the pilot entered the circuit for a landing at Derby. He operated the landing gear lever to lower the landing gear, however the expected green landing gear 'down-and-locked' light on the instrument panel did not illuminate. The pilot recycled the gear lever twice, but on both occasions the light remained extinguished. He then elected to lower the landing gear manually using the emergency hand pump. He operated the pump until there was a firm resistance to the pumping operation; the green light was still extinguished. Having turned onto the final approach, the pilot operated the manual pump again until he felt a firm resistance before concentrating on the approach. The approach and landing were normal and the landing was on the main wheels first. As the nosewheel touched down the nose leg collapsed and the aircraft then came to rest on the runway. The pilot was uninjured and he vacated the aircraft normally.

Landing gear system description

Retraction and extension of the landing gear is accomplished by a hydraulic system integrated with electrical control and indication circuits. There is one hydraulic actuator for the nose landing gear and one actuator that drives a gear system for both main landing gears. Hydraulic fluid is pressurised by an electrically-powered reversible pump and controlled by the landing gear selector mounted on the instrument panel. As the landing gear selector is moved to either the UP or DOWN position, the pump directs hydraulic fluid through a power pack control valve assembly to the landing gear actuators. Mechanical over-centre locks provide down locks for the nose landing gear and when a correctly adjusted landing gear is down-and-locked no hydraulic pressure is required to maintain it in that condition.

In the event of failure of the electrical hydraulic pump an emergency hand pump, located between the two front seats, is operated by the pilot to pressurise the hydraulic system manually to extend the landing gear. When the hand pump is operated, valves within the hydraulic system isolate the electrical pump from the system and therefore only direct the manual pressure to the landing gears for extension. To reinstate the normal hydraulic system requires the manual operation of a relief valve. According to the maintenance organisation that repaired G-AZVP following the accident, to ensure the gear is fully locked down, during manual extension, the hand pump is operated until a resistance is felt, after which it has to be operated further against this resistance until a 'clunk' or 'thud', heard and felt in the cockpit, indicates that the nose landing leg has locked in the down position.

A single green light, mounted on the instrument panel, illuminates when the landing gear is down and locked. Each of the three landing gears has a downlock microswitch operated by a microswitch target. All three microswitches have to be 'made' to complete the electrical circuit to illuminate the light.

Aircraft examination

When the aircraft was lifted from the runway, the nose landing gear was manually locked into position. Subsequent examination of the aircraft, by the maintenance organisation, revealed that the left main landing gear down-and-locked microswitch had moved out of position, thereby preventing the operation of the switch when the gear was locked down. The maintenance organisation examined the landing gear system and found no other defects with the system that would have contributed to the collapse of the nose landing gear leg.

Discussion

The reason for the lack of a green down-and-locked indication, when the pilot initially extended the landing gear, was due to the left main landing gear down-and-locked microswitch being out of position. Anecdotal evidence indicates that over-travel of the downlock microswitch target can push the microswitch out of its rigged position and that this can occur during a heavy or bounced landing.

Due to the lack of illumination of the green gear down-and-locked light, the pilot commenced a manual extension of the gear. The electrically-powered hydraulic system was operating normally, but the action of selecting the manual extension bypassed the electrical pump and the hydraulic pressure required for the gear extension was fully reliant on the pilot's operation of the hand pump. The pilot operated the manual hand pump until he felt resistance and it is likely that at this point the main landing gears had locked into position, but the nose landing gear was not fully locked down. According to the maintenance organisation, to lock fully the nose leg

into position required the operation of the hand pump beyond the initial feeling of the firm resistance, and to then continue pumping until a 'clunk' was heard and felt in the cockpit. In this case the nose leg had extended but had not locked into position, hence the reason the gear collapsed on landing.