ACCIDENT

Aircraft Type and Registration:	Cessna 421C Golden Eagle, N1FY
No & Type of Engines:	2 Continental Motors Corp GTSIO-520 piston engines
Year of Manufacture:	1981
Date & Time (UTC):	25 January 2010 at 1358 hrs
Location:	Kemble Airfield, Gloucestershire
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to the underside of the nose and to both propellers
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	47 years
Commander's Flying Experience:	7,000 hours (of which 500 were on type) Last 90 days - 70 hours Last 28 days - 25 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent enquiries by the AAIB

Synopsis

Following an uneventful approach into Kemble Airfield, the aircraft's nose gear collapsed on touchdown despite all three green 'down-and-locked' lights being illuminated in the cockpit. The aircraft suffered damage to the underside of the nose and to both propellers, but both occupants were uninjured and they exited the aircraft normally. Subsequent engineering analysis revealed a corroded downlock microswitch on the nose gear actuator.

History of the flight

The pilot was flying a visual circuit at Kemble Airfield. Upon selecting GEAR DOWN, the gear was felt to cycle and three green lights illuminated in the cockpit to indicate that the gear was 'down-and-locked'. The Kemble FISO (Flight Information Service Officer) on duty at the time was watching N1FY's approach, through Binoculars, and he observed that the aircraft's landing gears appeared to be in the down position before landing.

At touchdown, the nose gear collapsed causing the aircraft to slide along the runway on its nose until it came to a halt just to the left of the centre line. The pilot and passenger were not injured in the accident and they exited the aircraft through the rear door of the aircraft. The fire service were in attendance in less than one minute.

The pilot stated that even after the nose gear had collapsed, the three green 'down-and-locked' lights in the cockpit were still illuminated.

Landing gear operation description

The landing gear on the Cessna 421C is a fully retractable tricycle landing gear consisting of a nose gear and a main gear located aft of each engine nacelle.

The normal extension and retraction of the landing gear is by a hydraulic actuator at each gear. For normal extension of the gear, hydraulic pressure generated by engine driven hydraulic pumps is routed to a hydraulic unlock actuator at each gear uplock hook. When the hydraulic actuator has reached the full unlock position, fluid is routed to the gear actuator to extend the gear.

Downlock microswitches are located on each gear actuator and cut off the hydraulic pressure to the actuators when all three switches close to indicate that the gears are 'down-and-locked'. These switches also provide the status of the landing gear to several aircraft systems including the landing gear position indicators in the cockpit, the hydraulic gear extension/retraction system and the 'landing gear unsafe' aural alert warning system. Mounted in the instrument panel are three landing gear indicator lights that illuminate green when the respective gears are 'down-and-locked'. An 'in transit' light also illuminates when any gear is in an unlocked position.

The aircraft is equipped with an aural alert system to alert the pilot if the gear is unsafe when the throttles are retarded or the flaps are configured for landing. This system is disabled when all downlock microswitches are in a position that indicate all gears are 'down-and-locked'.

In the event of a loss of hydraulic pressure, emergency gear extension is available by means of an air bottle blow-down system actuated by an emergency control handle located in the cockpit.

Engineering examination

The repair agency for the aircraft conducted an engineering examination of the nose landing gear and ascertained that the landing gear failure occurred as a result of the nose gear downlock not being engaged. They also discovered that the nose landing gear downlock microswitch was stuck in the closed position due to corrosion.

In normal operation when GEAR DOWN is selected, the nose gear leg will usually lock down before the main gear legs. However, in certain circumstances, if the main gear legs lock down first, and the nose gear downlock microswitch has failed in the closed position, the hydraulic pressure will be removed and the system will give a nose gear 'down-and-locked' indication irrespective of the gear actuator position. The result would be an aeroplane configured for landing with the main gears 'down-and-locked', and the nose gear partially extended but not extended by a sufficient amount as to engage the mechanical downlock latch.

Related service information

In 1989, following identification of a potential problem with the landing gear downlock microswitches, the aircraft manufacturer issued a Service Newsletter (SNL 89-3), which was subsequently mandated by a CAA Airworthiness Directive (AD 002-02-90). The Service Newsletter instructions were to seal the downlock microswitches on affected aircraft to prevent moisture ingress and possible corrosion, with subsequent repetitive inspections and the reapplication of sealant

when necessary. AD 002-02-90 was cancelled in 2003 when the European Aviation Safety Agency took over responsibility for Airworthiness Directives from the National Airworthiness Authorities.

Maintenance history

The maintenance organisation for the aircraft confirmed that the sealant and regular inspection of the gear actuators and downlock microswitches on N1FY had been conducted in accordance with SNL 89-3. The maintenance organisation stated that due to previous experience with problems associated with the corrosion of the gear actuator components on other similar aircraft types, gear actuator inspections on N1FY were carried out annually and the associated sealant replaced every two years as a precautionary measure.

Previous accidents

According to CAA records, there have been several similar accidents that have involved Cessna 400 series aircraft nose gears collapsing on landing. In a number of these accidents it was confirmed that the three green 'down-and-locked' lights in the cockpit were erroneously indicating that the nose gear was 'down-and-locked', even after the nose gear had collapsed. In most of these previous accidents, the downlock microswitch attached to the nose gear actuator was found to have failed due to corrosion.

Discussion

The gear position microswitch on the nose gear actuator was found to be stuck in the closed position due to corrosion and thus it provided a false indication to the pilot, and to other aircraft systems, that the nose gear was locked down. Although the microswitch had been sealed against the ingress of moisture in accordance with SNL 89-3, any disturbance of the sealant during service would have reduced its effectiveness and allowed moisture to penetrate into the switch leading to corrosion.

The failure of the switch would have resulted in the premature disconnection of hydraulic pressure to the nose gear actuator, thus preventing the nose gear from locking into place. Furthermore, the direction of travel of the nose landing gear leg would have been hindered by the oncoming airflow, preventing the gear from locking down under its own weight. N1FY was equipped with a blow-down emergency landing gear extension system, but it was not used as there was no indication to the pilot that the nose landing gear had not locked down prior to touchdown.