

No: 4/92

Ref: EW/G92/01/01

Category: 1b

Aircraft Type and Registration: Cessna 421, N41098

No & Type of Engines: 2 Continental GTSIO-520 piston engines

Year of Manufacture: 1973

Date & Time (UTC): 1 January 1992 at 1315 hrs

Location: Fairoaks Airport, Surrey

Type of Flight: Private

Persons on Board: Crew - 2 Passengers - 2

Injuries: Crew - None Passengers - None

Nature of Damage: Right main landing gear, wing undersurface and propeller damaged, right engine shock loaded

Commander's Licence: Private Pilot's Licence with Instrument Rating

Commander's Age: 51 years

Commander's Flying Experience: 1,216 hours (of which 144 were on type)

Information Source: Aircraft Accident Report Form submitted by the pilot and AAIB examination of aircraft

The aircraft was on a flight from Le Touquet, France, to Fairoaks Airfield, where a visual approach was made in good weather. Runway 24 was in use, an 800 m long tarmac surfaced runway that was dry at the time. The reported wind was from 220°M at 15 kt. When the landing gear was selected down, green locked-down captions for the nose and left main gears illuminated, but the right main gear green caption remained extinguished and the red gear unsafe caption remained on. Recycling the selector did not alter the situation. The AFISO informed the crew that all three gears appeared to be fully extended, the gear was recycled a number of times and the manual lowering system was operated, but indications remained the same. A further fly past confirmed that all three gears appeared from the control tower to be fully extended and, with a fire truck standing by, a full-flap landing was made.

After a gentle touchdown the aircraft rolled normally for two to three seconds but the right wing then began to drop. The crew immediately shutdown the engines and selected the aircraft fuel and electrical systems off. The right wingtip contacted the runway and a right turn developed, causing the aircraft to

depart the right side of the runway onto the flat mown grassed area to the side before coming to rest. The four occupants were able to evacuate rapidly without injury.

Each main landing gear leg of the Cessna 421 is mounted on trunnions carried on the forward and aft wing spars and retracts by pivoting inboard about a fore-aft axis. Lateral support for the leg on this earlier version of the aircraft is provided by a two piece sidebrace. In the locked down position (Fig. 1) upper and lower sidebraces are held overcentred by a lock-link that is driven by a bellcrank. The bellcrank pivots on a bolt located in a pair of lugs on the main leg, and is operated by an electric actuator via a mechanical drive system. When the gear is in the locked down condition, the linkage formed by the lock-link and bellcrank is itself held overcentred by forces applied by the actuator drive system and by a light spring.

Inspection of N41098 showed that fracture of the bellcrank, the bellcrank pivot bolt and one of the bellcrank pivot bolt lugs had occurred. The characteristics indicated that all of the failures had resulted from overload, and no evidence of any pre-existing defect was found. An appreciable amount of play was present in many of the downlock mechanism pivots. In addition, the spherical bearing in the rod end of the lock-link, forming the pivot between the lock-link and the lower side brace, was found to be dry and somewhat corroded and very stiff. The torque required to pivot the lock-link when orientated in the position that it assumes as the gear locks down was measured as 13 lbf-ft. The stiffness would have resisted the overcentring of the lock-link/bellcrank linkage that constituted the final part of the gear downlocking sequence. Failure of the linkage to overcentre would prevent the downlock microswitch from operating and would remove the normal sidebrace lock and could prevent the sidebrace itself from overcentring. In this condition, sideloads on the wheel would be reacted through the retraction mechanism. The failures were consistent with the effects of such a situation.

The lock-link rod end spherical bearing is not provided with means for pressure lubrication. A Lubrication Diagram in the Cessna 421 Service Manual (Section 2-60, Figure 2-37, Sheet 6) includes a note to 'lubricate all spherical rod ends with a mixture of low temperature aircraft lubricating grease and moly-kote', but does not specify a frequency for this operation. The frequencies of other operations called for on this Diagram are specified.

A similar type of main landing gear is fitted to the Cessna C310, C340, and C401 and earlier models of the C414. Records listed 15 other cases since 1975, for Cessna 300 and 400 Series aircraft of UK registration or of foreign registration occurring in the UK, of main landing gear collapse on landing (AAIB Bulletins 2/76, 6/76, 7/76, 9/78, 3/81, 4/84, 9/84, 5/85, 4/86, 11/88, 11/88, 6/89, 12/90, 3/92 and one case, in France, investigated by the French authorities). In one other case (AAIB Bulletin 12/88) the pilot elected to land gear up when it proved impossible to lock the left main gear down. The

MAIN LANDING GEAR SIDESTAY SCHEMATIC

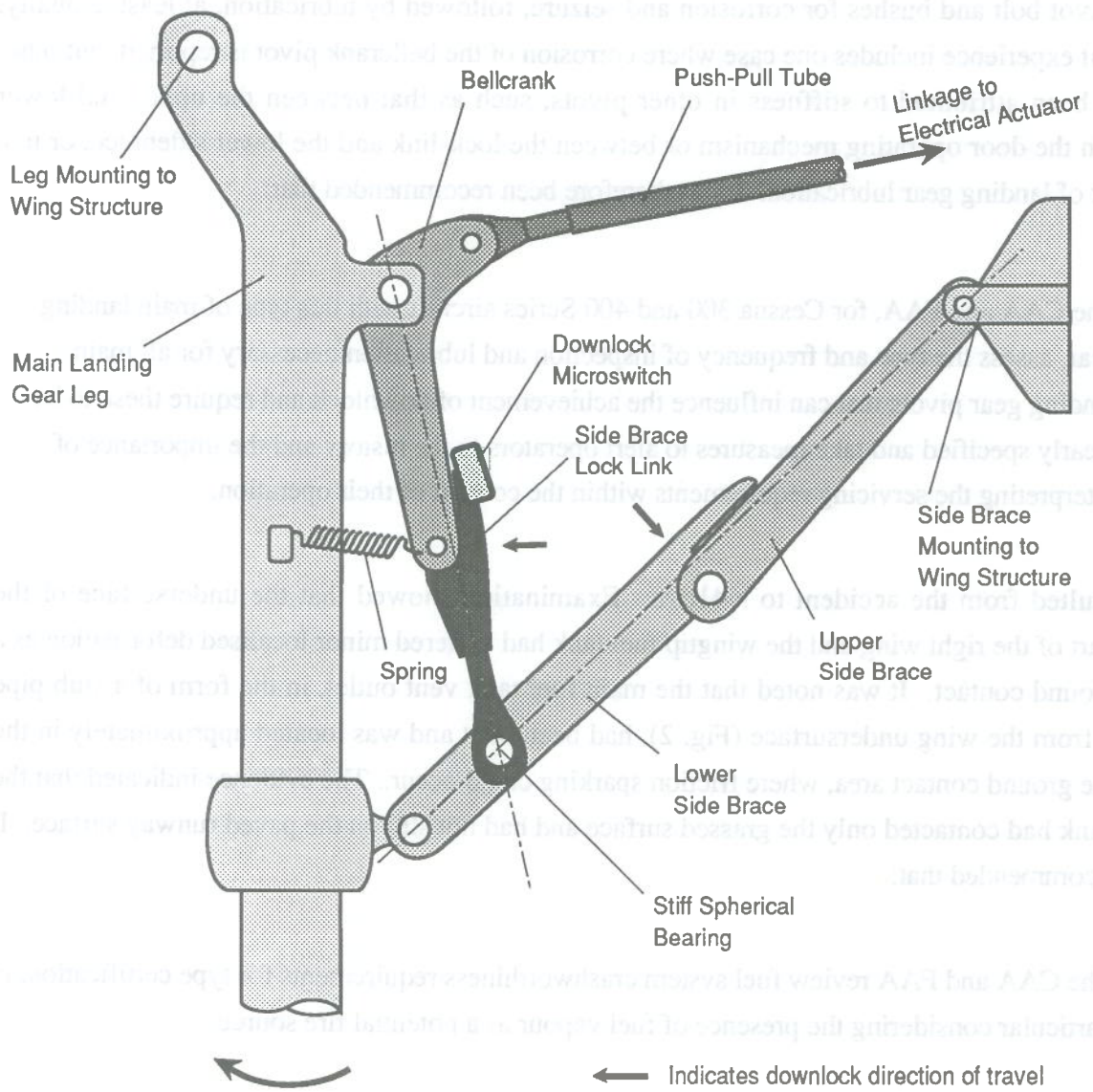


Fig 1

available evidence indicated that most of these accidents resulted from stiffness in various pivots in the landing gear mechanism that prevented the gear from entering downlock when extended. This was generally associated with corrosion and inadequate lubrication. Indication of the lack of downlock was given in many of the cases, but the problem was not resolved by use of the emergency manual lowering system.

CAA Airworthiness Directive 008-01-89, effective 1 February 1989, required inspection of the bellcrank pivot bolt and bushes for corrosion and seizure, followed by lubrication, at least annually. The accident experience includes one case where corrosion of the bellcrank pivot is reported, but other cases have been attributed to stiffness in other pivots, such as that between the upper and lower sidebrace, in the door operating mechanism or between the lock-link and the lower sidebrace, or to a general lack of landing gear lubrication. It has therefore been recommended that:

- 92-21** The CAA and FAA, for Cessna 300 and 400 Series aircraft with this type of main landing gear, assess the type and frequency of inspection and lubrication necessary for all main landing gear pivots that can influence the achievement of downlock and require these to be clearly specified and take measures to alert operators to the history and the importance of interpreting the servicing requirements within the context of their operation.

No fire resulted from the accident to N41098. Examination showed that the undersurface of the outboard part of the right wing and the wingtip fuel tank had suffered minor localised deformation as a result of ground contact. It was noted that the main fuel tank vent outlet, in the form of a stub pipe protruding from the wing undersurface (Fig. 2), had been bent and was located approximately in the centre of the ground contact area, where friction sparking could occur. The evidence indicated that the wing and tank had contacted only the grassed surface and had not slid on the paved runway surface. It has been recommended that:

- 92-22** The CAA and FAA review fuel system crashworthiness requirements for type certification, in particular considering the presence of fuel vapour as a potential fire source.

RIGHT WINGTIP AREA



Fig 2