No: 9/90 **Ref: EW/G90/02/03** **Category: 1a**

Aircraft Type and Registration:	Avions Marcel Dassault Falcon 20, N908FR
No & Type of Engines:	2 General Electric CF700-2D2 turbofans
Year of Manufacture:	1969
Date and Time (UTC):	8 February 1990 at 1915 hrs
Location:	Yeovilton, Somerset
Type of Flight:	Commercial (training)
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to left main landing gear, gear door and outer left wing
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	52 years
Commander's Total Flying Experience:	6,343 hours (of which 1020 were on type)
Information Source:	Aircraft Accident Report Form submitted by the pilot and a comprehensive report on the engineering aspects submitted by the operating company

The aircraft was engaged on a training detail, and had climbed to 19500 ft after a refuelling stop at St Mawgan. The detail continued with a simulated depressurisation during which the aircraft was rapidly descended to 12000 ft. This was followed by a stalling exercise which was intended to be carried out with 15 degrees of flap and the landing gear down. On selection, the following indications on the flight deck were seen; three red door lights, nose and right main landing gear green lights but with no indication at all for the left main landing gear. However, the green bulb for this illuminated during "Press to Test" function. The crew attempted to lower the left landing gear leg by following the 'abnormal drills' procedures A, B, and C as described in the pilots' checklists, but without any success. When both pilots attempted to operate the left landing gear manual release "D" ring, they felt only a "spongy" resistance to their pulling, instead of the more normal positive reaction. By this stage, the aircraft was orbiting at 2000 feet over RNAS Yeovilton in order to burn off fuel, whilst ground preparations for the emergency landing were carried out, which included the laying of a foam strip on one side of the runway. Two flypasts of the airfield ATC tower, and a chase aircraft, confirmed that the left main landing gear appeared to be fully retracted, but with the door in the open position.

After the crew had fully briefed themselves on the relevant emergency landing procedures, the aircraft was landed with 600 lbs of fuel remaining, and touched-down at Vref (120 kts) on runway 27, with the pilot "holding the left wing up" as long as he was able. The aircraft was kept straight and it was not necessary to deploy the drag parachute, since the aircraft came to rest within the foam covered length of runway. During the ground slide, the left landing gear became unlocked. The crew exited through the cargo door because the overwing emergency exit windows could not be opened. No injuries were sustained and no fire occurred.

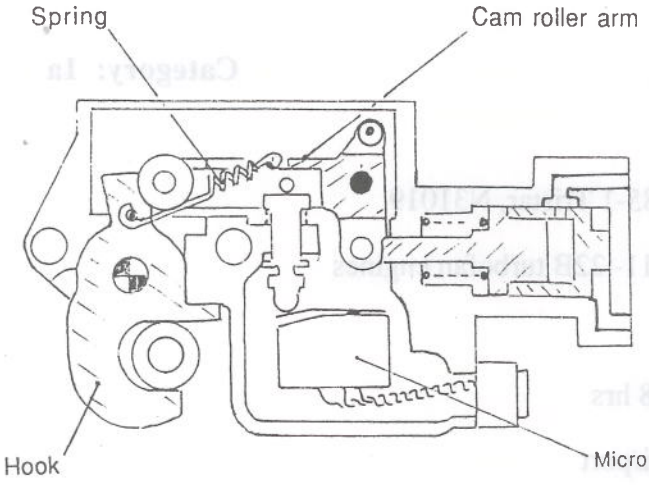
Due to operational reasons, the aircraft was soon recovered to a hangar at Yeovilton where a detailed investigation was begun, by the operating company, into the possible cause of this failure. With the aircraft on jacks, the landing gear was successfully cycled six times using the flight crew procedures A,B and C. No "sponginess" was felt in the manual release system. However, several significant points were noticed on subsequent inspection of the complete system.

1. There was a general lack of grease penetration throughout the landing gear mechanism.
2. The left landing gear leg uplock roller was found seized, due to lack of lubrication.
3. On test, a hesitation in the release of the left leg uplock was cleared following re-lubrication.
4. Beads of moisture were found present within the uplock.

With reference to the attached diagrams, the uplock hook itself for the main landing gear of this aircraft cannot be opened directly by hydraulic or mechanical means, but is solely acted upon through a tension spring connected to an unlocking arm and the uplock roller. In the absence of any relevant mechanical faults, it therefore appeared likely that high friction already present in the uplock mechanism may have been assisted by soaking to sub-zero temperatures, and the possible formation of ice, to such an extent that the tension spring was unable to move the hook to the unlock position. The profile of this hook is such that no opening motion is generated by any down-load from the roller.

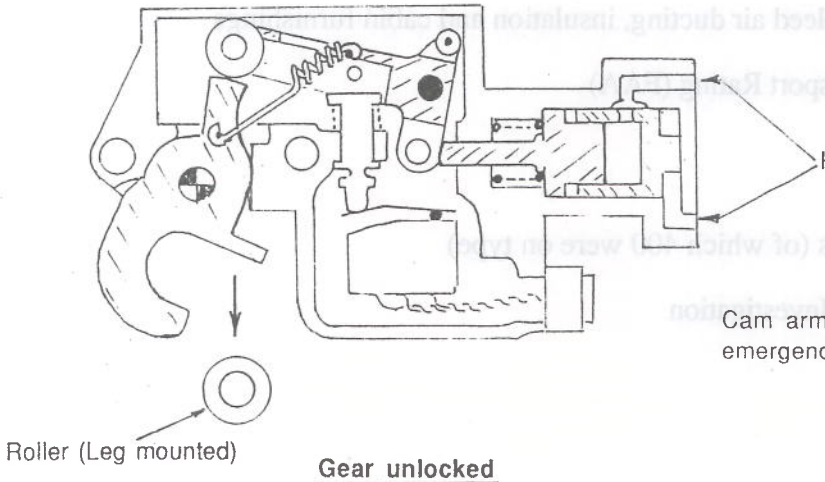
Although it was recorded in the aircraft documentation that lubrication of the landing gear system was last carried out in early December 1989, between January 1990 and the time of the incident three washes of the landing gear had been completed. Since this event, the operating company have increased the frequency of landing gear lubrication to 150/165 hour periods and required that this lubrication requirement is certified by a Certificating Engineer.

The failure of the crew to open the emergency overwing window exits was attributed to the fact that on the US registered aircraft operated by this company, the exit release handle is mounted on the airframe, rather than on the window itself. After operating the handle on this occasion, it became apparent to the crew that the trim surrounding these windows restricted their free inward movement, there being no positive means of grasping the window once released. On British registered aircraft, the release handle is mounted on the window structure, thus providing a positive means of opening the emergency window.



Hook held in position by cam arm

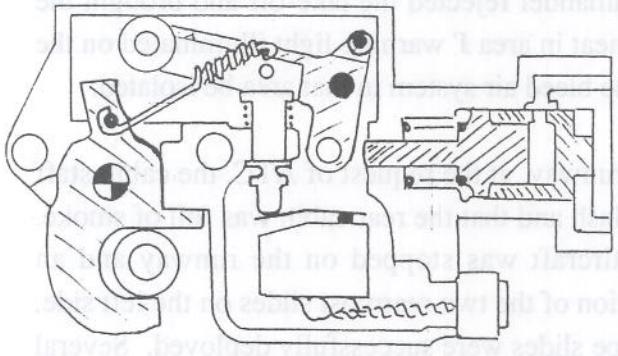
Gear up and locked



Cam arm operated by hydraulic piston or directly by the emergency release to pull hook open via the spring

Gear unlocked

Insufficient force applied by spring to overcome high friction generated by siezed roller and stiff hook when operated hydraulically or manually



Gear 'Hung Up' configuration

Main Gear Uplock Diagrams