SERIOUS INCIDENT

Aircraft Type and Registration:	Airbus A319-111 Airbus, G-EZDM
No & Type of Engines:	2 CFM56-5B5/3 turbofan engines
Year of Manufacture:	2008
Date & Time (UTC):	15 December 2008 at 2123 hrs
Location:	Shortly after takeoff from Charles de Gaulle Airport, Paris
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 6 Passengers - 130
Injuries:	Crew - None Passengers - None
Nature of Damage:	Severed hydraulic line
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	52 years
Commander's Flying Experience:	7,471 hours (of which 1,128 were on type) Last 90 days - 243 hours Last 28 days - 69 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent enquiries by the AAIB

Synopsis

Upon selecting landing gear UP, the crew received a message on the Electronic Centralised Aircraft Monitor (ECAM) that the main landing gear doors were not closed. Passing 1,500 ft agl, further messages relating to Green hydraulic system 'fluid low contents' and Yellow system 'fluid reservoir overheat' were also generated. This resulted in the aircraft operating for a short time on a single hydraulic system. Yellow system pressure was recovered and the aircraft made an uneventful precautionary landing.

History of flight

After takeoff the Pilot Not Flying selected the landing gear UP but received an ECAM message L/G DOORS NOT CLOSED. ATC were advised of the problem and that the speed would be kept low: the ECAM procedure for this failure was performed but to no avail. Upon reaching 1,500 ft agl, a HYDG RSVR LO LVL (Green system hydraulic reservoir low level) caption was displayed on the ECAM and a Green system low pressure caption illuminated. Whilst the crew performed the drill for this failure, a HYDY RSVR OVHT (Yellow system hydraulic reservoir overheat) caption was also displayed. The ECAM actions for this required switching off the Yellow system engine-driven pump (EDP) and the power transfer unit

(PTU, see below), putting the aircraft into single system hydraulic power operation.

A MAYDAY call was made with a request for radar vectors for landing. A short time after completion of the ECAM actions, the Yellow system overheat caption disappeared and the EDP was reselected, restoring hydraulic pressure in that system.

After briefing the senior cabin crew member, and advising the passengers to prepare for a precautionary landing, the commander took control. Because Paris CDG airport was operating low-visibility procedures at the time due to low cloud, a Category IIIA instrument landing was performed (the highest allowable with two hydraulic systems operating). The landing was uneventful but the commander asked for, and received, a fire service escort to the gate, where the passengers disembarked normally.

Engineering investigation

Upon examination, the flexible hose for the left main landing gear (MLG) 'door close' actuator was found damaged and leaking. After replacement of this, and the 'door open' hose, which was also found worn, the hydraulic systems were inspected, replenished as necessary and found serviceable. Leakage from these hoses had been experienced a number of times before, so the operator has imposed a 6,000 flight cycle life on the hoses until the aircraft manufacturer devises an engineering solution to the problem.

Analysis of the sequence of events showed that they could be rationalised in terms of the system and warnings philosophy. After liftoff, as the landing gear was selected UP, the 'door close' hose ruptured, depleting the Green hydraulic system contents. As the pressure in the Green system dropped sufficiently to provide a differential with the Yellow system of 500 psid, the power transfer unit (PTU) between the two systems automatically switched on. The PTU uses hydraulic power from one system to power the other in case of a loss of pressure. However, if the loss of pressure is caused by a lack of fluid, the PTU will overheat about two minutes after starting but the cautions for this condition, as well as the original Green system 'reservoir low fluid level', are inhibited by design below 1,500 ft agl in order to avoid pilot distraction.

The above sequence of events was thus invisible to the crew until they passed 1,500 ft, when the Green system contents caption was displayed followed shortly by the Yellow system overheat. Part of the drill for the latter involved switching off the PTU and reselecting the EDP when the overheat condition cleared.

At least one similar case of such a dual-system hydraulic power loss is known to the manufacturer, who reported on the scenario described above in their 'Safety First' magazine, Edition 4 in June 2007. Discussion is included concerning the pros and cons of various options to prevent the loss of a single system developing into a double failure. The manufacturer decided that the most satisfactory solution was to inhibit automatic operation of the PTU below 1,500 ft and Service Bulletin 29-1115 was issued to introduce two modifications which need to be embodied before accomplishing SB 29-1126, which activates the inhibition logic. New aircraft have the first SB embodied but the activating logic remains optional. The manufacturer encourages operators to retrofit the modifications.