Statens haverikommission
Swedish Accident Investigation Board

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Report RL 2004:21e

Accident involving aircraft LN-ALK at Malmö Sturup Airport, M county, Sweden, on 14 April 2004

Case L-07/04

The report is also available on our web site: www.havkom.se

Translated by Tim Crosfield from the original Swedish at the request of the Swedish Accident Investigation Board.

In case of discrepancies between the English and the Swedish texts, the Swedish text is to be considered the authoritative version.

Statens haverikommission (SHK) Swedish Accident Investigation Board

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01-07-2004 L-07/04

Swedish Civil Aviation Administration

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Report RL 2004:21e

The Swedish Accident Investigation Board (Statens haverikommission, SHK) has investigated an accident that occurred on 14 April 2004 at Malmö Sturup Airport, M county, Sweden, involving an aircraft with registration LN-ALK.

In accordance with section 14 of the Ordinance on the Investigation of Accidents (1990:717), the Board herewith submits a final report on the investigation.

Göran Rosvall Dan Åkerman

Appendix 1

Extracts from Register of Licences regarding the pilot (to the Swedish Civil Aviation Administration only)

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L-07/04
Report finalised 01-07-2004

Aircraft; registration and type	LN-ALK, Cessna F 177 RG
Class/airworthiness	Normal, Valid Certificate of Airworthiness
Owner/operator	Private ownership
Time of occurrence	14-04-2004, 16.50 hrs in daylight Note: All times given in Swedish summer time (UTC + 2 hours)
Place	Malmö Sturup Airport, M county, Sweden (pos 5532.9N 01321.2E; 72 m above sea level)
Type of flight	Private
Weather	According to SMHI analysis: wind 220°/11 knots, good visibility, no cloud, temp./dew point 12°/2°C, QNH 1023 hPa
Persons on board:	
crew members	1
passengers	-
Injuries to persons	None
Damage to aircraft	Limited
Other damage	None
Pilot in command:	
Sex, age, licence	Man, 60 years, Norwegian PPL/A
Total flying time	1 206 hours, of which 45 on type
Flying hours previous 90 days	7, all on type
Number of landings previous 90 days	10, all on type

The Swedish Accident Investigation Board (SHK) was informed on 14 April 2004 that an accident involving an aircraft with registration LN-ALK had occurred at Malmö Sturup Airport, M county, Sweden, that day at 16.50 hrs.

The accident was investigated by SHK in the persons of Göran Rosvall, Chair and Dan Åkerman, Chief Investigator.

The investigation was followed by the Swedish Civil Aviation Administration represented by Magnus Axelsson.

History of the flight

The pilot had taken off from Hönefoss-Eggemoens Airport in Norway to fly to Malmö Sturup Airport. When prior to landing he placed the undercarriage control in the “down” position the undercarriage did not move as anticipated. The pilot then used the hand pump, but stopped when it no longer offered resistance and hence was probably not building up hydraulic pressure. Since the undercarriage indicator lamp was not on, he contacted the tower and asked them to check visually that the undercarriage was down, which they did. The pilot then landed on the main wheels but could not prevent the nose wheel from being retracted on contact with the runway. The aircraft continued on its nose and its main undercarriage partly on the grass alongside the asphalt. The visible damage was limited to the pro-

peller and the lower part of the nose, and the nose wheel landing gear doors.

The Cessna F 177 RG is a four-passenger, high-wing aircraft with hydraulically manoeuvred undercarriage consisting of main wheels and a nose wheel. Hydraulic pressure is supplied by an electric pump which is integral with the hydraulic fluid reservoir. Pressure in the system is governed by a pressure switch set to close at approximately 1 000 psi (6.9 MPa) and open at ca 1500 psi (10.3 MPa).

The main undercarriage and the nose wheel are each operated by a hydraulic cylinder and the fluid is fed from the pump to these via hoses and aluminium tubes. The life of the hoses is limited and they had been replaced approximately ten flying hours and seven landings before the accident.

The nose wheel hydraulic cylinder operates the drag link and its locking function. This means that a certain hydraulic pressure is required for the drag link to snap into position and lock the undercarriage in the down position.

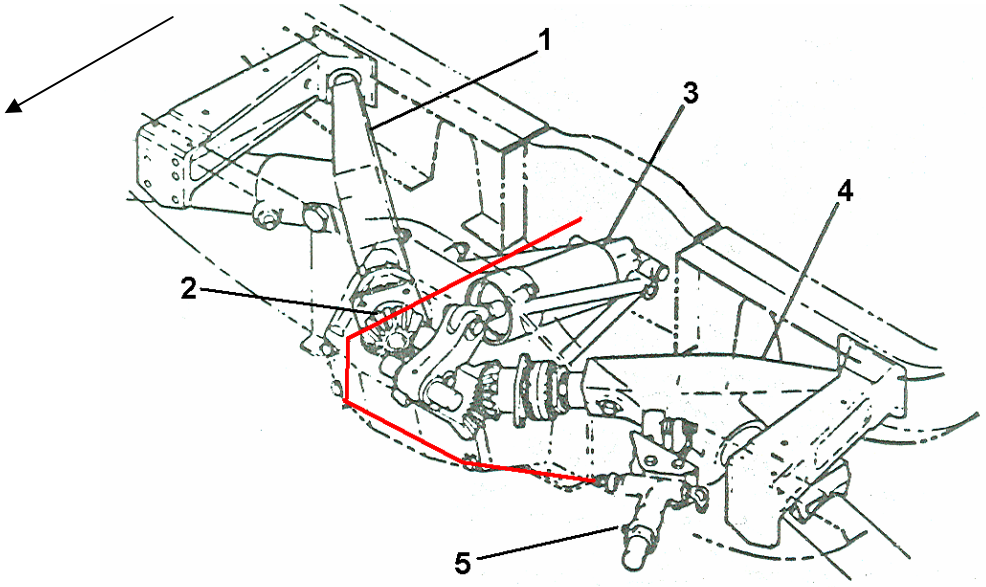
The main undercarriage on each side consists of a leg assembly fixed in the fuselage in a bearing that is angled to the aircraft's transverse axis. A conical gear is mounted on the inner part of the leg assembly. This meshes with a rack segment connected to the operating cylinder. To lock the main undercarriage in the down position, each leg has a ”down lock actuator”, i.e. a hydraulic cylinder the piston of which acts as a locking pin. This is held in the outer (locked) position by a spring and in the inner position by hydraulic pressure. Thus the undercarriage has no mechanical locking in the “up” position, being held up only by hydraulic pressure, which also maintains the ”down lock actuators” in an unlocked position against the spring loading.

The hydraulic line to the ”down lock actuators” pass close to the operating cylinder of the undercarriage in a relatively cramped position under the cabin floor. After the accident the aircraft was moved to a hangar for inspection. Here it was found that its underside was covered with hydraulic fluid and that the hydraulic fluid reservoir was empty. It was further noted that the hydraulic line serving the left down lock actuator showed abrasion damage clearly caused by the gear of the right-hand undercarriage leg. See illustration below.

Rack segment and damaged hydraulic line

The abrasion was deeply lined and the lines had a ”coarse” appearance. It was also noted that that the bracket supporting the line was faulty, giving

the line two rest positions: one well clear of all moving parts and the other up against the gear.



1. Right undercarriage leg assembly
2. Gear
3. Main undercarriage operating cylinder
4. Left undercarriage leg assembly
5. Left ”down lock actuator” with hydraulic line drawn schematically.

Analysis

The damage to the hydraulic line was ”coarse”, which suggests that the line had not rested up against the gear for any length of time. A check of the aircraft’s log book showed that all the hoses in the hydraulic system, including that to the main undercarriage operating cylinder, had been replaced on 2 February 2004, approximately ten flying hours and seven lowerings and raisings earlier. Since this hose can scarcely be replaced without affecting the position of the line in question it appears probable that while the hose was being replaced the line came into its second resting position against the gear. Here the line was damaged in connection with the subsequent lowering and raising of the undercarriage.

In flight, the undercarriage is kept raised only by the pressure in the hydraulic system. If a leak occurs, the pressure sinks, the pressure valve closes and the hydraulic pump starts. If the flight is long enough the system will be more or less emptied of fluid and difficulties will arise when lowering the undercarriage. In this case the main wheels were pumped down with the hand pump and locked in the down position when the ”down lock actuator” springs were activated. However there was insufficient fluid to cause the nose wheel drag link to snap into position, locking the nose strut. It therefore went up of its own accord during the rollout after landing.

The accident was caused by a hydraulic line becoming displaced during maintenance work and sustaining a leak when it came into contact with moving parts in the undercarriage mechanism.