



MINISTÈRE DU DÉVELOPPEMENT DURABLE
ET DES INFRASTRUCTURES
Département des transports

Administration des enquêtes techniques

FACTUAL REPORT

EMERGENCY LANDING OF A CESSNA C140 NEAR FILSDORF (L) ON 9 DECEMBER 2013

DATE OF ISSUE: 29 DECEMBER 2017

ADMINISTRATION OF TECHNICAL INVESTIGATIONS

CIVIL AVIATION – RAILWAYS – MARITIME – RIVER – ROAD



Ministry of Sustainable Development and Infrastructure
Department of Transports

Administration of Technical Investigations

Report N° AET/AC-2017/02

FACTUAL REPORT

**Emergency landing of a Cessna C140
near Filsdorf (L) on 9 December 2013**

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FOREWORD

In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No 996/2010 of the European Parliament and of the Council and Luxembourg law dated 30 April 2008 on technical investigations in relation to accidents and serious incidents which happened in the domains of civil aviation, maritime transport and railways, it is not the purpose of the aircraft accident investigation to apportion blame or liability.

The sole objective of the safety investigation and the Final Report is the prevention of accidents and incidents.

Consequently, the use of this report for purposes other than accident prevention may lead to wrong interpretations.

Note: All times indicated in this report are in Luxembourg Local Time (LT, UTC +1), unless stated otherwise.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

°C	Degree Celsius
°F	Degree Fahrenheit
AET	Administration des enquêtes techniques (Luxembourg safety investigation authority)
AIS	Aeronautical information service
AVGAS	Aviation gasoline (100 LL)
CAVOK	Ceiling and visibility OK
CB	Cumulonimbus
CTR	Control zone
DAC	Direction de l'aviation civile (Directorate of Civil Aviation)
ELLX	ICAO code of Luxembourg international airport
ft	Foot
hPa	Hectopascal
ICAO	International civil aviation organization
km	Kilometer
kt	Knot
lbs	Pounds
LT	Local time
m	Meter
METAR	Aerodrome routine meteorological report (ICAO Annex 3)
MSL	Mean sea level
NM	Nautical mile
NOSIG	No significant change
PIC	Pilot-in-command
POH	Pilot's operating handbook
PQ	Particle quantifier index
PSI	Pound-force per square inch

RPM	Revolutions per minute
RWY	Runway
SEP(A)	Single engine piston (aeroplane) class rating
TAF	Aerodrome forecast (ICAO Annex 3)
TBO	Time Between Overhaul
UTC	Universal co-ordinated time
VDR	Voyage data recorder
VFR	Visual flight rules
VHF	Very high frequency
VMC	Visual meteorological conditions

On the afternoon of 9 December 2013, the pilot and his passenger went on a cross-country flight within the Luxembourg airspace with a single engine piston airplane of the type Cessna C140. While leaving the Luxembourg Control Zone (CTR) in a southern direction, the pilot noticed a drop of oil pressure and an increase of oil temperature. Shortly thereafter the pilot observed a decrease of the engine power. As he estimated that a return to the airport of departure was not possible, the pilot took the decision to make an emergency landing in a crop field in the vicinity of the village of Filsdorf, situated about five and a half nautical miles (NM) south of Luxembourg International Airport (ELLX). The landing was uneventful, up to the point during rollout, where the pilot applied brake pressure in order to come to a stop before reaching a road cut straight ahead and the aircraft nosed over. The field was wet and showed muddy characteristics. The two occupants left the airplane uninjured.



2. FACTUAL INFORMATION

2.1 History of the flight

Two of the co-owners of the Cessna C140 independently decided to take the aircraft on a cross country flight within Luxembourg airspace in the afternoon of 9 December 2013. One of them had already filed a local flight plan with the Luxembourg Aeronautical Information Service (AIS). The runway (RWY) in use at ELLX was RWY24 and the pilot planned to leave the Luxembourg CTR to the south via the Visual Flight Rules (VFR) reporting point “Tango” (Water tower in the village of Frisange). Upon arrival at the airport, both co-owners met up and decided to fly together.

The aircraft was cleared for take-off at 14:57:59 and followed a southern track to leave the CTR via ‘Tango’. While approaching the south of the CTR, the pilot noticed the oil pressure gauge indicating 30 PSI¹ and thought that it might be on the lower side of the operating range. He checked the prescribed range in the Pilot’s Operating Handbook (POH) when the oil pressure began to drop to 25 PSI, and further decreasing. Shortly thereafter, the engine “Revolutions per Minute”-indicator (RPM) also began to drop down. At approximately 1’900 RPM, the pilot selected the carburetor heat on as he suspected carburetor icing. Upon activation, the RPM dropped by about 200 units down to 1’700 RPM, indicating that the carburetor heat was working. The pilot left the carburetor heat on for about 20 seconds but the RPM further dropped and the oil pressure steadily decreased. The oil temperature indicated around 200°F. Pushing the throttle full forward did not result in any power increase. With the oil pressure at approximately 20 PSI and decreasing and the engine running below 1’700 RPM, the pilot decided to perform an off-airport landing and declared an emergency at 15:04:54.

The pilot then selected a supposedly adequate landing site and retarded the throttle to idle position. He performed an uneventful emergency landing in a crop field located in the vicinity of the village of Filsdorf. The surface condition of the field was wet and muddy. During roll-out, the pilot saw a shallow road cut in front of the aircraft and applied brakes in order to stop the aircraft before reaching it. The speed at that time was estimated by the pilot at 5 knots. The aircraft then nosed over and came to rest in an inverted position.

None of the occupants was injured, but the aircraft sustained damage to the propeller, the vertical stabilizer and the left hand wing and strut.

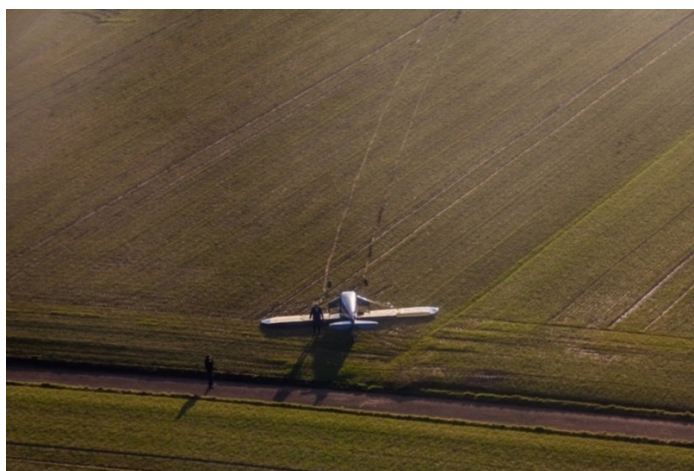


PHOTO: POLICE GRAND-DUCALE

¹ During normal operation, with the engine running at 2’300RPM, the oil pressure should show 40 PSI.

2.2 Injuries to persons

Completion of the following (in numbers):

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Others</i>
Fatal	0	0	0
Serious	0	0	0
Minor/None	1	1	0

2.3 Damage to aircraft

The aircraft sustained damage to the propeller, the vertical stabilizer and the left wing and strut.

2.4 Other damage

None.

2.5 Personnel information

The Pilot in command (PIC) was 53 years old and held a valid flight crew license with the class rating SEP(A) issued by the Directorate of Civil Aviation (DAC).

The PIC held a valid class 2 medical certificate in compliance with the prevailing regulation.

During the last three years, the PIC flew a total of 7.17 hours on the aircraft, 0.98 hours thereof during the year of the occurrence.

It should be noted that the PIC also flew on a twin-engine piston aircraft on a regular basis and had a total flight time of 1 689 hours on the day of the occurrence.

2.6 Aircraft information

The Cessna C140 is a single-engine, two-seat, conventional landing gear (tailwheel), light general aviation aircraft.

The airplane had a valid certificate of airworthiness.

Certificate of Airworthiness:	CDN-2010-1963
Airworthiness review certificate:	DAC-2013-084
Aircraft manufacturer:	Cessna Aircraft Company
Manufacturer's designation of aircraft:	C140
Aircraft registration:	LX-DIS
Aircraft serial number:	140-12409
Year of manufacturer:	1963
Engine type:	Continental C85-12F
Engine serial number:	26622-6-12
Aircraft empty weight:	1'003 lbs
Maximum take-off weight:	1'450 lbs
Last performed maintenance check:	4 September 2013
Total hours on 4 September 2013:	2'519 hours

Based on the logbook, the aircraft was operated a total of 70.47 hours in the previous 5 years, 16.11 hours thereof in the year before the occurrence.

The engine was operated beyond the Time Between Overhaul (TBO) calendar limitation on a 10 hour extension approved by DAC.

The type of fuel used for the engine was AVGAS 100LL.

The 'Weight and Balance' calculations for the occurrence flight were not available, but a reasonable assumption permitted to conclude that the aircraft remained within the prescribed envelope.

2.7 Meteorological information

The aerodrome forecast (TAF) is a format for reporting weather forecast information for aviation. TAF bulletins are issued every six hours and generally apply to a 24- hour or a 30- hour period.

ELLX TAF: (TAF times are in UTC)

201312090500 TAF ELLX 090500Z 0906/1012 26007KT 8000 NSC
 TEMPO 0906/0910 5000 BR
 TEMPO 1002/1009 0800 BCFG SCT001=

201312091100 TAF ELLX 091100Z 0912/1018 23005KT CAVOK
 BECMG 0919/0921 36004KT 4500 BR
 PROB40 TEMPO 1000/1008 0800 FZFG BKN001=

The observed meteorological conditions were available as coded information through the aerodrome routine meteorological report (METAR). A new METAR is published every 30 minutes.

ELLX METAR: (METAR times are in UTC)

201312091250 METAR ELLX 091250Z 25008KT 210V270 CAVOK 07/02 Q1030 NOSIG=

201312091320 METAR ELLX 091320Z 25008KT CAVOK 07/01 Q1031 NOSIG=

201312091350 METAR ELLX 091350Z 26007KT CAVOK 08/01 Q1031 NOSIG=

201312091420 METAR ELLX 091420Z 24007KT CAVOK 08/02 Q1031 NOSIG=

201312091450 METAR ELLX 091450Z 24007KT CAVOK 07/02 Q1031 NOSIG=

The relevant METAR at Luxembourg International Airport, which is situated 5.5 NM North of the accident site, was as follows:

Time of the weather report:	13:50 (14:50 LT)
Wind direction:	260° (Magnetic North)
Wind force:	7 kt
CAVOK:	"Ceiling And Visibility OK": No cumulonimbus cloud (CB), no cloud with base < 1'500m/5'000ft or below the highest minimum sector altitude, whichever is greater & visibility 10km or more & no significant weather
Temperature:	8°C
Dew point:	1°C
Local atmospheric pressure:	1'031 hPa
Weather evolution:	NOSIG (no significant weather change is expected to the reported conditions within the next 2 hours)

The meteorological conditions on the day of the occurrence reflected VMC conditions and were not considered to be a contributing factor to the accident.

2.8 Aids to navigation

Navigation aids were not of relevance.

2.9 Communications

The following table shows the communications between the airplane and the Luxembourg Control Tower (TWR) for the occurrence flight:

14:52:23	LX-DIS first contact with TWR
14:57:24	LX-DIS reports ready for departure
14:57:59	LX-DIS is cleared for take-off by TWR
14:59:58	LX-DIS appears on radar as a primary target
15:02:57	LX-DIS disappears from the radar
15:04:26	LX-DIS is calling TWR
15:04:54	LX-DIS declares an emergency

2.10 Aerodrome information

The pilot made an emergency landing in a crop field south of Luxembourg International Airport in the vicinity of the village of Filsdorf.

2.11 Flight recorders

The aircraft was not equipped with any kind of flight recorders.

2.12 Wreckage and impact information

The pilot reported that the emergency landing in the crop field was uneventful, but due to a road cut at the end of the field, braking was applied at low speed causing the airplane to nose over and come to rest in an inverted position. Damage was sustained to the propeller, the vertical stabilizer and the left hand wing and strut.

The field is situated about 5.35 NM south (~170° magnetic heading) of the aerodrome reference point of Luxembourg International Airport.

2.13 Medical and pathological information

An alcohol test of both occupants performed by the Police was negative.

2.14 Fire

The airplane did not catch fire.

2.15 Survival aspects

The PIC and his passenger were not injured. Damage to the airplane did not impair the livable space of the cabin and the accelerations and forces acting upon the occupants during the nose over were limited due to the low speed.

2.16 Tests and research

2.16.1 Engine inspection findings

The post-accident engine inspection performed by the maintenance company, in presence of the AET and the DAC, revealed that material from the connecting rod Nr. 4 bearing had melted (Pic. a). Furthermore, metal parts from the rod bearings were found in the engine oil (Pic. b) and scratch marks were visible on the inside surfaces of the remaining connecting rod bearings (Pic. c & d: connecting rod bearing cyl. Nr. 2).



Picture – a



Picture – c



Picture – b



Picture – d

2.17 Organizational and management information

The airplane was operated by a group of co-owners on a private basis for personal leisure.

2.18 Additional information

2.18.1 Engine calendar time extension

The Type Certificate Holder of a piston engine usually recommends a Time Between Overhaul (TBO) in terms of operating hours and calendar time. In General Aviation, privately owned and operated aircraft may see a low utilization, leading to a situation where the engine TBO calendar time will be the limiting factor long before the operating hours are reached. A commonly accepted practice to support the General Aviation community is to grant extensions for TBO calendar limitations.

In August 2012, the Luxembourg Directorate of Civil Aviation has granted a first engine calendar time extension of ten hours, with the obligation to perform an oil analysis. A year later, when a new request for an extension was applied for by the maintenance company, DAC discovered that the first extension of ten hours was exceeded by twenty-one hours and requested an explanation from the co-owners. The response was accepted and a second calendar time extension of 10 hours was finally approved by DAC on 18 October 2013, with the obligation to do a compression test at 10 hours plus an oil analysis. The accident occurred during the 3rd hour of the extension.

In the aftermath of the occurrence, in order to keep the TBO calendar limitation extensions under control and to prevent a trade-off favoring financial aspects over safety, DAC has published an airworthiness notice on 31 March 2014 (revised on 15 November 2016) on the “*Extension of the calendar TBO for piston engines*”². The notice applies to “*any piston engine installed on other-than complex motor-powered aircraft having a Maximum Take-Off Mass of 5700Kg or below except powered sailplanes, registered in Luxembourg since at least 12 months from the date of the first issue of this airworthiness notice*”. Calendar Time extensions can be approved under the following rules:

- *Several consecutive calendar extensions can be granted for the same engine.*
- *A calendar extension cannot be granted for more than 12 months.*
- *The accumulated calendar extensions can be granted up to 50% more than the calendar TBO defined by the TCH.*
- *For every calendar extensions granted, the engine TBO hourly limitation is decreased by 10% of the remaining time.*
- *The engine will have to undergo the necessary maintenance process when reaching the hourly/yearly limit, whichever is the sooner.*

2.18.2 Maintenance chronology

The following table illustrates the maintenance chronology.

30 June 2013	The owners reported to the maintenance company the existence of starter problems as well as variations in oil temperature and oil pressure indications.
3 July 2013	The maintenance company notified the owners that approx. 80% of the teeth of the starter motor sustained damage and had partially broken off.

² DAC Airworthiness Notice 2014-01 on the « Extension of the calendar TBO for piston engines » (<https://dac.public.lu/documentation/nav/Airworthiness-Notice-2014-01.pdf>)

4 September 2013	Last performed maintenance inspection.
20 September 2013	The company that performed the oil analysis on 19 September 2013 notified the maintenance company that the particle quantifier (PQ) index indicated a high content of magnetic ferrous particles (the PQ refers to the total amount of magnetisable iron in a sample). Copper and iron levels were increased.
20 September 2013	The maintenance company informed the owners about the oil analysis results.
22 September 2013	The maintenance company explained to the owners that the results of the oil analysis were partially caused by the worn tooth of the starter, as the metal particles of the worn starter motor are collected in the oil filter by gravity, together with the metal from other worn parts of the engine. The maintenance company informed the owners that a request for an engine extension would be addressed to DAC.
24 September 2013	The maintenance company addressed a request for extension (10 hours) to DAC and included the information that metal (supposedly from starter gear) was detected in the oil filter.
30 September 2013	The airplane had been flown for 21.32 hours since the initial 10 hour extension approved by DAC on 21 August 2012 (with request of new oil analysis thereafter).
18 October 2013	The extension request dated 24 September 2013 was approved by DAC.

2.18.3 Search and rescue operation

Approximately three minutes after the pilot of LX-DIS declared an emergency on TWR frequency, the pilot of a Luxembourg Air Rescue helicopter, who was positioned near Junglinster, asked if he should have a look at the occurrence aircraft. The helicopter reached the accident site approximately 10 minutes after the emergency landing and informed the TWR that LX-DIS had nosed over in a field and that nobody had been injured. Shortly thereafter, the Luxembourg Police Helicopter also overflew the accident site and confirmed that nobody had been injured.

3. CONCLUSIONS

After a loss of engine power on a cross-country flight, the pilot performed an off-airport emergency landing in a crop field. During rollout, the aircraft nosed over at low speed and sustained damage to the propeller, the vertical stabilizer and the left hand wing and strut.

The post-accident engine inspection revealed important material wear and the failure of the connecting rod bearing of cylinder Nr. 4.