



## Serious incident to the Robin DR400-120 registered F-GOVA

on 6 December 2014  
at Cambrai (Nord)

<sup>(1)</sup>Unless otherwise stated, all times given in this report are in local time.

<b>Time</b>	Around 20:30 <sup>(1)</sup>
<b>Operator</b>	Union Aéronautique du Cambrais
<b>Type of flight</b>	Night VFR instruction flight
<b>Persons on board</b>	Two pilots in instruction and an instructor
<b>Consequences and damage</b>	Occupants poisoned
This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in April 2020. As accurate as the translation may be, the original text in French is the work of reference.	

## Carbon monoxide poisoning on a night flight, U-turn and emergency landing, in instruction

### 1 - HISTORY OF THE FLIGHT

The pilot, who was accompanied by a second pilot in the rear and an instructor in the right seat, took off from paved runway 26 on a flight with a view to obtaining his night rating. As he passed an altitude of 500 ft, the pilot reported to the instructor that he was not feeling well and transferred control to the instructor.

At the same time, the instructor and the pilot in the rear seat also started feeling unwell. Despite difficulties in controlling his limbs, the instructor took control while the pilot in the front seat opened the canopy a third of the way to ventilate the cockpit.

The instructor made a steeply banked (estimated 45°) U-turn to the right to land counter-QFU as quickly as possible. Upon touchdown, the instructor described his state of lethargy, which was bordering on sleepiness. Nevertheless, he managed to control his path and stop the aircraft on the runway without any damage.

### 2 - ADDITIONAL INFORMATION

#### 2.1 Statements

The night was clear with some mist and visibility of 4,400 m. The outside temperature was +3°C.

<sup>(2)</sup>When there is no CO, the detector patch is orange in colour. It turns black as the concentration of CO increases.

The instructor indicated that, during the pre-flight inspection, the carbon monoxide (CO) detection patch was a normal colour<sup>(2)</sup>. After starting up and testing the engine, the patch appeared to him as not as light in colour as usual, but he had difficulty identifying the exact colour with his flashlight because of its bluish beam. He checked with his mobile phone light. The patch still appeared yellow/orange to him, but darker than normal. He opened the cabin vents. In the opinion of one of the pilots, the patch was dark green. The instructor thought that he might have misinterpreted the information because it was dark and the patch was not well lit on the right side of the instrument panel. Given the uncertainty, he indicated that if either pilot felt the least physiological effect, he was to say so immediately and the instructor said that they would then open the canopy.

During take-off, the instructor turned off the heating using the knobs, to make demisting more effective. He opened the two adjustable front air nozzles and the two rear air nozzles. He reported that his legs were wobbly and that he felt nauseous and dizzy. He turned off the demisting while the student in the front left seat unlocked the canopy and opened it about one third of the way, as mentioned in the briefing.

After the aircraft came to a stop, all three occupants displayed symptoms of carbon monoxide poisoning. They perceived a strong (unusual) smell of exhaust fumes, which they likened to the smell of heating. This odour had not been perceptible during the flight.

On the ground, the CO detector patch was black.

The aircraft's previous flight had taken place 30 minutes before the occurrence flight, with no problems being reported. The occurrence flight was the aircraft's fourth flight of the day and the third night flight.

The emergency services arrived quickly and gave oxygen to the three pilots, then took them to the hospital for further tests. After the hospital consultation, it was revealed that one of the occupants had 18% CO in his blood, the second 12% and the third 10%.

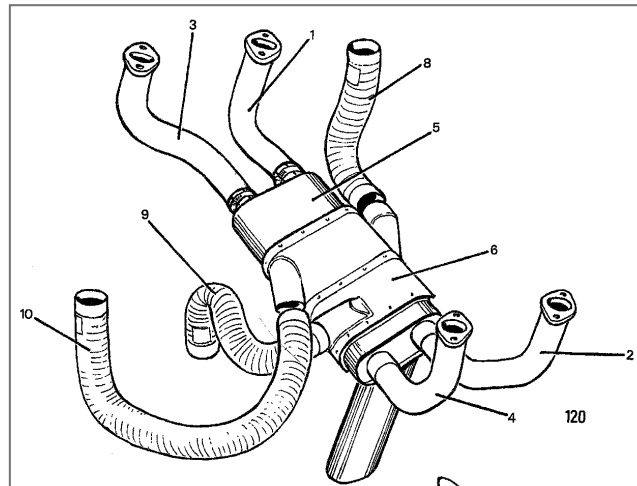
The incapacitation of the three persons onboard was the result of inhaling carbon monoxide.

## **2.2 Hot air conditioning (cabin heating, demisting, carburettor heating) on the DR400**

The 4-in-1 exhaust manifold is surrounded by a housing known as a "*heat exchanger housing*" (item 6), which is composed of two half-shells. It has two compartments completely sealed from the exhaust gas collection area: one for the carburettor heating unit and the other for the cockpit heating unit.

Three flexible hoses (numbered 8-9-10) are fitted to this housing. They have the following functions:

- ❑ To supply fresh air, taken from the front of the engine (item 8), to the compartment dedicated to the cockpit heating control unit via the flexible hose (item 10).
- ❑ To supply hot air to the carburettor heating unit (item 9). This flexible hose is connected to the "centre right" outlet of the exhaust manifold. The carburettor heating compartment is supplied with air taken from the engine compartment via a meshed surface in the lower half-shell of the heat exchanger.



Drawing of the exhaust manifold system of the O-235 engine on the DR400-120

### 2.3 Engine and engine compartment examinations

Observations of the engine compartment and the engine itself after the occurrence found:

- ❑ A leak at the ceramic seals of the exhaust pipe associated with wear of the gland packing of the exhaust manifolds of cylinders 2 and 4. The exhaust gases were thus able to permeate the engine compartment.
- ❑ Weld beads bearing witness to repairs made to numerous cracks in the manifold.
- ❑ Wear on the peripheral seal of the shut-off flap of the heating control box.
- ❑ The flexible hose connection supplying hot air from the heat exchanger housing to the heating control box had been switched with the connection supplying hot air to the carburettor air inlet.

### 3 - CONCLUSIONS

*The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation. They are not intended to apportion blame or liability.*

#### Scenario

During a night-time take-off and the initial climb with the windshield demisting activated, the three occupants experienced dizziness and nausea caused by inhaling carbon monoxide (CO). Despite his reduced flying ability, the instructor made an emergency counter-QFU landing, without any further damage.

The instructor's doubt as to the interpretation of the colour of the CO detector patch led him to discuss the risk of poisoning during the pre-take-off briefing. This enabled the crew to react quickly by turning back after the first symptoms of poisoning were detected.

#### Contributing factors

The windshield demisting system had been contaminated by exhaust fumes due to:

- the switching over of two flexible hose connections fitted to the exhaust manifold;
- a progressive leakage due to a worn ceramic gasket/gland assembly on the exhaust manifolds of cylinders 2 and 4.