AVIATION OCCURRENCE REPORT
A97Q0250

MID-AIR COLLISION

BETWEEN
CESSNA 172M C-GEYG
OF CARGAIR LTD.
AND
CESSNA 150H C-FNLD

MASCOUCHE AIRPORT, QUEBEC

07 DECEMBER 1997

Aviation Occurrence Report

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between
Cessna 172M C-GEYG
of Cargair Ltd.
and
Cessna 150H C-FNLD

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Summary

Following a pleasure flight in the area of Saint-Hubert, Quebec, the Cessna 150H, registration C-FNLD, serial number 15068912, joined the left-hand circuit downwind for Runway 29 at Mascouche Airport, Quebec, to come to a complete stop. At the same time, a Cessna 172M, registration C-GEYG, serial number 17266418, took off from Runway 29 for touch-and-goes on the runway following a left-hand circuit. The two aircraft collided in flight on the final leg for Runway 29 and crashed on the highway by an overpass abreast of Mascouche Airport. There were two occupants on board each aircraft, and all four suffered fatal injuries.

Ce rapport est également disponible en français.

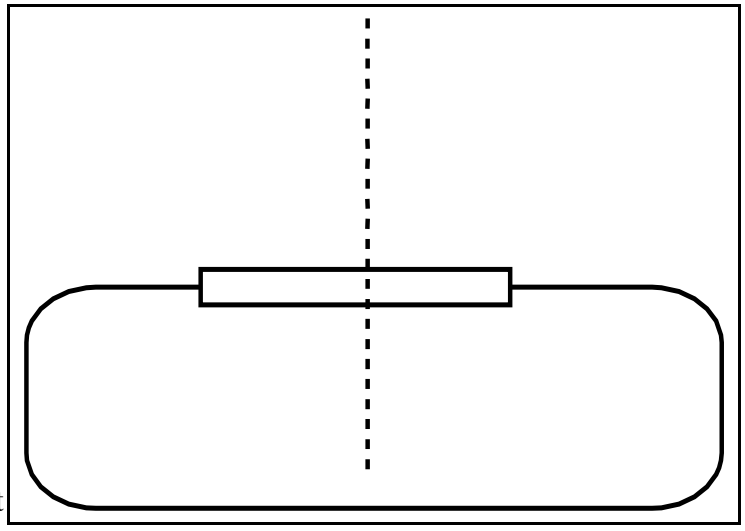
Factual Information

The pilot of Cessna 172 C-GEYG held a Class 3 Instructor Licence - Aeroplane Category. He had begun his training in August 1991 and had accumulated over 2500 hours' flight time at the time of the occurrence. The instructor was to review exercises in the circuit before letting the student pilot make a solo flight. The student pilot had a little over 21 hours' flight time. The pilot of Cessna 150 C-FNLD had owned the aircraft since April 1997 and held a Private Licence. He had begun his training in September 1994 and had accumulated over 200 hours' flight time. He had brought a passenger with him.

The autopsies were performed at the Laboratoire de médecine légale de Montréal. The reports indicate that the crews sustained severe, irreversible injuries in the occurrence, and that the deaths were due to multiple traumatic injuries sustained in the accident. Toxicological testing was conducted at the Centre de toxicologie du Québec. Toxicological test results were negative for the crews of both aircraft.

According to the meteorological data for 1400 eastern standard time at Mirabel Airport, there was a first, broken cloud layer at 2300 feet, and another layer at 4500 feet. Visibility was 25 statute miles, and the winds were blowing from 280 degrees true at seven knots; these conditions favoured the use of Runway 29.

Both aircraft were maintained in accordance with existing regulations. No irregularity was identified. The weight and centre of gravity were within the manufacturer-prescribed limits for both aircraft.



Both aircraft had joined a left-hand circuit for Runway 29 at Mascouche (meaning all turns in the circuit were to the left). Another aircraft, C-GADU, was preceding them, but it was on the ground, clear of the runway, by the time of the accident. The circuit is composed of several parts, as shown in Figure 1. The arrows on the upwind side indicate how aircraft can join this side from different directions before entering the circuit as such.

Data gathered from radar at the Montreal control centre made it possible to reconstruct the following information (Appendix A).

1420:51 Cessna 150 C-FNLD, arriving from the Saint-Hubert area, made a long detour northwards to approach Mascouche Airport on the upwind side of the circuit as Cessna 172 C-GEYG took off from Runway 29.

1421:49 When Cessna 150 C-FNLD joined the left-hand downwind leg for Runway 29, it was preceded by another aircraft that would be first in the landing sequence. At that time, Cessna 172 C-GEYG began its turn for the crosswind leg.

1423:11 Cessna 150 C-FNLD stretched its downwind leg while the aircraft ahead of it turned on the final leg. This aircraft would come to a complete stop. Cessna 172 C-GEYG began the left-hand downwind leg for Runway 29.

1424:38 Cessna 150 C-FNLD was now established on the final leg about 5.8 nautical miles (nm) from the end of the runway while Cessna 172 C-GEYG was established on the base leg.

1425:17 When Cessna 172 C-GEYG turned on the final leg, it was 4 nm from the end of the runway. Cessna 150 C-FNLD was ahead of it, but at a lower altitude. The approach speed of Cessna 172 C-GEYG was higher than that of Cessna 150 C-FNLD.

1426:00 The radar identified only one target and then none.

The radar data revealed that the circuit followed by each of the aircraft was similar to that followed by several other aircraft that had preceded them during the day.

The Lachenaie police department has equipped its patrol vehicles with a camera that activates as soon as the vehicle is started. At the time of the occurrence, a patrol car was eastbound on Highway 640 less than one kilometre from the exit for Mascouche Airport. The camera captured images of the collision showing that, shortly after the initial impact, the two aircraft adopted a high nose-up, almost vertical attitude. The aircraft appeared to become entangled and then separated again just before hitting the ground. When they separated, there was insufficient altitude available for either aircraft to effect a recovery. The report from the TSB Engineering Branch Laboratory in Ottawa indicates that the camera captured 12 seconds of the occurrence: five seconds before the collision, the collision and the fall to the ground. Measurements taken from the videotape's digitized images show that the aircraft were at an altitude of 450 feet above ground level at the time of impact. The images confirm that the Cessna 172 was higher than the Cessna 150. The images also confirm that the Cessna 172's landing light was on at the time of the mid-air collision while that of the Cessna 150 was off.

In the AIR section of the *Aeronautical Information Publication* (A.I.P. Canada), Transport Canada states that more and more operators have been using a landing light when flying at the lower altitudes, both during

daylight hours and at night, because they have confirmed that the use of the landing light greatly enhances the probability of the aircraft's being seen. Transport Canada therefore recommends that pilots use the landing light during the take-off and landing phases and when flying below 2000 feet within terminal areas or control zones.

The two aircraft crashed by the bridge crossing Highway 640 at the exit for Mascouche Airport, 2000 feet from the runway threshold. After the final impact, both aircraft came to rest on their backs. After the accident, the Cessna 150's cabin space was considerably reduced. There were several laceration marks—caused by a propeller—on the top of the cabin, such that the aircraft's structure was very damaged. The Cessna 172 showed evidence of impact with the ground and traces of colour transfer from the collision.

The two aircraft used two-way VHF communication radios, which allowed them to communicate on the frequency employed by crews using Mascouche Airport. Mascouche Airport does not have a control tower or a two-way communication recording system.

Canadian Aviation Regulations (CARs) 602.101 concerning joining the circuit at an uncontrolled airport lying within a mandatory frequency (MF) area specifies that:

> The pilot-in-command of a VFR aircraft arriving at an uncontrolled aerodrome that lies within an MF area shall report
> (a) before entering the MF area and, where circumstances permit, shall do so at least five minutes before entering the area, giving the aircraft's position, altitude and estimated time of landing and the pilot-in-command's arrival procedure intentions;
> (b) when joining the aerodrome traffic circuit, giving the aircraft's position in the circuit;
> (c) when on the downwind leg, if applicable;
> (d) when on final approach; and
> (e) when clear of the surface on which the aircraft has landed.

CARs 602.102 specifies for aircraft flying continuous circuits that:

> The pilot-in-command of a VFR aircraft carrying out continuous circuits at an uncontrolled aerodrome that lies within an MF area shall report
> (a) when joining the downwind leg of the circuit;
> (b) when on final approach, stating the pilot-in-command's intentions; and
> (c) when clear of the surface on which the aircraft has landed.

The information gathered indicates that the crews established radio communication on entering the circuit, on the downwind leg and on the final leg as prescribed in the regulations. Neither aircraft appears to have reported its position on the base leg, and was not required to do so. Just before the collision, a third aircraft tried to communicate with the two aircraft on the final leg to advise them of the dangerous situation they were in, but it was already too late.

During the period from April to November 1994, Transport Canada set up a mobile control tower at Mascouche

Airport. The working group involved says in its report that this experiment helped to make many pilots aware of the importance of complying with standards and procedures. During the period from April to November 1995, Transport Canada tried the experiment again, and also set up an awareness program.

NAV CANADA has a detailed policy on the delivery of air navigation services. The policy defines a set of assessment criteria and an Aeronautical Study process. One of the criteria for installing a control tower is that the annual movements must be equal to or greater than 60,000. This standard is not rigid and must be assessed in the light of other criteria, including the traffic mix and the level of risk defined by an aeronautical study. For the period from April to November of 1994 and 1995, the number of movements at Mascouche Airport stayed between 47,000 and 51,000. Mascouche Airport for the most part serves a population consisting of flying schools and resident and itinerant private pilots. The traffic is considered relatively homogenous and should remain so given the physical characteristics of the runway (length and width). Since the occurrence, no formal request for the installation of a control tower has been received by NAV CANADA or Transport Canada.

Visual flight is limited by the ability to see and be seen. Several factors can alter a pilot's chances of seeing and being seen, such as the aircraft appearance, the environment and the crew attention. Without being exhaustive, the main criteria that affect appearance are aircraft size, colour and shape, while the difficulty of seeing an aircraft in its environment seems to depend on brightness and background. The fuselage of Cessna 150 C-FNLD was red, and that of Cessna 172 C-GEYG was blue. Both aircraft had white wings. In several places on the circuit, the aircraft were in a position to see each other.

Crew attention is a determining factor in collision avoidance. Good scanning technique is required, as well as looking outside the cockpit as often as possible. Close attention to radio communications helps forming a mental image of the surrounding traffic and reducing the risks of collision.

CARs 602.19 deals with right of way. It specifies that the pilot-in-command of an aircraft that is approaching an aerodrome for the purpose of landing shall give way to any aircraft at a lower altitude that is also approaching the aerodrome for the purpose of landing. CAR 602.21 deals with collision avoidance and simply states that no person shall operate an aircraft in such proximity to another aircraft as to create a risk of collision.

Analysis

The flight crews were certified and qualified for the flight in accordance with existing regulations. The weight and centre of gravity of each aircraft was within prescribed limits, and each was maintained in accordance with existing regulations.

Although the Cessna 150's pilot was arriving from the south, he had bypassed the airport in a long detour to the east in order to approach the airport on the north side to join the Runway 29 circuit. He thus followed in every respect the procedure for joining the circuit of an uncontrolled aerodrome, just as the Cessna 172 was following the procedure for continuous circuits. Furthermore, the aircraft reported where they were supposed to as set out in CARs 602.101 and 602.102.

The pilot of Cessna 150 C-FNLD knew that another aircraft was ahead of him and probably decided to stretch out his downwind leg to give this aircraft time to touch down and clear the runway. The crew of Cessna 172 C-GEYG did not stretch their downwind leg to follow the aircraft ahead; the crew may have confused the Cessna 150 C-FNLD, still in the circuit, with the traffic that had just landed, or else was not attentive to the communications that would have allowed them to know what aircraft were ahead.

The crew of each aircraft could have seen the other aircraft at several places in the circuit. The pilot of Cessna 150 C-FNLD could have seen Cessna 172 C-GEYG at turning on the base leg and after his turn on the final leg. The pilot of Cessna 172 C-GEYG could have seen Cessna 150 C-FNLD while C-GEYG was on the downwind leg and during its descent on the base leg. Several factors, such as the appearance of the aircraft, the environment, a lack of attention or operation of the radios, could explain the collision, but no single factor could be identified in the investigation. The lack of evasive action by either aircraft indicates that neither aircraft had noticed the other.

The landing light of Cessna 172 C-GEYG was on, thereby increasing the possibility of its being identified by Cessna 150 C-FNLD during certain phases of flight. This advantage, however, proved useless when the aircraft were on the final leg, because Cessna 172 C-GEYG was behind and above the Cessna 150.

The aircraft collided in flight at an altitude of 450 feet on the final leg for Runway 29 at Mascouche and crashed, although, just before the collision, a pilot on the ground tried to warn them of the danger. The video sequences show that when the aircraft separated there was insufficient altitude available to effect a recovery.

Findings

1. Both flight crews were certified and qualified for the flight in accordance with existing regulations.

2. Both aircraft seem to have followed the joining, circuit and communication procedures in effect for an uncontrolled aerodrome.

3. Neither aircraft seems to have reported its position on the base leg, and was not required to do so under existing regulations.

4. Several factors such as the appearance of the aircraft, radio reception, the environment and the lack of crew attention were assessed, but none was identified as a determining factor in the accident.

5. The aircraft collided in flight at an altitude of 450 feet on the final leg for Runway 29 at Mascouche.

6. No evasive action was taken to avoid collision, indicating that neither pilot was aware of the other aircraft's presence.

7. The Cessna 172's pilot does not seem to have taken the presence of the Cessna 150 into consideration

when planning his circuit.

Causes and Contributing Factors

For an undetermined reason, the crew of the Cessna 172 did not maintain safe separation by stretching the downwind leg of the circuit to take the presence of the Cessna 150 into consideration. Several factors such as a failure of the radio equipment, the appearance of the aircraft, the environment and a lack of attention, may have contributed to the occurrence.

Safety Action

Since the accident in Mascouche, Transport Canada has delivered several presentations on the subject of circuit procedures at uncontrolled aerodromes. The presentations emphasize the importance of communication to ensure aircraft separation and the use of landing lights to increase the probability of being seen.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 01 March 2000.

Appendix A - Aircraft Position Data, from Radar