Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A01Q0009

LOSS OF CONTROL ON TAKE-OFF

PA-28-140 C-FXAY
MASCOUCHE, QUEBEC
13 JANUARY 2001

Canada

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Summary

A Piper Cherokee PA-28-140, registration C-FXAY, serial number 28-24659, with two pilots on board, took off from Runway 29 at Mascouche, Quebec on a visual flight rules flight to Lac-à-la-Tortue, Quebec. During climbout, about 25 feet above ground level, the aircraft rolled to the left. The pilot flying, who was also the owner of the aircraft, applied right aileron to compensate for the turn, but the aircraft continued to turn left. The other pilot also tried to straighten the aircraft by applying right aileron until the ailerons jammed in the full right position. The aircraft flew over Highway 640, and the left wing tip struck a snowbank on the side of the highway. The left wing separated at the fuel tank, and the aircraft came to rest in a field on the other side of the highway. The two pilots evacuated the aircraft and were taken to hospital for minor injuries. There was no fire.

Ce rapport est également disponible en français.

Other Factual Information

The pilot flying was certified and qualified for the flight in accordance with existing regulations. He had approximately 200 flying hours. Since he had not flown in just over three months, he asked a more experienced pilot to accompany him and supervise the flight. The other pilot held a valid commercial pilot licence and had owned an identical aircraft for several years. The purpose of the flight was to allow the pilot flying to confirm that his aircraft was operating correctly. The weather at Mascouche Airport, Quebec, was suitable for visual flight rules flight, and surface winds were calm.

Preliminary examination of the aircraft by the investigator at Mascouche Airport revealed that the bell cranks were installed backwards. The left wing had separated at the fuel tank, and one could clearly see that the bell cranks were not installed properly. By moving the ailerons from outside the aircraft, it was confirmed that the flight controls moved in the opposite direction.

The checklist used by the pilot provided three opportunities to confirm that the ailerons were functioning properly: the walk-around check, the before start check, and the before take-off check. The pilot had to ensure that the flight controls were operating properly by confirming that the deflection of the control surfaces matched the deflection of the flight controls. The flight controls were reportedly checked during the walk-around check, the engine warm-up, and again during the before take-off check. During these three checks, the two pilots ensured that the flight controls moved freely, but they did not pay particular attention to the directional deflection of the control surfaces. The checklist used by the pilot is the one he used during his pilot training; it is a general checklist not specific to any particular aircraft type. The checklist indicates that the flight controls must move freely, while the detailed checklist in the manufacturer's flight manual indicates that the flight control surfaces must be checked for proper deflection.

During the annual inspection, the aircraft maintenance engineer (AME) found that the aileron bell crank brackets were cracked and needed to be replaced. The aircraft owner had asked that his aircraft be repaired before the maintenance company closed for the Christmas break. The parts were ordered, and the replacement work began on 20 December 2000. The maintenance company was short one AME and had another aircraft to fix before closing, so the replacement work was completed in a hurry on Friday, 22 December 2000. This task involved removing the two fuel tanks to access the bell crank bracket mounting rivets. The work was laborious because the numerous fuel tank fastening screws were extremely rusted and hard to remove. The work took much longer than usual. The task consisted of releasing the tension on the aileron cables in order to move the bell cranks into the wing without having to remove them from the aircraft. But because the bell cranks were so greasy, the AME decided to remove them to clean and inspect them. The two bell cranks were not marked with a part number for identification. It would have been necessary to use the manufacturer's maintenance manual or parts manual for a diagram of the bell cranks installation, but this was not done. It was not the first time this task had been done in recent months; the AME had performed this task a few times during the past year.

Most aircraft maintenance shops use a microfiche reader system for aircraft maintenance. Microfiche systems take less space and cost less than maintenance manuals, but the reader

cannot be used near the aircraft. As a result, the AME must either read the microfiche and memorize the procedure or go back and forth repeatedly to the reader. Some readers have a feature allowing the microfiches to be printed out. This particular reader did not have a print feature. Consequently, the AME elected to perform the work from memory instead of using the microfiches. As a result, he interchanged the bell cranks when reinstalling them, thereby reversing the aileron controls.

The bell cranks were removed from the wing during reassembly, contrary to normal procedures. Therefore, an additional check— "Installation of aileron bell crank assembly", mentioned in section 5.11 of the maintenance manual—was required. Section 5.11(d) also indicates that aileron deflection must be verified using the method specified in section 5.12. If this check had been performed according to the procedures, the AME would have noticed that the bell cranks were installed backwards.

The *Canadian Aviation Regulations* (CARs) require an independent inspection because of the potential serious consequences of maintenance on flight or engine controls. CAR 571.10 requires that any work that disturbs engine or flight controls be inspected by at least two persons for correct assembly, locking, and directional deflection. The technical record must also contain the signatures of both persons. The requirement for a second person to inspect the work is to prevent an aircraft from being returned to service with defective controls.

The AME who performed the work is the company president and director of maintenance. He has been a licenced AME for more than 15 years. An independent licensed AME recorded the independent inspection in the aircraft technical log; he did not notice that the controls were reversed.

Tests were done on the same model of aircraft to determine whether there was an obvious difference between the two installations that would have alerted an AME performing this maintenance task. Both bell cranks were removed and mounted backwards as on the occurrence aircraft. The installation appeared correct at first glance, except that the fasteners for the aileron control rod, located toward the wing tip, put the rod out of alignment and caused a very slight rubbing against the skin of the trailing portion of the wing. The rubbing was not audible, and there was nothing wrong with the operation of the ailerons, except that the aileron directional deflection was reversed and the range of deflection was changed.

According to the aircraft maintenance manual, the ailerons must be adjusted to deflect upward 30° and downward 15° with a tolerance of 2°. Bell crank travel is limited by stops on either side. Before the bell cranks were mounted backwards, the aileron deflection during this test was within the limits prescribed by the manufacturer. After the bell cranks were mounted backwards, the left bell crank did not come into contact with the forward stop, and the aileron deflection was not within the prescribed range. The right aileron could deflect upward 18° and downward 14°, and the left aileron could deflect upward 25° and downward 14°.

Analysis

The pilot-owner was aware that he should pay particular attention to the ailerons because maintenance work had been done on them. Consequently, his decision to be supervised by a

more experienced pilot was reasonable since he had not flown for more than three months. However, the two pilots concentrated on the unrestricted movement of the flight controls instead of on the aileron deflection relative to flight control input.

Only the before start checklist indicated that the control surfaces deflection must be checked to ensure that it matches flight control input. Although that checklist was not followed, the pilots could have noticed the problem if they had paid closer attention to the deflection of the aileron relative to the deflection of the flight controls during the walk-around inspection, the engine warm-up, and the before take-off check.

This was not the AME's first time installing an aileron bell crank assembly. For that reason, he elected to perform the work from memory without checking each step in the maintenance manual. The work took much longer because of the many rusted screws that made the work more difficult, and the AME had to hurry to finish the job. Because of the poor appearance of the bell cranks, he elected to remove them from the wing to clean them.

Since he was accustomed to doing this kind of work, the AME did not have to check the aileron deflection or movement with the diagram. Every time he had performed this task in the past, he had left the bell cranks in place and simply adjusted the cable tension and returned the aircraft to service without rechecking the controls deflection. When he removed the bell cranks from the wing, he should have checked the deflection as indicated in the maintenance manual, but he did not do so.

Tests confirmed that there are significant differences between the two installations. If the AME had followed the maintenance manual procedures, the error could have been prevented.

Findings as to Causes and Contributing Factors

1. The aircraft was returned to service with the aileron controls reversed.

2. The independent inspection made by another aircraft maintenance engineer (AME) did not reveal the reversed aileron controls. As a result, a defective aircraft was returned to service.

3. During their pre-flight checks, the two pilots did not notice that the ailerons were reversed.

4. The AME elected to perform the work from memory instead of using the microfiches. As a result, a check was not made when the aileron controls were reassembled.

5. The procedures described in the manufacturer's maintenance manual for installing the aileron bell cranks were not followed, resulting in an error when the bell cranks were reinstalled.

This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on 18 December 2001.