Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT

A00O0057

MIDAIR COLLISION

BETWEEN
ISLAND AIR FLIGHT SCHOOL & CHARTERS INC.
CESSNA 172 C-GSAR
AND
CESSNA 337 SKYMASTER C-GZYO
TORONTO/CITY CENTRE AIRPORT 18 NM NE
13 MARCH 2000

Canada

Aviation Investigation Report

Midair Collision

Between
Island Air Flight School & Charters Inc.
Cessna 172 C-GSAR
and
Cessna 337 Skymaster C-GZYO
Toronto/City Centre Airport 18 nm NE
13 March 2000

Report Number A00O0057

Summary

A Cessna 337, registration C-GZYO, serial number 33701846, with only the pilot on board, was orbiting at 2000 feet above sea level. The aircraft was in a left turn when it passed from right to left underneath a Cessna 172. The Cessna 172, registration C-GSAR, serial number 172S8214, conducting a training session with one instructor and one student on board, was returning to Toronto/City Centre Airport from the practice area. Both pilots were flying under visual flight rules. The Cessna 172 was descending on a steady southwesterly heading when the two aircraft collided about 18 nautical miles northeast of Toronto/City Centre Airport. The nose gear of the Cessna 172 struck the left vertical stabilizer of the Cessna 337. Approximately half of the left vertical stabilizer and left rudder separated from the Cessna 337. The Cessna 172 nose gear assembly was damaged. Both pilots were able to maintain control of their aircraft. The Cessna 172 instructor pilot continued to Toronto/City Centre Airport and landed safely. The Cessna 337 pilot returned to Toronto/Buttonville Municipal Airport and landed without further incident. The accident occurred at 1658 eastern standard time, during daylight hours, in visual meteorological conditions.

Ce rapport est également disponible en français.

Other Factual Information

The Cessna 337 pilot, employed by a media company, was conducting a highway traffic reporting mission and was monitoring Downsview Unicom on frequency 126.2 MHz. For some time prior to the occurrence, the Cessna 337 pilot was in a left-hand orbit at 2000 feet above sea level over a section of Highway 401 that had a lane restriction. The Cessna 172 instructor pilot and student, returning from the practice area after an instructional lesson, were in a busy visual flight rules (VFR) corridor approaching the Highway 2 Route depicted in the CFS. The Cessna 172 pilot was monitoring frequency 122.9 MHz, the flying practice area frequency. The Cessna 172 was heading approximately 240 degrees magnetic and was in a shallow descent with the student pilot at the controls, under the direct supervision of the instructor pilot.

At the time of the collision, the Cessna 172 was in a shallow descent with the wings level; while the Cessna 337 was in a gentle left turn with approximately 10 degrees of bank (see Appendix A). The Cessna 337 passed underneath the Cessna 172. The nosewheel of the Cessna 172 contacted the left vertical stabilizer of the twin-tailed Cessna 337. The instructor pilot of the Cessna 172 saw the Cessna 337 a split second prior to the collision, but the Cessna 337 pilot did not see the other aircraft until after the collision.

The Cessna 172 instructor pilot heard a shearing, crackling metal sound, which he believed to be caused by the turbulence of the other aircraft passing very close to him. He immediately took control of the aircraft and checked for damage. Since the engine was running fine and he was unable to see any damage, he assumed that the aircraft had missed each other. He contacted Toronto/City Centre tower and advised the air traffic controller of the near miss. He did not declare an emergency but proceeded for a normal approach and a precautionary soft-field landing. During the landing roll-out, the pilot noted that the aircraft was difficult to steer, so he stopped the aircraft on taxiway E and inspected it for damage. He noted that the nosewheel area had been damaged, and the aircraft could not be taxied to the ramp.

The Cessna 337 pilot initially thought he had a bird strike. After checking the engine instruments and noting that everything was normal, he noticed the Cessna 172 off to his right and realized that a midair collision had occurred. He checked his aircraft for damage and noted extensive damage to the aft portion of the left vertical tail and rudder. He followed the Cessna 172 and switched to the Toronto/City Centre tower frequency but did not advise the air traffic controller or the Cessna 172 pilot of the collision. After listening to the communications between air traffic control (ATC) and the Cessna 172 pilot, he was aware that the Cessna 172 pilot believed that a near miss had occurred. He contacted another company pilot who was on the ground at Toronto/Buttonville Municipal Airport, advised him of the collision and asked him to contact Toronto/City Centre tower by telephone so that the air traffic controller could inform the Cessna 172 pilot of the collision. By the time contact was made with the controller, the Cessna 172 was on the ground. After following the Cessna 172 for approximately 10 minutes, the Cessna 337 pilot conducted some controllability checks to determine if the aircraft was fully controllable: the ailerons and elevator controls reacted normally, and the rudders were free and clear through full travel. He returned to Toronto/Buttonville Airport, contacted the tower, and conducted a normal approach and landing. He did not advise the Buttonville tower air traffic controller that his aircraft had sustained damage nor did he declare an emergency.

The pilot of the Cessna 172 held a valid commercial licence with a Class 4 instructor rating—Aeroplane Category. His commercial licence was originally issued in September 1999, and the Class 4 instructor rating was issued in February 2000. He had accumulated approximately 260 flight hours, 40 hours of which were on this aircraft type and approximately 20 hours of which were instructional. He was certified and qualified for the flight in accordance with existing regulations. The student pilot was enrolled in a private pilot course and was completing his third instructional lesson.

The pilot of the Cessna 337 held a valid commercial pilot licence originally issued in April 1970. He had accumulated over 25 000 flight hours, approximately 1500 of which were on this aircraft type. He was certified and qualified for the flight in accordance with existing regulations.

According to the routine aviation weather reports (METAR) for 1700 eastern standard time, Toronto/Buttonville Municipal Airport reported a broken cloud layer at 4000 feet above ground level (agl), another broken layer at 12 000 feet agl, and an overcast condition at 25 000 feet agl. Visibility was reported to be 15 statute miles (sm). The 1700 METAR for Toronto/Lester B. Pearson International Airport reported a broken cloud layer at 4000 feet agl, another broken layer at 8000 feet agl, and visibility of 15 sm. The Toronto/City Centre METAR for 1700 reported a broken cloud layer at 3400 feet agl and visibility of 9 sm.

Both pilots indicated that the in-flight weather conditions were very similar to the reported weather. Although there was some haze, visibility was estimated to be greater than 10 sm. The cloud cover obscured the sun, so there were no restrictions to visibility due to glare from the sun. Both pilots were wearing sunglasses, and the sun visor on the Cessna 337 was down.

The midair collision occurred in Class E airspace in a busy VFR corridor several miles northeast of a VFR route depicted in the CFS on the Toronto/City Centre VFR Terminal Procedures Chart. The CFS does not specify a radio frequency for use by VFR aircraft flying on this route. Class E airspace is controlled airspace within which instrument flight rules (IFR) or VFR operations may be conducted. In Class E airspace, ATC separation is provided only to aircraft operating under IFR. There are no special requirements for VFR flight.

The safety of VFR flight depends on the ability of pilots to see and avoid other aircraft and to be seen by other aircraft. This is particularly true in uncontrolled airspace or Class E controlled airspace, where ATC does not provide traffic information or conflict resolution to VFR aircraft. *Aeronautical Information Publication (AIP)*, section 2.5.1 of Rules of the Air and Air Traffic Services (RAC), states

> Due to … the density of air traffic at certain locations and altitudes, the 'see and be seen' principle of VFR separation cannot always provide positive separation. Accordingly, in certain airspace and at certain altitudes VFR flight is either prohibited or subject to specific restrictions prior to entry and during flight.

Several factors can alter the likelihood of seeing and being seen, including aircraft appearance, the environment, aircrew attention, and air traffic information gathered from other sources.

Size, colour, shape, and lighting are the main appearance elements that can influence an aircraft's visibility to other aircrew. *AIP*, section 4.5 of Airmanship (AIR), states

> Pilots have confirmed that the use of the landing light(s) greatly enhances the probability of the aircraft being seen…Therefore, it is recommended that all aircraft show a landing light(s) during the takeoff and landing phases and when flying below 2000 feet AGL within terminal areas and aerodrome traffic zones.

The collision did not occur within a terminal area or an aerodrome traffic zone, but it did occur in a busy VFR corridor . The blue and white Cessna 337 was flying with only its anticollision lights on, which included three strobe lights, one on the right vertical tail fin and one on each wingtip. The red and white Cessna 172 was flying with only its beacon on.

The primary environmental factors are in-flight visibility, ambient light or brightness, and background. Environmental factors at the time of the collision were favourable for safe VFR flight.

Aircrew attention is a determining factor in collision avoidance. Looking outside the cockpit as often and as much as possible and using a systematic technique to scan the sky for other aircraft are fundamental to safe VFR flight. Additional tasks that demand the pilot's attention detract from the pilot's ability to maintain a constant and vigilant lookout for other air traffic.

A significant amount of air traffic information can be gleaned from other sources such as ATC traffic advisories and radio transmissions from other aircraft. Traffic advisories improve a pilot's ability to visually acquire other aircraft. Advisories warn of potential conflicts and will generally increase the time that the aircrew devote to visually searching for traffic. Advisories also aid the aircrew in concentrating their visual search in the vicinity of the traffic. Similarly, onboard equipment such as a traffic alert and collision avoidance system (TCAS), designed to operate independently of the ATC system, will provide pilots with traffic information to assist them in visually acquiring other aircraft. The TCAS uses the radio transponder returns of other aircraft to provide azimuth, altitude, and range information. Aircraft without transponders are invisible to the TCAS. The Cessna 172 and the Cessna 337 were both equipped with transponders, but neither aircraft was equipped with a TCAS. The pilots of the two aircraft were monitoring different radio frequencies.

Records indicate that the Cessna 172 was certified, equipped, and maintained in accordance with existing regulations and approved procedures. It sustained substantial damage to the nose gear assembly and surrounding structure. The lower landing gear support/attach bracket was sheered off but remained attached to the landing gear leg. The upper landing gear support/attach bracket remained attached by one bolt. The steering arms were torn off at their attach points, the rudder torque tubes were bent, the lower firewall was wrinkled, the lower engine cowl mount was damaged and wrinkled, and the upper forward cockpit floor skin was slightly deformed.

Figure 1 The damaged Cessna 172 nose gear assembly

Records indicate that the Cessna 337 was also certified, equipped, and maintained in accordance with existing regulations and approved procedures. It sustained substantial damage to the left vertical tail and rudder. The aft portion of the upper half of the vertical tail was torn off along with the upper half of the rudder. The forward portion of the upper half of the vertical tail was bent inwards and displayed an imprint of the Cessna 172 nosewheel tire. The lower portion of the vertical tail and rudder were slightly deformed.

Figure 2 The Cessna 337's left vertical tail and rudder

Analysis

Both pilots were familiar with the airspace and were aware of the generally high volume of VFR traffic in the corridor . The environmental conditions at the time of the occurrence were favourable for safe VFR flight. However, a number of factors combined to create a significant risk of collision. This analysis will examine those factors, including the limitations of solo VFR operations, the airspace, and post-collision action taken by the pilots.

Although see-and-avoid is the primary means of providing safe separation between aircraft operating under VFR, it may be inadequate in areas where the volume of air traffic is high. Similarly, when pilots conduct flight operations that require focussing some of their attention on tasks that are not related to the safety of the flight, such as monitoring highway traffic and reporting, additional means of gathering air traffic information may be necessary to reduce the risk of midair collision.

The Cessna 337 pilot was conducting a highway traffic reporting mission that required him to monitor traffic on the ground and conduct live radio broadcasts while flying the aircraft and maintaining safe separation from other aircraft. The pilot's awareness of nearby air traffic would have been enhanced by ATC traffic advisories, an additional person in the aircraft to perform some of the mission duties, and TCAS equipment. Aircraft certified for single-pilot operation, including Cessna 337's, are used in commercial air operations that cause a considerable amount of the pilot's attention to be diverted from normal flying duties. A second pilot or mission specialist in the aircraft would increase the likelihood of seeing and avoiding other aircraft. Similarly a TCAS, if installed and functioning, would have warned the pilot of his proximity to other aircraft operating with transponders. A TCAS warning could have provided the pilot with adequate time to take appropriate actions to avoid the collision.

The VFR route near where the midair collision occurred was designed many years ago when the volume of VFR traffic was significantly less than it is now. The high volume of VFR traffic arriving and departing from Toronto/City Centre Airport, combined with other VFR traffic in the Toronto area, requires that pilots be constantly on the lookout for other aircraft. Minor changes to the route or airspace structure could significantly enhance pilots' awareness of other air traffic in the corridor , thereby decreasing the risk of midair collisions.

Mandatory reporting points and a radio frequency published in the CFS for the VFR route would provide pilots additional sources of information from which to build a better air picture. Reporting points could be geographically significant and easily recognizable from the air so that pilots would have no difficulty spotting them and making the mandatory radio calls.

A further reduction to the risk of midair collision in this busy VFR corridor could be realized by changing the airspace structure so that the air route is in Class D airspace. Class D airspace is controlled airspace within which both IFR and VFR flights are permitted, but VFR flights must establish two-way communication with the appropriate ATC agency prior to entering the airspace. ATC separation is provided only to IFR aircraft, but all aircraft are provided with traffic information. Equipment and workload permitting, conflict resolution would be provided between VFR and IFR aircraft, and upon request, between VFR aircraft.

The pilots' actions immediately after the collision had the potential to significantly alter the safe conclusion of both flights. The pilot of the Cessna 172, unable to see any physical damage to his aircraft, assumed that his aircraft had not made contact and was undamaged.

The pilot of the Cessna 337 was aware of the collision and could see that his aircraft had sustained substantial damage. Since he was experiencing no control problems, he decided not to land immediately and did not declare an emergency. He followed the Cessna 172 toward Toronto/City Centre Airport to determine if the Cessna 172 was experiencing any control problems. He was aware that the Cessna 172 pilot believed no contact had occurred; however, he did not advise the pilot of the collision and that the Cessna 172 must have sustained some damage. Knowing there had been a collision would have allowed the Cessna 172 pilot to make informed decisions regarding landing problems and the declaration of an emergency.

Once he was reasonably certain that the Cessna 172 pilot was experiencing no control problems, the Cessna 337 pilot performed controllability checks and returned to Toronto/Buttonville Municipal Airport. During the controllability checks, he verified that the rudders were free and clear through full travel. When control surfaces are damaged, extensive control movements can result in further damage or jammed controls. A preferable course of action would be to verify that no control problems existed in a safe landing configuration and land as soon as possible while minimizing control inputs and airspeed variations. By not advising Buttonville ATC of the situation or not declaring an emergency, the Cessna 337 pilot precluded a rapid response by emergency services in the event of a landing accident.

Findings as to Causes and Contributing Factors

1. Neither the Cessna 337 pilot nor the Cessna 172 instructor or student pilot saw the other aircraft in time to avoid the collision.

2. The collision occurred in Class E airspace in a busy VFR corridor near a VFR route that is published in the CFS. No frequency is specified for use by VFR aircraft flying on the route. ATC does not provide traffic information or conflict resolution to VFR aircraft in Class E airspace.

3. The aircraft were on different radio frequencies, and there was no direct communication to alert either pilot to the presence of the other aircraft.

4. The Cessna 337 pilot was conducting a highway traffic reporting mission, a task that detracted from his ability to maintain an effective lookout for other air traffic.

5. The see-and-be-seen principle of VFR separation has inherent limitations and cannot always provide positive separation, particularly in areas of high-density air traffic. The VFR corridor where the collision took place is a known high-density air traffic area.

Findings as to Risk

1. Neither aircraft was equipped with TCAS, depriving the pilots of a defence against collision. TCAS equipment was not required by regulation.

2. The Cessna 337 pilot did not inform the Cessna 172 pilot through direct radio communications that a collision had occurred.

3. The Cessna 337 pilot's verification that the rudders were free and clear through full travel and the consequent decision to not land as soon as possible, increased the risk of an in-flight control failure.

4. The Cessna 337 pilot did not declare an emergency or advise ATC that his aircraft was damaged.

Safety Action

Action Taken

Transport Canada initiated a System Safety Review of VFR operations in the Greater Toronto Area following the occurrence. This is a systematic evaluation process in which a Safety Review Team identifies hazards and system deficiencies and develops mitigation plans for these hazards and system deficiencies.

The operator of the Cessna 337 Skymaster has taken steps to improve the safety of the operation. The aircraft is operated with landing lights, navigation lights, anti-collision lights and beacon activated. Additionally they are in the process of installing TCAS equipment in the aircraft.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 21 March 2001.

Appendix A—Radar Depiction of Flights