Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

# AVIATION INVESTIGATION REPORT
# A01C0230

## LOSS OF CONTROL AND COLLISION WITH TERRAIN

## PERIMETER AVIATION
## BEECH 95 TRAVEL AIR C-FCNU
## WINNIPEG INTERNATIONAL AIRPORT, MANITOBA
## 2.4 nm N
## 27 SEPTEMBER 2001

Canada

# Aviation Investigation Report

# Loss of Control and Collision with Terrain

# Perimeter Aviation
# Beech 95 Travel Air C-FCNU
# Winnipeg International Airport, Manitoba
# 2.4 nm N

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## *Summary*

A Beech 95 Travel Air, C-FCNU, serial number TD668, was on a local training flight practising simulated single-engine procedures in the circuit for Runway 18 at Winnipeg International Airport. Shortly after the aircraft was turned onto the final approach to Runway 18, near the end of a scheduled one-hour training session, the aircraft made a rapid uncontrolled descent and struck the embankment of a ditch on the north side of Jefferson Avenue in Winnipeg, Manitoba. The aircraft bounced and came to rest approximately 70 feet northwest of the initial point of impact, 2.4 nautical miles short of the runway. A post-crash fire broke out that consumed most of the centre wing and cabin sections of the aircraft. The aircraft was destroyed. The two pilots, the only occupants of the aircraft, sustained fatal injuries. The crash occurred during daylight hours at 0954 central daylight time.

# *Other Factual Information*

The aircraft, C-FCNU, was being used for multi-engine, flight-training exercises. It had accumulated approximately 13 784 hours total airframe time and, according to a review of available documentation, was certificated, equipped and maintained as required by existing regulations and approved procedures. The aircraft's weight and centre of gravity for take-off were calculated to have been within the certified limits. C-FCNU was not equipped with a flight data recorder or cockpit voice recorder; they were not required by regulations.

The instructor pilot and student pilot were both properly qualified for the training flight. The instructor held a valid Canadian airline transport pilot license, with a Group I instrument rating and Class II Instructor rating. The student pilot held a valid Canadian commercial pilot license. The occurrence flight was the first flight of the day for both pilots, and a review of the company's dispatch logs revealed that both pilots were adequately rested. The flight was scheduled to include engine-failure recovery and single-engine approach-to-landing exercises. These exercises are included in the Transport Canada-approved company training curriculum. On this particular flight, the training was to be accomplished under visual flight rules, whereby the pilot has visual reference to the ground and other air traffic in the area.

The weather report for Winnipeg for 1000[1], six minutes after the accident, states the following: winds 120 degrees at 5 knots; visibility 15 statute miles; a few clouds at 25 000 feet; temperature 13 degrees Celsius; and dew point 6 degrees Celsius.

At 0851, C-FCNU was cleared for take-off and the crew proceeded with the training session as planned. They flew a series of touch-and-go landings for approximately one hour. At approximately 0952, the Winnipeg tower controller advised the crew of C-FCNU that their traffic position was number 2 to land followed by the words "wake turbulence". An Airbus A320 was in front of them, cleared to land. The instructor acknowledged that he had received and understood the tower controller's instruction. This was the last communication received from C-FCNU.

At 0952, the occurrence aircraft was on final approach to Runway 18 at approximately 500 feet above ground level (agl) in a normal approach attitude. Suddenly the aircraft pitched up, rolled rapidly, and entered a very steep dive in the opposite direction, a manoeuvre similar to a spin or stall. Radar data for this time show the aircraft decelerated from 130 to 100 mph at an altitude of 1300 feet above sea level (asl), approximately 500 agl. At 0953:18, radar contact was lost at a position coincident with the occurrence site.

The wreckage trail and associated ground scarring indicated that the aircraft struck the north side of Jefferson Avenue on a heading of approximately 310 degrees in a wings-level, approximately 5 degree nose-down attitude. It then struck the far side of the adjacent ditch, bounced into the air, travelled about 70 feet on a track of 310 degrees and came to rest facing 030 degrees. The aircraft burst into flames on impact.

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1 All times are CDT (Coordinated Universal Time [UTC] minus five hours) unless otherwise noted.

The landing gear and both propellers were torn off at impact with the ditch and remained within 30 feet of each other. The right propeller was almost completely imbedded in the soil of the ditch embankment. The landing gear would have had to be in the extended position for it to tear off. All of the cockpit engine power controls were destroyed.
On-site inspection of the remaining aircraft components revealed three anomalous factors:

- the rudder trim had 15 units of right trim input selected;
- the left mixture cable was in the idle cut-off position; and,
- the left magneto switch was in the Off position.

The positions of the remaining engine and propeller control cables were consistent with the settings for maximum power.

Most of the aircraft, including the aircraft's cockpit and a large portion of the centre fuselage section, was destroyed by a post-crash fire. There were no avionics or instruments intact that could provide any useful information. Most of the aircraft's mechanical, hydraulic and electrical systems were destroyed. The propeller blades were damaged and scored and had separated from the engine at the crankshaft flanges due to a combination of shear and tensile overload forces. Wreckage information, primarily the ground scarring, indicates that the aircraft was in the process of recovering from a very steep dive when the impact with the ditch occurred.

Autopsy results indicated that both pilots perished from deceleration injuries before the aircraft was consumed by fire. The nature of the instructors' injuries suggested that he was at the controls at the time of impact. There was no evidence of smoke inhalation or any medical condition which might have caused pilot incapacitation. Toxicology reports revealed no substance that could have caused impairment of either pilot.

The minimum airborne control speed (Vmca) listed in the Beech 95 operators manual is 80 mph. However, Beechcraft has published an additional speed limitation associated with single-engine operations specific to simulated engine failure training. This limitation is referred to as velocity safe single engine (Vsse) and is listed in Perimeter Aviation's procedures as 100 mph minimum. Perimeter Aviation directs their instructors to use this, or an even higher minimum speed of 108 mph, when practising single-engine drills.

Transport Canada *Air Carrier Advisory Circular,* 0051 93-06-22, and TSB Recommendation 92-03 refer to this aircraft type's tendency to enter into spins at low airspeeds. These reports identify this tendency as a potential safety issue and emphasize the need for heightened awareness of it.

Following this accident, flight tests were carried out using an identically equipped and configured Beech 95 aircraft in similar atmospheric conditions. When the landing gear was selected down, with a simulated power loss of the left engine, there was an airspeed loss of approximately 30 mph.

Perimeter Aviation's training program requires that one actual in-flight shutdown be accomplished during the course of a student's multi-engine training. Company records indicate that this had been done with the occurrence student on September 26. There was also a company procedure that precluded an intentional in-flight engine shutdown, for training purposes, near an airport. Another procedure required that company maintenance be advised if such an engine shutdown was scheduled. In this occurrence, maintenance personnel had not been so advised.

Although C-FCNU was not under radar control, it did have an operational transponder which allowed its movements to be recorded by radar. Radar data analysis showed the following.

- C-FCNU was following approximately two miles behind an Airbus 320 aircraft.

- C-FCNU's airspeed decreased from 130 to 100 mph in approximately 15 seconds immediately before the radar image disappeared from the radar screen. An airspeed reduction of this magnitude at this point in the circuit is similar to the airspeed decrease exhibited when the landing gear is selected down with a simulated power loss of one engine.

- The last positive radar contact with C-FCNU coincides closely with the location of the wreckage site.

- The last observed radar position of C-FCNU was approximately 200 feet lower than the preceding Airbus 320 at the same point on the approach.

The radar data do not show an end to the aircraft's deceleration or the aircraft stabilizing at an airspeed above 100 mph. Such an airspeed stabilization would indicate that this rapid deceleration was a scheduled segment of the approach and that it would have eliminated control loss due to airspeed decay as a factor in this accident.

Transport Canada's *Aeronautical Information Publication (AIP) Canada* states:

> Wake turbulence is caused by wing tip vortices and is a by-product of lift. The greatest vortex strength occurs under conditions of heavy weight, clean configuration, and slow speed. One should avoid the area below and behind other aircraft, especially at low altitude where even a momentary wake turbulence encounter could be disastrous.
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> ...wake turbulence can persist for periods in excess of two minutes, it normally descends after it is produced, and it will last longer in calm wind conditions; aircraft flying into the core of a wingtip vortex can experience a rapid vortex-induced roll in the direction of the vortex air flow; and, small aircraft encountering large vortices may not be able to recover.

There are no mandatory wake turbulence separation criteria for arriving aircraft operating under visual flight rules. Wake turbulence avoidance is the pilot's responsibility when operating under these circumstances. The only air traffic control (ATC)procedure for arriving VFR aircraft is that a light aircraft landing behind a medium weight category aircraft be cautioned as to the possibility of encountering wake turbulence on approach to the runway. Such a caution was the last communication that ATC issued to the pilots of C-FCNU.

The recommended pilot technique for avoiding wake turbulence is to fly the approach higher than the preceding aircraft's approach, and plan to land past the point where the preceding aircraft touched down.[2] The crew of C-FCNU did not follow this technique; they flew a lower approach profile, which put them below the preceding aircraft's approach path.

Pilot task and thought process workload increases considerably during intensive training compared to routine non-training flights. Aviation psychology research has shown that when cockpit workload is increased, pilots make more attention-based errors—forgetting to carry out intended actions or not noticing abnormalities. The combined effect of these errors is often referred to by human factors experts as a decreased level of situational awareness.[3]

# *Analysis*

Because of the absence of flight recorder information and pilot interviews and because many of the aircraft components were destroyed by a post-crash fire, it is difficult to draw definite conclusions with respect to the loss of aircraft control.
ATC radar information shows the aircraft decelerated toward minimum airborne control speed. It is likely that the aircraft transitioned from a normal approach into an unrecoverable manoeuvre, such as a spin or stall. What induced this type of uncontrolled manoeuvre is unclear. There was a rapid deceleration toward Vmca, with no apparent aircraft stabilization, immediately prior to the stall. It is likely that the aircraft continued to slow below the minimum control speed of 80 mph. The aircraft was then in a flight regime where control of the aircraft was lost and was not recoverable. The positions of the engine controls—except the left engine mixture cable and the left magneto switch—were consistent with the configuration expected during attempted recovery from an aircraft upset or a sudden altitude loss.

The rudder trim was positioned at 15 units of right trim, and the left mixture cable was in the idle cut-off position. Both of these indicate that either an engine failure was being simulated or that the aircraft had experienced an actual engine failure prior to the time control of the aircraft was lost. Damage and blade angle scoring of the propellers show that both engines were at high

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2 Canadian Aeronautical Information Publication AIP 2-10.

3 Weigmann & Shappell. A Human Error Approach to Accident Investigation: The Taxonomy of Unsafe Operations," *The International Journal of Aviation Psychology*, 7/4, pp. 269-291

power and high RPM at impact. It is unlikely, therefore, that the left mixture was actually at idle cutoff and that the magneto switch OFF before the impact. It is probable that the left mixture control and the left magneto switch were moved as a result of the high impact forces or by being struck by flying debris inside the cockpit on impact.

The absence of any communications advising ATC of an emergency situation reduces the likelihood that an actual engine failure occurred. The rudder trim also indicates that a simulated engine failure check had been actioned by the pilots prior to the loss of control. A simulated engine failure therefore was not likely the initiating factor in the control loss.

ATC Manual of Operations directs controllers to caution pilots against wake turbulence with the phrase " Caution possible turbulence" or "Caution wake turbulence". In this instance only the words "wake turbulence" were issued after the tower controller advised the pilots of their traffic. However, the instructor's level of experience and his reply to the controller's advisory suggest that he understood those words were issued as a caution. Consequently, the controller's non-standard phraseology likely did not contribute to a possible wake turbulence encounter.

Operating the aircraft in a simulated single-engine configuration would place the aircraft in a low-energy and asymmetric flight regime. Flight in a low-energy state at low altitudes greatly increases the difficulty of recovery from stalls or unusual attitudes. Consequently, although a simulated failure of the left engine was likely not the initiating factor of the control loss, it would have made recovery from an upset or stall at that altitude unlikely.

Because they were operating VFR, the pilots of C-FCNU were solely responsible for wake turbulence avoidance. Under the high cockpit workload conditions of engine failure training, it is likely that the pilots of C-FCNU did not comprehend the significance of the controller's wake turbulence comment or, with understanding, did not see the need to take action to address the possibility of wake turbulence. As a result they continued to fly the approach in a manner where wake turbulence from the preceding Airbus A320 aircraft was likely encountered. The light wind conditions provided an ideal environment for the persistence of wake turbulence. In the absence of other plausible reasons for the aircraft upset, the aircraft most likely encountered wake turbulence, which, at the low speed of the aircraft, led to a vortex-induced roll and loss of aircraft control from which the crew could not recover.

## *Findings as to Causes and Contributing Factors*

1. The pilots of C-FCNU experienced loss of aircraft control at an altitude and flight configuration from which recovery was not possible.

2. The control loss most likely resulted from a combination of low aircraft speed and encountering wake turbulence, during a simulated engine failure approach.

## *Findings as to Risk*

1. There are no mandatory air traffic control wake turbulence separation criteria for VFR aircraft on approach, specifically VFR training aircraft. There is a continued risk that training aircraft operating in high traffic areas among heavier aircraft types, can inadvertently encounter wake turbulence.

## *Safety Action Taken*

Since this occurrence, the operator has expanded discussions on wake turbulence during pre-flight briefings and amended their Beech 95 Standard Operating Procedures (SOP) as follows:

- single-engine approaches behind medium or heavy weight category aircraft are now prohibited.

- simulating a failed engine by retarding the mixture levers, is restricted to altitudes greater than 1000 feet above ground level.

*This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 07 January 2003.*