

**CANADIAN FORCES
FLIGHT SAFETY INVESTIGATION REPORT

FINAL REPORT**

FILE NUMBER: 1010-C-GTHL (DFS 2-3-3)
DATE OF REPORT: 15 October 2004

AIRCRAFT TYPE: Cessna 172
DATE/TIME: 14 1430Z/1130 Local August 2003
LOCATION: Fredericton, New Brunswick
CATEGORY: "C" Category Accident

This report was produced under authority of the Minister of National Defence (MND) pursuant to section 4.2 of the Aeronautics Act, and in accordance with A-GA-135-001/AA-001, Flight Safety for the Canadian Forces.

With the exception of Part 1 – Factual Information, the contents of this report shall be used for no other purpose than accident prevention. This report was released to the public under the authority of the Director of Flight Safety, National Defence Headquarters, pursuant to powers delegated to him by the MND as the Airworthiness Investigative Authority (AIA) of the Canadian Forces.

SYNOPSIS

The solo student-pilot was participating in the Air Cadet Atlantic Region Powered Flying Scholarship program through Moncton Flying College (MFC). She had just completed the first leg of a VFR cross-country flight when, while on short final to Fredericton Airport, she changed from a normal approach and landing configuration to a short-field approach and landing configuration in anticipation of holding short of a runway intersection to allow another aircraft use of the crossing runway. The accident aircraft landed hard, bounced several times, and finally came to rest on the runway past the intended hold-short intersection. The cadet received minor injuries while the aircraft received "C" category damage.

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1. FACTUAL INFORMATION

1.1 History of the Flight

The solo Air Cadet student-pilot was participating in the Atlantic Region's Powered Flying Scholarship program through Moncton Flying College (MFC). The student was conducting a solo cross-country flight from Moncton to Fredericton, to St John, and back to Moncton. The purpose of the flight was to consolidate VFR navigation skills, develop self-confidence, and build flight time towards the Private Pilot License (PPL) requirements.

The student arrived at MFC at 0800 the morning of the flight to discuss route planning and flight preparations. The accident flight was to be her first flight of the day, although it would be her third time to Fredericton after previous instructional and solo flights. The student filed a flight plan via telephone with the Halifax Flight Information Centre (FIC). The flight plan code ("code red") used to locally identify a solo student was not passed, nor was it standard to pass it, to Halifax FIC during the filing of the flight plan.

The student conducted the pre-flight inspection, start-up, and taxi with no reported abnormalities. The pre-take-off check was also correctly completed prior to departure from Moncton. Post-take-off, the flight went smoothly and the student anticipated a straight in approach to land on runway 27 in Fredericton. Upon the student's arrival, there was a high volume of air traffic within the local area with six different aircraft and Moncton Area Control Centre in frequent communications with the Fredericton Flight Service Station (FSS).

Fredericton FSS identified runways 15 and 27 as active and was providing advisory information to both IFR and VFR traffic when the student requested a stop-and-go to runway 27. She was then advised of a Cessna 414 completing an ILS approach to runway 15 with the intention of circling to join left downwind and land on runway 33.

The student had configured the aircraft for a normal approach with 20° flaps and 65 KIAS. While on short final and approximately one minute back from landing, the student was asked by Fredericton FSS if she could hold short of the runway 27/33 intersection; the student accepted this restriction to her landing intentions. In order to comply with the FSS request to hold short, the student then reconfigured the aircraft for a short-field landing with 40° flaps and an intended airspeed of 60 KIAS. The student stated that, due to the difficulty she had in trying to achieve 60 KIAS, the airspeed remained at 70 KIAS until touchdown.

By now the Cessna 414 was also on short final and was number two to the student's aircraft. Both the Cessna 414 crew and the FSS specialist observed the student's aircraft change to a nose-low attitude. The FSS specialist noticed the student over the threshold of runway 27 and, after assessing her as being too

high to be able to land and stop before the runway intersection, advised the Cessna 414 to overshoot.

A skilled pilot can land the Cessna 172 in approximately 500'. With the student's intended touchdown point of the 1000' marker, the remaining length of runway 27 before the 27/33 intersection was only 900'. The aircraft touched down hard abeam the PAPI lights with power on and approximately 30 knots faster than the normal 40 KIAS touch down speed of a short-field landing. The Cessna 172 bounced back into the air about 50' before it again hit very hard, this time on the nose wheel; this was followed by three subsequent bounces diminishing from about 30' in height. After the aircraft came to rest approximately 500' past the 27/33 intersection on runway 27, the student carried out an emergency shutdown. The Cessna 414 was able to land and come to a stop before the 27/33 intersection. A Fredericton crash, fire, response crew was on scene immediately after the student egressed on her own. After the student's safety was ensured, local maintenance personnel immediately towed the aircraft off the runway. Nav Canada initiated notification of the occurrence to the Transportation Safety Board, classifying the occurrence as a blown tire.

1.2 Injuries to Personnel

The student received minor injuries.

1.3 Damage to Aircraft

The aircraft sustained "C" category damage.

The nose wheel tire ruptured and the wheel rim edges shattered (Annex A - Photo 1). The nose wheel oleo end-cap was pushed off after a retaining bolt failed. There was warping of both the firewall and the cabin floorboard panels. (Annex A - Photos 2 and 3). The propeller and engine were undamaged.

1.4 Collateral Damage

The accident site was on runway 27 at Fredericton Airport. No collateral damage was evident and no claims against the crown should result from this accident.

1.5 Personnel Information

Table 1: Personnel Information

	Student	FSS Specialist
Rank	Cadet	FSS03
Age	17	38
Currency/Category valid	U/T	Yes
Medical Category valid	Yes	No Restrictions
Total Flying Time (Hrs)	38	N/A
Instructional (Hrs)	0	N/A
Flying hours on type	38	N/A
Flying hours last 30 days	24	N/A
Duty time last 24 hrs	14	12

1.6 Aircraft Information

The aircraft was serviceable prior to the accident. All maintenance and inspections were up to date. The weight and balance was within limits.

1.7 Meteorological Information

Moncton:

METAR CYQM 141400Z 3307KT 15SM SCT030 BKN240 22/17 A3005 RMK CU4CI2 SLP17=

TAF CYQM 141138Z 141224 25008KT P6SM SKC

Fredericton:

METAR CYFC 141400Z 31013KT 15SM BKN200 23/15 A3009 RMK CI2 SLP188=

METAR CYFC 141500Z 34011KT 15SM FEW040 BKN240 24/14 A3008 RMK CU1CI2

TAF CYFC 141138Z 141224 27005KT P6SM FEW100 FM1400Z 30008KT P6SM SCT050 RMK NXT FCST BY 18Z=

1.8 Aid to Navigation

Nil.

1.9 Communications

The Fredericton Airport has a Class E control zone around it to a radius of 5 NM. Traffic advisory information is provided to aircraft within the zone and in nearby areas by a Flight Service Station (FSS) specialist. Communications between aircraft and the FSS specialist are via the Fredericton Radio frequency.

1.10 Aerodrome Information

The FSS specialist has full 360° view of the airfield from the tower. Runway 27 is 8005' in length; the available length of runway 27 before the runway 27/33 intersection is 1900'.

Aviation traffic at Fredericton is defined by Nav Canada as “complex” in that the FSS must provide advisory services to a wide variety of dissimilar civil and military aircraft, must provide advisory services to VFR and IFR traffic, must work with nearby airspace restrictions, and must accommodate a very high level of seasonal aviation traffic.

1.11 Flight Recorders

The Cessna 172 is not equipped with any onboard voice or flight data recording devices.

1.12 Wreckage and Impact Information

The aircraft came to rest on runway 27, 500' past the runway 27/33 intersection. Nose wheel rim fragments were found on runway 27 before the intersection. Additionally, hydraulic fluid was found on the runway in the vicinity of where the aircraft came to rest. A debris (FOD) sweep of the runway was conducted prior to returning runway 09/27 to active status.

1.13 Medical

The student was slightly injured as a result of impact forces. She was taken to the local hospital and X-rayed for lower back injuries. No toxicological samples were taken. The student was discharged from hospital with no significant injuries noted and was returned to flying status.

1.14 Fire, Explosives Devices, and Munitions

Nil.

1.15 Survival Aspects

1.15.1 Crash Survivability

The crash was survivable. The cockpit maintained its survivable volume and was undamaged. The deceleration forces were within the tolerance level of the human body.

1.15.2 Life Support Equipment

The Cessna 172 four-point harness system functioned as intended; this likely prevented further injury from occurring.

1.15.3 Emergency Transmitters

The Cessna 172 was equipped an aviation Emergency Locator Transmitter (ELT). Although the ELT was armed, post-impact transmission did not occur.

1.16 Test and Research Activities

Nose wheel rim fragments were sent to Quality Engineering Test Establishment (QETE) for failure analysis. Results indicated that the rim fractured under overload conditions.

1.17 Organisational and Management Information

The Air Cadet Powered Scholarship is a national summer program that is available to all eligible Air Cadets. The program is run through civilian flying training centres in each of the five Air Cadet regions across Canada. Upon completion of the program, an Air Cadet will hold a Transport Canada private pilot's licence (PPL). Although not a requirement, Air Cadets have typically completed the Gliding Scholarship program the year before participating in the Powered Scholarship program. In this case the student had completed the gliding program the previous year. There were 12 Air Cadet students under training at MFC. MFC has been involved with the Air Cadet flying training program since 1948.

The students have up to 48 hours flying time to complete the syllabus flights; however, the average student is finished in 45 hours. The students' daily training routine is from 0800-1700, with mandated study time from 1900-2100, six days per week.

1.18 Additional Information

The CDS is tasked with command and control of the Air Cadet flying program by Section 43 of the National Defence Act. As such, aircraft leased by the Air Cadet League of Canada are military conveyances.

The Canadian Transportation Aviation Investigation and Safety Board (CTAISB) Act defines a military conveyance aircraft as any civil-registered aircraft that is leased, rented, operated, or otherwise hired by the Department of National Defence (DND). As such, the CTAISB Act gives DND, through the Directorate of Flight Safety, the investigative responsibility for any occurrence involving a military conveyance aircraft.

1.19 Useful or Effective Investigation Techniques

Nil.

2. ANALYSIS

2.1 The Aircraft

The aircraft was serviceable prior to the flight. There were no previously reported aircraft malfunctions with flight controls or instruments prior to the accident. The investigation was unable to determine when the nose gear actually failed but it is likely that it occurred on the second or third bounce.

2.2 The Student

The student was one day from completing the program. Prior to the accident the student had demonstrated average ability but both she and her instructor agreed that she had difficulty with landings; particularly the flare. Post-accident the student acknowledged that she had experienced 'bounces' as a result of poor flare technique and she readily identified the correct procedure for bounce recovery: set cruise attitude (straight and level) and flare or add power to over-shoot.

According to the student's logbook it appears that she had previously performed full-flap short-field approach and landings during four dual and two solo flights.

2.3 The Flight Plan

The student had previously flown to Fredericton airport twice on dual and solo flights, using different runways. She indicated that was prepared and confident of the cross-country flight.

The student filed a VFR flight plan for the flight but did not include MFC's "code red" in the remarks section. A "code red" is a statement on the flight plan that signifies only to Moncton ATC and FSS that a solo student pilot is flying the aircraft. There is no requirement to include this remark on flight plans for flights that leave the Moncton area.

2.4 The Approach and Landing

Upon the student's arrival at Fredericton there were two Griffon helicopters, a Cessna 414, a Dash 8, and one unidentified aircraft in the vicinity of the airport. On her initial contact with the Fredericton FSS, the student indicated that she would be carrying out a straight-in stop-and-go on runway 27. Fredericton FSS acknowledged her contact but when she reported the VOR a few minutes later, he asked to confirm her intentions for a touch-and-go.

Despite the obviously busy traffic situation, the student continued with her plan for a stop-and-go.

Approximately two minutes from landing, the Fredericton FSS recognized a possible traffic conflict with a Cessna 414 and asked the student if she could hold short prior to the intersecting runway. Although the student had the right of way she accepted this request and altered to a full-flap short-field approach and landing. Considering her experience level, this reconfiguration of approach and landing technique while on short final would likely have been very challenging.

Runway 09-27 is 8005' long and intersects with runway 15-33 at the 1900-foot mark. This leaves approximately 6000' of useable runway after the intersection.

The normal landing configuration for a C172 is 20° flap. Approach speed is 65 KIAS and touch down speed is between 45 – 50 KIAS. In the case of a short-field landing, the configuration is with 40° flap; approach speed is 60 KIAS; and touch down speed is 40 KIAS. The significant difference between the two types of approaches and landings is the attitude of the aircraft. During an approach for a short-field landing the aircraft attitude is considerably more nose down and the attitude change required for the flare is greater. For a student this is a major shift in landing technique. The transition to this new skill could take some time. An experienced C172 pilot requires approximately 500' ground run to complete a short-field landing, however, MFC expects a student to be able to stop within 3000'.

At about one mile from the threshold, the student reconfigured the aircraft from a normal (20° flap) to a short-field (40° flap) configuration. Shortly thereafter the student recognized that, given her airspeed and altitude, she would probably not be able to hold short of the intersection.

The student continued with the approach, keeping the nose down and the airspeed at approximately 70 KIAS (maximum flap speed) until commencement of the flare. The investigation could not determine whether the aircraft power was set to idle or not.

The aircraft touched down for the first time hard on the main gear and bounced at least 50 feet. The second touch down was also on the main gear followed immediately by the nose wheel and again was sufficiently hard to cause another significant bounce. Two or three bounces of decreasing amplitude followed.

After the first touch down and subsequent bounce, the student most likely tried to expedite the landing by adding forward pressure on the yoke thereby causing the aircraft to touch down hard a second time.

The student clearly indicated in the post accident interview that she was aware of the requisite bounce recovery technique and had on occasion put it into practise. She also indicated that she did not consider an overshoot after the first bounce. This indicates that her theoretical ability to choose a potentially preferred course of action existed. However the student could not apply this theory to practice.

2.5 The FSS Specialist

The FSS specialist had 15 years experience; all in the Maritimes. He was not aware that a student was piloting the aircraft because the “code red” was not included on the ATC flight information “strip”, but he was aware that the aircraft belonged to the MFC. He gave advice, as he would have to a skilled pilot. In the post-accident interview, the FSS specialist indicated that the student sounded competent.

The FSS specialist was aware that his responsibilities were to provide air traffic advisory services and to make specific suggestions to air traffic in order to ease congestion and affect more efficient use of the airport and local airspace.

2.6 Human Factors

The student placed herself in a difficult situation when she accepted the FSS request to stop short of the intersection. As the student attempted to reconfigure for a full-flap, short-field landing and approached the runway, her situation became less and less tenable. The following human factors were found to have contributed to this accident:

- a. The student made two conscious decisions (accepting the FSS request and electing to land even though she was well beyond the normal landing parameters) that lead directly to this incident. Had she chosen differently in either case it is likely that the outcome would not have resulted in an accident.
- b. The student was unable to control the aircraft adequately both in terms of reconfiguring for a short-field landing and also in terms of responding to the bounces following the initial landing. It is questionable whether more experience would have made a difference in terms of being able to control the aircraft.
- c. In electing to reconfigure for a short-field landing while on short final the student appears to have overestimated the limits of her abilities substantially. She might also have felt a need to comply with the FSS request that trapped her into a rapidly degrading situation. In terms of not deciding to overshoot, it is unclear what caused the student not to choose that course of action. Fixation, commitment to the approach and misplaced motivation are all suggested as possible causes.

The Human Performance in Military Aviation (HPMA) is a recently implemented program that is designed to train CF personnel to deal with this type of situation. HPMA teaches that, in general, when forced to make complex decisions under time pressure there are only two possible strategies: either simplify the problem or allow more time. Clearly there was inadequate time or space for this student to safely land the aircraft due to her inexperience and the difficulty of the required landing. A decision to overshoot would certainly have simplified the problem, however, the student instead elected to continue with a poor approach. It was noted that HPMA, or a similar program, is not included in the Air Cadet Powered Flying Scholarship Program.

In summary, the most troubling human factor aspect of this accident was the decision not to overshoot. A decision to overshoot would have been made at numerous points during this occurrence and would likely have lead to a safe outcome.

3. CONCLUSIONS

3.1 Findings

3.1.1 The aircraft was serviceable prior to the accident.

3.1.2 Although the student had demonstrated the requisite skill to perform a full-flap, short-field landing, during training she had experienced difficulty in landing.

3.1.3 The student accepted the request from Fredericton FSS to hold short of the intersecting runway.

3.1.4 The aircraft was reconfigured on final to full-flap at a higher than normal airspeed which resulted in an unstable approach.

3.1.5 The student realized that she would not be able to stop before the intersection after reconfiguring the aircraft to full-flap.

3.1.6 The student touched down at a higher than normal airspeed for the configuration for the aircraft

3.1.7 The aircraft landed sufficiently hard to cause two to three bounces and associated hard landings. This series of hard landings resulted in C Category damage to the aircraft

3.1.8 The student did not opt for an overshoot after realizing her inability to stop before the intersection or after the first bounce or after subsequent bounces.

3.1.9 The FSS specialist was unaware of the pilot's student status, which may have had a bearing on the request he made for her to hold short.

3.2 Causes

Following an unstable approach, the student attempted to complete a full-flap, short-field landing at a higher than prescribed airspeed.

3.3 Contributing Factors

3.3.1 The student accepted a request to hold short of a runway when given her minimal experience, she should have refused the request or conducted a low approach and overshoot.

3.3.2 The student did not commence an overshoot after realizing that the full-flap short-field landing would not be successful.

3.3.3 The FSS specialist unknowingly requested an inexperienced pilot to hold short of the intersecting runway and that request set in motion a set of circumstances that led up to the accident. Had the FSS not been involved in this scenario, the accident may not have occurred.

4. SAFETY MEASURES

4.1 Safety Measures Taken

Nil.

4.2 Further Safety Measures Required

4.2.1 Establish a requirement to include “code red” on all flight plans regardless of destination when a solo student is piloting the aircraft

4.2.2 Incorporate Human Performance in Military Aviation (HPMA) training into the ground and air training syllabus of the Air Cadet Powered Flying Scholarship Program.

4.2.3 Remind students during the training program that they have limited experience and should not attempt to perform complex manoeuvres under pressure without supervision.

4.3 Other Safety Concerns

Aircraft leased by the Air Cadet League of Canada are military conveyances, and therefore any aircraft accidents involving Air Cadet aircraft will be investigated by DFS.

The A-GA-135 clearly outlines DFS responsibilities with respect to Air Cadet Gliding occurrences. However, this document does not contain clear direction on the Air Cadet power-flying program. The A-GA-135 will be amended to include a specific reference to the Air Cadet power-flying program and all other Air Cadet League sponsored flying activities.

4.4 DFS Comments

This accident was unfortunate in that the student was faced with a situation that was beyond her abilities. She may have placed herself in this situation by overestimating her own capabilities or she may have felt compelled to accommodate the FSS Specialist's request to hold short of the runway intersection. Both of these types of errors are common with relatively inexperienced student pilots. Most pilots learn to avoid these types of mistake as they gain experience and discover that it is far better to overshoot and try again rather than try to salvage a poor approach. Unfortunately, experience only comes with time. In the interim, HPMA training would have provided this pilot with a very valuable tool that would have helped her cope with this situation. While HPMA is not a replacement for experience, it does provide excellent training that can, if properly applied, prevent accidents like this.

//signed on original//

A.D. Hunter
Colonel
Director of Flight Safety

Annex A: Photographs

Photo 1: Nose Wheel Damage



Photo 2: Firewall Warping



Photo 3: Floorboard Warping

