

CANADIAN FORCES FLIGHT SAFETY INVESTIGATION REPORT (FSIR)

FINAL REPORT

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AIRCRAFT TYPE: Schweizer 2-33A Glider
DATE/TIME: 31 1303Z October 2004
LOCATION: Trois-Rivières Airport, Trois-Rivières, QC
CATEGORY: "B" 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

Two gliders were being positioned from the main runway to the grass strip where gliding operations were to continue for the day. There was no runway inspection carried out at the grass strip and the first glider was forced to land in between the two landing lanes in order to avoid a wet area on the runway. The second glider was inbound for landing and the launch control officer (LCO) was forced to make a quick decision to remove the obstructing glider from the grass strip. Because the LCO did not have the minimum crew required at the launch point, limited options were available and the LCO requested that a nearby instructor pilot (IP) launch on an instructional trip in order to clear the obstructing runway. The launch was expedited with no pre-flight briefing conducted for a simulated cable break procedure. The glider took off from the grass strip under air tow in challenging wind conditions. At 600 feet above ground level (AGL), a simulated premature cable release procedure was initiated by the IP. The student pilot (SP) then elected to conduct a modified circuit procedure, keeping the glider in a tight pattern and 15 mph below the required airspeed. Pushed towards the runway by the strong crosswind at circuit altitude, the glider overshot the extended runway centreline on the turn to final. In an attempt to regain the centreline, the IP took control and increased the angle of bank to at least 45 degrees. The glider overshot the runway centreline again, and was heading towards the nearby trees at a very low altitude. The IP then initiated a left turn but during this turn the left wing struck the ground followed immediately by the landing gear and the tail section. The aircraft came to rest on the runway pointing approximately 130 degrees from the runway axis. The SP was uninjured while the IP suffered minor injuries. The glider sustained "B" category damage.

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1. FACTUAL INFORMATION

GENERAL

1.1 History of the Flight

The crew was participating in the Eastern Region Gliding School (ERGS) Fall Familiarisation Flying Program in Trois-Rivières, Quebec. The cadets were operating two gliders and one tow plane on the day of the accident. The gliding operation had just begun with the first two flights originating from the main runway and the accident flight, the third flight of the day, from the grass strip. See Annex A for airfield layout. The majority of the cadets and instructors were enroute from the main runway to the grass strip during the launch of the accident glider.

When the first glider approached the grass strip for landing, the crew noticed an area of wet grass to one side, so they landed in between the two landing lanes. This prevented the second glider from landing on the grass strip. On short notice, the Launch Control Officer (LCO) at the grass strip asked the IP to take the SP on an instructional trip; the IP agreed. The IP and the SP then quickly inspected the glider, strapped in and took-off with the SP at the controls. The IP occupied the front seat with the rear seat manned by the SP participating in the ERGS pilot proficiency program (PPP). The objective of this flight, the cadet's second flight of the day, was to conduct a premature cable release procedure.

There was no pre-flight briefing and the IP did not use the regular seat spacers to be positioned closer to the flight controls. Additionally, the pedals were found adjusted fully forward on the aircraft; forward of the pilots' normal pedal adjustment position.

The SP's previous flight had been completed with a different IP. That flight consisted of a simulated stuck deployed spoilers. The flight went well and was uneventful.

Gliders were operating from the grass strip paralleling the main runway 23. The winds at the surface were estimated at 250 degrees magnetic at 14 knots, gusting to 23kts and turbulence was noted on departure. At 600 feet AGL the IP initiated the simulated premature cable release by pulling on the release knob. The SP then executed a right turn to downwind with the intention of carrying out a downwind landing on the grass runway. Realizing that the winds were excessive, he then decided to execute a modified circuit pattern in accordance with standard procedures.

The downwind leg was flown very close to the grass runway. The spoilers were opened prior to turning onto the base leg and were never closed prior to landing. Prompted by the IP on his intentions and position in the circuit, the SP provided adequate oral response but failed to correct the circuit. In addition, airspeed was

15 mph slower than required throughout the manoeuvre. The SP initiated the turn to base leg late. This combined with the strong crosswind component resulted in a lateral overshoot of the grass runway, which placed the aircraft in a difficult position to reach the intended landing area. The IP then took control while the glider was still on base and increased the bank to at least 45 degrees in an attempt to realign the glider with the grass runway. The grass runway was overshoot a second time and the glider was now heading towards nearby trees on the right side of the grass runway. The IP then banked left at a low height in an attempt to return to the runway. In close proximity to the launch point, the glider contacted the ground left wing first, followed immediately by the landing gear and tail of the aircraft. It skidded across the ground for approximately 30 meters bouncing on the right wing tip prior to stopping almost 130 degrees from the runway centreline (Photo 1).

The SP exited the aircraft. Feeling some pain, the IP remained in the cockpit until the arrival of the ambulance. Both the SP and IP were taken to the St-Joseph Hospital in Trois-Rivières. The SP was released the same day; the IP was released the next day.

1.2 Injuries to Personnel

The IP suffered minor injuries. The SP was uninjured.

1.3 Damage to Aircraft

The glider sustained “B” category damage.

The damage observed on the glider consisted of the following:

- a. Right Wing:
 - Out board aileron slightly bent; and
 - Outrigger is bent (Photo 5).
- b. Left Wing:
 - Rear spar showed wrinkles at station 32, 47 and 77 from wing root (underneath) (Photo 2);
 - Wing tip rib is unserviceable;
 - Wing tip leading edge skin is unserviceable;
 - Outrigger is bent (Photo 6);
 - Wrinkles are observed on the rear spar at station 34 and 76; and
 - Trailing edge cracks found at station 32, 36 and 76.

c. Fuselage:

- Tube cut at mid fuselage;
- Fabric cut and wrinkled at mid fuselage (Photo 2);
- Tail leaf bent;
- Tail leaf upper bracket bent (unserviceable) (Photo 3);
- Ballast box was found out of its attachment;
- Vent tube adapter pulled out of nose cone;
- Elevator was stretched and will require new rigging;
- Rudder had hit the elevator and elevator will need a patch (Photo 6); and
- Headset Jack dismantled.

1.4 Collateral Damage

The crash site was on the grass landing area of the Trois-Rivières Airport and no collateral damage was incurred. No claims against the crown concerning the facilities should result from this accident.

1.5 Personnel Information

Table 1: Personnel Information

	Student Pilot	Instructor Pilot
Rank	Flight Sergeant	Lieutenant
Currency/Category	Glider Pilot	Glider Pilot
Medical Category Valid	Valid till May 07	Valid May 05
Total Flying Time (hours)	29	100 (gliders) 400 Hrs (Powered Aircraft)
Total on Type	29	100
Duty Time Last 48 Hours	11	11
Duty Time Last 24 Hours	8	8

1.6 Aircraft Information

The Schweizer 2-33A is a tandem seat glider used by the Air Cadet organization for training. The high wing construction allows excellent visibility from either the front or rear seat. The 2-33's rugged construction withstands the rigors and demands of ab initio flying, making it well suited to the Air Cadet training

environment. Additionally, the glider's exceptional occupant protection has been well documented during its years of Air Cadet service.

The cockpit avionics consist of an airspeed indicator (ASI), a vertical speed indicator (VSI), an altimeter, and a hand-held radio that is secured within the cockpit. Flight controls additional to the rudder pedals and control column are a control column trim and over/under wing spoilers. Movement of the spoiler control handle past the fully extended position controls the disc brake on the single fuselage-mounted wheel. Both wingtips have an outrigger wheel that prevents ground-wingtip contact.

1.7 Meteorological Information

Just prior to the accident flight, Trois-Rivières UNICOM reported winds at 240° at 12 kts G19kts. Shortly after the accident, they were observed to be 250° at 14 kts G23kts. The altimeter setting was reported at 29.46 inches.

1.8 Aids to Navigation

N/A.

1.9 Communications

The glider operation at Trois-Rivières utilizes a mandatory frequency (MF) for all operations. The LCO, tow-planes, gliders, and local traffic all monitor the MF while in the areas and circuit. Both the LCO and glider radios were checked prior to the launch and were serviceable at the time of accident.

An attendant at the airport terminal reports on known traffic, wind conditions and altimeter settings, using call sign Trois-Rivières UNICOM on MF.

1.10 Aerodrome Information

The glider site is located on the Trois-Rivières Airport (CYRQ), located west of the intersection of Quebec highways 40 and 55, within the boundaries of the City of Trois-Rivières. Airfield elevation is 199 feet above sea level (ASL). The main asphalt runway (runway 05/23) is 6,000 feet long by 150 feet wide and there is a parallel grass strip to the north.

Glider operations are normally conducted from the grass strip. Both sides (left and right) of the grass landing area are used to maintain a steady flow of aircraft. Gliders take off and land from the south side of the airstrip whereas the tow plane lands on the north side of the strip. The tow plane then manoeuvres to the south lane in preparation for the next launch. In order to ensure aircraft separation, a glider is launched when another one joins the downwind leg. If the south lane becomes fouled, an incoming glider can land on the north side of the strip and the tow plane can continue to orbit or land on the main runway. There are no markings on the grass strip to visually delineate between the two lanes. The

cadets, instructors, and staff, including LCO, maintain a position abeam the touchdown points on the grass landing area. After a glider has landed, cadets retrieve and align the glider for the next launch.

The municipality operates the Airport and municipal resources provide crash response: police, ambulance and firefighting; using the 911-telephone dispatch system.

The LCO monitors and controls all Air Cadet flying operations, giving launch clearances; the LCO also manages and coordinates responses to any emergency situation with the airport staff. A site supervisor, the on-site commander (OSC), oversees the entire operation, including the LCO. The OSC arrived at the site shortly after C-FARD launched and initiated the emergency response by calling 911.

1.11 Flight Recorders

Air Cadet gliders are not equipped with voice or flight data recording devices.

1.12 Wreckage and Impact Information

The impact site was within the grass landing area, approximately 300 meters from the approach end of runway 23 and beside a line of trees along the right side of the runway. The aircraft nose was pointing approximately 130 degrees from the runway axis (centerline) opposite the launch point with the left wing resting on the ground. The wreckage was found in one piece with the exception of the canopy that had been removed by emergency response personnel. The left wing, landing gear and tail impact scars were easily discernable and within approximately 30-35 meters of the glider's final resting point, indicating a shallow angle low airspeed approach at ground impact. This was consistent with the glider's damage.

The ballast-retaining bracket was found loose in the front cockpit area and some washers and bolts were found on the ground under the nose of the aircraft. Three washers were found below the release hook, on the ground; they were believed to be mounting screws for the ballast bracket.

The spoilers were found in the extended position (Photo 7) and the rudder pedals were adjusted in the full forward position. The spoilers functioned normally when checked post accident. The cockpit instruments appeared to be functional.

The crew harness straps appeared to be in very good condition for both the front and rear seats. Only the normal seat cushions were found in both seats, and no additional seat spacers were used by either pilot. The trim lever was found in the full forward position (Photo 8). The release knob and flight controls appeared to function correctly.

There was a significant accumulation of dirt between the skid and the fuselage and the tail spring and the fuselage. Marks on the ground are consistent with the dirt accumulation. During impact, a significant force was likely applied to the tail sufficient enough to have bent the spring such that soil was scraped up off the ground.

1.13 Medical

The SP was not injured and he exited the aircraft almost immediately. The IP was feeling pain and remained in the aircraft until the ambulance attendants arrived. Both were taken to the Trois-Rivières St-Joseph Hospital a short distance away. The SP was discharged from the hospital the same day with no injuries. The IP was released the next evening suffering minor injuries as a result of impact forces.

Toxicology tests were requested by both the Flight Safety Officer and the 430 Sqn (Valcartier) Flight Surgeon. Both the IP and the SP had agreed to the tests, but the hospital was not willing to complete the required toxicology tests.

1.14 Fire, Explosives Devices, and Munitions

Not applicable.

1.15 Survival Aspects

Due to pain, the IP remained strapped in the seat until ambulance personnel arrived and were able to assist with the IP's exit from the aircraft.

1.15.1 Survivability

The crash was survivable. The cockpit maintained its survivable volume and was undamaged with the exception of the ballast-retaining bracket, which became loose during ground impact.

1.15.2 Life Support Equipment

The glider's ruggedness and four-point harness systems likely prevented further injury from occurring.

1.15.3 Emergency Transmitters

The glider was not equipped nor was it required to be equipped with any type of aviation Emergency Locator Transmitter (ELT).

1.16 Test and Research Activities

Not applicable.

1.17 Organisational and Management Information

The ERGS is a part of the Air Cadet Gliding Program (ACGP). Its purpose is to provide practical aviation experience to Royal Canadian Air Cadets of the Quebec and eastern Ontario regions. The program comprises several gliding activities, using the Schweizer 2-33 Glider and the L-19 tow aircraft. The flight of occurrence took place on the last day of the Fall Familiarisation Flying Program, which aimed at improving flying and instructional abilities of glider pilots.

The ERGS has developed and implemented a pilot proficiency program (PPP), the purpose of which is to further develop and complement the training that student pilots receive during the summer glider training programs. This program allows for air cadets who have their glider wings to continue to develop their flying skills, to stimulate their interest, and to maintain their motivation. This program is documented consisting of specific directives, course outlines, and lesson plans. Cadet pilots in the Eastern Region who have successfully completed the Summer Glider Pilot Training Program are eligible to participate in the PPP. The PPP is divided into two distinct phases. The purpose of Phase I is to improve their demonstration flying skills and to qualify the cadets to work as Glider Familiarization Pilots. As familiarization pilots, the cadets can fly air cadet famil flights from the front seat. The purpose of Phase II is to develop the students flying proficiency and to select applicable candidates for future training on the Glider Pilot Instructor Course. Embedded into Phase II training is the rear seat qualification. The glider pilot involved in this accident was participating in Phase II of the PPP and had obtained his rear seat qualification.

The ACGP is a partnership between the Department of National Defence (DND) and the Air Cadet League of Canada (ACL) and is governed by a renewable Memorandum of Agreement (MOA). The various Provincial Committees of the ACL own the gliders and tow aircraft used in the ACGP. They are civilian registered in accordance with Canadian Aviation Regulations (CARs) and are fully insured (hull and liability) by the ACL.

Regional Cadet Support Units such as the ERGS are responsible for the conduct of the ACGP within each region in accordance with Transport Canada (TC) regulations, and in accordance with DND National operational, training and maintenance policies, standards and instructions.

All flying and related ground activities are conducted in accordance with applicable CARs, A-CR-CCP-242/PT-005 Air Cadet Gliding Program Manual (ACGPM), ERGS Pilot Proficiency Program, policies, directives, Standard Operating Procedures (SOPs) and instructions as approved by the Operational Airworthiness Authority (OAA), and Technical Airworthiness Authority (TAA) maintenance and repair directives.

1.18 Additional Information

The Trois-Rivières Municipal police was one of the first responders to the accident. They completed a police report (#013 – 31 Oct 04) and provided initial security at the site

2. ANALYSIS

2.1 The Aircraft

Glider C-FARD was serviceable prior to the accident. All maintenance and inspections were up to date. The weight and balance was within limits. A daily inspection had been completed on the aircraft and a limited pre-flight inspection had been completed prior to the aircrew strapping into the glider. No deficiencies were noted on the Daily Inspection sheet or Journey Log. The glider had flown approximately 60 hours since its last 100 hr inspection. There were no unusual occurrences reported during the glider's previous flight.

2.2 Airfield Information

Glider operations in Trois-Rivières are normally conducted on a grass strip that is located 0.5nm to the north and parallel to the main asphalt runway. Because the gliders are kept outside, near the main runway, the first launch of the day is conducted from this location. On the morning of the accident, two gliders launched from the main runway and terminated their trips on the grass strip to the north. The remainder of the gliding activities were to continue from this location. The student pilot (involved in the accident) was in the first flight from the main runway with an instructor to conduct a Phase II instructional trip.

The grass strip is approximately 150ft wide and 2000ft long. The width of the strip enables dual lane operations, which involves launching and recovering aircraft from both sides of the runway. There are no markings on the grass strip to distinguish between the two sides of the lane and there are trees that border the length of each side of the grass strip.

The Trois-Rivières Regional Flying Orders state that 'before each day of flying, the entire length of the runway will be inspected by the LCO to ensure that it is in good condition and that there are no objects which might jeopardize operations'. The LCO who recovered the first glider at the grass runway stated that no runway inspection was completed. When the first glider was on final approach to land on the grass strip, the aircrew observed a large puddle of water on a portion of the grass runway, thus the glider landed in the middle of the grass strip avoiding the wet portion of the runway. This information was not passed to the second glider that launched from the main runway and was intending to land on the grass strip.

Shortly after the C-FARD glider landed, the launch control officer (LCO) observed the second glider joining downwind to land on the grass strip. Because the position of the C-FARD glider on the grass runway impeded the glider from landing on either lane, the LCO asked a nearby instructor to immediately take the cadet flying in order to clear the runway for the incoming glider. Because the remainder of the air cadets and instructors had not yet arrived at the grass strip,

the LCO did not have the option of directing personnel to physically move the obstructing glider out of the way, enabling other aircraft to land safely.

The trees that border the Trois-Rivières grass runway represent a significant obstacle to gliding operations in that they limit the landing options available to the glider pilots. In emergency situations that occur in close proximity to the runway, such as during take off and landing, the options for off field landings are limited. In this accident, the aircraft came dangerously close to the trees as it was maneuvering on short final to land on the grass strip. Had the surrounding landing area been clear of obstacles, the pilots may have had more options for landing once they realized the problems with the approach.

2.3 Weather

According to the ACGPM, gliding operations may be conducted in surface wind conditions not exceeding 25kts headwind, 8kts crosswind, or a maximum tailwind component of 5kts. The maximum permissible wind gust differential is 10kts. The air cadets and instructors participating in the gliding activities on the day of the occurrence all received a weather briefing during the morning prior to commencing flying activities. The wind prior to the first launch was 240 degrees at 12kts G19kts. The on-site commander, (OSC), a glider instructor pilot, was responsible for making all weather related decisions for safety of flight. The OSC was aware of the strong wind conditions and carefully observed the first two launches from the main runway. The OSC had decided that cadets would not be allowed to launch on a solo trip prior to flying a trip with an instructor in order to become comfortable and confident with the challenging wind conditions.

The accident flight was the second flight of the day for the SP and the first flight of the day for the IP. The IP was aware of the briefed wind conditions, but was surprised with the turbulence that was experienced during the take off, climb and turn to the downwind leg. Following the accident, the reported winds were 250 degrees at 14kts G23kts. According to the crosswind limitations chart in the ACGPM, these wind conditions are at the limits of acceptability, and were clues to the pilots about the existing challenging wind conditions. Combined with the trees paralleling the landing strip, the resultant mechanical turbulence would also add to the pilot's workload during take off and landings. It was estimated from other pilots who were airborne at the time of the accident that the wind at 500'AGL would have been approximately 280 degrees at 20kts. Because of the glider's relatively slow flying speeds, this crosswind would have to be anticipated and corrected for during the circuit in order to successfully land on the grass strip.

2.4 Cable Break Procedures

2.4.1 Description

The ACGPM describes the initial response to a premature cable/rope release from an air tow as follows: in the event of a cable break, the glider pilot shall simultaneously fly the aircraft, activate the release twice and select a suitable landing area. When a premature cable or rope break occurs above an altitude of 500 feet AGL, the pilot has four landing options:

- a. To fly a modified circuit with an abbreviated downwind leg back to the runway followed by an into wind landing or crosswind landing;
- b. To carry out a crosswind or alternate runway landing;
- c. To perform a downwind landing on the same runway; or
- d. To carry out a straight ahead landing to a suitable field.

As the maximum permitted crosswind component is 8kts and the maximum tailwind component is 5kts, options b and c would not be considered safe. A straight ahead landing would be difficult due to some trees and obstacles in the area, and it would not be possible to reach the hard surfaced runway at the 10 o'clock position due to the strong winds. Thus the only option in this scenario would be to fly a modified approach to the grass strip.

When a modified circuit is selected, the ACGPM emphasizes not to attempt to return to the launch point and to make every effort to be established on final approach by 300 feet AGL. In Trois-Rivières there is ample usable runway beyond the launch point. The ACGPM states that a common error associated with cable/rope breaks is the perceived necessity to return to the launch site.

2.4.2 Effects of Wind

Due to the glider's relatively slow speed, the implications of the strong wind must be anticipated. The maximum tailwind component is 5kts, thus a downwind landing to the same runway was not an option. When planning a simulated cable break procedure, the pilot must consider many factors including position from the desired landing area, altitude, wind speed, and runway layout. As well, the pilot must plan to be aligned on the final approach prior to 300' AGL.

When planning the cable break procedure, it would be important for the crew to discuss how the wind would affect the manoeuvre and how they would fly the procedure differently as compared to a calm wind day. Ideally the crew may want to initiate the cable break at a higher altitude than normal to compensate for the stronger winds. The ACGPM states the following rule of thumb for circuit procedures: adding an extra 100ft of altitude will compensate for approximately

10 mph of headwind. Thus with approximately 20kts of wind, ideally the crew should have initiated the manoeuvre 200 ft higher than normal, and modified their circuit accordingly to be on final approach with 300 ft. Witnesses indicated that the glider was approximately 150' AGL on the base leg. The ACGPM states that altitude lost cannot be regained, but excess altitude can be eliminated when necessary with the use of spoilers or slipping. This rule of thumb for extra altitude in higher wind conditions is not mentioned in the cable break procedures section of the ACGPM.

Ideally, in strong wind conditions, once the cable break procedure is initiated, the pilot would want to crab into wind to eliminate drift and he would want to make the turn to base and final much earlier than normal. Another consideration for the glider pilot is the importance of airspeed control. As the glider has a relatively slow stall speed, the ACGPM states that the reported wind speed, including any gusts, must be added to the normal circuit speed of 50 mph to a maximum of 65 mph. Thus the desired speed for this manoeuvre including during the final approach would have been 65 mph. The IP stated that the SP was maintaining an airspeed of 50 mph on the downwind leg and on the turn to base.

2.5 The Accident Flight

2.5.1 The Instructor Pilot

The IP was a qualified glider instructor pilot with 400 hrs total flying time, including 50 hrs of glider instructional hours, and 40 hrs of pilot in command of a glider. The accident flight was the IP's first flight of the day. The IP attended the morning weather briefing and was aware that there were strong winds in the local flying area. The LCO asked the nearby IP to take the SP on his next trip to practice a cable break procedure. The LCO had just returned from a flight with the same cadet and had conducted a stuck spoilers procedure. The LCO stated that the SP had successfully completed that mission. Shortly after, the LCO noticed that a glider was joining downwind for landing and the glider, C-FARD, was blocking the landing area. The IP and the SP then conducted a limited pre-flight inspection of the glider in accordance with the ACGPM and they quickly launched for their trip allowing the incoming glider to land on the grass strip. The IP did not conduct a pre-flight briefing with the cadet. The IP's seat configuration was not adjusted during the pre-flight inspection indicating that an incomplete pre-take off check was conducted.

The SP flew the take off, and the IP was surprised with the amount of turbulence during the departure. With the SP still at the controls, the IP initiated the cable break procedure on the upwind leg at 600' AGL (see Annex A for the accident diagram). The SP then turned immediately to the right to join the downwind leg. The IP noticed that the glider was being blown towards the runway and the IP verbally prompted the SP to correct the drift. The IP did not provide physical assistance to correct the error when the student was not responding to the verbal coaching. During the downwind leg, the aircraft descended to approximately

300'AGL, and the airspeed decayed to 50 mph. The IP was very concerned with the SP's airspeed control but still felt that the glider could make the landing point. The SP made the turn to base leg later than ideal considering the strong winds and had not yet corrected his airspeed error. The SP deployed the spoilers during the turn to base leg. At this point the IP took control of the glider as the aircraft was being pushed to the south of the final approach track and descending below 150' AGL. The IP started a turn to the right, increasing the angle of bank (AOB) to at least 45 degrees to correct the approach path. The glider then came very close to the nearby trees on the north side of the airstrip, and the IP again manoeuvred the aircraft to the left in an attempt to align the aircraft with the runway. At this point the left wing struck the ground and shortly after the aircraft came to a stop on the runway.

The IP did not adjust the spoilers during the approach to land and they remained in the full open position until the final touchdown. The effect of the open spoilers would be to increase the rate of descent, create a slight change in pitch attitude, reduce airspeed, and increase the stall speed. Because the glider was below the desired altitude on final approach, the spoilers in the open position would have only aggravated the situation by decreasing the amount of time the crew had to align the aircraft with the grass runway.

The IP maintained vigilant attention to the SP's airspeed control during the manoeuvre, however, it appears that the crew was not aware of the adjustments required to the normal modified circuit procedure in order for the glider to safely return to the airstrip due to the stronger winds at altitude.

The IP recognized that the SP was not correcting for drift on the downwind leg, however the IP did not provide physical assistance when the SP did not respond to the verbal cues. The SP is a qualified glider pilot; however the IP was responsible for the safety of the flight and perhaps the IP could have taken control earlier (on the downwind leg) when it was evident that the SP was having difficulty maintaining track and airspeed.

The investigation team discovered that the IP's pedals were in the full forward position. The IP told the investigation team that the pedals were normally adjusted closer in order to reach full deflection. As well, the IP did not use the regular seat spacer. This consists of a cushion behind the pilot's back that placed the IP closer to the control column. Although this abnormal seating position for the instructor may not have contributed to the accident, it is another indication of how rushed the crew was prior to launch. Ensuring that the rudder pedals are correctly adjusted is included in the pre-take off check. Being able to reach the rudder pedals to aid with full deflection is required for coordinated flight during steep angle of bank turns. An uncoordinated turn would result in a slip causing a decay in airspeed and/or altitude. The time the instructor had to strap in and prepare for departure was limited because of the incoming traffic, this induced pressure to expedite the launch lead to a possible physical limitation with the IP's ability to manoeuvre the aircraft in coordinated flight.

2.5.2 The Student Pilot

The SP was an air cadet who had successfully completed the glider pilot course and had received his glider wings. The SP had completed Phase I of the ERGS's PPP and had recently completed his rear seat glider qualification. The SP was nearing the end of Phase II where a check flight is conducted to determine if the cadet has the potential to succeed in the Glider Instructor Course.

The accident flight was the second flight of the day for the SP, thus he was familiar with the existing wind conditions in the local area. The SP stated that he did not receive a pre-flight briefing prior to the launch. The SP described the take-off as normal, and when the IP initiated the cable break procedure, the SP momentarily thought about conducting a downwind landing. He quickly realized that this would not be suitable in the strong winds, so he continued the downwind leg to fly a modified circuit and land into wind on the grass strip.

It is clear that the SP did not have a solid plan in his mind of how he was going to fly this manoeuvre prior to departing on this flight. The IP and SP did not have the time to discuss the conditions of the day, when the emergency would be simulated, or how they should modify the approach due to the strong winds. The PPP manual details the full Lesson Plan to be covered by the instructor and cadets prior to every flight. The lack of a pre-flight briefing prevented critical information from being discussed between the IP and the SP.

2.5.3 Supervision

The person responsible for the overall activities at the Trois-Rivières gliding site was the On-Site Commander (OSC). The OSC during the occurrence was a highly experienced air cadet glider instructor. The OSC was not present at the launch point to observe the departure of the accident glider; however the OSC arrived at the site shortly after and observed the C-FARD glider on downwind until its final stop on the grass strip. The OSC initiated the crash response plan.

It is the Launch Control Officer's responsibility under the direction of the OSC to direct and ensure the safe and efficient operation of all gliding activities on the airfield. The LCO also co-ordinates the launches, the recoveries, and all ground movements of the gliders and tow planes.

The LCO was the SP's instructor for his first trip that departed from the main runway. Following this trip the IP assumed the responsibilities of LCO at the grass strip.

The ACGPM states that the ground personnel required for air tow launching of gliders 'shall normally consist of an LCO, a hook-up person, a wing person and a tow aircraft signaller. Additional personnel such as a tail person and retrieval crew may be utilised where appropriate.' Because another glider was approaching downwind for landing, the LCO felt a sense of urgency to get the

parked glider airborne and the LCO asked the IP to take the SP for an instructional trip. Thus the launch of the C-FARD glider was conducted without the minimum personnel required to conduct the launch in accordance with the local Flying Orders. Without the additional personnel at the launch site, the LCO was placed in a difficult situation with few options. Had the minimum personnel been available, they would have been able to move the parked glider off of the grass runway allowing the incoming glider to land. When the decision was made to launch the C-FARD glider, the IP and the SP conducted their pre-flight inspection and launched without completing a pre-flight briefing.

2.6 Safety Culture

2.6.1 Pre-Flight Briefings

The ACGPM states that before every flight in ACGP aircraft, the cadet shall receive a detailed briefing covering flight safety, the type of aircraft, the purpose and detail of the flight as well as emergency procedures. As well, the PPP details the items to be discussed in each pre-flight briefing prior to conducting an airborne exercise. The PPP also states that the IP and SP should consult the ACGPM Chapter 2 for a more detailed description of emergency procedures. The purpose of the pre-flight briefing is to confirm that the student is prepared for the trip mentally and physically. Additionally, it confirms that the student fully understands the complexity of the manoeuvres and understands how the conditions of the day will affect how they fly the glider in order to safely accomplish their desired mission. The SP stated that he normally was provided with a pre-flight briefing prior to his trips.

2.7 Human Factors Analysis and Classification System (HFACS)

The analysis of the C-FARD accident has shown that the actions of both the organisation and several individuals contributed to the outcome of this accident. The flight safety investigation process uses the HFACS criteria to identify both active and latent cause factors so that preventive measures can be implemented to reduce the likelihood of reoccurrence.

2.7.1 Active Cause Factors

Technique-based Errors The glider was placed in a position in the circuit where a safe return to the landing strip would have been very difficult due to the strong winds and the natural obstacles surrounding the grass landing strip. The IP did not ensure the SP made the necessary corrections during the downwind leg and delayed taking control of the aircraft until the glider was on the final approach.

2.7.2 Latent Cause Factors

Supervision - Rules and Regulations The lack of a pre-flight briefing resulted in important information not being discussed between the crew prior to the accident flight. The IP was pressured to expedite the launch and did not comply

with the existing rule that states that all glider pilots will conduct a pre-flight briefing prior to flight.

Supervision - Rules and Regulations During the morning of the accident, the gliding operations at the Trois-Rivières Gliding Site were not conducted in accordance with the following established directives. There was no runway inspection carried out on the grass strip prior to commencing glider operations, and the air tow launch at the grass strip was conducted with less than the minimum number of required personnel. The lack of a runway inspection resulted in a glider landing in the middle of the grass strip obstructing the runway. The lack of personnel at the launch site resulted in the LCO having to make a quick decision on how to remove the obstructing glider from the runway.

Conditions of Personnel: Physical Limitations The IP did not properly adjust the seating position prior to launch. The incorrectly adjusted rudder pedals and the lack of a seat spacer may have limited the pilots' ability to use full deflection on both the rudder pedals and the control column.

2.8 Other Flight Safety Concerns

The ACGP gliders have the capability to carry a ballast box weight in the front cockpit area in order to keep the aircraft within C of G limitations. This aircraft had the ballast box installed plus a 5lb lead-acid battery mounted on top of the box. The procedure in the Eastern Region Gliding Sites is to leave the ballast mounted in the aircraft unless the additional weight is required for the crew. Thus only if two heavier persons were in the glider seats, would the ballast box be removed. During this accident, the ballast box became dislodged from its mounts during the hard landing. The box is not bolted to the floor; it is only screwed into place with washers installed. It was determined that the holes were too big for the washers, thus the washers came loose during the hard landing. The ERGS has since increased the size of the washers in order to prevent this from re-occurring. The lack of security with this ballast box is a potential hazard that still requires investigation by DAEPM(TH).

3. CONCLUSIONS

3.1 Findings

3.1.1 The glider C-FARD was airworthy and within the C of G limitations prior to the accident.

3.1.2 The IP was a qualified glider instructor pilot.

3.1.3 The SP was a qualified air cadet glider pilot who was participating in Phase II of the ERGS's pilot proficiency program.

3.1.4 The Trois-Rivières grass landing strip enables dual lane operations but there are trees bordering the length of both sides of the runway.

3.1.5 There was no runway inspection carried out at the grass runway prior to commencing glider operations.

3.1.6 At the time of the accident, the wind conditions were on the limits of acceptability for glider operations.

3.1.7 The ACGPM describes a rule of thumb for the requirement for additional altitude in strong wind conditions while conducting circuits; this rule of thumb is not mentioned nor is it referred to in the cable break emergency section of the ACGPM.

3.1.8 The C-FARD glider landed in between the two lanes in order to avoid a puddle of water on a section of the grass runway. The information regarding the water on the runway and the position of the C-FARD glider was not passed to the second glider prior to its launch from the main runway.

3.1.9 The launch point was staffed below the minimum manning required for an air tow launch, as the majority of the air cadets and instructors including the OSC were enroute from the main runway to the grass strip during the launch of the accident flight.

3.1.10 The launch of the glider C-FARD was expedited because its position on the grass strip was obstructing incoming glider traffic.

3.1.11 The IP conducted the instructional trip without a pre-flight briefing.

3.1.12 The IP did not use the normal seat spacer and did not correctly adjust the rudder pedals in accordance with the pre-take off check.

3.1.13 The spoilers were deployed prior to turning the base leg and remained open for the remainder of the flight.

3.1.14 The aircraft struck the ground left wing tip first after manoeuvring the glider in order to avoid the trees and land on the grass strip.

3.1.15 The SP was uninjured while the IP sustained minor injuries.

3.1.16 The Trois-Rivières hospital was not willing to complete the toxicology tests on the accident aircrew as requested by the Flight Safety Officer and the 430 Sqn Flight Safety Officer.

3.1.17 The glider sustained "B" category damage.

3.1.18 The ballast-retaining bracket was found loose in the front cockpit area after the landing.

3.2 Cause Factor

3.2.1 The cause of this accident was that the aircraft was placed in a position from which it could not be landed safely. The weather conditions at the time of the accident were very challenging and the airfield environment at this particular landing strip leave few viable options to safely compensate for errors in judgement.

3.3 Contributing Cause Factors

3.3.1 The crew did not conduct a pre-flight briefing prior to the accident flight. This is a mandatory element of instructional flight training that includes a discussion on items such as wind assessment, airspeeds, techniques, emergencies, and conditions of the day.

3.3.2 On the morning of the accident, an inspection of the grass runway was not completed prior to commencing flight operations, nor was the launch site at the grass strip manned by the required minimum number of personnel. These two factors placed both the LCO and the IP in a difficult situation requiring rushed decisions resulting in the expedited launch of an unprepared crew.

3.3.3 The IP's seating position was not ideal. The lack of a seat spacer combined with the incorrectly adjusted rudder pedals may have hindered the IP's ability to properly fly the aircraft. Adjustment of the rudder pedals is included in the pre-take off check.

4. PREVENTIVE MEASURES

4.1 Preventive Measures Taken

4.1.1 The Eastern Region Gliding School has amended their flying orders to include the following, "Once the gliders have been transferred to the grass strip from the main runway, gliding operations will cease and all cadets and instructors involved with the flying activities will receive another full operations briefing prior to continuing glider operations." This will ensure that glider launches do not take place under minimum manning and all of the aircrew will be briefed on the conditions at the grass runway.

4.1.2 A detailed diagram has been added to the ACGPM describing the modified circuit for premature cable releases above 500ft AGL, the diagram provides clear direction with respect to landing areas and minimum altitudes.

4.1.3 The ERGS has increased the size of the washers used in the installation of the ballast-retaining bracket. This may prevent the ballast from coming loose during a hard landing. DAEPM(TH) continues to investigate other solutions to this problem.

4.1.4 The ACGP Standards and Evaluation Team (SET) has added this accident as a case study in the glider instructor work up training and the air cadet Human Performance in Aviation (HPA) program.

4.1.5 The following statement has been added to the ACGPM, "Site supervisors shall be in possession of a hand-held anemometer or equivalent. Operations may be based on hand-held anemometer readings, particularly where ATS reports are inadequate or field site readings may provide a more accurate indication of winds in the launch/touchdown zones. Site supervisors must exercise sound judgment when ATS reports if available, differ significantly from wind readings taken on the field."

4.2 Further Preventive Measures Required

It is recommended that:

4.2.1 The ERGS consider the following procedure when conducting the initial launch of the gliders from the main runway: not allowing the second glider to release from the tow plane until it has been confirmed that the first glider has safely landed and the grass runway is clear.

4.2.2 The ERGS ensure that there is sufficient crew available at the grass runway to retrieve the incoming gliders and ensure that they are capable of handling a glider emergency scenario.

4.2.3 The Air Cadet Gliding Standards and Evaluation Team consider adding the following rule of thumb to the ACGPM describing the requirement for an additional 100 ft for every 10 mph of wind when planning simulated cable break procedures.

4.2.4 DAEPM(TH) review the installation procedure for the ballast-retaining bracket to ensure the safety of the installation in case of hard landing.

4.2.5 The 1 Cdn Air Div Flight Surgeon should coordinate with the Trois-Rivières Hospital to ensure that the requirements for toxicology examinations are understood and supported.

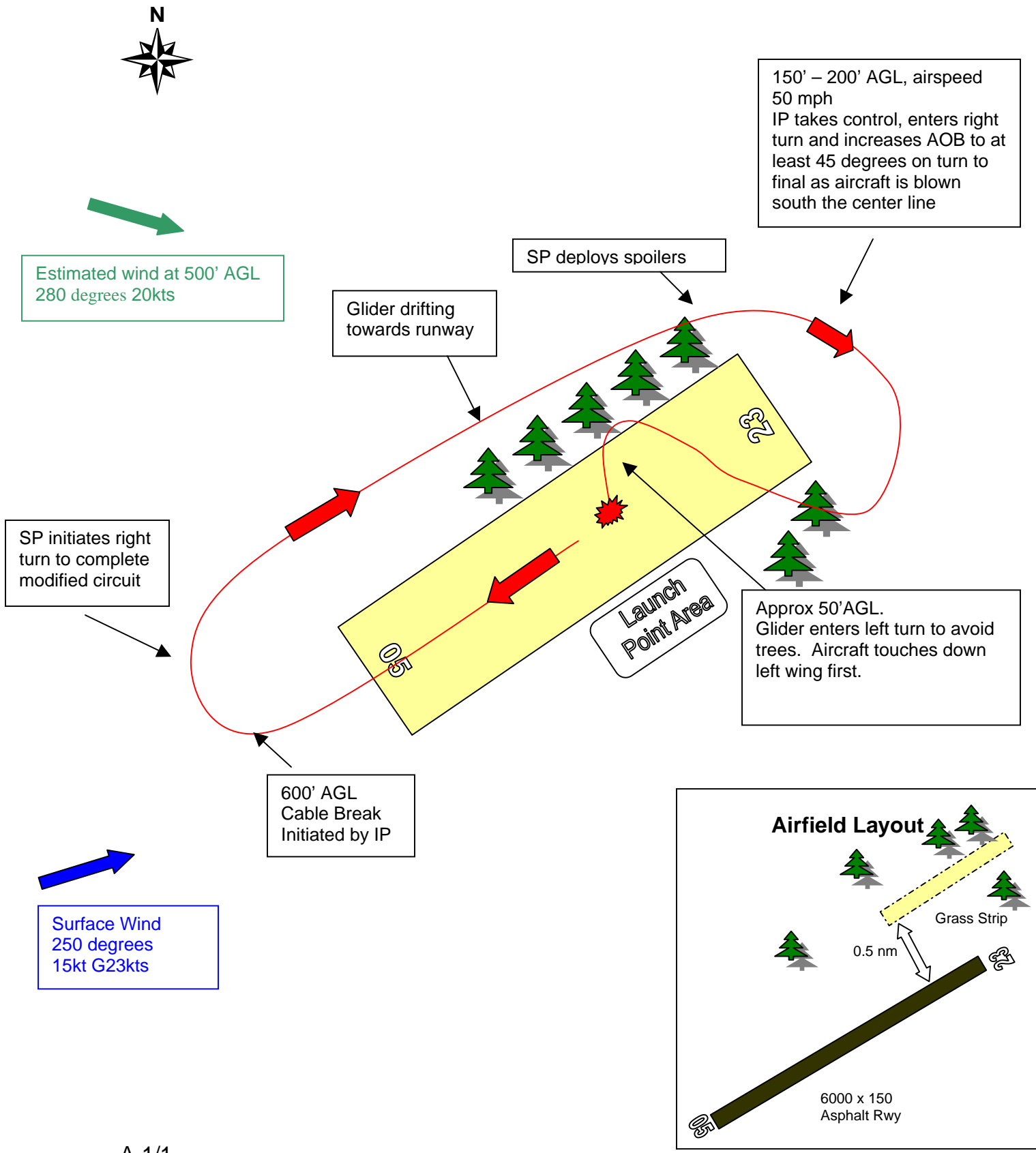
4.3 DFS Remarks

There is no doubt that the Air Cadet organization has an impressive safety record. This is significant given the large number of aircraft movements and the large number of flying hours that this organization conducts every year. The basis for this excellent safety record is that the Air Cadet organization, like the Canadian Forces, has developed sound, logical and effective procedures to conduct operations safely. However, as can be seen in this accident, decisions to make seemingly minor deviations from these well-established procedures can have significant consequences.

//ORIGINAL SIGNED BY//

A.D. Hunter
Colonel
Director of Flight Safety

ANNEX A: AIRFIELD LAYOUT AND ACCIDENT DIAGRAM



ANNEX B: PHOTOGRAPHS



Photo 1: Final Resting Place



Photo 2: Right wing tip



Photo 3: Left wing tip



Photo 4: Left Wing and Fuselage damage



Photo 5: Tail leaf bracket damaged



Photo 6: Rudder / elevator contact



Photo 7: Spoiler Positions



Photo 8: Spoilers and trim controls position

ANNEX C: ABBREVIATIONS

ACGP	Air Cadet Gliding Program
ACGPM	Air Cadet Gliding Program Manual
ACL	Air Cadet League
AGL	Above Ground Level
AOB	Angle of Bank
ASI	Airspeed Indicator
ASL	Above Sea Level
CAR	Canadian Aviation Regulations
DND	Department of National Defence
ELT	Emergency Locator Transmitter
ERGS	Eastern Region Gliding School
HFACS	Human Factors Analysis and Classification System
IP	Instructor Pilot
KTS	Knots
LCO	Launch Control Officer
MF	Mandatory Frequency
MOA	Memorandum of Agreement
MPH	Miles per Hour
MSL	Mean Sea Level
OSC	On-Site Commander
PPP	Pilot Proficiency Program
SP	Passenger Pilot
TAA	Technical Airworthiness Authority
TC	Transport Canada
VSI	Vertical Speed Indicator