

CANADIAN FORCES FLIGHT SAFETY INVESTIGATION REPORT

FINAL REPORT

FILE NUMBER: 1010-C-GXAC
DATE OF REPORT: 11 April 2002

AIRCRAFT TYPE: Bellanca Scout (BL-28)
DATE/TIME: 9 June 2001 1810Z
LOCATION: Markham Ontario
CATEGORY: B Category Air Accident

This report was produced under authority of the Minister of National Defence (MND) pursuant to Section 4.2 of the Aeronautics Act (AA), 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 aircraft was being flown in support of the Central Region Spring Familiarization Flying Program at the Markham Airport near Toronto. The pilot and passenger had taken off on a staff familiarization flight. On landing the aircraft was observed to “sink” to the runway from an altitude of approximately ten to fifteen feet and land harder than usual. On touchdown the left landing gear separated at the fuselage and the aircraft exited the runway on the left side. It came to rest on the left wing tip in the grass area adjacent to the left side of the runway. The pilot and passenger exited the aircraft unassisted and were not injured. The local emergency vehicles responded to the “911” call and secured the accident site. The Regional Cadet Air Operations Officer contacted DFS and an investigation team assembled in Markham that evening.

TABLE OF CONTENTS

1.	FACTUAL INFORMATION	1
1.1	History of the Flight	1
1.2	Injuries to Personnel	1
1.3	Damage to Aircraft	2
1.4	Collateral Damage	2
1.5	Personnel Information	2
1.6	Aircraft Information	3
1.7	Meteorological Information	3
1.8	Aid to Navigation	3
1.9	Communications	3
1.10	Aerodrome Information	3
1.11	Flight Recorders	4
1.12	Wreckage and Impact Information	4
1.13	Medical	4
1.14	Fire, Explosives Devices, and Munitions	4
1.15	Survival Aspects	4
1.16	Test and Research Activities	5
1.17	Organisational and Management Information	5
2.	ANALYSIS	5
2.1	The Aircraft	5
2.2	The Airfield	6
2.3	The Pilot	6
2.4	Emergency Response	7
3.	CONCLUSIONS	8
3.1	Findings	8
3.2	Causes and Contributing Factors	9
4.	SAFETY MEASURES	9
4.1	Safety Measures Taken	9
4.2	Further Safety Measures Required	9
5.	DFS COMMENTS	10
	Annex A:Photographs	A-1

1. FACTUAL INFORMATION

1.1 History of the Flight

The aircraft was being flown in support of the Central Region Spring Familiarization Flying Program at the Markham Airport near Toronto. The pilot was Civilian Instructor (CI) with the Air Cadet organisation. (The expression “Civilian Instructor” denotes a person that is hired by the Cadet organisation but that is not recruited into the Cadet Instructor Cadre (CIC) and does not wear the uniform. The expression does not necessarily imply that the person is an instructor). The passenger was a staff member of the gliding site and a member of a local Air Cadet Squadron. On the morning of the accident, one of the local Cadet Squadrons scheduled for the familiarization flights was unable to participate and did not travel to the site. The site supervisor decided to take this opportunity to allow staff members to increase their flying experience and allowed them to remain airborne for as long as they could. With both gliders in the air, the tow aircraft could be used for staff familiarization flights (without the tow rope).

On landing from one of the staff familiarization flights, the tow aircraft was observed to “sink to the ground” from a height of approximately ten to fifteen feet and landed harder than normal. On touchdown, approximately 200 feet past the threshold of the runway, the left landing gear broke at the fuselage attachment point and was dragged along the runway by the stainless steel brake line. The aircraft exited the paved surface of the runway on the left side, 400 feet from the threshold and came to rest on the left wingtip 500 feet from the threshold and 100 feet to the left of the edge of the pavement. (see photo 1)

The pilot and passenger exited the aircraft normally and were uninjured. The local emergency response personnel responded to the “911” call from the Emergency Response Officer (ERO) in three minutes and secured the site. The pilot and passenger were sent to the local hospital in Markham and were released after a quick examination. Toxicology samples were not obtained.

1.2 Injuries to Personnel

The pilot and passenger were not injured in the accident.

	Crew	Passengers
Fatalities	0	0
Injuries	0	0

1.3 Damage to Aircraft

The aircraft received B Category damage. The landing gear leg broke at the bend adjacent to the fuselage (see picture 2). The left main wheel first pivoted upward and contacted the windscreen, fracturing it and then pivoted down and aft rupturing the fabric cover of the fuselage and the side window. The landing gear was then dragged along the runway by the stainless steel brake line causing severe damage to the left brake master cylinder mounted on the left rudder pedal.

The left wing tip contacted the runway surface causing damage to the “spade” (an aerodynamic balancing device for the aileron) and to the underside of the wingtip (see photo 3). The propeller contacted the soft ground three times after the aircraft left the runway resulting in two bent tips (see photo 4). The engine was at idle at the time the propeller contacted the ground and was sent to a repair facility to be inspected and repaired, as per manufacturer recommendation.

1.4 Collateral Damage

The accident site is located on a private airfield. A small quantity of fuel was spilled on the grass of the infield through the vent line of the left wing fuel tank. Containers were used to recover most of the fuel dripping from the vent line. The 8 Wing Environment Officer was advised of the minor fuel spill. The spill is too small to require intervention and therefore, a claim against the crown is considered improbable.

1.5 Personnel Information

The pilot holds a commercial licence and flies Beech 18 and DC-3 for his civilian employer. Both aircraft types are equipped with a conventional (Tail Dragger) landing gear. He attended the tow pilot conversion course on the Scout aircraft the previous summer and has accumulated 40 hours of flying time on the Scout.

	Pilot
Rank	CI
Currency/Category valid	Yes
Medical Category valid	Yes
Total Flying Time (Power)	1521 hrs
Total “Tail Dragger” Time	950 hrs
Flying hours on type	40 hrs
Flying hours last 30 days	56 hrs
Duty time last 24 hrs	5 hrs

1.6 Aircraft Information

The aircraft was serviceable prior to the accident. All maintenance and inspections were up to date. The gear leg had accumulated 290 hours since the last 500 hours NDT inspection. The weight and balance was within limits. A review of the records indicated that the left landing gear leg had accumulated 8 242 hours in operation.

1.7 Meteorological Information

There are no Metars or Forecasts issued for the Markham airport. Weather briefings for this gliding site are obtained from Toronto FSS and are usually comprised of the Metars and Forecasts for the Buttonville airport (6 miles SW) and the other airports in the Toronto area (Pearson International, City Centre, etc...) as well as the local area and upper winds forecasts. Actual conditions for these airports at the time of the accident were VFR with little to no clouds and light winds and unrestricted visibility. Weather is not considered a factor in this accident.

1.8 Aid to Navigation

Not applicable

1.9 Communications

The tow aircraft is equipped with a standard aviation type panel mounted VHF radio. This radio was serviceable during the flight and the pilot made all the appropriate radio transmissions. The Launch Control Officer (LCO) uses a hand held battery powered aviation VHF radio to maintain contact with the gliders and the tow aircraft.

1.10 Aerodrome Information

The Markham airport is a private uncontrolled airfield with a single paved runway 2000 feet long by 50 feet wide and oriented 09-27. The glider-operating site is in the grass area immediately to the North of the paved runway. This grass area is much longer than the paved runway and allows the Cadets to set-up their launch site at midfield. The tow aircraft usually lands in the grass abeam the runway threshold and taxis up to the launch point. The glider is then moved into position behind the aircraft and hooked up. The gliders and the tow aircraft very seldom use the paved runway and confine their operation (practice area and circuits) to the north of the airfield. Other civilian traffic is asked to keep their circuit to the South.

Approximately thirty minutes prior to the accident, members of the local flying club had started to carry out repairs to the runway pavement around the threshold of runway 27. The airfield manager had "closed the runway" for that

purpose but did not notify the gliding site personnel. The tow pilot was aware of the work party on the runway since he had noted their presence on his previous flights. On approach for his last landing, the pilot noted that the grass area was not available to him since both gliders were on the ground and one of them was occupying his intended landing area. He decided to move over to the paved runway and notified the LCO of his intentions. The workers noted the aircraft on final but were slow to clear the runway since they expected the Scout to land in the grass. They were not monitoring the VHF radio frequency and only moved away from the runway when they noticed the glider personnel at the launch site shouting at them and waving their arms. The workers were well clear of the runway when the Scout landed. The pilot indicated that he leveled his descent momentarily at approximately 10 to 15 feet above the threshold in order to ensure good clearance abeam the workers. He was just reestablishing his descent to the runway when the aircraft “sank to the ground”.

1.11 Flight Recorders

The aircraft is neither equipped nor required to be equipped with any type of flight recording device.

1.12 Wreckage and Impact Information

The aircraft touched down hard on the centreline of runway 27 approximately 200 feet from the threshold where the left landing gear leg broke. The aircraft then drifted to the left side of the runway and exited into the grass area to the south. It came to rest 100 feet to the south of the runway and 500 ft from the threshold, facing east (180 degrees from its original heading). The aircraft remained in one piece except for the left landing gear, which separated from the fuselage in the very last moments and came to rest immediately behind the left aileron.

1.13 Medical

The local ambulance responded to the accident and transported the crew to the Markham Hospital. Hospital personnel were unsure as to why the uninjured crew needed to be seen in the hospital. The crew indicated that they were there for “blood work”. Hospital staff assessed that they did not need any blood work since they were uninjured and released them.

1.14 Fire, Explosives Devices, and Munitions

Not applicable

1.15 Survival Aspects

Once the accident occurred the LCO and the ERO initiated the Emergency Response Checklist. Since both gliders were on the ground, the LCO was free to handle the emergency response while the ERO manned the telephone and

alerted the appropriate authorities. Staff personnel went across the runway to the wreckage to assist the crew and secure the site.

1.15.1 Crash Survivability

The crash was survivable. The grass cushioned the left wingtip and the very slow deceleration subjected the crew to very little impact forces. The cockpit area was undamaged except for the broken windshield and left side window.

1.15.2 Life Support Equipment

The four-point harness used by the pilot and passenger effectively restrained them and prevented injury. Flying debris from the broken Plexiglas did not injure the crew

1.15.3 Emergency Transmitters

The aircraft was equipped with a standard general aviation type emergency transmitter. The transmitter switch was found in the ARM position but the fore-aft forces were insufficient to activate the transmitter.

1.16 Test and Research Activities

The broken landing gear leg was sent to the Quality Engineering Test Establishment (QETE) in Hull for analysis.

1.17 Organisational and Management Information

All training, administrative and maintenance files were reviewed and found to be in order.

2. ANALYSIS

2.1 The Aircraft

2.1.1 The Airframe

The aircraft was examined on site and found to have been in proper working order before the accident. The Airspeed Indicator, the Pitot System and the Stall Warning Device were checked and found to be within limits. All maintenance requirements were up to date and records were found to be in good order.

The broken landing gear leg was sent to QETE for analysis. The metallurgy specialists at QETE determined that the failure originated at a 0.5mm fatigue crack under the bend in the leg and propagated upward across the thickness of the material. The fatigue zone was assessed to be much too small to be the cause of the failure and the landing gear would have failed even if the crack had

not been present. This indicates that the landing gear must have been subjected to loads well in excess of the design limits.

2.1.2 The Flight Manual

The Flight Operations Manual produced by the manufacturer is too basic for an operation like the Air Cadet Gliding Program. The two Regions that operate the Scout (Central and Prairies) have therefore produced their own different version of an Aircraft Operating Manual. In some cases, these two region's manuals specify slightly different operating parameters for the aircraft. In this case, the "Normal Procedures" sections of the Central Region manual does not provide for a specific approach speed. It only states that, after glider release, the pilot should maintain 80 MPH in the descent (for engine cooling purposes). The "Landing Performance" section does mention an approach speed of 60 MPH but the Central Region Scout pilots interpret this speed as "Threshold Crossing Speed". In practice, the details of the normal procedures are taught during the Tow Pilot Conversion Course and only basic information about those procedures is included in the Aircraft Operating Manual. It was also noted that, although both the Central and Prairie regions use very similar techniques and procedures, the pilots from Central Region are approaching at a slightly slower airspeed than the pilots from the Prairie Region. At the latest Gliding Conference (after the accident) a decision was made to harmonize the Scout Flight Manual but it has not yet been completed.

2.2 The Airfield

The workers from the local flying club who were repairing the runway surface had observed that the glider operation remained exclusively on the north side of the runway. They were therefore expecting the Scout aircraft to land on the grass as it had been doing before. They were slow to realize that the aircraft was now lining up with the paved runway and only moved off to the south side when prompted by the launch crew. This indicates that the workers were not monitoring their portable radio since the pilot of the Scout aircraft broadcasted his intentions on the local frequency.

The Glider operation at the Markham Airport is new. All airfield operators are only beginning to understand each other's operation. The local flying club had "closed the runway" in order to carry out their repairs but they failed to notify the Glider Operations personnel of this fact.

2.3 The Pilot

2.3.1 Technique

Although the work crew was well clear of the runway, on the south side, the pilot momentarily levelled off over the threshold in order to ensure vertical separation from the workers. He did not increase power to compensate for the reduced rate

of descent and the airspeed was allowed to decay. He was in the process of re-establishing his descent when the aircraft sank to the ground and landed hard on the left main landing gear. This sinking feeling was most probably the result of the aircraft stalling with a slight left wing drop. The resulting high sink rate on landing produced excessive loads on the left landing gear leg and resulted in failure.

2.3.2 Habituation

The pilot indicated that the stall warning usually comes on regularly during flight. This fact was not supported by the aircrew members of the investigation team (from the Prairie Region) and other pilots from Central Region who indicated that their stall warning rarely comes on during flight. This may indicate that this pilot has a tendency to fly at the slower end of the acceptable airspeed range and to have regular incursions into the five to ten MPH margin provided by the stall warning device. This tendency, combined with an accepted approach speed range slightly slower than in the Prairie Region could result in regular stall warnings, which could lead the pilot to “tune-out” the stall warning device. This habituation may have resulted in the pilot being slow to recognize the impending stall and take corrective action.

2.3.3 Fatigue

This pilot has substantial recent experience in “Tail Dragger” aircraft. He flies for a local company that operates a Beechcraft 18 and a Douglas DC-3 to ferry automotive parts across the Canada/US border. This work is mostly performed in late evening or at night and requires the pilot to alter his sleep patterns between weekday flying for the company and weekend flying at the Gliding Site. Although not noticeable to the pilot, this shifting of sleep patterns could have lead to some degree of fatigue.

2.3.4 Nutrition

Although the pilot was well hydrated, he only had a light breakfast approximately five hours before the accident and may have become “energy depleted”. This may have exacerbated the fatigue mentioned above and further decreased his mental performance.

2.4 Emergency Response

The aircrew, accompanied by a member of the Gliding Site Staff, were taken to the local hospital. They indicated to the attending personnel that they were there for “blood work”. To hospital workers the term “blood work” means the sampling and analysis of a patient’s blood in order to determine the presence of disease. Since they were uninjured, the hospital staff determined that they did not need any blood work and released them. The aircrew and the accompanying Gliding Site Staff member were unaware that the purpose of the hospital visit was to get

the hospital staff to secure blood and urine samples from the crew for toxicological analysis by the military medical authorities.

3. CONCLUSIONS

3.1 Findings

3.1.1 The aircraft was fully serviceable and properly maintained in accordance with existing regulations prior to the accident.

3.1.2 The pilot was properly licensed, briefed and authorized to carry out the mission as assigned.

3.1.3 The weather was not a factor and the winds were within limits.

3.1.4 Until the accident, glider operations had been carried-out in the grass area to the right (north) of the active runway.

3.1.5 Workers from the local flying club were at the threshold of Runway 27 patching holes in the asphalt surface. Once they noticed that the Scout was landing on the runway, they moved over to the south edge of the runway.

3.1.6 The pilot momentarily levelled his descent over the runway threshold without increasing power.

3.1.7 Habituation caused by excessive use of the slow end of the airspeed spectrum led the pilot to “tune-out” the stall warning device.

3.1.8 The aircraft was observed to “sink to the ground” and land hard.

3.1.9 The left landing gear leg broke at the fuselage and was dragged by the brake line.

3.1.10 QETE was able to determine that the landing gear leg broke in overload and that metal fatigue was not a factor.

3.1.11 The pilot and passenger were not injured in the accident.

3.1.12 The pilot was well hydrated but only had a light breakfast five hours before the accident.

3.1.13 The pilot had to shift his sleep pattern between weekdays and weekends, leading to some degree of fatigue.

3.1.14 The Prairie and Central Regions use different Aircraft Operating Manuals. In some places, these two manuals specify slightly different operating parameters for the aircraft.

3.1.15 A reference to a specific approach speed can only be found in the Performance section of the Aircraft Operating Manual. The pilots of Central Region interpret this approach speed as threshold crossing speed.

3.1.16 Due to some confusion as to the nature and the purpose of the crew's request, toxicology samples were not obtained at the Markham Hospital.

3.2 Causes and Contributing Factors

3.2.1 This accident was caused by the pilot momentarily levelling his descent over the runway threshold without a corresponding increase in power. This allowed the airspeed to decay and induced a stall in close proximity to the runway. The resulting high sink rate on ground contact subjected the left landing gear to loads in excess of the design limits.

3.2.2 The presence of the work crew at the threshold of the runway contributed to this accident by distracting the pilot at a critical moment in the flight.

3.2.3 The pilot almost certainly had a tendency to fly at the slow edge of the approach speed range. This caused regular stall warnings, which led the pilot to "tune out" the stall-warning device. This prevented the pilot from realizing and responding to the impending stall until too late.

3.2.4 The fatigue caused by the requirement for the pilot to alter his sleep patterns between the week and the weekend combined with a reduced energy level from a light breakfast may have contributed to this accident.

4. SAFETY MEASURES

4.1 Safety Measures Taken

The Regional Cadet Air Operations Officer was briefed on the accident with an emphasis on the need to improve communication with airfield managers and other operators.

4.2 Further Safety Measures Required

4.2.1 All Gliding Site personnel should again be reminded that rest and nutrition play a significant role in maintaining ones mental abilities. Gliding site Commanders need to continually ensure that all their personnel maintain adequate states of rest, nutrition and hydration throughout the day. Furthermore,

all gliding site's morning Pre-Ops Checklists should be amended to include a check of everyone's state of rest and nutrition.

4.2.2 The Harmonization of the Scout Flight Manual should be completed as soon as possible. This manual should be modelled after other Aircraft Operating Instructions (AOIs) in use in the Canadian Forces and should provide specific speeds for various manoeuvres instead of offering acceptable speed ranges.

4.2.3 All Regional Operations Officers should ensure that every member of the Gliding Program is aware of the requirements for toxicological sampling following an accident. Furthermore, each Gliding Site's emergency response checklists should be amended to indicate that Gliding Site personnel are to request that the hospital secure blood and urine samples from the crew, indicating that the appropriate military medical authority will contact the hospital to arrange for the transfer of the samples to the proper laboratory. The use of the term "blood work" should be discouraged since it causes confusion as to the nature of the request.

5. DFS COMMENTS

As usual with accidents, this accident had not a single cause, but a chain of causes, the absence of any one of which could have prevented its occurrence. It is that lesson I wish to highlight. A slight ambiguity re approach speeds in the manuals does not seem like such a big thing. One pilot tending toward the lower end of what is generally accepted, and getting used to hearing the horn but knowing it means he's close to the stall (rather than at it) doesn't seem like a problem for someone who flies accurately. A failure to advise the glider operation that the runway is being closed for repairs when they weren't using the runway anyways could be considered a pretty minor oversight. But all of these factors together with a pilot just possibly very slightly impaired through insufficient nourishment and fatigue were enough to cause an accident. The lesson? If it seems like your Flight Safety people are excessively concerned about little things, it's because they've seen similar patterns before!

R.E.K. Harder
Colonel
Director of flight Safety

Annex A: Photographs



Photo 1: Final Resting Place



Photo 2: Broken gear leg and fuselage damage



Photo 3: Spade damage



Photo 4: Propeller damage