Air Accident Investigation Unit
- (Belgium)
CCN
Rue du Progrès 80 Bte 5
1030 Brussels

FINAL REPORT ON THE ACCIDENT TO THE BEECHCRAFT 77 REGISTERED OO-PBL IN CHARLEROI ON JANUARY 10TH 2009

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FOREWORD

This report is a technical document that reflects the views of the investigation team on the circumstances that led to the accident,

In accordance with Annex 13 of the Convention on International Civil Aviation, it is not the purpose of aircraft accident investigation to apportion blame or liability. The sole objective of the investigation and the Final Report is the determination of the causes, and define recommendations in order to prevent future accidents and incidents.

In particular, Article 13 of the King's Decree of 9 December 1998 stipulates that the safety recommendations made in this report do not constitute any suspicion of guilt or responsibility in the accident.

Unless otherwise indicated, recommendations in this report are addressed to the Regulatory Authorities of the State having responsibility for the matters with which the recommendation is concerned. It is for those Authorities to decide what action is taken.

The investigation was conducted by L. Blendeman and D. Wintershoven.
The report was compiled by D. Wintershoven and approved by L. Blendeman.

NOTE:
For the purpose of this report, time will be indicated in UTC, unless otherwise specified.

Federal Public Service
Mobility and Transport
Air Accident Investigation Unit

AAIU-2009-01

Synopsis

Date and hour of the accident
January 10th 2009 at 14:40UTC.

Aircraft
Beechcraft “Skipper” BE77.

Accident location
Charleroi Brussels South Airport EBCI

Aircraft owner
Belgian Flight School S.A.

Type of flight
Instruction flight PPL.

Persons on board

Injuries	Pilot	Passenger	Others	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	1	0	0	1
Total	1	0	0	1

Abstract
After performing three rounds of the airport circuit, the flight instructor clears the PPL student to do his first solo flight. The goal of which is to do several touch & go’s.

The student performs a first round and landing. Once on the runway the student pushes the right rudder pedal in anticipation of the increase of the engine thrust for take-off.
However, the plane starts to head to the left side of the runway before any increase of engine thrust. The student pushes harder on the right rudder pedal, without result.
Heading outside the runway the student gives full throttle in an attempt to take off before reaching the runway edge, behind which an accumulation of snow lies. This attempt fails and the plane hits the pile of snow frontally as well as a signalisation sign, a few meters further, with the left wing.
Immediately the student starts to brake gradually. At the following irregularity in the terrain the plane dives nose down and the propeller hits the ground.

After coming to a standstill the student cuts off all power and climbs out the aircraft to wait for aid 20m further.

1. Factual information.

1.1 History of flight.

The student pilot and instructor performed an instruction flight between 14:00 and 15:00 UTC on the 10th of January 2009 at EBCI. Having performed three successful rounds of the airport circuit (appropriate velocity, good approach and landing according to the instructor), the instructor judged the student had the necessary experience to perform his first solo flight.

The student put off the instructor before going for his first solo flight, of which the goal was to perform several touch & go manoeuvres. Take-off, flight and the first touchdown were uneventful.
During the taxiway run the student pilot pushed the right rudder pedal in anticipation of the thrust increase and take-off. However, before increase in throttle the airplane started to head left. The student pushed harder on the right rudder pedal without result.
Heading out of the taxiway, just before the S4 exit, and for an accumulation of snow (stated to be about 60 cm high) left of the runway the student decided to give full throttle and attempt a take-off. This attempt failed and the aircraft hit the pile of snow followed by a signalisation sign (S4) with the left wing. At the next irregularity in the ground the nose of the plane pitched down and the propeller impacted the ground.

The airplane stopped, the student shut down all systems and engine[1] and climbed out of the wreckage. He waited about 20 m further for help to arrive.

1.2 Injuries persons.

Injuries	Pilot	Passenger	Others	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	1	0	0	1
Total	1	0	0	1

[1] Except the magnetos, which the student forgot. This is however of no further significance.

1.3 Damage to aircraft.

The landing gear nose wheel leg was bent backwards and the torque link was bent.

Figure 1: Bent nose wheel leg.

The left wing (spar, flaps and aileron) was damaged due to impact with the signalisation sign.

Figure 2: Damaged flaps and ailerons on left wing.

Figure 3: Damaged left wing spar.

The propeller was bent backwards due to contact with the ground.

Figure 4: Bent propeller due to impact with ground.

Several smaller dents on wings and fuselage were caused by the accident.

Figure 5: Dented engine support assembly.

The engine support assembly was bent in several places as shown above.

1.4 Other damage.

The signalisation board (S4), located left of the runway at 16.50m, was damaged.

1.5 Personnel information.

Student pilot:

Sex: male
Age: 32
Nationality: Belgian
License:

- Student pilot licence aeroplanes (PPL) B200461 delivered on 15/07/2008, valid until 31/10/2013.
- The student had 18.25 FH at the beginning of the instruction flight.

Medical:

- Class 1, valid until 15/07/2009.

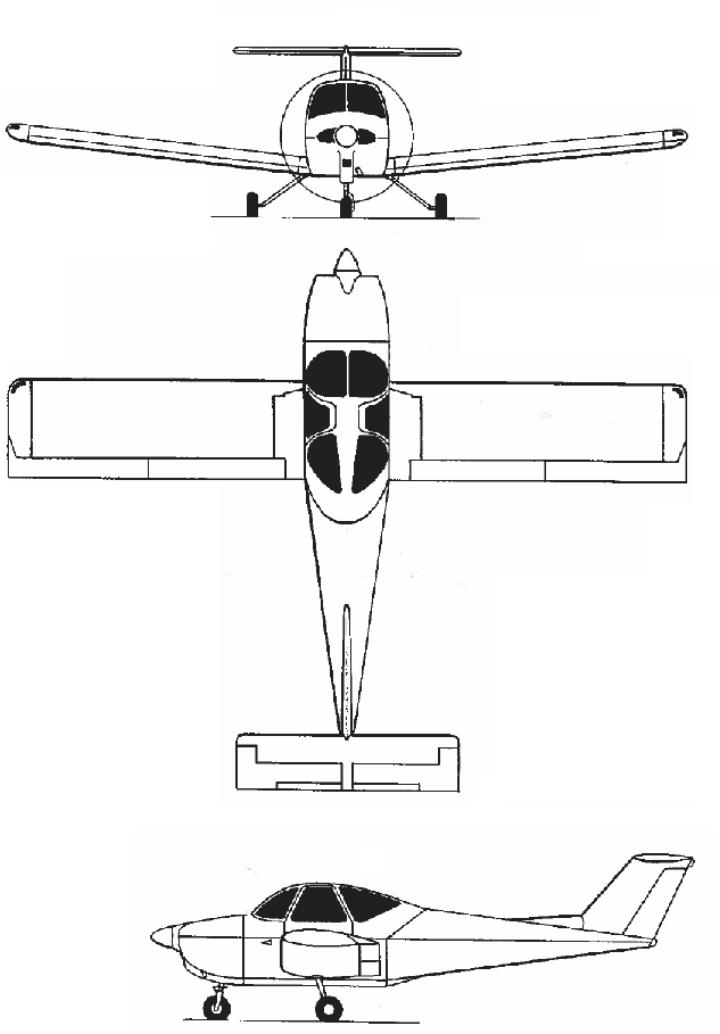
At the time of the instruction flight the student pilot was wearing light mountain shoes of category AB[2].
The student stated to be aware of his particular shoes and had, before the actual flight, been training in the simulator to, among other reasons, get used to the shoes while flying.

The student stated to have paid particular attention to the position of his feet on the pedals during flight.

[2] AS Adventure: category A being normal shoes and B being mountain shoes for trekking.

1.6 Aircraft information.

The **Beechcraft Model 77 Skipper** is a two-seat side by side, low wing, T-tail, fixed tricycle gear general aviation airplane, originally designed for flight training.



General characteristics

- **Length:** 7.29 m
- **Wingspan:** 9.14 m
- **Height:** 2.30 m
- **Wing area:** 12.1 m²
- **Empty weight:** 500 kg
- **Max takeoff weight:** 760 kg

Performance

- **Never exceed speed:** 143 knots (263 km/h)
- **Cruise speed:** 105 knots (194 km/h)
- **Stall speed:**
  - **Clean:** 49 knots (91 km/h)
  - **With full flaps:** 47 knots (87 km/h)
- **Range:** 388 nm (719 km) at best economy

Airframe:

- Manufacturer: Raytheon Aircraft Company
- Type: Beechcraft “SKIPPER” BE-77
- Serial number: WA-250
- Built year: 1981
- Registration: OO-PBL
- Certificate of registration: 5408 issued on 04/07/1982
- Certificate of airworthiness: N° 538 issued on 02/10/2007.
- ARC: Issued on 15/10/2008 valid until 14/10/2009.

Engine:

- Manufacturer: Arco Lycoming
- Type: O-235-L2C
- Total flight hours: 6107 FH
- Serial number: L-15485-15

Propeller:

- Manufacturer: Sensenich
- Type: 72 CSK12-0-52
- Total flight hours: 5108 FH
- Serial number: K7165

Owner:

- Belgian Flight Group S.A.

Operator:

- Belgian Flight Group S.A.

1.7 Meteorological conditions.

Time [UTC]	Wind		Visibility [m]	Clouds	Temperature [°C]	Dew point [°C]	Pressure [QNH: hPa]
	Direction [°MAG]	Velocity [KTS]					
14:50	180	4	7000	Clear skies	- 2	- 8	1026

At the time of the flight it had snowed. The runway was clear of snow and slightly wet. The conditions were damped.

1.8 Aids to navigation.

Not applicable.

1.9 Communication.

Not applicable.

1.10 Aerodrome information.

The airport of EBAW Charleroi / Brussels South is located 4NM North of Charleroi. Permitted traffic types are VFR and IFR.

The aerodrome has category 7 services for fire fighting (CAT 8 might be allowed or refused with a delay of 1 hour).

The accident happened on the runway 25 at approximately the height of the S4 signalisation board, shown in the pictures below.

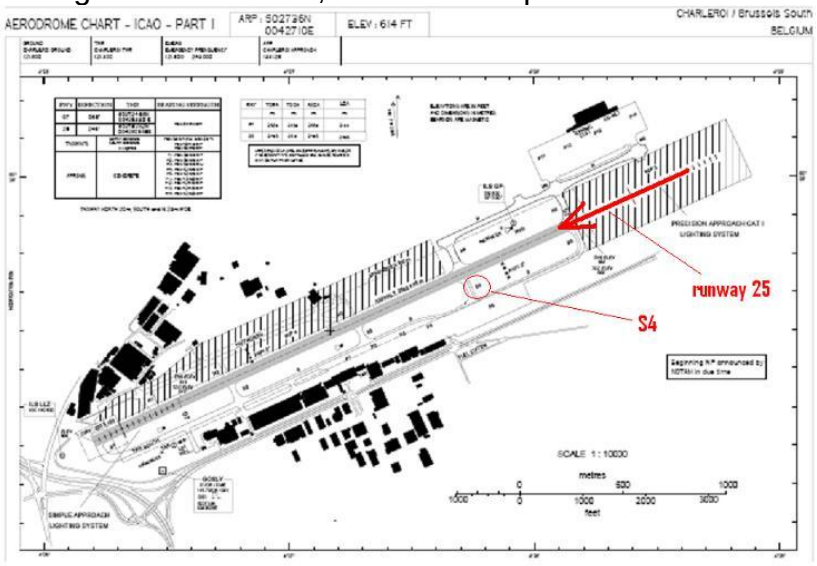


Figure 6: aerodrome chart.

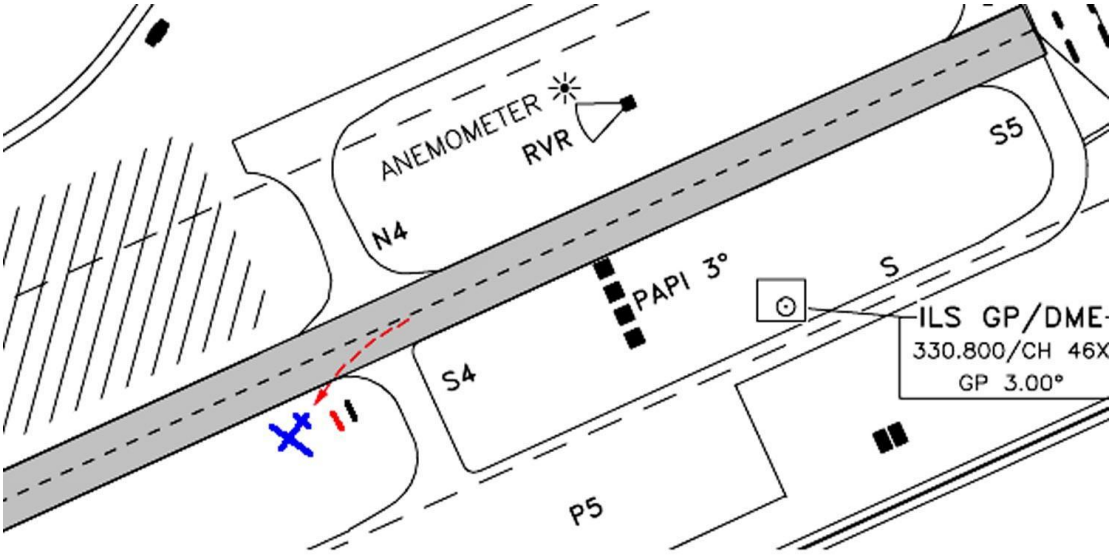
Figure 7: View runway 25 and S4 sign.

1.11 Flight recorders.

Not applicable.

1.12 Wreckage and impact information.

The final position of the aircraft was about 10m further than the initial position of the S4 sign. The sign's initial position was 16.5m from the border of the runway. After impact with the plane's left wing the sign ended up about 4m of it's initial position.
This is showed in figure 7 below.



Red arrow: estimated trajectory of the plane
Black line: signalisation board S4 - initial position
Red line: signalisation board S4 - final position after impact (approx. 4m from initial position)

Figure 8: Estimated trajectory and position of signalisation board S4.

1.13 Medical and pathological information.

Not applicable.

1.14 Fire.

Not applicable.

1.15 Survival aspects.

The student pilot was not harmed and vacated the aircraft after shutting down all systems[3]. He waited for help some distance from the wreckage.
The airport emergency plan was activated and performed immediately. Initial contact was established with ATC 1 minute after the accident occurred. The airplane was secured and evacuated from the runway in less then 20 minutes.
Members of the Belgian Flight Group were on site immediately.
The airport inspection, which had been notified by ATC, emitted a NOTAM for closure of the airport (temporarily). Debris from the taxiway was removed by the airport inspection team in order to re-open the runway as soon as possible.
The wreckage was moved to a hanger by the airport fire brigade less than on hour after the accident occurred.

[3] Except for the magnetos. This is of no further significance.

1.16 Tests and research.

Visual inspection of the wreckage showed that the damage described in 1.3 originated from the accident.
The integrity of the different controls were checked and appeared to be intact and functional.

Investigation of the rudder pedals showed a particularly short length of stroke to apply braking, i.e. the foot just has to tilt very slightly to induce the braking effect.
This is however in compliance with the maintenance manual of the aircraft seen how no specifications on this subject are given.

Study of the aircraft shows it has differential braking i.e. the brakes can be applied separately to be used for steering purposes (on the ground).

The plane has a linkage between the rudder (or rudder pedals) and the orientation of the nose wheel. This is for steering purposes on the ground.
When no force is applied on the nose wheel, as in flight, this linkage is undone so to prevent the nose gear from moving.

1.17 Organizational and management information.

The student pilot reported after the accident that during his training he had been given different instructors during a relatively short time span.
These different instructors, reportedly, gave different teachings on the same matters, causing possible confusion for the student.

1.18 Additional information.

Not applicable.

1.19 Useful or effective investigation techniques.

Not applicable.

2. Analysis.

During the instruction flight the student was wearing light mountain shoes. These shoes provided less then optimal feedback from the rudder pedals to the pilot because the heavier soles restrict the feelings in the foot. Therefore the student had a lessened sensitivity to control the rudder, nose wheel and brakes.
Being aware of this less than optimal footwear the pilot stated to have been particularly careful with the position of his feet on the pedals. Nevertheless the system of differential braking allows the possibility for the rudder to swerve to one side while braking in opposite direction due the actual position of the foot on the pedals (positioned too high on the pedal or tilted too much).
In this particular case the small length of stroke of the braking pedal should be mentioned. However compliant with technical specifications, this increased the possibility of an accidental braking action.

Another possible factor originates from the fact that the nose wheel steering mechanism only functions when enough force (weight) is exerted onto it. This is a common system that prevents the nose wheel from moving during flight to, among other things, reduce drag. However, this creates the possibility that during the run, due to the intention of taking off, the plane did not press down enough for the steering mechanism to work so that the action on the rudder pedals did not translate into nose wheel (steering) movement.
This might explain the unwanted course of the plane.

The fact that the inexperienced student pilot had been given different instructors during his training could have caused some confusion and might therefore be a minor contributing factor to the accident.

The presence of the snow bank just besides the runway contributed to the gravity of the accident.

The proper guidelines and procedures on this matter were in place[4] at the time of the accident.
These regulations stipulate that snow banks on both sides of the runway have to be removed and that the clearance of the apron area should be done as soon a possible.

[4] ICAO Doc 9137-AN/898; Airport Services Manual, Part 9; Airport Maintenance Practices, Chapter 4.7; Removal of snow and ice & Doc 9137-AN/898; Airport Services Manual, Part 2; Pavement Service Conditions, Chapter 4.7;

4.7.17 The snow banks on one or both sides of the cleared surface have to be removed by throwing all of the compacted snow far beyond the edge of the surface by means of snow blowers. Snow blowers run at the end of a snow removal train. If time and air traffic situation permit, this strip can be further cleaned by another sweeper running over it after the blower has done its work. The aim

Figure 9: Extract of Doc 9137, Part 9.

Moreover, related to the subject of snow and ice clearance, the guidelines speak of movement area (runway + taxiways + aprons) and not just the runway as can be seen on the extract given below.

10.2 Pavements

10.2.1 **Recommendation.**— *The surface of pavements (runways, taxiways, aprons, etc.) should be kept clear of any loose stones or other objects that might cause damage to aircraft structures or engines, or impair the operation of aircraft systems.*

10.2.9 **Recommendation.**— *A taxiway should be kept clear of snow, slush, ice, etc., to the extent necessary to enable aircraft to be taxied to and from an operational runway.*

10.2.10 **Recommendation.**— *Aprons should be kept clear of snow, slush, ice, etc., to the extent necessary to enable aircraft to manoeuvre safely or, where appropriate, to be towed or pushed.*

10.2.11 **Recommendation.**— *Whenever the clearance of snow, slush, ice, etc., from the various parts of the movement area cannot be carried out simultaneously, the order of priority should be as follows but may be altered following, as necessary, consultation with the aerodrome users:*

1st — runway(s) in use;

2nd — taxiways serving runway(s) in use;

3rd — apron(s);

4th — holding bays; and

5th — other areas.

Figure 10: Extract Annex 14; Aerodromes, Chapter 10.2

7.1.5 Clearance of snow, slush, ice and standing water from the movement area should be based on flight safety and schedule considerations. In most circumstances, the priority will be:

a) runway(s) in use;

b) taxiways serving runway(s) in use;

c) apron(s);

d) holding bays;

e) other areas.

Figure 11: Extract of Doc 9137, Part 2.

Even though all above given extracts, when interpreted progressively, encourage to remove snow and ice from as much of the airport area as possible, and certainly from the sides of the runway, none of the above given guidelines are binding unless imported in the airports' manual.
The regulations were at the time adequately implemented into the aerodrome manual; chapter 4.7.1. This gives the procedure describing how to remove the snow from the runway, including the taxiways. An extract is shown below.

Renseignements sur les procédures d'exploitation et les mesures de sécurité d'aérodrome - 4-45

Mise en action des deux Boschung pour le déneigement de la piste. Les deux machines commenceront chacune à une extrémité de piste, et ce de la manière suivante:

Positionnement en bout de Taxyway sud +/- 30 mètres avant les bretelles S1 ou S5, positionnement au centre et inclinaison de la lame et brosse vers l'extérieur (les deux opérateurs prennent contact par radio pour coordonner leurs mouvements afin de ne pas travailler du même côté de la piste)

Dès l'arrivée en bout de piste, poursuite vers le début de Taxiway sud et demi-tour à l'endroit ou l'autre machine aura débuté. Afin d'éviter les congères, il est nécessaire de relever la lame pour le demi-tour

Poursuite de la manœuvre jusqu'au dégagement de la piste, de S1 à S5 et en début de Taxiway

Prise d'un repère sur la balisage latéral et arrêt de la congère à +/- 6 mètres de celui-ci

Déneigement du Taxiway sud à l'aide des Bulldozers et des brosses de type Schörling:

Positionnement des deux machines au début du Taxiway sud à la bretelle utilisée en fonction de la piste en service. Commencement par le bord du taxiway sud et repoussage de la neige ver le nord du Taxiway sud afin de ne pas créer de congères aux abords des parkings avions

Déneigement des bretelles S2, S3, S4 et enlèvement des congères laissées par les Boschung (piste) et Schörling (Taxiway sud). Dégagement de la P1 et de la P2. en ce qui concerne le déneigement P1 et P2, repoussage de la neige vers la SABCA et passage du casse congère pour étendre la neige vers les parties herbeuses (en regard des hangars)

Figure 12: Extract of EBCI Airport Manual.

Particularly the last part describes the procedure to avoid snow banks at the intersections of the runway and taxiways (just besides the runway).

Seen how the snow bank referred to during the accident reportedly laid near the intersection of the runway and the taxiway S4[5] there might have been a minor deviation of the airport and its services[6] to their manual procedures at the time of the accident.
In any case the airport should strive to clear as much snow on the area as is practicable, as can be deduced from higher mentioned guidance documents.

[5] This can however not be determined with certainty due to the volatile nature of phenomenon.
[6] According to the manual the clearance of the airport is always the responsibility of the airport operator, while meteo services must warn the responsible for the clearance operations when snow conditions occur. The fire department is charged with the execution.

3. Conclusions.

3.1 Findings.

- The student pilot was licensed, but did not have a lot of experience.
- There might have been a deviation from the airport manual by the airport.
- The student pilot was wearing less than optimal shoes.
- The investigation did not reveal any technical malfunctions of the plane.
- The plane was airworthy at the time of the accident.

3.2 Causes.

The accident was likely caused by inadequate footwear and the absence of extended flight experience of the pilot. This might have lead to unintentional actions initiated by the pilot.
Possibly contributing to this was the fact that the student had several instructors during his training.

A contributing factor to the accident was the non-compliance of the airport services to the airport manual, in particular to the procedure of snow removal (chapter 4.7.1).

4. Safety recommendations.

4.1. To Training Schools.

The AAIU.be advises that the schools should emphasize more the importance of choice of footwear while flying.
Particular attention must be paid during the training of pilot students to the dangers of inadequate footwear.
Instructors should always check for appropriate footwear of their students before commencing flight, and should if necessary take appropriate measures.