Federal Public Service
Mobility and Transport
Air Accident Investigation Unit

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(Belgium)
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Safety Investigation Report

Ref. AAIU-2013-16
Issue date: 1st April 2016
Status: Final

SYNOPSIS

Classification:	Accident
Level of investigation:	Standard
Date and time:	Sunday 02 June 2013 at 13:59 UTC
Aeroplane:	Apex aircraft DR 400/140 B (former Robin). The aircraft was registered in Belgium and held a Certificate of Airworthiness and a valid Airworthiness Review Certificate (ARC).
Owner:	Noordzee Vliegclub VZW, a flying club based in EBOS
Total flight time:	1255:20 FH
Engine:	One Thielert TAE 125-02-99 SN: 02-02-03166
Accident location:	Ostend airport (ICAO: EBOS)
Type of flight:	General Aviation - Cross-country
Phase:	Landing
Persons on board:	4
Injuries:	None

Abstract

Immediately after touching down on runway 26 at EBOS, the aeroplane veered to the right and rolled towards the side of the runway. The directional control could not be recovered in time by the pilot, leading to a runway excursion in which the aeroplane first hit a runway edge light with the left landing gear wheel fairing and further collided with an airport 'Direction Sign' panel with the right wing leading edge. It finally came to a halt about 100 metres further.

Cause

As no pre-existing technical anomalies were found after the accident but the pilot declared that at the initial phase neither braking (on the main wheels) nor steering helped to counteract the deviation to the right, the hypothesis is that the nose gear was bearing a higher portion of the weight than the main wheels after touchdown ('wheelbarrowing phenomenon'). This wheelbarrowing would have been the consequence of not applying adequate back pressure on the stick during the touchdown with fully extended flaps (landing configuration) at excessive airspeed.

The initial turn to the right was probably due to the 'weathervane effect' of the crosswind pushing on the tail of the aeroplane and turning it into the wind.

Contributing factors:

- Low flying experience of the pilot.
- Phenomenon of wheelbarrowing (directional instability with tricycle gear aircraft) not well known within the pilot community.

Safety message[1]

It is advised that, using this report, instructors emphasize the need for proper attitude and airspeed control during approach and landing, particularly in crosswind conditions, and also instruct how to recover from the phenomenon 'wheelbarrowing' if it is ever experienced.

FACTUAL INORMATION

History of the flight

The aeroplane took off from EBOS airport on 10:00 UTC with 1 pilot and 3 passengers on board for a flight to EHMZ Midden-Zeeland airfield (The Netherlands). In the afternoon at around 13:15 the aeroplane took off from runway 27 of EHMZ, with a northerly wind, for the return flight. The return flight itself was uneventful, ending by a straight-in approach (no circuit before landing) on EBOS runway 26 at 13:59. Almost immediately after touchdown the aeroplane veered to the right and ran towards the grass area. The aeroplane first hit a runway edge light with the left landing gear wheel fairing, went on the grass area and further hit an airport direction sign panel with the right wing leading edge, causing the separation of the outboard part of the wing. The aeroplane continued to ride about 100 metres straight ahead, crossed taxiway A and finally came to rest in the grass with flaps still in landing configuration. Nobody was injured.

Pilot statement

After the accident, the pilot stated that the approach was stable at an airspeed of 70 KIAS with the ailerons into the wind, applying small corrections using the left rudder pedal to keep the nose into the runway axis and to counteract the crosswind (= 'wing-low' or 'sideslip' method). The flaps were set in landing configuration (second notch). Asked why he performed the approach at the airspeed of 70 KIAS (approach speed in landing configuration is 62 KIAS in POH), the pilot declared that it was because there was an MD-11 behind him in final.
According to the pilot, the touchdown on the main landing gear was normal, with a small left rudder correction for the crosswind, followed by a smooth nose landing gear touchdown. At that moment, the aeroplane suddenly deviated to the right. The pilot stated he tried to address the right drift by pushing the left rudder pedal forward and by slightly and briefly operating the left brake, however without any result. He momentarily added some power again - reportedly to generate prop wash

[1] **Safety message:** An awareness which brings under attention the existence of a safety factor and the lessons learned. AAIU(Be) can disseminate a safety message to a community (of pilots, instructors, examiners, ATC officers), an organization or an industry sector for it to consider a safety factor and take action where it believes it appropriate. There is no requirement for a formal response to a safety message, although AAIU(Be) will publish any response it receives.

on the rudder - but also without any result. He had the impression that the nose wheel steering control was regained after hitting the runway edge light. The pilot also stated the passenger sitting next to him had both feet free from the rudder pedals. He declared that he didn't want to put too much pressure on the brake pedal to avoid worse as, according to him, it was taught during his initial training in the training organisation to avoid excessive braking during the landing roll.

As seen on Figure 1, the different phases of the runway excursion were reconstructed based on records from the action camera that the pilot installed on board for this flight.
The rolling distance between the touchdown point and the position where the aeroplane came to a full stop has been determined to be about 370 m.

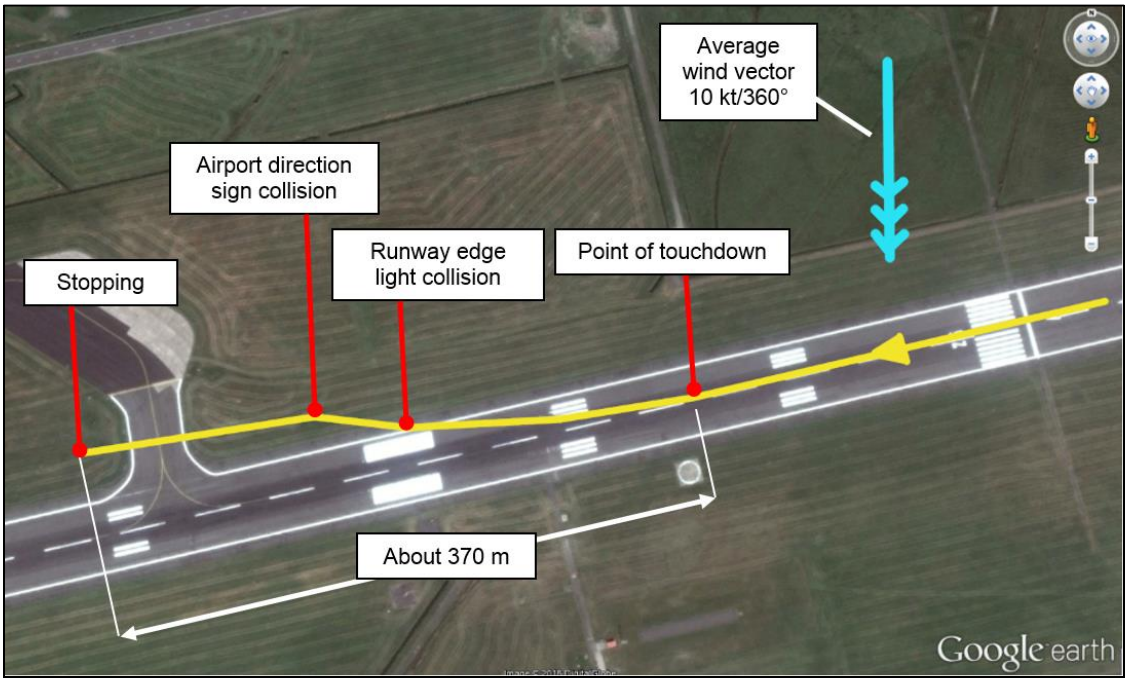


Figure 1: rolling path reconstruction

Damage to aircraft


Figure 2: general view of the damage

The aeroplane suffered extensive structural damage to the right wing. The outboard part from the tip to the dihedral change was torn off. The fairing of the left landing wheel was destroyed and the fairing of the nose wheel was damaged on its left side.

Damage to airport infrastructure

A runway edge light and the direction sign panel ‘Alpha’ were damaged during the excursion. There were almost no traces visible on the runway.

Pilot information

Age: 34 years old.
Private Pilot Licence (PPL(A) first issued on 07 September 2010, valid until 07 September 2015.
Rating: SEP (land), valid until 30 September 2014.
Total flight experience SEP: 121:07 flight hours (FH) of which 88:06 FH as Pilot in Command (PIC).
Total flight experience flying Robin DR400: 39:48 FH.
Last 6 month flight experience: about 15 FH of which 8:20 FH using the accident aeroplane, the remaining hours were performed using C150 and PA28 aeroplanes.

Landing footage

An action camera installed in the aeroplane by the pilot recorded the runway excursion. Snapshot views of interesting phases of the landing were selected and timed starting from the touchdown. The recorded sound of the touchdown could determine that the nose landing gear touched the ground almost immediately after the main landing gear (less than 1 second).

Figure 3: Aeroplane in flight – The airspeed needle is not yet visible

Figure 4: Touchdown – reference time: 0 – Airspeed about 62 kt

Figure 5: The A/C begins to deviate to the right
Time: 2 seconds after touchdown - Airspeed about 61 kt

Figure 6: Just before hitting the edge light with the left wheel fairing
Time 6 seconds after touchdown – Airspeed 52 kt

Figure 7: Just before colliding with the direction sign panel
Time 9 seconds after touchdown - Airspeed 45 kt (Edge of the white arc)

Figure 8: Time 12 seconds after touchdown – Airspeed 35 kt

Figure 9: Time 15 seconds after touchdown – Airspeed needle close to the stop


Figure 10: Time 19 seconds after touchdown, just before stopping
Airspeed needle on the stop

Meteorological information

METAR at 13:50 UTC (9 minutes before the accident):
Temperature: 14°C,
Wind: 360°/10 knots, no gust reported but variable between 330° and 30°,
Visibility +10 km
QNH: 1029 hPa.

Airfield information

Ostend-Bruges International Airport (ICAO: EBOS, IATA: OST) is located in Ostend, near the coast and about 25 km west of the city centre of Bruges. Geographical coordinates are 511156N - 0025144E and elevation is 13 ft. The airport is equipped with one asphalt 08/26 bi-directional runway. Dimensions of the runway are 3200 m length x 45 m width. The full runway length is available for take-off. The landing distance available (LDA) for runway 26 is 2785 m. Both runways are equipped with PAPI lights, installed on their left, serving as a visual approach slope indicator with a set angle of 3°.

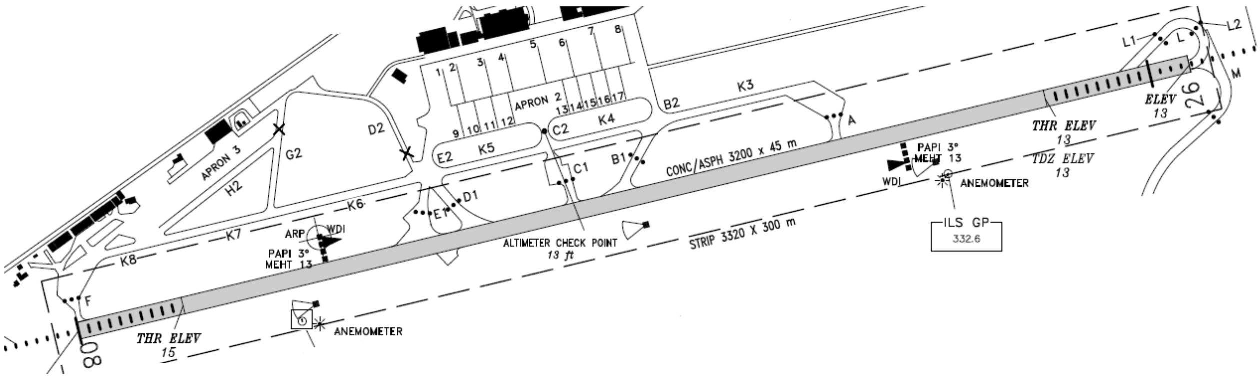


Figure 11: EBOS airport drawing

In the Aeronautical Information Publication (AIP) of Belgium and G.-D. Luxembourg the following information can be found under the section of EBOS:

> Between 2100 and 0700, when the crosswind component - including gusts - does not exceed 15 kt, or the tailwind component - including gusts - does not exceed 5 kt and traffic permitting and with approval of pilot-in-command, ATC shall use RWY 26 for departing and RWY 08 for arriving aircraft.

Because of the presence of the CTR of Koksijde (EBFN) and the gunnery area of Lombardsijde (EBR17) in the approach zone of RWY 08, the ILS sensitive area of RWY 26 is considered better protected against interference during daytime. For that reason the use of RWY 26 is also preferred during daytime for arriving aircraft if the tailwind component does not exceed 5 kt.

Aeroplane

Pilots' Operating Handbook (POH) airspeed limitations

SECTION 2
LIMITATIONS

APPROVED OPERATION

AIRSPEED LIMITATIONS	km/h	kt
Vne, never exceed	270	146
Vno, normal operation	260	140
Va, maneuvering speed	215	116
Vfe, flaps extended limit speed	170	92

Table 2-1 Airspeed Limitations

AIRSPEED INDICATOR MARKINGS		km/h	kt
Red line (never exceed)	Vne	270	146
Yellow arc (operate with caution and only in "smooth air")	Vno-Vne	260 - 270	140 - 146
Green arc (normal operating range)	Vs1-Vno	99 - 260	53 - 140
White arc	Vso-Vfe	87 - 170	47 - 92

Table 2-2 Airspeed Indicator Markings

Figure 12: POH airspeed limitations

The lower limit of the green arc (53 kt) represents the flapless (or clean configuration) stall speed, V_{s1}.

Lower limit of the white arc (47 kt) represents the stall speed in landing configuration (full flaps), V_{s0}.

NB: The reference landing approach airspeed in landing configuration (62 KIAS, see figure Figure **13**) is required by certification to be at least 1.3 times V_{s0} (safety margin), leading to a touchdown airspeed of maximum 1.15 V_{s0}.

Landing speed, final approach
Flaps in landing position (2nd notch)........................(62 KIAS) 115 km/h

Figure 13: Extract of POH supplement Section 4 "Normal Procedures" DR400/135CDI.

Demonstrated crosswind capability, as mentioned in the POH, is 22 kt, 40km/h.

Airspeed indicator

The analogue airspeed indicator has both a scale in km/h (outer scale) and a scale in kt (inner).

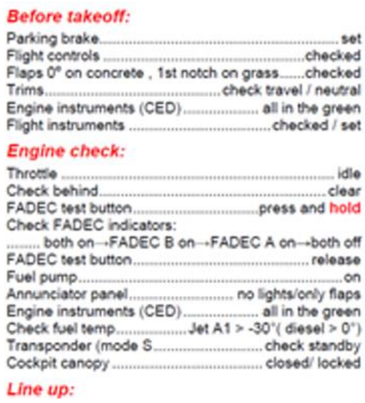
The needle moves clockwise if the speed is increasing. At rest, the needle is in the 6 o' clock position on the stop of 50 km/h (+- 27 kt).

Figure 14: airspeed indicator

Aeroplane checklist

The extract of the 'Noordzee Vliegclub' checklist reproduced here shows the last actions to be performed before the take-off.

It has to be noted that the parking brake must be set during the 'Before take-off' checks, but no subsequent release of the parking brake (push on the control), or check that the parking brake is properly released, was required by the checklist at the time of the accident.



Before takeoff:

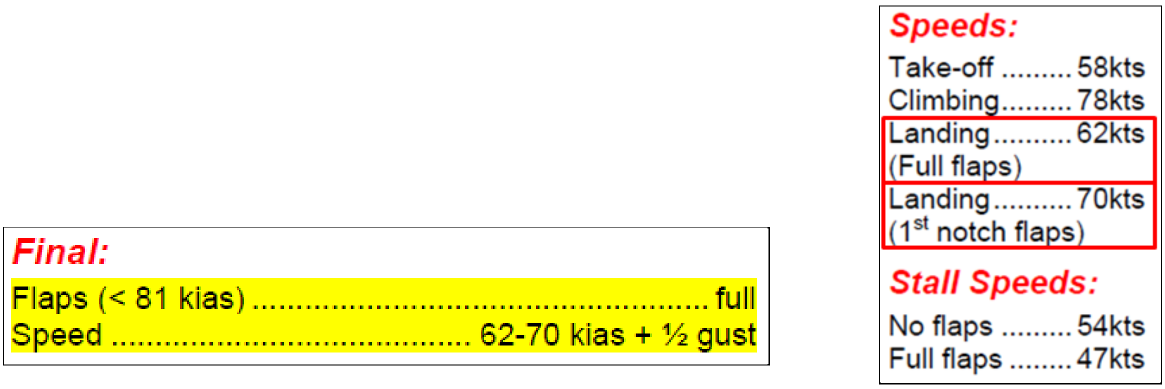
Parking brake........................set
Flight controls........................checked
Flaps 0° on concrete , 1st notch on grass......checked
Trims........................check travel / neutral
Engine instruments (CED)........................all in the green
Flight instruments........................checked / set

Engine check:

Throttle........................idle
Check behind........................clear
FADEC test button........................press and hold
Check FADEC indicators:
.... both on→FADEC B on→FADEC A on→both off
FADEC test button........................release
Fuel pump........................on
Annunciator panel........................no lights/only flaps
Engine instruments (CED)........................all in the green
Check fuel temp........................Jet A1 > -30°(diesel > 0°)
Transponder (mode S........................check standby
Cockpit canopy........................closed/ locked

Line up:

Figure 15: extract of the owner's checklist



Final:

Flaps (< 81 kias)........................full
Speed........................62-70 kias + ½ gust

Speeds:

Take-off 58kts
Climbing.........78kts
Landing..........62kts
(Full flaps)
Landing..........70kts
(1st notch flaps)

Stall Speeds:

No flaps 54kts
Full flaps 47kts

Figure 16: The owner's checklist showing the landing speeds and the stall speeds indifferent configurations of flaps

Weight and balance

The weight and balance calculated by the pilot before the take-off at EBOS shows the following data and was between limitations.

- Take-off weight: 979.8 kg
- Moment: 450 m.kg
- Centre of gravity (CG) location of 0.46 m behind the leading edge of the wing (about 26% of mean aerodynamic chord).

Taking an average fuel consumption of 20 l/h, the total weight of the aeroplane after 1:35 of flight was calculated by the Air Accident Investigation Unit of Belgium, or AAIU(Be), to be 955,5 kg with a moment of 433 m.kg, giving a CG location of 0.45 m behind the leading edge.

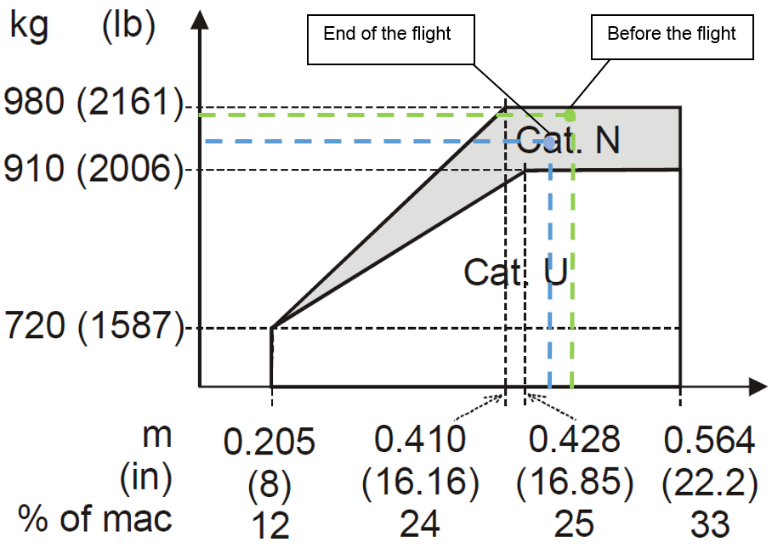


Figure 17: CG positions before and at the end of the flight

As can be seen on figureFigure **17**, the weight and balance was within limitations.

Aeroplane examination

The aeroplane examination focused on the nose wheel steering and on the brake system.

The aeroplane was first moved several times back and forth which showed that there was no friction caused by the brakes. Inspection of both brake discs and brake callipers didn't show any abnormally. The brake pedals and their associated torque tubes and linkages were also externally examined as well as the master cylinders. The parking brake system was tested by pushing on the brake pedals and closing the parking brake valve. After opening the parking brake valve again, no particular friction remained between the discs and the brake pads. No anomaly was found in the brake system.

The nose wheel steering was also carefully examined and tested. No anomaly was found in the steering system. The test performed a few days after the accident, first with the aeroplane standing on the ground and later with the nose oleo-strut extended (aeroplane nose jacked up – as in flight position), showed the nose wheel steering system was working properly.

This inspection involved specifically the verification that the compression of the nose oleo strut, as submitted to the aeroplane own weight when resting on the ground, positively disengaged the nose wheel (steering) rod lock. In this position, the nose wheel steering system was available to control the aeroplane rolling on the ground.

On the same way, it was determined that the nose wheel steering rod positively locked the nose wheel parallel to the fuselage centreline when the nose oleo-strut was extended, as in flight position.

Brake controls, parking brake valve

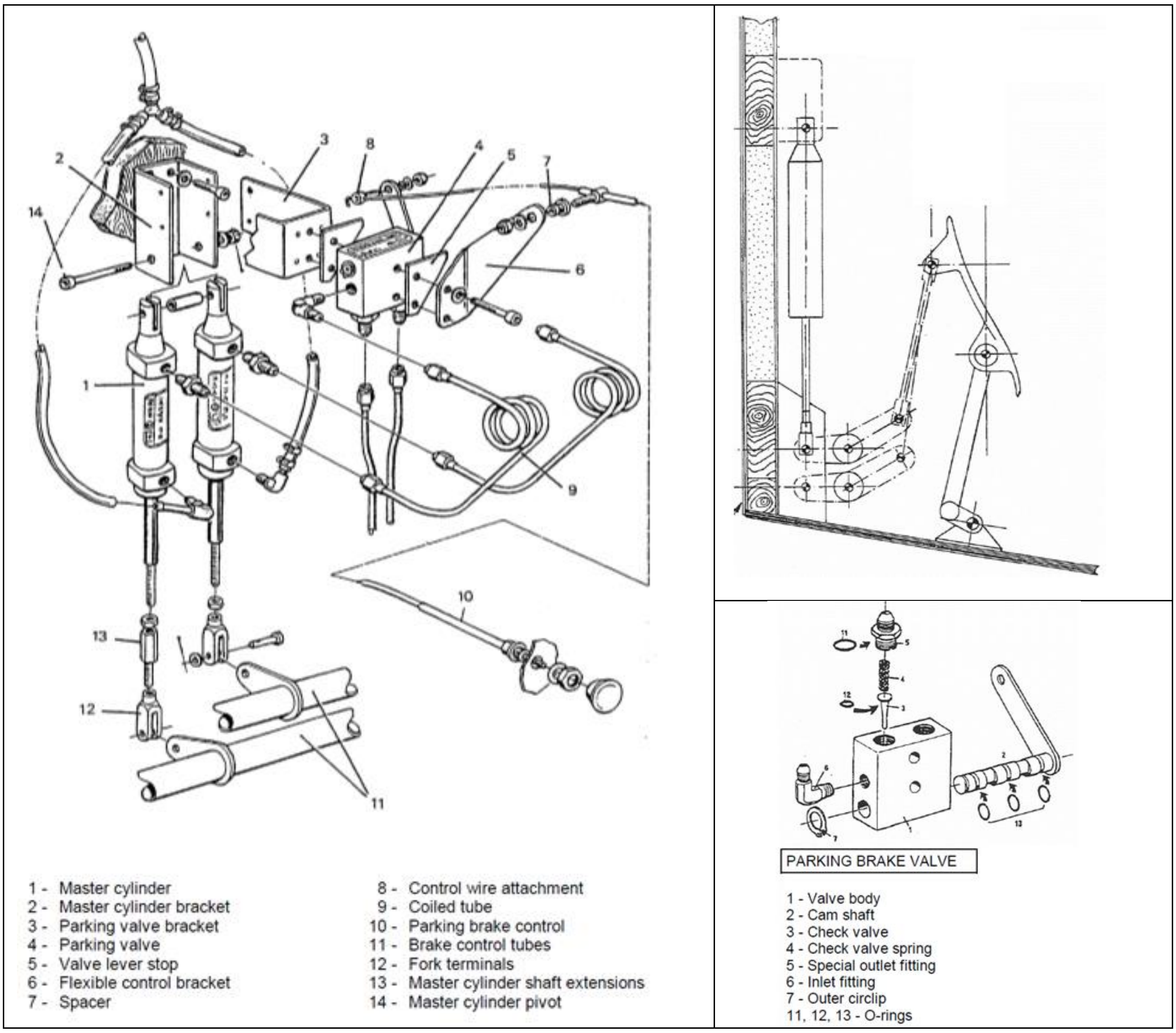


Figure 18: Extract of the parts catalogue showing the brake system.

To set the parking brakes on, the pilot must press on both pedals and keep pressure on while pulling the parking brake control. Just after that, the pressure on the pedals is released but the parking brake control must remain in pulled position. To set the parking brake off, the pilot must push the parking brake control in.

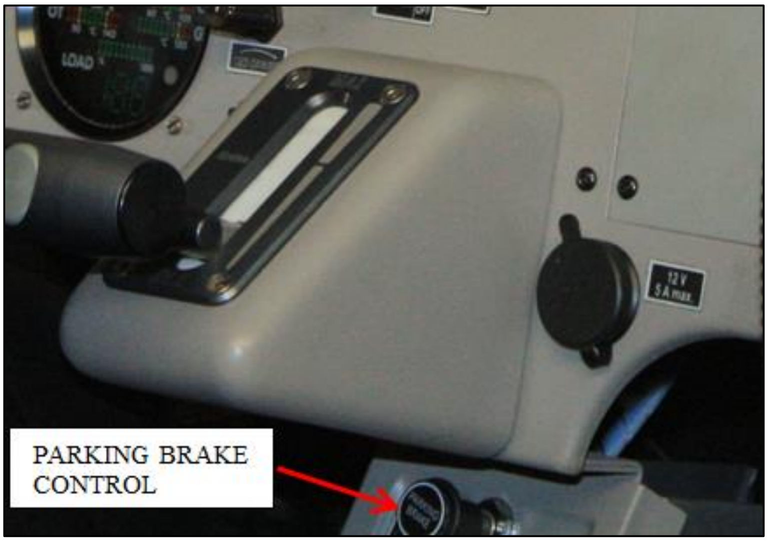


Figure 19: location of parking brake control

The parking brake control is located on the centre console, under the throttle control pedestal, see .

Nose wheel steering and rudder control

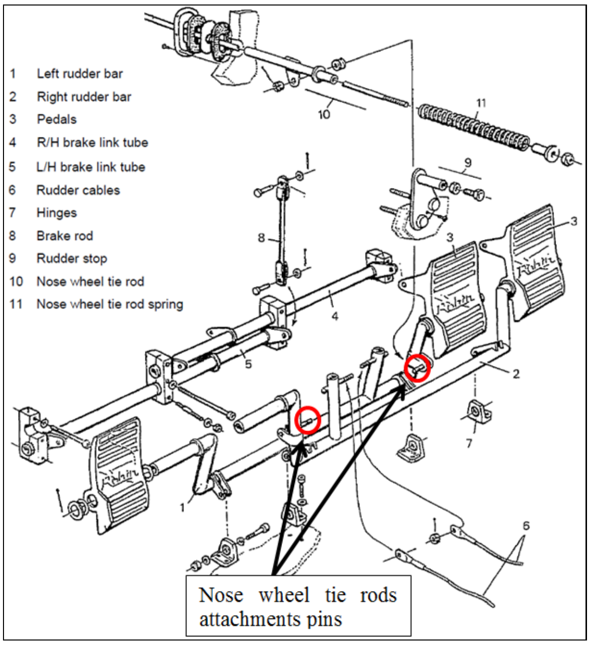


Figure 20: nose wheel steering system and rudder control cables (n°6 on the drawing).

In flight, the 3 landing gear oleo struts remain extended. The expansion of the nose landing gear strut acts on the nose wheel lock rod and forces the nose wheel to position itself in line with the centreline of the fuselage. When the pilot applies pressure on the rudder pedals, it rotates the rudder bars, causing the rudder to move as wanted, while the nose wheel steering remains in position.

From the moment the aeroplane touches the ground, the oleo strut is pushed inward causing the lock rod to move upward and allowing it to rotate freely in its guidance.

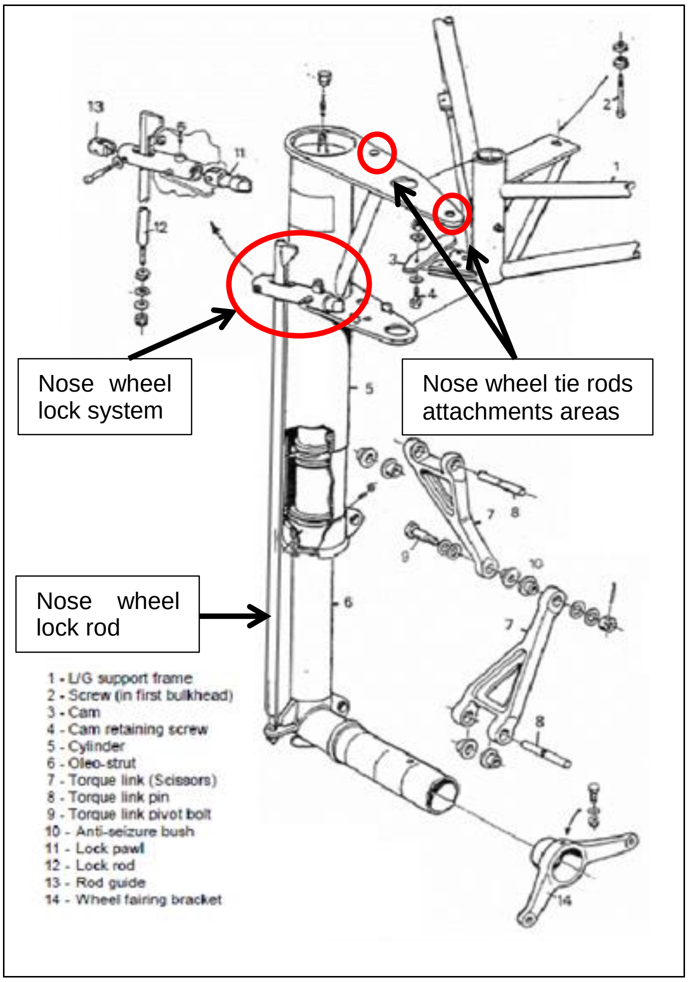


Figure 21: nose wheel steering system.

Aeroplane repair and return to service

The aeroplane was disassembled at Oostende and transported to a maintenance organization located at EHMZ. The wing was thereafter repaired by “CEAPR Maintenance”, a specialized repair station belonging to the aeroplane’s manufacturer. Thereafter, during the reassembly of the repaired wing and the repair of other damages caused by the accident, a 6 years inspection was carried out.

This 6 years inspection included an inspection of the brake system and of the landing gear. No discrepancy was found to the landing gear, except the damaged nose and L/H wheel fairings and the R/H worn tire. After reassembly of the wing and the landing gear, the brake linings were replaced due to normal wear and the bleeding of the brake hydraulic circuit was performed further to the reassembly of the wing. The operations carried out on the brake system did not reveal any anomaly.

Since the release to service of the aeroplane performed after the accident repair on 8 November 2013, no difficulty to control the aeroplane at landing or during the taxi was reported.

ANALYSIS

Action camera records analysis

Thorough examination of the action camera footage during the runway excursion could determine that:

- The touchdown occurred in a rather flat pitch attitude, with a very short period of time between the touchdown of the main landing gear and the touchdown of the nose landing gear (less than 1 second).
- The touchdown airspeed was determined to be about 62 KIAS, which is above the maximum recommended touchdown speed of 1.15 V_{SO} (54 KIAS)
- The aeroplane started to deviate just after the touchdown. However, the almost simultaneous touchdown on the main and nose landing gear made it impossible to verify the pilot's statement that the aeroplane started to deviate when the nose landing gear contacted the runway.
- From the images, it was impossible to determine the stick movement during the landing and subsequent roll out.
- A runway edge light was hit by the left or by the nose landing gear.
- Neither the feet nor the lower legs of the pilot are visible on the camera images, only his knees are. However no significant movement of any knee is observed after touchdown.

After the accident, the pilot was asked by the AAIU(Be) investigators, when sitting in the aeroplane to apply full pressure on the left rudder pedal in order to evaluate how the displacement of the knee could be observed on the action camera. This exercise could determine that a full deflection of the rudder pedals doesn't require a large movement of the pilot's knee. It was therefore impossible to determine the amount of pressure on the pedals by use of the camera images.

Nose wheel steering examination

No anomaly was found in the directional control system. The test performed a few days after the accident, first with the aeroplane standing on the ground and later with the nose oleo-strut extended (aeroplane nose jacked up – as in flight position), showed the nose wheel steering system was working without anomalies.

This test involved specifically the verification that the compression of the nose oleo strut, as submitted to the aeroplane's own weight when resting on the ground, positively disengaged the nose wheel (steering) rod lock. In this position, the nose wheel steering system was available to control the aeroplane rolling on the ground.

In the same way, it was determined that the nose wheel steering rod positively locked the nose wheel, parallel to the fuselage centreline, when the nose oleo-strut was extended, as in flight position. Therefore a locked nose wheel rod can be excluded as the cause of the initial swerve to the right.

Brake controls and parking brake examination

Although no evidence of malfunction was found during the aeroplane's inspection, possible malfunction of the parking brake system was investigated by studying the operating principle and the construction of the brake system.

The troubleshooting chapter of the maintenance manual consultation did not reveal any new information susceptible to explain a possible unwanted right hand wheel braking. None of the following possible causes, as listed in the maintenance manual, could be detected.

FAULT	CAUSE	REMEDY
PARKING BRAKE REMAINS LOCKED ON ONE OR BOTH SIDES	Check valve seal out of order	Remove the valve and renew the check valve seal.
	Valve control cam shaft worn	Remove the valve and check. Replace if necessary.
	Control detached	Check.

Figure 22: extract of the troubleshooting chapter of the maintenance manual

After the aeroplane's repair, the maintenance organization stated that they didn't find any anomaly in the brake system. In the same way, the maintenance documents related to the repair and 6 years inspection don't record any brake system repair, except the replacement of worn pads.

Additionally, no brake problem was reported by the owner, neither before the accident nor after the return to service of the aeroplane.
The aeroplane manufacturer was contacted in order to help identify other possible problems that may have contributed to an unwanted asymmetrical braking. The manufacturer's representative stated that a parking brake control not fully positioned in 'off' position can, exceptionally and in conjunction with an inadvertent pushing on the brake pedals, cause an accidental setting of the parking brakes.

Not fully applying the parking brake's control can just sufficiently open the parking brake valves to release the hydraulic pressure, giving the impression that the brakes are safely released. Whenever this is the case, an undetected subsequent closing of one or both valves can occur as a result of a small backward movement of the control, under the effect of the control own elasticity or when the valve assembly and/or control is worn. However, examination of the valve assembly and its control did not show excessive wear. Several parking brake tests were performed after the aeroplane's repair, with the control placed just at the valve opening position. None of these tests brought to light the existence of such a phenomenon.

However it could not be completely excluded that an unwanted/undetected parking brake hydraulic pressure can be establish in the circuit(s) if the pilot pushes inadvertently on the brake pedal(s).

Applying pressure on one of the brake pedals during taxi will cause unwanted turning, easily noticeable by the pilot. By contrast, if this done during the flight, it cannot be detected prior to landing. If such a situation occurs, the aeroplane will have tendency to turn in the direction of the braking wheel at touchdown, creating an unexpected directional change.

Wind speed and wind direction

The aeroplane landed on runway 26 while the wind came from 360°, with a speed of 10 kt (see figure Figure **1**: rolling path reconstruction. Hence, there was a 100° offset with respect to the landing direction, resulting in a 9,8 kt right-hand crosswind component combined with a 1,7 kt tailwind component.

The crosswind value when the accident occurred was less than half the 22 kt demonstrated crosswind capability of the aeroplane. Therefore, an into-wind aileron combined with adequate left rudder pedal action would have been required to control the sideways drift and maintain the aeroplane's nose (or longitudinal axis) aligned with the centreline of the runway during flare and immediately after the touchdown, when rolling on the runway.

Speed

The pilot stated that the final approach was performed at an airspeed of 70 KIAS, which was confirmed to be a realistic value, by analysing the travelled distance and the rate of descent (400 ft /min) on the camera footage. However the approach airspeed in landing configuration (full flaps or 2nd notch) should be 62 KIAS according to the POH and the checklist. The approach speed of 70 KIAS as published in the POH and on the checklist is with only 1st notch of flaps (take-off configuration).

Approaching with a slight faster airspeed than the one published in the POH should not be a problem and is in case of gust even advisable (by adding maximum one half of the gust factor). But in that case, only the 1st notch of flaps is advisable. The drawback of this is that the touchdown will be made at higher airspeed and thus longer rolling distance to come to a full stop will be needed. But on the other hand fully deflected flaps can cause less directional stability on the ground because of the increased wing surface area the gust and/or crosswind can work on.

The published approach speeds are 1.3 times the stall speeds in that configuration. An approach at that speed will after the flare lead to a touchdown speed of slightly above the corresponding stall speed (less than 1.15 V_S), this to keep some safety margin and on the other hand ensure enough load on the main wheels to have good ground control.

However the approach speed of 70 KIAS resulted in a touchdown speed of 62 KIAS (observed on the camera footage), which is 1.3 times the stall speed in landing configuration (47 KIAS).

Excessive airspeed at touchdown means higher lift remaining. Moreover, with the flaps fully deflected, the lift vector shifts aft. This together with a greater value of lift results in a higher pitch-down moment around the centre of gravity and more load on the nose wheel if not counteracted by applying adequate back pressure on the stick.

Runway condition

The concrete runway has a landing distance available of 2785 m and has a width of 45 m. It was a dry day and there was no contamination. The runway edge lights and the direction sign panels are installed on distances in accordance with ICAO standards. The PAPI lights were fully functioning. The runway did not play any contributory role in the accident.

Possible reasons for the initial swerve

- Parking brake issue

As the pilot did not report any drift tendency during the last taxi and/or take-off at EHMZ, it can be concluded that there was no brake (or parking brake) problem at that moment.

As seen above, the possibility exists that the parking brake was not completely released. This, combined with an inadvertent push on the right brake pedal during the flight could have caused an hydraulic pressure build-up.

Should an unwanted right parking brake setting have occurred, then the pilot would have been surprised by the aeroplane tendency to turn right immediately after touchdown. However hazardous at higher speeds, the pilot should still had the possibility to counteract the unwanted right braking by applying a proportional left brake action.

As the parking brake system had been found in good condition and the investigation could not identify any factual information showing that this type of event occurred, an unwanted right parking brake setting is considered as unlikely. The lack of skid marks on the runway support this assumption.

- Drift due to the 'weathervaning'

Because the aeroplane has a greater profile or side area behind the main landing gear, the dynamic pressure of the crosswind can cause the aeroplane to turn or weathervane into the wind.
In the sideslip approach with sufficient aileron into the wind only a small deflection of opposite rudder may be needed to keep the aeroplane in the axis on the runway. However, after touchdown some 'negative factors' come into play;

- A decrease in adverse yaw
  Aileron deflection into the wind during approach has as secondary effect the so-called 'adverse yaw' that yaws the aeroplane into the opposite direction of the bank. In the sideslip approach this can be considered as an advantage that will help to keep the aeroplane on the right heading. But when the stick is not kept into the wind after touchdown, this adverse yaw effect will decrease
- Slower airspeed, decreasing the rudder effectiveness

Furthermore, when the weight of the aeroplane becomes concentrated on the nose wheel due to not applying adequate back pressure when landing with full flaps at excessive airspeed, the above phenomenon is aggravated. This condition is called 'wheelbarrowing'. The aeroplane will then tend to turn around the nose gear instead of the main gear. Because in that case the centre of gravity is lying behind the pivot point (like a taildragger), the aircraft will get directionally unstable, which will be hard to counteract without releasing the load on the nose gear.

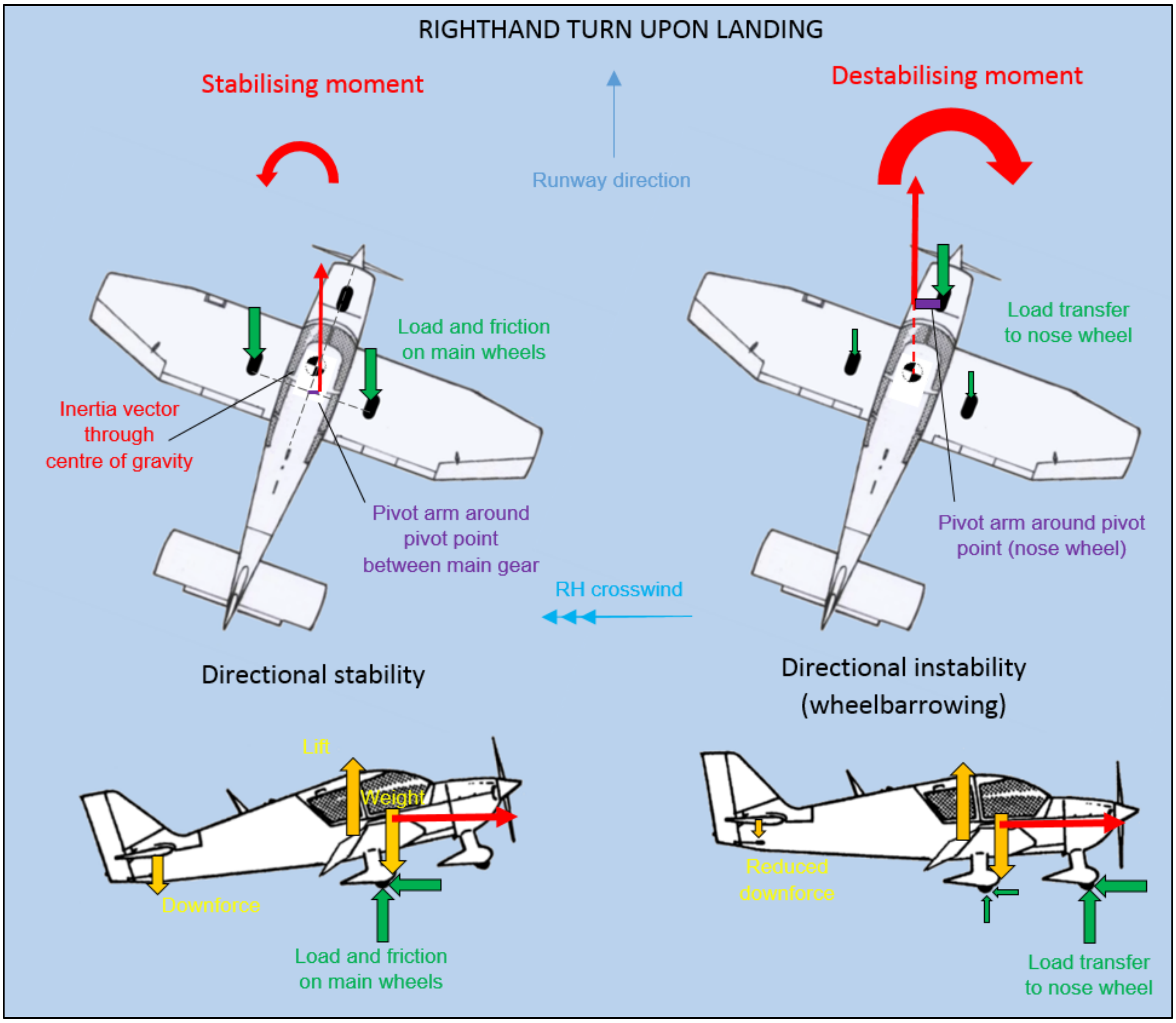


Figure 23: Wheelbarrowing effect with right hand crosswind

The wheelbarrowing is described in the *FAA Airplane Flying Handbook FAA-H-8083-3A chapter 8.* The following is stated about the recovery;

"*If the pilot decides to stay on the ground rather than attempt a go-around or if directional control is lost, the throttle should be closed and the* ***pitch attitude*** *smoothly but* ***firmly rotated to the proper landing attitude****.* ***Raise the flaps to reduce lift and to increase the load on the main wheels*** *for better braking action*".

CONCLUSIONS

Findings

- The pilot was holder of a valid Belgian PPL(A) licence but was somewhat low on experience
- The aeroplane held a valid Airworthiness Review Certificate.
- Investigation of the damaged aeroplane did not reveal any pre-existing mechanical anomaly susceptible to have led to a non-commanded drift at landing.
- The W&B evaluation performed by the pilot during the flight preparation shows that the centre of gravity was within the limits of the balance envelope.
- The parking brake control not fully applied in off position in conjunction with an inadvertent pushing on the brake pedals can cause an accidental setting of the parking brakes.
- The release of the parking brake was not an item on the 'engine checklist'.
- There was a right hand crosswind component of somewhat less than 10 kt.
- Investigation shows that the landing approach airspeed (70 KIAS) was 12% above the POH recommended airspeed (62 KIAS) with flaps in landing configuration.
- Flaps were and remained in landing configuration during the whole roll out.

Cause

As no pre-existing technical anomalies were found after the accident but the pilot declared that at the initial phase neither braking (on the main wheels) nor steering helped to counteract the deviation to the right, the hypothesis is that the nose gear was bearing a higher portion of the weight than the main wheels after touchdown ('wheelbarrowing phenomenon'). This wheelbarrowing would have been the consequence of not applying adequate back pressure on the stick during the touchdown with fully extended flaps (landing configuration) at excessive airspeed.

The initial turn to the right was probably due to the 'weathervane effect' of the crosswind pushing on the tail of the aeroplane and turning it into the wind.

Contributing factors:

- Low flying experience of the pilot.
- Phenomenon of wheelbarrowing (directional instability with tricycle gear aircraft) not well known within the pilot community.

SAFETY ACTIONS AND RECOMMENDATIONS

Safety action

It was noted that on the owner's checklist the parking brake must be set during the 'Before take-off' checks, but no subsequent release of the parking brake (push on the control) was mentioned as item on the checklist.

The 'Noordzee Vliegclub' was informed of this issue during the investigation and reacted positively by incorporating the parking brake release at the end of the 'engine check' chapter. The AAIU(Be) supports this action.

Safety message

It is advised that, using this report, instructors emphasize the need for proper attitude and airspeed control during approach and landing, particularly in crosswind conditions, and also instruct how to recover from the phenomenon 'wheelbarrowing' if it is ever experienced.

About this report

As per Annex 13 and EU regulation EU 996/2010, each safety investigation shall be concluded with a report in a form appropriate to the type and seriousness of the accident and serious incident. For this occurrence, a limited-scope, fact-gathering investigation and analysis was conducted in order to produce a short summary report.
It is not the purpose of the Air Accident Investigation Unit to apportion blame or liability. The sole objective of the investigation and the reports produced is the determination of the causes, and, where appropriate define recommendations in order to prevent future accidents and incidents.