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Schweizerische Unfalluntersuchungsstelle SUST  
Service d'enquête suisse sur les accidents SESA  
Servizio d'inchiesta svizzero sugli infortuni SISl  
Swiss Accident Investigation Board SAIB

Aviation Division

# **Final Report no. 2150 of the Swiss Accident Investigation Board, SAIB**

concerning the accident involving the  
Piper PA46-500TP Meridian aircraft,  
registration N747AW

on March 8, 2011

on the aerodrome of  
Lausanne-La Blécherette (LSGL) / VD

**Causes**

L'accident est dû à une perte de contrôle à l'atterrissage, probablement générée par une instabilité dynamique du train avant, ayant conduit à une sortie de piste.

Facteurs ayant contribué à l'accident:

- Cumul d'anomalies du train avant et du système de guidage
- Absence de prise en compte de la lettre d'information aux clients n°3/27/08 publiée par le constructeur

## General information on this report

This report contains the Swiss Accident Investigation Board's (SAIB) conclusions on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with Art 3.1 of the 10<sup>th</sup> edition, applicable from 18 November 2010, of Annex 13 to the Convention on International Civil Aviation of 7 December 1944 and Article 24 of the Federal Air Navigation Act, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the accident investigation. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, due consideration shall be given to this circumstance.

The definitive version of this report is the original in the French language.

All times in this report, unless otherwise indicated, follow the coordinated universal time (UTC) format. At the time of the accident, Central European Time (CET) applied as local time (LT) in Switzerland. The relation between LT or CET and UTC is:  
LT = CET = UTC + 1 hour.

## Final report

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<b>Aircraft type</b>	PA46-500TP	Registration N747AW
<b>Operator</b>	SARL PRIV'AIR, 2 rue Poterne, 21202 Beaune Cedex, France	
<b>Owner</b>	N747AW Corp Trustee, PO Box 1347, Wilmington DE 19899-1347, USA	

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<b>Pilot A</b>	Swiss citizen, born 1963		
<b>Licence</b>	Commercial pilot according to the Federal Aviation Administration - FAA, USA, issued on 7 August 2000		
	Airline transport pilot according to the FAA, issued on 27 February 2011, valid till 27 June 2011		
<b>Rating class/type</b>	Airplane multiengine land instrument airplane private privileges, Airplane single engine land / CE-525(S)		
<b>Medical certificates</b>	First class according to FAA issued on 2 March 2011		
	JAR-FCL3 Class 1 valid till 2 March 2012		
<b>Flying hours</b>	<b>Total</b>	3684 hours	<b>In the last 90 days</b> 106:30 hours
	<b>On the type involved</b>	18:12 hours	<b>In the last 90 days</b> 2:55 hours

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<b>Pilot B</b>	Swiss citizen, born 1986		
<b>Licence</b>	Commercial pilot CPL (A) according to JAR, first issued by the Federal Office of Civil Aviation (FOCA) on 12 November 2010		
	Commercial pilot according to the FAA, issued on 7 November 2009		
<b>Rating class/type</b>	According to JAR-FCL: Multi-engine piston aeroplane - MEP (land) with instrument rating – IR, valid till 2 November 2011		
	Single-engine piston - SEP (land) valid till 2 November 2012		
	According to FAA: Airplane single & multiengine land, instrument airplane. Date of issue 7 November 2009		
<b>Medical certificate</b>	JAR-FCL3 Class 1 valid till 11 October 2011		
<b>Flying hours</b>	<b>Total</b>	795 hours	<b>In the last 90 days</b> 3:42 hours
	<b>On the type involved</b>	3:42 hours	<b>In the last 90 days</b> 3:42 hours

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<b>Location</b>	Lausanne-La Blécherette (LSGL) aerodrome, Switzerland
<b>Date and time</b>	8 March 2011, 15:31

**Type of flight** VFR by day, private  
**Flight phase** Landing  
**Type of accident** Leaving the runway

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**Injuries to persons**

Injuries	Crew	Passengers	Total number of occupants	Others
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	2	1	3	Not applicable
Total	2	1	3	0

**Damage to aircraft** Badly damaged

**Other damage** Slight damage to the ground caused by the aircraft's wheels and propeller. Minor pollution due to oil leakage and the use of firefighting foam.

## 1 Factual information

### 1.1 Pre-flight history and history of the flight

#### 1.1.1 General

The description of the history of the flight involved in the accident and its pre-flight history is based on the statements of the pilots and witnesses, and on the images from the webcam installed on the aerodrome of Lausanne-La-Blécherette.

#### 1.1.2 Pre-flight history

On 7 February 2011, pilot B made a flight to Saanen (LSGK) in aircraft N747AW. The aerodrome manager described the approach as being too fast and too steep. He observed the aircraft flying over the first third of runway 26 with a pronounced "nose down" attitude and contacting the runway with the nose gear. He saw the aircraft rebound with lateral displacement to the left, touching down again heavily on the three wheels at a relatively high speed.

No notice of any defects was mentioned in the aircraft's logbook. The aircraft departed with the same pilot for Paris-Le Bourget (LFPB).

From 8 to 28 February 2011, six flights with different pilots were made with the aircraft. The last flight ended in Sion (LSGS). No notice of any defects was reported in the logbook. No more flights were made with the aircraft until the day of the accident.

On the evening of 7 March 2011, two VFR flight plans from Lausanne-La Blécherette to Dijon-Longvic (LFSD) and back were submitted.

On 8 March 2011, the day of the accident, pilots A and B got together to coordinate the four planned flights: a ferry flight (no passengers) from Sion to Lausanne-La Blécherette, followed by a round trip from Lausanne to Dijon-Longvic with one passenger and then a return ferry flight from Lausanne to Sion. They decided that pilot A would perform the function of commander for the first three flights and that he would occupy the left seat in the cockpit. They also decided that pilot B would be the commander for the return flight to Sion. At 07:59 the crew printed out a folder flight preparation dossier using the *Homebriefing* system.

Before starting the four planned flights, pilot A made a local flight in Sion. At approximately 08:40 aircraft N747AW, with pilots A and B on board, took off from Sion, destination Lausanne-Blécherette. Pilot A made the landing on runway 18 and described it as "very good". Then, as planned, the crew boarded the passenger to take her to Dijon-Longvic where landing took place at 12:30. In relation to the landing in Dijon, the pilot stated: "...*the aircraft deviates to the left and we bring it back to the centre of the runway. No visible problem after inspection.*" No defect entry was made in the aircraft's logbook.

The aircraft was refuelled with kerosene at Dijon-Longvic before departure to the destination of Lausanne-La Blécherette.

#### 1.1.3 History of the flight

On 8 March 2011, the Piper PA46-500TP aircraft, registration N747AW, took off from Dijon-Longvic at 15:00, destination Lausanne-La-Blécherette. On board were pilot, the commander in the left seat, pilot B and a passenger. The flight lasted approximately 28 minutes and proceeded without any problems until the landing.

According to his statement, the commander made a "normal" landing approximately 50 to 100 m after the threshold of runway 18. The main gear touched down first, then the nose wheel. Just after this, the aircraft deviated to the left and left the runway (see Fig.1a and 1b). The nose gear collapsed. The aircraft continued its course in the grassy strip between the runway and the taxiway and then came to a standstill in the grass 427 m from the start of the runway, some 8 m from the left edge. The nose of the aircraft was oriented slightly to the right in relation to the runway axis.

The commander made his way to the rear of the cabin to help the passenger to vacate the aircraft, while pilot B turned off the main cockpit switches. All three occupants left the aircraft by the main door, which opened normally. None of the occupants was injured.

The aerodrome manager observed the aircraft leaving the runway and immediately raised the alarm. Fire did not break out. The grassy ground was slightly damaged by wheel and propeller marks.

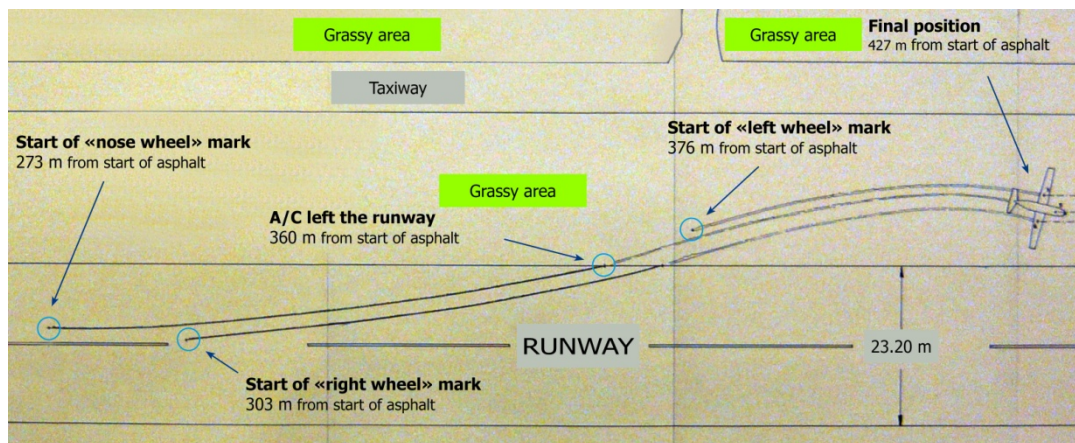


Fig. 1a: Wheel marks found on the runway and grass area

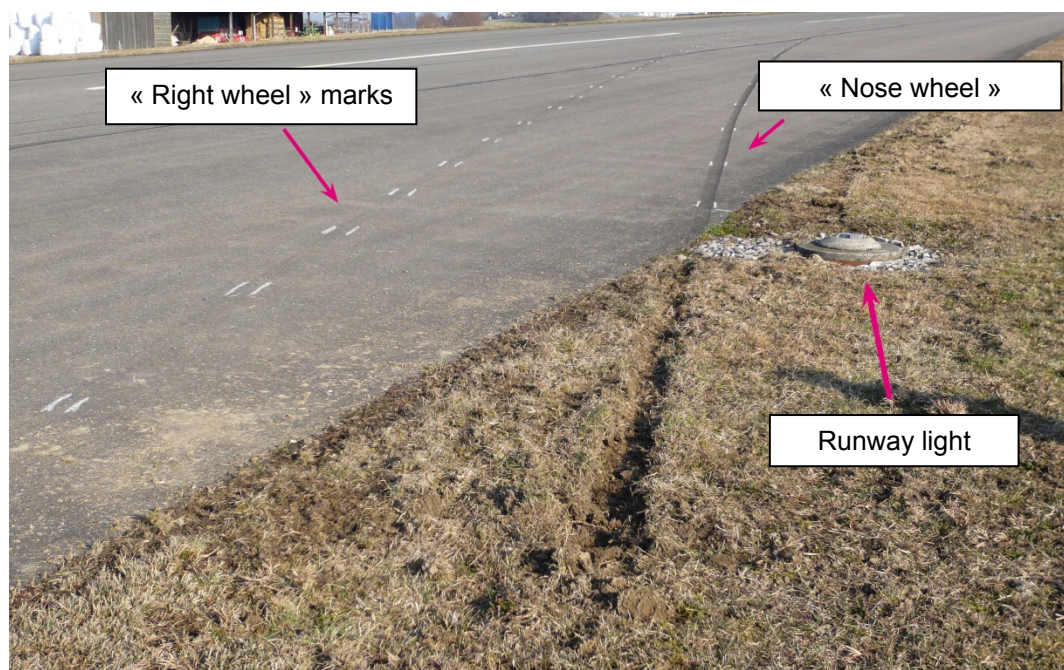


Fig. 1b: Details of the wheel marks

#### 1.1.4 Description of the landing according to the pilots and the passenger

Pilot A: *"During the landing, my heels were placed on the floor and I maintained lateral control by applying rudder with the tip of my feet." Before I had time to lift my feet to operate the brakes and before I used the reverse, the aircraft veered sharply to the left and left the runway. I tried to apply "full right", but without success. At that moment, I thought that my left wheel was jammed. I did not hear any particular noise or feel any particular vibration..."*

Pilot B: *"The speed on final was 83 kt...the landing was perfectly normal on the main gear (not hard). The centerline was maintained and then suddenly the aircraft deviated sharply to the left and left the runway. Thrust reverse was not used. I did not hear any particular noise or felt any particular vibration. After leaving the runway, the aircraft settled on its nose without any major impact just before stopping..."*

According to the passenger, the aircraft touched down without any problems, smoothly and without any particular impact.



## 1.2 Meteorological information

### 1.2.1 General

The information contained in sections 1.2.2 and 1.2.3 was provided by MeteoSwiss.

### 1.2.2 General situation

*An anticyclone centred over Eastern Europe kept the weather stable over the region of Switzerland.*

### 1.2.3 Meteorological conditions at the time and place of the accident.

The aerodrome of Lausanne-La Blécherette did not publish an aviation routine weather report (METAR). The information below is the result of a spatial and temporal interpolation of the values measured in the surrounding stations.

*Cloud: 1/8, base around 6000 ft AMSL*

*Weather: hazy*

*Visibility: Approximately 10 km*

*Wind: South-south-west 4-6 kt*

*Temperature/dewpoint: 10°C / 00°C*

*Pressure: QNH LSGG 1025 hPa, QNH LSZH 1025 hPa, QNH LSZA 1030 hPa*

*Position of the sun: Azimuth 228 °, Elevation 27 °*

*Hazards: None*

### 1.2.4 Meteorological conditions and runway condition according to the pilots

Pilot A: “ ... the runway was perfect, dry, with roughly 3 KTS of headwind .. “.

Pilot B: “ ... the runway was dray with a wind from 170° at 4 KTS... “

## 1.3 Aircraft information

### 1.3.1 General information

Registration N747AW

Aircraft type PA46-500TP Meridian

Characteristics Mono-turbine aircraft, six-seater, pressurised, metal monoplane, cantilever low wing with retractable landing gear with nose wheel. Onboard access via a single door located on the rear left of the fuselage.

Manufacturer Piper Aircraft Inc., Vero Beach, USA

Year of manufacture 2000

Serial no. 4697017

Owner N747AW Corp Trustee, PO Box 1347, Wilmington DE 19899-1347, USA

Operator SARL PRIV’AIR, 2 rue Poterne, 21202 Beaune Cedex, France

Engine	Pratt and Whitney Canada PT6A-42A Serial no. PCE-RM0148 Maximum power 373 kW (500 shp)
Propeller	Hartzell HC-E4N-3Q, metal, 4 blades Serial no. HH1027
Equipment	IFR equipment Garmin GTX 330D Mode S Transponder Emergency Locator Transmitter, ARTEX ELT ME406
Braking system	Hydraulic, non-powered with disc brakes and without antiskid system
Operating hours	Airframe: 1938:12 hours time since new – TSN Turbine: 1508:12 hours TSN Propeller: 1938:12 hours TSN 560:12 hours time since overhaul –TSO
Max. allowed mass	Ramp: 4892 lb (2219.2 kg) Take-off: 4850 lb (2199.9 kg) Landing: 4850 lb (2199.9 kg)
Mass and centre of gravity	Mass at take-off: 5100 lb Mass at landing: 4940 lb  At the moment of the accident, the mass and centre of gravity were outside the limits specified by the aircraft flight manual Pilot's Operating Handbook – POH
Fuel	Kerosene Jet A1 Total tanks capacity: 173 US gal, corresponding to 1160 lb Fuel remaining on landing (LSGL): 950 lb
Maintenance	The last annual inspection (Annual Inspection Event 1 & 2) was carried out on 10 May 2010 at 1844:24 hours TSN
Airworthiness certificate	Category Standard Normal issued by the FAA on 15 December 2005
Registration certificate	Issued by the FAA on 27 August 2007

### 1.3.2 Maintenance work

The regular maintenance work on aircraft N747AW was carried out according to a progressive maintenance programme.

The manufacturer's maintenance manual specifies in section 5-20-00 Scheduled Maintenance, paragraph 4, Progressive Inspection Procedure:

*“The progressive inspection program cycle consists of two (2) 100 Hour Events, which provides for a complete aircraft inspection in 200 aircraft flying hours. The complete inspection cycle, Event (1) and (2), must be completed within twelve (12) calendar months”.*

The last periodic inspection, Annual Inspection Event 1 & 2, was carried out on 10 May 2010 at 1844:24 hours TSN, i.e. 94 hours before the accident.

Extract from the Aircraft Log:

- *1 April 2009, 1712:36 hours TSN, Performed Event 2 I.A.W Piper PA46-500TP Meridian per Section 5-20-00 of the M.M 767-005, Rev. Apr. 15/07. (...) Inspected brake and hydraulic pump fluid level. Replaced LH and RH MLG trailing link bolt and bushing. Servicing MLG and nose oleo strut. (...)*
- *2 February 2010, 1817:30 hours TSN Jacked aircraft, performed retraction LDG and found time to retract out of specification. Checked hydraulic powerpack fluid level and found level too low. Checked LDG hydraulic system for leak and no leak found. Adjusted hydraulic powerpack fluid level, bled LDG hydraulic system and performed several LDG retraction/extension and emergency extension, all systems work fine. Checked and adjusted tyre pressures. Fixed LH and RH main LDG torque knee bolt play. (...)*
- *10 May 2010, 1844:24 hours TSN Performed Annual Inspection Event 1 & 2 (...) Resealed RH brake cylinder and bled LH and RH brake system. Replaced LH and RH brake lining. Replaced LH and RH tires (...) Replaced bolt and bushing in LH and RH Main LDG link assy. Replaced Nose LDG emergency down spring p/n 687-931. Servicing Nose oleo strut. (...)*
- *22 November 2010, 1901:42 hours TSN Jacked aircraft, checked LDG hydraulic system for leak, no defect found, serviced hydraulic powerpack and performed several retract LDG. All system work good.(...)*

N747AW had several maintenance actions on its landing gear. The last one with jacking the aircraft was done on 22 November 2010, i.e. 36:30 hours prior to the accident. No anomalies were found.

### 1.3.3 Damage to the aircraft and findings

The nose gear leg collapsed and folded under the fuselage. Damage was found on the front of the fuselage and on the nose gear doors.

The four propeller blades were damaged on their leading edges and were bent backwards, indicating that reverse mode had not been activated when the aircraft left the runway. The turbine was badly damaged by the impact. An oil leak caused minor pollution of the ground.

Positions of the various levers and switches noted after the accident:

- Landing gear lever: down
- Flaps lever: 10°
- All electrical switches: OFF
- Rudder trim: Neutral
- Elevator trim: Takeoff range
- Power control: IDLE-BETA
- Propeller control: OFF / FEATHER
- Manual control OVRD: OFF

The Emergency Location Beacon Aircraft (ELBA) did not trigger.



Fig. 2: Final position of aircraft N747AW

## 1.4 Tests and research

### 1.4.1 Nose gear steering system

The braking, steering and linkage mechanisms were checked from the pedals to the nose gear. Examination of the hydraulic system revealed no defects. The tension of the steering control cables, ailerons and the travel of the control surfaces were in line with the prescribed values.

Because of the fractures on the upper right front gear trunnion assembly and the rod end bearing of the hydraulic actuator, it was not possible to verify if the clearances in the steering mechanisms were within the prescribed tolerances.

### 1.4.2 Nose gear

The upper part of the right trunnion assembly on the turbine-mounting frame was fractured (Fig. 3). The actuator rod end bearing fractured on the gear leg side (Fig. 4). These fractures were inspected and analysed using macroscopy. As a result of a shock, the rod end of the hydraulic actuator fractured on its attachment to the trunnion. The expert analysis revealed no evidence of material fatigue.

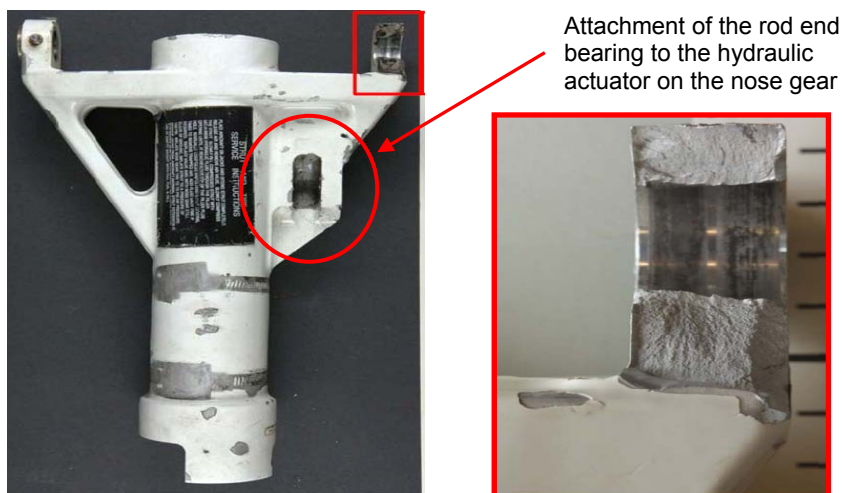
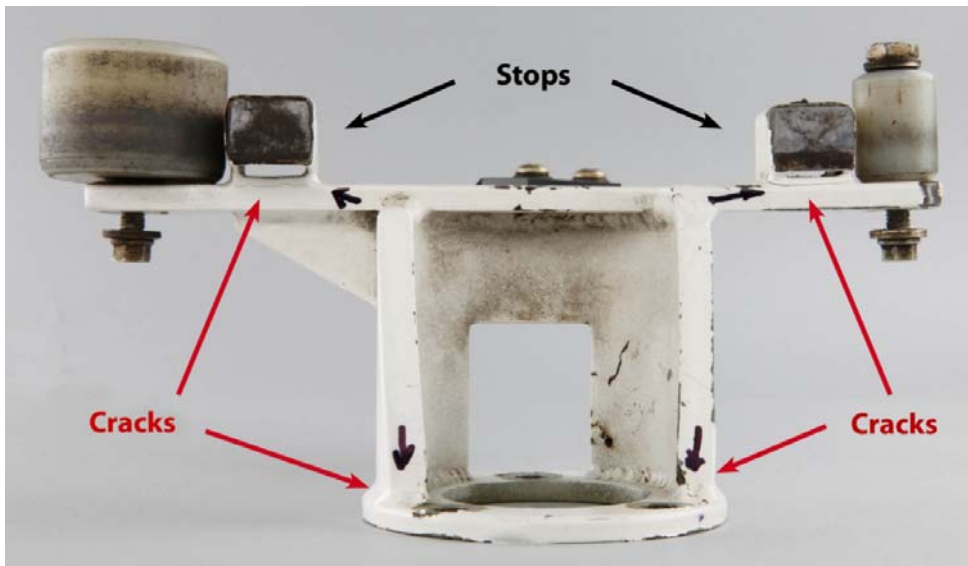


Fig. 3: Attachment of the actuator and fracture of the right attachment of the trunnion assembly with its detail

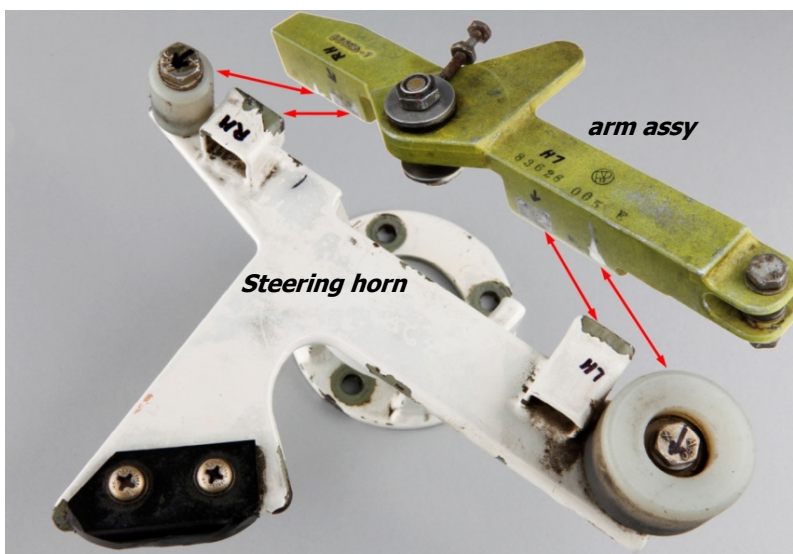


**Fig. 4:** Rod end bearing of the nose gear actuator

Several defects were found. The steering horn, mounted on the upper part of the gear, exhibited multiple cracks on the two stops and on the mounting plate. The fixing screws of the nylon guide rollers were slightly bent. The counterpart of the steering horn, the arm assy shows marks caused by the stops and the nylon guide rollers (Fig. 6). Some bushes of the torque link mounting shafts (Fig. 7) were cracked.



**Fig. 5:** Steering horn with the nylon guide rollers



**Fig. 6:** Steering horn with nylon guide rollers and his counterpart arm assy

Note: The steering horn and the arm assy are shown to different scales.

#### 1.4.3 Examination of the front wheel

The front tyre treads exhibited asymmetric wear and one of the ridges of the profile was missing. The tyre exhibited very pronounced wear on the right outer edge. This friction wear shows that the wheel in its maximum left position while still turning skidded on the runway. This matches the marks found on the runway.

The tyre also exhibited several marks which could not be attributed to this accident. Some of them form an angle of approximately 60° with the tread pattern, indicating a skid to the left but without the wheel being locked.

A trace of adhesive was found on the left side of the wheel flange indicating the recent existence of a balancing weight. A test indicated an imbalance of 60 grams on the opposite side of this mark. It has not been possible to balance the wheel using the position where the trace of glue was found.

The tyre pressure measured after the accident was 65.6 psi. The manufacturer recommends a pressure of 70 psi. The bearings and the rolling bearing cages on the wheel flange had marks caused by an impact.

#### 1.4.4 Examination of the main landing gear

The main gear was subjected to a visual inspection. The security paste on several screws and gear mounting bolts on the airframe had partially disappeared. The wheels and the braking system were checked. No anomalies relating to the accident were found.

The inner side of the left tyre exhibited a large groove. This was caused by the back support plate assembly of the lower brake pad plate following major deformation of the tyre during lateral stress.

#### 1.4.5 Manufacturer's tolerances

The geometry of the nose gear is conventional, with zero rake and zero trail. Aware of the complexity and the technical sensitivity of the nose gear, the manufacturer has issued very specific instructions concerning adjustments and admissible clearances. In the event of a taxiing problem and/or "*shimmy*" during take-off or landing manoeuvres, the troubleshooting list (troubleshooting nose gear) in the maintenance manual draws particular attention to the front tyre pressure, the balancing of the nosewheel and the adjustments to the nose gear steering system.

Two nylon rollers (Figs. 5 and 6) are mounted on the upper part of the nose gear, on the steering horn. They are used to transmit the movement of the rudder pedals to the front wheel. When the nose gear is extended and locked, these two rollers press against the arm assy. Excessive play between the rollers and the arm assy allows the front wheel to oscillate which may lead to steering difficulties.

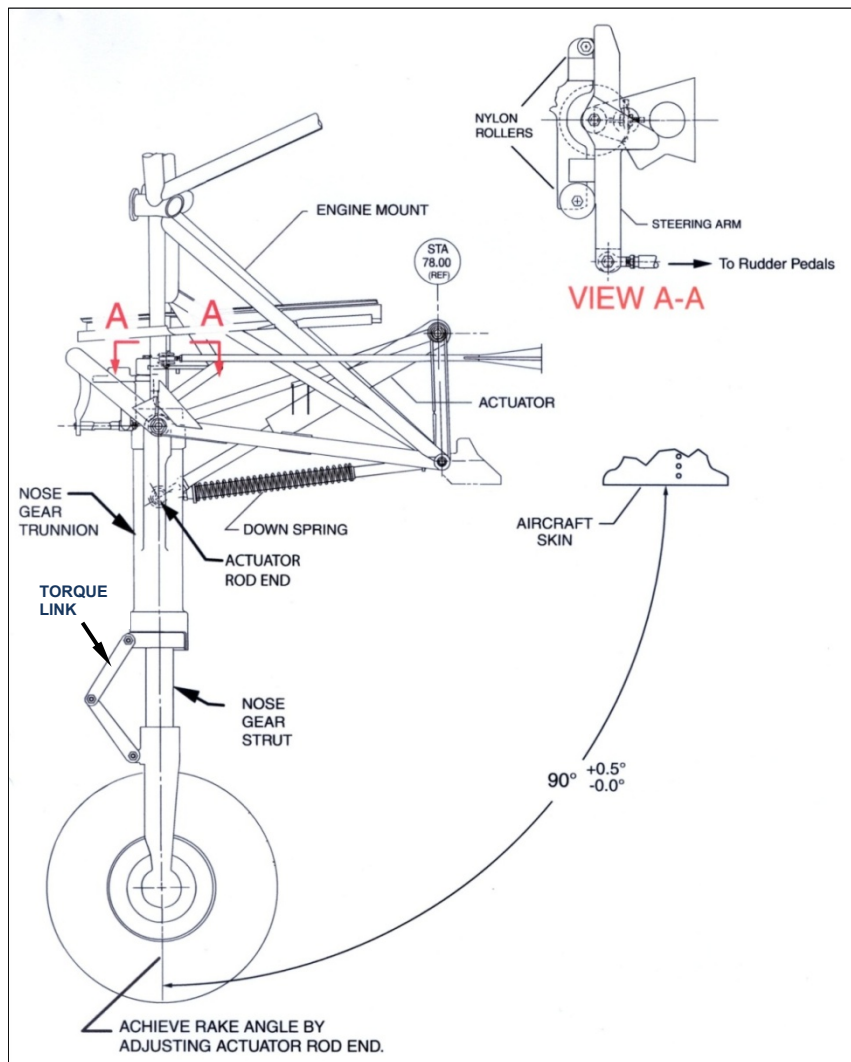


Fig. 7: Nose gear of the Piper PA46-500TP, view from the left

Section 32-20-00 of the maintenance manual specifies a rake angle of  $90^\circ$  with a tolerance of  $+0.5^\circ / -0.0^\circ$  for the adjustment of the angle between the extended nose gear and the underside of the fuselage (Fig. 7).

Because of the damage sustained during the accident, the angle of  $90^\circ$  could not be verified.

#### 1.4.6 Modification of the front gear steering system

Several runway excursions with the PA46 aircraft type have been reported. The manufacturer has identified certain problems and put in place a technical modification in the form of a service bulletin (SB) published on 28 January 2002, Piper Service Bulletin no. 1106. Piper considers its compliance mandatory. Its application requires the installation of the kit 767-336 relating to replacement of various parts of the nose gear and its steering system. It also recommended a reinforced tyre with a pressure of 70 psi instead of 50 psi.

Extract from SB no. 1106:

Purpose:

*There have been field reports of turning tendency immediately following nose wheel touch down during landings primarily, when cross wind conditions are present and/or when applying full propeller reverse. A contributing cause of the*

*turning tendency has been identified as reduced nose gear steering authority which, under certain conditions, can allow the nose gear steering rotation to momentarily exceed the pilot's input.*

*This Service Bulletin recommends mandatory incorporation of the following nose gear installation modifications that increase the pilot's steering authority. Failure to incorporate these modifications may increase the possibility of a turning tendency during landing.*

The application of SB no. 1106 was attested in the technical documents of N747AW dated 3 May 2002 at 345:30 airframe hours.

#### 1.4.7 Nose gear actuator

The nose gear actuator was tested and inspected. It was locked normally after the accident. No anomalies were found.

### 1.5 Operational information

#### 1.5.1 Customer Information Letter

On 27 March 2008, the manufacturer published a customer information letter no. 3/27/08, entitled PA46 Operational & Maintenance Information, Nose Gear Steering.

In addition to the application of SB no. 1106, the manufacturer draws particular attention to the fact that all the adjustment tolerances of the nose gear assembly and its steering system including the pressure and the type of the front tyre are of paramount importance to the dynamic stability and control of the aircraft during taxiing. It also mentions the recommendations made by the manufacturers of tyres approved to be used on the PA46 models, that it advocates a daily cold front tyre pressure check, or at least before each flight when the aircraft is not used daily.

It also specifies that failure to comply with the tolerance of the rake angle of the nose gear may cause a dynamic instability, generating forces exceeding the physical capabilities of the pilot. It also specifies that the rake angle must be checked whenever the pilot experiences steering difficulties.

Pilot A stated that he had knowledge of this information letter.

Pilot B stated that he had no knowledge of this information letter.

#### 1.5.2 N747AW Pilot's Operating Handbook - POH

Section 4 of the flight manual § 4.5a, Pre-flight Checklist - Nose Section, under Nose Tyre, does not mention a tyre pressure value or an interval for checks.

Section 3, Emergency Procedures, makes no reference to possible dynamic instability of the nose wheel and possible steering difficulties.

#### 1.5.3 Flying experience of the pilots on the type involved

The commander estimated his total experience on the PA46 and similar aircrafts at approximately 100 flying hours. He said he had not noted all the flights he had made. He also stated: "... *I don't have an extensive experience on this type of aircraft...*". According to his logbook, he had 18:12 hours experience on the PA46.

Pilot B estimated his total experience on the PA46 at approximately 15 flight hours. According to his logbook, he had 3:42 hours experience on the PA46.



## **2 Analysis**

### **2.1 Technical aspects**

#### **2.1.1 Technical aspects of the main landing gear**

According to the statements of the three occupants, the landing of the flight involved in the accident was not hard. The partial missing of the security paste on the gear mountings indicates that the aircraft was subjected to major stresses during previous landings. Based on the technical inspections and the analysis of the tyre traces, it can be deduced that the brakes worked properly.

#### **2.1.2 Technical aspects of the nose gear**

The macroscopic examinations of the fractures to the rod end bearing of the hydraulic actuator and the right mounting of the trunnion assembly indicated that these fractures occurred when the aircraft left the runway at Lausanne-La Blécherette. Expert analysis revealed no evidence of metal fatigue.

The cracks on the stops of the steering horn, the deformations of the fixing screws of the nylon rollers transmitting the movements of the steering pedals and the marks on the arm assy, attest to the stresses to which the entire steering system had been subjected. The collapse of the gear towards the rear increased the distance of the steering horn from the arm assy (see Figs. 6 and 7). The anomalies are therefore not attributable to the aircraft leaving the runway and consequently predate it. The last technical intervention on 22 November 2010 did not reveal any defects. The latter therefore probably occurred between 22 November 2010 and the day of the accident. They may have produced excessive play in the nose gear steering system.

The observed anomalies were probably caused during hard landings on the nose wheel. On 7 February 2011 such a landing occurred with aircraft N747AW on Saanen aerodrome.

The accumulation of excessive play, insufficient inflation and wear on the front tyre and the poor wheel balancing probably led to dynamic instability as described by the manufacturer in its customer information letter.

### **2.2 Operational and human aspects**

During the landing in Dijon-Longvic, the last landing before the accident, pilot A mentioned an unexplained deviation to the left and carried out a visual inspection without identifying any defects. The manufacturer, in its Customer Information letter no. 3/27/08 specifies that the rake angle must be checked whenever the pilot experiences steering difficulties. This check was not carried out.

Apart from the visual check of the shock absorber, the flight manual contained no specific information on the nose gear.

On the accident flight, the approach and initial contact with the runway were normal. The pilot stated that during the landing his heels were on the floor and that he was steering the aircraft with the tips of his feet. This may have limited his force on the right rudder. It is likely that the nose wheel was subjected to dynamic instability. According to the manufacturer's information letter, this phenomenon may generate forces beyond the physical capabilities of the pilot and may cause loss of lateral control of the aircraft.

Braking increased the pressure on the nose wheel and kept it against the stops.

The meteorological conditions and the state of the runway had no effect on the history of the accident.

### 3 Conclusions

#### 3.1 Findings

##### 3.1.1 Technical aspects

- The aircraft was approved for VFR/IFR flights.
- The Piper Service Bulletin no. 1106 and the installation of the 767-336 kit relating to the replacement of various parts of the nose gear and of its steering system were certificated.
- The last Annual Inspection Event 1 & 2 was carried out on 10 May 2010 at 1844:24 hours TSN.
- The actuator rod end bearing and the right trunnion fixing fractured on impact.
- Cracks were found on the stops of the steering horn.
- Deformation of the mounting screw of the nylon rollers which transmitted movements of the rudder pedals to the arm assy were found.
- Marks on the arm assy, caused by the stops and the nylon guide rollers were found.
- The front wheel was unbalanced, the tyre exhibited asymmetric wear and its pressure was 65.6 psi after the accident.
- The Emergency Location Beacon Aircraft, ELBA, was working correctly and did not activate during the accident.

##### 3.1.2 Human and operational aspects

- The pilots were in possession of the appropriate licenses.
- The mass and centre of gravity were outside the limits specified by the aircraft manufacturer.
- The N747AW flight manual made no reference to possible dynamic instability of the nose wheel and to steering difficulties.
- Apart from the visual check of the shock absorber, the flight manual contained no specific operational information on the nose gear.
- On 27 March 2008, the manufacturer issued a letter of information to customers (Customer Information Letter) no. 3/27/08, entitled PA46 Operational & Maintenance Information, Nose Gear Steering.
- Pilot A stated that he had knowledge of the customer information letter published by the manufacturer.
- Pilot B stated that he had no knowledge of the customer information letter published by the manufacturer.
- A month before the accident the aircraft made a hard landing.
- During the landing immediately prior to the accident, the aircraft drifted to the left for no apparent reason.

- The check recommended by the manufacturer in case of steering difficulties was not carried out.
- The nose wheel and the right main wheel left marks on the runway.
- The meteorological conditions played no part in the history of the accident.

### 3.2 Causes

The accident is attributable to a loss of control on landing, probably due to dynamic instability of the nose landing gear, causing the aircraft to leave the runway.

Factors that contributed to the accident:

- Accumulation of nose gear and steering system defects.
- Lack of consideration of customer information letter no. 3/27/08 published by the manufacturer.

Payerne, 4 October 2012

Swiss Accident Investigation Board

*This final report was approved by the management of the Swiss Accident Investigation Board SAIB (Art. 3 para. 4g of the Ordinance on the Organisation of the Swiss Accident Investigation Board of 23 March 2011).*

*Berne, 13 November 2012*