



**Federal Public Service  
Mobility and Transport**  
*Belgian Civil Aviation Authority*

***Air Accident Investigation Unit***

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**FINAL REPORT ON THE ACCIDENT OCCURRED  
ON 21/7/2007  
AT CHARLEROI ON A PIPER SENECA II  
REGISTERED OO-MLF**

**Ref. AAIU-2007-13**  
**Issue date: 25 March 2008**  
Status: Final

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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.

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 is led by L. Blendeman, designated investigator. The Members of the team are Mr M. Bourguignon, technical expert of BCAA.

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

## **Synopsis**

### **Date and hour of the accident**

Thursday, 21 July 2007, around 13.45 UTC.

### **Helicopter**

Type: Piper PA 34-200T Seneca II  
Registration: OO-MLF

### **Accident Location:**

Charleroi Airport - EBCI

### **Aircraft Owner**

Belgian Flight School SA

### **Type of flight**

Training flight

### **Persons on board**

2 Pilots (1 student pilot, 1 instructor)

### **Abstract.**

The aircraft registered OO-MLF took off from EBCI, Charleroi Airport, for the proficiency check of a student pilot by an instructor.

After 1 hour flight, around 13.45, the aircraft landed back in EBCI.

The landing was reported as normal, at first. Then, after a few seconds, the aircraft banked slightly to the right. The pilot reacted in switching off both engines.

The aircraft came to a stop at 795m from the runway 25 end, and 5m from the lateral side.

The RH tyre left a trace on the runway, starting 204m from the end position of the aircraft, while the LH tyre left a trace, starting 94m from the end position of the aircraft.

The touch down itself was reported normal.

Inspection of the aircraft showed the RH Landing gear was separated from the forward and aft support fittings. The fittings themselves were sheared.

## 1. Factual Information

### 1.1. Chronology of the events.

The aircraft registered OO-MLF took off from EBCI, Charleroi Airport, for the proficiency check of a student pilot by an instructor.

After 1 hour flight, around 13.45, the aircraft landed back in EBCI.

The landing was reported as normal, at first.

The aircraft was in final, for the landing on Runway 25, in landing configuration (flaps 10 degrees, 3 green lights). The student pilot was pilot-in-command.

The touch down was normal, not excessively hard, and after two seconds, the Master Warning "Gear Unsafe" went on, and immediately after that, the RH Landing Gear light went out.

The aircraft banked slightly to the right. The instructor reacted by switching off both engines.

The aircraft remained on the runway. The aircraft came to a stop at 795m from the runway 25 end, and 5m from the lateral side.

The RH tyre left a trace on the runway, starting 204m from the end position of the aircraft, while the LH tyre left a trace, starting 94m from the end position of the aircraft.

Inspection of the aircraft showed the RH Landing gear was separated from the forward and aft support fittings. The fittings themselves were sheared.

### 1.2. Injuries to persons

Injuries	Pilot	Passenger	Others	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	2	0	0	2
Total	2	0	0	2

### 1.3. Damage to aircraft

The aircraft shows substantial damages on the Main Landing gear system, and structural damage on the Right wing spar, landing gear compartment and both upper and lower side of the wing. The flap is also damaged.

The RH propeller has contacted the ground and the tip is damaged.

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The aircraft was inspected by the experts of BCAA - Section General Aviation. (ref. Inspection report LA/C-GEN/M.B./2007).

Right Landing gear.

The RH Landing Gear is broken. The forward and aft Support Fitting are sheared.

Right Wing.

The lower side of the wing is damaged, including the flap.



The lower side of the main spar shows several serious dents.



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There is a hole in the RH Wing upper surface.



There are also internal damage on the lower side of the secondary wing spar:



and on the MLG door hinge support web:



#### 1.4. Other damage

The propeller has caused minor damages to the runway; 6 impacts were found.

#### 1.5. Personnel information

##### **Student Pilot.**

Sex: Female

Age: 30 years-old

Nationality: Luxemburg national

Licence: First issue 2 March 2007, expiring 2 March 2017.

Class Rating: CPL (A).

Ratings: IR (A), SE piston (Land);

Limitations: none.

Medical: Last 8/1/2007, expiring 19/1/2008.

The pilot accumulated a total of 230 Flight Hours.



**Instructor.**

Sex: Male

Age: 51 years-old

Nationality: Belgian

Licence: First issue 23 December 1985, expiring 5 September 2008;

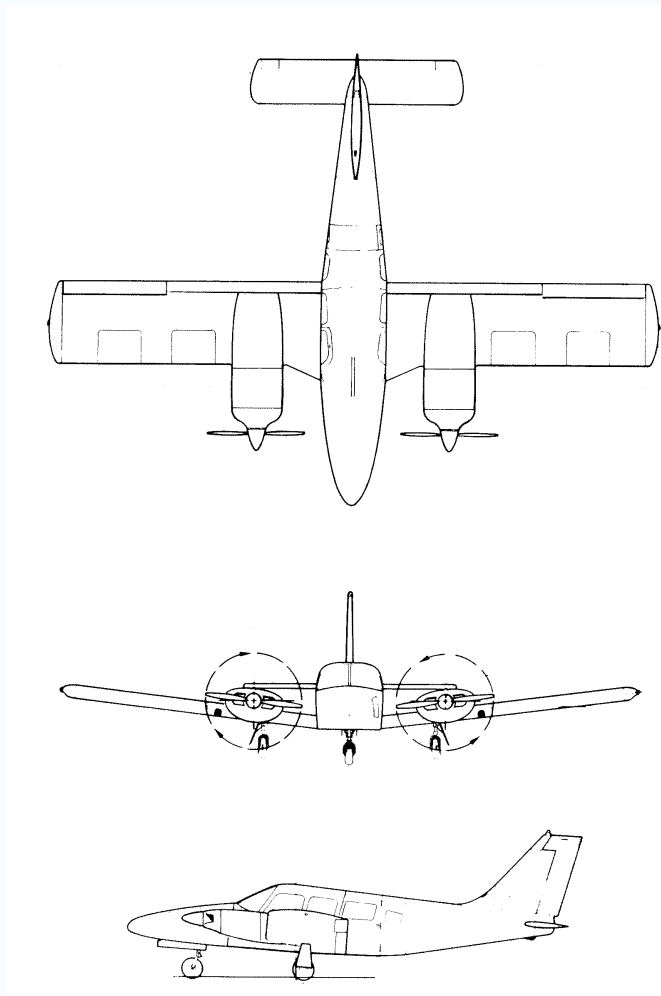
Class Rating: CPL(A)

Ratings: ME piston (Land), SE piston (Land), FI (A), IRI (A), IR(A).

**1.6. Aircraft information**

The Piper PA-34-200T Seneca II is a low-wing twin engine light metallic aircraft. It can accommodate one pilot and up to 5 passengers; it is mainly use for transport. The Type Certificate Data Sheet bears the reference A7SO; revision 17 dates August 7, 2006. The Model PA-34-200T was approved on July 18, 1974.

The aircraft features a retractable tricycle landing gear.



Piper Seneca II drawing.

### **Airframe**

Manufacturer: Piper  
Type: PA-34-200T  
Serial Number: 34-7970216  
Built year: 1979  
Registration: OO-MLF  
Certificate of Registration: N° 4286, issued 10 May 2006.  
Certificate of Airworthiness: issued 16 November 1992.  
Airworthiness Review Certificate: issued 20 March 2007, expires 12 March 2008  
Total Flight Hours: 6484,5 FH  
Time Since Overhaul: 2905,75 FH

### **Engines**

Manufacturer: Continental  
Type: LH: TSIO-360-EB (2)  
RH: LTSIO-360-EB (2)  
Serial Number: LH: 826792-R  
RH: 807805-R  
Total Flight Hours (both): 1548 FH

### **Propellers**

Manufacturer: Hartzell  
Type: LH: PHC-C3YF-2KUF  
RH: PHC-C3YF-2LKUF  
Serial Number: LH: EB5496B  
RH: EB5503B  
Total Flight Hours (both): 1548 FH

### **Owner**

Belgian Flight School SA  
Rue des Tayettes,5  
B-6280 Gerpinnes

## **1.7. Meteorological information**

Visibility: +10km

Wind Direction : 220°  
Wind speed : 10 kts

Temperature : 21°C

Atmospheric pressure : 1015 mb

Clouds: Scattered, at 4200 ft  
The meteorological conditions do not have influenced the event.

**1.8. Aids to Navigation**

Not applicable.

**1.9. Communication**

Not applicable.

**1.10. Airfield information**

The aircraft had taken off and landed on Charleroi airport.

Geographical and administrative data

<i>ARP COORD and site:</i>	502736N - 0042710E 337° MAG / 205 m from the TWR
<i>Direction and distance from (city)</i>	4 NM N from Charleroi
<i>ELEV / Reference temperature</i>	614 ft / 22°C
<i>Types of TFC permitted (IFR / VFR)</i>	IFR / VFR

<b>RWY designator</b>	<b>TRUE BRG</b>	<b>Dimensions of RWY (m)</b>	<b>THR COORD</b>	<b>THR ELEV and highest ELEV of TDZ of precision APCH RWY</b>
07	065.47°	2550 x 45	502724.68N 0042633.01E	THR 611 ft TDZ 612 ft
25	245.47°	2 405 x 45	502752.82N 0042809.85E	THR 583 ft TDZ 589 ft

**1.11. Flight Recorders**

Not applicable

### 1.12. Wreckage and Impact information



The aircraft landed safely on the runway.

The aircraft came to a stop at 795m from the runway 25 end, and 5m from the lateral side.

The RH tyre left a trace on the runway, starting 204m from the end position of the aircraft, while the LH tyre left a trace, starting 94m from the end position of the aircraft.

The touch down itself was reported normal.

### 1.13. Medical and pathological information.

Not applicable.

### 1.14. Fire.

There was no fire.

### 1.15. Survival aspects

Both pilots wore the safety belts, and were adequately protected.

### 1.16. Test and research.

Support was received from the aircraft manufacturer – Piper, that delivered the technical specifications of the landing gear parts.

Support was also requested to a metallurgical laboratory to determine the fracture mode of the landing gear components.

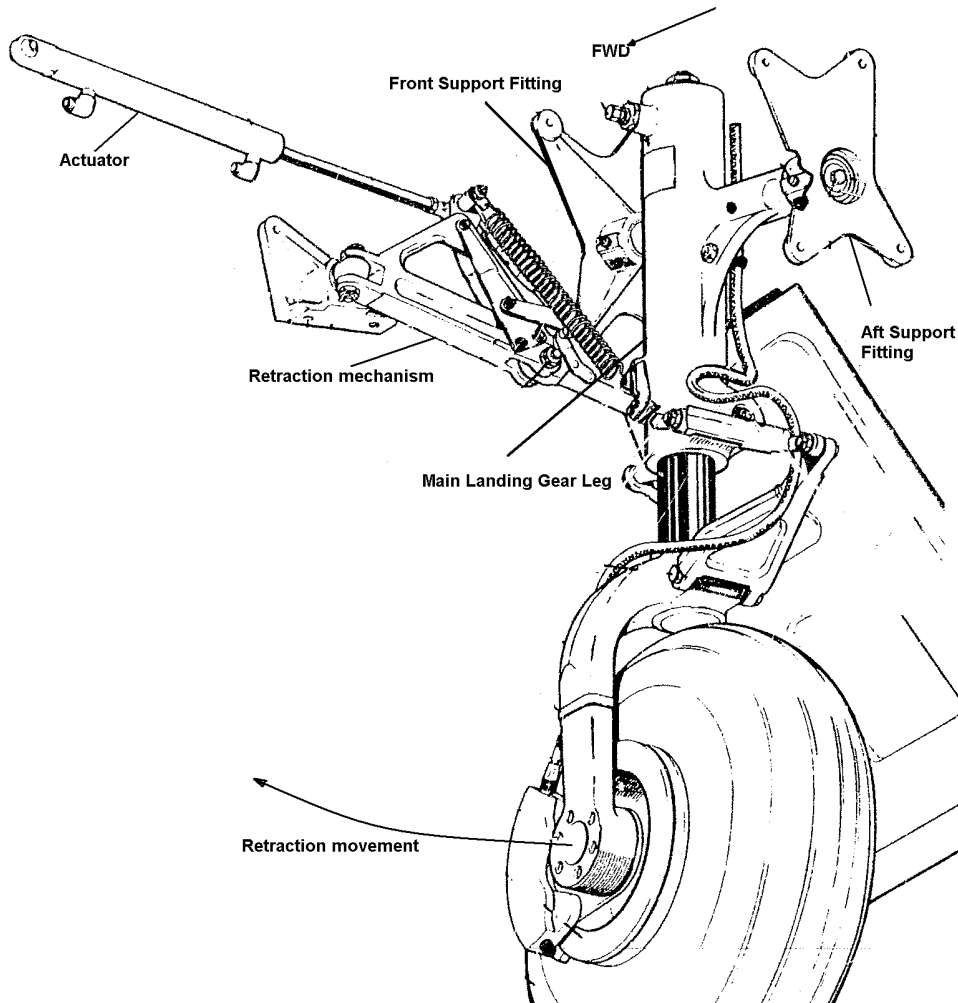
## 2. Analysis

### 2.1. Main Landing Gear system.

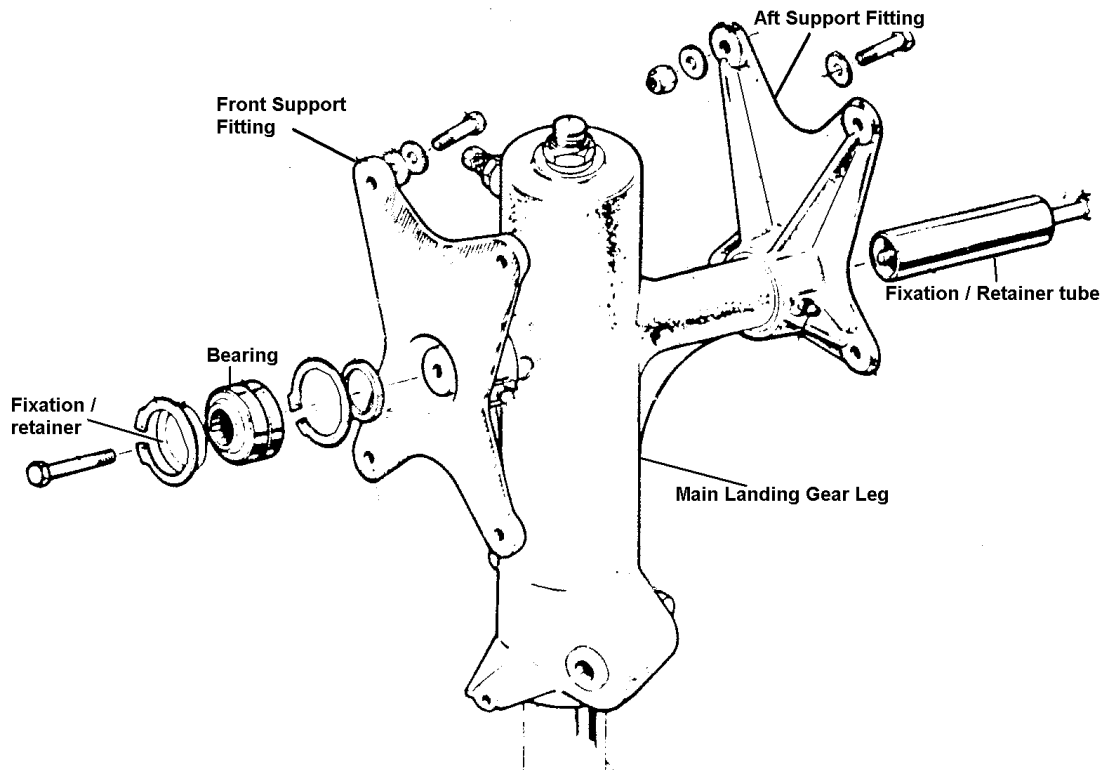
The landing gear system of the PA-34-200T is tricycle.

The Main Landing gear leg (RH and LH) are attached to the structure of the wing on the Front Spar and rear spar by 2 Support Fittings.

The Main Landing Gear leg is held in place on both support fitting by a retainer and a bearing, allowing the movement of retraction and the extension, as controlled by the retraction mechanism.



RH Main Landing gear.



Both Support Fittings were found sheared.



**2.1. Aft Support Fitting.**

The Aft Support Fitting is severed in 3 pieces. All 3 pieces were still attached to the rear spar by the mounting bolts.

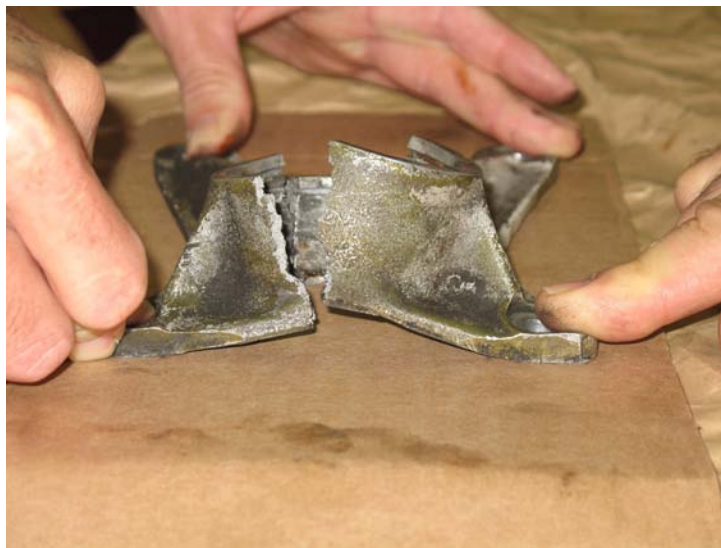
The fixation device; the retainer tube assembly and the bearing were still in place.

The snap-rings, used to hold the bearing in place were not found.

The Support fitting itself is deformed in a conical shape.



Aft Fitting, view from below



Aft Fitting, showing deformations.

## 2.2. Forward Support Fitting.

The Forward Support fitting is severed in 3 pieces; the 2 main parts were recovered, as they were still attached to the wing front spar.

The Forward Support fitting does not show the same deformation as the aft fitting: the 2 pieces are still plane.

However, a third piece is missing on the Forward support fitting. This small piece is located on the outboard side of the fitting, indicating a possible lateral force.

The retainer device: hook, downlock, is heavily bent.

The colour of the fracture is different from the fracture of the aft support fitting.

Both snap-rings, used to held the support bearing in place were recovered.

The Forward Front fitting was replaced during the airworthiness inspection of 20 March 2007.

The fitting was replaced because the inspection revealed an ovalisation of the fixation holes.

The fitting (Part Number 67040-013) was bought new from the manufacturer.

The aircraft had a total of 6352 FH 46'. At the date of the accident, it had 6484h 32'. The difference is 131 FH 46'



Front fitting, fracture.



### 2.3. Fracture mode analysis.

From the pilot's statements, the landing of the aircraft on that day was not hard. This means that the structure was already weakened prior to the accident flight, probably by an earlier event.

This event was not recorded.

The Landing gear front and aft fittings were sent to a laboratory for further analysis. The following examinations were performed:

- Optical inspection.
- Inspection with electronic microscope of the fracture zone.
- Metal analysis.
- Metal conformity verification.

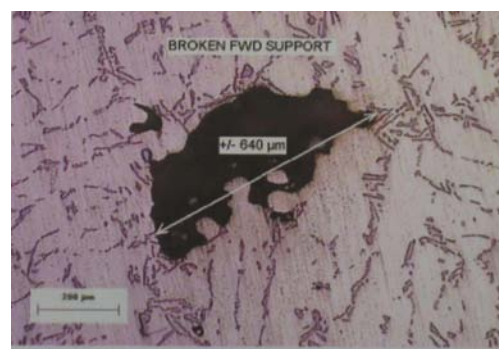
#### **Forward Support Fitting**

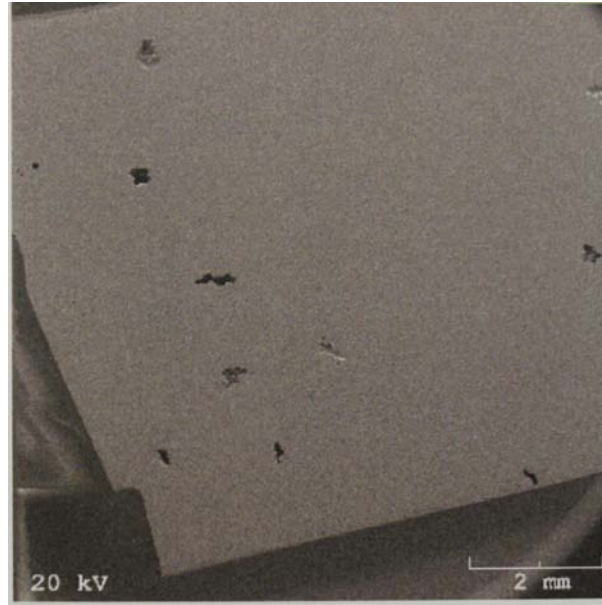
The performed analyses show that the Forward Support Fitting (pn 67040-013) has different metal characteristics than the Aft Support Fitting, and differ from the normal A356 alloy specifications.

In particular, the Forward Support Fitting show a content in Silicium of 14%, while an A356 alloy has a typical Silicium content of 6,5 to 7,5 %. The Silicium was found present under euhedral form (linear and fragile), instead of the fiber form.

The mechanical characteristics of the A356 alloy are negatively influenced by a high content of Silicium, specifically under the euhedral form.

The metal structure of the fitting showed also an abnormal presence of porosities, and linear precipitate.





The porosities could be seen with the naked eye.

The fitting failed under a totally fragile (static) fracture mode.

#### **Aft Support Fitting**

When analysing the Aft Support Fitting, no anomaly was detected.

The metal composition of the Aft Support Fitting is consistent with an Almag 35 alloy ( 7% Mg).

The Aft Support Fitting failed under a fragile (static) fracture mode, followed by a ductile fracture mode.

Out of the analysis, we can conclude that the forward support fitting failed first, and this failure caused an overload on the aft support fitting.

**2.4. Maintenance Program.**

This aircraft was maintained in accordance with the manufacturer's (Piper) recommendations. The program requires inspections at every 50FH, 100FH, 50FH, 500FH and 1000FH.

Since replacement of the Forward Support fitting, the aircraft had undergone three times a 50FH inspection and once a 100FH inspection.

The program as applicable for the Main Landing gear is as follows:

Nature of inspections	Inspection Time (FH)			
	50	100	500	1000
1. Check oleo struts for proper extension	x	x	x	x
2. Check wheel alignment		x	x	x
4. Inspect tires for cuts, uneven and excessive wear and slippage		x	x	x
5. Remove wheels, clean, inspect and repack bearings		x	x	x
6. Inspect wheels for cracks, corrosion and broken belts		x	x	x
7. Check tyre pressure	x	x	x	x
8. Inspect condition of brake backing plates		x	x	x
9. Inspect condition and security of brake lines and retaining clamps		x	x	x
10. Inspect condition of center spring and bungees		x	x	x
11. Inspect gear forks for damage		x	x	x
12. Inspect oleo struts for fluid leaks and scoring		x	x	x
13. Inspect gear struts, attachment, torque links, retraction links and bolts for condition and security.		x	x	x
14. Check downlocks for operation and adjustment		x	x	x
15. Inspect torque link bolts and bushings		x	x	x
16. Inspect drag end side brace link bolts		x	x	x
17. Inspect gear doors and attachments for condition and security		x	x	x
18. Check operation of gear warning horn and light		x	x	x
19. Retract gear – check operation and gear doors for clearance		x	x	x

Nature of inspections	Inspection Time (FH)			
	50	100	500	1000
20. With gears retracted, check "free fall" valve operation.		x	x	x
21. Check operation of squat switch		x	x	x
22. Check downlock switches, up switches		x	x	x

	and electrical leads for operation, condition and security of mounting				
23.	Inspect all hydraulic lines, electrical leads, and attaching parts for security, routing, chafing, deterioration, wear and correct installation		x	x	x
24.	Lubricate per Lubrication Chart	x	x	x	x

During 100FH inspection, a damage to the main support fitting caused by a (very) heavy landing, although not specifically required by the maintenance program, should have been detected.

The 50FH inspection does not require an inspection that could have detected damages to the support fittings.

We could therefore assume that the existing damage to the landing gear fixation was quite recent, certainly not older than 31FH.

### **3. Conclusions.**

#### **3.1. Findings**

- The aircraft is used by a pilot's school.
- The pilot who performed the landing was a student pilot under supervision of an experienced instructor.
- The instructor had a valid Instructor's license and medical certificate. The instructor has considerable flight experience on this type of aircraft.
- The aircraft had a valid airworthiness certificate and was maintained in accordance with the manufacturer's maintenance program.
- The Forward Support Fitting of the RH Main Landing Gear (Part Number 67040-013) was replaced during the airworthiness inspection of 20 March 2007, and was bought new from the manufacturer. The fitting had accumulated 131 FH 46' since new.
- A metallurgical analysis of the RH MLG Forward Support Fitting revealed that the component did not comply with the manufacturer's specifications.
- The aircraft was inspected 31FH prior to the event, and no anomaly was detected.

#### **3.2. Causes.**

The RH Main Landing Gear failed due to the initial failure of the Forward Support Fitting. This failure was followed by an overload on the Aft Support Fitting, that failed, causing the liberation of the RH MLG leg.

The initial failure of the Forward Support Fitting was caused by external stress, due to the normal forces acting on the landing gear upon landing, or by extraordinary load caused by a hard landing, although none was reported.

The Forward Support Fitting failed due to an out-of-specification metal composition, that has weakened the component.

**4. Recommendations.**

**4.1 To NTSB / FAA / Aircraft Manufacturer**

To further determine the cause of the departure from manufacturing specifications of the Forward Support Fitting, and take appropriate action to ensure continuing conformity.