



**Federal Public Service
Mobility and Transport**
Air Accident Investigation Unit

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Safety Investigation Report (Interim Report)

ACCIDENT TO THE BOEING B737-45D REGISTERED SP-LLB IN EBBR ON 26 MAY 2011

Ref. AAIU-2011-16-EBBR-SP-LLB
Issue date: 25 May 2013
Status: Interim

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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, Art. 17.3 of EU Regulation 996/2010 stipulates that a safety recommendation shall in no case create a presumption of blame or liability for an accident, serious incident or incident.

EU Regulation 996/2010 requires investigation reports to be produced within one year from the date of the accident, or when not possible, the safety investigation authority shall release an interim statement at least at each anniversary of the accident or serious incident, detailing the progress of the investigation and any safety issues raised.

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, H. Metillon and S. Laureys.
The report was compiled by L. Blendeman

The investigation team acknowledges the precious support received from the Polish Investigation Authority, LOT Polish Airlines, the US NTSB and the Boeing Company.

NOTE:

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

Synopsis

Date and hour of the accident

26 May 2011 at 16:30 UTC

Aircraft

Boeing B737-45D, msn 27156, registered SP-LLB

Accident location

On Runway 25L, EBBR Brussels Airport

Aircraft operator

LOT Polish Airlines

Type of flight

Scheduled Commercial Air Transport

Persons on board

105

1. Factual Information

1.1. History of flight.

The Flight LO233, originating from Warsaw (EPWA) landed at EBBR Runway 25L at 16:29UTC.

The pilot reported a normal, smooth touch down of the LH MLG first, then a bumpy touch down of the RH Landing Gear.

The landing roll was hard to control due to vibrations increasing steadily.

The EBBR tower reported heavy smoke by landing and airplane seems to be leaning on the right.

The crew stopped the airplane on the runway, and exited to taxiway C3.

Airport inspection found some airplane parts on the runway.

AAIU (Be) was notified at 19.00 UTC, and went to see the airplane the day after.

1.2. Injuries to persons.

Injuries	Pilot and crew	Passenger	Others	Total
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	0	0	0	0
None	6	99	0	105
Total	6	99	0	105

1.3. Damage to aircraft.

The RH landing gear was damaged.

1.4. Other damage.

None

1.5. Personnel information.

Captain: Male, Polish, holder of ATPL(A) licence issued by Polish Authority, valid until 28 Jan 2012

Co-Pilot: Male, Polish, Captain, Instructor, holder of ATPL(A) licence issued by Polish Authority, valid until 05 Oct 2011

1.6. Aircraft information.

The Boeing 737 is a short- to medium-range twin-engine narrow-body jet airliner. Originally developed as a shorter, lower-cost twin-engine airliner derived from Boeing's 707 and 727, the 737 has developed into a family of nine passenger models with a capacity of 85 to 215 passengers.

Originally envisioned in 1964, the initial 737-100 flew in 1967 and entered airline service in February 1968. Next the lengthened 737-200 entered service in April 1968. In the 1980s Boeing launched the -300, -400, and -500 models, subsequently referred to as the Boeing 737 Classic series. The 737 Classics added capacity and incorporated CFM56 turbofan engines along with wing improvements.

Airframe:

- Manufacturer: Boeing.
- Type: B737-45D

- Serial number: 27156
- Delivery date: 25 January 1993
- Airworthiness Review Certificate: valid until 28 March 2012.
- Registration: SP-LLB
- Time since new: 44899:08 FH
- Cycles since new: 23668 FC

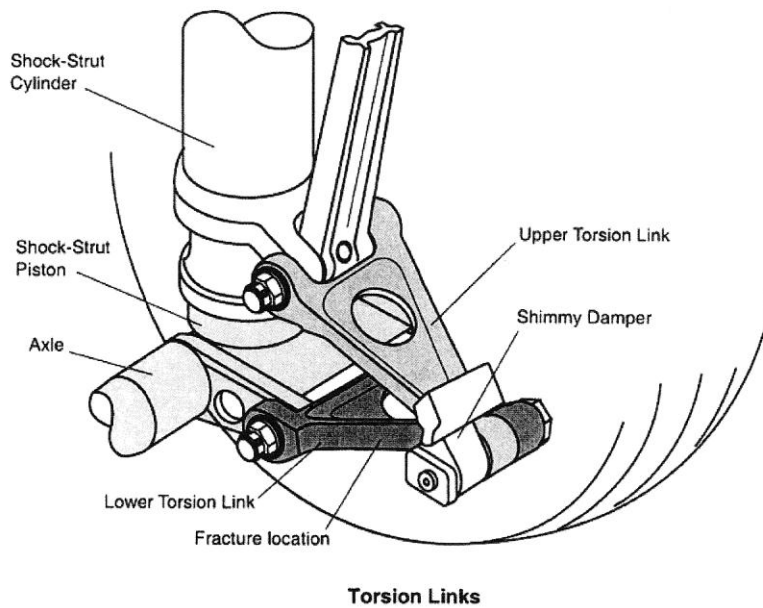
Engine:

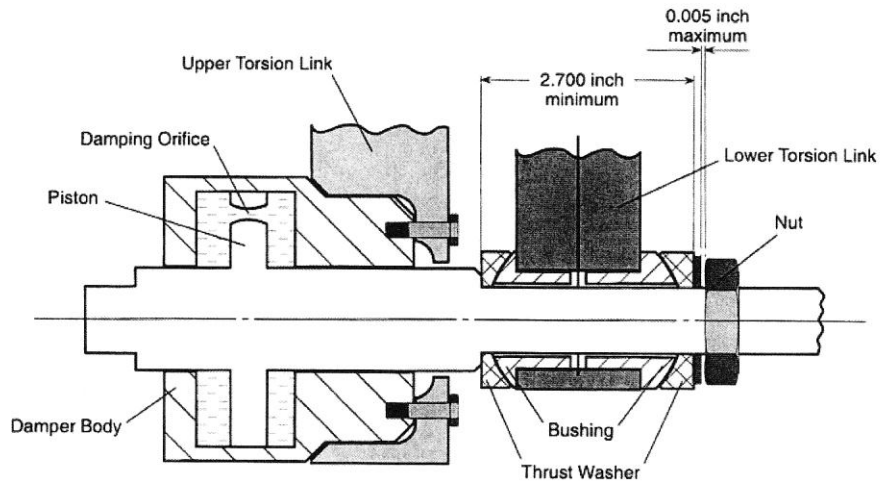
- Manufacturer: CFMi.
- Model: CFM56-3C1L

Main Landing Gear (RH)

PN: 65-73761-120
SN: MCO4058P2062

Last overhaul date: 18.12.2001
Installation date: 16.01.2002





Shimmy Damper Schematic

1.7. Meteorological conditions

Wind:

Direction: 240 degrees

Speed: 19 kts

Visibility: more than 10 km

Temperature: 17°C

QNH: 1012 hPa

Wind speed

Time	Average (2 min) wind direction	Average (2 min) wind speed	Maximum wind speed recorded during the last 10 min
16:25	238	16,7	24,3
16:26	238	16,9	24,3
16:27	235	15,7	24,3
16:28	239	15,7	24,3
16:29	237	15,6	24,3
16:30	228	16,1	22,9
16:31	227	15,7	22,2
16:32	232	15	22,2
16:33	230	15	22,2
16:34	226	13,6	22,2
16:35	224	13,6	22,2

1.8. Aids to navigation.

Not applicable.

1.9. Communication.

Not applicable

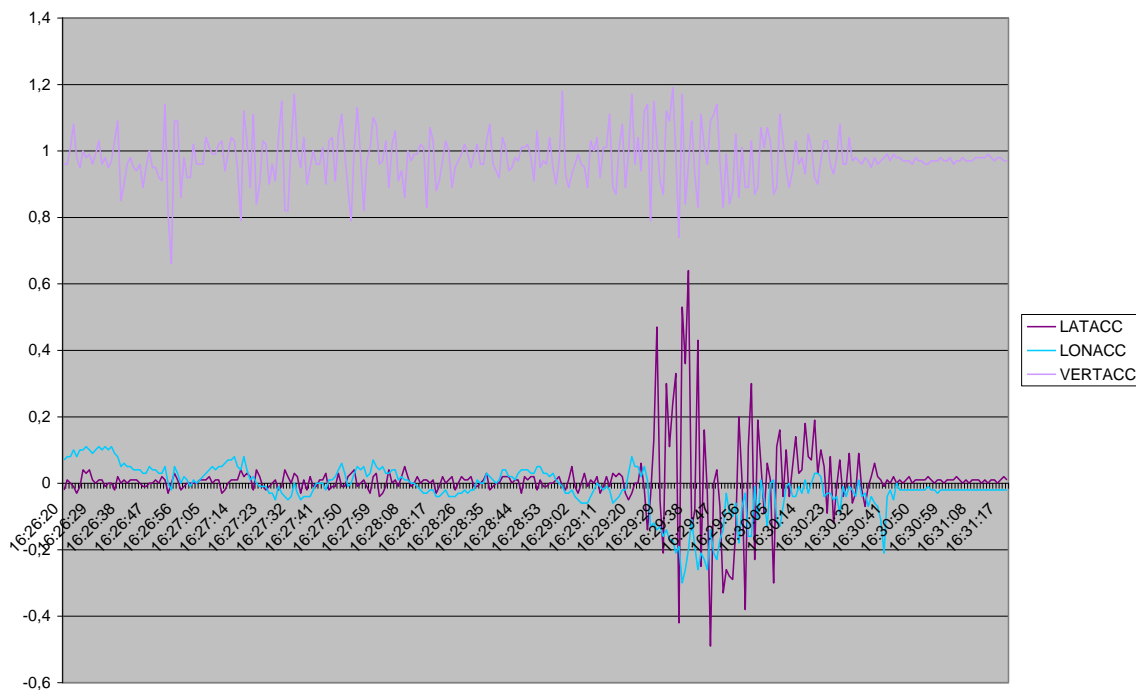
1.10. Aerodrome information

Not applicable

1.11. Flight Recorder

The aircraft was equipped with a Flight Recorder and Cockpit Voice Recorder, but no download was requested, and a download of the QAR, using the same data was obtained from LOT.

The data pertaining to the acceleration was retrieved from the on-board QAR:

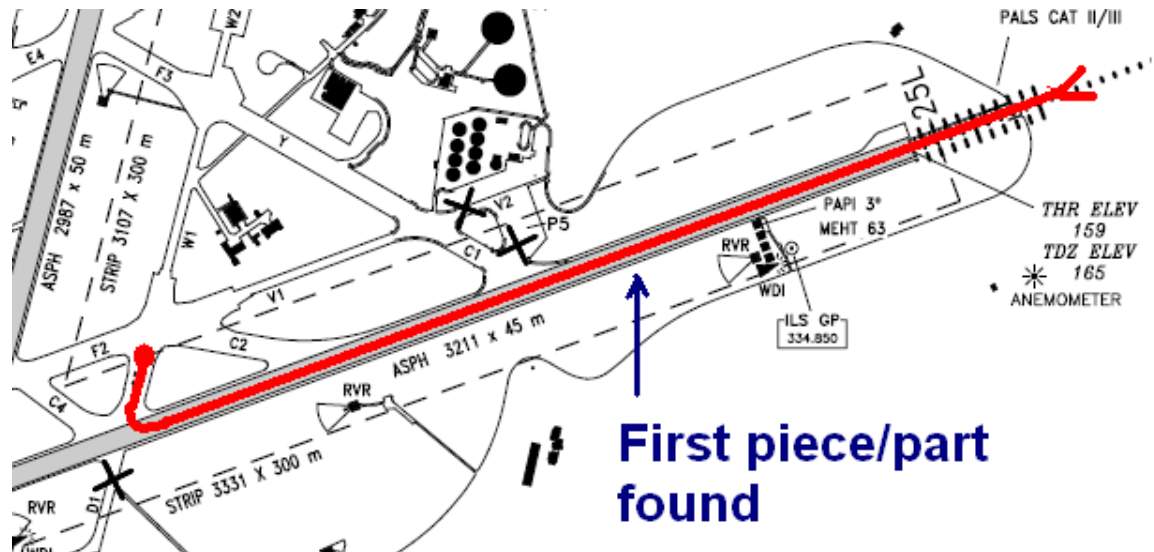


The record shows severe lateral acceleration, up to 0.6 G, from touch-down and decreasing with the ground speed.

1.12. Wreckage and impact information:

Landing Run

The airplane exited via C3 and stopped at the stop bar.
Most piece / parts that fell on the runway were found near C3 exit.



A black plastic part (from the fixture retaining the hydraulic hose) was found near the threshold.



All other parts found on the runway include chips from the tyres, metallic chips and bolts.

The traces left on the runway confirm a zig-zag of the RH MLG tyres, and are visible from the threshold on.



The damage to the tyre and wheel flange seem consistent with contacts between tyres / flange and the upper part of the lower torsion link.



The flaps were found covered by hydraulic fluid, that escaped during the landing roll, causing the smoke that was visible by ATC.

1.13. Medical and pathological information.

Not relevant

1.14. Fire.

There was no fire.

1.15. Survival aspects

Not Relevant.

1.16. Test and Research

Not Applicable

2. Analysis.

Initial Findings

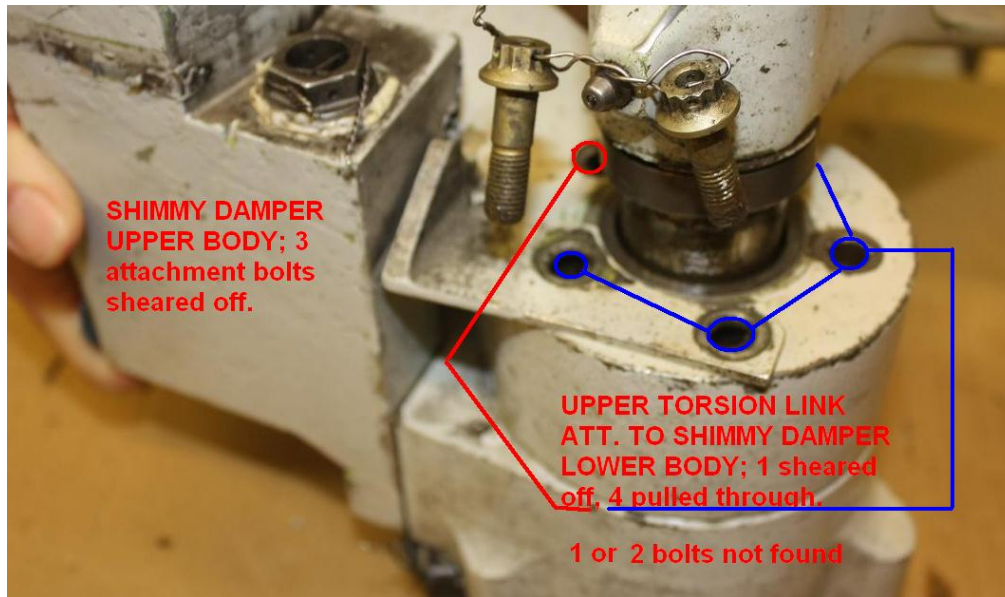
The torsion link assembly was removed from the Main Landing Gear.



Shimmy damper.

- **PN: 65-44771-4; SN: TRI4745**
- **CYCLES SINCE INSTALLATION: 10775 FC**
- **INSTALLATION DATE: 16.01.2002**

The shimmy damper upper body (manifold casing) was found separated from the lower body.



All bolts attaching the shimmy damper upper body were found sheared.

Only one bolt attaching the shimmy damper lower body to the upper torsion link was found sheared, all 4 others were pulled through. One bolt was not found.

The attachment bracket was broken, showing deformation.



One bushing of the bearing assembly connecting the lower torsion link to the damper piston was found broken.





The damper check nut was not found, however, this part of the shimmy damper took a lot of beating from contact with the wheel.



The nut was (most probably) unscrewed in an attempt to open the shimmy damper.

Torsion Links

The lower torsion link of the RH MLG was found broken mid-way along its length.

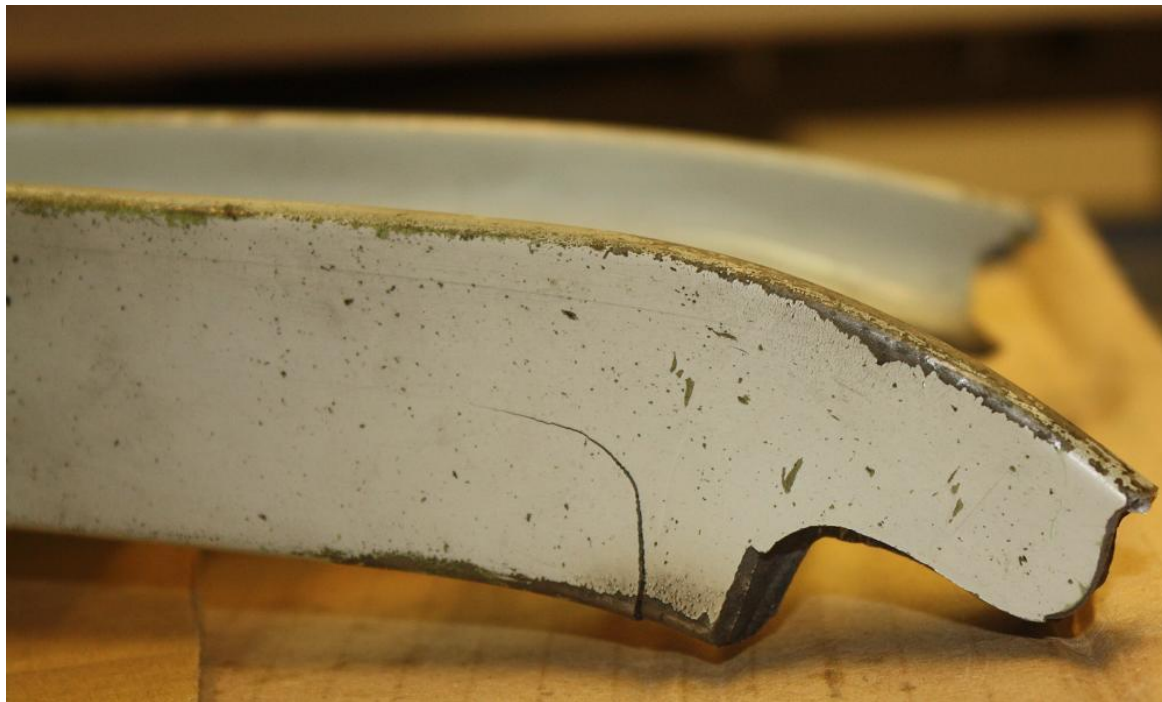
- **PN: 65-46102-23; SN: SS4163;**
- **CSN: 24837**
- **CSO: 10775**
- **LAST OVERHAUL DATE: 18.12.2001**
- **INSTALLATION DATE: 16.01.2002**



Close-ups of one fracture area:



The lower torsion link is bent downward,



And one branch is bent to the left (outward):



Both bronze lugs of the lower torsion links showed similar deformation:





Others.

The wing lower surface, flaps ,fuselage skin, wheel well and stabilizer were inspected for damage, without findings.

The MLG attachment points (forward and aft trunnion bearings, links, beams, spars and skins) were submitted to a detailed visual inspection and NDT by a LOT technician. No damage was found.

Further investigation

The parts of the RH MLG were sent to the Boeing Equipment Quality Analysis laboratory for detail examination.

The report is in appendix.

APPENDIX 1: Boeing EQA laboratory report