KBSZ TSB
KÖZLEKEDÉSBIZTONSÁGI SZERVEZET
TRANSPORTATION SAFETY BUREAU

FINAL REPORT

2007-432-4

INCIDENT

FARKASHEGY
4 October 2007

PH-WIM
Piper PA-38 Tomahawk

The sole objective of the technical investigation is to reveal the causes and circumstances of aviation accidents, incidents or irregularities and to initiate the necessary technical measures and make recommendations in order to prevent similar cases in the future. It is not the purpose of this activity to apportion blame or liability.

This present investigation was carried out on the basis of

- Act XCVII of 1995 on aviation,
- Annex 13 of MTCW (Ministry of Transport, Communications and Water) Decree 20/1997. (X. 21.) on the declaration of the annexes of the Convention on International Civil Aviation signed in Chicago on 7th December 1944,
- Act CLXXXIV of 2005 on the technical investigation of aviation, railway and marine accidents and incidents (hereinafter referred to as Kbvt.),
- MET Decree 123/2005 (XII. 29.) on the regulations of the technical investigation of aviation accidents, incidents and irregularities,
- In absence of other related regulation of the Kbvt., the Transportation Safety Bureau of Hungary carried out the investigation in accordance with Act CXL of 2004 on the general rules of administrative authority procedure and service,
- The Kbvt. and the MET Decree 123/2005 (XII. 29.) jointly serve the compliance with the following EU acts:
    a) Council Directive 94/56/EC of 21 November 1994 establishing the fundamental principles governing the investigation of civil aviation accidents and incidents, with the exception of its Annex;
    b) Directive 2003/42/EC of the European Parliament and of the Council of 13 June 2003 on occurrence reporting in civil aviation, with the exception of its Annex I and Annex II.
- The competence of the Transportation Safety Bureau of Hungary is based on the Kbvt. until 31st December 2006 and on Government Decree 278/2006 (XII. 23.) from 1st January 2007 respectively.

Under the aforementioned regulations

- The Transportation Safety Bureau of Hungary shall investigate aviation accidents and serious aviation incidents.
- The Transportation Safety Bureau of Hungary may investigate aviation incidents and irregularities which - in its judgement - would have resulted in accidents in other circumstances.
- The technical investigation is independent of any administrative, infringement or criminal procedures.
- In addition to the aforementioned laws, the ICAO DOC 6920 Manual of Aircraft Accident Investigation is applicable.
- This present Draft Report shall not be binding, nor shall an appeal be lodged against it.

Persons participating in the technical investigation did not act as experts in other procedures concerning the same case and shall not do so in the future.

The IC shall safe keep the data having come to their knowledge in the course of the technical investigation. Furthermore the IC shall not be obliged to make the data – regarding which the owner of the data could have refused the disclosure of the data pursuant to the relevant act – available to other authorities.

Abbreviations

BME	Budapest University of Technology and Economics (Budapesti Műszaki Egyetem)
CAVOK	„Ceiling and Visibility are OK”
IC	Investigating Committee
ICAO	International Civil Aviation Organization
Kbvt	Act CLXXXIV of 2005 on the technical investigation of aviation, railway and marine accidents and incidents
MAA	Military Aviation Authority
MET	Ministry of Economy and Transport (Gazdasági és Közlekedési Minisztérium, GKM)
MTCW	Ministry of Transport, Communications and Water (Közlekedési, Hírközlési és Vízügyi Minisztérium, KHVM)
NTA DAT	National Transport Authority - Directorate for Air Transport (CAA of Hungary)
TSB	Transportation Safety Bureau

Synopsis

Occurrence category	incident
Type of the aircraft	Piper Aircraft Corporation
Manufacturer	PA-38-112
Registration mark	PH-WIM
Serial No.	38-78A0592
Owner	private owner
Operator	Fly for Fun B. V., The Netherlands
Date and time of event (UTC)	4 October 2007. 13:40 LT
Location	Farkashegy airfield, Budapest (LHFH)
Number of injured	none
Damage to vehicle	substantial
State of registry	The Netherlands
Registering authority	Civil Aviation Authority of the Netherlands

Notifications

The occurrence was reported to the duty services of TSB by the personnel of the Aviation Safety Organisation of the Hungarian Aeronautical Association at 14 hours 10 minutes on 4th October 2007.

The on duty personnel of TSB reported the occurrence to TSB's head of department on duty at 14 hours 11 minutes on 4th October 2007, then to the on duty personnel of NTA AD at 14 hours 14 minutes.

The appointment of the Investigating Committee

The Director-General of TSB appointed the following Investigating Committee (hereinafter referred to as IC) on 4th October 2007 to investigate the aviation incident:

- János DUSA, Investigator-in-Charge (IIC)
- Zsófia OLÁH, IC member

Summary of the investigation

The IC received comments from the pilot and has taken them into consideration during the compilation of this present Final Report.

1. FACTUAL INFORMATION

1.1. History of the flight

The pilot took off for Prague from Farkashegy airfield when at about one-third of the take-off run he heard a sharp clap and the aircraft banked slightly to the right.
The pilot aborted the take-off and attempted to keep the aircraft on the runway but it did not respond accurately, swerved to the right, and left the runway at an acute angle. The aircraft ran into an uneven surface; at first the right main landing gear broke, then the left one.

1.2. Injuries to persons

There were no injuries.

1.3. Damage to aircraft

The nose gear was folded toward the tail, both main landing gears were torn off, the flaps were crinkled while in take-off position.
The leading edge of the left wing one metres from the end was dented, the propeller was bent. The cabin floor was deformed.

1.4. Other damage

The IC did not receive any information on further damage by the completion of the investigation.

1.5 Personnel information

Pilot

Age and gender	53-year-old man
License	PPL, Cat. A valid until 1 May 2008
Medical certificate	valid until 3 January 2008
Total flight hours	250
in the last 12 months	20
in the last 30 days	10
Total flight hours on this type of aircraft	150
in the last 12 months	20
in the last 30 days	10

1.6. Aircraft information

	flight time	**number of landings**
Since manufacturing	7564 hours 55 minutes	n.a.
Since last maintenance	9 hours 50 minutes	6

The 50-hour-maintenance was performed on 26th September 2007.

1.6.1. Engine data

The characteristics of the engine had no effect on the course of events therefore their analysis was not required.

1.6.2. Loading data

The loading data of the aircraft had no effect on the course of events therefore their analysis was not required.

1.7. Meteorological information

The meteorological parameters had no effect on the course of events therefore their analysis was not required.

1.8. Aids to navigation

The aircraft was equipped with navigational instruments described in the aircraft's airworthiness certificate and they functioned normally. They had no effect on the course of events therefore their analysis was not required.

1.9. Communications

The aircraft was equipped with communications instruments described in the aircraft's airworthiness certificate and they functioned normally. They had no effect on the course of events therefore their analysis was not required.

1.10. Aerodrome information

Farkashegy airfield is a non-public airfield with a 1000-metre-long, 200-metre-wide grassy runway. The ground outside the edge of the runway is uneven, weedy and is in a bad condition. Its height is 215 metre above sea level; its track angle is 150/330 degrees.

The airfield had a valid operating licence.

1.11. Data recorders

The aircraft did not have an on-board flight recording device. It is not required for this type of aircraft and mission.

1.12. Wreckage and impact information

The aircraft came to a halt 68 metres beyond the end and 15 metres right of the edge of the runway. The left main landing gear was found 56.5 metres from the aircraft, the right main landing gear was found 100 metres from the aircraft, both parts were lost during the skidding and were in the skidding path.

Both main landing gears were broken off the airframe. The IC impounded the main landing gear mounting bolts for analysis.
The technical expert opinion stated that the bolts suffered fracture due to a dynamic shearing load. There was no evidence of fatigue or pre-accident cracks.

1.13. Medical and pathological information

The crew of the aircraft had a valid medical licence prior to the commencement of the flight.

1.14. Fire

There was no fire.

1.15. Survival aspects

There was no injury.

1.16. Tests and research

There was no need to conduct tests and research for reaching the conclusion.

1.17. Organizational and management information

The characteristics of the organizational and management environment had no effect on the course of events therefore their analysis was not required.

1.18. Additional information

The IC did not receive any relevant additional information.

1.19. Useful or effective investigation techniques

Stereo and light microscope, and Hanemann hardness measuring objective were used for the analysis of the fracture surface of the bolts, their hardness and metallurgic characteristics.

2. ANALYSIS

The IC did not find any potholes on the landing strip that could have caused damage to the main landing gears.

The wheels were freely turnable, the braking discs and braking shoes were undamaged.

The expert opinion on the mounting elements of the main landing gear stated that there was no evidence of pre-accident cracks or wear indicating fatigue; material defect was unlikely.

According to the pilot's account, there had been no hard or overweight landings prior to the incident.

The fracture of the main landing gears and further damage to the airframe are consequences of runway side excursion and the uneven surface of the runway.

The pilot was qualified and rated for the flight in accordance with the current rules and regulations.

According to the maintenance documentation, the aircraft was equipped and maintained adequately.

The mass and centre of gravity of the aircraft were within the prescribed operational limits.

The IC found no evidence of pre-accident malfunction of the aircraft or any of its systems.

3. CONCLUSIONS

The direct cause of the accident was the fracture of the inner mounting bolt of the right main landing gear.

In spite of the statement of the pilot, the IC assumes that the indirect cause of the incident was a previous hard landing during which the mounting elements sustained a greater than usual load. This load did not break or crack the mounting bolt but caused excess strain in its structure, and as a result the strength of the bolt was reduced.

4. SAFETY RECOMMENDATIONS

AMI2007-432-4_1: As an immediate preventive action, the IC recommends the NTA DAT to ordain a one-time immediate check of the mounting bolts of the main landing gear for all PA-38 Tomahawk aircraft (Maintenance Manual, Chapter 32, Fig.32-1, Pos.9).

The IC did not find any other reason that would call for issuing a safety recommendation.

5. APPENDICES

5.1. Technical expert opinion

Budapest, 18th August 2008.

Signed, János DUSA IIC	Signed, Zsófia OLÁH IC member

NOTE:

This present document is the translation of the Hungarian version of the Final Report.

Although efforts have been made to translate it as accurately as possible, discrepancies may occur.

In this case, the Hungarian is the authentic, official version.

Appendix 5.1.

Technical expert opinion

Piper Tomahawk landing gear fracture analysis

Budapest, 7th November 2007.

Completed by Dr. Gyula KISS

Technical expert opinion

Subject of the analysis: Piper Tomahawk landing gear damage

Instruments used in the analysis:

- Olympus SZX7 stereo microscope
- Fuji 602Z digital still camera
- Zeiss-Metaval light microscope
- HPO hardness measuring tool with Hanemann objective

Upon request from Transportation Safety Bureau (TSB) Hungary I have analysed selected parts of the broken right main gear of a Piper Tomahawk aircraft. The outcome of the analysis was to assist to answer the following questions:

- The type of the fracture (shear, twist, tension, determined from the bolt's fracture surface),
- Strength of the mounting bolt (determined from hardness and texture),
- Characteristics of the bolt stemmed from the heat treatment technology (ductility, rigidness),
- Possibility of fracture caused by fatigue.

The following parts have been provided by TSB Hungary for the analysis:
Two (2) bolt heads with cca. 6…8-mm-long stems remaining and one (1) bolt stem from the left main landing gear mount,
Two (2) bolts (both slightly bent) from the right main landing gear mount,
Two (2) main landing gear mounting clamps, one of which had a bent end at one side.

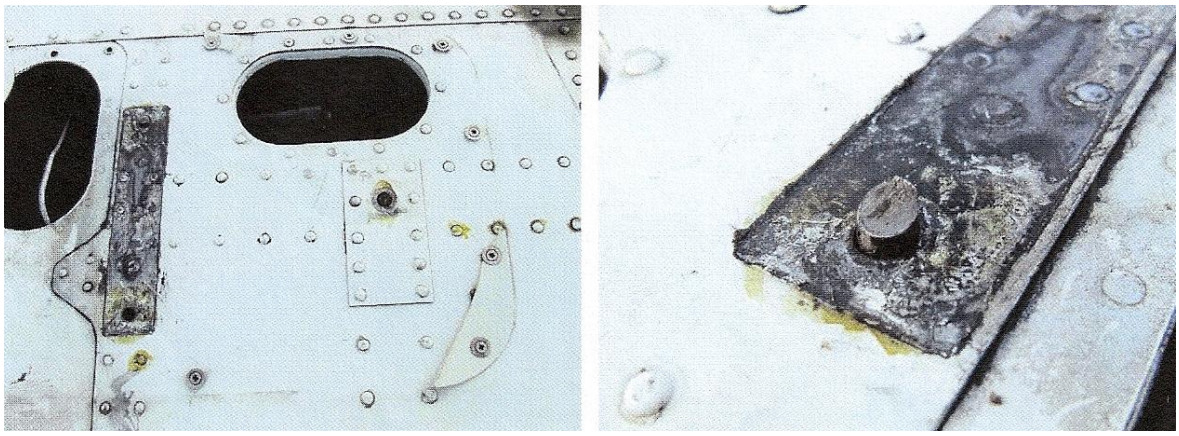

Fig.1.

Findings

Bolt length 45 mm, stem diameter 9 mm, head size 14 mm, thread pitch 1 mm. The head is marked with letters „CXS” in vertical arrangement.

Fig. 2.

The bolts have galvanic cadmium coating. Deformations visible on the sides of the heads demonstrate multiple screw-ons/screw-offs, tightenings and loosenings. The threads are undamaged.

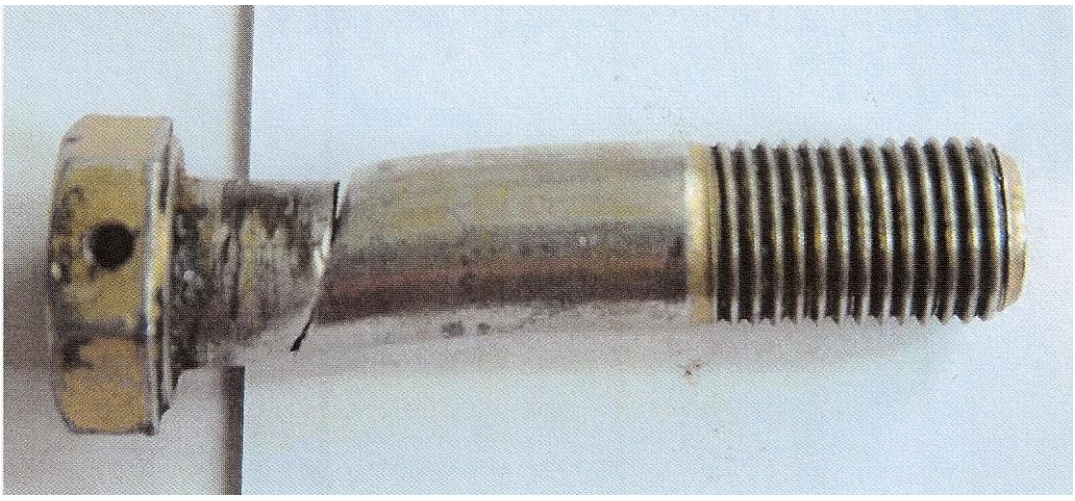

Fig. 3.

The cylindrical surface of the bolts of the right main landing gear show superficial scratches but these bolts are otherwise intact. The stems are bent almost identically, the bending angle is about 5 degrees.
The 2 mounting bolts of the left main landing gear have been bent and their stems sheared aslope at a distance of 6…8 mm from the plane of the bolt head bottom.

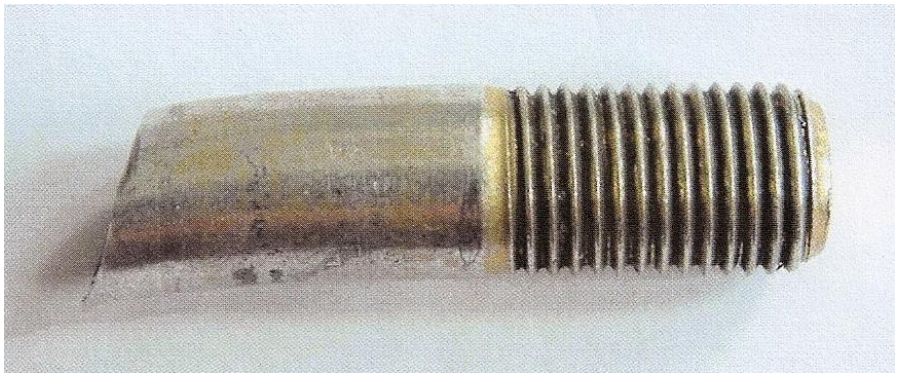

Fig. 4.

One of the bolts shows an approx. 0.8-mm-deep dent at the edge of the sheared surface. It is most possible that this dent was the trigger for the shear that cut the whole cross-section of the bolt stem.

Fig. 5.

The sheared surfaces are smooth, the skid traces are clearly visible even with a naked eye.

Fig. 6.

The bolts are made of sublimated structural steel. The texture is even and practically free of bubbles.
Hardness: HV=344…362
Tensile yield strength is an estimated 1000 N/mm^2
Shearing strength is 800 N/mm^2 accordingly.

The total shearing force is approx. 50 kN on each bolt. (The bending has slightly increased this shearing force.)

Summary and conclusions

Both mounting bolts have been broken in an identical way, due to dynamic shearing tension. The fracture surfaces demonstrate an almost clean shear, although some bending and dent could be observed.

The material of the bolts is sublimated toughened steel. The good quality is evident from the fracture surface as well as from the hardness values, the dent at the sheared edge, and the bent stems.

No pre-accident cracks were found.
There was no evidence of fatigue.
The possibility of a material defect can be excluded.
The bending of one of the landing gear clamps is obviously an outcome of the gear tear-off.

Budapest, 7th November 2007.

Signed,
Dr. Gyula KISS