



MINISTRY FOR
INNOVATION AND TECHNOLOGY
TRANSPORTATION SAFETY BUREAU

PRELIMINARY REPORT

2018-322-4

accident

Pécs-Pogány Airport SW 1.8km

31 May 2018

Magnus eFusion

HA-XEF

The sole objective of the technical investigation is to reveal the causes and circumstances of accidents, and incidents, 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.

The safety investigation authority in charge shall be authorized to inform victims and their relatives or their associations or make public any information on the factual observations, the proceedings of the safety investigation, possibly preliminary reports or conclusions and/or safety recommendations, provided that it does not compromise the objectives of the safety investigation and fully complies with applicable legislation on the protection of personal data.

General information

This investigation is being carried out by Transportation Safety Bureau on the basis of

- Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC,
- Act XCVII of 1995 on aviation,
- Annex 13 identified in the Appendix of Act XLVI. of 2007 on the declaration of the annexes to 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 Kbt.),
- NFM Regulation 70/2015 (XII.1) on technical investigation of aviation accidents and incidents, as well as on detailed investigation for operators,
- In absence of other relevant regulation in the Kbt., in accordance with Act CXL of 2004 on the general rules of administrative authority procedure and service, and, as of 1 January 2018, in accordance with Act CL on General Public Administration Procedures.

The competence of the Transportation Safety Bureau of Hungary is based on Government Decree № 278/2006 (XII. 23.), and, as from 01 September 2016, on Government Decree № 230/2016. (VII.29.) on the assignment of a transportation safety body and on the dissolution of Transportation Safety Bureau with legal succession.

Pursuant to the aforesaid laws,

- Transportation Safety Bureau Hungary shall investigate aviation accidents and serious incidents.
- Transportation Safety Bureau Hungary may investigate aviation and incidents which – in its judgement – could have led to more accidents with more serious consequences in other circumstances.
- Transportation Safety Bureau Hungary is independent of any person or entity which may have interests conflicting with the tasks of the investigating body.
- In addition to the aforementioned laws, the ICAO Doc 9756 and the ICAO DOC 6920 Manual of Aircraft Accident Investigation are also applicable.
- This Report shall not be binding, nor shall an appeal be lodged against it.
- The original of this Preliminary Report was written in the Hungarian language.

The 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 its disclosure pursuant to the relevant act – available for other authorities.

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This report was issued by:

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Translation

This 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.

Definitions and Abbreviations

BFU	<i>German Federal Bureau of Aircraft Accident Investigation / Bundesstelle für Flugunfalluntersuchung</i>
CRI	<i>Class Rating Instructor</i>
SW	<i>Southwest</i>
EASA	<i>European Aviation Safety Agency</i>
FI(A)	<i>Flight Instructor(Aeroplane)</i>
GKM	<i>Ministry of Economy and Transport</i>
IC	<i>Investigating Committee</i>
ICAO	<i>International Civil Aviation Organization</i>
ITM	<i>Ministry for Innovation and Technology</i>
Kbvt.	<i>Act CLXXXIV of 2005 on the technical investigation of aviation, railway and marine accidents and incidents and other transportation occurrences</i>
LAPL	<i>Light Aircraft Pilot Licence</i>
LT	<i>Local Time</i>
MTOW	<i>Maximum Takeoff Weight</i>
NFM	<i>Ministry of National Development</i>
NTA AA	<i>National Transport Authority Aviation Authority, Hungary (till 31 December 2016)</i>
PPL(A)	<i>Private Pilot Licence (Aeroplane)</i>
SEP	<i>Single Engine Piston</i>
TMG	<i>Touring Motor Glider</i>
TSB	<i>Transportation Safety Bureau</i>
ULPL	<i>Ultralight Pilot Licence</i>
UTC	<i>Coordinated Universal Time</i>
VFR	<i>Visual Flight Rules</i>

Introduction

Occurrence category		Accident
Aircraft	Manufacturer	Magnus Aircraft Zrt
	Type	Magnus eFusion
	Registration	HA-XEF
	Operator	Magnus Aircraft Zrt.
Occurrence	Date and time	31 May 2018, 10:02
	Location	Pécs-Pogány Airport, SW 1.8 km (Figure 1)
Fatalities related to the accident:		2 persons
Extent of damage to the aircraft involved in the incident:		Destroyed

Each time indicated in this Report is local time (LT). At the time of the occurrence: LT= UTC+ 2 hours.

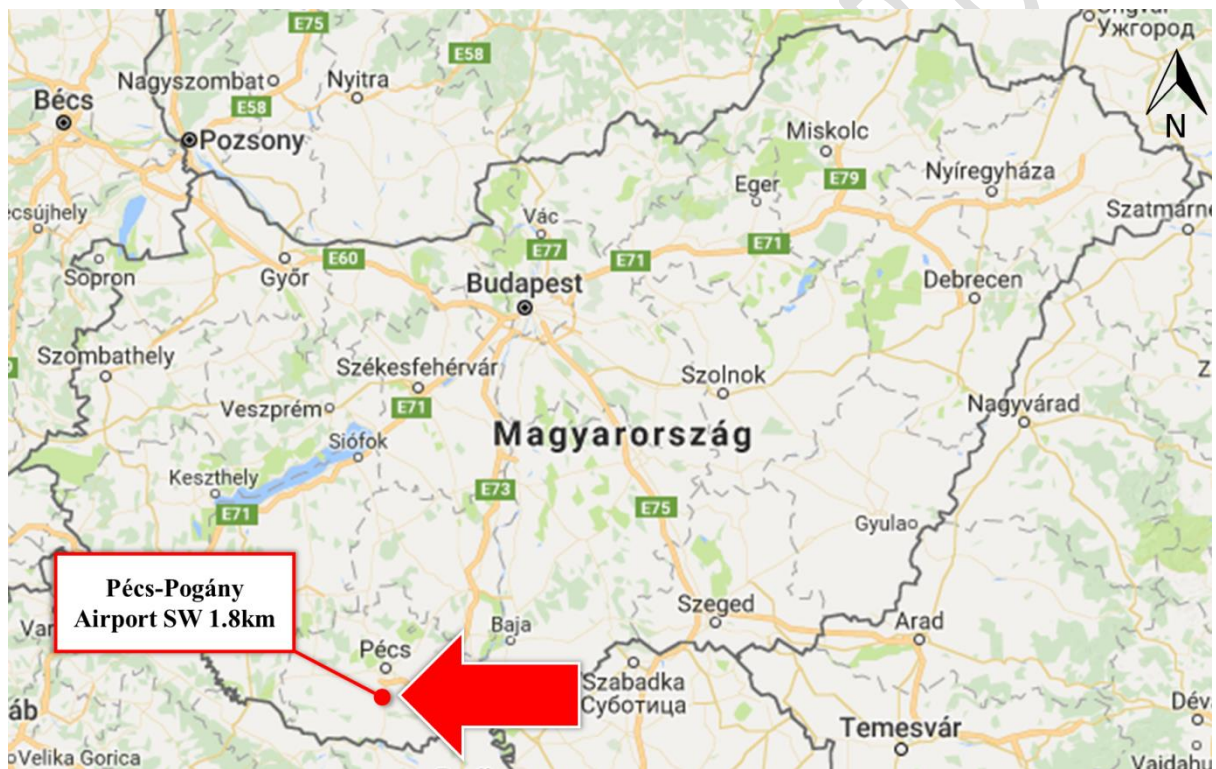


Figure 1: Location of the occurrence in Hungary

Reports and notifications

The occurrence was reported to the duty service of TSB on 31 May 2018, at 10:20, by the person in charge of Pécs-Pogány Airport.

TSB Hungary notified:

- the investigating body (BFU) of the state of the manufacturer, on 31 May 2018, at 15:19,
- EASA, on 31 May 2018, at 15:22.

The following notified foreign organizations assigned and authorised representatives for the investigation:

- State of the manufacturer: German Federal Bureau of Aircraft Accident Investigation (BFU)
- Other entity involved: European Aviation Safety Agency (EASA)

Overview of the investigation

This preliminary report is based on relevant factual data collected during the investigation performed by the IC until issuance thereof.

The IC took the following major steps since the date of the accident:

- The IC surveyed the scene on 31 May 2018, where, among others, we:
 - investigated the scene of the accident and the wreck of the aircraft involved in the accident, seized 1 SD card found during the survey, as well as the remaining parts of the instruments;
 - interviewed witnesses;
 - took photos of the scene, the wreck of the aircraft and the documents available;
 - collected such information and documents from the operator of the aircraft, relating to the preparation of the flight, as well as to the aircraft and to the pilots, which were available at the departure aerodrome.
- On 14 June 2018, the IC performed an additional survey, where, among others, we inspected the wreck of the aircraft with the technical expert of the police, in the presence of representatives from each stakeholder.
- On 21 June 2018, the IC sent the SD card of the built-in camera unit found at the scene of the accident to BFU for the sake of recovering possible recorded data on the card.
- On 27 June 2018, the IC, accompanied by a representative and expert of Siemens Zrt., inspected the remains of the instruments collected at the scene of the accident and stored at the evidence storage of TSB.
- On 19 July 2018, the IC obtained the report of the forensic medical expert.
- On 19 July 2018, the IC conducted detailed inspection of the electric motor, and inspection of the inverter found in the wreck, at the manufacturer's workshop/laboratory, in the presence of representatives from EASA, BFU and all other stakeholders.

1. Factual information

1.1. History of the flight

The experimental, electrically powered experimental aircraft with registration sign HA-XEF took off from Pécs-Pogány Airport for a local VFR training flight with two people on board. After take-off from Runway 16 of the aerodrome, the aircraft was flying along the right traffic circuit, roughly at the place of the second turn of the right traffic circuit when, at 10:02 am, after a steep fall, it crashed to the ground at a low angle, and it caught fire. Firefighters and the ambulance arrived quickly, but they had no chance to save the lives of the two people on board.

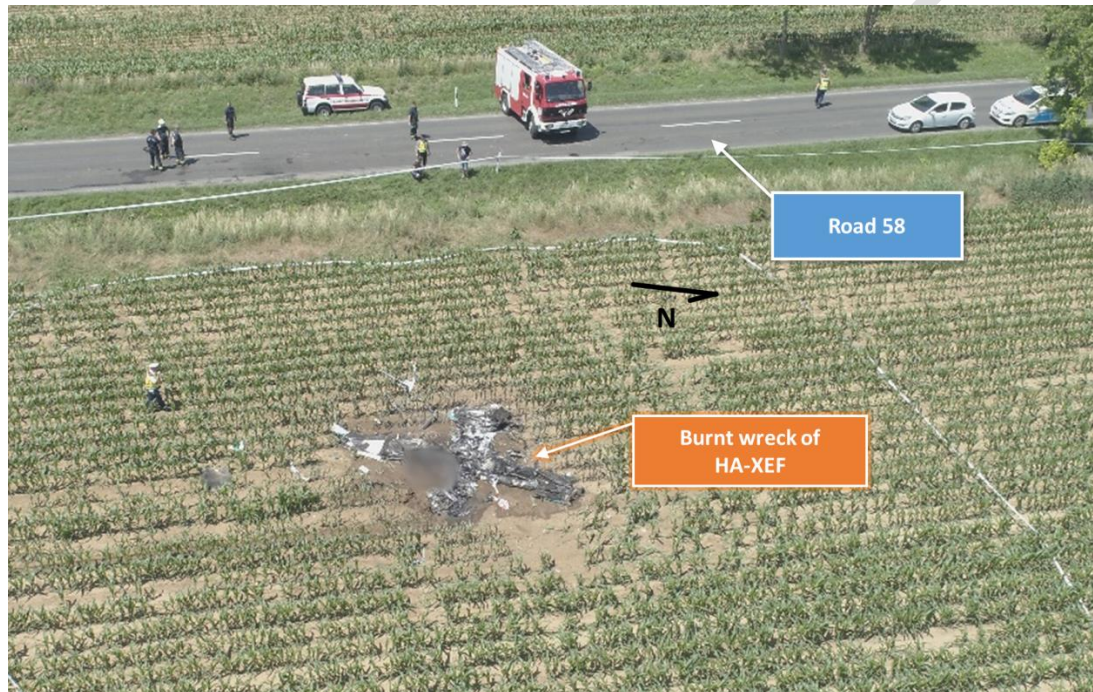


Figure 2: Scene of the accident (source of the photo: Police)

1.2. Injuries

Injuries	Crew		Passengers	Other
	Pilot	Flight Attendant		
Fatal	2	-	-	-
Serious	-	-	-	-
Light	-	-	-	
Uninjured	-	-	-	

1.3. Damage to aircraft

The aircraft was destroyed in the accident.

1.4. Other damage

The IC has not been informed on any other damage by this stage of the investigation.

1.5. Crew data

1.5.1. Data of the pilot occupying the right seat of the aircraft (pilot-in-command)

Age, citizenship, gender		61 years old, Hungarian, male
License data	Type	PPL(A), ULPL
	Professional validity until	PPL(A) 31/01/2020 ULPL 14/12/2020
	Ratings	SEP(land), TMG
Certificates		Pilot
Medical certificate valid until		2 / LAPL, 02/08/2018 / 02/08/2019

1.5.2. Data of the pilot occupying the left seat of the aircraft

Age, citizenship, gender		42 years old, Hungarian, male
License data	Type	PPL(A)
	Professional validity until	PPL(A) 30/06/2019
	Ratings	SEP(land), TMG, FI(A), FI(A)/CRI(A)SE
Certificates		Pilot
Medical certificate valid until		2 / LAPL, 10/07/2019 / 10/07/2019

1.6. Aircraft data

1.6.1. General data

Class	Fixed wing aircraft (MTOW<5700kg), (experimental aircraft)
Manufacturer	Magnus Aircraft Zrt.
Type	Magnus eFusion
Year of manufacturing	2016
Serial number	MG 11-004
Registration	HA-XEF
State of registry	Hungary
Date of registry	18/03/2016
Owner	Siemens Zrt.
Operator	Magnus Aircraft Kft.

	Hours flown	Number of take-offs
Since manufacturing	217:38	723
Since last periodical maintenance	32:27	90

1.6.2. Notes relating to Airworthiness

Airworthiness certificate	Number	LFH/12741-1/2018-NFM
	Date of issue	15/12/2018
	Valid until	The permit shall remain valid all conditions are adhered to as stated, until planned test flights are carried out, or 19 October 2018 (whichever comes first).
	Restrictions	Flights shall be carried out in accordance with the procedures and limitations written in eFusion Pilot's Operating Handbook (Rev. 00, 04/05/2016.) and the Flight Test Program (MAG-EN-50-001-A). Flights shall be carried out in airspace of Hungary only, in accordance with simple meteorological conditions and VFR day flight rules.

1.6.3. Aircraft engine data

Class	Electrical
Manufacturer	Siemens Zrt
Type	E-motor SP45D-V9
Serial number	008

SP45D-V9 is a permanent magnet synchronous machine with 3-phase, specially developed for flight applications by Siemens, and is operated by a Siemens inverter.

The Electric Propulsion Unit is the unit responsible for generating controlled power from the batteries to the propeller. The battery DC power is converted in the inverter into the proper three phase AC power for the permanent magnetic synchronous motor, type SP 45 Dv 9, that directly turns the propeller.

Propulsion unit parameters are displayed on the dedicated cockpit display.

1.7. Meteorological data

Anticyclonal influence was prevailing in Hungary on the day of the event, with a lot of sunshine with little cirrostratus and cumulonimbus cloud formation due to descending movement of the air. Daytime maximum temperatures varied between 28°C and 33°C.

The event took place at daytime, in good visibility conditions.

1.8. Airport data

The take-off leading to the accident took place from Pécs-Pogány Airport at 10:00 a.m. on 31 May 2018.

The planned destination aerodrome was Pécs-Pogány Airport.

Name of the aerodrome	Pécs-Pogány Airport
ICAO code of the aerodrome	LHPP
Altitude above sea level / reference temperature	198 m / 27.4°C
Runway directions	16 / 34

1.9. Data recorders

A small-size device, capable of recording data, audio and visual information, was mounted on the rear wall of the aircraft, in between the pilots. The device was positioned in such manner that its recordings should show the instrument panel in front of the pilots almost fully, the sight out of the aircraft partly, and the movement of the controls partly.

The data recording device installed on the aircraft was in operation. According to information obtained by the release of this Preliminary Report, data recorded by the device was fit for evaluation, except for on-board audio information.

Flight data recorder	Manufacturer	APPAREO SYSTEMS INC
	Type	Appareo Vision 1000
	Place of reading	Germany – BFU
	Place of finding the device, condition of the device	Scene of the accident; damaged



Figure 3: Appareo Vision 1000

(source of the photo: <https://www.appareo.com/aviation/flight-data-monitoring/vision-1000>)

The device was able to record and store the following major data types, among others:

- video, and audio information in the flight cabin,
- GPS coordinates,
- Time data,
- Aircraft orientation data (roll, pitch, direction... etc.).

The device stores the aforesaid information on an SD card which is able to fall out the housing of the device in the case of an accident, which largely decreases the possibility of data loss.

The IC sent the SD card found at the scene to BFU for the sake of recovery of data.

BFU successfully downloaded data which provided useful information for the investigation, except for on-board audio information. An initial processing of the video information offers the following findings:

During the flight leading to the accident:

- the video records available show neither smoke nor any sign of on-board fire (within the visual field of the camera);
- the displays related to the electric propulsion system showed normal operation;
- the large on-board multifunctional flight data display was in operation, as well as the on-board barometric instruments;
- there was no information relating to malfunction in the steering control systems;
- there was no sign of technical malfunction of the airframe structure.

1.10. Wreckage and impact information

The wreck of the aircraft was found on the spot with geographical coordinates N45.97551° E018.23002°, by Road 58, as shown in Figure 2.

1.11. Forensic medical information

According to the forensic investigation, there is no evidence of physiological factors or other obstacle which would have influenced the flight crew's capacity.

1.12. Fire

According to data available, there is no sign of smoke or fire during the flight which ended in an accident. The IC's position is that the fire started after the aircraft crashed to ground.

1.13. Survival aspects

The accident was not survivable. Both occupants of the aircraft suffered lethal injuries at the moment of the impact; their lives could not have been saved even by immediate medical intervention.

1.14. Tests and research

1.14.1. 14 June 2018 – additional survey

The Investigating Committee of TSB performed an additional survey in Pécs in presence of representatives from each stakeholder.

Relying on circumstantial evidence, it was concluded that the fire started after the aircraft crashed to ground.

1.14.2. 18 and 19 July 2018 – additional survey, investigation

On 18/07/2018, the Investigating Committee of TSB Hungary had the remaining parts of the electric motor and the inverter, among others, dismantled (in the presence of representative of the owner of the aircraft) from the wreck (seized in the city of Pécs), for further inspections to be made. According to on-site visual assessment, the state of the dismantled units was fit for further inspection. The units were transported to the aircraft owner's workshop/laboratory for such inspection, where the items were placed in a box, locked by TSB Hungary, for the inspection to be performed on the subsequent day. On 19/07/2018, the electric motor and the inverter found in the wreck were inspected in detail at the owner's workshop/laboratory, in presence of representatives from EASA, BFU, and all stakeholders.

(a) After disassembly of the permanent magnet 3-phase synchronous motor type SP45Dv9, the IC make the following major comments:

- After disassembling the motor we could not observe any causes (mechanical, electrical or thermal) from the electric machine side which could be the reason of operational malfunction,
- The damages clearly appear due to mechanical impact and subsequent external fire.

(b) Inspection of the inverter:

- Based on observations/measurements, no short-circuit occurred inside the inverter which could cause the immediate stop and blocking the motor rotation.
- The heat, which melted the grey material and detached the parts inside the inverter, was coming from an external heat source.
- Impact and the external heat after the impact caused the damage of the inverter.

2. Summary

According to the forensic investigation, there is no evidence of physiological factors or other obstacle which would have influenced the flight crew's capacity.

The accident was not survivable. Both occupants of the aircraft suffered lethal injuries at the moment of the impact; their lives could not have been saved even by immediate medical intervention.

The aircraft had valid Airworthiness Certificate issued by the competent authority.

The technical investigation performed by the release of this Preliminary Report has not revealed any evidence of malfunction of the structure or any system of the aircraft prior to the accident and would have contributed to the occurrence of the accident or influenced the course of the accident.

The flight ending in an accident took place at daytime, in good visibility conditions.

The data recording device installed on the aircraft was in operation, and data recorded by the device was fit for evaluation, except for on-board audio information.

According to data available, there is no sign of smoke or fire during the flight; the fire started after the aircraft crashed to ground.

The damages of the motor were clearly due to mechanical impact and subsequent external fire.

Impact and the external heat after the impact caused the damage of the inverter.

Budapest, 24 July 2018