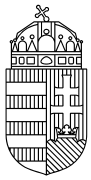


MINISTRY OF
TECHNOLOGY AND INDUSTRY

TRANSPORTATION SAFETY BUREAU

FINAL REPORT

Aero AT-3, HA-BHL

Tököl Airport (LHTL), 18 November 2019

Accident

2019-1049-4

The sole objective of a safety investigation is to find the causes and circumstances of aviation accidents or incidents and to initiate the necessary safety measures; furthermore, to make recommendations in order to prevent similar cases in the future. It is not the objective of an investigation to apportion blame or liability.

Introduction

Synopsis

Occurrence class		Accident
Aircraft	Model	Aero AT-3
	Registration	HA-BHL
Occurrence	Date and Time	18 November 2019 12:28 LT
	Location	Tököl non-public take-off and landing site (LHTL) *(hereinafter: 'Airport')*
Purpose of flight		Instruction (Training)
Injuries		No one was injured
Damage to Aircraft		Damaged beyond repair

During the trainee's first solo flight with the light aircraft mentioned in the table above, he lost control over the aircraft during take-off phase of the touch and go. According to witness statements, he crashed to the ground from about 2 to 3 metres and came to rest as seen in *Figure 1.*

The Investigating Committee (hereinafter: "IC") of the Transportation Safety Bureau attributed the direct cause of the crash to human factors related to the student pilot, identifying the most important factor as the reduced performance due to his mental strain.

The IC has not found any circumstances that would justify a safety recommendation.

Figure 1: The damaged aircraft

Definitions and abbreviations

Aerodrome	*A defined area (including any buildings, installations and equipment) on land or water or on a fixed offshore or floating structure intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft*
ARP	*Airport Reference Point*
ATO	*Approved Training Organisation*
EASA	*European Union Aviation Safety Agency*
Flight plan	*Specified information provided to air traffic service units, relative to an intended flight or portion of flight of an aircraft;*
IAS	*Indicated Airspeed*
IC	*Investigating Committee*
ICAO	*International Civil Aviation Organization*
Kbvt.	*Act CLXXXIV of 2005 on the safety investigation of aviation, railway and marine accidents and incidents and other transportation occurrences*
LT	*Local Time*
MTI	*Ministry of Technology and Industry*
NFM	*Ministry of National Development (until 18 May 2018)*
PPL	*Private Pilot Licence*
TSB	*Transportation Safety Bureau*
UTC	*Coordinated Universal Time*
Vx	*The indicated forward airspeed for the largest angle of climb*
Vy	*The indicated airspeed for the highest rate of climb*

General information

All times indicated in this report are in local time (LT). LT at the time of the occurrence: UTC+1 hour.

Geographic locations throughout this document are provided in WGS-84 standard.

The capitalised positions used throughout this document (e.g. Captain, Pilot, etc.) refer to the particular persons concerned in the event investigated.

Pursuant to point k) Subsection (1) Section 7 of Act CLXXXIV of 2005 on the safety investigation of aviation, railway and marine accidents and incidents, the Draft Report has been written in a form appropriate to the seriousness and nature of the occurrence.

Reports and Notifications

The occurrence was reported to TSB's call center at 12:35 on 18 November 2019, by the on-call officer of the competent police unit.

TSB of Hungary notified the following organisations:

- Accident Investigation Authority of the State of Manufacture on 19 November 2022, at 13:46.
- EASA on 19 November 2022, at 13:46.
- Accident Investigation Authority of Turkey on 19 November 2022, at 13:55.

Investigation Committee

The Head of TSB appointed the following persons in the investigating committee (hereinafter: IC).

Investigator-in-Charge	Mr. Gábor Erdősi	investigator
Member	Ms. Kitti Dusnoki	investigator

Overview of the Investigation Process

Receiving event notification, the on-duty manager of the TSB ordered an immediate dispatch to the site.

Pursuant to Article 5 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/ECA the TSB is required to initiate an investigation in the following circumstances.

1. *Every accident or serious incident involving aircraft other than specified in Annex II to Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency (6) shall be the subject of a safety investigation in the Member State in the territory of which the accident or serious incident occurred.*
2. *When an aircraft, other than specified in Annex II to Regulation (EC) No 216/2008, registered in a Member State is involved in an accident or serious incident the location of which cannot be definitely established as being in the territory of any State, a safety investigation shall be conducted by the safety investigation authority of the Member State of registration.*
3. *The extent of safety investigations referred to in paragraphs 1, 2 and 4 and the procedure to be followed in conducting such safety investigations shall be determined by the safety investigation authority, taking into account the lessons it expects to draw from such investigations for the improvement of aviation safety, including for those aircraft with a maximum take-off mass less than or equal to 2 250 kg.*

4. *Safety investigation authorities may decide to investigate incidents other than those referred to in paragraphs 1 and 2, as well as accidents or serious incidents to other types of aircraft, in accordance with the national legislation of the Member States, when they expect to draw safety lessons from them.*

Based on the findings of the site inspection and with regard to Article 5 (1) of Regulation (EU) No 996/2010 of the European Parliament and of the Council, the head of the TSB decided that an investigation is required and will be launched.

In the course of the investigation the IC has taken the following steps:

- carried out an immediate inspection at the airport in Tököl, during which photographs were taken and a report was made;
- interviewed witnesses at the scene of the occurrence;
- requested the student pilot's training logbook, the flight school's ATO Manual, Training Manual and the aircraft maintenance documentation;
- interviewed witnesses subsequently.

Investigation Principles

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

- 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 safety investigation of aviation, railway and marine accidents and incidents (referred to as Kbvt. throughout the document),
- NFM (Ministry for National Development) Regulation 70/2015 (XII.1) on safety investigation of aviation accidents and incidents, as well as on detailed investigation for operators,
- In matters not covered by Kbvt., Act CL of 2016 on General Public Administration Procedures.

The competence of the Transportation Safety Bureau of Hungary is based on Government Regulation № 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 legislation,

- Transportation Safety Bureau of Hungary shall investigate aviation accidents and serious incidents.
- Transportation Safety Bureau of Hungary may investigate aviation and incidents which – in its judgement – could have led to accidents of more severe consequences in different circumstances.
- Transportation Safety Bureau of Hungary is independent of any person or entity that may have interests in conflict with the objectives of the investigating body.
- In addition to the aforementioned legislation, TSB of Hungary shall conduct safety investigations in line with ICAO Docs 9756 and 6920 Manual of Aircraft Accident Investigation.
- This Report shall not be binding, nor shall an appeal be lodged against it.
- The original of this report was written in Hungarian.

No conflict of interest has been identified between safety investigators appointed to the IC. No investigator assigned with a safety investigation has been involved as an expert in any other procedure pertaining to the same case and shall not do so in the future.

The IC shall retain all data and information having come to their knowledge in the course of the safety investigation. Furthermore, the IC shall not be obliged to make such data and information available to other authorities, whose disclosure could have been legally refused by their original owner.

This Final Report is based on the Draft Report prepared by the IC and shall be sent to all involved parties for comments, as set forth by the relevant regulations.

No comments on the draft report were received from the interested parties within the legal deadline.

Copyright

Translation

This document has been translated from Hungarian. Although efforts have been made to provide a translation as accurate as possible, discrepancies between the versions might occur. In such eventuality, the Hungarian version shall prevail.

Factual information

Flight history

On the day of the accident, the student pilot and his flight instructor arrived at the airport (LHTL) at around 8 a.m. to conduct a training flight need for obtaining a private pilot licence with the Aero AT-3 aircraft, registration HA-BHL. After they arrival, they began preparation for the first flight task, which included the practicing emergency procedures based on the training logbook. Following preparation and acceptance of the aircraft, they started the engine and taxied to the runway 32 holding point. During the engine check, the aircraft's engine was running at 4900 rpm at full throttle instead of the 5050 rpm according to aircraft flight manual, so they taxied back to the hangar where they consulted the flight school's mechanic about solving the engine problem. The mechanic advised the flight instructor and his student pilot that this reduction in RPM was not to the extent that it would affect the execution of the task. After that, they performed the first flight task lasting 1 hour and 30 minutes, including the associated emergency drills were carried out at Kiskunlacháza airport. After returning to Tököl airport and rest/preparation of about half an hour, they started the second flight task, which was a one-hour check flight on a traffic pattern. After completing the traffic pattern, they took a 20-minute break and the instructor allowed the student pilot for his first solo flight, which involved flying two laps in the traffic pattern. After completing the first pattern, he performed a touch and go at an airspeed of more than 45 knots during the initial climb according to his account, which was sufficient for the flight in his opinion. The flight instructor and the aerodrome flight information service officer agreed that, after performing this manoeuvre, the aircraft began a sudden steep climb and banked left from the intended path. The left wing then dipped and hit the ground, causing the aircraft span to the left and then hit the ground with the nose and right main landing gear next to the runway. The aircraft came to rest at 12:28 at the coordinates 47°20'33"N, 018°59'09"E after a short drift about 25 m. The propeller blades and the nose wheel broke off, and the right main landing gear collapsed in the accident.

Aircraft Damage

The aircraft was damaged beyond repair as a result of the ground impact. The propeller blades and the nose landing gear broke off, the RH side main landing gear mount was bent out, the wings were severely deformed together with the wing spar root joints; the canopy and the engine cowling fractured.

Figure 2: Visible damages to the aircraft

The investigation did not reveal any information that the aircraft structure had failed prior to the incident, thereby contributing to or influencing the occurrence of the incident.

Personnel Information

The student pilot's data

The foreign student pilot started his theoretical PPL training on 26 July 2019 and completed it on 04 October 2019. Then he passed the theoretical exam on 28 October 2019. He started his practical training shortly before his theoretical exam and had approximately 22 hours flight time before the accident.

The student had a valid medical certificate for the training at the time of the accident, but his stay in Hungary was limited by the expiry date of his visa.

The flight instructor's data

The flight instructor was very experienced: he had been teaching and instructing at the flight school for more than 2 years, according to his account. According to the training logbook, he had flown 7 hours and 30 minutes with the student.

Aircraft data

General information

The aircraft is a metal-frame, low-wing, 2-seat, single-engine, piston-powered training aircraft built in 2017. Due to its low maximum take-off mass (582 kg) and the relatively large lateral surface area of the rear fuselage and tail section, the aircraft is sensitive to crosswinds.

According to section *4.6.4 Crosswind take-off or landing* of the Flight Manual[1], the maximum allowable crosswind component determined during the production flight testing is 11.7 knots (6 m/s). According to the aforesaid manual, this means such a large crosswind that does not require the pilot to have sophisticated airplane driving skills, a high level of concentration or intensive steering force.
The flight manual lists the take-off steps as follows:
After releasing the brakes, open throttle to full travel, maintain direction using rudder pedals, maintain airspeed of 60 kts after lift-off, brake rotating wheels of the landing gear, increase airspeed to 65 kts when 50 ft/15 m height is reached, retract wing flaps, switch the auxiliary fuel pump off.

The two tables below show the relevant airspeed values (in knots) in the flight manual:

Flap position	Lift-off (IAS)	Rate of climb (IAS)	Vy (IAS)	Vx (IAS)
0	46	65	65	59
15	42	60	59	54

Table 1: Airspeeds required for take-off

Angle of wing flap displacement (degree)	value of banking angle (degree)	Stalling speed (IAS)	
0	0	46	kts
15		44	kts
40		39	kts
0	30	50	kts
15		49	kts
40		43	kts
0	60	70	kts
15		67	kts
40		60	kts

Table 2: Stalling speeds in various configurations (take-off weight: 582 kg)

[1] AEROPLANE FLIGHT MANUAL for the AT-3R100 VERY LIGHT AEROPLANE (SEPTEMBER, 2004)

Weather Information

According to meteorological data of Tököl airport, the weather was rainy with variable cloudiness in the morning, but cleared up with time, however, the wind increased. During the morning flights, the wind speed was 5 knots, from 090 degrees, with gusts of 7 knots, which changed to 180 degrees and increased to 10 knots with gusts of 18 knots by the time of the accident.

Communication

The student pilot had radio contact with the airport service and his flight instructor was also monitoring the radio traffic using a handheld radio with a transceiver function.

Aerodrome Information

Name of aerodrome	Tököl Non public take-off and landing site
Location indicator	LHTL
Airport operator	Master Sky Kft.
Reference point (ARP)	47°20’44”N, 018°58’51”E
Elevation	101 m
Runway identification	14/32
Runway dimensions	concrete: 1768 m x 60 m grass: 1100 m x 50 m
Runway surface	concrete, grass

Data Recorders

No data recorder is required for the aircraft type affected, but it did have the capability to record engine parameters (engine control instrument, type Electronics International Inc. MVP-50). The speed and altitude values relevant to the investigation were not recorded, but the recorded engine speed data was used by the IC during the investigation. The curve of the engine speeds of the accident flight versus elapsed time is shown below:

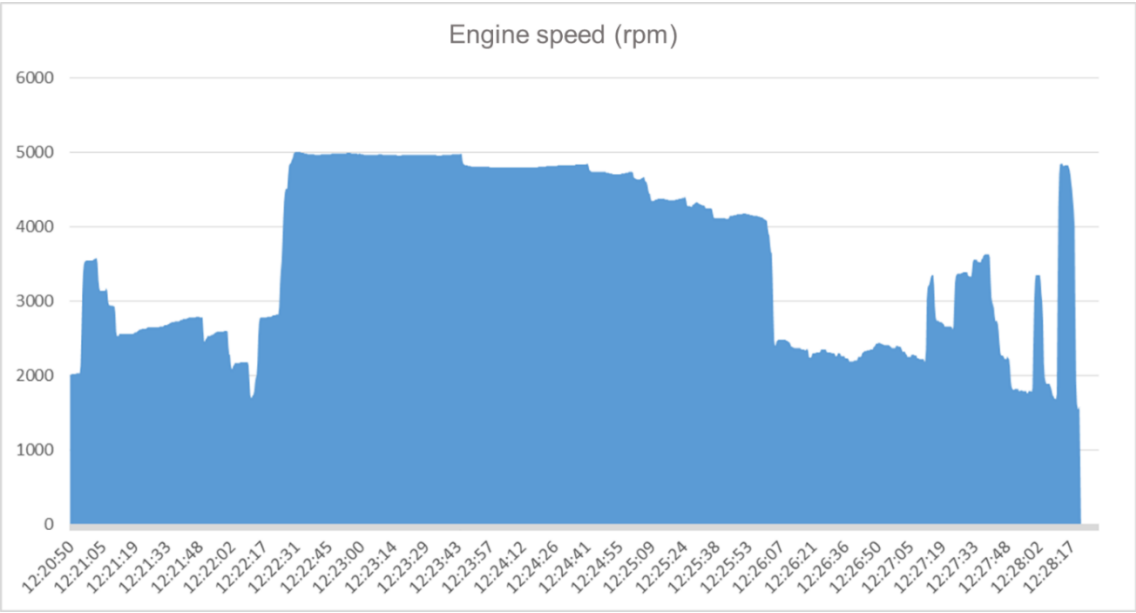


Figure 3: Diagram of engine speed as a function of time

Wreckage and Impact Information

Following an uncontrolled flight after a touch and go, the wreckage of the aircraft was found 100 m to the left of the centre line of the runway 14, more than 180 degrees to the left of the take-off direction, at the coordinates 47°20'33"N, 018°59'09"E. The locations of the marks in the ground are shown in *Figure 4*.

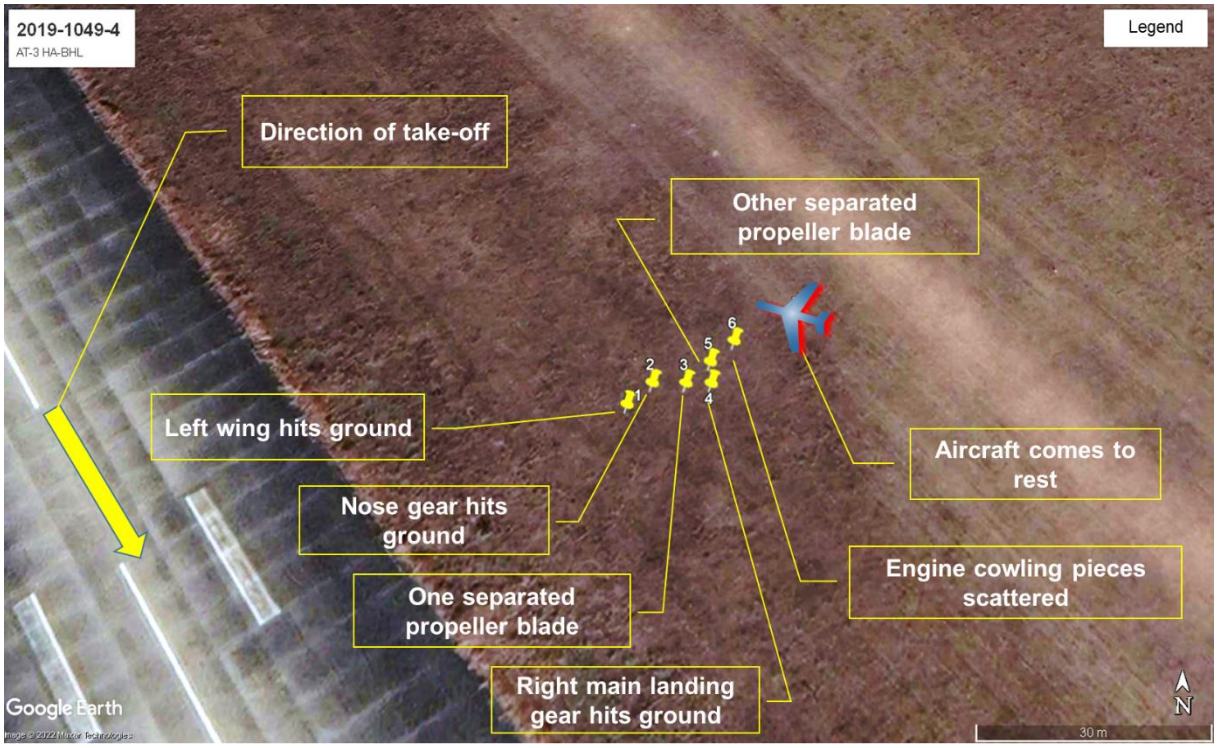


Figure 4: Locations of the marks in the ground

The point of ground impact of the left wing and the position of the propeller blade fracture were identified, as well as the skid marks created by the landing gear. There was no video recording of the accident of sufficient quality, but, based on witness accounts and the traces on the ground, the IC determined the flight path (see *Flight history* chapter for details).

Organizational and Management information

According to IC's information, the training organisation moved its headquarters from Esztergom Airport to Tököl Airport as of 01 November 2019.

The IC has examined the Operations Manual of the flying school as an ATO organisation, which limits the maximum flight time for students to a maximum of 2.5 hours per day (unless the task is cross-country flying), and allows a maximum of 3 flight tasks per day. In addition, the ATO Operations Manual limits the maximum wind speed as well as the crosswind component. The maximum permissible wind speed for a solo flight by a student pilot is 20 knots, and the maximum speed for a crosswind component is 10 knots. The Manual provides for standardised training for flight instructors upon joining the flight school, in which they will be familiarised with the requirements of the Operations, Training and Aircraft Flight Manuals, as well as the contents of theoretical and emergency training. They must confirm the acquisition of this knowledge with their signature. In addition, the chief flight instructor appointed by the training organisation shall conduct refresher training for flight instructors once a year.

Additional Information

The student pilot's training

An insufficient driving skills was recorded in the training logbook recorded where the student could only maintain the expected airspeed with a large deviation (10-15 knots). In addition, the IC found in the student's training document a set of questions for the AT-3 theoretical internal exam, which included, among others, the question "*What is the lift-off speed with the flaps open to 15 degrees?"* That question was found to be misleading by the IC.
According to one of his flight instructors, the student pilot had a tendency to take the aircraft into a steep climb with intense steering movements, and on several occasions he was able to avoid a dangerous reduction in speed only on the instructor's instructions. In addition, the instructor who had flown most of the time with the student described him as '*not a cool headed person'.*

Analysis

The foreign student involved in the occurrence had a valid medical certificate appropriate for the flight and, according to the training logbook, had flown 22 hours of practical PPL training. At the time of the occurrence, he had been flying for the 3rd consecutive day at the less familiar Tököl Airport, due to a change of base airport by the training organisation.

The fact that the student pilot's stay in Hungary was limited by visa had a negative impact on his acquisition of a licence, as he was heavily burdened with several daily flight tasks and several consecutive days of flights in order to rush the training. As a consequence, the experience of the flights could not be retained in the mind of the student to the expected quality and the efficiency of learning and acquisition of experience decreased in the IC's opinion.

According to reports, the student pilot had a tendency to steer the aircraft into an intense climb after the lift-off, which critically reduced the aircraft's speed and increased the angle of attack of the wings and bring the aircraft into a near-stall position. During the traniee's course, there were several instances where he did not realise the critical value in time and only made the necessary manoeuvres upon instruction from the flight instructor. In the IC's opinion, it is a common phenomenon for physically and mentally stressed people to act instinctively in response to an unexpected situation, if they have not been trained to deal with the situation at a skill level (this is often detrimental to inexperienced pilots, because humans do not have the basic instinct to fly). A combination of stressful personality and exhaustion is particularly detrimental to human performance. During the previous flight exercises, the student presumably had not practiced the phases of take-off precisely and to a skill level, as he also began an overly intense climb during the take-off that ended up in an accident. The combined effect of the strong and gusty crosswinds and the flight at the stall limit allowed a flight situation to develop from which the aircraft fell back to the ground after the left wing had stalled.

During the investigation, the IC studied the ATO Operations Manual. According to those requirements, a maximum of 2 hours 30 minutes of flying per day per student is allowed, except for cross-country flights. In contrast, the student had already completed 2 flight tasks with his instructor, with breaks of 20 to 30 minutes, prior to his solo flight, and had already reached the maximum permitted flying time. In these two tasks, emergency drills and touch and go were performed in various configurations. According to the IC, these flight tasks, when practised for such a long time, represent a serious mental strain even for an experienced pilot, while for a less experienced student this strain can lead to a dangerous level of overload. It was seen in the training logbook that, for several flight tasks, the student pilot had flown for 2 to 2.5 hours daily on consecutive days with different airspace and traffic pattern flight tasks. Once, during the 3 flight tasks of the day, he performed more than 3 hours of traffic pattern flight with his instructor, despite the limits in the manual. In the IC's opinion, the student pilot's exhaustion due to too much flight was a major contributing factor to the accident

In the IC's opinion, the theoretical exam (an internal "type" exam for the AT-3 R100) includes a definitely misleading question which asks for the value of the lift-off speed, while the speed required for a safe climb is not included in the questions. Presumably, the speed value the student pilot fixed in his mind was not the much more relevant speed required for climb (60 then 65 knots), but the speed required for a lift-off (42 knots), which can be life-threatening for further climb, especially in windy, gusty weather. The student pilot said several times during his hearing that his speed was over 45 knots, so it must have been sufficient to stay airborne. However, this is only true for flights in 0° bank and in calm weather conditions. On the basis of this information, the IC concludes that the speed values required for lift-off were more effectively fixed in the student pilot's mind than those required for a safe climb.

The aforementioned wind of 10 knots coming from the 180 degrees (40° angle of attack), with gusts of 18 knots blowing at the time of the accident requires a high level of attention and skill, which is not the case for a student pilot, especially for such a low hour trainee and after a high number of consecutive flights. The maximum crosswind component value of 10 knots, as specified in the ATO Manual, was also exceeded by 1.6 knots when calculated from the gusts, and the student should not have flown according to the training organisation's instructions. It is true that on the day of the accident, the winds had been within limits during the previous flights, but with time, the wind speeds increased and the winds showed an increasingly S-SW, which the instructor should have monitored. In the IC's opinion, flying the student pilot alone in this conditions that near the aircraft's weather limits and exceeded the wind speed maximums prescribed by the organisation also contributed to the accident.

The aircraft's engine was operating normally before the accident *(Figure 5).* During the take-off ending up in the accident, the engine was running at the correct speed.
In the last third of the descent phase, a range of engine speed rise can be seen. Based on the IC's experience, in this flight phase, a thrust increase by the student pilot is seen to correct the low attitude approach, which is a phenomenon that often occurs during the approach in powered aircraft. After the flare, the diagram shows an abnormal rpm rise and then fall for about 6 seconds, which was not shown in the rpm data of previous traffic pattern flights. Based on a comparison of data, the IC identified the thrust increase as a result of the student pilot's haste resulting from exhaustion. The right side of the diagram shows the power increase to maximum and the engine stop after impacting terrain.

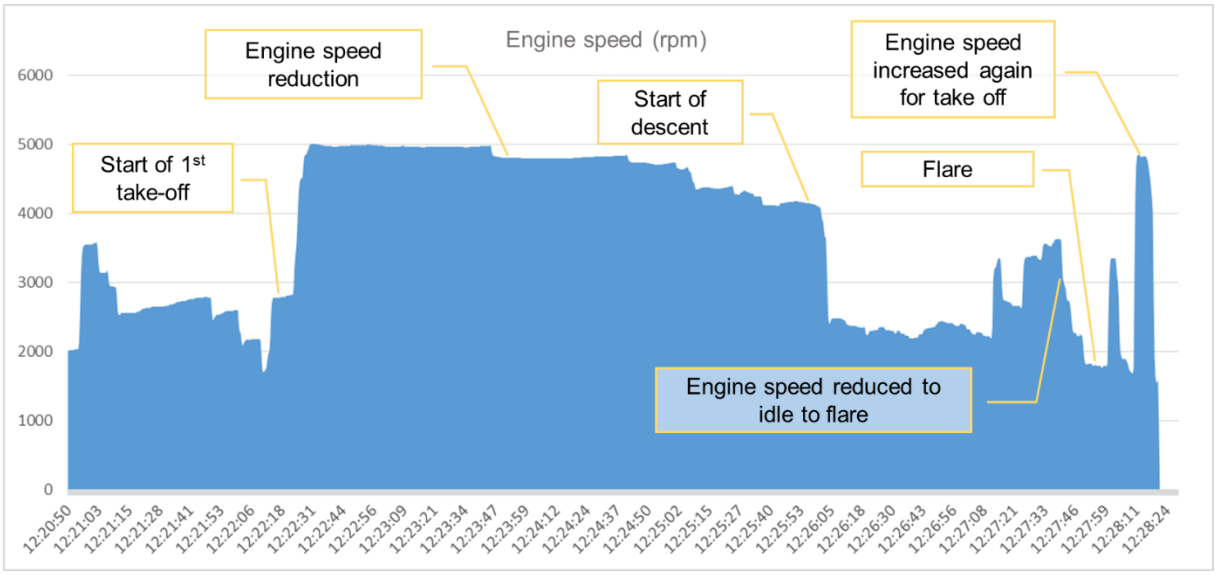


Figure 5: Engine speed diagram as a function of time during the flight ending up in the accident

Based on the relevant phase of flight and the evidence on the ground the aircraft impacted to the terrain at low speed and from a low altitude. The student pilot had no injury due to the favourable sequence of impact of the structural elements of the aircraft, as the ground impact of the left wing, then the nose landing gear, the nose section and the main landing gear absorbed a significant proportion of the total impact energy.

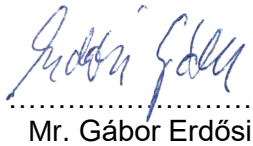
Conclusions

The IC attributed the direct cause of the accident to human factors related to the student pilot, in which the main factor is the student pilot's reduced performance due to mental strain.

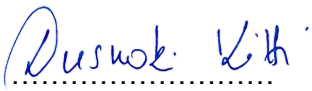
As an indirect cause, the IC found the flight instructor had not sufficiently careful activity, furthermore identified the deviation from the requirements of the Training Manual as a contributing factor.

The Investigating Committee of the TSB identified no circumstances that would justify a safety recommendation.

Dated in Budapest, on 11 November 2022



Mr. Gábor Erdősi
Investigator-in-Charge



Ms. Kitti Dusnoki
Investigator