

MINISTRY FOR Innovation and Technology Transportation Safety Bureau

# FINAL REPORT

2018-548-4

Accident

5 km West of Vésztő 5 August 2018

Cirrus Standard OK-7077 SZD-41 Jantar Standard HA-4361

The sole objective of the safety investigation is to reveal the causes and circumstances of aviation accidents or incidents 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 investigate or apportion blame or liability.

# **General information**

This investigation has been 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 7<sup>th</sup> December 1944,
- Act CLXXXIV of 2005 on the technical investigation of aviation, railway and marine accidents and incidents (hereinafter referred to as: Kbvt.),
- 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 related regulation of the Kbvt., the Transportation Safety Bureau of Hungary conducted the investigation in accordance with Act CXL of 2004.

The competence of the Transportation Safety Bureau of Hungary is based on Government Decree N 278/2006 (XII. 23.), and, as from 01 September 2016, on Government Decree N 230/2016. (VII.29.) 23) on assignment of a transportation safety body and on the dissolution of Transportation Safety Bureau with legal succession.

### Pursuant to the aforesaid laws

- The Transportation Safety Bureau of Hungary shall investigate aviation accidents and serious aviation incidents.
- The Transportation Safety Bureau of Hungary may investigate aviation accidents and incidents which – in its judgement – could have led to more accidents with more serious consequences in other circumstances.
- The Transportation Safety Bureau of 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 version of this Report was written in the Hungarian language.

Incompatibility did not stand against the members of the IC. 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 safekeep 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.

### **This Final Report**

was based on the draft report prepared by the IC and sent to all affected parties (as specified by the relevant regulation) for comments.

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#### Transportation Safety Bureau, Ministry for Innovation and Technology

2/A. Kőér str. Budapest H-1103, Hungary www.kbsz.hu kbszrepules@itm.gov.hu

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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.

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# **Definitions and abbreviations**

- 3D Three-dimensional (spatial) display
- EASA European Aviation Safety Agency
- FI(R) Flight Instructor (Restricted)
- GKM Ministry of Economy and Transport (Hungary)
  - IC Investigating Committee
- ICAO International Civil Aviation Organization
- igc file Digital data format which plots the flight path stored by a GPS-based flight recorder
  - ITM Ministry for Innovation and Technology (Hungary)
- Kbvt. Act CLXXXIV of 2005 on the technical investigation of aviation, railway and marine accidents and incidents
  - LT Local Time
- MND Ministry of National Development
- NTA AA National Transport Authority Aviation Authority (till 31 12 2016) (Hungary)
  - S Sailplane
  - SPL Sailplane Pilot Licence
  - thermal A column of air rising for thermal reasons, in which the pilot of a sailplane may increase the flight altitude of the aircraft without using an engine.
- thermal soaring When an aircraft tries to increase its flight altitude, without using an engine, by soaring circularly in a thermal.
  - TSB Transportation Safety Bureau ((Hungary)
  - UTC Coordinated Universal Time
  - VFR Visual Flight Rules

# Introduction

Occurrence category		Accident	
	Manufacturer	Schempp-Hirth	PZL-Bielsko
	Туре	Cirrus Standard	SZD-41A Jantar Standard
Aircraft	Registration sign	OK-7077 (Figure 1)	HA-4361 (Figure 2)
	Operator	Plachtařskŷ spolek ČR, IČO:037 01 280	Aero Club Hajdúszobosz- ló Sport Club
Occurrence Date and time Location		05 Aug 2018, 15:23	
		Vésztő west, 5 km (Figure 3)	
Number of people severely injured in the accident:		0 / 0	
Extent of damage of the aircraft involved in		OK-7077: seriously damaged	
the occurrence:		HA-4361: substantially damaged	

Any clock-time indicated in this report is given in local time (LT). Time of the occurrence: LT= UTC+ 2 hours.



Figure 1.: The Cirrus Standard aircraft involved in the occurrence (source: Internet)



Figure 2: The SZD-41 Jantar Standard aircraft involved in the occurrence (source: Internet)



Figure 3: Location of the occurrence in Hungary

### **Reports and notifications**

The occurrence was reported to the dispatcher of TSB by the duty service of Hungarocontrol Zrt. on 05 August 2018, at 15:34.

#### **TSB Hungary notified:**

- the investigating authority of the state of registration of the aircraft with reg. mark HA-4361, on 05 August 2018, at 18:19.
- the investigating authority of the state of registration of the aircraft with reg. mark OK-7077, on 05 August 2018, at 15:59.
- the investigating authority of the state of the manufacturer of the aircraft with reg. mark HA-4361, on 13 August 2018, at 10:56.
- the investigating authority of the state of the manufacturer of the aircraft with reg. mark OK-7077, on 13 August 2018, at 10:53.

### **Investigation Committee**

The Head of TSB assigned the following investigating committee (hereinafter referred to as IC) to the investigation of the case:

Investigator-in-charge	Miklós FERENCI	Investigator
Member	György HÁY	Investigator

### **Overview of the investigation process**

- The IC commenced investigation of two scenes at the same time: at the wreck of the crashed aircraft with reg. mark OK-7077, and at the scene of landing of the aircraft with reg. mark HA-4361 at Békéscsaba Airport, and during that, the IC:
  - ♦ inspected both aircraft.
  - $\diamond$  took photos of both aircraft.
  - $\diamond$  interviewed the pilots involved.
  - $\diamond$  downloaded and listened to the audio records of the radio communication.
  - $\diamond$  downloaded the contents of data recorders, or seized the originals.
  - $\diamond$  found and interviewed the eye witnesses of the collision.
  - ♦ photocopied the documents of the pilots, the aircraft, and the flight tasks.
- Based on analysis of information from flight data recorders, the damage to the aircraft, and the information from the interviews, the IC reconstructed the spatial situations and movements of the aircraft before and after the collision.
- The IC also downloaded data published by the organisers of the competition on the internet, and reconstructed the respective positions of other aircraft around the location of the accident.
- The IC requested a human factor expert to inspect and analyse in detail the acts and motivations of the pilot who had caused the collision.
- The IC prepared diagrams to demonstrate facts and contexts of major importance.

# Short summary of the occurrence

During a cross-country flying task as an event of the XI. Flatland Cup, which is an international competition for sailplanes, the type Cirrus sailplane with reg. mark OK-7077 collided mid-air with a type Jantar sailplane with reg. mark HA-4361 while soaring in a thermal near Vésztő town. The pilot of the Cirrus left his aircraft immediately after the collision, and landed safely using his parachute. The pilot of the seriously damaged Jantar first continued his flight in the direction of Szeged Airport (which 110 km ahead), but then, after flying for almost 30 minutes and receiving a suggestion through radio, he landed at Békéscsaba airport which was closer.

The IC attributes the occurrence primarily to human factors on the part of the pilot of the Standard Jantar.

The IC proposes no safety recommendation because similar occurrences can be prevented by following relevant rules.

# **1.** Factual information

## **1.1.** History of the flight

Both of the aircraft involved in the accident participated in the XI. Flatland Cup, which is an international competition for sailplanes at Szeged Airport. The competitors were offered two categories ("FAI Club" and "Mixed-Open"). On the day of the accident, there were 25 participants in the Mixed-Open category, and 35 in the FAI Club category. The pilots involved in the occurrence were competing in the FAI Club category. On the day of the accident, the task for competitors in the FAI Club category was to fly the Zsombó-Kisszállás-Zsáka-Sándorfalva-Finish (Szeged Airport) route of 353.2 km as fast as possible. On that day, participants in the Mixed-Open category headed for the Kiskundorozsma-Csengele-Mezőhegyes-Nádudvar-Sándorfalva-Szeged Airport route of 391.8 km.



Figure 4: The specified task route (black line) and the flight path of the HA-4361 (blue line) (Source: flight data recorder)

The sailplane with reg. mark HA-4361 took off at 11:38 and the sailplane with reg. mark OK-7077 at 12:07, both from Szeged Airport, and both by aerotow. The sailplane with reg. mark OK-7077 crossed the start line (Zsombó) at 13:04, at the altitude of 1650 metres, and the sailplane with reg. mark HA-4361 7 minutes earlier, at 12:57, at the altitude of 1500 metres. The two aircraft involved in the accident reached Zsáka turnpoint practically at the same time, at 15:07; the sailplane with reg. mark OK-7077 at the altitude of 1980 metres, and the other one at 2200 metres, i.e. 240 metres higher. Next, turning almost completely back, both aircraft headed toward Sándorfalva, the next turnpoint (Figure 4).

After gliding ca. 28 km, they reached a large cumulus cloud at the western side of Vésztő town. The sailplane with reg. mark HA-4361 began to circulate beneath the cloud, clockwise, at an altitude of 1520 m, at 15:19, and climbed 1.9 m per second on average. The sailplane with reg. mark OK-7077 reached the same cloud one minute later, at an altitude of 1530 m, and also began to soar in the thermal, climbing 2.1 metres per second on average, but stopped soaring after two minutes, glided about a kilometre southwest, and continued thermal soaring to climb there, 2.1 m/s on average, until the collision occurred (Figure 5).



Figure 5: Movement of the aircraft involved, right before and after the collision

Somewhat before 15:23, the HA-4361 stopped circulating, at the altitude of 1990 m, and also headed southwest. Its flight path began to approach, to a proximity of 2 to 3 wingspans, the earlier circular path of the OK-7077. Its altitude somewhat decreased while cruising, and the altitude of its centre of gravity got a few metres higher than that of the OK-7077. When getting beside the circular path of the OK-7077, the HA-4361 began to get into a path which was to go round the path of the OK-



Figure 6: Centre of gravity and height of wingtip at bank

7077, running outside of it (Figure 5). However, the pilot of the OK-7077 reduced the bank of his aircraft, thus increasing the radius of its turn, so its path got closer to that of the HA-4361 aircraft which was outside of his primary visual field and the altitude of which was gradually nearing his own altitude. Due to the banking orientation, the altitudes of the wingtips were 4 to 5 metres different from those of the centres of gravity (Figure 6).

Prior to the collision, the fuselage and the right wing of the HA-4361 approached the left wing of the OK-7077 from behind and below. The impact force lifted the left wing of the OK-7077, and the aircraft tipped to the right along its longitudinal axis. The pilot of the OK-7077 jettisoned the canopy of the plane, unfastened the harness system, and, relying on the force of gravity, dropped out of the plane which was turning on its back. He deployed his parachute by pulling the rip cord handle, and landed safely after a temporary uplift in the thermal. Due to shift of its centre of gravity, his sailplane crashed in a spin on its back.

After the collision, the pilot of the HA-4361 aircraft came out of the turn, checked if his aircraft was controllable, then took a wide left turn to return to the scene of the collision in two minutes, and flew six circles in the thermal within four minutes, climbing up to the cloud ceiling which was at 2200 m (Figure 7). From there, he continued gliding in the usual

manner, heading to Szeged Airport, but first to Sándorfalva turnpoint, which was almost in the same direction. After almost half an hour flight, he was advised by radio from Szeged Airport to land his damaged aircraft as soon as possible, but at Békéscsaba Airport at latest, which he then performed.



Figure 7: The path of the aircraft with reg. mark HA-4361 during the six minutes following the collision

By analysing detailed flight data (IGC files) published on the Internet by the organisers of the competition, the IC found that there were 14 aircraft (9 FAI Club class and 5 Mixed-Open class) soaring in the thermal near Vésztő at the time of the accident, and five of them (including the two involved in the collision) were within a 100-metre altitude range between 1950 m and 2050 m. The distances of other aircraft within that altitude range from the spot of the accident varied from 110 to 250 metres (Figure 8). Simultaneous thermal soaring by aircraft from both sailplane classes could have occurred because some of the FAI Club class sailplanes returning from the direction of Zsáka (towards Sándorfalva turnpoint) met some outbound competitors of the Mixed-Open class (heading to Nádudvar) in the column of rising air beneath the cloud near Vésztő.



Figure 8: Spatial positions of the aircraft flying in the thermal simultaneously at the time of the collision

# **1.2.** Injuries to persons

Injurios	Crew		December	Other
injuries	Pilot	Flight Attendant	Passengers	Other
Fatal	-	-	-	-
Serious	-	-	-	-
Light	-	-	-	
Uninjured	2	-	_	

### **1.3.** Damage to aircraft

<u>**OK-7077**</u>: During investigation of the site, a continuous, red skid mark of 1.5 metres length was seen, running from the wing root towards the wing tip on the bottom part of the left wing of the aircraft found lying on its back. The structure of the wing was not damaged in this section. The trailing edge of the left wing was damaged in the section between the left aileron and the wingtip. Part of the lower surface of the wing was torn off in this section.





Figure 9: Photo of the cabin in recovered position



# Figure 10: The landed aircraft in upside down position

Figure 11: Lower part of left wing with the damaged trailing edge

The right wingtip showed scratches and paint damages parallel to the longitudinal axis of the aircraft. The canopy fractured, and the cover on the nose of the aircraft cracked and broke in several places. The inlet tube of the airspeed meter broke off. The trailing edge of the rudder at the side of the tail fin split apart along the trailing edge. Inside the cabin, the instrument console, which is a plate, was bent. As regards instruments, the display of the navigation system cracked, but proved to be serviceable, notwithstanding.

<u>**HA-4361</u>**: The rear 1/3 part of the Plexiglas of the rear part of the canopy broke and misses, some of its debris was found scattered inside the cabin. A longitudinal, gradually deepening scratch runs along the centreline of the canopy backwards as far as the edge of the fracture. At a distance of 25 cm from the fuselage, the leading edge of the right wing cracked to a depth of 15 cm. A piece of a trailing edge (made of composite and painted blue and red) broken off another aircraft (OK-7077) was wedged in the crack. Non-continuous abrasion and paint damages can be seen on the leading edge of the right wing. The red paint on the top front section of the right wingtip was completely rubbed off.</u>



Figure 12: The damaged canopy and the piece of trailing edge (from the OK-7077) which wedged into the wing

### **1.4.** Other damage

The IC had got no information on other damage by the completion of the investigation.

### **1.5. Personnel information**

### 1.5.1. Data of the pilot in command of the aircraft with reg. № OK-7077

Age, nationality, gender		19 years old, Czechish, male
	type	SPL
Licence data	professional valid until	Until withdrawal
	ratings	S
Certificates		SPL
Medical class and valid until		Class 2 / 08 Mar 2019
	in the previous 24 hours	8 hours / 2 take-offs
Flying hours/take-offs	total:	272 hours / 247 take-offs
	on the affected type, total:	208 hours / 72 take-offs

#### 1.5.2. Data of the pilot in command of the aircraft with reg. № HA-4361

Age, nationality, gender		23 years old, Hungarian, male
	type	SPL
Licence data	professional valid until	Until withdrawal
	ratings	Sailplane, FI(R)
Certificates		SPL
Medical class and valid until		Class 2 / 01 Feb 2021
	in the previous 24 hours	10 hours and 49 minutes / 2 take-offs
	in the previous 7 days	17 hours / 6 take-offs
hours/take-offs	in the previous 90 days	67 hours / 147 take-offs
	total:	603 hours / 590 take-offs
	on the affected type, total:	150 hours / 45 take-offs

# **1.6.** Aircraft information

No information emerged during the investigation relating to any such malfunction of the structure or any system of any of the aircraft preceding the occurrence which would have contributed to the occurrence or influenced its course. Aircraft data had no effect on the course of the occurrence, so it need not be discussed in detail.

### 1.6.1. OK-7077

General information

Class	Fixed-wing sailplane without engine
Manufacturer	Schempp-Hirth Flugzeugebau GmbH
Model	Standard Cirrus
Year of manufacture	1974
Serial number	385
Nationality and registration marks	OK-7077
State of registry	Czech Republic
Date of registry	16/01/2018
Name of the owner	Letecké sportovni centrum Aeroklubu Česke republiky z.s., IČO: 00528102
Name of the operator	Plachtařský spolek ČR, IČO:037 01 280

#### Notes relating to airworthiness of the aircraft

	Number	4255/2
Airworthiness	Date of issue	01 Apr 2008
Certificate	Valid until	Until withdrawal
	Restrictions	None

	Number	4255/10
Airworthiness	Date of issue	16/02/2018
Review Certificate	Valid until	06/03/2019
	Date of latest review	16/02/2018

#### **On-board warning system**

In compliance with the rules of the competition, (Section 1.17.2) both aircraft were equipped with an on-board FLARM collision warning system.

<u>FLARM system</u>: The purpose of the equipment is to warn the pilots of aircrafts equipped with this system when they approach each other in a dangerous manner and proximity while flying. The principle of operation of the system is that it emits information, on radio frequency, relating to its own spatial position and receives similar information coming from nearby aircraft, and its computer unit determines the current position and movement of each aircraft, and if it finds any position or movement risky on the basis of predetermined criteria then it alerts the pilot by visual and acoustic signals.

The on-board FLARM system of the given aircraft was in operation and no disorder relating to its operation was reported to the IC.

### 1.6.2. HA-4361

#### **General information**

Class	Fixed-wing sailplane without engine
Manufacturer	PZL Bielesko Biala
Model	SZD-41A Jantar Standard
Year of manufacture	1975
Serial number	B-692
Nationality and registration marks	HA-4361
State of registry	Hungary
Date of registry	05 Apr 2016
Name of the owner	Aero Club Hajdúszoboszló Sportegyesület
Name of the operator	Aero Club Hajdúszoboszló Sportegyesület

#### Notes relating to airworthiness of the aircraft

	Number	7359
Airworthiness	Date of issue	04 Jul 2007
Certificate	Valid until	Until withdrawal
	Restrictions	None

	Number	MVSZ/113/2018
Airworthiness	Date of issue	15/06/2018
Review Certificate	Valid until	15/06/2019
	Date of latest review	31/03/2018

#### **On-board warning system**

The aircraft was equipped with an on-board FLARM collision warning system. The system was in operation and no disorder relating to its operation was reported to the IC.

### **1.7.** Meteorological information

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

The general weather situation in the affected area was characterised by slightly elevated barometric pressure. The weather was clear in the morning, but cumulus clouds, occasionally towering, arrived at noon. The cloud ceiling varied between 1500 and 2400 metres. There was no rain in the affected area around the time of the occurrence, and visibility was over 10 km. The wind speed at ground level was 1 to 3 m/s, from a direction of 200 to 270°, and at altitudes of 1500 to 2000 metres, the respective values were 1 to 4 m/s and 220 to 270°. The temperature at ground level was 32 to 33 °C, and the dew point was 13 to 16 °C.

### **1.8.** Aids to navigation

The navigation equipment did not influence the course of events, so it needs no detailed discussion.

## **1.9.** Communications

According to the announcement for the day of the accident, the official radio frequency of the competition was 122.800 MHz. The frequency for take-offs and landings offered by the information service at Szeged Airport was also 122.800 MHz. General frequency for use by sailplanes: 122.700 MHz.

While approaching Békéscsaba Airport, the pilot of the aircraft with reg. mark HA-4361 established radio contact at 123.250 MHz with the take-off site in operation at the airport without mentioning that his aircraft was damaged.

The communication equipment did not influence the course of events, so it needs no detailed discussion.

### 1.10. Aerodrome information

Take-off was performed from Szeged Airport (LHUD). Date and time: 05 August 2018, <u>OK-7077</u>: 12:07pm, <u>HA-4361</u>: 11:38am.

The scheduled destination aerodrome was also Szeged Airport (LHUD).



Figure 13: Szeged Airport (LHUD) (Source: HungaryAirport.hu)

Data of actual landings:

<u>OK-7077</u>: outside the airport, 5 km west of Vésztő town, (46.92986°N; 021.18897°E) at 15:26.

HA-4361: at Békéscsaba Airport (LHBC) at 16:17.

# **1.11.** Flight recorders

The data recording systems required by the Rules of the competition were serviceable and the data recorded by them was evaluable.

### <u>OK-7077:</u>

On-board data recorder	Manufacturer	LX Navigation d.o.o.
	Model	LX9000PF
	Place of readout	TSB, Budapest
	Location when found; state of repair	Vésztő west 5 km, good
	Could recorded data be used?	Yes

The IGC file read out from the data recorder, as displayed using the IGC Webview website:





Figure 14: Path of the OK-7077 aircraft

Figure 15: Altitudes flown by the OK-7077 aircraft

### <u>HA-4361:</u>

On-board data recorder	Manufacturer	LX Navigation d.o.o.
	Model	LX Colibri II.
	Place of readout	TSB, Budapest
	Location when found; state of repair	Békéscsaba Airport, good
	Could recorded data be used?	Yes

The IGC file read out from the data recorder, as displayed using the IGC Webview website:

250



2000 (s) 1000 500 12:00 12:30 13:00 13:30 14:00 14:30 15:00 15:30 16:00 Figure 17: Altitudes flown by the HA-4361

Figure 16: Path of the HA-4361 aircraft

### **1.12.** Wreckage and impact information

<u>**OK-7077**</u>: The aircraft touched down 5 kilometres west of Vésztő town; coordinates:  $46.92986^{\circ}N \ 021.18897^{\circ}E$ . The state of the surrounding vegetation and the wreck suggests that the aircraft hit the ground on its back, moving almost in vertical direction, at not very high speed. During the site investigation, a continuous, red skid mark of 1.5 metres length was seen, running from the wing root towards the wing tip on the bottom part of the left wing of the aircraft found lying on its back (Figure 18). This section of the wing structure was not damaged.

The trailing edge of the left wing was damaged between the aileron and the wing tip. A piece of the lower surface of the wing was torn off in this section. The right wingtip showed scratches and paint damages parallel to the longitudinal axis of the aircraft. The canopy fractured, and the cover on the nose of the aircraft cracked and broke in several places. (Figure 19). The inlet tube of the airspeed meter broke off. The trailing edge of the rudder at the side of the tail fin split apart along the trailing edge. Inside the cabin, the instrument console, which is a plate, was bent. As regards instruments, the display of the navigation system cracked, but proved to be serviceable, notwithstanding. That part of the trailing edge of the left wing which is between the aileron and the wing tip split apart in the width of a man's palm and its lower surface was torn off. The jettisoned canopy was not found in the vegetation which was as tall as a man.



Figure 18: Aircraft and vegetation

Figure 19: The nose of the aircraft returned to upright position

**HA-4361**: The damaged aircraft was able to fly as far as Békéscsaba Airport where it landed successfully. The rear 1/3 part of the plexiglas of the rear part of the canopy broke and misses, some of its debris was found scattered inside the cabin (Figure 20). A longitudinal, gradually deepening scratch runs along the centreline of the canopy backwards as far as the edge of the fracture. At a distance of 25 cm from the fuselage, the leading edge of the right wing cracked to a depth of 15 cm. A piece of a trailing edge (made of composite and painted blue and red) broken off another aircraft (OK-7077) was wedged in the crack (Figure 21). Non-continuous abrasion and paint damages can be seen on the leading edge of the right wing. The red paint on the top front section of the right wingtip was completely rubbed off.





Figure 20: The aircraft with reg. mark HA-4361 after landing

Figure 21: piece of trailing edge wedged in the wing

## **1.13.** Medical and pathological information

There was no evidence that physiological factors or other impediments had affected the legal capacity of the personnel concerned.

The expert psychologist appointed by the IC summarised his opinion relating to the pilot of the aircraft with reg. mark HA-4361 as follows:

"Based on the aforesaid, the causes leading to the occurrence on the part of the screened person (hereinafter: S.P.) are as follows:

- Underestimation of the risks related to the relative positions of his aircraft and the other one;

- Mental blockage, i.e. lack of action or passive behaviour, which is rooted in the operation of individual personality, may emerge in a situation which becomes critical;

- On the basis of those above, failure to assess the situation which would be necessary to perform an evasive manoeuvre;

Phenomena which are consistent with the aforesaid:

- Obvious underestimation of the risks (damage to aircraft, continuing the flight) emerging after the collision (that was also confirmed by the investigators of TSB,) omission of procedures expected in a danger situation, mental isolation from the real situation;

- Appearance of introverted reaction which also manifested in reduced air-to-ground communication.

In contrast with all these, and according to information available, he performed the remaining section of the flight as well as landing in orderly manner as far as flying techniques are concerned, which suggests that his precise spatial and sensory motor capabilities remained intact. It follows therefrom that thoroughly practised, reflexive psychophysical and flying skills of the S.P. worked in order, the error might have occurred in his mental operation responsible for long-term decisions of theoretical nature. Regarding that, according to literature, it is the capabilities learnt last and in more superficially that break down under stress, the question which may emerge is to what extent the P.S. had the opportunity to acquire and prove, in addition to flight tasks in normal situations, the situation awareness and responsiveness required in rarely occurring critical situations."

### 1.14. Fire

There was no fire in connection with the occurrence.

### **1.15.** Survival aspects

No one was injured. The collision took place at 15:23 o'clock. Practically at the same time, pilots of aircraft flying nearby informed Szeged Airport on the occurrence by radio, and the

Airport alerted the disaster management service. The helicopter of the search and rescue service at the Szolnok Helicopter Base was set on 15-minute alert. The helicopter took off from Szolnok at 16:16 o'clock. The pilot who escaped by parachute was found at 16:25, and his aircraft at 16:47. The other pilot involved in the collision reached Békéscsaba Airport on his own and landed his aircraft there.

### **1.16.** Tests and research

The IC appointed an expert psychologist to analyse and evaluate the actions and motivation of the pilot causing the collision more in detail (Section 1.13).

### **1.17.** Organizational and management information

#### 1.17.1. Implementing Regulation (EU) № 923/2012

Pursuant to provisions in Implementing Regulation (EU) № 923/2012:

"SERA.3210 Right.of-way

a) The aircraft that has the right-of-way shall maintain its heading and speed.

b) An aircraft that is aware that the manoeuvrability of another aircraft is impaired shall give way to that aircraft.

c) An aircraft that is obliged by the following rules to keep out of the way of another shall avoid passing over, under or in front of the other, unless it passes well clear and takes into account the effect of aircraft wake turbulence.

- •••
- 2. Converging. When two aircraft are converging at approximately the same level, the aircraft that has the other on its right shall give way, except as follows:
- *i.* power-driven heavier-than-air aircraft shall give way to airships, sailplanes and balloons;
- *ii. airships shall give way to sailplanes and balloons;*
- iii. sailplanes shall give way to balloons;
- iv. power-driven aircraft shall give way to aircraft which are seen to be towing other aircraft or objects.

3. Overtaking. An overtaking aircraft is an aircraft that approaches another from the rear on a line forming an angle of less than 70 degrees with the plane of symmetry of the latter, i.e. is in such a position with reference to the other aircraft that at night it should be unable to see either of the aircraft's left (port) or right (starboard) navigation lights. <u>An aircraft that is being overtaken has the right-of-way</u> and the overtaking aircraft, whether climbing, descending or in horizontal flight, shall keep out of the way of the other aircraft by altering its heading to the right, and no subsequent change in the relative positions of the two aircraft shall absolve the overtaking aircraft from this obligation until it is entirely past and clear.

*i.* <u>Sailplanes overtaking</u>. A sailplane overtaking another sailplane may alter its course to the right or to the left."</u>

#### 1.17.2. Local procedures of the sailplaning competition

A./

On the basis of Hungarian Gliding Competition Rules, the rules named Local Procedures issued for participants of the competition (63<sup>rd</sup> Hungarian National Gliding Competition, XI. Flatland Cup) made it compulsory to use of a device which monitors air traffic and warns of the danger or collision and which is based on FLARM technology (or compatible with it):

Hungarian Gliding Competition Rules

"4.10 FLIGHT SAFETY DEVICE (FLARM)

Aircraft participating in the competition events shall be equipped with a device which monitors air traffic and warns of the danger or collision and which is based on FLARM technology (or compatible with it). The device shall be turned on and serviceable at the time of take-off at each event. Any anomaly related to the flarm will qualify as serious breach of the order of the competition. Flying with the device intentionally turned off will merit sanctions. Repeated offence may be sanctioned by disqualification from the competition. The organisers of the competition may make registration of the devices compulsory. The method of such registration shall be published in the Announcement of Competition and in the Local Procedures."

Local Procedures issued for participants of the competition (63<sup>rd</sup> Hungarian National Gliding Competition, XI. Flatland Cup)

"C - Technical requirements

... compulsory accessories:

•••

• Aircraft shall be equipped with a device which is based on FLARM technology or is compatible with it. The device shall be turned on and serviceable at the time of take-off at each event. Any anomaly related to the flarm will qualify as serious breach of the order of the competition. Flying with the device intentionally turned off will merit sanctions. Repeated offence may be sanctioned by disqualification from the competition. Registration of the devices is compulsory (Contest Number)."

B./

...

• • •

Further requirements according to the Local Procedures issued for participants of the competition (63<sup>rd</sup> Hungarian National Gliding Competition, XI. Flatland Cup):

- "C Technical requirements
- ... compulsory accessories
- Serviceable mobile phone on board: it is prohibited to use a mobile phone while flying."

"...visibility provisions:

- The use of visibility stickers is highly recommended
- *if justified, the organisers may order the use of visibility stickers*"

"G - Competition procedures

...directions of circling:

In the thermal, pilots shall adopt the direction of circling of the aircraft which arrived first, regardless of altitudes".

### **1.18.** Additional information

The IC does not find any other factual data or circumstances than those above important for the drawing of its conclusions or for proposing safety recommendations, and thus, the IC does not intend to present further data.

### **1.19.** Useful or effective investigation techniques

During the investigation, the IC downloaded the IGC files describing the flights performed by participants of the affected gliding competition on the day of the occurrence, and reconstructed the movement of the two aircraft involved in the collision and also the spatial positions of several other sailplanes soaring nearby, on the basis of the information obtained from such IGC files.

# 2. Analysis

# 2.1. Development of the collision situation

Prior to the collision, the aircraft with reg. mark OK-7077 travelled three full circles at the given location, applying a correction of 30 to 50 metres in each circle when against the wind, in southwest direction. The aircraft with reg. mark HA-4361 finished circling and started a straight-line course to join the circular course flown by the OK-7077. Due to their positions, they arrived at a certain point of the circular path at the same time. The pilot of the aircraft with reg. mark HA-4361 perhaps intended to follow the circular path from outside, from where he could join the inner circle in some time, in function of the respective situations of other aircraft. However, the aircraft with reg. mark OK-7077, which was circling at the same altitude, widened its circular path and adopted a path of larger diameter, to which the pilot of the HA-4361 did not respond, so the two aircraft adopted paths intersecting each other, and stayed there until the collision occurred (Figure 22). The pilot of the aircraft with reg. mark HA-4361 first underestimated the risk of the situation he had created, and then, when the situation became critical, he blocked and failed to perform the evasive manoeuvre necessary to avoid the accident. The chronology of the events in detail:

- <u>15:23:11</u>: (15 seconds before the collision) The aircraft with reg. mark OK-7077 is circling in the thermal to the right on an arc with a diameter of 160 to 170 metres (dotted line). The aircraft with reg. mark HA-4361 is approaching, in straight line, the left side of the arc. If both of them had kept the course, a distance of 40 to 50 metres would have remained between their paths.
- <u>15:23:14</u>: The bank of the aircraft with reg. mark OK-7077 has decreased from ca.  $40^{\circ}$  to ca.  $35^{\circ}$ , and the diameter of its circle has increased to 210 to 220 metres. It may be assumed that, looking for the "core" of the thermal, the pilot was trying to shift the centre point of his circling more to southwest.
- <u>15:23:17</u>: The aircraft with reg. mark OK-7077 is gradually getting farther, outward, from its initial circular path. The aircraft with reg. mark HA-4361 is not changing its course.



Figure 22: Temporo-spatial visualisation of the pre-collision movements of the aircraft involved

- <u>15:23:20</u>: The OK-7077 follows the arc with increased diameter (dashed line). Banking gradually to the right, the HA-4361 starts a turn in the direction of the path of the OK-7077.
- <u>15:23:23</u>: The HA-4361 is turning right, with a bank of ca.  $35^{\circ}$ , in the direction of the OK-7077.

<u>15:23:26</u>: The collision takes place.

### 2.2. Mutual visibility of the two aircraft prior to the collision

During the minutes preceding the collision, the aircraft with reg. mark OK-7077 was circling to the right (clockwise), with a bank of 35 to 40 degrees. As the other aircraft (HA-4361) was situated on the left in the 10 seconds preceding the collision, the pilot of the OK-7077 had limited view of it only, and he had to focus his attention primarily on the area where his aircraft was heading, i.e. to the right (Figure 24). The aircraft with reg. mark HA-4361 first approached the spot of the collision in a straight line, and finally with a bank of ca. 35°, so he had undisturbed sight of the sailplane with reg. mark OK-7077, and his attention should also have been directed there. (Figure 23). The IC is not aware of any circumstance which could have excluded or limited visibility of the sailplane with reg. mark OK-7077 for the pilot of the aircraft with reg. mark HA-4361.



Figure 23: View from the HA-4361 aircraft

Figure 24: View from the OK-7077 aircraft

# 2.3. Activity of the pilot of the aircraft OK-7077 prior to the collision

Sailplanes soaring in a thermal usually shift their circles by changing the curve of their path in order to make optimum use of the uptake of the rising air. As a matter of course, they monitor the movements of other sailplanes staying in the same thermal in the meantime, so that they can maintain safe separation. As regards the pilot of the aircraft with reg. mark OK-7077, it may be stated that he acted as expected. In a case like this, monitoring the movement of aircraft arriving from the left is not a priority task for him because he clearly has the right of way over them (Section 1.17).

### 2.4. Activity of the pilot of the aircraft HA-4361 prior to the collision

The pilot of the aircraft with reg. mark HA-4361 took high risk when he edged close to the expected path of the other sailplane. When a real danger situation formed due to a sudden change of direction of the other aircraft, he probably blocked and failed to perform the manoeuvre necessary for avoiding the collision. When joining other aircraft in the thermal, he should have followed the paths of the aircraft circling there, moving to a position in front of or behind them, taking care to not jeopardize them. He failed to react on time to the situation, which was more and more obvious during their approach, that his aircraft and the aircraft with reg. mark OK-7077 would arrive to an intersecting point of their circular paths

at similar altitudes and almost at the same time, so he would not be able to move to a position in front of or behind the other aircraft. He also failed to react to the other situation in which his aircraft and the aircraft with reg. mark OK-7077 entered a collision course due to widening of the circular path of the aircraft with reg. mark OK-7077.

### 2.5. Course of the collision

On the basis of data from the IGC files describing the movement of the aircraft and the damages suffered by the aircraft, the IC reconstructed and visualised in 3D (using the Poser software) the course of the collision as follows (Figures 25 to 30):



Figure 25: The sailplanes approaching each other a few seconds before the collision.



Figure 26: The left wingtip of the OK-7077 hits the canopy of the HA-4361.



Figure 27: The left wingtip of the OK-7077 hits the leading edge of the HA-4361.



Figure 28: The trailing edge of the left wing of the OK-7077 slides on the leading edge of the HA-4361.



Figure 29: The right wingtip of the HA-4361 slides under the left wing of the OK-7077, and tips it upside down.



Figure 30: The pilot of the OK-7077 leaves the tipped aircraft; the HA-4361 continues flying.

### 2.6. Activity of the pilot of the aircraft OK-7077 after the collision

When the pilot of the aircraft with reg. mark OK-7077 realised that his aircraft had suddenly turned upside down for a reason he did not know, he decided that it was safer to leave the aircraft than to attempt to continue the flight. After jettisoning the canopy and releasing his seat harness, he fell out of the sailplane by the force of his body weight, and when in a safe distance from the aircraft, he opened his emergency parachute manually. Taking into account the unexpected turning of his aircraft upside down (the cause of which was unknown to him) and the presence of numerous (thirteen) sailplanes nearby, his decision (made within the fairly short period of time available) to leave the aircraft can be regarded justified and appropriate according to the position of the IC.

### 2.7. Activity of the pilot of the aircraft HA-4361 after the collision

Due to the accompanying acoustic effects and impact forces, the pilot of the aircraft with reg. mark HA-4361 surely perceived the collision, and he could see directly the gross damages to the canopy and the right wing of his aircraft. In a situation like this, the safest solution is to finish flying as soon as possible because the pilot does not know the extent of damages to his aircraft exactly, which may led to loss of airworthiness of the aircraft later on. The size and condition of some of the terrain below the occurrence would have been appropriate for an emergency landing. In addition, by landing immediately, he would have had the opportunity to try to help his potentially injured fellow pilot involved in the collision.

The pilot of the aircraft with reg. mark HA-4361 moved away from the scene of the accident for one minute, then turned back, and continued thermal soaring in the same place, and stopped it only at the top of the rising air stream. Although he heard other pilots' communication through his radio, but he continued his flight, apparently undisturbed, towards the next turnpoint. He stopped that only when, after half an hour, he was clearly ordered by radio to land. When he radioed Békéscsaba Airport before landing there he did not mention the accident or that his aircraft was damaged.

### 2.8. Causes and management of dense traffic of aircraft around the scene

According to information obtained by the IC, 14 sailplanes (9 FAI Club class and 5 Mixed-Open class) were soaring in the thermal near Vésztő town at the time of the accident, and five (including the 2 aircraft involved in the accident) of them were in the 100-metre altitude range of 1950 to 2050 metres. The respective distances from the scene of other aircraft in that range were 110 to 250 metres. The cause of such dense traffic in the given airspace was the meeting and common thermal soaring of aircraft from the two sailplane classes participating in the competition. The reason for this was that some of the FAI Club class aircraft returning from the direction of Zsáka (and heading to Sándorfalva turnpoint) met some outbound Mixed-Open class contestants (heading to Nádudvar turnpoint) in the thermal beneath a cloud near Vésztő.

The FLARM collision warning system may be very helpful, especially when one cruises in limited visibility conditions (e.g. facing the sun). When thermal soaring in a group, the aircraft moving in constantly changing directions only a few hundred metres away from one another evoke warning from the device so often that pilots' interest in the warnings will inevitable decrease after some time, and some pilots may even fully disregard these warnings.

### 2.9. Psychic loads of pilots participating in a gliding competition

The psychic loads of a person flying an aircraft are typically higher than of those driving surface vehicles, which is due partly to the larger number of parameters to be monitored and partly to expected worse consequences of the mistakes the pilot may make. An extra task for pilots flying aircraft without engine (gliders) is to find and make use of a rising air stream (thermal, ridge wind, wave wind, etc.) which enables the aircraft to stay in the air longer, but it contains a stochastic element as well. In the case of a cross-country flight when the aircraft leaves the vicinity of the airport, the pilot missing a rising air stream may be forced to land on open terrain or to rely on the auxiliary engine. In a contest situation, the pilot's strong intent to achieve as high average speed and/or to cover the longest possible distance and the tactics possibly implied by the contest may add to the pilot's psychic loads.

# 3. Conclusions

### **3.1.** Findings

The pilots involved hat appropriate licences and ratings as well as sufficient experience for the given flight task. The pilot of the aircraft with reg. mark OK-7077 performed his flight in compliance with the relevant requirements.

Both aircraft were airworthy. Both had valid airworthiness certificates. According to their documents, both aircraft were equipped and maintained in compliance with the requirements in effect and according to received procedures.

The investigation revealed no such information which would relate to possible malfunction of the structures or any system of any of the aircraft prior to the occurrence and would thus have contributed to the occurrence or to the course of events in the occurrence.

The cross-country flight event of the competition for sailplanes proceeded in good visibility conditions, at daytime, in accordance with the Announcement of Competition.

The two affected aircraft were flying from Zsáka turnpoint towards Sándorfalva, the next turnpoint when, during an attempt to join a line of aircraft soaring in a thermal, the sailplane with reg. mark HA-4361 collided with the sailplane with reg. mark OK-7077 circling in the thermal.

The pilot of the sailplane with reg. mark OK-7077 left his aircraft right after the collision and landed safely using his parachute. The sailplane with reg. mark HA-4361 continued its flight for 54 minutes, and finally landed at Békéscsaba Airport.

Fourteen sailplanes were manoeuvring beneath the affected cloud at the time of the occurrence, three of them at altitudes close to that of the collided aircraft ( $\pm 50$  m).

No such information relating to the activities of the air traffic management or ground personnel or airport characteristics emerged which could be linked to the occurrence.

### 3.2. Causes

The IC concluded during the investigation that the cause of the occurrence was that the pilot of the aircraft with reg. mark HA-4361 attempted to join the aircraft in the thermal along a risky path, disregarding the relevant rules, and then failed to react, in a timely manner, to the danger of collision which had formed in the meantime.

In the opinion of the IC, the following factors might also have contributed to the occurrence:

- increased psychic stress due to the competition (Section 2.9)
- large number of aircraft manoeuvring close to one another beneath the same cloud (Section 2.8).

# 4. Safety recommendations

### 4.1. Actions taken during the investigation

The IC has no information on any action taken during the investigation.

### 4.2. Safety recommendation(s) issued during the investigation

TSB issued no safety recommendation during the investigation.

### 4.3. Safety recommendation(s) issued on completion of the investigation

Similar occurrences may be prevented by observing the relating rules, i.e. no safety recommendation needs to be issued.

Budapest, 05 Nov 2019

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Miklós FERNCI Investigator-in-charge

György HÁY

Gyorgy HAY Member