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AIR ACCIDENTS INVESTIGATION INSTITUTE
Beranových 130
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CZ-15-354

FINAL REPORT

Investigation of Causes of a Parachute Jump Accident at the Příbram Airport on 15 July 2015.

Prague
October 2015

Glossary of Abbreviations Used in this Report

°C	Temperature in degrees Celsius
AAD	Automatic activation device
AGL	Above ground level
AMSL	Above mean sea level
ATPL(A)	Air transport pilot license
BKN	Broken
CU	Cumulus
CHMI	Czech Hydrometeorological Institute
CR	Czech Republic
E	East
FEW	Few (category of cloud amount: 1-2 oktas)
ft	Foot (unit of length – 0.3048 m)
h	Hour
hPa	Hectopascal
km	Kilometre
kt	Knot (unit of speed – 1.852 $km.h^{-1}$)
LKPM	Příbram, Public domestic airport
m	Metre
min	Minute
N	North
NIL	None
PAR	Paradrop qualification
RW	Cooperation of parachutists in freefall formations
RWY	Runway
ERS	Emergency Rescue Service
DZM	Drop zone manager
SC	Stratocumulus
sec	Second
CEST	Central European Summer Time
s.r.o.	Limited liability company (Ltd.)
SYNOP	Report of surface weather observation from a land station (in meteorological code)
TWY	Taxiway
UTC	Co-ordinated Universal Time
CAA	Civil Aviation Authority
AAII	Air Accidents Investigation Institute
VFR	Visual Flight Rules
VRB	Variable
MIFM	Military Institute of Forensic Medicine

A) Introduction

Operator:	private person
Main parachute type and version:	NAVIGATOR 200
Localisation:	Příbram airport
Date:	15 July 2015
Time:	17:02 CEST (15:02 UTC, hereinafter all times given in UTC)

B) Synopsis

On 15 July 2015, the AAII was notified of a parachuting accident at LKPM. A female parachutist made a parachute jump from the altitude of 4,000 m AGL. The jump was carried out in a standard manner down to the altitude of 1,200 m AGL when the parachutist activated the main parachute and kept descending in the right spiral until she crashed against the ground. The parachutist had suffered injuries to which she succumbed on the spot.

In the afternoon on the day of the parachuting accident, the AAII inspectors in cooperation with the Czech Police started investigating the causes of the accident.

The cause of the incident was investigated by the AAII commission. The investigation team comprised:

Investigator-in-charge:	Ing. Josef BEJDÁK
Committee members:	Ing. Jiří DVOŘÁK
	Col. MUDr. Miloš SOKOL, Ph.D., MIFM Praha

The Final Report was issued by:

AIR ACCIDENTS INVESTIGATION INSTITUTE
Beranových 130
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Dated: 21 October 2015

C) This Final Report consists of the following main parts:

1) Factual Information
2) Analysis
3) Conclusions
4) Safety Recommendations
5) Appendices

1. Factual information

1.1 History of the Jump

1.1.1 Circumstances Preceding the Critical Situation

Over the past eight years, a group of parachutists, Israeli nationals, has been organising their sporting holiday at LKPM, during which they made parachute jumps. This year the group comprised of 50 persons in total. Some of them had their own equipment, but many others, including the parachutist concerned, borrowed a complete parachute equipment directly at LKPM. The said female parachutist was making jumps in accordance with the training curriculum for cooperation of parachutists in creating freefall formations.

Based on the statement of the drop zone manager and other eyewitnesses, the parachute it has been stated that operations commenced at 07:00 by the first take-off and have continued in a standard manner. The 14 take-offs for parachute jumps operation mostly from the altitude of 4,000 m AGL were carried out. The parachutist concerned made her first through fourth jumps of the day in the second, fourth, eighth and tenth paradrop. She made the critical parachute jump in the fourteenth group consisting of twelve parachutists which boarded the aircraft approx. at 14:35. The aircraft took off at 14:42.

1.1.2 History of the critical Jump

The history of the critical jump has been described on the basis of the testimony of witnesses, photographic documentation, video recordings from outdoor sport cameras installed on the helmets of some of the parachutists and m2 AAD data recordings.

The aircraft crew did not notice anything extraordinary while the parachutists were boarding the aircraft, or during the flight. Upon achieving the set altitude, the pilot adjusted the speed to 130–140 $km \cdot h^{-1}$ and the parachutists started to leave the aircraft in the given order. At the start, group of three parachutists performing the RW discipline left the aircraft first. After this group the parachutist in concern, together with her brother, entered the aircraft cargo door upon instructor's command. The brother was standing at the edge of the door with his back turned outwards and the parachutist stood facing him. They were holding each other's shoulders and made a parachute jump together. The instructor who had approached the pair and had given them instructions in an agreed manner parachuted immediately after them.

The pair started rotating horizontally to the right and after two spins stabilised the RW head-on position while holding hands. The parachutists stopped rotating, separated and continued belly flying individually. The female parachutist approached the instructor and communicated with him using agreed signals. After that she executed a manoeuvre to reach a sufficient distance. In his testimony the instructor said exactly: "I checked whether they were flying away from each other because sometimes students are lazy and don't fly in sufficiently different directions. I checked that and I saw her deploying her parachute. She was in a very good position in accordance with the rules and I saw her activating the parachute."

The drop zone manager was watching the female parachutist who had activated the main parachute at the altitude of approx. 1,200 m AGL and was holding her hands up for the entire period of parachuting, most probably holding the steering toggles.

While rotating around the vertical plane of a right-handed spiral in a vertical descent, she crashed against the ground at high angular velocity.

Fig. 1: Place of parachutist's fall

1.2 Injuries to Persons

Injury	Female parachutist	Others (inhabitants, etc.)
Fatal	1	0
Serious	0	0
Light/No injury	0/0	0/0

1.3 Damage to the Parachute

The parachute set consisting of the main parachute, reserve parachute, harness with the container and the automatic activation device have not been damaged.

1.4 Other Damage

No other damage has been suffered.

1.5 Information about the Female Parachutist

1.5.1 Basic Information

Age/Gender:	30/female
Parachutist licence:	valid
Category:	A
Medical fitness certificate:	valid
Total number of parachute jumps:	44

1.5.2 Experience and track record of parachuting activities

The female parachutist took a theoretical accelerated course in freefall parachute jumping assisted by two instructors, applying the AFF (Accelerated Free Fall) method, from 5 to 20 July 2014 at LKPM. She completed this training on 20 July 2014 by passing the final exam. She commenced her practical AFF training on 21 June 2014 at LKPM and made 25 parachute jumps over the following seven days. In Israel she completed a theoretical course with an AFF instructor and having successfully passed the test, she received a parachutist licence of category "A".

She engaged in parachuting activity mostly at LKPM and stated 44 jumps in the records of participants in parachuting operations. On 15 July 2015, the parachutist made five parachute jumps, including the critical one.

According to the instructor's testimony, during the training she was in good physical and mental condition and had no problems to release the parachute at a given altitude. So far she had had no experience with breaking away and then activating the reserve parachute.

1.5.3 Number of parachute jumps made at LKPM

Year	Number of parachute jumps
2014	25
2015	20

1.5.4 Number of parachute jumps made at LKPM in 2015

Date	Number of parachute jumps
11/07/2015	5
12/07/2015	5
13/07/2015	5
15/07/2015	5

In his testimony the instructor stated that the parachutist had made two or three parachute jumps in Israel during the given period.

1.6 Information on the Parachute

1.6.1 Main parachute

The student parachute NAVIGATOR is made in various sizes from 200 to 300 square feet. The NAVIGATOR is a type of student and advanced student training canopy for those who have very high requirements for safety and excellent landing performance.

Type:	NAVIGATOR 200
Manufactured by:	PERFORMANCE DESIGNS, Inc., USA
Date of manufacture:	10/2005
Serial number:	002046
Technical certificate:	valid
Liability insurance:	valid

1.6.2 Reserve parachute

Type:	AIRFORCE 180
Manufactured by:	Parachutes Australia
Date of manufacture:	11/2004
Serial number:	1591
Technical inspection:	valid
Container:	valid until 30 November 2015

1.6.3 Harness

Type:	PS – 034S
Manufactured by:	MarS a.s., ČR
Date of manufacture:	20 November 2006
Serial number:	2250/06
Technical certificate:	valid

1.6.4 Container

Type:	OP – 087 C, / size 06N
Manufactured by:	MarS a.s., ČR
Date of manufacture:	20 November 2006
Serial number:	2250/06
Technical certificate:	valid

1.6.5 Automatic activation device

Type:	m2 AAD
Manufactured by:	MarS a.s., ČR
Date of manufacture:	06/2015
Serial number:	003648
Technical inspection:	valid

1.6.6 Inspection of the parachute set

1.6.6.1 Initial survey of the parachute set

The initial survey of the parachute set was conducted at the place of the air accident in the presence of the AAII inspectors, the Czech Police, the LKPM operations manager and the drop zone manager.

After the fall, the main parachute canopy was found spread over the wheat and the inspection detected no signs of damage. There was the harness with the container in its close proximity.

The reserve parachute was placed in the container, flaps were sealed, the paper seal on the red sealing tape was missing. The main parachute carrying and steering lines were intact in full length. Both steering toggles were connected with steering lines of the main parachute and had been activated by the parachutist.

The harness showed no signs of damage, the three ring release ripcord was located in its place. The ripcord handle reserve was located in its place in the pocket on the harness.

The m2 AAD was set in the EXPERT mode and was on.

1.6.6.2 Professional survey of the parachute set

The parachute set was surveyed by an expert in a specialised centre. The NAVIGATOR 200 main parachute, serial number 002046, was used for the total of 387 parachute jumps over 2007–2014. The main parachute canopy was surveyed in detail. The bottom and top skin of the canopy has not been damaged and all the cells were clean and obstacle free. The pilot chute with canopy trim was free of any defect. The slider was intact, the metal rings in its corners had smooth surface and were not mechanically damaged. Steering toggles of steering lines were removed from the straps. All the lines were intact and in very good condition, free of any signs of burning or fraying, or other mechanical damage. They were attached to the exchange of risers of the harness by clamps. This attachment was free of any defects and signs of damage. It is possible to state that during inspection of the main parachute no deficiencies which could affect the correct functionality were identified.

The AIRFORCE 180 reserve parachute was packed correctly. Its steering elements were located in their places and were not blocked by any obstacles. The cord and the needle were not deformed, the reserve static line was connected correctly.

The PS-034S harness was not damaged by hard collision with the ground. The steering elements of the harness were fully functional. A handle of the three ring release ripcord was placed in its pocket located on the right upper side of the harness and was completely functional. A plastic-coated steel cable was placed in armoured hoses free of any deformities or damages. The rings were showed no signs of damage and provided for reliable functionality in this case. The ripcord handle reserve was functional, the handle was correctly located in its place in the pocket on the harness. The pocket with a knife was in its place. Both leg straps were mechanically damaged by strap buckles. The elastic tag on the left loose end of the leg strap was split and there was none on the right loose end.

The OP-103 C, M size 06 container was not damaged, metal bushings of closing flaps were neither deformed, nor damaged.

The activation device of the m2 AAD type was removed from the container. It was sent to the manufacturer's specialised centre for downloading of data from the last two jumps and their analysis.

1.7 Meteorological Information

The analysis of the meteorological situation at 15:02 at LKPM is based on the expert estimate of probable weather at the place of parachute accident made by the CHMI for the day of 15 July 2015.

1.7.1 General weather information

The situation: The weather on the territory of the Czech Republic was under the influence of an insignificant high-pressure area.
Ground wind: 290 – 320°/8 – 10 kt
Upper wind: 2000 ft AGL 280°/3 kt,+17°C, 5000 ft AGL 290°/17 kt, +10°C, 10000 ft AGL 300°/23 kt, +02°C
Visibility: over 10 km
Weather: Broken, no precipitation
Cloudiness: FEW SC, CU base 3500 – 4000/9000 ft AGL, BKN SC base 6000 ft AGL/top 8500 ft AGL
Turbulence: NIL
Zero isotherm level: 11000 ft AMSL
Ice: NIL

Conclusion: A SC layer from the dissipated waved cold front persisted in the insignificant high-pressure area. The weather had not any dangerous meteors and the visibility was excellent.

1.7.2 An extract from SYNOP reports from the weather station Kocelovice at 13-17 UTC

Time	Visibility [km]	Wind direction [°MAG]	Wind velocity [kt]	Wind gust [kt]	Cloudiness [type/altitude]
13:00	65	310	10	NIL	2/8 SC 3600
14:00	70	310	10	NIL	2/8 SC 3600
15:00	70	300	10	NIL	2/8 SC 3600
16:00	70	300	8	NIL	2/8 SC 3600
17:00	75	300	6	NIL	1/8 SC/4000

1.7.3 Weather records from the DZM documentation

The order of the DZM command for 15 July 2015 specifies the air pressure of 1,018 hPa, wind direction of 240 - 300° and wind speed of 1–5 $m \cdot s^{-1}$.

1.8 Radio Navigation and Visual Aids

Radio navigational aids used at the aerodrome were no aspect relevant to the parachuting accident. Visual aids on LKPM to navigation used were relevant to the class of aerodrome.

1.9 Communications

At the time of parachuting operations the air traffic at the aerodrome was controlled by a RADIO traffic dispatcher.

1.10 Aerodrome Information

LKPM is a public domestic airport. Its operability is VFR day. Parachuting activities were permitted. The parachute drop zone was placed in the south-western area of the aerodrome between RWY 06 R and TWY D, approx. 100 m westwards from the service building of the company.

1.11 Flight Recorders and Other Means of Recording

1.11.1 Automatic activation device m2 AAD

The data recorded and stored in the m2 AAD, serial number 003648, were used for the survey. The data were downloaded and evaluated by a specialised centre and the Report on Activity of the m2 AAD Automatic Activation Device, Serial Number 003648, was drawn up.

Device description:

The device showed no signs of mechanical damage. The display and buttons were fully functional. Connector cables and connectors inside the device were not damaged. The cutter was not activated, the closing cord was not cut. The original data of last jumps remained stored in the activation device. When on, the device performed calibration, checked the circuits and confirmed its standby mode. The device was set in the EXPERT mode. It is activated at the falling speed of 35 $m \cdot s^{-1}$ at a given altitude above the terrain.

Device outputs:

The data from the last two parachute jumps were downloaded from the device. Data analysis indicates that in both cases the free fall descent showed nearly the same trajectory of a free fall, including the falling speed. The main parachute canopy was also released nearly at the same altitude of 1,080 m AGL. After the canopy was deployed during the last but one parachute jump, the falling speed slowed down to 6–7 $m \cdot s^{-1}$. During the last jump, however, the released canopy slowed down the falling speed to approx. 14–15 $m \cdot s^{-1}$. It was descending at this speed until the parachutist fell to the ground, while it was slightly slowing down to 14.1 $m \cdot s^{-1}$.

1.11.2 Outdoor cameras recordings

The data stored in the memory of GoPro outdoor cameras used by the experienced parachutists for the preservation of the skydiving experience were used in the investigation. The video footage was transferred to the commission via electronic mail in MP4 format. The Committee had at its disposal a footage in overall length of 13

minutes 13 seconds. The part of the footage depicting the activities of the parachutists on board of the aircraft, the jump from the aircraft and their cooperation during the freefall flight was not modified in any way. The remaining part of the footage sequences where, during the flight on the chutes, the parachutists recorded casually the canopy of the female parachutist concerned in the downward spiral flight were edited into one single sequence that was later zoomed-in and slow-motioned.

The unedited part of the recording evidences for trouble-free movement of the female parachutist on board of the aircraft, the jump in formation with her brother, the joined flight in pair and her subsequent independent activity during the free fall. However, the position of the parachutist at the moment of the main parachute activation is not captured in this part of the recording. The second part of the recording confirmed the flight of the parachute in the right-hand spiral with a rotation of 360 degrees per approximately 2 seconds.

1.12 Accident Place Information

The parachutist fell on the field with wheat 70 cm high. The place of fall was located approx. 322 m north-westwards from the LKPM reference point.

Geographical coordinates:	N 49°43´16.4´´
	E 14°05´46.1´´
Altitude:	456 m above sea level

1.13 Medical and Pathological Information

The immediate cause of parachutist's death was the traumatic rupture of the thoracic aorta with haemorrhage in the thoracic cavity. The injury was clearly fatal due to its general nature.

The autopsy revealed multiple severe injuries, in particular, in the area of pelvis, abdomen and chest. From the forensic medical point of view, the parachutist's figure was subjected to blunt violence of great intensity, primarily in the pelvic area. The parachutist fell on the ground nearly in the direction of the vertical axis of her body after a spiral flight/downfall.

The autopsy has not detected any traumatic changes which could not have been explained by the mechanism of the accident concerned, such as, e.g., bullet hitting, collision with a large bird, etc. No traumatic changes in the parachutist's upper limbs preventing her from active control of the parachute (steering, breaking away, activation of the reserve parachute, etc.) have been disclosed.

Biomechanical expert opinion, focusing on an estimate of the impact velocity of the parachutist, prepared on the basis of an analysis of suffered injuries, has determined that the probable speed of the collision of the body of the injured against the ground was 16 $m \cdot s^{-1}$.

The autopsy results have not shown any such pathological changes that might have been involved in the causes of the accident, or that could have been considered as a causal link with the parachutist's death.

Toxicological examination has not detected any ethyl alcohol or other toxicologically significant substances prohibited for aviation duty in the parachutist's body.

Biochemical examination of the parachutist's somatopsychological condition was not carried out due to her (albeit short) survival.

1.14 Fire

NIL

1.15 Search and Rescue

No search and rescue procedures were organised. The drop zone manager, together with a colleague, drove off immediately to the place of the fall of the parachutist and reported the event to the Police, using the emergency line 158. The said colleague commenced the first aid procedures by cardiac massage. They were taking turns in performing the massage and upon the instruction from the ERS operator they released the parachutist from the harness. After the ERS ambulance arrival, the arrived physician continued in the resuscitation procedures. Subsequently the same physician pronounced the parachutist dead due to her succumbing to her injuries.

1.16 Tests and Research

NIL

1.17 Organisational and Management Information

On 15 July 2015 the parachuting operation was in progress at LKPM of Sky Centrum s.r.o. in accordance with Directive V – PARA – 1 issued by the CAA.

1.17.1 Operating shift and jump organisation

A respective command of the drop zone manager, the list of participants, the composition and order of the individual paradrops had been processed for the given operation. The following operation shift was assigned by the DZM:

- drop zone manager,
- drop zone supervisor,
- parachute jump instructor,
- emergency vehicle driver.

The DZM issued instructions to commence the operation together with the enquiry to the parachutists regarding their fitness to take part in the operation. All of the parachutists confirmed with their signature that they had been acquainted with the DZM's command for this operation, they were fit and able to perform parachute jumps, and that all equipment used in operation conformed to the requirements for parachute jump operations in accordance with the effective regulations. The participants were familiarised with the rules for performance of parachuting activities at LKPM. Further, the DZM filled in the forms for individual paradrops, made the co-operation agreement with the aircraft pilot and with the RADIO dispatcher.

1.17.2 Flight security

Jump plane crew information – the aircraft Captain

Age/Gender:	72/male
Pilot's licence,	ATPL(A) – valid
Qualification:	PAR – valid
Medical fitness certificate:	valid

Jump plane information:

Type:	L – 410
Registration mark:	OM - DAC
Manufactured by:	Let Kunovice n.p.

1.18 Additional Information

1.18.1 The main parachute female rigger statement

The main canopy was packed by the female rigger who stated for the record: "I have been involved in the airport operation for over four years of which I have been active in the main parachute packing for a second season. I have been trained in packing by the local instructors. At the beginning I was packing under the supervision of instructors and experienced riggers. Currently, I pack independently all types of the main chutes and harnesses used in the parachuting operations. I have packed in overall several hundreds of main parachutes.

On the day of the incident I packed the Navigator 200 in total five times. As far as I can remember, the said parachutist had never complained about the way the parachute had been opening until then. Before the last jump, I packed the canopy in the same standard manner as before, including the usual checks, with no aberrations in the packing procedure, and I didn't notice any damage or anything unusual."

1.18.2 DZM's statement

DZM stated for the record, that he had jumped with the parachutist concerned in the days prior to the day of the incident and that the jumps he had observed had had improving tendency. She was sufficiently trained in regular as well as emergency procedures and was using the same parachute she was accustomed to invariably.

During the boarding of the aircraft before the jump he personally checked the gear individual members of the paradrop. Each one was dressed in accordance with the regulations and directives in effect.

Between 15:00 and 15:15 he was observing paradrop No. 14 from the ground. The female parachutist performed the jump together with her brother and the instructor at 4,000 m AGL. At 1,200 m AGL they separated and the main parachute of each one of them opened. The parachute of the female parachutist, however, immediately after opening began rotating and descending in a spiral to the ground. The DZM literally stated, that "he saw her holding both of her arms up at the moment of the fall."

After reaching the spot of the fall, he began to perform the resuscitating procedures together with another colleague. Following the instructions of the ERS operator they took off the harness of the parachutist. During performing the lay resuscitation procedures they made the following photographs with a mobile phone.

Fig. 2 The parachute set at the time of providing the lay first aid

1.19 Useful or Effective Investigation Techniques

Parachute air accident investigation was carried out in compliance with Annex13.

2 Analysis

2.1 Parachuting equipment

It is possible to state that during inspection of the main parachute no deficiencies which could affect the correct functionality were identified. On the day of the incident jump, the main parachute was packed five times by an experienced female parachute rigger who during the packing proceeded in accordance with the instructions provided by the manufacturer. On the given day, the parachutist concerned was performing the jumps with the same parachute and after completing the jumps she did not complain of any problems during activation or steering the parachute during the flight and landing.

The controls on the harness were placed in their respective designated places and during their simulated activation no complications arose. Mechanical damage on the leg straps was caused by operational wear and tear and bore no influence on the air incident course.

The reserve parachute was placed in the container in accordance with the manufacturer's instructions. Since the activation device used was set in the EXPERT mode where the activation is set at the given altitude at the falling speed of 35 $m \cdot s^{-1}$, the reserve parachute could not be activated with this device.

2.2 Meteorological Conditions

The meteorological conditions were adequate for performing parachute jumps, the wind speed limit for the parafoil types of parachutes did not exceed the 9 $m \cdot s^{-1}$ value.

2.3 Operation Organisation

The organisation of the paradrops was controlled by the DZM and the operation staff. The members of the staff in the shift had no influence on the history of the air incident and could not prevent it from happening. The drop zone was situated in the south-western part of the LKPM in accordance with the aerodrome code of conduct and it was used by Sky Centrum s.r.o. for jumps of sport parachutists on regular basis, permanently.

2.4 The Parachutist and the Critical Jump History

The parachutist gained the "A" category certification of training which was confirmed not only by the record in the parachutist licence issued in Israel, but also by the instructor. The said category, in accordance with directive V – PARA – 1 qualified her to perform free fall jumps up to 60 seconds within the framework of instruction scheme under instructor supervision.

She had been trained in this activity, her training had been carried out in the AFF crash course during a week-long training camp at LKPM in 2014. Before commencing the jumps at LKPM in 2015, the parachutist was practising under the instructor supervision the emergency procedures performance in the full parachute harness gear on the parachute simulator. It was her 25th jump this year. Over the period when she was making parachute jumps, no case was known of her having a difficulty during activation of the main parachute. She had had no practical experience with a defect on the main parachute that she would have had to solve through cut-away.

On the critical day, before commencing the activities, the parachutist consulted the planned activities with the instructor and together they checked the whole harness and the gear including the switched on position of the safety device. Subsequently by signing into the list of the participants in the parachuting operation she confirmed that she was able to perform the jump.

She made the first four jumps from the altitude of 4,000 m AGL on the NAVIGATOR 200 parachute with no difficulties. She decided to perform the fifth jump from 4,000 m AGL as well. She asked the instructor to oversee her cooperation with her brother during their duo RW flight and to observe whether she had made any progress in independent manoeuvring in the belly flying position during the free fall.

She had the full parachute set on, in the standard way, and her equipment was fully in compliance with the valid regulations. According to the statements of the witnesses the complete preparation for the jump was following the usual course. The performance of the jump itself was initially following the standard course of procedure. The parachutist disembarked the aircraft in pair with her brother. They managed to stop the initial horizontal rotation successfully and after facing each other for a short hold in the stable position, they broke away from each other and followed in the free fall each on their own in the stable belly flying position. The female parachutist performed approach towards the instructor and responded correctly to the agreed signals. Before activating the main parachute she ensured the safety distance was sufficient. The instructor said in his statement that he was watching her until the moment when she performed the main parachute opening from the stable position. The said manoeuvre cannot be seen in the footage from the outdoor camera placed on his helmet. The accidental shots from another camera show the parachute descending in the right-handed spiral. This fact was confirmed also by the DZM in his statement.

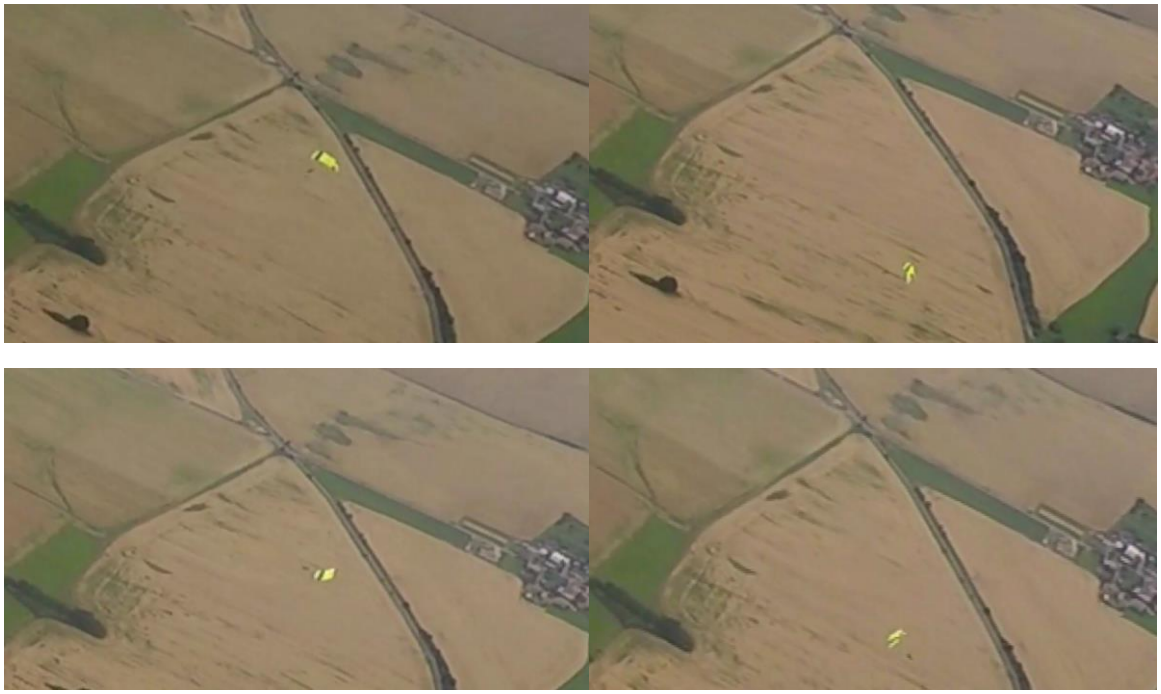

Fig. 3 Sequenced recording of one rotation in the spiral

The parachutist did not negotiate the situation by an immediate cut-away of the main parachute, but was probably attempting to compensate the rotation with the steering toggles. According to the data of the activation device and also the witness testimony the rotation started at the moment of opening of the main parachute and the

speed of descent stabilised between 15 and 16 $m \cdot s^{-1}$. The parachutist, after approximately 75 seconds of flight, crashed into the ground at the speed of 14.1 $m \cdot s^{-1}$. In the collision she suffered injuries incompatible with life.

2.5 Critical situation Origin

During a detailed inspection of the parachute set at the specialised laboratory no malfunction, defect or damage have been found on the main parachute and container with the harness, which would be related to the parachuting accident.

In the photograph made by the DZM during the time of providing the lay first aid there is a marked knot in the main parachute lines in the area of the back right slider eye (see Fig. 4). After consulting the expert, the commission has come to the conclusion that the main parachute rotation might have been caused by a self-induced spontaneous creation of the loop in the carrying lines that might have occurred during the loosening of the lines from the elastic bands. This knot was created by tightening a loop emerged on one side of the steering lines during contact with the slider eye. Thus caused asymmetry in the length of the lines resulted in an uncontrolled parachute rotation and its descent in a spiral.

Fig. 4 The knot in the main parachute lines

3. Conclusions

3.1 The AAII Commission concludes the following:

3.1.1 Female parachutist:

- held a valid parachutist licence;
- had the relevant appropriate qualifications to perform jumps;
- held a valid medical certificate and the health failure as the grounds for the subject incident was ruled out by forensic medical expertise;
- prior to the critical jump had correctly put on the parachute set;
- prior to the critical jump had been equipped in accordance with the valid regulations;
- after the free fall performed opening of the main parachute at the correct AGL altitude;

- performed all operations after the main parachute opening and likely attempted to steer the parachute;
- did not carry out the main parachute cut-away, and very likely not even attempted to do so;
- from causes not ascertained did not respond to the critical situation although thoroughly trained for such cases.

3.1.2 Parachuting equipment

- size and type were appropriate to the level of training the parachutist had;
- had a valid certificate of airworthiness;
- its steering elements were located in their places and were not blocked by any obstacles;
- the activation device had been in its place and on during the time of the jump;
- activation of the AAD did not take place as it had been programmed in the EXPERT mode and the speed of descent in the spiral did not exceed the value of 35 $m \cdot s^{-1}$;
- the parachute set has been manipulated with.

3.1.3 Meteorological information

- in no way had any influence on the origin and course of the parachuting accident.

3.2 Causes

The cause of the parachuting accident was a collision with the ground in a spiral at a great forward velocity resulted from the fact that the parachutist for unknown reasons had not managed to be in control of the critical situation arisen, the descent on the main parachute in a spiral, and did not respond by an immediate cut-away of the main parachute.

4. Safety Recommendations

Given the circumstances of the parachuting accident, the AAII issues no safety recommendation.

5. Appendices:

NIL