

# FINAL REPORT

on

investigation of an aviation accident, realized on 27.07.2015 with aircraft P92-JS, registration marks LZ-DBV, in the region of Dolna Banya airfield



2015

## **Purpose of the Report and responsibility**

In accordance with Annex 13 for aircraft accident and incident investigation to the Chicago Convention on International Civil Aviation dt. 07.12.1944, Regulation Nr. 996/2010 of the European Parliament and the Council on the investigation and prevention of civil aviation accidents and incidents, and Ordinance Nr. 13 dt. 27.01.1999 of the Ministry of Transport, Information Technology and Communications (am. and suppl. 16.11.2012), the purpose of the investigation of an aviation event shall be: establishment of the cause of its realization, in view of its elimination and prevention in the future, **without searching for anybody's guilt or responsibility.**

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## 01. LIST OF ABBREVIATIONS

A/C	- Въздухоплавателно средство/Aircraft;
DG CAA	- Directorate General “Civil Aviation Administration”;
SG	- State Gazette;
CAA	- Civil Aviation Act;
AMRAIUD	- Aircraft, Maritime and Railway Accident Investigation Unit Directorate;
MTITC	Ministry of Transport, Information Technology and Communications;
ATO	- Approved training organization;
RWY	- RUNWAY;
TSP	- Technical service program;
AOM	- Aircraft Operation Manual;
AAIU	- Aircraft Accident Investigation Unit;
TLB	- Technical logbook;
TS	- Technical service;
OPC	- Operation Permit Certificate;
ATO	- Approved training organization;
EASA	- European Aviation Safety Agency;
FM	- Flight Manual;
ICAO	- International Civil Aviation Organization;
MTOW	- Maximum take-off weight;
UTC	- Universal coordinated time.

## 1. Introduction

Date and hour of the aviation event: 27.07.2015, 09:15 a.m. local time (06:15 h UTC).

Informed authorities and parties: “Aircraft, Maritime and Railway Accident Investigation Unit Directorate and “Civil Aircraft Administration” Directorate General at the Ministry of Transport, Information Technology and Communications of the Republic of Bulgaria, the European Aviation Safety Agency and the European Commission, Agenzia Nazionale per la Sicurezza del Volo of the Republic of Italy.

On the grounds of Art. 9, par. 1 (am. – State Gazette, issue 83 dt. 2004, suppl., issue 77 dt. 2005, issue 90 dt. 2012) of Ordinance Nr. 13 dt. 27.01.1999 on the investigation of aviation accidents, the event is classified by the Unit for Investigation of Aviation Events at the Aircraft, Maritime and Railway Accident Investigation Unit Directorate of the Ministry of Transport, Information Technology and Communications as an aviation accident. The materials on the aviation event are filed in case Nr. 05/02.09.2015 to the archive of the Aircraft Accident Investigation Unit.

On the grounds of Art. 5, par. 1 of Regulation (EU) Nr. 996/2010 on the investigation and prevention of accidents and incidents in civil aviation, Art. 142, par. 2 of the Civil Aviation Act of the Republic of Bulgaria dt. 01.12.1972 and Art. 10. Par. 1 of Ordinance Nr. 13 of the Ministry of Transport dt. 27.01.1999 on the investigation of aviation accidents, by Order Nr. ПД-08-439/24.08.2015 of the Minister of Transport, Information Technology and Communications a commission is appointed for the investigation of the aviation accident.

The difference between local and universal coordinated time is +3 h. The time applied everywhere in the report is local time.

On 27.07.2015 aircraft P92-JS, registration marks LZ-DBV, operated by “Ratan” OOD Aviation Training Center, takes off from RWY 27 at Dolna Banya airfield for the performance of a training flight. After the takeoff, between the first and the second bend, the instructor simulates an engine failure, upon the selection of a platform for forced landing and landing simulation, the aircraft lands in an unmowed meadow suffering substantial damages. The instructor and the trained pilot leave the aircraft without having got any injuries.

### **The direct cause for realization of the event is:**

Committed errors in the technology of the aircraft operation the upon the performance of the planned exercise by the crew of the aircraft.

### **The major cause is:**

Incorrect decision of the commander instructor for choosing of the height and place to perform a simulation run for landing with stopped engine, as well as the absence of methodological development for the fulfillment of Exercise 16 from the Flight Training Program for amateur pilots for aircraft PPL (A) at “Ratan” OOD ATO and the unsatisfactory preparation of the crew before the flight.

## 2. Factual information

### 2.1. History of the flight

#### 2.1.1. Flight number, type of operation, last point of departure, time of departure and point of intended landing

**Number of flight:** LBDB - LBDB.

**Type of operation:** a training flight, fulfillment of Exercise 16 from the Flight Training Program for amateur pilots of “Ratan” OOD ATO.

**Last point of departure:** “Dolna Banya” airfield

**Time of departure:** about 09:10 a.m.

**Point of intended landing:** “Dolna Banya” airfield.

### 2.1.2. Flight preparation and description of the flight

The flight, upon which the aviation event is realized, is the second for the day for the instructor and first for the trained pilot. Before the flight the instructor performs a 30-min. briefing with the trainee on Exercise Nr. 16 “Forced landing without thrust” from the Flight Training Program for amateur pilots of “Ratan” OOD ATO. Before the briefing the trainee has not used methodological development of the training organization connected with the forthcoming fulfillment of the exercise. During the briefing, the matter of the distinction between actual malfunction of engine and simulation of engine malfunction was not discussed. After the briefing the trainee under the supervision of the instructor performs pre-flight inspection of the aircraft, and after having established that the aircraft is ready for the flight both of them prepare for takeoff. Upon takeoff the piloting pilot is the trainee. Takeoff is carried out on RWY 27. At a height of 150 ft a checklist procedure is carried out – switch off of lights, reaction of the wing flaps, switch off of the electric fuel pump. At a height of 200 ft a bend on the right at 90<sup>0</sup> is executed, after that the aircraft lifting continues up to 400 ft after QNF, where the instructor shifts the gas lever to a “small gas” position, simulating engine malfunction upon attained speed of 70 kt. Immediately after that the trainee establishes gliding speed of 66 kt and a platform for forced landing is selected – an unmowed meadow found left from the maintained route. With an established inclination of about 20<sup>0</sup>, the route of the aircraft is changed on the left to 90<sup>0</sup>, in conformity with a scheme of the flight, drawn by the trainer. Upon the performance of the bend the instructor notices an abrupt increase of vertical speed, undertakes the operation of the aircraft and makes a try to suspend the maneuver and take control of the aircraft. He puts the engine in a maximum mode of operation but the drop down of the aircraft continues till crushing onto the ground. After stopping of the aircraft the trainee leaves it through the left door, the instructor closes the fuel taps, switches off the electricity supply and leaves the aircraft also through the left door, as the right door is blocked from impact deformation. The emergency rescue team from “Dolna Banya” airfield arrives at the place of the even on the signal rendered by the commander instructor.

### 2.1.3. Location of the aviation event

The location of realization of the event is an unmowed meadow, wiped by the air with the performance of the forced landing, which in accordance with the fulfilled exercise has to be simulated. It s found at 1,39 km in the north-western direction from the center of RWY of “Dolna Banya” airfield on a straight line, as exhibited on the photo on Figure 1, Appendix 1, made after a Google’s map. Figures 3, 4 and 5 of Appendix 1 present photos of the place. The coordinates of the aircraft’ nose at the location of the event are: N 42<sup>0</sup> 19’ 06,15”, E 23<sup>0</sup> 48’ 23,56”, at an altitude of 559 m.

### 2.2. Injuries to persons

<b>Bodily injuries</b>	<b>Crew</b>	<b>Passengers</b>	<b>Other persons</b>
<b>Mortal outcome</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Serious</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Absent</b>	<b>2</b>	<b>0</b>	<b>0</b>

### 2.3. Damages to aircraft

Upon the performed examinations of the aircraft after realization of the aviation accident the following damages were established:

- The nose stand knocked out, the nose wheel is found under the tail of the aircraft, Figure 5 of Appendix 1.
- The airscrew and the prop are destroyed, the axis of the airscrew is bended on the right, Figure 9 of Appendix 1.
- Bended motoframe.
- Deformed covers from the engine collapse.
- Destroyed front glass.
- Deformed cabin supporting frame, Figure 10, Appendix 1.
- The shield of the right semi-wing torn apart close to the connection surface to the body and back spar beam torn apart, Figure 11, Appendix 1.
- Bending and deformation of the right semi-wing.
- Collapsed right AHO.
- Deformed right aileron.
- Deformation of fixing units of right L/G and right strut, Figure 11, Appendix 1.
- Deformation of the left end of the right wing flap.
- Deformed and blocked right door of the cabin.
- Deformation of fixing units of left L/G and left strut, Figure 13, Appendix 1.
- Deformation and destructions on the edge of the left semi-wing, the shielding is destroyed on its bottom side, Figure 14, Appendix 1.
- Destroyed oil radiator.

#### **2.4. Other damages**

There are no other damages.

#### **2.5. Personnel information**

##### **2.5.1. Commander – aircraft instructor – man, 36 years of age.**

**Professional capability certificate:** Professional capability certificate of a professional pilot CPL(A). Date of initial issue: 11.09.2013. Valid classification class MEP (land)/IR, SEP (land), instructor: SEP (land) FI(A), MEP (land) CRI(A).

The commander of aircraft is holder of medical capability certificate class 1, issued on 21.05.2015, valid till 21.05.2016. At the time of realization of the event the medical capability certificate of the pilot is valid.

##### **Flying experience:**

Total hours in flight - 1017:30 h;

On aircraft of the concerned type - 159:00 h;

##### **Information on working hours and rests:**

##### **Hours in flight:**

– for the last 24 h – 02:00 h;

– for the last 30 days – 58:20 h;

– for the last 90 days – 142:20 h.

During the night before the flights the pilot has rested for 08 h.

The commission accepts that the commander instructor possesses the requested training and experience for the functions performed on his part.

##### **2.5.2. Piloting pilot, trainee – man, 21 years of age.**

The piloting pilot fulfills a program on flight training of amateur pilots on aircraft PPL(A) of “Ratan” OOD ATO. At the time of realization of the event he performs Exercise Nr. 16 “Forced landing without thrust” from this program. The training organization has no detailed methodological development of the Exercise. The trainee gets acquainted with the details of its performance at the briefing held with the commander instructor.

At the time of realization of the event the trainee has flown 16:30 h.

At the time of realization of the event the trained pilot does not possess the requested training and experience to cope with situations in flight where the safety of flight is endangered.

## **2.6. Aircraft information**

### **2.6.1. Airworthiness information**

Aircraft P92-JS, registration marks LZ-DBV, serial number 048, is manufactured in March, 2006 by Construzioni Aeronautiche TECNAM S.r.l., the Republic of Italy. The aircraft has Registration Certificate Nr. 2357, issued by the “Civil Aviation Administration” Directorate General of the Republic of Bulgaria on 22.12.2011. The aircraft is owned by “Ratan” OOD ATO with address: Dolna Banya, 1 “Letishte”str. The aircraft has Airworthiness Certificate Nr. 2357/22.12.2011, issued by the “Civil Aviation Administration” Directorate General. Its Airworthiness Inspection Certificate Nr. BG-ARC – 2357 is issued on 19.06.2014 and is valid till 18.06.2015. A first extension of the above Certificate is issued, valid till 17.06.2016. At the time of realization of the aviation event the aircraft has valid Airworthiness Certificate.

The aircraft has Certificate on conformity with the aviation noise norms Nr. 2357. The Certificate is issued by the “Civil Aviation Administration” Directorate General on 22.12.2011. Item 10 of this Certificate provides: Maximum landing weight 229 kg. This value is incorrect, as the maximum landing weight of the aircraft in accordance with FM is 550 kg.

Since the beginning of operation till the date of realization of the aviation event the aircraft has 2313:20 h in flight in accordance with the records made in the aircraft Form and the readings of the moto reader.

The maintenance of aircraft airworthiness is carried out in conformity with the Technical Service Program of aircraft P92-JS, registration marks LZ-DBV and LZ-DBF. The last revision of the Program is approved by the “Civil Aviation Administration” Directorate General on 28.04.2015. In accordance with the Technical Service Program, on 24.07.2015 the aircraft and its equipment have undergone base technical servicing. On the performance of such an Operation Permit Certificate Nr. P92- DBV-014 is issued, signed by manager of “Ratan” ATO.

There is an aviation crankshaft engine ROTAX 912 S2, serial number 4.924.140, mounted on the aircraft. Till the time of realization of the event the engine has operated for 413:20 h, the repair period being 2000 flight hours or 15 years. The engine is manufactured in 2011 and is mounted on the aircraft in October, 2014 with 0:00 hours in flight.

The aircraft has a mounted airscrew HOFFMANN HO 17GHMA174177C, serial number 79577. Till the time of realization of the event, the airscrew has operated for 2313:20 h. The operational resource of the airscrew is not limited.

In conformity with the Technical Service Program, before the first flight of the aircraft for the day a pre-flight inspection is carried out by a technical expert. The inspection is recorded in onboard logbook of the aircraft Nr. 610, which is filled in on 27.07.2015, the date of realization of the event. There are no enlisted comments from the inspection. There are no comments enlisted also in onboard logbook Nr. 609, filled in on 26.07.2015. On 27.07.2015 for the first flight the aircraft is accepted by the commander instructor, for the second flight, as stated above, the pre-flight inspection is carried out by the trained pilot under the control of the commander instructor. There are no comments recorded on any malfunctions detected upon the above inspections. Recorded is 80 l benzene available in the aircraft reservoirs before the first flight.

Taking in consideration the stated in the present paragraph, the commission accepts that before the performance of the last flight the aircraft is prepared in conformity with the requirements on maintenance of airworthiness and is tanked with sufficient fuel quantity for its realization.

Upon the performed check of a working card, fulfilled upon the technical servicing before the first flight, it was proven that item 7, Section 5 of the Technical Service Program reads: “The pressure and condition of the tires of the nose and the main L/G shall be checked.”

Nose tire – 0,8 bar (11 psi);

Main tire – 1,0 bar (14 psi).“

Such wording of the item is incorrect, as the pointed values correspond not to pressure but to over-pressure.

The aircraft onboard logbook does not contain record on the number of the crew members and the family name of the second crew member.

### 2.6.2. Brief information on the technical characteristics of the aircraft

The maximum take-off weight of aircraft P92-JS is 550 kg. The standard weight of an empty aircraft is 325 kg. At the time of occurrence of the aviation event, the aircraft had onboard about 30 l fuel and a crew of two members. Thereupon the flight weight was about 527 and the gravity center was within the range of operation. The maximum landing weight of the aircraft is 550 kg.

Provided hereunder are some characteristic velocities and limitations in accordance with the Operation Manual of aircraft P92-JS.

#### Velocity limitations

Velocity		KIAS
V <sub>NE</sub>	Maximum speed	134
V <sub>NO</sub>	Maximum cruising speed	106
V <sub>A</sub>	Maneuvering speed	93
V <sub>FE</sub>	Maximum speed with dropped flaps	68

#### Stall speeds:

Stall speed in landing configuration V<sub>SO</sub> – 39 KIAS;

Stall speed upon horizontal flight V<sub>S1</sub> – 43,6 KIAS;

Stall speed upon inclination of 20° - V<sub>S</sub> – 45 KIAS;

Maximum admissible overload with flaps at 0°: +3,8; -1,9.

Engine ROTAX 912 S2, mounted on the aircraft, is certified in conformity with the requirements of FAR 33. The engine is four-cylinder, Boxer type, with two carburetors, with mixed cooling and maximum power limitation of 73,5 kW (98,6 h.p.) at 5800 min<sup>-1</sup> within the limits of 5 minutes. There is no time limitation upon its operation in mode 5500 min<sup>-1</sup>, with power of 69,0 kW (92,5 h.p.).

The screw is with two blades, wooden, with fixed step.

### 2.6.3. Information on the type of fuel used.

In accordance with the records entered in the onboard logbooks, the aircraft is tanked with 80 l fuel before its takeoff for the first flight. The fuel is automobile benzene A-95. The type of fuel is not recorded in the onboard logbook of the aircraft. At the place of realization of the event it was established that the point of the left fuel indicator reads availability of fuel a little bit over ½ of the reservoir’s volume, and the right indicator reads between ½ and ¼.

On the right wing the shielding is torn apart, which also covers the reservoir's surface, and probably a part of the fuel has leaked off. The fuel left in the aircraft is about 35 l. At the aircraft onboard there has been enough fuel for successful finishing of the commenced fight.

At the place of realization of the event 1,5 l benzene was drained from the aircraft for sampling purposes. The sample is tested at the Chemical Laboratory for Fuels and Lubricants of Sofia Airport. The results from the performed tests are included in Test Protocol Nr. 274/30.09.2015, enclosed to the investigation documents' file.

The obtained results correspond to the norms for the relevant indices, except for the content of lead which, upon a norm of up to 5 mg/l, is 29 mg/l.

Pages 2-9, Chapter 2 "Limitations" of the aircraft's Flight Manual contain the following **warning**: "The long-term use of aviation benzene 100 LL may result in bigger wearing of valve saddles and larger sedimentations may occur on the inside of cylinders, due to the higher lead content. Thereupon, proposed is the avoidance of such type of fuel, except in cases of necessity".

### **2.7. Meteorological information**

The meteorological conditions at 09:00 a.m., provided by Sofia meteorological station, are as follows:

- temperature – 21,6<sup>0</sup> C;
- pressure - 1009,1 hPa;
- wind – 1 m/s from the north-eastern direction;
- visibility – more than 10 km, without clouds.

There are no meteorological phenomena which may exercise impact for the realization of the event.

### **2.8. Navigation**

The standard navigation equipment of the aircraft.

### **2.9. Communications**

The standard communication equipment of the aircraft.

### **2.10. Aerodrome information**

The flight, upon which the aviation event is realized, is carried out from certified airfield "Dolna Banya". In conformity with the Operation Manual, the airfield has RWY of:

- direction 090<sup>0</sup>/270<sup>0</sup>;
- dimensions 800/25 m, of which
  - 440 m asphalt concrete;
  - 280 m ground coating in the western part;
  - 80 m ground coating in the eastern part.

The RWY of the airfield allows flawless takeoff of the type of aircraft with which the event is realized.

The control point of the airfield (the middle of the flight field) is with coordinates: N 42<sup>0</sup>18'31" and E 23<sup>0</sup>49'14". The altitude is 542 m.

### **2.11. Flight recorders**

No flight records are used on the aircraft.

### **2.12 Wreckage and impact information**

The place of realization of the aircraft crash with the earth surface is an unmowed meadow, swept by the air of the forced landing, which in accordance with the performed

Exercise was to be simulated. It is located at 1,39 km in the north-western direction from the center of RWY of “Dolna Banyá” airfield on a straight line, as exhibited on the photo on Figure 1, Appendix 1, made on a Google map. Figures 3, 4 and 5 of Appendix 1 provide photos of the place. The coordinates of the aircraft’s nose at the place of the accident are: N 42° 19’ 06,15”, E 23° 48’ 23,56”, and the altitude is 559 m.

Upon the initial touch of the aircraft with the earth surface, the nose L/G is destroyed and the airscrew leaves traces on the earth surface at a distance of 8,90 m in the south-eastern direction from the point whose coordinates are given above. The traces on the earth surface may be seen on Figure 6 of Appendix 1.

Upon the examination of the aircraft’s cabin the following was established:

1. The carburetor’s heating is in end front position.
2. The main switch is in “off” position.
3. The ignition switch is in position “two”, as the key is broken in the key lock.
4. The moto reader of the engine reads 413,2 h.
5. The revolution counter reads 1466,8 h.
6. The throttle lever is in end front position.
7. The trimmer switch – declined on the left.
8. The flaps switch is in neutral position.
9. The carburetor heating lever is in end front position.
10. The operation lever deviates normally in longitudinal and cross direction, as its connection with the steering wheels is not disrupted.
11. The horizontal steering wheel reacts to the movement of pedals.
12. The brakes lever is in end back position.
13. Fuel taps to the two tanks are in “off” position.
14. Fuel indicators read half-full tanks.

The above findings are illustrated by photos on Figures 7 and 8 of Appendix 1.

An external examination of the aircraft’s glider was carried out, as a result of which the following was established:

- The nose stand knocked out, the nose wheel is found under the tail of the aircraft, Figure 5 of Appendix 1.
- The airscrew and the pap are destroyed, the axis of the airscrew is bended on the right, Figure 9 of Appendix 1.
- Bended moto frame.
- On the engine there are no traces of burn-out or leaks of operational liquids.
- Deformed covers from the engine collapse.
- Destroyed front glass.
- Deformed cabin supporting frame, Figure 10, Appendix 1.
- The shield of the right semi-wing torn apart close to the connection surface to the body and back spar beam torn apart, Figure 11, Appendix 1.
- Bending and deformation of the right semi-wing.
- Collapsed right AHO.
- Deformed right aileron.
- Deformation of fixing units of right L/G and right strut, Figure 11, Appendix 1.
- Deformation of the left end of the right wing flap.
- Deformed and blocked right door of the cabin.
- There are no damages on the vertical and horizontal stabilizers.
- The trimmer of the horizontal stabilizer is deviated downwards at 2 cm on the exit edge, figure 12, Appendix 1.
- No damages on the vertical steering wheel, its aerodynamic compensator is deviated at 45°.

- Deformation of fixing units of left L/G and left strut, Figure 13, Appendix 1.
- Deformation and destructions on the edge of the left semi-wing, the shielding is destroyed on its bottom side, Figure 14, Appendix 1.
- The stings controlling the valves of the left and right carburetors are not damaged, Figures 15 & 16, Appendix 1.
- There is no visible tearing of pipes in the engine compartment.
- Destroyed oil radiator.
- Oil in the engine is within the norms between 2 and 3 l.
- On the left side of the body in front of the horizontal stabilizer, aircraft identification panels are fixed, Figure 17, Appendix 1.

In accordance with the readings of the fuel measuring devices, onboard in the aircraft there should be about 35 l of fuel.

### **2.13. Medical and pathological information**

Upon the realization of the event there were no consequences for the commander instructor and the trained pilot, so no medical and pathological investigations have been performed.

There is no information that any physiological factors or loss of ability have influenced the working capacity of the crew.

### **2.14. Fire**

No fire has occurred.

### **2.15. Survival aspects**

The commander instructor and the trained pilot have used protective belts.

After stopping of the aircraft, the trained pilot evacuates through the left door, the commander instructor evacuates also through the left door as the right door is blocked from the impact deformation.

### **2.16. Tests and research**

For the purposes of the investigation in connection with safety the following measures were taken:

- Examination of the place of contact of the aircraft with the earth surface;
- Examination of aircraft P92-JS, registration marks LZ-DBV, after the realized event;
- Discussions with the crew of the aircraft – the commander instructor and the trained pilot;
- Discussion with witnesses of the realized event;
- Survey and analysis of operational documents of the aircraft;
- Survey and analysis of the methodological documentation on the performance of the Exercise;
- Assessment of the flying and operational characteristics of the aircraft;
- Survey of the functioning of the aircraft engine, to establish the possibility for partial loss of power during the last stage of the flight;
- Survey of the condition and functioning of the aircraft operation system;
- Logic & probability analysis of eventual causes of the aviation event.

### **2.17. Organizational and management information**

The aviation event is realized upon training of a pilot at “Ratan” OOD ATO. The Organization possesses Training Manual, approved by the “Civil Aviation Administration” Directorate General. To the commission was provided, as part of this Manual, a Flight

Training Program for amateur pilots for aircraft PPL (A) and a brief description of Exercise 16 “Forced landing without thrust” from the Program. The commission expressed the opinion that the contents of the description is insufficient for preparation for the fulfillment of the Exercise. This establishes preconditions for admission of errors upon the performance of the Exercise. Upon the preparation for the fulfillment of the Exercise, the trained pilot has not maintained any records and has relied only on memorized information.

### **2.18. Additional information**

Chapter 3 of the aircraft’s Flight Manual provides control cards and detailed procedures applied in emergency situations. Before flight operation of the aircraft, the pilot has to study the Flight Manual well, and particularly the above Chapter.

The introductory part of the Chapter provides specification of the safe operational speeds of the aircraft in case of emergency situation:

Upon engine failure after takeoff - 60 kt;

Upon engine failure in flight - 66 kt;

Maneuvering speed - 93 kt;

Maximum gliding speed - 66 kt.

The specified velocities pertain to an aircraft of 550 kg MTOW.

Provided are control cards for the cases of:

- Engine failure upon speeding-up of the aircraft;
- Engine failure immediately after takeoff;
- Engine failure in flight.

Requested is the acknowledgement with these cards for the execution of the Exercise, , as the formulation “without thrust” means a problem with the power system, and most of all with the engine, as the airscrew is with a fixed step and after the establishment of its integrity upon the pre-flight inspection there is nothing to obstruct its functions.

The Chapter also provides control cards for the cases of:

- Forced landing with no engine power. The naming of the situation is in full conformity with the name of the performed Exercise, as the loss of engine power means loss of thrust power of the airscrew.
- Forced landing with an operating engine.

Provided are emergency control cards also for cases which do not have reference to the realized event.

Section “Other emergency situations” dwells on the possibility for using carburetor’s heating. It is mentioned that with a fully opened throttle in a takeoff mode of operation, the carburetor heating is usually switched off. At temperatures lower than 15<sup>0</sup> C or in rainy days, in fog, clouds, high humidity conditions, or where loss of power is noticed, the carburetor heating remains switched on while the engine power gets recovered.

It is not mentioned anyway that the flight experience shows that icing of carburetor may occur even at temperatures of about 25<sup>0</sup> C upon the condition that the engine operates for a long time upon full opening of the throttle valve in a “small gas” mode of operation.

### **3. Analysis**

The realized aviation accident results from an controlled flight close to the earth surface, aimed at simulation of forced landing of an aircraft at a platform selected from the air, upon failure of the engine. Engine malfunction is simulated through complete put off of the throttle valve control lever and putting of the engine into a “small gas” mode of operation.

The commission considers the fact that Chapter 3 of the Flight Manual of the aircraft provides a control card for the case of “Forced landing without engine power”. The difference between the contents of the card and the really performed actions is that in the first case there

is a real engine malfunction, and in the second case there is a failure simulation, where the appropriateness of some actions requests consideration, which are performed in the first case and whose application may be transferred mechanically to the second case. Such an assessment shall be appropriately included in a methodological development on the Exercise, which is absent in the case.

For example, while putting or leaving of the electric pump in a switched off position upon real forced landing is appropriate, upon the simulation of forced landing under artificially created complicated flight conditions this may lead to impairment of the normal engine operation due to the risk for formation of a gas clog in the pipes of the combustion system, resulting from the reduction of input pressure of the mechanical pump. Such danger is as bigger as higher is also the temperature of the surrounding environment.

The prolonged operation of the engine in a “small gas” mode may lead to the occurrence of icing of carburetor even at high temperatures, as was mentioned in paragraph 2.18 above. This may cause obstructions in the operation of the engine, including delay of its reaction upon putting of the throttle lever at a takeoff mode of operation. To avoid such a situation, it would be appropriate when the engine operates in a mode of a completely closed throttle, the carburetor heating to remain switched on; the latter should be switched off immediately before putting the throttle control lever at maximum power.

Deviation in the characteristics of the engine, as was mentioned in paragraph 2.6.3, may be caused by the use of benzene of an increased lead content.

In accordance with paragraph 2.1.2 above, during the flight upon reaching of height of 400 ft the instructor puts the throttle valve lever at a “small gas” position, simulating engine failure. Taking in consideration the actions which the trainee has to perform – establishing of an appropriate gliding speed, selection of a suitable landing platform, selection of trajectory for approaching the platform, control of the flight and engine parameters, and the necessity to provide minimum safe height of 150 ft, the commission accepts that this height is small, especially in view that the pilot lacks flying experience. The selection of a landing platform on which the aircraft has to change its course to  $90^0$  is inappropriate, which on its part means loss of time and height.

During the performance of the bend the instructor notices an abrupt increase of the vertical speed. Upon the condition that according to the assertions of the crew the aircraft glides with a speed of 66 kt, the increase of vertical speed may be connected only with the increased resistance of the aircraft. Increased resistance requires bigger loss of height for maintaining of permanent air speed. Upon the condition of no changing of the aircraft’s configuration, the resistance may increase on two causes: due to increasing of the angle of inclination of the aircraft, and due to impairment of the normal operation of the engine, leading to burdening of the airscrew operation.

A prerequisite for increasing the angle of inclination is the necessity for changing the direction of flight to reach the course of landing on the selected landing platform. It would have been appropriate where the selected platform laid or was with small deviations from the maintained course at the time the instructor took off the gas lever.

Upon the performance of “simulation of landing with stopped engine”, recommendable is the use of small flaps (flaps in a position of takeoff mode), aimed at reducing  $V_S$  and achieving greater maneuvering capacity.

Burdening of airscrew may be provoked by one of the causes described above in the present analysis, leading to impairments of the normal operation of the engine, or their joint impact.

After noticing the increase of vertical speed, the instructor takes control of the aircraft and makes a try to suspend the maneuver, bringing the engine to a maximum mode of operation, but the drop-down of the aircraft continues till its crash onto the ground. The traces

left on the earth surface from the airscrew and the nature of airscrew damage evidence for engine operation at an increased rotation speed at the moment of impact.

The drop down of the aircraft till the moment of crash is probably due to the impact of higher inert forces with the increased vertical speed, on the one part; probable is also some impairment of the characteristics of engine operation succession due to the already mentioned causes.

There is no data evidencing stopping of the engine in the air and malfunctions of the aircraft operation system on the three channels – longitudinal, cross and on-road ones. Upon the performed inspection of the aircraft at the point of accident, no interruption of the operation chains on the relevant channels is detected as well.

In view of the above stated, it may be concluded that the direct realization of the accident is a result from errors in the technology of piloting of the aircraft upon the execution of the planned Exercise, made after the incorrect decision of the commander instructor on the selection of height and place for performance of the simulation.

The cause of these errors is the lack of a developed methodology on the fulfillment of the Exercise and the unsatisfactory preparation of the crew before the flight.

## **4. Conclusion**

### **4.1. Findings**

- Aircraft P92-JS, registration marks LZ-DBV, serial number 048, is manufactured in March, 2006 by Construzioni Aeronautiche TECNAM S.r.l., the Republic of Italy.

- The aircraft has valid Airworthiness Certificate and is maintained in conformity with the requirements of the regulations.

- The aircraft has Certificate on conformity with the aviation noise norms Nr. 2357. The Certificate is issued by the “Civil Aviation Administration” Directorate General on 22.12.2011. Item 10 of this Certificate stipulates: Maximum landing weight 229 kg. This value is incorrect, as the maximum landing weight of the aircraft in accordance with FM is 550 kg.

- The maintenance of aircraft airworthiness is carried out in conformity with the Technical Service Program of aircraft P92-JS, registration marks LZ-DBV and LZ-DBF. The last revision of the Program is approved by the “Civil Aviation Administration” Directorate General on 28.04.2015.

- On 24.07.2015 the aircraft and its equipment have undergone base technical servicing. On the performance of such, Operation Permit Certificate Nr. P92- DBV-014 is issued, signed by manager of “Ratan” ATO.

- The maintained technical service records prove that the aircraft is equipped and maintained in conformity with the applicable regulations and approved procedures.

- The onboard logbook of the aircraft does not contain record of the name of trainee and the type of tanked fuel.

- Before the last flight the aircraft is prepared in conformity with the requirements on maintaining airworthiness and is tanked with sufficient fuel quantity for the realization of the flight.

- Item 7, Section 5 of the Technical Service Program reads: “The pressure and condition of the tires of the nose and the main L/G shall be checked.”

  - Nose tire – 0,8 bar (11 psi);

  - Main tire – 1,0 bar (14 psi).“

- Such wording of the item is incorrect, as the pointed values correspond not to pressure but to over-pressure.

- The aircraft load corresponds to the operational requirements.
- There is no evidence for any defects or malfunctions of the aircraft which may have lead to the realization of the accident.
- The structural integrity of the aircraft was not impaired till the moment of impact onto the earth surface.
- The damages of the aircraft, described in paragraph 2.3, result from an impact onto the earth surface after simulation of engine failure.
- There is no fire outburst upon the aircraft crashing onto the earth surface.
- After the realization of the event, the pilot instructor closes the fuel taps and switches off el. power supply.
- The used fuel is automobile benzene A-95.
- The tested samples from the aircraft onboard fuel exhibit an increased lead content, which upon a norm of up to 5 mg/l is 29 mg/l.
- Upon the contact with the earth surface the engine was in operation.
- During the realization of the event the electric fuel pump is switched off.
- During the realization of the event the carburetor's heating is switched off.
- The airscrew is destroyed upon an impact onto the earth surface, leaving traces which correspond to its rotation.
- The pilot instructor possesses the requested professional qualification and medical capability for the performance of the flight.
- There is no information that any physiological factors or loss of ability have influenced the working capacity of the crew.
- The pilot instructor puts off the throttle valve lever at a height of 400 ft, which is insufficient for the safe performance of the Exercise.
- The trainee establishes gliding speed of 60 kt.
- The aircraft landing platform, selected from the air, is inappropriate as its use needs changing of the aircraft's route at 90<sup>0</sup>.
- Upon the performance of the bend the instructor notices abrupt increase of vertical speed and undertakes the control of the aircraft.
- The pilot instructor makes a try to suspend the maneuver and puts the throttle valve lever to a maximum position, but his actions are overtime.
- The drop down of the aircraft continues till crashing onto the ground.
- The drop down of the aircraft till the moment of crash is probably due to the impact of higher inert forces with the increased vertical speed, on the one part; probable is also some impairment of the succession characteristics of engine operation due to the causes mentioned in paragraph 3.
- The meteorological conditions do not exercise direct impact for realization of the event.
- The activities on organization and performance of flights at "Ratan" OOD ATO are carried out in conformity with Training Manual, approved by the "Civil Aviation Administration" Directorate General.
- "Ratan" OOD ATO does not dispose of methodological development of Exercise 16 "Forced landing without thrust" from the flight training program for amateur pilots for aircraft PPL (A).
- Upon the preparation for the fulfillment of the Exercise, the trained pilot has not maintained any records and has relied only on memorized information.
- The aircraft is not equipped with flight recorders.
- The crew have used protective belts.
- After stopping of the aircraft the trained pilot evacuates through the left door, the commander instructor also evacuates through the left door, as the right door is blocked from the impact deformation.

- The actions of the emergency rescue team from Dolna Banya are adequate to the occurred situation.

#### **4.2. Causes**

On the basis of the performed analysis, the commission points out that the aviation accident is a result from the following causes:

##### **Direct cause:**

Commenced errors in the technology of the aircraft piloting upon the performance of the planned Exercise by the aircraft crew.

##### **Main cause:**

Incorrect decision of the commander instructor regarding the selection of the height and the place of performance of the simulation of approach to landing with stopped engine, as well as the lack of methodological development for the fulfillment of Exercise 16 from the flight training program for amateur pilots for aircraft PPL (A) at “Ratan” OOD ATO and the insufficient preparation of the crew before the performance of the flight.

### **5. Safety recommendations**

Taking in consideration the causes for the realized aviation accident and the deficiencies detected upon the investigation, the commission recommends the fulfillment of the following safety measures:

1. “Civil Aviation Administration” Directorate General shall deliver a copy from the present Report to all Approved Pilot Training Organizations which shall acknowledge their pilots with its contents.

Responsible person: The Director of “Aviation Safety” Directorate at the “Civil Aviation Administration” Directorate General.

2. “Ratan” OOD ATO shall develop methodology for the fulfillment of Exercise 16 “Forced landing without thrust” from the flight training program for amateur pilots for aircraft PPL (A), taking in consideration the comments provided in the present Report on the performance of the Exercise.

Responsible person: The Manager of “Ratan” OOD.

3. “Civil Aviation Administration” Directorate General shall issue new Certificate of conformity with the aviation noise norms to aircraft P92-JS, registration marks LZ-DBV, serial number 048, which shall reflect the actual maximum landing weight of the aircraft.

Responsible person: The Director of “Aviation Safety” Directorate at the “Civil Aviation Administration” Directorate General.

4. “Ratan” OOD shall correct item 7, Section 5 from the technical service program of aircrafts P92-JS, registration marks LZ-DBV and LZ-DBF, clarifying that the cited values of tire pressure pertain to overpressure.

Responsible person: The Manager of “Ratan” OOD.

5. “Civil Aviation Administration” Directorate General shall issue a bulletin, stipulating that in all cases of complicated flight conditions, for the aircrafts with piston engines from the super light aviation, switching on of the electric fuel pump shall be appropriate.

Responsible person: The Director of “Aviation Safety” Directorate at the “Civil Aviation Administration” Directorate General.

6. Upon the performed annual checks of the aircraft documentation, the “Airworthiness” Department at the “Civil Aviation Administration” Directorate General shall check for the availability of records, entered in the technical onboard logbooks, on the type of used fuel and the names of the crew members.

Responsible person: The Head of “Airworthiness” Department at the “Civil Aviation Administration” Directorate General.

7. The quality assurance programs of ATOs shall include activities enabling control of crew preparation, and particularly the preparation of the trained pilot for the flight.

Responsible persons: The managers of the Approved Training Organizations.

Enclosure: Appendix 1.

The investigation commission reminds hereby to all organizations, to which safety measures have been communicated, that on the grounds of Art. 18 of Regulation 996/2010 on the investigation and prevention of accidents and incidents in civil aviation, and Art. 19, par. 7 of Ordinance Nr. 13 on the investigation of aviation events they are obliged to notify in writing the Aircraft, Maritime and Railway Accident Investigation Unit Directorate with the Ministry of Transport, Information Technology and Communications on the status of safety measures.

**Chairman of the commission:**

..... (Hr. Hristov)

**Members:**

..... (St. Petrov)

..... (V. Karaliyski)

..... (Hr. Fandakov)

**ATTACHMENT 1**

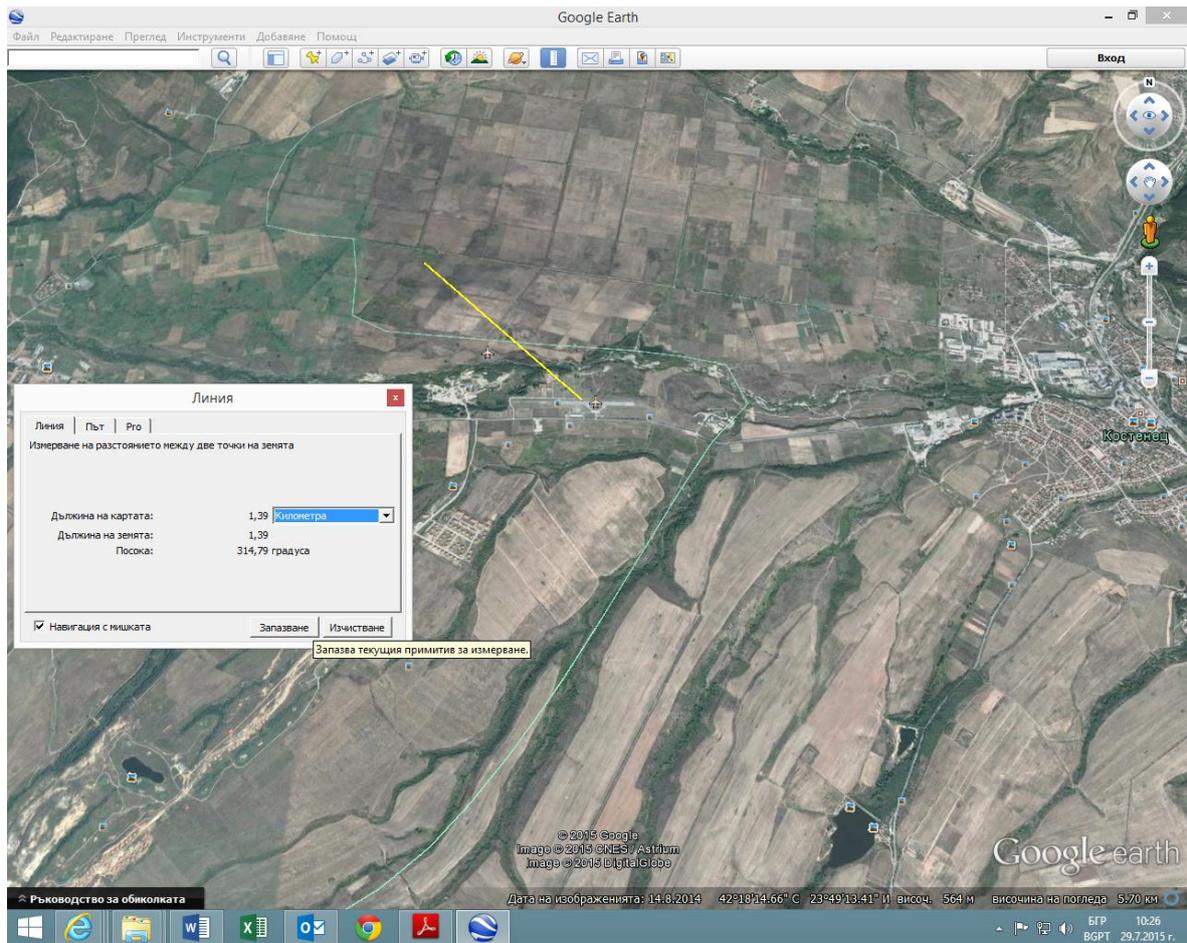


Figure 1.



Figure 2.



Figure 3.



Figure 4.



Figure 5.



Figure 6.



Figure 7.



Figure 8.



Figure 9.



Figure 10.



Figure 11.



Figure 12.



Figure 13.



Figure 14.



Figure 15.



Figure 16.



Figure 17