CIVIL AVIATION SAFETY INVESTIGATION AND ANALYSIS AUTHORITY (SIAA)

FINAL REPORT

of civil aviation safety investigation

CLASSIFICATION	**ACCIDENT**
Owner	STS AVIJACIJA d.o.o.
Operator	STS AVIJACIJA d.o.o.
Manufacturer	Piper Aircraft Corporation
Aircraft	PIPER PA-28-161
Registration country	Republic of Serbia
Registration	YU-DDB
Location	Mădăraș forest area, Harghita county Latitude: 46° 30' 22.9261" N Longitude: 025° 35' 43.9168" E
Date and time:	27.06.2019 / 10:59 LT (07:59 UTC)

No. A 21 - 14
Date: 21.12.2021

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ADVERTISMENT

This REPORT presents data, analyses, conclusions and safety recommendations of the civil aviation safety investigation Commission appointed by the General Director of SIAA.

The civil aviation safety investigation was conducted in accordance with the provisions 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, of the provisions of the Annex 13 to the Convention on International Civil Aviation signed in Chicago on 7 December 1944, as well as with the Romanian Government Ordinance no. 26/2009, approved and completed by Law no. 55/2010, amended and supplemented by the Romanian Government Ordinance no. 17/2018.

The objective of the civil aviation safety investigation is to prevent the occurrence of accidents and incidents, by the actual determination of the causes and circumstances that led to the occurrence of such events, to establish the necessary recommendations for the civil aviation safety.

The civil aviation safety investigation does not have the purpose of apportioning blame, legal responsibility or liability.

Consequently, the use of this REPORT for other purposes than those regarding the prevention of aviation accidents and incidents, may lead to misinterpretations.

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SYNOPTIC

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Location	The forested area of Mădăraș locality, Harghita County Coordinates: Latitude: 46° 30' 22.9261" N Longitude: 025° 35' 43.9168" E Quota: 1357 m
Date and time	27.06.2019 / 10:59 LT (07:59 UTC)

SYNOPTIC

On 27.06.2019 during the return flight to the airport in Târgu Mureș, when the aircraft was flying over a forested mountain area, in the conditions of a descent flight, the pilot noticed a loss of the engine power. By successive repositioning of the engine control levers, he tried to re-establish power, but he did not succeed.

The pilot tried to maintain the aircraft speed at a value of 65-70 kt by setting the aircraft in a slight descent attitude to avoid the speed decrease below the stalling speed, and when the impact with the fir trees was imminent, he pulled out the flap to reduce the speed upon the impact with the fir trees and nosed up the aircraft in order for the impact to be first with the horizontal empennage and the fuselage underside.

After the ground impact, the aircraft caught fire and burned almost completely.

The aircraft pilot, but also the vaccine scattering device operator was picked up by a SMURD helicopter (Mobile Emergency, Resuscitation and Release Service) and were transported to the hospital where they received medical care.

The investigation commission could not establish the exact cause of the engine loss of power, but it considers that the most probable cause of this loss, under the given conditions, might be the occurrence of the carburettor icing phenomenon.

1.

1. PRELIMINARY INFORMATION

On 27.06.2019, the Civil Aviation Safety Investigation and Analysis Authority – SIAA was notified by phone at 12:04 LT (09:04 UTC) through the emergency service 112, about an aviation occurrence involving the aircraft type PIPER PA-28-161, registered YU-DDB.

According to the regulations in force, SIAA notified NTSB – USA as the representative of the aircraft manufacturer, the investigation authority in the Republic of Serbia as the representative of the operator state and the European Aviation Safety Agency - EASA.

1.1 History of occurrence

Between June - July 2019, it was carried out in Romania a vaccination campaign against rabies in foxes, by distributing vaccine baits by air. During this campaign, in the morning of 27.06.2019 around 08:10 LT (05:10 UTC), a number of eleven aircrafts operated to distribute vaccine baits with the appliance by scattering in flight, with take-off from Târgu-Mureș Airport (LRTM). For correct appliance and orientation, it was used the satellite-based navigation and distribution system (GPS).

The aircraft type Piper PA-28-161, registered YU-DDB took-off from LRTM with the pilot and the operator of the vaccine bait scattering device on board.

According to the pilot's statement, after a flight of almost 2 hours and 50 minutes, after scattering all the vaccine doses, when the aircraft was on the return route to the airport in Târgu Mureș, while flying over a forested mountain area, the air traffic controller asked the aircraft pilot to descent from the altitude of 7000 ft. to 6000 ft. due to a military aircraft activity in that area.

The pilot switched on the electric fuel supply pump and reduced the engine speed from 2300 RPM to 2000 RPM in order to descent at the indicated altitude. After the aircraft reached 6000 ft., the pilot put the engine power lever control in maximum position, when speed oscillations and strong vibrations appeared. He checked the engine operating parameters and noticed that the fuel supply pressure indicator was in the green area, but at the lower limit of the minimum admitted pressure indication.

The pilot tried to re-establish the speed of 2300 rpm by successive repositioning of the engine control levers, but he did not succeed. The engine started to lose power, and the aircraft indicated speed started to decrease. The pilot tried to maintain the aircraft speed at a value of 65-70 kt. by establishing the aircraft in a slight descent attitude to avoid the speed decrease below the stalling speed.

Given the emergency situation occurred in the overflown area, the pilot had to perform an emergency landing on a forested surface. When the impact with the fir trees was imminent, he pulled out the flap to reduce the speed upon the impact and nosed up the aircraft in order for the impact to be first with the horizontal empennage and the fuselage underside.

The aircraft impacted the fir trees, on a distance of almost 15 meters, the final position being overturned, and the fuselage underside upwards, at the coordinate point:

Latitude: 46° 30’ 22.9261” N

Longitude: 025° 35’ 43.9168” E

Quota: 1357 m. (4452 ft)

After the ground impact, the aircraft caught fire and burned almost completely.

The aircraft pilot and the vaccine scattering device operator managed to leave the aircraft before the fire spread, and they were later transported to the hospital.

Fig. 1 Burned wreck

Fig. 2 – Burned wreck

1.2 Victims

Injuries	Crew	Passengers	Total no. onboard of the aircraft
Fatal	-	-	-
Serious	1	-	1
Minor	1	-	1
TOTAL	2	-	2

The two occupants of the aircraft were of Serbian nationality.

1.3 Damage to aircraft

After hitting the fir trees and the post-impact fire, the aircraft was almost completely destroyed.

Fig. 3 – Wreck after impact and fire

1.4 Other damage

After the accident, a few fir trees were affected by the fire.

1.5 Crew information

Pilot	Male, 24 years old
License	IE.FCL.....(A) valid
Medical certificate	Class 1 / 2 / LAPL valid
Flight experience	Total number of hours 324:40, out of which 168 on Piper PA-28

1.6 Aircraft information

Manufacturer and aircraft type	Piper Aircraft Corporation / PA-28-161
Serial number and manufacturing year	28-7916057 - 1979
Registration state and mark	Republic of Serbia – YU-DDB
Owner	STS AVIJACIJA d.o.o.
Owner (Operator)	STS AVIJACIJA d.o.o.
Airworthiness certificate	Valid
Number of flight hours	7729 hours
Last certificate of rendering into service	20.06.2019 / 7706 FH

Engine

Manufacturer and engine model	Lycoming O-320-D3G
Series	RL-7381-39A
Total operating hours – TSN	5522:56 hours
Date of last overhaul	10.11.2014 – Engine operating hours 3965:18
Operating hours since the last overhaul – TSO	1557:38 hours
Operating hours since the last inspection	23:00 hours

Magnetos:

Date of magnetos overhaul / aircraft flight hours	10.11.2014 / 6171:27 hours
Operating hours since the overhaul	1557:38 hours
Date of last magnetos overhaul / aircraft flight hours	22.11.2018 / 7584:42 hours
Operating hours since the last inspection	144:23 hours

YU-DDB aircraft was modified by installing a vaccine bait scattering device, being used in fox rabies vaccination campaigns.

The aircraft modifying project was elaborated on 02.10.2014 by a design organisation approved by EASA. This project involves minor modifications to the aircraft so that it can perform vaccine bait scattering missions.

According to the project, in the variant for vaccine bait scattering, the aircraft configuration should have been the following:

- The last row of seat removed;
- The vaccine bait scattering device installed in the baggage compartment;
- The pilot seat on the right side is oriented in the opposite direction of the flight direction.

The pilot right hand seat is intended for the vaccine scattering device operator, who must use the safety belts.

The investigation commission arrived at the accident site identified a single seat installed on board of the aircraft, namely the pilot left hand seat.

Aircraft history

On 07.06.2014, the aircraft registered YU-DDB, was involved in an accident in Bulgaria.

At that time, the aircraft performed a flight for scattering vaccine baits on the route Balchik - Svishtov - Balcik. When the aircraft was on the return route due to an accentuated deterioration of the meteorological situation, the pilot-in-command performed a forced landing on an uncertified aerodrome in the area of Gradishte village.

The aircraft touched down the ground before the runway threshold and it hit the runway concreted threshold. The vaccine bait scattering device operator was seriously injured. The aircraft pilot-in-command was not injured, and the aircraft suffered significant damage.

According to the investigation report elaborated by the Bulgarian Investigation Authority:

During the flight, the pilot-in-command used the safety belts. There is no seat on the left side on board of the aircraft. The vaccine bait scattering device operator was placed in the aircraft rear part, along with the vaccine scattering device and the vaccine boxes. The operator was not secured with the safety belt or with other safety system.

As a consequence of the impact with the runway concreted threshold, the operator hit the instrument panel and suffered serious injuries that required hospitalization.

Fig. 4 – Photo taken from the Final Report of the Bulgarian Investigation Authority

From the photos attached in the report elaborated by the Bulgarian Investigation Authority it can be noticed that the right pilot seat was installed, but the left pilot seat was removed:

Fig. 5 – Photo with the aircraft cockpit taken from the Final Report of the Bulgarian Investigation Authority

The modification project was approved at 25.08.2014 (after the accident occurrence in Bulgaria). This requires changing the orientation of the right seat and does not refer to removing one of the pilot seats.

1.7 Meteorological situation

At the time of take-off, the meteorological situation at LRTM was the following:

METAR LRTM 270600Z VRB02KT CAVOK 23/18 Q1020

Interpretation: June 27th, at 06.00 UTC: variable wind direction, wind direction of 2 kt., CAVOK (there are no clouds below 1500 meters or below the minimum sector height, there are no clouds of vertical development TCu or CB and there is no significant meteorological phenomena) atmospheric temperature of 23º C, dew point of 18º C, atmospheric temperature of - QNH - 1020 hPa.

At the time of the accident occurrence (07:59 UTC) the meteorological situation at LRTM was the following:

METAR LRTM 270800Z 27004KT 220V320 9999 FEW047 27/19 Q1019

Interpretation: June 27th, at 08.00 UTC: wind direction of 240º, wind speed of 4 kt, wind direction variable between 220º and 320º, horizontal visibility of 10 km or more, ceiling/coverage 1-2/8 at 4700 ft AGL (Above Ground Level - height), atmospheric temperature of 27º C, dew point of 19º C, atmospheric temperature of – QNH - 1019 hPa.

Based on the radio survey data taken from Afumați weather station at the time of the accident occurrence, the investigation commission made an interpretation and analysis to determine the exterior temperature and the dew point at the place and time of the accident occurrence.

Therefore, the determined values were: exterior temperature of 17.6º C, and dew point of 12.3º C.

According to the carburettor icing probability nomogram (Fig. 10), it can be noticed that at the time of the accident, for the descent flight, the carburettor icing probability was serious, and for the cruise flight it was moderate.

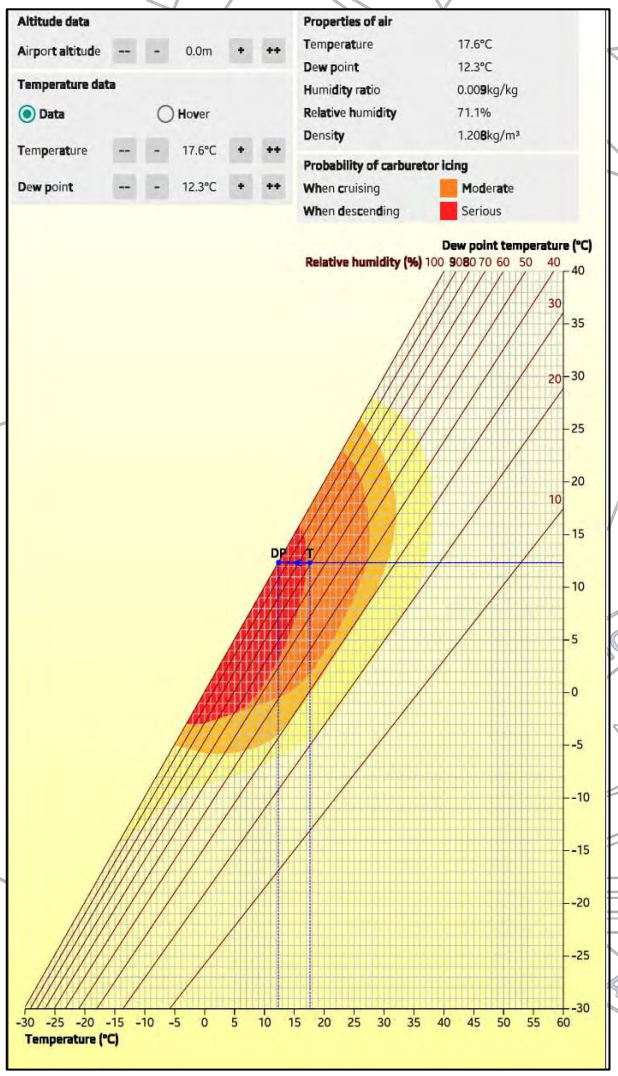


Fig. 6 – Carburettor icing probability nomogram

1.8 Aids to navigation

N/A.

1.9 Communications

The aircraft had a radio contact with the control tower of LRTM on 119.180 MHz frequency. After take-off, while exiting from CTR Târgu Mureș (08:15:07 LT), the pilot was instructed to contact Bucharest Information on 136,230 MHz frequency.

1.10 Aerodrome information

Transylvania International Airport is situated at 14,5 km from Târgu Mureș municipality and at almost 115 km from the accident site.

The take-off/landing runway is headed on 07/25 (070º/250º) direction and has the following characteristics:

- Length 2000 m;
- Width 45 m;
- Elevation 293,5 m (963 ft.).

Fig. 7 - Târgu Mureș Transilvania Airport

On 27.06.2019, the areas LRTRA 72A, LRTRA 73 A, LRTRA 14 and LRTRA 28 were active for military activities.

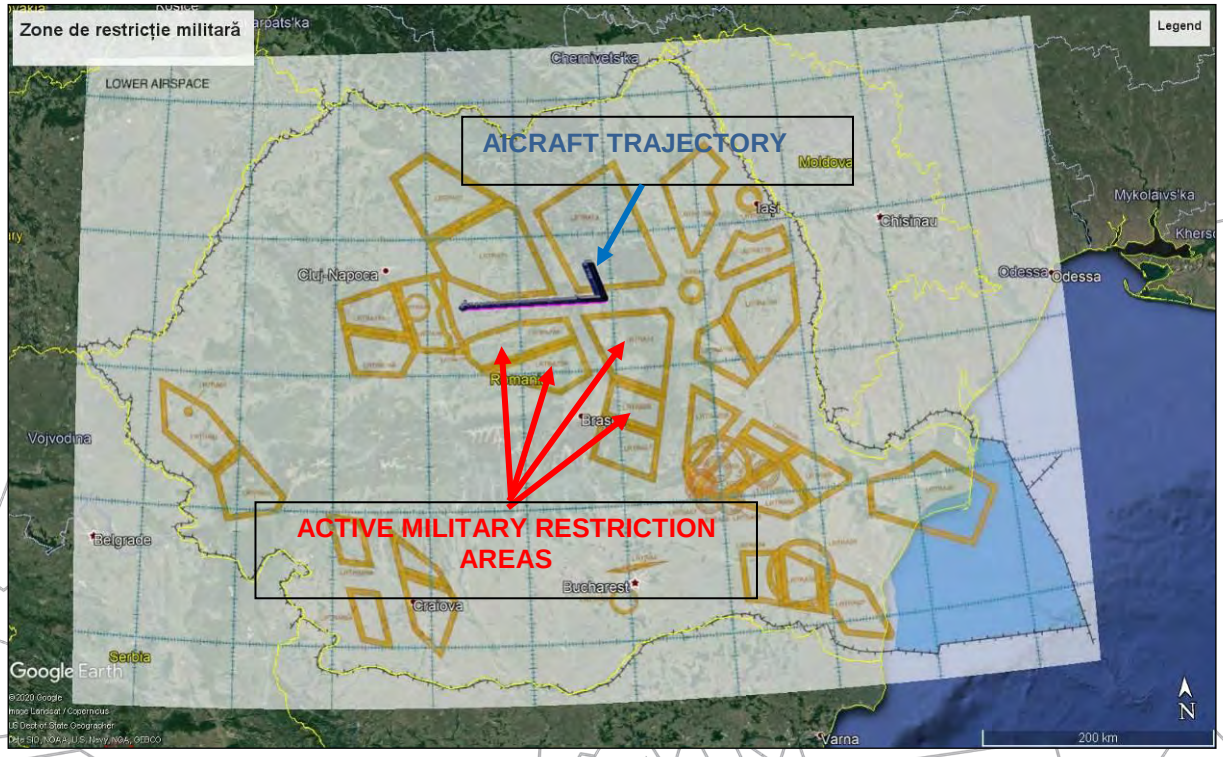


Fig. 8 – Active military restriction areas / Aircraft trajectory

1.11 Flight recorders

The aircraft was not equipped with a flight data recorder device or with a voice recorder. Such a recording device was not required by the regulations in force.

It was equipped with a GPS type Garmin Aera 500 device that was used by the aircraft pilot to scatter vaccine baits in the dedicated areas.

Following the fire started after the impact, this device was partially damaged.

Fig. 9 – GPS - Garmin Aera 500 device

The GPS device was inspected and disassembled to check the status of the circuit board and the internal memory chip. After verification it was found that the circuit board was not affected by fire.

The data stored in the memory chip were recovered and thus the aircraft trajectory could be reconstructed.

1.12 Wreck and impact information

The aircraft crashed in a forested mountain area, at the quota of 1357 m. The aircraft hit the fir trees with the fuselage underside, with the wings and the horizontal and vertical stabilizer.

The first impact with the fir trees was at a distance of 15 m from the aircraft final position. The investigation commission identified a number of nine fir trees hit by the aircraft.

Fig. 10 – Aircraft final trajectory and the i

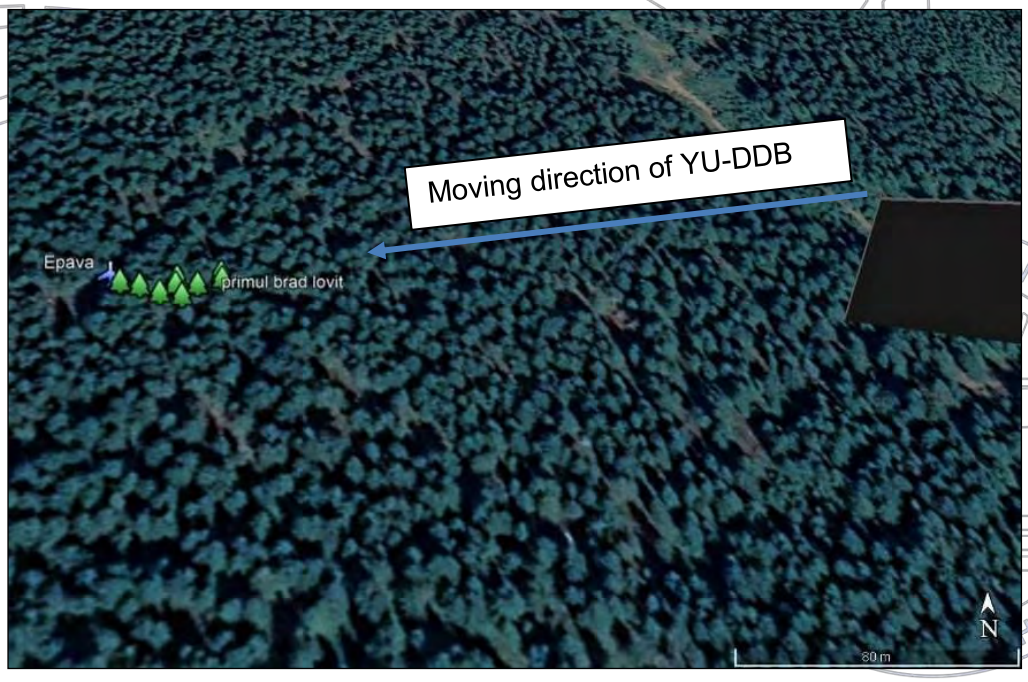


Fig. 11 – Fir trees hit by the aircraft

The right and left half-plane suffered severe hits, detaching from the fuselage. The horizontal stabiliser and the steering presented severe deformations after contact with the firs.

Fig. 11 – Deformations suffered by the aircraft upon impact with the firs/ground

1.13 Medical and pathological information

N/A.

1.14 Fire

According to the pilot's statement, immediately after the aircraft contact with the ground, a fire started around the engine area. Having his legs caught in the rudder pedals, he did not manage to leave the aircraft alone, being helped by the vaccine bait scattering device operator.

After the pilot managed to get out of the aircraft, he used the fire extinguisher with which the aircraft was equipped and discharged it in the engine compartment. The fire was not extinguished, spreading to the aircraft cockpit.

The aircraft fuselage burned almost completely. The left half-plane was caught under the aircraft fuselage and burned partially. The right half-plane, detached from the fuselage was not affected by fire.

Fig. 12 – Left half-plane caught under the burned fuselage

The engine compartment burned completely, the aircraft engine being seriously affected by the fire.

Fig. 13 – Engine Lycoming O-320-D3G model

There were recovered the mechanical fuel supply pump, the electric pump and two magnetos.

Fig. 14 – Mechanical fuel supply pump

Fig. 15 – Electric fuel supply pump

The magnetos were seriously affected by the fire, the cases being deformed, and the interior components melted.

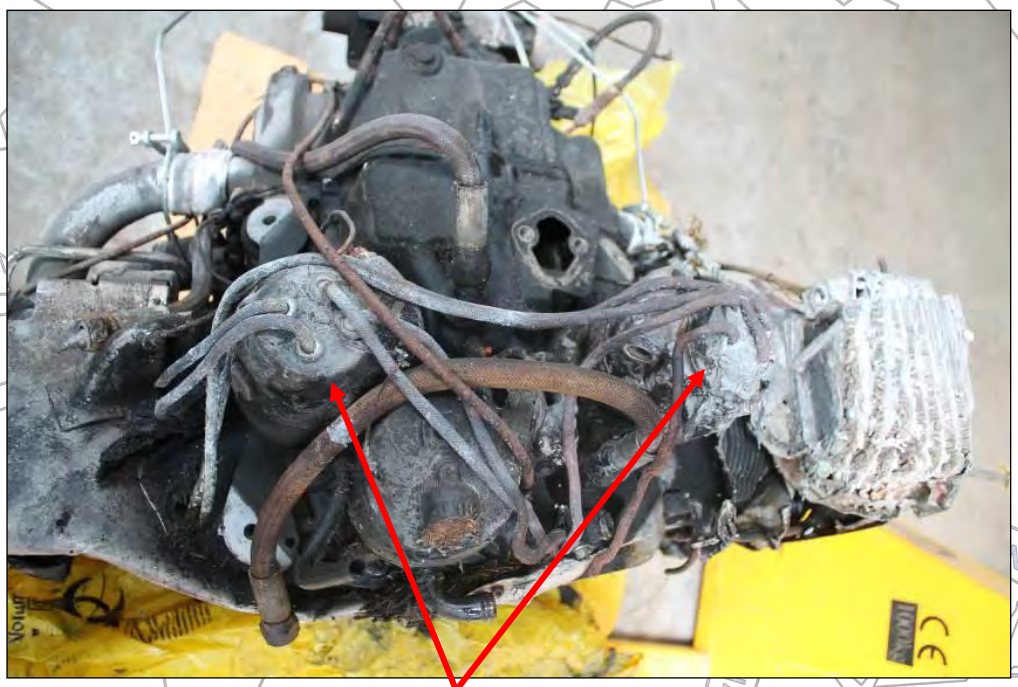


Fig. 16 – Magnetos affected by the fire

Fig. 17 – Left magneto –3059152 series

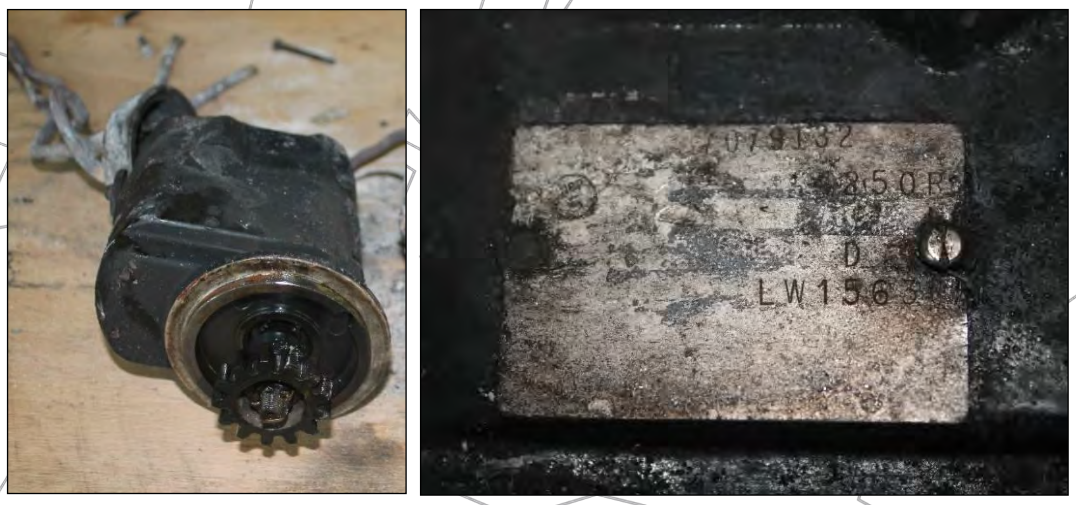


Fig. 18 – Right magneto – 7079132 series

The instrument panel was completely destroyed, as well as the engine fuel supply selector tap.

Fig. 19 – Instrument panel

1.15 Survival aspects

After the ground impact the aircraft caught fire, which started in the engine area. The vaccine bait scattering device operator came out of the aircraft wreckage alone, and after that he helped the pilot to leave the pilot seat because he had a leg stuck between the aircraft rudder pedals. The fire spread to the rest of the aircraft.

The fire was intense and lasted about 10 minutes. Being next to a forest road, the pilot and the operator went to the east for almost 2 km to a place where they could be picked up by a SMURD helicopter and were transported to a hospital in the area.

According to the aircraft pilot's statement, the last raw of seats was removed along with right pilot seat, in its place being placed the boxes with the vaccine baits that were supposed to be scattered.

The vaccine bait scattering device operator did not have a seat as stated in the aircraft modification project. He was sitting and operating the equipment on the aircraft floor, without benefiting from any security measure, both at take-off, during the flight but also upon landing. The operator suffered injuries that need hospitalization.

After this accident, on 11.11.2020, on G. V. Bibescu Strejnic aerodrome, it occurred a serious incident with an aircraft type Piper PA-28 operated by the same operator. The investigators of AIAS who went to the occurrence site found the same non-conformities regarding the aircraft configuration.

During this investigation, the commission discussed with many pilots of the operator, and they declared that Piper aircraft never had the right-hand pilot seat, mounted for this type of operation.

1.16 Tests and research

N/A.

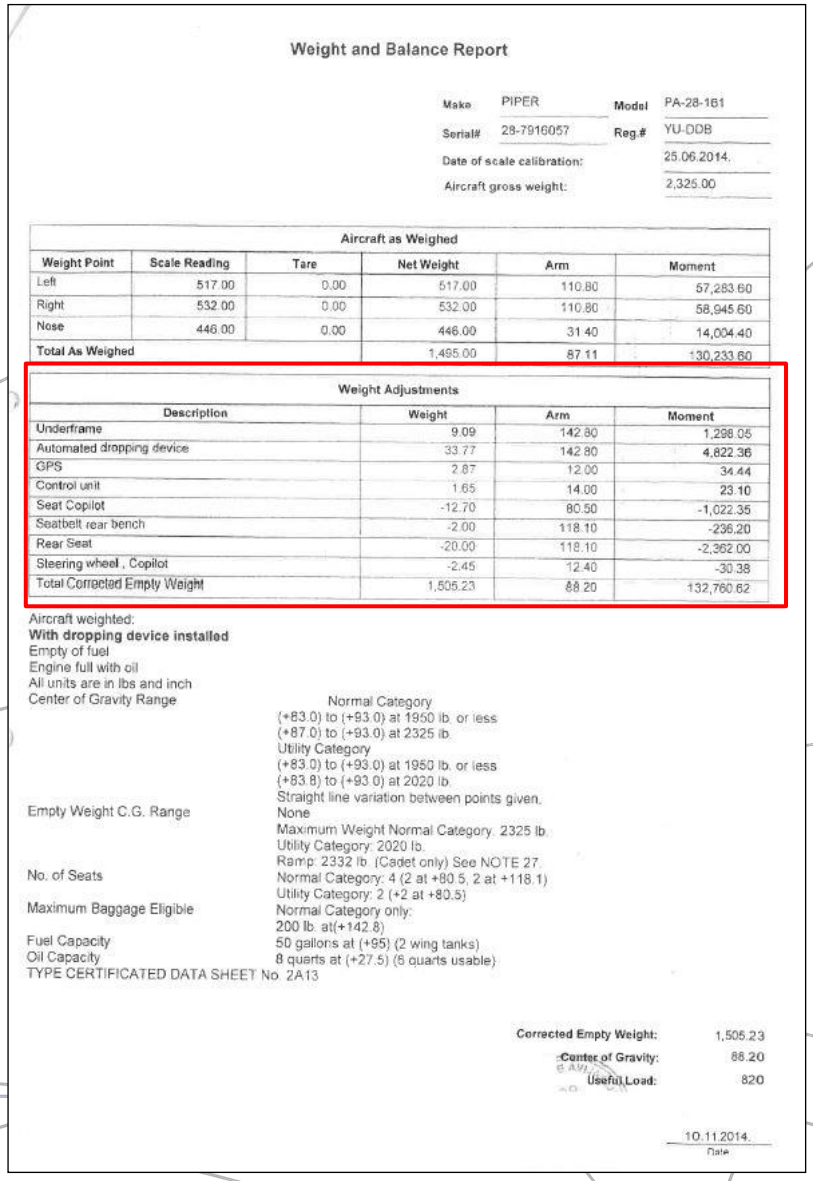
1.17 Management and organizational aspects

On 07.06.2019 the Romanian Civil Aviation Authority – RCAA issued the Approval Letter through which it permitted a Romanian operator to rent in "wet" system, from the Serbian air operator STS Avijacia d.o.o, a number of nine aircraft that were supposed to perform aerial work activities – *„veterinary dropping flights"*. According to this letter, the entire responsibility on operating and maintenance of the aircraft rests with the air operator STS Avijacia d.o.o .

Among the documents in the file for renting the aircraft, there were:

- ***Weight and Balance Report***

In this Report, it can be noticed that, in terms of the number of seats on board the aircraft, the aircraft weighting was made with the front right hand seat removed, as well as with the right hand pilot steering wheel and with the rear seat row.



Weight and Balance Report

Make	PIPER	Model	PA-28-161
Serial#	28-7916057	Reg.#	YU-DDB
Date of scale calibration:			25.06.2014.
Aircraft gross weight:			2,325.00

Aircraft as Weighed

Weight Point	Scale Reading	Tare	Net Weight	Arm	Moment
Left	517.00	0.00	517.00	110.80	57,283.60
Right	532.00	0.00	532.00	110.80	58,945.60
Nose	446.00	0.00	446.00	31.40	14,004.40
Total As Weighed			1,495.00	87.11	130,233.60

Weight Adjustments

Description	Weight	Arm	Moment
Underframe	9.09	142.80	1,298.05
Automated dropping device	33.77	142.80	4,822.36
GPS	2.87	12.00	34.44
Control unit	1.65	14.00	23.10
Seat Copilot	-12.70	80.50	-1,022.35
Seatbelt rear bench	-2.00	118.10	-236.20
Rear Seat	-20.00	118.10	-2,362.00
Steering wheel , Copilot	-2.45	12.40	-30.38
Total Corrected Empty Weight	1,505.23	88.20	132,760.62

Aircraft weighted:
With dropping device installed
Empty of fuel
Engine full with oil
All units are in lbs and inch
Center of Gravity Range

Normal Category
(+83.0) to (+93.0) at 1950 lb. or less
(+87.0) to (+93.0) at 2325 lb.
Utility Category
(+83.0) to (+93.0) at 1950 lb. or less
(+83.8) to (+93.0) at 2020 lb.
Straight line variation between points given.

Empty Weight C.G. Range: None
Maximum Weight Normal Category: 2325 lb.
Utility Category: 2020 lb.
Ramp: 2332 lb. (Cadet only) See NOTE 27.

No. of Seats: Normal Category: 4 (2 at +80.5, 2 at +118.1)
Utility Category: 2 (+2 at +80.5)

Maximum Baggage Eligible: Normal Category only:
200 lb. at(+142.8)

Fuel Capacity: 50 gallons at (+95) (2 wing tanks)
Oil Capacity: 8 quarts at (+27.5) (6 quarts usable)
TYPE CERTIFICATED DATA SHEET No. 2A13

Corrected Empty Weight:	1,505.23
Center of Gravity:	88.20
Useful Load:	820

10.11.2014.
Date

Fig. 20 – Extracted from the Weight and Center Report

- ***Pilot's Operating Handbook***

Here are the additions to the operating handbook after installing the vaccine bait scattering device.

At Section 2 – *Limitations,* the following are mentioned:

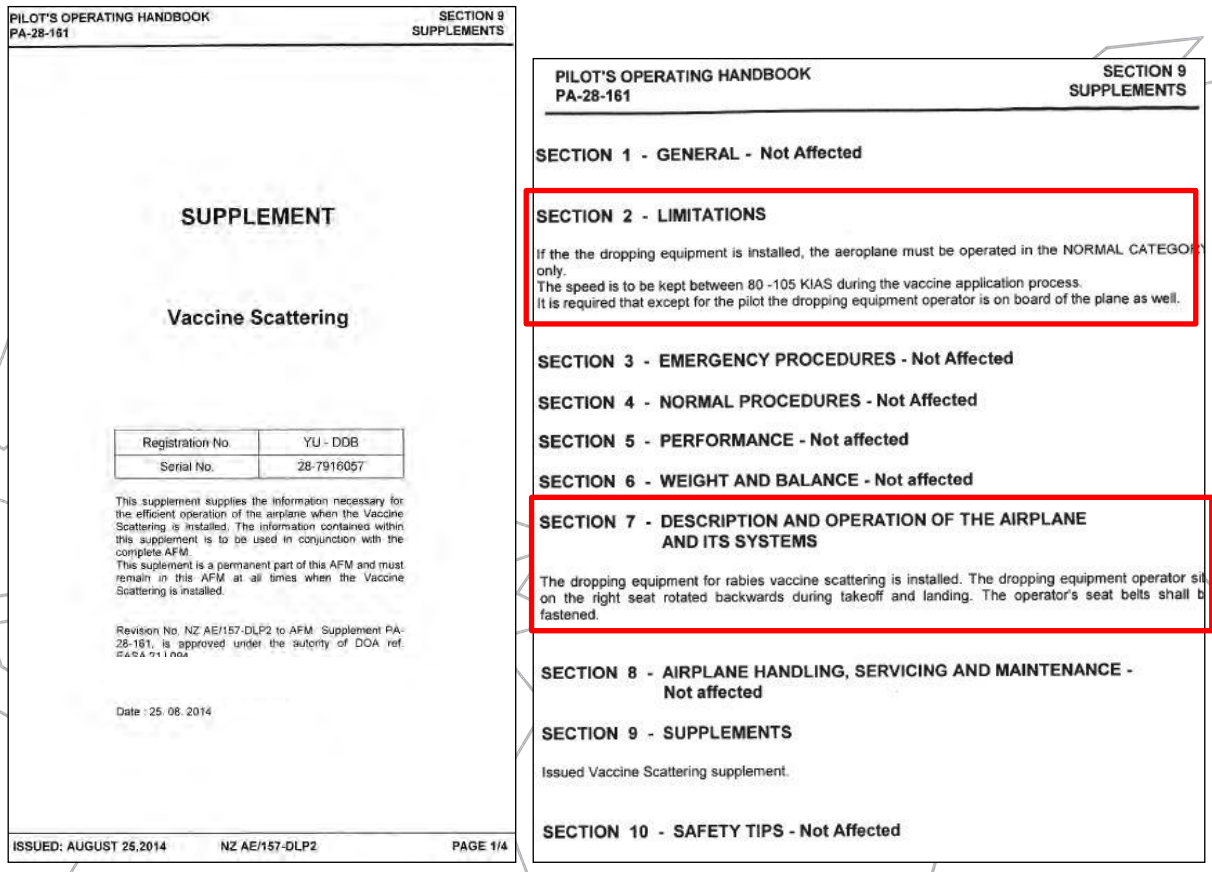
"If the dropping equipment is installed, the aeroplane must be operated in the NORMAL CATEGORY only.

The speed is to be kept between 80 – 105 KIAS during the vaccine application process.

It is required that except for the pilot the dropping equipment operator is on-board of the plane as well."

At *Section 7 – Description and operation of the airplane and its systems* the following are mentioned:

"The dropping equipment for rabies vaccine scattering is installed. The dropping equipment operator sit on the right seat rotated backwards during takeoff and landing. The operator's seat belts shall be fastened."



PILOT'S OPERATING HANDBOOK PA-28-161 — SECTION 9 SUPPLEMENTS

SUPPLEMENT

Vaccine Scattering

Registration No.	YU - DDB
Serial No.	28-7916057

This supplement supplies the information necessary for the efficient operation of the airplane when the Vaccine Scattering is installed. The information contained within this supplement is to be used in conjunction with the complete AFM.
This suplement is a permanent part of this AFM and must remain in this AFM at all times when the Vaccine Scattering is installed.

Revision No. NZ AE/157-DLP2 to AFM Supplement PA-28-161, is approved under the autority of DOA ref. EASA.21J.094

Date : 25. 08. 2014

ISSUED: AUGUST 25,2014 NZ AE/157-DLP2 PAGE 1/4

PILOT'S OPERATING HANDBOOK PA-28-161 — SECTION 9 SUPPLEMENTS

SECTION 1 - GENERAL - Not Affected

SECTION 2 - LIMITATIONS

If the the dropping equipment is installed, the aeroplane must be operated in the NORMAL CATEGORY only.
The speed is to be kept between 80 -105 KIAS during the vaccine application process.
It is required that except for the pilot the dropping equipment operator is on board of the plane as well.

SECTION 3 - EMERGENCY PROCEDURES - Not Affected

SECTION 4 - NORMAL PROCEDURES - Not Affected

SECTION 5 - PERFORMANCE - Not affected

SECTION 6 - WEIGHT AND BALANCE - Not affected

SECTION 7 - DESCRIPTION AND OPERATION OF THE AIRPLANE AND ITS SYSTEMS

The dropping equipment for rabies vaccine scattering is installed. The dropping equipment operator sit on the right seat rotated backwards during takeoff and landing. The operator's seat belts shall b fastened.

SECTION 8 - AIRPLANE HANDLING, SERVICING AND MAINTENANCE - Not affected

SECTION 9 - SUPPLEMENTS

Issued Vaccine Scattering supplement.

SECTION 10 - SAFETY TIPS - Not Affected

Fig. 21 – Extracted from the Pilot's Operation Handbook supplement

- ***Statement of the Civil Aviation Directorate of the Serbian Republic***

This document confirms that the aircraft involved in this accident is also modified in accordance with EASA legislation.

- ***Platform Inspection Checklist***

For the aircraft involved in the accident, on 10.06.2019 it was performed the platform inspection by RCAA. This inspection involved verifications of the required documents on-board of the aircraft and the aircraft physical inspection.

At the aircraft control chapter, under the headings "Crew seats" and "Crew safety belts", "C" box is checked - according to the requirements.

At the end of the inspection list, under the heading "Observations" it is mentioned that the „*The aircraft is suitable for the air operations for which the lease has been requested".*

2. ANALYSIS

According to the pilot's statement, the engine loss of power appeared after a descent flight. Before starting the descent, he switched on the fuel supply electric pump and reduced engine speed. After reaching the desired altitude, he increased the speed again, but vibrations and engine malfunction occurred associated with the loss of power.

The investigation commission analysed the following scenarios as possible causes of this loss of power:

1. Decrease of fuel supply pressure

The fuel pressure is provided by the mechanical pump, which is driven by the engine and the electric pump, which is switched on by the pilot during take-off, landing, descent flight and when switching the tank from which the engine is fuelled.

The case of fuel pressure decrease can be associated with a depletion of the fuel in the tank due to consumption, or with a failure of the mechanical fuel pump (engine driven).

In the event of a drop in fuel pressure, it is recommended to check the fuel quantity in the tanks, to position the selector switch corresponding to the tank containing fuel and to switch on the electric fuel pump.

If the pressure loss is due to the mechanical fuel pump malfunction, then the electric fuel pump should provide enough pressure for a normal engine operation to be able to land as soon as possible on an adequate field.

The two aircraft fuel pumps .were seriously affected by the post-impact fire, so that their functional condition could not be determined.

Considering the pilot's statement, according to which the fuel pressure indicator was in the green area, the investigation commission considers that the engine loss of power was not generated by the fuel supply pressure drop.

2. Malfunction of magnetos

Magnetos are high voltage generators that ensure the ignition of the engine air-fuel mixture by means of spark plugs. The two magnetos, left and right, activates each of the two spark plugs on each cylinder. There are two magnetos, so that, if one does not work, the engine continues to run, but it will be less efficient.

If both magnetos malfunction, speed variations are possible, along with a loss of the engine power.

In this case also, due to the post-impact fire, which seriously affected the two magnetos, the investigation commission did not manage to determine their operating condition.

The investigation commission considers that a simultaneous malfunction of the two magnetos is less probable, but it cannot be excluded.

3. Carburettor icing

The carburettor icing can occur in the case of flying in the ceiling or in the open air. The appearance of ice in the carburettor can occur as a result of the fuel vaporization effect and of the phenomena associated to Venturi tubes, which determined a sudden temperature decrease in the carburettor. If the water steam in the air condenses when the carburettor temperature is equal to or less than the freezing point, ice can form on the carburettor inner surfaces. Ice is generally formed in the Venturi tube and in the intake area. This limits the flow of fuel mixture and reduces the engine power.

Following the weather modelling, at the place and time of the accident occurrence, the exterior air temperature had a value of 17.6º C, and the dew point had a value of 12.3º C.

According to the carburettor icing probability nomogram, it can be noticed that for the descent flight the carburettor icing probability was serious.

The investigation commission considers that the carburettor icing scenario during the descent flight is the most probable for explaining the occurrence of engine speed fluctuations and loss of engine power, after the aircraft passing to horizontal flight.

Operational analysis

According to the Pilot's Operating Handbook, the engine abnormal operation (vibrations, speed oscillations, abnormal noises) is usually associated with the carburettor icing, which results in a decrease in engine speed that may be accompanied by a slight loss of speed or altitude. If the accumulation of ice is massive, then the restoration of maximum power will not be possible and it is necessary to carry out immediate actions:

- Carburettor heat ON. The engine speed will decrease slightly, and the engine operating noise will increase;
- It is expected that the engine operating noise will decrease or the RPM will increase, which would indicate that the ice has been removed. If for one minute there is no change, the carburettor heat system will be switched OFF;
- If the engine still shows signs of abnormal operation, the pilot will try to eliminate them by appropriate modification of the fuel mixture. The abnormal operation will persist if the mixture is too rich or too poor. The electric fuel pump switches ON and the fuel tank selector will switch to the other tank to check if it is not a problem caused by fuel contamination. All engine operating control devices are checked, and if something abnormal is observed, they will proceed accordingly. The magnetos switch is positioned first on L (left) then R (right) and after that it is repositioned on BOTH. If the action outcome is satisfactory for each of the magnetos, the flight shall continue with reduced power, with

the fuel mixture fully rich, and landing shall be performed on the first available airport.

- If the abnormal operation persists then the decision of a safety landing will belong to the pilot.

According to the pilot's statement, he only visually checked the engine operating parameters and tried to regain speed by successive repositioning of the engine control levers, without taking into consideration the possibility of carburettor icing, which implies as the first action, the carburettor heat system switching ON.

Unable to restore the engine speed, he made sure that the aircraft did not reach the stalling speed and configured the aircraft for imminent contact with the forested surface.

The place where the wreck was found has an elevation of 1357 m (4452 ft.).

When the symptoms occurred, the aircraft was at a height of almost 1500 ft. above the ground level, and in order to maintain the indicated speed of 65-70 kt., it needed a vertical speed of 500 ft./min. Considering these elements, it can be assumed that the pilot had at disposal almost 3 minutes till the contact with the forested surface.

Under the given conditions, the pilot had to perform a forced landing on a forested surface. He performed correctly the manoeuvres prior to contact with the firs on the slope, by positioning the flap at the maximum value to reduce the aircraft speed and nose up so that the contact is first with the horizontal rear empennage and the fuselage underside.

How to deal with such an emergency occurring during flight is directly related to pilot training, both theoretical and practical, as well as with his experience and skill.

Documents analysis

The investigation commission analysed the documents provided by the Romanian Civil Aviation Authority– RCAA which were the basis for issuing the Letter of Approval dated 07.06.2019 through which it allowed a Romanian operator to rent in a "wet" system from the Serbian air operator STS Avijacia d.o.o, a number of nine aircraft, that were supposed to perform aerial work activities – *„veterinary dropping flights".*

According to the "Weight and Balance Report", the aircraft weighing was performed with the rear seats removed, the front right seat removed, with the right steering wheel removed and with the vaccine bait spreading device installed.

The weighting action that was performed is in contradiction with the aircraft specification in the "Pilot's Operating Handbook Supplement", which states that the equipment operator sits on the right pilot seat, which is rotated 180°. Therefore, the right hand pilot seat should have been installed in the aircraft cockpit at the time of the aircraft weighting to correctly determine the airplane empty weight and its gravity centre.

The discrepancy between the two documents was not noticed by RCAA when analysing the documents submitted in the file for issuing the Letter of Approval. Even during the aircraft platform inspection, the discrepancy was not observed. RCAA stated that, because the ”Weight and Balance Report” was not among the mandatory documents on-board of the aircraft, this wasn’t checked.

In the form filled after the platform inspection, under the heading *Crew seats and Crew safety belts*, it is checked the box "C"– meaning according to the requirements.

The number of seats and safety belts installed in the aircraft cockpit at the time of the inspection could not be determined because the regulations in force do not stipulate the obligation to objectively document the aircraft inspection, and the form used to perform the platform inspection is a form with general applicability.

Taking also into account the pilots’ statements, according to which Piper aircraft never had the right pilot seat installed, the investigation commission takes into consideration two possible scenarios, namely: the aircraft had the right pilot seat installed at the time of the platform inspection, which was subsequently removed by the operator, or, the second scenario, at the time of the aircraft platform inspection, the inspection performed by RCAA was not in conformity with the requirements for mission type for which operating approval was requested.

What is certain is that the operator of the aircraft used this aircraft outside the technical specifications, the seat on the right being dismantled and the operator of the vaccine bait spreading equipment did not have a seat available as required.

From the analysis of other events involving Piper 28 aircraft of the same operator, it can be concluded that, for him, the operation of aircraft for this type of mission, with changes outside the technical specifications, had become a practice, which shows deficiencies in the company's safety culture.

The aircraft performing this type of aerial work operations are modified, compared to the standard variants. Even though the documents show that Piper 28 aircraft, involved in the occurrences investigated by SIAA, are modified according to the approved project, in fact, these aircraft have been shown to differ from the specifications in the documents.

Considering this fact, the investigation commission considers that the platform inspection of the aircraft involved in aerial work operations of this type should check if the aircraft are modified and operated according to the documents on-board of the aircraft.

The investigation commission considers that the objective documentation (by photo/video means) of the aircraft platform inspection, as well as the subsequent organisation of some unannounced inspections checking if the operators keep the aircraft configuration presented during the platform inspection, it might reduce the risk that they could operate the aircraft with a non-compliant configuration.

3. CONCLUSIONS

3.1 Findings

1. The aircraft pilot had a license and medical certificate, both valid.
2. The aircraft had a valid Airworthiness Certificate.
3. The aircraft standard configuration was modified to perform aerial work mission of spreading rabies vaccine baits.
4. The aircraft configuration changing project was elaborated by the design organisation approved by EASA.
5. The aircraft had other configuration than the one in the approved documents.
6. On-board of the aircraft were the pilot who occupied left hand pilot seat and the vaccine bait spreading device operator, who did not have a dedicated seat, operating from the floor, unsecured.
7. The company's safety policy shows major deficiencies in the safety of persons on-board the aircraft.
8. After the aircraft impact with the ground, it caught fire and burned almost entirely.
9. The electric supply pump, the mechanical supply pump and both magnetos were destroyed by the post-impact fire.
10. According to the carburettor icing probability nomogram, at the time of the accident, for the descent flight, the carburettor icing probability was serious, and for the cruise flight it was moderate.
11. On 07.06.2014 the aircraft was involved in another accident, in Bulgaria, during a fox rabies vaccination campaign.
12. According to the investigation report elaborated by the Bulgarian Investigation Authority:
    " During flight, the captain used the safety belts. On-board of the aircraft there was no left seat. The vaccine bait spreading device operator was placed in the aircraft rear side, along with vaccine distribution equipment and vaccine boxes. The operator was not fixed with a safety belt or another safety system. As a result of the impact with the runway concreted threshold, the operator hit the instrument panel and suffered serious injuries that required hospitalization."

3.2 Cause of accident occurrence

The probable cause of the accident occurrence was the appearance of the carburettor icing phenomenon, which led to the engine power loss, under the conditions of a descent flight over a forested mountain area.

4. RECOMMENDATIONS

The investigation commission makes the following recommendations:

1. It is recommended for the Romanian Civil Aviation Authority - to check the compliance of the aircraft configuration and the configuration approval documents during the platform inspection.
2. It is recommended for the Romanian Civil Aviation Authority – to amend the section *Aircraft control in the Platform Inspection Report*, to include information on the number of seats with safety belts on-board of the aircraft.
3. It is recommended for the Romanian Civil Aviation Authority – the objective documentation by photo/video means of the aircraft configuration at the time of platform inspection.
4. It is recommended for the Romanian Civil Aviation Authority – to perform unannounced inspections of aircraft during the fox rabies vaccination campaign aiming to check if the aircraft configuration was modified from the time of the platform inspection.
5. It is recommended for the Civil Aviation Directorate of the Republic of Serbia – during the oversite processes of both the operator STS AVIACIJA d.o.o. as well as other operators performing aerial work operations, to compare the physical configuration of the aircraft with that approved in the relevant documents.