FINAL REPORT
of civil aviation safety investigation

CLASSIFICATION  Accident

Owner  VICTOR AVIA SRL
Operator  VICTOR AVIA SRL
Manufacturer  Polskie Zakładny Lotnicze Sp. Polonia
Aircraft  Antonov AN-2
Registration country  România
Registration:  YR – PBL
Location:  Comuna Ulmeni, jud. Câlărași
Coordonate:  Latitudine: 44°12'27.45"N
  Longitudine: 26°42'7.19" E
Date and time:  10.05.2008 / 17:30 LT (14:30 UTC)
ACCIDENT DURING EMERGENCY LANDING
ON AGRICULTURAL FIELD

Aircraft | AN-2 / YR-PBL
Date and time | 10.05.2008 / 17:30 LT (14:30 UTC)
Operator | Victor Avia SRL
Flight type | Aerial work
Persons onboard | The pilot and a passenger (ground mechanic)
Victims | The passenger died and the pilot was seriously injured
Pilot | Valid CPL(A) licence
Damage | Aircraft completely destroyed
Location | Ulmeni Commune, Călărași County
Coordinates: Latitude: 44°12'27.45"N
Longitude: 26°42'7.19" E

1. HISTORY OF OCCURRENCE

On 10.05.2008, the AN-2 aircraft registered YR-PBL, owned by a private operator, with a pilot and a ground mechanic onboard, performed aerial chemical treatments for the agricultural company in Ulmeni, Călărași County.

Total flight time was about 3 and a half hours, with several short flights (of 16-17 minutes, on average), each flight consisting of several low-altitude passes over the farmlands. After each flight, the aircraft was refueled with both fuel and chemical products required for the aerial chemical treatments.

After the last refueling, the aircraft took-off and performed 3 passes over the working area. At the last pass, in order to align on the working direction, it was necessary to perform a maneuver to cross a high voltage line situated in the immediate vicinity of the working area.

According to a witness statement, when the aircraft crossed over the high voltage line, the aircraft being inclined to the right, a loud noise was heard (similar to a bang, as described by the witness), followed by a fire in the rear of the aircraft. Subsequently, the aircraft had a pronounced descending trajectory, with a rough, flattened, touchdown. After the impact, the aircraft wreckage was scattered on a radius of about 35 m. The aircraft fuselage was broken, the fuel tanks were broken, and the remaining fuel intensified the fire, the aircraft being completely destroyed (fig. 1).
Due to the impact with the ground, the pilot and the passenger (the ground mechanic) were ejected from the aircraft and suffered multiple injuries. The pilot was transported to the hospital and the passenger died on the accident site.

2. ADDITIONAL INFORMATION

2.1 Meteorological information

During the morning of the accident, there were rain showers in the working area. After lunch, when the flight activity started, the weather conditions were appropriate for the flight.

2.2 Airfield data

The flight was performed on an airfield belonging to the agricultural company in Ulmeni, having the following dimensions: 100 m wide and 600 m long.

2.3 Aircraft

Antonov AN-2 aircraft (fig. 2) was manufactured in Russia (1947), initially as an agricultural aircraft (AN-2SH, AH-2C). Subsequently (1960), it was manufactured in Poland (Mielec WSK PZL AN-2R). The airplane can take-off and land on grassy,
graveled runways, being suitable for use on improvised airfields and in regions without airport infrastructure.

Antonov AN-2 aircraft, PLZ AN-2R version (manufactured in Poland) can be provided with a dusting equipment for spreading solid substances (powders, crystals, granules) or with a spraying equipment. The hopper, with a total volume of 1350 liters (or 1600 kg), is mounted inside the fuselage. It is made of fiberglass reinforced synthetic resins and can also be used as a tank for chemical solutions.

Depending on the activity carried out, spraying or granules dispersion, the aircraft may be equipped with a spraying system or with a spreader to administer solid products. Both devices are mounted under the fuselage, and the spraying ramps under the lower wings (fig.3).

![Fig. 3 Spraying equipment scheme](image)

The adjustment of the sprayed liquid flow is made by changing the size of the nozzles mounted in the distribution pipes. The total flow rate of the sprayers can be set between a minimum of 12 l/s and a maximum of 18.5 l/s (720 - 1100 l/min).

The sprayer working swath width is up to 60 m, at a speed of 150 – 160 km/h and a flight altitude of 10 to 15 m (forest crops). For agricultural crops it is recommended a flight altitude of about 5 m.

YR-PBL aircraft was built in 1982, with the serial number 1GT19636. The maintenance was performed according to the operator’s approved maintenance program, the last scheduled major inspection being completed on 16.04.2008, by an approved maintenance organization for this type of aircraft (on the same date, the Certificate of Release to Service no. 23 was issued), the aircraft having 8146 operating hours and 940 cycles at the time of this maintenance.
2.4 Operational aspects

The flight activity performed on 10.05.2008 was carried out on the basis of a contract on supplying aerial chemical services, concluded between the aircraft operator and Ulmeni Agricultural Society.

The aircraft Flight Manual specifies the requirements for flight crew composition depending on the flight type performed (fig. 4). Regardless of the flight type, the aircraft crew is composed of at least two persons, who must hold the appropriate qualifications/authorizations.

Depending on the flight type, the flight crew shall consist of:

1. for VFR flights: 2 pilots or pilot and navigator or pilot and flight engineer;
2. for IFR flight: 2 pilots or pilot and navigator;
3. for agricultural flights: 2 pilots or pilot and flight engineer.

![Fig. 4 Crew composition (extract from Flight Manual)](image)

The requirement that, in case of an agrotechnical flight, the crew shall be composed by two members is justified by the fact that a person have to focus on piloting the aircraft, while the second person will maneuver the sprayer. Therefore, it is mandatory that at least one of these persons be an authorized pilot, the sprayer being maneuvered by the flight engineer.

The aircraft Flight Manual also provides specific instructions for each crew member, starting with taking over the aircraft from the ground technical staff, aircraft
inspection, engine starting, take-off run, as well as instructions for crew members cooperation when performing agrotechnical flights.

For performing the flights, the operator provided two pilots authorized for the AN-2 aircraft. During the morning of the accident, because it was raining, the operator’s administrator informed one of the pilots, who was not in Ulmeni at that time, that there was no need to come to the airfield, since the weather conditions would not allow the flight operations. Due to improved weather conditions after lunch, the aircraft took-off to perform spraying flights, having onboard a pilot and a ground mechanic. The Investigation Commission could not determine who took the decision as the aircraft to carry out these flights, provided that a crew compliant with the requirements of the Flight Manual was not on board the aircraft.

The pilot involved in the accident held a valid flight license, appropriate to the aircraft type and activity performed, as well as a valid medical certificate. According to the notes in his personal flight notebook, the pilot started his flight activity in 1982 and at the end of 2007 he performed a total of 4252.55 flight hours and 12576 landings (of which 4205.23 flight hours and 12359 landings with AN-2 aircraft).

The engineer onboard the aircraft held a valid aircraft maintenance personnel licence (ground mechanic). No other documents have been identified to certify his qualification as a flight engineer.

Also, the investigation commission did not succeed to identify documents to prove the flight activity during the day of the accident, except for a sheet from the pilot’s personal notebook, in which only lubricant and fuel supplies, and the duration of each performed flight were registered (fig. 5).

Fig. 5 Sheet from the pilot’s personal notebook
The following aspects can be observed from these notes:
- performing a 25-liters oil supply at the beginning of the activity;
- the aircraft performed 12 flights during the accident day, totaling about 3 and a half flight hours;
- performing 4 fuel supply of 200 liters each.

2.5 Medical and pathological information

As a result of the passenger death, the necropsy was performed. According to the forensic report, death was violent and was due to the traumatic and hemorrhagic shock, as a result of a cranio-thoraco-abdominal and limb polytrauma, with multiple fractures and internal organ breakages.

The aircraft’s pilot was transported to the hospital with multiple trauma, fractures and sprains, being hospitalized for a long period of time and subject to many surgeries. Physically, he is partially recovered, but has never piloted an aircraft again.

During the accident, the pilot suffered also a serious craniocerebral trauma.

Following the discussion with the pilot, due to the amnesia he suffered of, the investigation commission did not get any relevant information about what happened on the accident date.

Biological samples were collected and alcohol tests were performed to the pilot and passenger, their results being negative.

2.6 Analysis

The pilot performed an aerial chemical flight at low altitude, in the vicinity of an high voltage lines, requiring maneuvers to cross over it. At the time of the accident, the weather conditions were adequate for the flight, even though there were rain showers that morning.

From the flights records, registered in the pilot’s agenda, the investigation commission found that he performed several flights, totaling about 3 hours and a half, each performed flight having a short duration (approximately 16-17 minutes). The short duration of the flight is specific to aerial chemical flights, because it is necessary to refill the tank with the necessary substances for the plant treatment, and also to refuel the aircraft.

After the last refueling, the aircraft took-off and performed 3 passes over the working area. At the last pass, in order to align on the work direction, it was necessary to perform a maneuver to cross a high voltage line (110 kV) situated in the immediate vicinity of the working area.
According to a witness statement, when the aircraft crossed over the high
voltage line, the aircraft being inclined to the right, a loud noise was heard (similar to
a bang, as described by the witness), followed by a fire in the rear of the aircraft.
Subsequently, the aircraft had a pronounced descending trajectory, with a tough,
flattened, touchdown. After the impact, the aircraft wreckage was scattered on a
radius of about 35 m. The aircraft fuselage was broken, the fuel tanks were broken,
and the remaining fuel intensified the fire, the aircraft being completely destroyed.

Samples of oil and fuel used in aircraft engine operation were taken and sent
for analysis to a laboratory authorized by RCAA. According to the analysis bulletins
issued, it was revealed that the oil was adequate, but the fuel was inadequate – it
was not identified as aviation gasoline.

The following scenarios that could have led to the accident have been
analyzed:

2.6.1 An engine failure that caused the unexpected engine shutdown

The engine failure (misfires, blasting, flames in the exhaust manifold), followed
by an engine shutdown would have been generated by at least one of the following
factors:

a) Improper fuel quality;

According to the laboratory test results, the fuel used to supply the aircraft was
inadequate (it was not identified as aviation gasoline). Non-compliant fuel could
cause an engine failure, evidenced by temperature rising, engine speed variations
and engine power loss, but would not have led to an unexpected engine shutdown.
But an anomaly of this kind in engine operation, which would affect flight safety, does
not justify the pronounced descending trajectory of the aircraft;

b) Anomalies in the ignition system (magnetos faults or wrong selection of
their operating position);

Anomalies generated by the malfunction of the ignition system (magnetos,
high-voltage conductors, spark plugs), could generate the above described
phenomena, but none of these causes an unexpected engine shutdown. The position
in which the magneto switch (fig. 6) was found after the accident is according to the
Flight Manual requirements.
In addition, according to the statement of the second pilot used by the operator for these flights, the aircraft was in a good condition on the day of the accident, a malfunction of the ignition system being fixed a few days before, by replacing the spark plug set (18 pcs.) and two high-voltage conductors (to spark plugs), and magnetos cleaning.

c) Lack of fuel supply to the engine

Lack of fuel in the engine intake manifold could be explained by the lack of fuel in the tanks or inappropriate selection of the fuel tank for the engine powering. Data available to the investigation commission confirms that the aircraft was supplied with 200 liters of fuel before the last take-off. It can be assumed that at least 50 liters of fuel were also left in the fuel tanks since the last fueling, because pilots usually refuel the aircraft before consuming all the fuel in the tanks.

The flight consisted of 2 passes over the working area, the accident occurring during the third one. It can be assumed that, after the first 2 passes (approx. 10 minutes of flight), about 200 liters of fuel were left in the aircraft fuel tanks.

The position in which the control lever of the fuel tank selector was found invalidates the possibility of accidental stop of the engine fuel supply.

Also, the way the propeller blades have been distorted at ground impact leads to the conclusion that the engine was running when the propeller came into contact with the ground (fig. 7).
By analyzing the available data, the investigation commission considered that the assumption of engine shutdown during the flight is not sustainable, and its possible abnormal operation would not justify the aircraft's trajectory at impact.

2.6.2 Unexpected event inside the aircraft

According to the recommendations, the aerial chemical application should be performed at an altitude of approximately 5 m.

The aircraft performed two passes/treatments over the working area, and after the last pass, in order to align on the working direction, it was necessary to perform a maneuver to cross over a high voltage line situated in the immediate vicinity of the working area. During this maneuver, the sprayer system had to be turned off.

The height of the high-voltage pylons is of 30 m, therefore the aircraft had to climb rapidly from the working flight altitude (approximately 5 m) to an altitude that allows safe crossing over the high-voltage lines.

The investigation commission did not receive any specific information about the altitude at which the aircraft performed this maneuver. It can be assumed that the altitude used when performing the high-voltage line crossing-over maneuver was of approximately 5 - 10 m. Given the witness's statement according to which the aircraft was slightly inclined to the right when crossing over the high-voltage line, it may be considered that the right wing of the aircraft was situated at a lower height over the high-voltage line, despite the initial assumption.

If the sprayer has not been properly turned off, it may be possible for the liquid sprayed from the sprayer, continuing to flow, to reach the high-voltage lines and thus to produce an electric arc between the high-voltage conductive wires and the aircraft.
this could have resulted in a fire in the aircraft’s passenger/cargo cabin. Because it rained in the morning of the accident, it is possible that the air high humidity has a contribution to this phenomenon.

This scenario was generated by the statement of an accident witness, who declared that, when the aircraft was above the high-voltage conductive wires, a loud noise was heard (similar to a bang, as described by the witness), followed by a fire in the rear area of the aircraft. The witness also said that the aircraft “caught fire in the air” and then “crashed with flames behind it”.

It can be assumed that the electric arc thus formed led to a fire in the rear area of the aircraft (passenger/cargo cabin).

The occurrence of an unforeseen event (possibly fire) inside the aircraft (passenger/cargo cabin) could have determined the pilot to decide performing an immediate, emergency landing, very likely at a high speed, considering the position the engine/propeller control levers have been found after the accident (maximum rpm and low pitch) (fig.8).

The low altitude of the aircraft at that time did not allow to control its evolution to perform an emergency landing according to the procedures described in the aircraft Flight Manual under the Emergency Procedures chapter, the aircraft having rough, flattened, touchdown. The pilot and the passenger were ejected from the aircraft, the fuselage and the auxiliary fuel tanks were broken, and the leaked fuel intensified the already existing fire, destroying the aircraft. The fire almost destroyed the passenger/cargo cabin (area situated behind the cockpit), while the components in the cockpit (dashboard, navigational instruments, indicators, central console, pilot seats) have no signs of fire.

Neither the engine nor the propeller has signs of fire, suggesting the conclusion that the fire occurred and intensified in the passenger/cargo cabin area,
without affecting the front area of the aircraft (i.e. the cockpit, the engine and the propeller).

It was not possible for the investigation commission to analyze the aircraft wreckage, so this scenario can’t be backed up by objective data and scientific arguments to certify the findings needed to define the cause of the accident.

Regardless of the scenarios made, it can be said with certainty that the fire occurred and was developed in the passenger/cargo cabin.

3. CONCLUSIONS

3.1 Findings

1. The flight activity performed on 10.05.2008 was carried out on the basis of a contract on supplying aerial chemical services, concluded between the aircraft operator and Ulmeni Agricultural Society;

2. The aircraft Flight Manual specifies the crew composition for agricultural flights: 2 pilots or pilot and a flight engineer.

3. The pilot held a valid flight license, appropriate to the aircraft type and activity performed, as well as a valid medical certificate;

4. The second person onboard the aircraft held a valid aircraft maintenance personnel licence (ground mechanic); no other documents have been identified to also certify his qualification as a flight engineer;

5. The Investigation Commission could not determine who took the decision as the aircraft to carry out flights on the day of the accident, provided that a crew compliant with the requirements of the Flight Manual was not on board the aircraft;

6. Aircraft maintenance was performed according to the operator’s approved maintenance program, the last inspection being completed on 16.04.2008;

7. During the morning of the accident, there were rain showers in the working area. After lunch, when the flight activity started, the weather conditions were appropriate for the flight;

8. According to the laboratory tests results, the fuel used to supply the aircraft’s engine was inadequate (it was not identified as aviation gasoline), but the oil used in the aircraft’s lubrication system was declared to be adequate;

9. Inappropriate fuel quality did not cause the engine shutdown, the way propeller blades have been distorted due to impact showing that the engine was running when the propeller hit the ground;

10. The position of the engine/propeller control levers have been found after the accident (maximum rpm and low pitch) indicates that the engine was functioning at its maximum capacity before the accident;
11. The position in which the magneto switch has been found after the accident is according to the Flight Manual requirements;

12. The fire has almost completely destroyed the area behind the cockpit, while components in the cockpit have no signs of fire;

13. The engine and the propeller have no signs of fire.

3.2 Cause of the accident

3.2.1. Determinant cause

Performing an unsuccessful emergency landing, the touchdown being rough, flattened, and most likely with a high speed.

3.2.2 Favoring cause

The occurrence of an undetermined event onboard the aircraft.

3.3 Safety recommendations

The investigation commission issued no safety recommendations after this accident.

Note: This report was drawn up on the basis of the information available to the CIAS at the date of the appointment of this investigation commission as well as of the additional information obtained by the commission.

Observation: The documents and analysis objects used for the issuance of the flight safety investigation Report are confidential and archived at the Civil Aviation Safety Investigation and Analysis Center, according to the legal provisions.