

FINAL REPORT

on

investigation of an aviation occurrence with Aviatica-890 SH aircraft,
registered LZ-AVB, owned by MORENA-CHAR Ltd, City of Stara
Zagora, occurred on 11.04.2006 during aero-chemical works (ACW)



2006

The materials about aviation occurrence have been classified under state file number 02/11.04.2006 in the archives of the Aircraft Accident Investigation Unit (AAIU).

Air Operator (AO): The company-owner of the aircraft MORENA-CHAR Ltd. as to the moment of the air occurrence has no air operator certificate, the company's main office is: City of Stara Zagora, 45 TZAR KALOYAN Str., entrance B, apartment 11.

Aircraft Manufacturer: ZAO AVIATICA-LIGHT - Russia.

National and Registration Marks: LZ-AVB according Certificate for Registration No 1048, issued on 01.08.1994 by the Civil Aviation Authority.

Place and Date of Air Occurrence: A field in the of the Pet Mogili village area, municipality of Nova Zagora, District of Sliven, on 11.04.2006.

Notified: Aircraft Accident Investigation Unit (AAIU), Civil Aviation Authority, Interstate Aviation Committee (MAK) – Russia and International Civil Aviation Organization (ICAO).

Type of Flight: Aero-chemical work (ACW) flight for herbicide spraying.

On 11.04.2006 the pilot of single-seat aircraft AVIATICA 890SH, registered No LZ-AVB carried out a series of flights for ACW. After refilling the chemical tank with herbicides he took-off from an old agricultural landing field in the Pet Mogili village area, flew over the village heading Southwest for treatment of a field at about 500 m to the west from the village. The flight altitude was 15...20 m. Just at the southern end of the village at a distance of 40...50 m before the perpendicular high voltage electric line with 15 m high pylons, the aircraft made a sharp turn of 180° with steep descent and hit the ground with a right bank. As a result of the impact the aircraft airframe was destroyed, the pilot was injured and died before ambulance arrival.

In accordance with Para.3 of Additional Provisions to Regulation No 13 of the Ministry of Transport of 27.01.1999 about aircraft accident investigation the occurrence was classified as an Accident. A commission was appointed for investigation of the aviation occurrence by an order RD-08-172/13.04.2006 of the Minister of Transport

1. Factual Information

1.1 History of Flight

1.1.1 Flight Number: Eleventh ACW flight for the day.

1.1.2 Preparation and description of the flight and events:

The aircraft commander, conducting ACW flights in the Pet Mogili village area, was the manager of the MORENA-CHAR Ltd. Aircraft flight preparation was conducted on an old agricultural aviation airfield in the northern end of Pet Mogili village. The aircraft was refueled and refilled with chemicals by the pilot and there wasn't any documentation about it. As the ACWs were executed by a person, who had no rights of air operator, there was no registration documentation about the flight preparation and aircraft airworthiness maintenance. As the performed activity was illegal, the pilot didn't submit preliminary request for ACW according the established procedure and didn't report for the start and the end of works to the Sofia Flight Information Center. There were no documents to certify the preparatory and current activities for aircraft servicing during the flights executed.

According the witnesses information, the flight in which the aviation occurrence emerged was the eleventh for the day. Before the flight the herbicide tank was filled in full (60 liters), the aircraft wasn't refueled. The aircraft took-off at about 18 hrs for spraying of a field to the southwest of the Pet Mogili village. The pilot has familiarized himself in advance with the field situation and a signaler was waiting for him at the place. During the flight to this field, the aircraft flew over the village in southwest heading at an altitude of 15...20 m. Immediately after the last house, the aircraft started to climb, suddenly changed the flight direction to 180° and with a right bank in steep descent hit the ground. During the maneuver, a sharp increasing of engine noise was heard by witnesses. The place of impact was a freshly ploughed field, immediately to the last house yard at the southwest end of the village. Close to the field boundaries high voltage overhead lines were situated to the southeast, south and southwest direction with the height of pylons between 12 and 20 m. In southwest direction, an electrified railway is situated. The sketch of the place of occurrence is shown on Figure 1 of Enclosure 1.

The aircraft was destroyed by the impact. The cockpit was destroyed and the pilot was pressed down by the vertical main beam, on which the engine-propeller unit and the chemical tank were fixed on a horizontal cantilever. The pilot was seriously injured by the impact. He was taken out by witnesses after cutting the fasten belt. An ambulance for emergency medical care from the town of Radnevo, situated at a distance of 4 km, arrived to the place of accident after about 45 minutes. The pilot died before ambulance arriving.

The aircraft at the place of accident is shown on Figure 1 & Figure 3, Enclosure 1.

1.1.3 Location of the Occurrence: ploughed field immediately to the south end of Pet Mogili village, between the fences of the last houses and two tangential high voltage power lines, with coordinates N - 42°18'03'', E - 026°02'08'', elevation 133 m, local time 18:10 hrs, daylight.

1.2 Injuries to Persons

Injuries to persons	Crew	Passengers	Other persons
Fatal	1	0	0
Serious	0	0	0
Minor/ None	0	0	0

1.3 Damage to Aircraft

The main bearing structure of the aircraft frame was destroyed and the longitudinal beam was ruptured at three points. The nose gear attachment point was torn away, there was a rupture of the beam between the landing gear attachment point and the attachment point of the two half-wings and there was a rupture just behind the landing gear attachment point. The rupture behind of the landing gear attachment point probably was a result of aircraft parts movement on the ground, because such a rupture was not visible on the photos, made on the site of occurrence immediately after it by Investigation Unit of Ministry of Interior in the town of Nova Zagora. The vertical bearing beam was ruptured at the place of connection with the horizontal cantilever, which served as a engine nacelle and for attachment of chemical tank and the battery. The upper half-wing attachment point was placed on this beam. After the rupture of this assembly the upper wings with a piece of the beam and engine-propeller unit were detached forward and they were connected by stretching wires only. The lower half-wings twisted up, creating positive V-shape. The cockpit was destroyed. Two of the propeller blades were destroyed, one of them entirely, the other one – partially. The air filter was castaway, the carburetors were detached from their places. The chemical tank was castaway, its attachment points were destroyed. There were destructions and deformations on the spraying system. The tail unit has preserved its structural integrity. All main structural elements, independently of their condition, were placed on a surface with a radius of 6 m. The aircraft was in non-recoverable condition.

The destruction of aircraft structure is given on figures 2, 3, 4, 5, 7 &10 in Enclosure 1.

1.4 Other Damages

No other damages.

1.5 Personnel Information

1.5.1 Commander – male, aged 49.

According an information, given by him in connection with an incident realized on 14.05.2005, forced landing on Hemus Highway, he has possessed Glide and Propeller Aircraft License from the OSO organization, which was not revalidated more than 10 years and it was invalid. In year 2002 he passed a medical examination in Air Medical Commission (AMC) for a professional pilot and graduated a theoretical course for pilots of An-2 aircraft, but didn't succeed to be certified. In March 2005 he appeared for

medical examination in AMC, but by decision of medical commission he was in flight prohibition and he was asked to cure his hernia.

On the grounds of a lease contract with Bulgarian Airspace Agency from 12.09.2005 he possess an A-890 SH aircraft, reg. LZ-AVB, with which he has made the abovementioned forced landing.

License: As for the time of aviation occurrence the pilot didn't possess a pilot license and medical certificate. The commission possesses the following documents in connection with the pilot's qualification:

- Examination list for prolongation of the validity of pilot's license No.....

The Protocol was approved by the Head of Air Club of Stara Zagora on the 10.10.1989. In the Examination list there were two main points: the pilot has passed a refreshing course for control tower operator in the Training Centre of OSO (confirmed by a protocol) and successful medical examination in Air Medical Commission, confirmed by a protocol. As a conclusion in the protocol the Head of Air Club of Stara Zagora wrote, that the "pilot is trained excellently as a pilot and control tower operator";

- According to a reference from the Instruction about Air Crew Medical Certification in People's Republic of Bulgaria from 04.06.1986 the pilot was certified by AMC according a protocol as "clinically healthy" and "able for flight training as a pilot-sportsman of propeller-driven aircraft";

- Protocol from 12.06.1986 for an exam for certification as a control tower operator;

- Reference about issuing of pilot certificate, signed by the Head of Air Club of Stara Zagora, where it could be seen, that he was permitted for flights as a pilot by Order No26/24.12.1981. His total flying hours up to the moment of issuing of the certificate was 53:40 hrs. In the conclusion of the medical certificate it was written "fit for sportsman – glider pilot".

- An excerpt from Order from 2402.1981 of the Head of Air Club in Stara Zagora concerning admission for commander's work on BLANIK aircraft. (On the grounds of Examination Protocol No 7 on theoretical disciplines, flight check and medical certification he was admitted for flights as BLANIK aircraft commander)]

- Deed for flight check on circling flight, made on 11.03.1981 on L 13 BLANIK 24 aircraft in VFR, day;

- Deed for flight check in training flying area, made on 11.03.1981 on L 13 BLANIK 24 aircraft in VFR, day;

- An excerpt from Protocol from 24.02.1981 for an examination on theoretical disciplines;

- Reference from Protocol No 4/14.03.1981 of AMC, according which the pilot was certified as "fit for flying activity as a sportsman – glider pilot".

In a protocol from 14.03.2005 of National Transport Hospital (NMTB-OMGE-BT) for temporary medical certification as a pilot he was diagnosed *Hernia inquiscrotelis sick*, for surgical treatment and temporary disabled until full recovery. After this date there was no information about surgical treatment.

The pilot has fulfilled commercial ACW flights without pilot certificate and medical certificate until aviation occurrence emerging.

Professional experience:

- total flying hours: not kept

Information about duty time:

- Flying hours:
 - Last 24 hours: about 5 hours;
 - Last 30 days: N/A;
 - Last 90 days: N/A;
 - Rest before duty: 12 hours.

1.6. Aircraft information

1.6.1. Airworthiness information

Aircraft AVIATICA-890 SH, serial number 135, registration number LZ-AVB was manufactured in April 1994 by ZAO AVIATICA-LIGHT, Russia and it was designed by OSKBES MAI. The aircraft possess Registration Certificate No 1048, issued by CAA on 01.8.1994. Bulgarian Airspace Agency was registered as aircraft owner. It granted the aircraft for operation by sole trader company ORSO from Stara Zagora with a Lease Contract No 1/12.09.2000. By an agreement to this contract from 05.12.2003 between the Bulgarian Airspace Agency, sole trader ORSO and MORENA-CHAR, the last company replaced ORSO as a lessee under the contract No 001 from 12.09.2000 with all ensuing rights and obligations. On 29.12.2004 a Contract for a sale-trade was concluded between Bulgarian Airspace Agency and MORENA-CHAR Ltd., according which the aircraft AVIATICA-890SH, serial number 135, registration number LZ-AVB became a property of MORENA-CHAR Ltd. On 27.10.2005 the manager of MORENA-CHAR Ltd submitted a request for re-registration of the aircraft, but because of the lack of the standard performance data it wasn't done until the occurrence. Registration certificate No 1048 was issued with the following limitations: "For aircraft performance assessment flights in air chemical works, for maintenance of pilot's qualification flights, for air demonstration flights and for participation in air shows."

The manufacturer has determined aircraft service life of 10 years, which has expired in April 2004. No application was submitted in order to conduct works for aircraft service life prolongation and no such works were conducted.

The aircraft was equipped with Rotax-582 engine, serial No 4169580.

The Interstate Aviation Committee (MAK) of Russia sent following information: "The aircraft Aviatika-890SH, serial number 135 with Rotax-582 wasn't certified by OSKBES MAI and it wasn't equipped for air chemical works system SON-4".

The company MORENA-CHAR Ltd. - owner of the aircraft - didn't submit documents to the commission in order to certify the technical condition of the aircraft. There was no maintenance program, no technical logbook, the flight time and works done were not recorded in accordance with the Maintenance Manual for A-890 aircraft. It was written in Annex 1 to the contract No 001/12.09.2000, that the lessor has handed over to the lessee the documentation with the records about aircraft technical condition.

An airworthiness certificate wasn't ever issued for the aircraft.

The following maintenance works should be performed in accordance with the Technical Maintenance Manual for Aviatika-890 aircraft with Rotax-582 engine, approved by the Chief Designer of OKB MAI:

- after each 50 hrs flight time or 1 time monthly;
- after each 100 hrs flight time or 1 time in 6 months;
- after each 200 hrs flight time or 1 time yearly.

After each 2000 hrs flight time or after 5 years in operation an overhaul should be performed.

The total life time of 4000 hrs flight time or 10 years in operation was established for the aircraft.

The aircraft operational (line) maintenance includes:

- preflight check (Form A), it should be performed before the first flight for each flight day;
- between flights servicing (Form B), it should be performed before each next flight;
- post-flight ckeck (Form C), it should be performed at the end of each flight day;
- periodical check (Form D), it should be performed no less than one time monthly using instrumental methods of control.

The commission failed to define the total aircraft flight time as to the moment of occurrence, but according substituted data from witnesses it should be 750...800 flight hours, but in accordance with information from the design bureau at moment of occurrence the aircraft life time was exceeded by two years.

Taking into account the abovementioned, the conclusion could be made that in the moment of occurrence the aircraft wasn't airworthy in accordance with the legal requirements and normative base for civil aeronautics in Republic of Bulgaria.

1.6.2. Aircraft performance

Aircraft maximum take-off weight for the accident flight with full chemical tank 60 kg, pilot (100 kg) and full refueling (39 kg) is 470 kg.

Maximum landing weight 470 kg.

Normal take-off weight with full chemical tank 60 kg, pilot (75 kg) and 50% fuel (20 kg) is 425 kg.

Maximum fuel quantity 50 l.

Maximum operational speed of the aircraft equipped with spraying device 110 km/h.

Minimum speed in horizontal flight in km/h:

- with idle engine speed – 65;

- with maximum engine speed – 60;
- Maximum vertical descend speed – 5 m/s;
Take-off speed from unpaved runway – 65 – 70 km/h
Landing speed on unpaved runway - 65 km/h
Landing run:
- on hard unpaved surface - 105 m;
 - on grassy surface – 115 m.

Maximum allowable operational g-load:
(by strength data of the attachment points for agricultural equipment and the limitation by maximum allowable operational speed):

- positive +2.5;
- negative – 0

(by condition for reliable engine operation):

Minimum g-load +0.5

Maximum pilot's weight 100 kg, minimum pilot's weight 70 kg.

Aircraft operation for ACW is permitted when the turbulence is not greater than moderate, with $V_y \leq 1,5$ m/s.

1.6.3. Fuel

The fuel is gasoline with octane number not lower than 90, mixed with oil for two-stroke engines in 50:1 proportion. The commission established after arriving on the place of occurrence established there was no fuel in the aircraft tanks. Probably the fuel has leaked from ruptured tubes. But there was fuel in the transparent tube at the inlet to the carburetor, what was an evidence that the engine didn't stop because of the lack of fuel. Indirect signs in relation of engine work, witnesses evidences and propeller position on the place of impact on ground confirmed the hypothesis, that there was fuel onboard.

1.7. Meteorological information

Daylight, visual flight conditions (CAVOK, cloud base over 1000 m, visibility over 20 km, wind 2 – 3 m/s from South).

1.8. Aids to navigation

N/A

1.9. Communications

N/A

1.10. Airport

Pet Mogili village airfield, municipality of Nova Zagora.

1.11. Flight data recorders

No envisaged for the aircraft type.

1.12. Wreckage and impact information

The place of occurrence was a ploughed field without young growth, placed immediately to the southern end of Pet Mogili village, between the fences of the last houses and two tangential high voltage power lines, with coordinates N - 42°18'03'', E - 026°02'08'', elevation 133 m. A sketch of the place of occurrence is shown on Figure 1, Enclosure 1.

The aircraft met the ground with a high angle of descent and right bank with low forward speed, what is visible by the traces. The cockpit, vertical bearing beam together with the cantilever and upper half-wings, motor frame and propeller were destroyed. As it was noted in Para.1.3, all main elements of the structure, independently of their condition, were placed on a surface with a radius of 6 m. The chemical tank was at 8 m from the place of the impact and at a distance of 15 m was the first band of its fixing to the lower surface of the motor frame. There were pieces of cockpit glazing and of the propeller at a distance, the cause for which is probably the ground impact.

1.13. Medical and pathological information

As a result of the impact the pilot was severely injured and died before arriving of the first aid ambulance. A forensic medical examination on the corpse was performed in the Forensic Medicine Unit at MBAL-EAD – University Hospital in Stara Zagora. The forensic medical examination is under No 58/2006 and copy of it is enclosed to investigation materials.

In the forensic medical examination, the following conclusion is made:

“During the examination and autopsy ... it was established: Craniofacial and craniocerebral trauma - bruises and rubs on the soft cranial tissues, rubs on the face, ruptures and contusions on the lower lip of the mouth and under the chin, fracture of the chin with teeth knocked out from upper and lower dentition, haemorrhage under the soft brain membranes.

Chest trauma – bruises on the thoracic cavity, fractures of ribs in the right hand chest half and fracture of the breastbone, 500 ml of blood in the right-hand thoracic cavity. Swelling of the brain and lungs.

Fracture of the pelvis, blood in the abdominal cavity 150 ml.

Fracture of the sublingual bone and thyroid cartilage at left side. Fracture of the right hand femur. Fracture in the upper and lower third part of the left hand shank and the inner ankle of the left hand lower limb. Scarce fat embolism in the lungs.

Multitude bruises and ribs on the upper and lower limbs. A number of micro-cicatrix on the heart muscle. Thickening of the left hand (aortic) ventricle of heart.

Fatty dystrophy of the liver. Lack of alcohol in the blood.

The immediate cause for the death of ... was a trauma shock in result of the heavy and multitude traumatic injures, described above.

The above described traumatic injuries are a result of the impact of hard and blunt objects and they correspond to be suffered on time and the way, reflected in the preliminary information – aircraft accident.

All injuries are in lifetime.

No traumatic injuries were established, which wouldn't be explained with the specific aircraft trauma.

The presence of micro-cicatrices on the heart muscle in the inter-ventricular septum area could cause heart rhythm disturbance, with which eventually may be explained the loss of control of aircraft.

Corpse condition corresponds to the death in the first day.“

1.14. Fire

No fire emerged.

1.15. Survival aspects

The pilot has used the safety belt during the flight. After the impact, the witnesses arrived couldn't unfasten the belt in order to take out the badly injured pilot. They had to wait for a knife from one of adjacent houses to cut the belt. There were some difficulties during the taking out of the injured pilot from the aircraft wreckage.

1.16. Tests and research

For the purposes of technical investigation the following was accomplished:

- examination of the traces from the impact on the scene of air accident;
- examination of the wreckage of the aircraft, engine and propeller;
- examination of the assemblies for chemical tank attachment;
- recording and analysis of the gauges readings and electrical switches position in the cockpit;
- collecting of witnesses explanations and comparative analysis of them;
- inspection of Aviatika-890U aircraft;
- investigation and analysis of documentation, related with aircraft operation;
- forensic medical examination of the died pilot corpse;
- investigation and analysis of documents, related with professional qualification of the pilot.

The materials and the results of the tests and research made are enclosed to the deed.

2. Analysis

After collection and examination of the facts, related to the aviation occurrence emerged, the commission has developed three basic hypothesizes for clarification of the causes:

1. Destruction or failure of the aircraft in flight;
2. Loss of control of aircraft because of health cause;
3. Pilot's errors.

2.1 First basic hypothesis - destruction or failure of the aircraft in flight

The work under this basic hypothesis was conducted in several directions:

1. Loss of structural integrity of the aircraft with destruction of the main aircraft structure in flight;
2. Occurrence of inadmissible vibration and imbalance in result of propeller destruction in flight;

3. Occurrence of imbalance and oscillations of the centre of gravity in result of destruction of chemical tank fixation in flight;
4. Control system failure in flight;
5. Engine flame-out in flight.

For the first direction: The main bearing structure of the aircraft consists of longitudinal beam and support, shown on Figure 14 in Enclosure 1. On the longitudinal beam consecutively from forward are placed: nose landing gear attachment point; lower docking device for the lower wings attachment, attachment point for the shock absorbers of the main landing gear legs, the attachment points for tail assembly. On the support are placed: upper docking device for upper wings attachment and an assembly for fixation of the cantilever for motor frame, on which the engine with propeller and chemical tank are fixed. On the scene of occurrence the commission established destruction of the main bearing structure in four points:

- Destruction of the longitudinal beam immediately after the nose landing gear attachment point, shown on Figure 13;
- Destruction of the longitudinal beam between the lower docking device and the shock absorbers attachment point, marked with 1-1 on Figure 14 and shown on Figure 12;
- Destruction of the longitudinal beam immediately after the shock absorbers attachment point looking from the nose of the aircraft, marked with 2-2 on Figure 14 of Enclosure 1 and shown on Figure 11;
- Destruction of the support in the point of attachment of the cantilever of the motor frame, marked with 3-3 on Figure 14 in Enclosure 1 and shown on Figure 8.

The nature of fracture, shown on figures 13, 12 & 8, corresponds to the nature of fracture, caused by single shock load resulting by ground impact. This load emerged from inertial forces of relatively big mass of the engine and chemical tank, mounted on the motor frame cantilever. In the area of fracture, shown on Figure 11 and marked with 2-2 on Figure 14, a heavy corrosion is visible. Taking into account the expired operational life time of the aircraft and typical for aluminum alloys inter-crystal corrosion, it was possible to assume, that such fracture might emerge in result of operational overloads. If this fracture occurred in flight, it should cause loss of stability and controllability of the aircraft and may result in the consequences emerged in the investigated accident. The investigation of the photos, made on the scene of occurrence by the investigator from MVR – Nova Zagora shows, that such fracture doesn't exist, Figure 9 and Figure 10 of Enclosure 1. The fracture was caused by the aircraft wreckage removal from the place.

Having in mind the Para.1.12 and on the grounds of aforementioned, it is possible to reject as improbable the hypothesis, that the aviation occurrence has emerged in result of loss of structural integrity of the aircraft because of destruction of the main aircraft bearing structure in flight.

For the second direction: Occurrence of inadmissible vibration and imbalance in result of propeller destruction in flight.

The destruction of the propeller in flight may occur in result of:

- hit by foreign objects, being in the air space;
- hit by objects, detached from parts of the aircraft, placed in front of the propeller;
- engine operation at rotational speed over the limits.

The propeller was three-blade, composite, made in Germany, NEOFORM make, with fixed pitch. The propeller blades are shown on Figure 15 in Enclosure 1. There are no visible traces from impact, which couldn't be explained by the ground impact. There are no traces from bird impact. On 12.04.2006 a private pilot, who visited the scene of occurrence, discovered at 1 m out of the police barrier in southern direction and at about 15 m from the point of impact, a piece of upper forward edge of the propeller blade with rectangular form and area of 7.5 cm². There were no signs of any influence, which couldn't be explained by the impact at destruction of aircraft. If the readings of revolution counter may be considered reliable, Figure 16 in Enclosure 1, the revolution speed of the engine rotor was 5600 rpm at the moment of ground impact and a piece of the periphery of the blade possessed considerable kinetic energy, which could throw it to the place, where it was found. There is no information about detached in flight elements of the structure, which may destruct a blade of the propeller. There were no signs of propeller impact on the chemical tank, which was found detached from the aircraft at 8 m from the point of impact. Maximum allowable rotation speed of the engine is 6800 rpm and obviously it wasn't exceeded both because of above mentioned revolution counter readings and because the propeller is with fixed pitch.

On the base of the abovementioned it is possible to consider as unlikely the assertion, that the aviation occurrence is a result of propeller destruction in flight.

For the third direction: Occurrence of imbalance and oscillations of the centre of gravity in result of destruction of chemical tank fixation in flight. The chemical tank is fixed on underside of the cantilever, on which the engine is fixed, Figure 17, Enclosure 1, Position 9. It is the biggest mass concentrated on-board of the aircraft. The change of the tank position in result of bad fixation should cause confusion in stability and controllability of the aircraft. According information from the previous lessee, about two years ago there was a case of rupture of the rear fixing band of the tank. In result vibrations emerged, which considerably complicated the aircraft control and the pilot made a forced landing. On the Figure 18 and 19 the fixing assembly on the cantilever was shown, where it is visible that it was repaired. Permission for this repair was asked neither from the manufacture, nor from the aviation authorities. On Figure 20 are shown ruptures of the fixing bands of the tank. Mrs. Bozhana Mikhailova Tabakova, Assistant Professor, Doctor of Science, Engineer, member of Metallography and Metal Technology Chair at Technical University in Sofia, was invited as an expert for an outlook about the type of the destruction of the attachment assemblies of the tank. Her outlook is enclosed to the investigation materials. There are two main conclusions in it:

1. The fractures of double Γ -shaped profiles for tank fixing to the lower part of motor frame had pronounced texture of the material by rupture, caused by extreme loading, no presence of cracking was established, no presence of fatigue cracking was established, and the cause for destruction was extreme loading.

2. On the double Γ -shaped profiles for tank fixing were found areas of plastic deformation; areas of thinning of the wall of the double Γ -shaped profile of the rear band in result of wear.

On the front side of the chemical tank there was a heavy bending in result of contact with the vertical support of the load-bearing structure at the ground impact.

Having in mind the abovementioned, it is possible to conclude that the chemical tank has been detached from the place of fixing at the moment of ground impact. This conclusion makes not likely the assertion, that emerging of imbalance and oscillations of the center of gravity in result of destruction of tank fixation in flight may be the cause of the aviation occurrence emerged.

For the fourth direction: Control system failure in flight.

On the scene of occurrence, the members of commission examined the condition of the control surfaces and condition of connections of the control system in the all three channels. No facts were established, which may be connected with possible failure of control system and which wouldn't be explained with the destructions after the ground impact. On Figures 2, 5 & 9 of Enclosure 1 the condition of control surfaces and aileron control assembly is shown. The 11 flights at low altitude fulfilled during the day and explanations of the witnesses about the flight trajectory at the last part of the flight didn't support the hypothesis for control system failure.

For the fifth direction: engine flameout in flight.

No reason to believe there was an engine flameout on the grounds of the following causes:

- witnesses testimonies, who informed about a raised noise of engine work during the last stage of the flight;
- revolution counter reading, as it is visible on the photo on Figure 16, Enclosure 1, was 5600 rpm, what is in normal operational range of engine modes;
- during the ground test by the commission members the engine shaft rotated and there was compression.
- condition of the spark plugs after their removal corresponded to normal engine operation;
- On the place of ground impact, two of the blades were destroyed by impact and the third was driven in the ground, Figure 6, Enclosure 1. On the figure it is visible the torn fabric of the upper wing, possibly by the propeller, after loss of structural integrity.

The recital on the five directions makes the first basic hypothesis - destruction or failure of the aircraft in flight – unlikely as a cause for aviation accident occurrence.

2.2 Second basic hypothesis - Loss of aircraft control because of health causes

On the grounds of witnesses testimonies, forensic medical expertise, available medical documentation, as well doctor's standpoint - internist and surgeon from AMC (air medical commission), the following conclusions could be done:

In the forensic medical expertise was noted, that the immediate cause for the pilot's death was traumatic shock in result of severe and multiple traumatic injuries, all of which could be explained with aircraft accident. No changes were described, which categorically might bring to a sudden worsening of the pilot's health condition in flight and that to be a cause for the catastrophe.

The pilot appeared before AMC on 14.03.2005 after three-year interruption of his medical certification for Second Class – private pilot. Then the AMC surgeon established right-hand side inguinal-scrotal hernia (*Hernia inquiscrotelis sik*). This diagnosis brought to estimation for temporary disqualification until the end of respective surgical treatment. Since no changes in the intestinal tract were noted in the autopsy protocol, which may be considered as a sign for locked inguinal-scrotal hernia, this diagnoses wouldn't be a cause for the occurrence.

From the analyses made during the same examination on 14.03.2005 – blood analysis, ECG, echography, as well from the standard objective examination, there were no reasons to assume any pathological changes, which may lead to acute loss of work efficiency, according to the AMC internist. The blood analysis was normal. Abdomen echography showed no pathological changes. The pulse and blood pressure were normal, too. ECG – sine rhythm, without rhythm disturbances and without changes in comparison with the ECG from 2002, when the pilot performed a bicycle ergometer test (with loading), which was also normal.

From all described until now it is very difficult to accept, that there was sudden worsening of health condition of the pilot during the flight, which may be in causal connection with the air accident.

2.3 Third basic hypothesis - pilot errors

In analysis of this hypothesis, the commission based on the following facts and circumstances:

- Aviation accident area is exceptionally difficult for ACW because of very dense placed high voltage network, consisting of pylons and wires with height of 15-20 m, limiting the ability for maneuvering to East, South and West in relation with the flight direction;
- Extended chain of low-voltage poles and wires with a height of 8-10m, placed under the high-voltage network and perpendicularly to the direction of flight;
- Presence of railway line and railway electrical network of poles and wires, placed perpendicularly to the flight direction;
- Obsolete windscreen of the cockpit with micro-cracks and soiling, especially in case of sunlight from ahead.

On 11.04.2006 at 17.30 hrs the flight direction was in the sector between 250° -280°, i.e. to the west and the sun position was about 10° - 15° over the horizon.

- Flight altitude was 15-20 m according witnesses' information;

- Aircraft weight was close to MTOW;
- The flight was the last one, 11-th for the day.
- The flight was the first one for field treatment to the west from the railway with working passes from east to west.

According witnesses' information, flying horizontally in heading of 260° at an altitude of 15-20 m, during the last stage of the flight, the pilot has forced the engine and started right-hand turn with a big bank and “stepped” steep descend.

On the scene of occurrence, the commission established that the ground impact was at an angle of 60° - 70° and dispersion of the destructed elements was circular, almost compact, in a small radius on the ground.

There were two elements, which make an exception:

- a band for fixation of the chemical tank, was found out at 9 m from the place of aircraft falling, torn probably by the ground impact;
- piece of propeller blade with rectangular form and surface of 7.5 cm² , found at about 15 m from the point of impact in direction of flight.

The commission didn't establish any traces on the ground, which to show forward movement of the aircraft immediately before the impact as a result of force landing attempt.

The aircraft met the ground with the nose part at an angle of trajectory 60° - 70° in heading 20° - 30° and an angle of turn from original heading of 120° - 130°, what confirmed whiteness's assertion for tight right-hand turn with change of flight direction and steep descend.

Analyzing the physical features of the aviation occurrence area, the placed in semicircle and in depth in flight direction obstacles with equal height with the flight altitude, as well the abovementioned facts and circumstances, the commission assumed that because of limited visibility the pilot saw too late the obstacles perpendicular to the flight direction. In order to avoid the frontal impact he forced the engine in order to climb, but with this aircraft weight (about 470 kg, MTOW = 485 kg) and increased drag because of spraying equipment, the power reserve was low and according AOM ensure scarcely 1.5 – 2 m/s, which wasn't enough to overpass the obstacle.

The only possibility to avoid the frontal impact was to make a sharp, forced turn to the clear from obstacles side, in this case to the right (heading north-northeast).

The flight characteristics of the aircraft are given in “Flight Operation Manual of Aviatica-890 aircraft with Rotax 582 engine” and in supplement to it “Supplement No 1/Aviatica-890 SH”. In Chapter 5 - “In flight emergency situations”, in Para.5.2 it is written that with full deflection of the rudder and fully deflected stick to the rear the aircraft can't spin, but change to spiral with lowering of the nose and increasing of speed.

With horizontal flight speed according AOM of 90-100 km/h, in confirmation of the above, the speed indicator reading at the place of ground impact was 120 km/h (Figure 16, Enclosure 1).

In case of rotation about all three axes on the aircraft act not only the moments, depending on angle of attack and angle of slide, but also on the angular velocity of aircraft rotating about the three axes: with considerable angular velocity about the longitudinal and yaw axes and with fast increasing intensity about the lateral axis.

During the aircraft rotation, the streamlining condition are changing both for the different components and in general for total aerodynamic configuration, what lead to initiation of additional redistribution of the aerodynamic forces and moments in very short time and which determine the aircraft trajectory of movement.

On the base of flight characteristics of the aircraft, represented in Para.5.2 and 5.3 of AOM and taking into account the inertial influence of the liquid in chemical tank, the aircraft trajectory, described by witnesses (excluding stall and spin) as corresponding to aircraft movement in deep spiral, which is described as descending spatial maneuver, in which there is no stall from the wing or flight with critical (supercritical) angle of attack and aircraft descending spatial trajectory is formed by redistributed aerodynamic and inertial forces and moments.

The pilot's attempt to raise aircraft nose and to stop descending without elimination of the bank at best may result in temporary slowing of aircraft rotation (slowing of the angular speed and vertical speed of descend), interpreted by witnesses as a "stepped" descend.

On the base of witness information about the flight altitude (15 – 20 m) and the speed before the forced turn to the right (90 – 100 km/h), the commission defined that the time for performing of a full step of the spiral was 6.3 s.

Respectively for 120° angle of turn with loss of altitude of 15-20 m to the ground impact the time should be 2.1 s.

According the ergonomics, human reaction time, including assessment of the situation and motor-muscle reaction, is average 1.5 s.

The radius of the spiral turn with abovementioned parameters is 14.5 m. It was confirmed by the general disposition of the obstacles along the flight direction and the place of ground impact.

The low altitude and process development dynamics after the pilot's reaction predetermined greatly the actual outcome of the complicated situation emerged, which developed exceptionally rapidly into emergency and catastrophic one.

3. Conclusions

The technical investigation conducted, the results of examination and analysis give the grounds for the commission to make the conclusion, that the aviation occurrence was a result from the following

Main Cause: Pilot's underestimation of the area complexity in connection with the presence and disposition of the obstacles in flight direction and pilot error, led to complex aircraft attitude and intensive descend.

Immediate Reason: Aircraft impact on ground.

Contributing Factors:

1. The aircraft has no airworthiness certificate.
2. The type of aircraft wasn't certified for agricultural works.
3. The pilot wasn't certified as a pilot.
4. The pilot has medical inhibition for flight work.
5. Illegal conducting of ACW flights.

Safety recommendations:

1. CAA should develop and carry out procedures for fulfillment of Article 29 of Civil Aviation Act.

Person responsible: Executive Director of CAA. Time: Three months after submission of the report.

2. During the year inspection of general aviation aircraft for certifying of airworthiness, the inspectors from CAA to check for unregulated repairs on aircraft.

Person responsible: Head of Airworthiness Department of CAA. Time: permanent

3. For ACW aircraft crews should make analysis in depth of obstacle features and disposition in relation with the flight path and in the area of ACW and the results should be reflected as a graphical sketch in the logbook.

Person responsible: Managers of Air Operators Time: permanent