

FINAL REPORT

on

investigation of an aviation occurrence with An-2 aircraft, registered as LZ – 1217, operated by air operator „BASK AIR” JSC, realized on 18.04.2006 during an operational flight for aero-chemical works



2006

The materials about the aviation occurrence have been classified under state file number 05/18.04.2006 in the archives of the Aircraft Accident Investigation Unit (AAIU).

Air Operator (AO): BASK AIR JSC with main office in the City of Varna, 19 Slavyanska Str. and air operator certificate (AOC) No BG 440, issued by Civil Aviation Authority (CAA) on 05.04.2006 and valid until 13.04.2004.

Aircraft Manufacturer: PZL – Mielec, Republic of Poland

National and Registration Marks: LZ-1217, according to Certificate for Registration, issued on 27.03.2002 by the Civil Aviation Authority.

Place and Date of Air Occurrence: A field at Shtipsko village area, Suvorovo Municipality, District of Varna, on 18.04.2006

Notified: Aircraft Accident Investigation Unit (AAIU), Civil Aviation Authority, Aircraft Accident Investigation Bureau of Republic of Poland and International Civil Aviation Organization (ICAO)

Type of Flight: Flight for aero-chemical work (ACW).

An-2 aircraft registration No LZ-12-17, was fulfilling a flight for ACW from an airfield at Vetrino village. During a working pass for spraying with herbicides at 4 km Northwest from the airfield, the aircraft commander noticed an engine vibrations raise and after that he ceased the work and made a circle at safe altitude in order to check engine operational parameters. The commander determined that it was impossible to increase the engine speed above 1600 rpm. Taking into consideration the distance to the airfield and the obstacles in all directions (high voltage transmission lines), the commander made the decision for landing at the place, where he was. The crew made three approaches, selected a proper place from the air and landed. The landing was without any consequences for the crew and the aircraft.

In accordance with Para.3 of Additional Provisions to Regulation No 13 of the Ministry of Transport of 27.01.1999 about the aircraft accident investigation, the occurrence was classified as a serious incident. A commission for investigation of the aviation occurrence was appointed by an order RD-08-208/28.04.2006 of the Minister of Transport

1. Factual Information

1.1 History of Flight

The flight assignment was given by the Executive Director of the Air Operator in accordance with the requirements of Flight Operation Manual of the company BASK AIR JSC.

1.1.1 Flight Number: Fifth aircraft flight for the day.

1.1.2 Preparation and description of the flight:

The crew started ACW from the airfield at Vetrino village, District of Varna, at 9:50. Before this a preflight check of the aircraft has been made, during which a full engine check and a check of refueling and oil refill for the forthcoming flight were performed. The aircraft was refueled with 300 l of fuel and 75 l of oil.

The fields of Cherventsi Cooperative to be treated with herbicides, were at about 7-8 km from the airfield. There were no complaints by the crew about the aircraft systems functioning during the first four flights. Two refuelings were made – first time with 200 l and the second time with 400 l. The oil system was filled with 101 l of oil.

During the fifth flight at working altitude and about 10 minutes after the take-off vibrations of the engine emerged. The gauge readings were in norms. The crew started a climb, ejected the chemical solution and headed to the airfield at Vetrino for landing. Already at the end of the field the engine speed regulator R-9SM failed and the engine started to work at 1600 rpm. The power decreased and because of the big density of high voltage lines the crew took a heading to another airfield – Iskar. The power kept decreasing and other high voltage lines appeared ahead. The commander made the decision to land at the closest airfield – Suvorovo. The power kept decreasing, but the engine control gauges readings were in admissible limits. According to the commander's explanations, the head cylinder temperature was 200°C, oil temperature was 65°, fuel pressure was 0.3 kg/cm² and oil pressure was 5 kg/cm². The flight speed started to lessen, at first 120 km/h, after that 115 km/h, 110 km/h. A leak of oil appeared from the upper left part of the engine, which sprayed the fore left-hand part of cockpit glazing and worsened the visibility. The commander decided it would be impossible to reach Suvorovo airfield and undertook a forced landing in a field at the village of Shtipsko, which he knew from before.

The landing was normal, with engine running. After the landing the engine was shut-downed and the crew left the aircraft.

There were no consequences for the crew and the aircraft.

1.1.3 Location of the Occurrence

The serious incident emerged on 18.04.2006 at 13:25 local time during a working pass for herbicides spraying at 4 km to Northeast from the airfield at Vetrino village. The forced landing was performed at the village of Shtipsko, Suvorovo municipality, District of Varna, sown with wheat. The coordinates of the forced landing place are: N – 43°20'50"; E - 027°32'47"; elevation 180 m.

1.2 Injures to Persons

No injures to crew and passengers.

1.3 Damage to Aircraft

There were no damages to the airframe. During the engine disassembly it was established piston seizing of the first cylinder and seizing of compressor impeller shaft and of the flexible shaft of the accessory drive.

1.4 Other Damages

No other damages

1.5 Personnel Information

1.5.1 Commander – male, aged 51, with a valid license and medical certificate.

1.5.2 First Officer – male, aged 38, with a valid license and medical certificate.

1.6. Aircraft information

1.6.1. Airworthiness information

An-2 airplane, reg. LZ 1217 was manufactured in 1985 by PZL-Mielec, it possesses Registration Certificate, issued by CAA on 27.03.2002 and a Certificate of Airworthiness, issued by CAA on 27.03.2002, re-attested on 23.03.2006 and valid till 10.01.2007.

The aircraft has accrued since new, to the moment of aviation occurrence, 3577:17 hrs and since the last overhaul 1579:17 hrs, and it has a total lifetime of 16000 hrs and time between overhauls 2000 hrs. The remaining time to the next overhaul is 420:43 hrs.

An engine Ash-62IR was installed on the aircraft. From the beginning of the operation the engine has accrued 3949:22 and 224:22 hrs since the last overhaul with a total lifetime of 6200 hrs and time between overhauls 1000 hrs. The remaining time to the next overhaul was 775:38 hrs.

A propeller AV-2 was installed on the aircraft. The total life time of the propeller is 8000 hrs, and the time between overhauls is 1500 hrs. The remaining time to the next overhaul was 1315:24 hrs.

Aircraft maintenance is organized on the base of the Aircraft An-2 Maintenance Program in BASK AIR JSC, approved by CAA. In accordance with this program the following technical servicing of the aircraft was performed during the period between 07.02.2006 till 14.02.2006: F2, F180 and PLE. After the technical servicing a Certificate for Admission to Operation No 3/14.02.2006 was issued by the maintenance organization of the Air Operator, possessing Certificate of Competency No BG CAA-0106.

From the above mentioned, the conclusion can be made that the airframe, engine and propeller had the necessary lifetime for the flight mission on 18.04.2006.

The line technical servicing of the aircraft was performed by the AO and includes pre-flight servicing, short-time servicing, after-flight servicing and 50-hours form. The 50-hours form was not fulfilled on the An-2 aircraft, reg. LZ 1217, because after the last 100 hours servicing the aircraft had flown 18:57 hrs only. In the aircraft technical logbook there was registered after-flight servicing on 17.04.2006. There wasn't any additional works registered and removal of defects. On the day of the occurrence a record for preflight check at Vetrino airfield was written. The registered quantity of fuel was 300 l and oil 175 l. The aircraft commander has signed the aircraft reception at 9:00. There were no records for short-time servicing and failure removal in the intervals between the flights. Two refueling were registered – respectively 200 l and 400 l. During the second refueling the aircraft was refilled with 10 l of oil. The presence of 240 l of fuel in the tanks was found on the place of the forced landing.

On the base of the aforementioned, the conclusion can be made that the aircraft was airworthy and filled with enough quantity of fuel and oil for the mission to be fulfilled.

1.6.2. Aircraft performance

According to the Certificate of Airworthiness of the aircraft the maximum take-off weight is 5250 kg. Aircraft empty weight in accordance with the aircraft technical logbook is 3400 kg.

The aircraft was without chemicals fill during the flight from the treated field to the place of the forced landing. The crew consisted of two men with total weight 160 kg. Fuel weight during the landing was 350 kg. The oil onboard was 67 kg. The aircraft weight when landing was 3977 kg. Maximal allowable weight at landing is 5250 kg. Aircraft weight was 1273 kg less than maximum allowable landing weight.

Maximum allowable speed of the aircraft with ACW equipment is 250 km/h.

Minimum allowable speed of the aircraft in horizontal flight with ACW equipment is 250 km/h

Allowable g-load of the aircraft with ACW equipment is +3.0, -1.

Engine operational regimes (in rpm):

- Take-off regime 2200;
- Nominal 2100;
- 0.5 Nominal 1670;
- Idle 550.

Landing run:

- a) on a concrete runway with flaps at 39.5° and brakes 225 m;
- b) on grassy runway with flaps at 39.5° and brakes 210 m

1.6.3. Fuel

The aircraft was refuelled with air gasoline type 91. The presence of 240 l of gasoline in the two tanks on the place of forced landing has been determined. A sample of fuel was taken from the place of occurrence. The laboratory analysis of this sample and of the fuel, taken during the pre-flight preparation, in the Chemical Laboratory for Fuels and Lubricants at Sofia Airport didn't show any deviation from GOST 1012-72, according which the fuel for this type of engines should be assessed.

1.7. Meteorological information

Meteorological situation: visual flight rules, visibility 10 km, wind 2-3 m/s from 180°, temperature 20°C.

1.8. Aids to navigation

Standard aids for An-2 aircraft.

1.9. Communications

Standard communication equipment for An-2 aircraft

1.10. Airport

The aviation occurrence emerged in flight at 50 m altitude in the working area in the vicinity of Shtipsko village, Suvorovo municipality, District of Varna.

Elevation of the chosen place for forced landing is 180 m with coordinates N 43°20'50" and E 027°32'47".

1.11. Flight data recorders

N/A

1.12. Wreckage and impact information

There was no impact and destruction of the aircraft.

The occurrence emerged in flight and in result led to an engine power loss and landing on chosen from the air landing place. The landing passed without complications and consequences for the crew and the aircraft.

On figures 1 & 2 in Enclosure 1, the general view of the aircraft on the place of forced landing is shown.

1.13. Medical and pathological information

N/A in aviation occurrence emerged.

1.14. Fire

No fire emerged.

1.15. Survival aspects

After the examination and analysis done by the commission the following main survival aspects may be pointed out:

- in time registration of the complicated flight conditions by the pilot, caused by engine power loss;
- in time commander's decision for ceasing of ACW and discharge of the chemical solution;
- correct choice of landing site for emergency landing;
- safety belts in flight usage.

1.16. Tests and research

For the purposes of the technical investigation the following has been accomplished:

- inspection of the site of the forced landing and condition of the aircraft and engine;
- laboratory examination for assessment of the oil compliance with the specification requirements;
- laboratory examination for assessment of the fuel compliance with the specification requirements;
- full disassembly and flow detection of Ash-62IR in TEREM-LETETS EOOD Repair Plant in Sofia;
- examination of the records in the operational documentation of the aircraft;
- examination of the records in the repair documentation of Ash-62IR;
- comparative analysis of the explanations of the flight and ground crews;
- examination of the operational documentation of the air operator.

2. Analysis

The forced landing of the aircraft in the field in Shtipsko village area was caused by engine loss of power and leak of oil from the left-hand upper part of the engine. The check made on the place of forced landing showed loss of pressure in first cylinder. After cylinder removal, it has been determined a piston seizing and sticking of piston rungs. The piston of the first cylinder is shown

on Figure 3 of Enclosure 1 and on Figure 3 the bushing of the cylinder, where the bruises by the piston are visible. A decision to replace the first cylinder piston has been made. After the piston replacement a wedging of the engine shaft has been noticed. It was impossible to define the cause for the wedging. A decision was made for an engine replacement and sending it to MRP (Military Repair Plant) TEREM - LETETS EOOD in Sofia. The oil leak in flight was caused by dislodging of R-9SM2 (engine speed regulator) sealing – paranite pad from the regulator drive and the regulator itself. The leakage from the sealing was due to the regulator filter clogging. The oil flow reducing through the regulator caused increasing of the propeller pitch and fixing of the engine speed to lower values. The filter clogging was caused by accumulation of chippings, possibly emerged in result of piston seizing and presence of high consistence of coke in the oil.

A laboratory analysis of a sample of MC-20 oil, taken from engine crank case was made in Independent Laboratory for Analyses – 2000 Ltd, Sofia. The results of analysis showed oil coke residue of 0.68% with norm no more of 0.29%. There was water content of 0.2% with norm – lack of water.

The results of the engine disassembly performed at MRP TEREM - LETETS EOOD in Sofia are given in a report, approved by the Director of the plant and enclosed to the investigation materials. The main ascertainments in this report are:

- During the disassembly of the piston-cylinder groups sticking of piston rings and piston seizing in 1st cylinder was discovered. First compressing ring of 7th cylinder was broken. There were aluminium chippings in the central crank case, possibly from the 1st cylinder seizing;
- During the disassembly of the transmission in the rear housing a presence of aluminium chippings on the drives was determined. The compressor shaft No 68.18.12 and the flexible shaft of the accessories drive No026600 didn't turn one to another, which resulted into the whole engine blockage. After disassembly and cleaning of the two shafts on the bushings of the compressor shaft deep bruises were discovered. After assembly of the joint the transmission shaft rotated freely.

On the grounds of the above mentioned ascertainments the commission made the following conclusions:

The engine blockage was due to ingress of chippings from the seized piston into the oil system, followed by blockage of the compressor shaft and drive shaft.

Two shafts blockage in assembled position is shown on Figure 6, in disassembled position on Figure 7. On Figure 8 the chippings are visible, which led to shafts blockage.

The engine shaft blockage is a result of first cylinder piston seizing.

During the inspection of the first cylinder piston traces from overheating were visible on the piston head.

The possible cause for piston rings sticking and it seizure may be the increased coke content in the oil, what was established during the laboratory analysis done.

The engine oil change is provided after every 50 hours. In accordance with the records in the technical documentation after the 100-hour check, certified on 14.02.2006 (during which in accordance with the schedule the oil was changed) till the day of the occurrence 18.04.2006 the aircraft had flown 18:57 hours and the change of oil had not been made. On the 16.04.2006 in the aircraft technical logbook in the column “Fault repair during short-time checks” is written: MFM-25 oil filter cleaned. The operational short-term check doesn't envisage MFM-25 oil filter

check. This check should be done during the after-flights technical servicing in accordance with item 3.30.18 of the schedule. But the following note is made to this item: In case of severe contamination of MFM-25 filter the engine speed regulator should be rinsed and during the installation the gasket should be replaced. There was no record about the note fulfillment. It is possible to assume, that the above mentioned record was connected with severe contamination of the oil filter, otherwise the record above should be a routine action in fulfillment of item 3.30.18, for which it would be not necessary to make a record in the technical documentation. As to the date mentioned the aircraft has flown 8:57 hrs after the 100-hrs check and it wouldn't be expected after such a work the changed oil to be contaminated in such a level to clog the filter. The oil sample taken two days later showed more than twice coke content over the allowable, and the flight time was 18:57, which was two times less than the allowable. In result of this analysis a question emerged if the oil was really changed during the 100 hrs check or it was refilled only in order to compensate the consumption. Such a hypothesis may be supported by the fact that since the last check F2 (corresponding to 100 hrs flown), made on 19.09.2005, the aircraft didn't fly till 14.02.2006. It was done only engine oiling.

The preceding may be a possible cause for worsened lubrication quality of the engine oil of Ash-62IR engine.

It is necessary to note, that in the situation emerged during the next 5th flight for ACW on the 18.04.2006 of the An-2 aircraft reg. No LZ-1217, the crew acted professionally and prevented it to turn from a dangerous into an emergency situation and reduced it to flight safety endangering only.

3. Conclusions

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

MAIN CAUSE:

Engine power loss, led to impossibility for flight continuation

IMMEDIATE CAUSE:

Seizure of first cylinder piston, accompanied by disturbed functioning of the engine speed regulator.

During the investigation the following irregularities were also disclosed:

1. Increased coke content in the oil sample, take from the engine.
2. Imperfect fulfilment of the requirements of Item 3.30.18 of the Technical Servicing Schedule of An-2 aircraft, Part "Operational Technical Servicing"
3. The date of replacement of the carburetor wasn't recorded in the engine logbook.
4. After the medical examination at KAMO, the certificate for medical fitness of the first officer wasn't certified by CAA
5. The first officer's licence was certified without a presence of certified document for medical fitness in his personal file.

SAFETY RECOMMENDATIONS:

During the investigation the following immediate safety measures were recommended to the CAA by a letter reg. No 10-01-64/05.05.2006 for all air operators operating an An-2 aircraft:

1. A check of cylinder compression of engines Ash-62 IR should be performed and the results should be recorded in the Engine Logbook.
2. A check of the engine spark plugs condition should be performed.
3. A check of ignition adjustment of engines should be performed.
4. A check of fuel filter condition to be checked: gravitation filter, paper filter, carburetor filter.
5. A check of condition and an adjustment if necessary of carburetor altitude compensator of ASh-62IR engines should be performed.
6. A check of coarse oil filter condition and a visual assessment of the oil condition should be performed.
7. A check of the control surfaces and cinematic chains of the control system in all three channels of An-2 aircraft to be performed.
5. CAA should conduct an inspection for crew staffing by air operators who operates An-2 aircraft.
Due date – 31.05.2006.

In relation with the fulfillment of aforesaid safety measures CAA issued Airworthiness Directive No LZ-2006-230 from 10.05.2006.

Having in mind the results of the investigation performed the commission recommended also the following safety measures:

1. Inspectors from CAA should require copies from the certified request of CAA for medical examination at KAMO.
Time – permanently.
2. Air operators, who operate An-2 aircrafts, should include in their theoretical training program for operation during the spring & summer operation of the technical staff a practical training for fulfillment of Item 3.30.18 of Technical Servicing Schedule of An-2 aircraft, Part “Operational Technical Servicing”.
Time – the beginning of the theoretical training for spring & summer operation, person in charge – Airworthiness Department Head at CAA.