

# FINAL REPORT

on  
investigation of an aviation occurrence with MD-82 aircraft, registered LZ-  
LDC, operated by Bulgarian Air Charter, occurred on 28.05.2006 during  
international chartered flight BUC 7105 Varna – Dresden



The materials about the aviation occurrence have been classified under state file number 06/28.05.2006 in the archives of the Aircraft Accident Investigation Unit (AAIU)

**Aviation Operator (AO):** Bulgarian Air Charter Ltd., with main office at Sofia 1138, 35 Pavel Krassov Str, Goroublyane Neighborhood and Air Operator Certificate No BG 06, issued by Civil Aviation Administration on 11.10.2000, reissued on 07.10.2004 for period of validity till 10.10.2006.

**Aircraft Manufacturer:** Douglas Aircraft Company, USA

**National and Registration Marks:** LZ-LDC according Certificate for Registration No 1948, issued on 28.01.2005 by the Civil Aviation Administration.

**Place and Date of Aviation Occurrence:** In flight, at FL300 (30000 ft), in Romanian airspace, on 28.05.2005

**Notified:** Aircraft Accident Investigation Unit (AAIU) of the Ministry of Transport, CAA of Republic of Bulgaria, International Civil Aviation Organization (ICAO), National Transportation Safety Board of USA and National Bureau for Air Accident Investigation of Romania

**Type of Flight:** international chartered flight for passenger transportation BUC 7105 on route Varna – Dresden (VAR-DRS)

Aircraft MD-82 reg. LZ-LDC took-off for a charter flight Varna-Dresden at 12:04 UTC on 28.05.2006 with 16 passengers on board. After take-off and climbing to FL300, just before leaving Romanian airspace the crew ascertained cabin altitude increasing (depressurization). The oxygen masks in the passenger cabin dropped automatically. Emergency descending was made to FL 90, the aircraft returned and landed at Varna airport. There were no consequences for the passengers, crew and aircraft.

In accordance with Para.3 of Additional Provisions of Regulation 13 of the Ministry of Transport of 27.01.1999 about aircraft accident investigation, the aviation occurrence has been classified as a serious incident. A commission was appointed for investigation of the aviation occurrence by an order RD-08-264/05.06.2006 of the Minister of Transport. An authorized representative was appointed by NTSB to take part in investigation.

## **1. Factual Information**

### **1.1 History of Flight**

#### **1.1.1 Flight Number: BUC-7105**

#### **1.1.2 Flight Preparation and Description**

The flight mission was assigned by the Air Operator to the crew consisting of commander, first officer, five cabin attendants and two technical persons. Crew preflight preparation for the flight on route Varna – Dresden – Nuremberg – Varna was conducted at Varna Airport. The crew received aeronautical and meteorological information, flight plan and flight documentation. The cabin crew was briefed. As a flying pilot was appointed the first officer.

The commander and first officer conducted an inspection of the aircraft and they didn't establish any faults. The crew was informed by the technical personnel that Temperature Controller No 1 doesn't work in automatic mode, what didn't hampered the flight according the MEL, but it

needed manual temperature control. Aircraft boarding with 16 passengers was performed under the first officer supervision. The aircraft was refueled with 15 tons of fuel.

The take-off from Varna was planned for 15:00 local time. Actually it was performed at 15:03:34.

The crew climbed to FL300 at 15:19. Just before leaving Bucharest Flight Information Region at 15:34, the red indication MASTER WARNING came on and aural signal CABIN ALT sounded. The oxygen masks enabled (dropped) in the passenger cabin. The commander put his oxygen mask, ordered the first officer to do the same and started emergency descent with deviation of 15° to the right from the flight heading with Bucharest Control permission to FL90. At about FL140 the commander requested clearance to return to Varna at FL90, he was cleared for this and the flight passed normally from this point. The commander ordered the first officer to fulfill the requirements of QRH in case of depressurization. The first officer made attempt to close the cabin pressure exhaust valve manually. The cabin crew put their oxygen mask and helped the passenger to do the same. The commander informed passengers about the situation emerged and for return to Varna Airport. After descending to a safe altitude the cabin crew helped one female passenger to calm down and gave her additional oxygen, validol, valerian and headache tablets were given to some of the passengers.

The landing at Varna Airport at 16:10:54 was normal. The flight ended without any consequences for the passengers, crew and aircraft.

### **1.1.3 Location of the Occurrence**

The serious incident occurred at 12:33:42 UTC on 28.05.2006 in horizontal flight with M=0.788, HEAD=303° in the Romanian airspace at an altitude of 30011 ft (FL300), when the indication Master Warning triggered.

### **1.2 Injuries to Persons**

No injuries to persons.

### **1.3 Damage to Aircraft**

No damage to aircraft.

### **1.4 Other Damages**

No other damages.

### **1.5 Personnel Information**

**1.5.1 Commander – male, aged 52, a valid ATPL license and medical certificate holder.**

**1.5.2 First Officer – male, aged 45, a valid ATPL license and medical certificate holder.**

**1.5.3 Chief Cabin Attendant - female, aged 37, a valid C/AL and medical certificate holder.**

**1.5.4 Cabin Attendant - female, aged 44 (instructor), a valid C/AL and medical certificate holder.**

**1.5.5 Cabin Attendant** - female, aged 27, a valid C/AL and medical certificate holder.

**1.5.6 Cabin Attendant** - female, aged 24, a valid C/AL and medical certificate holder.

## **1.6. Aircraft information**

### **1.6.1. Airworthiness information**

MD-82 aircraft, registered LZ-LCD, manufacturer serial number (MSN) 49217, manufactured on 20.04.1986, Registration Certificate No 1948, issued on 28.01.2005 and Certificate of Airworthiness No 1948, issued on 28.01.2005 by CAA, confirmed on 20.03.2006 and valid until 19.03.2007.

As on the day of aviation occurrence realized the aircraft has accumulated 38811:35 hrs total time since new and 42094 cycles since new.

The last C3 Check was performed on 28.06.2005 and since that date the aircraft has accumulated 907 flying hours and 500 cycles. On the base of Amendment No 2 of MD-82/83 Maintenance Program of the Air Operator, approved by CAA, the next C Check (C1+C2+C3) should be performed no later than December 28, 2006 or after 3500 flying hours after the last C Check performed (which comes first). According the preceding information the remaining flying hours available till next C Check were 2593 hrs or 7 months (which comes first).

The last 1A Check was certified on 17.03.2006 with 38677 flying hours and 42008 cycles and after it the aircraft accumulated 134:35 flying hrs and 86 cycles, what was confirmed by a Certificate of Release to Service.

The next A Check (1A+2A+4A) according to the approved by CAA Maintenance Program should be performed no later than 120 days after the date of the last check or after 500 flying hours (which comes first). According the preceding information the remaining flying hours available till next A Check were 365:25 hrs or 51 days (which comes first).

Two engines Pratt & Whitney JT8D-217A/C were installed on the aircraft.

Position No 1 engine was with serial number 708470 and it accumulated 53954:20 hrs and 29715 cycles since new. The engine had 4644 flying hours till the next shop visit.

Position No 2 engine was with serial number 725971 and it accumulated 23322:06 hrs and 24497 cycles since new. The engine had 3896 flying hours till the next shop visit.

According to the Aircraft Technical Logbook sheet No 0002137, a failure of Automatic Temperature Controller No 2 was registered on 27.05.2006 during the flight No BUC 6118 Leipzig – Varna. At Varna Airport Air Operator's maintenance personnel switched the places of Temperature Controller No 1 and No 2 according to the Aircraft Maintenance Manual, Part 21-61-06. Functional test of both systems was performed and no deviations from the technical requirements were established.

According the Aircraft Technical Logbook sheet No 0002139, on 28.05.2006 a Service Check of the LZ-LDC aircraft was performed before the flight BUC 7125 according the approved by CAA MD-82 Aircraft Maintenance Manual, which was valid for the next 72 hours. No remarks about failures were written in the Aircraft Technical Logbook during the check.

According the same Aircraft Technical Logbook sheet, a Preflight Check was performed before the flight BUC 7125 (Varna – Paderborn – Berlin - Varna) in accordance with the approved by Aircraft Maintenance Program. No remarks about failures established were written.

After the flight BUC 7126 Berlin – Varna a failure of Automatic temperature controller No1 was registered in the Aircraft Logbook. In accordance with AMM 21-30, the aircraft was dispatched for flight with one inoperative automatic temperature controller and on the same date (28.05.2006) was opened HIL No 8, Cat C (10 days or 240 flying hours), which permitted to operate the aircraft with one inoperative Automatic temperature controller for 10 days.

During the preparation for the next flight on 28.05.2006 on route Varna-Dresden-Nuremberg-Varna at Varna Airport a preflight check was performed and the aircraft was cleared for flight on the term of HIL No 8 opened. In the HILs column of Aircraft Technical Logbook sheet No 0002140 there was a remark: “LH auto control temperature system inoperative”.

On the grounds of above-stated information the conclusion could be done that as on the time of serious incident realized airframe and engines of LZ-LDC aircraft had the necessary life time for conducting the flight and the required maintenance was fulfilled. All this was a good reason to consider the aircraft airworthy under the operational restrictions, resulting from current limitation of HIL No 8/28.05.2006.

### **1.6.2. Airplane performance**

The maximum take-off weight of the airplane in accordance with the Certificate of Airworthiness No 1948/28.01.2005 is 66680 kg. The actual take-off weight of the aircraft for the flight BUC 7105 according to the loadsheet was 58110 kg. The balance was within the operational limits and did not influence the occurrence.

The aircraft is equipped with Airborne Collision Avoidance System (TCAS) and Enhanced Ground Proximity Warning System with improved additional function for terrain assessment along the flight direction (EGPWS).

### **1.6.3. Fuel**

The aircraft had 15 tons fuel on board, JET A1. According the Delivery Receipt No 70702/28.05.2006 the aircraft was refueled with 14200 liters of kerosene JET A1 with relative weight 0.802 during the preparation for the flight.

### **1.7. Meteorological information**

The meteorological information at take-off from Varna Airport (VAR) was determined by anti-cyclonal baric field. The air mass was dry and stable. According forecast information, there were two parallel jet streams at FL310 and FL340 with a speed of about 200 km/h and direction to SE. At RWY 09 the weather was without peculiarities, CAVOK, visibility more than 10 km, cloudiness 1-2/8 at 4500 ft, wind 100°-120°, wind speed 7-10 m/s, temperature 21°C, QNH 758.3 (1016 hPa).

The weather conditions for landing at Varna Airport were the same as for take-off.

### **1.8. Aids to navigation**

Standard aids for MD-82 aircraft.

### **1.9. Communications**

Standard communication equipment for MD-82.

### **1.10. Airport**

The aviation occurrence emerged in flight at FL 300 in the airspace of Romania.

The aircraft took-off from Varna Airport and after the aviation occurrence returned and landed again at Varna Airport on RWY 09 .

The reference point of the airport is with coordinates 43° 13'55" N; 027° 49'31" E.

Airport elevation is 70 m. RWY dimensions – length 2500 m, width 45 m.

### **1.11. Flight data recorders**

The data from FDR was taken at Varna Airport after landing. Read-out of the data of recorded parameters are given in Enclosure 1.

After read out and analysis of the the records from FDR it was established, that:

- the aircraft took-off at 12:03:34 with flaps at 11° and IAS=135 kt. It proceeded with climb till 12:19:00, when the  $H_b=30011$  ft. The flight went normally at the same altitude with IAS=299kt ( $M=0.788$ , „Air Condition” – „ON”, „Air Condition High Pressure Bleed” – „OFF”, HEAD=303°), till 12:33:42, when indication Master Warning triggered);
- at 12:47:33 the crew started descent with descent rate  $V_y = 3490$  ft/min till altitude  $H_b=15300$  ft (12:38:14), when the descent rate was decreased to  $V_y=1326$  ft/min. The descent with this descent rate continued to altitude of 9000 ft (12:43:05). During the descent the Master Warning turned off at 12:37:10;
- after descending to  $H_b=9000$  ft the flight continued with IAS=289 kt, ( $M=0.512$ , „Air Condition” – „ON” , „Air Condition High Pressure Bleed” – „OFF”, HEAD=129°);
- at 12:47:38 Air Condition switch over was registered from ON to OFF, Air condition High Pressure Bleed” from OFF to ON and switching continued as follows: at 12:53:08 Air Condition from OFF to ON, and Air Condition High Pressure Bleed from ON to OFF; at 12:53:39 Air Condition from ON to OFF, and Air Condition High Pressure Bleed from OFF to ON;

The aircraft headed for landing at  $H_b=1035$  with flaps at 41° and IAS=132 kt at 13:09:30 and landed at 13:10:54 with  $N_y=1.25g$  and IAS=132, using thrust reverse.

After landing the aircraft vacated RWY 09, taxied and stopped at a permanent park rest. The crew performed landing approach and landing normally, without peculiarities.

### **1.12. Wreckage and impact information**

No impact and destruction on the aircraft and engines.

The occurrence emerged in flight and as a consequence it led to cessation of the flight by the crew and landing. The landing was without any complications and without consequences for the passengers, crew and aircraft.

### **1.13. Medical and pathological information**

Not medical and pathological researches were performed.

### **1.14. Fire**

No fire appeared.

### **1.15. Survival aspects**

The cockpit crew, cabin crew and passengers used oxygen masks. An additional quantity of oxygen was given to a female passenger from portable oxygen bottle. Validol, valerian and headache tablets were given to some of passengers.

The passengers and crew used their safety belts during descend and landing.

### **1.16. Tests and research**

For the purpose of the technical investigation the following tests and research have been conducted:

- Aircraft documentation for organization and execution of the flight;
- Documentation related with aircraft maintenance;
- Documentation related with engines and system maintenance;
- Read-out and analysis of the flight data records;
- An interview with the crew was carried out and written explanations were taken in relation with the aviation occurrence;
- An analysis of conditioning system and pressurization system of pressurized areas of the aircraft was done;
- The works provided in MD-82 AMM following depressurization were performed;
- A check of aircraft fuselage was performed;
- Logical and probabilistic analysis of the possible reasons for the aviation occurrence were done.

The materials and results of the tests and research performed were enclosed to the investigation deed.

## **2. Analysis**

After the examination of documentation, related with aircraft airworthiness maintenance the following ascertainments were done:

According the Aircraft Technical Logbook sheet No 0002137, on 27.05.2006 during the execution of the flight BUC 6118 Leipzig – Varna a failure of Automatic temperature controller No 2 was established. At Varna Airport the air operator's maintenance staff switched the places of Automatic temperature controller No 1 and No2 according the Aircraft Maintenance Manual, Part 21-61-06. A functional test of the both systems was conducted and no deviations from the technical requirements were established.

According Aircraft Technical Logbook sheet No 0002139, on 28.05.2006 at Varna Airport a Preflight Check was performed before the flight BUC 7125 (Varna – Paderborn –

Berlin - Varna) in accordance with the approved by CAA Aircraft Maintenance Program. No remarks about failures established were written.

After the flight BUC 7126 Berlin – Varna a failure of Automatic Temperature Controller No1 was registered in the Aircraft Logbook and in accordance with AMM 21-30, the aircraft was dispatched for flight with one inoperative Automatic Temperature Controller and on the same date (28.05.2006) a HIL No 8, Cat C (10 days or 240 flying hours) was opened, which permitted to operate the aircraft with one inoperative Automatic Temperature Controller for 10 days.

During the preparation for the next flight on 28.05.2006 on route Varna – Dresden - Nuremberg-Varna at Varna Airport a preflight check was performed and the aircraft was cleared for flight on the term of HIL No 8 opened. In the HILs column of Aircraft Technical Logbook sheet No 0002140 there was a remark: “LH auto control temperature system inoperative”.

The crew was informed by the maintenance staff that Temperature controller No1 is inoperative in automatic mode, what doesn't hinder the execution of the flight according the MEL, but it is necessary to control the temperature manually.

During the climb the air feed in the left-hand trunk of conditioning system was turned off automatically as a result of temperature raising and FLOW indication came on. Because of the lessen air quantity to the cabin, the cabin altitude started to increase. The automated system for cabin pressure control couldn't compensate the cabin altitude increasing which was indicated by blue lamp TRANSFER LOCK OUT. In result of this the cabin altitude for activation of the oxygen masks was reached in the passenger cabin.

One possible reason for the temperature increasing in the left-hand trunk of the conditioning system, led to its automatic cutting-off, was unfavorable combination of three factors:

- necessity of manual control;
- small number of passengers in the passenger cabin;
- higher air temperature at flight altitude for the day.

The manual temperature control was performed by the first officer. Before the flight he was informed by the maintenance staff about this necessity and he tried to make it during the flight. Manual control system consists of a switch with two positions – “cold” and “hot”. The temperature is to be controlled by the thermometer. This construction of the system is very inert and creates possibilities for errors, such as longer than necessary hold at one or another position. On Figure 1 and Figure 2 in Enclosure 1 the air conditioning system control panel and pressure regulation shutter control panel are shown respectively.

The low number of passengers determined the necessity of higher quantity of heat for cabin air warming and higher temperatures along the system ducts respectively.

According the commander's information, the temperature at the flight altitude was 5°C higher than usual. It decreased the heat exchange in the air radiators of conditioning trunks.

After the change of Temperature Controller No 1, the functioning of MD-82, LZ-LDC air conditioning system meets the technical requirements.

### **3. Conclusions**

The technical investigation conducted gives the grounds for the conclusion, that the aviation occurrence is a result from the following

**Main cause**

Cabin altitude increasing over the limits because of automatic shutting-off of the left-hand trunk of the air conditioning system.

**Immediate cause**

Unfavorable combination of the following factors: necessity of manual control, small number of passengers and higher air temperature at flight altitude for the day.

Having in view the above described, the Commission proposes the following

**Safety recommendations:**

During the investigation process, the following immediate safety measures were recommended by a letter reg. No 10-01-79/05.06.2006 to the CAA Chief Director:

1. Pressurization test of MD-82 aircraft fuselage, No LZ – LDC.

Having in mind the results of investigation conducted, the Commission recommended also the following safety measures:

1. Air Operator Bulgarian Air Charter Ltd to require during simulator check of the pilots their training for situations with failures, which don't hamper the execution of flight in accordance with Minimum Equipment List (MEL), but requiring some actions by the crew, to be checked.

Time: permanently, Person Responsible: Air Operator

2. Air Operator Bulgarian Air Charter Ltd to make a briefing to the personnel, related with MD-82 operation, with the investigation conclusions and to pay special attention to the especially dangerous consequences of events, related with air conditioning system and cabin pressure systems failures.

Time: 15 days after handing the report, Person Responsible: Air Operator