FINAL REPORT

on

investigation of a serious incident with FALCON 2000 aircraft, registered No LZ-OOI, operated by Aviodetachment 28, occurred on 25.07.2005 during HEAD domestic flight BULG-001 Varna – Sofia (VAR-SOF)

2005

The materials about the aviation occurrence have been classified under state file number 05/03.08.2005 in the archives of the Aircraft Accident Investigation Unit (AAIU)

Aviation Operator (AO): Aviodetachment 28, with main office at Sofia 1540, Sofia Airport

Aircraft Manufacturer: DASSAULT AVIATION S.A., FRANCE.

National and Registration Marks: LZ-OOI, according Certificate for Registration No1922, issued by CAA.

Place and Date of the aviation occurrence: During take-off from Varna Airport at 23:50 on 25.07.2006

Notified: Aircraft Accident Investigation Unit (AAIU) at the Ministry of Transport, CAA and International Civil Aviation Organization (ICAO).

A commission has been appointed for investigation of the aviation occurrence by an order RD-08-359/05.08.2005 of the Minister of Transport. By decision of the commission an expert from CAA was involved to take part in investigation on the human factor.

Type of Flight: HEAD, domestic

FALCON 2000 airplane, reg. No LZ-OOI, took-off for HEAD flight Varna – Sofia at 23:50 local time on 25.07.2005. After engine starting and clearance for taxi via taxiway A, the aircraft was cleared for runway 27 by Varna Tower, lined-up for RWY27 and stopped at its right-hand end part. The commander began a take-off run, maintaining the direction. At 450m from the beginning of the runway the aircraft, moving close along the runway edge, hit a wooden peg placed on runway shoulder by the arc of the end fairing of the right-hand wing. At about 650m from the beginning of the runway the inner tire of the right-hand main landing gear passed over one of side edge lights and keeping up the take-off, destroyed the next light with the wheel rim of the same tire. At 850m the slat leading edge hit and broke a second wooden peg 1.10 m high. The flight to Sofia Airport and landing were conducted without peculiarities and consequences for the crew and passengers.

After landing during the post-flight check the servicing technical staff found out bruises on the slat leading edge of the right-hand wing and during the check performed on the next day, found out disturbed protector (deep cutting) of the inner tire of the right-hand main landing gear.

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.

1. Factual Information

1.1 History of Flight

The flight assignment was given by Order No RD-20-41/22.07.2005 of the Director General of Aviodetachment 28 to the crew consisting of aircraft commander, first officer, maintenance person and an official.

1.1.1 Flight Number: BULG-001

1.1.2 Flight Preparation and Description

In accordance with Order No RD-20-41/22.07.2005 the crew has performed preflight preparation from 16:15 to 16:55 for the flight Sofia – Varna – Sofia. On 24.07.2005 one hour before take-off the crew performed pre-flight briefing. According the assignment the take-off from Sofia to Varna was for 14:30 on 24.07.2005. The take-off was performed at 14:25 local time (11:25 UTC) on 24.07.2005 and the landing at Varna Airport was at 15:10 local time (12:10 UTC). After execution of this segment of the flight the crew was accommodated for rest at Hotel Splendid. The conditions at the hotel were very good and the crew rest wasn't disturbed. On 25.07.2005 the crew left the hotel and went to Varna Airport for execution of the flight BULG 001. On 25.07.2005 the flight was planned according the assignment for 20:00 local time. The take-off was performed at 23:50. At arriving to the airport the crew became acquainted with the aero-navigation and weather situation for execution of the flight VAR-SOF.

After performing outer and inner inspection the crew received clearance for engine start-up. The air traffic controller from Varna Tower cleared taxi via taxiway A for runway 27 for takeoff. After the clearance the aircraft lined-up on RWY27 at the end right-hand part of the runway.

The commander (flying pilot) started take-off run, maintaining the take-off direction. At 450 meters from the beginning of the runway the aircraft, moving closely to the right-hand edge, hit and broke by the end fairing arc a wooden peg 1.10m high, placed at 4.4m from the runway pavement and at 7.90m from runway sideline. The aircraft proceeded with the take-off and at about 650m from the beginning of the runway the inner tire of the right-hand main landing gear passed over one of side edge lights. Keeping up take-off, the aircraft destroyed the next light with the wheel rim of the same tire. At 850m the slat leading edge hit and broke a second wooden peg 1.10m high, placed at 4.30m from the end of runway pavement and at 7.80m of the runway end marking line. The take-off, climbing, the flight to Sofia and landing were performed without any consequences for the crew and passengers. After moving the aircraft to the technical parking and during the post-flight check the technical staff established bruises on the on the slat of the right-hand wing in the area of its outer part and during the check performed on the next day, found out disturbed protector (deep cutting) of the inner tire of the right-hand main landing gear.

1.1.3 Location of the Occurrence

Aviation occurrence emerged on 25.07.2005 at 23:50 local time (20:50 UTC) in the night during take-off from Varna Airport.

1.2 Injures to Persons

No injures to crew and passengers.

1.3 Damage to Aircraft

- permanent deformation by bruises on the right-hand wing slat in its outer area;
- disturbed protector (deep cutting) of the inner tire of the right-hand main landing gear;
- crack on the plastic fairing of the right-hand wing.

The aircraft damages are shown on Fig.1, Fig.2, Fig.3, Fig.4 and Fig 5 in Enclosure 1 and a sketch of aircraft damaged area is shown on Fig.10, Enclosure 1.

1.4 Other Damages

- two sidelights of light marking of the RWY damaged, Fig.6, Enclosure 1;
- two marking pylons of bird scarring system destroyed, Fig.7 and Fig.8, Enclosure 1.

1.5 Personnel Information

1.5.1 Commander – male, aged 53, with a valid CPL license and medical certificate.

1.5.2 First Officer – male, aged 39, with valid CPL license and medical certificate.

1.5.3 Technical person – male, aged 37, with valid aircraft maintenance license

Cabin attendant – female, aged 45, licensed and medical certificated

1.6. Aircraft information

1.6.1. Airworthiness information

FALCON 2000, serial number No 123, registered No LZ-OOI, manufactured by DASSAULT AVIATION, Certificate of Airworthiness No 1922, issued on 11.10.2004 by CAA, confirmed on 16.05.2005 and valid until 15.05.2006. Certificate for Registration was issued on 11.10.2004.

The aircraft has accumulated 1332 hrs total time since new and 953 cycles since new; after base maintenance in Basel the aircraft has accumulated 12:45 hrs and 19 cycles.

Two engines CFE738-1-1B are installed on the aircraft.
Engine No1 serial number P-105322 has accumulated since new 1368:50 and 12:45 after base maintenance in Basel.
Engine No2 serial number P-105330 has accumulated since new 1339:20 and 12:45 after base maintenance in Basel.

Aircraft maintenance was performed according a Maintenance Program, approved by CAA.
The aircraft possesses Operational Clearance Certificate BLOO1009/15.07.2005. In accordance with it the aircraft was maintained in the volume of Form A/A, 2A/2A+ и 4A/4A+ and it is valid till airframe flight time 1619:40 hrs or till the end date 15.01.2006, whatever occurs first.

On 25.07.2005 according to the aircraft Technical logbook No 000499 on the aircraft was performed line maintenance Daily Check Form and the aircraft was refueled with 2766.9 kg (6100 lbs) and accepted according the procedure without failures and remarks written by the commander.

On the grounds of abovementioned the conclusion may be done, that at the moment of the serious incident the aircraft was in airworthy condition.

1.6.2. Airplane performance

Aircraft maximum take-off weight according Aircraft Airworthiness Certificate is 16250 kg. The take-off weight at take-off for the flight BULG-001 was 14285 kg, landing weight 13424 kg. The weight of 9 passengers with baggage was 900 kg. On the base of this it is obvious, that the

maximum take-off weight was not exceeded and the balance was within the operational limits of from the take-off till landing.

For FALCON 2000:

- configuration for climb mode;
- V_1 speed 120kts
- climbing speed 260kts;
- landing speed 125 kts;
- aircraft is equipped with upgraded on-board enhanced ground proximity warning system with additional function for terrain assessment along the flight path (EGPWS);
- aircraft is equipped with ACAS-TCAS II Version 7 Airborne Collision Avoidance System.

No Fig. 9, Enclosure 1, main dimensions of the aircraft are shown.

1.6.3. Fuel

At Varna Airport on 25.07.2005 the fuel quantity on-board was 2766.9 kg and it was enough for execution of the flight from Varna to Sofia. At landing at Sofia Airport there was 1904.7 kg of fuel.

The commission considered the condition and the quantity of fuel, as well the functioning of the aircraft and engine fuel systems didn't create conditions or didn't influence in any way the serious incident emerging.

1.7. Meteorological information

Visual meteorological conditions, CAVOK, visibility over 10 km, wind VRB 02 m/s, temperature +22°C.

1.8. Aids to navigation

Standard aids for FALCON 2000 aircraft.

1.9. Communications

Two-way communication with Varna Tower on frequency 119.5 MHz within listening norms, what was confirmed by the quality of recorded radio communications by the airport recorders.

1.10. Airport

The serious incident occurred during the take-off from Varna Airport. A sketch of RWY of Varna Airport is shown on Fig.11, Enclosure 1.

The runway 27 for take-off with coordinates and reference point of the airport 43 16 55N and 027 49 31E is situated 8km to the west from the city of Varna with elevation of 70 m and reference temperature 28°. Magnetic deviation is 4°E/2001. The airport is with around-the-clock service.

The physical features of the runway are as follows:

- runway marking is **09** and **27;**
- runway dimensions: length 2500m, width 45m **with characteristic widening at the east end and at the taxiway A side,** which shape and dimensions may be seen on the airfield sketch in the enclosure to the report;
- clearway (CWY) dimensions for RWY 09 are 160x120m, for RWY270 they are 185x120m;

- obstacle free zone (OFZ) for RWY 09 are 190x150m, for RWY270 are 215x150m;
- TORA, TODA & ASDA for both runway directions are 2500m.

Runway lighting

- length, distance, color and intensity of centerline lights of RWY 09/27 are W VRB LIH 1600 m, W/R VRB LIH 600 m, R VRB LIH 300 m, spacing - 15 m;
- length, distance, color and intensity of runway edge lights are W VRB LIH 1900 m, Y VRB LIH 600 m, spacing - 60 m;
- color of runway end lights цвят and wing bar lights for runway 09 and 27 are R VRB LIH, WBAR-NIL;
- side and centerline lights of taxiway – Edge: All TWY-blue LIL CL: NIL.

On Fig.12, Enclosure 1 the tables with characteristic values of the runway lighting at Varna Airport are shown.

1.11. Flight data recorders

A. On-board aircraft flight data recorders:

Cockpit Voice Recorder: it safes the radio communication during the last 30 minutes of the flight. That was the reason for lack of recording from the phase of the flight, when the serious incident occurred.

Flight Data Recorder (FDR)

Flight data records were downloaded and read-out by the Safety Department of ATC SE and delivered to the commission. They were enclosed to the materials of the investigation in File No 05/03.08.2005.

The flight data reading and analysis didn't show deviation, which may contribute for the serious incident emerging.

B. From Varna Tower

Record of radio communication between the aircraft and air traffic controller in Varna Tower:

The radio communication was listened and analyzed by commission, appointed for serious incident investigation.

The CD with the recorded radio communications was enclosed to the investigation materials in File No 05/03.08.2005.

1.12. Wreckage and impact information

During the take-off from RWY27 from Varna Airport the aircraft hit consequently with the wing end arc and the slat leading edge two wooden pegs and with the inner tire of the right-hand main landing gear two of right-hand side edge lights of RWY. The hits resulted in bruises and a crack on the end fairing arc of right-hand half-wing and cutting of the inner tire of the main landing gear leg.

The damages on the wing didn't lead to any consequences for the crew and passengers and the aircraft took-off with normal configuration.

1.13. Medical and pathological information

After the aviation occurrence at Varna Airport, flight and landing at Sofia Airport there were no injures of crew and passengers.

1.14. Fire
No fire appeared.

1.15. Survival aspects
No conditions for passengers and crew injuries existed.
The actual conditions didn't impose the use of emergency equipment for aircraft evacuation.

1.16. Tests and research
For the purpose of the technical investigation the following tests and research were conducted by the commission:

- on-site inspection, sketch and documentation of the facts available by photographing;
- interviews with crew members and taking of written explanation;
- interview with passengers, who were on-board during the serious incident and taking written explanations;
- examination of the documentation, related with the aircraft preparation for the flight;
- examination of the documentation, related to the aircraft airworthiness;
- read-out and analysis of the flight data recorders;
- inspection of the condition of light equipment and the condition for observation of the tarmac of Varna Airport, taxiways, side edge lights and centerline of the runway;
- logical and probabilistic analysis for the possible reasons for the serious incident.

2. Analysis
After fulfillment of abovementioned activities, acquaintance and studying the facts and circumstances available, the commission analyzed the phases of execution of the flight and the circumstances, contributed for complication of the flight conditions and led to the serious incident, endangering the flight safety.

The organization, execution of flight No HEAD, BULG-001 Sofia – Varna – Sofia, assignment of flight commander and crew were based on the Order No RD-20-41/22.07.2005 of Aviodetachment 28 Director General.

On the same date the assigned crew executed preflight preparation under the flight commander's supervision.

On 23.07.2005 the crew in accordance with the prescribed requirements made a check flight for aircraft operational condition and the aircraft components and systems flight check. No remarks were established and registered by the crew.

After the check flight no downloading of information from flight data recorders was done for establishing of the flight parameters and for control of system and components functioning.

On 24.08.2005 at 15:30 the crew conducted preflight briefing, the aircraft commander was assigned as flying pilot and after engines start-up the crew took-off for the first leg Sofia – Varna at 17:25.

This was the first flight of the first officer for passenger transport on the type of aircraft, excluding his participation in the crew for the check flight with duration of 00:20 hrs.

First leg of the flight Sofia – Varna was uneventful, the aircraft after landing at Varna Airport was parked on the apron stand, a post-flight check was performed, the aircraft was locked and the crew transported for a rest.

The rest of the crew was normal and its duration complied with the normative requirements, there weren't and disturbing circumstances, which could be in the base of the later occurred serious incident.

On 25.07.2005 at 21:10 the crew arrived at Varna Airport for execution of the second leg of the flight Varna – Sofia.

Under aircraft commander' control a preflight briefing was conducted, the aircraft commander was appointed for a flying pilot, a preflight inspection of the aircraft was performed and the aircraft systems and components were prepared for the flight in full.

The take-off was planned for 20:00 hrs.

After the passengers boarding and report for crew readiness, the air traffic controller cleared for engine start-up and taxiing via taxiway A for line-up on runway 27.

The taxiing procedure is regulated by STANDART OPERATIONG PROCEDURES - FALCON 2000, where in Chapter 9, page 3, is written:

"The aircraft commander is responsible for safe aircraft manoeuvring during the whole taxi. Only the requirement for control of check list reading may divert for a moment commander's attention from taxing. The first officer during the taxi performs radio communication, control checks, radio frequencies, transponder and lights setting. The commander should supervise the right setting."

In the same chapter on page 5 is written:
"The first officer is obliged to assist in the observation and should not permit receiving of clearances or check list reading to lessen this function".

It may be said with a high level of possibility to assume, that the relatively short taxiing distance, coupled with the small experience on the aircraft type of the first officer and the necessity to perform a number of activities and checks for a short period of time have created conditions for the commander to divert substantially his attention from taxiing.

In an attempt to ensure comfort for the passengers during the taxi having in mind the existing roughness on the taxiway, the commander violated the requirement for aircraft movement along the yellow line marked, which should lead the aircraft to the beginning of runway central line. The commander brought out the aircraft in the area of concrete widening at the end of taxiway A and the beginning of runway 27. The width of the widening at the beginning of runway is 22m and the minimal radius of the aircraft turn during taxi is 15.03m (FALCON 2000, OPERATING MANUAL - PROCEDURES, Section 1, Subsection 060, page 2).

The inspection of this part of the runway and the runway shoulder permitted the commission to find out and to fix the traces of the two tires of the right-hand main landing gear, the two light

struck, and on the runway shoulder into direction of the flight 5 wooden pegs 4 x 4 cm in dimensions and height of 1.10 m, placed at a distance from 4.3 to 5.2 m from the right-hand of the runway pavement.

The measurements made by the commission showed that the runway edge lights were placed at a distance of 1.3m from the center of right white sideline. The landing gear track dimensions permit to define the aircraft position and the left main landing gear, i.e. the aircraft center line (X-axis) at line-up was 0.53cm to the left from the right-hand runway white sideline.

The commission's opinion was that the aircraft was positioned in the beginning of line-up at the end right-hand part of the runway in take-off direction of 270°.

The measured distance from aircraft X-axis to the end of runway pavement was 4.8m and the rest part of right-hand wing, which was 4.864m, during the take-off-run was over the grass part of the runway shoulder.

The first wooden indicating peg in the take-off direction was placed at a distance of 5.10m from the right edge of the runway pavement. This explained its intactness.

The first wooden peg struck was placed at a distance of 4.30m from the right-hand edge of the runway pavement. This defined the place of deformations along the right-hand half-wing span.

In its next movement the aircraft broke with the inner tire of right-hand main leg of the landing gear two side edge lights at a distance 650…750m and by the arc of right-hand wing fairing hit the second wooden peg, placed at 4.2m from the end of pavement and at 850m from the beginning of the runway.

The sequence of the abovementioned events was determined by the height of wooden peg fracture and the distance of the runway side edge lights.

At the line-up the first officer established the aircraft position and warned the commander. No consequent reaction. The first officer didn't manifest insistency to the aircraft commander for orientation of the aircraft along the centerline of the runway and for positioning the aircraft at the prescribed place at line-up.

The commission didn't establish aircraft deviation from the take-off heading and aircraft leaving of the runway pavement at the phase of take-off run.

3. Conclusions

The investigation and analysis conducted gives the grounds for the conclusion, that the serious incident was result from the following

Main cause

Non-observing of horizontal marking for taxing and wrong determination of aircraft position at line-up for take-off by the aircraft commander

Immediate cause:

Aircraft movement with acceleration with the right-hand main landing gear outside the runway sideline and a hit of slat leading edge into irregularly positioned obstacles in right-hand runway shoulder.

Contributing factors:

1. Small experience on the aircraft type of the first officer and manifested insufficient persistence for occupation the right aircraft position at line-up.
2. Violation of the requirements of Regulation No 14 on the airports and airport provisions of the Ministry of Transport and Communications of 29.09.2000, Art.41, Para.1; Art.52, Para.3; Art.280, Para.3, led to irregular placing of obstacles in immediate proximity of the RWY.
3. Aircraft commander's error at the end of taxiway A at going into the wideness of RWY27 in determination of the real aircraft position, runway central line and the placement of runway edge lights.
4. Insufficient visual observation of air traffic controller from Tower for control of aircraft movement during the taxi phase and its positioning at line-up.

During the investigation the commission revealed also the following irregularities;

1. Varna Airport – Insufficient control for presence of obstacles in runway shoulder
2. The commission established inconsistency in the content and lack of development for one the phases of the flight training and the normative for it in "Preparation, Training and Flight Check of Flying Crew of FALCON 2000 Airplane Program" of Aviodetachment 28:
   - The content of Section 2, item 2.2, page 1 was not compliant with the content of Section 2 of the Program;
   - In section 2, letter A, item 4, page 4 are shown three phases of the flight training: airport training, line training, en-route check in line conditions for clearance for flights. In letter D of the same section on page 11 the individual phases of the training were not clearly defined and there were not given the content, volume, order of execution and the norms for line training phase, given in Section 2, letter A.
3. No organisation and procedures were established for use of flight data recorders, which register the functioning of the aircraft systems and components as well as the flight parameters and the usage of those data for the purpose of flight safety.

Safety recommendations:

1. CAA to conduct an inspection of the airfield at Varna Airport and to order immediately removing of all irregularly placed obstacles.

Person responsible: Executive Director of CAA. Time: Immediately (fulfilled).

2. CAA to order and to conduct examinations of the flight crew, which realized the serious incident, on the knowledge of:
   - STANDARD OPERATING PROCEDURES-FALCON-2000;
   - OPERATING MANUAL-PROCEDURES, Section 4;
   - Cooperation and crew resources management (CRM);
   - AERONAUTICAL INFORMATION PUBLICATION (AIP) – Part AD2 LBWN:
     - LBWN AD 2.8 "Aprons, taxiways and check locations data";
     - LBWN AD 2.9 "Surface movement guidance and control system and markings";

   LBWN AD 2.10 "Aerodrome obstacles"
   LBWN AD 2.12 "Runway physical characteristics";

LBWN AD 2.14 „Approach and runway lighting";
Person responsible: Executive Director of CAA. Time: 01.10.2005.

The management of Aviodetachment 28 should order the execution of one instruction flight and proficiency check after serious incident realized by:

- aircraft commander;
- aircraft first officer.

Person responsible: Director General of Aviodetachment 28. Time: 15.10.2005.

4. The management of Aviodetachment 28 should submit at CAA "Preparation, Training and Flight Check of Flying Crew of FALCON 2000 Airplane Program", in which the deficiencies revealed in the report should be eliminated.
Person responsible: Director General of Aviodetachment 28. Time: 25.10.2005.

5. The management of Aviodetachment 28 should submit at CAA upgraded Flight Safety Program as an element of Flight Operation Manual of Aviodetachment 28, in which the organization and the procedures for use of flight data recorders of FALCON-2000 for assurance of flight safety should be defined.
Person responsible: Director General of Aviodetachment 28. Time: 25.10.2005.

6. The management of Aviodetachment 28 should submit at CAA for approval Survival Equipment Support Functional System for FALCON-2000.
Person responsible: Director General of Aviodetachment 28. Time: 25.10.2005.

7. ATC SE should submit at CAA a Plan-Program for the perspectives for radar equipment of the Towers at Sofia, Varna, Bourgas, Plovdiv and Gorna Oryahovitsa airports for ground control movement and personnel licensing in accordance with Art.333, Para2, item 1 of Regulation No 1 of the Ministry of Transport and Communications of 16.01.2003 for aviation personnel licensing.
Person responsible: Director General of ATC SE. Time: 30.10.2005.