FINAL REPORT

from

The investigation of a serious incident occurred on June 30, 2017 related to a bird strike of AIRBUS A321-211 aircraft, registration marks D-AIAC, in the controlled air space of the Republic of Bulgaria.

2018

Purpose of the Report and responsibility

In accordance with Annex 13 to the Convention on International Civil Aviation of 7 December 1944, Regulation 996/2010 of the European Parliament and the Council on the investigation and prevention of accidents and incidents in civil aviation and Ordinance 13 of 27.01.1999 of the Ministry of Transport, Information Technology and Communications, the objective of the aviation occurrence investigation is to establish the causes that have led to its realisation in order these to be eliminated and not allowed in the future without apportioning blame or liability.

CONTENTS

01 List of Abbreviations

AO	-	Aircraft Operator;
A/C	-	Aircraft;
A/THR	-	Auto thrust;
AAIU	-	Air Accident Investigation Unit;
ALT	-	Altitude;
AMRAIUD	-	Aircraft, Maritime and Railway Accident Investigation Unit Directorate;
AP	-	Autopilot;
APP	-	Approach Control Unit;
ARP	-	Aerodrome reference point;
ATCO	-	Air traffic controller (officer);
ATPL	-	Airline transport pilot licence;
ATS	-	Air Traffic Service;
BULATSA	-	Bulgarian Air Traffic Services Authority;
CAT	-	Category;
DFDR	-	Digital Flight Data Recording;
DG CAA	-	Directorate General "Civil Aeronautical Administration";
EASA	-	European Aviation Safety Agency;
EDDP	-	Airport Leipzig;
F/C	-	Flight crew;
FCOM	-	Flight Crew Operating Manual;
FCTM	-	Flight Crew Training Manual;
FD	-	Flight director;
FDR	-	Flight Data Recorder;
FL	-	Flight level;
FMA	-	Flight Mode Annunciator;
FPA	-	Flight Path Angle;
GAT	-	General Air Traffic;
GW	-	Gross Weight;
ICAO	-	International Civil Aviation Organization;
IFR	-	Instrument flight rules;
LBBG	-	Airport Burgas;
M	-	Mach number;
MAG	-	Magnetic;
MSN	-	Manufacturer Serial Number;
MTITC	-	Ministry of Transport, Information Technology and Communications;
MTOW	-	Maximum Take Off Weight;
NM	-	Nautical Mile;
PFD	-	Primary Flight Display;
PIC	-	Pilot in Command;
RWY	-	Runway;
UTC	-	Universal Time Coordinated;
V/S	-	Vertical speed.

1. Introduction

Date and time of air occurrence 30 of June 2017, 07:10 h UTC

Notified: Aircraft, Maritime and Railway Accident Investigation Unit Directorate (AMRAIU and General Directorate Civil Aircraft Administration at the Ministry of Transport, Information Technology and Communications (MTITC) of the Republic of Bulgaria, the European Commission, the International Civil Aviation Organization (ICAO), the National Bureau of Aviation Occurrences Investigation (BEA) of the Republic of France, European Air Safety Agency (EASA) and Federal Bureau of Aircraft Accidents Investigation of Germany.

On the grounds of the provisions of Article 9, para.1 of Ordinance No 13 dated 27.01.1999 on Investigation of Aviation Accidents, the occurrence was classified as a serious incident by the Aircraft Accident Investigation Unit at the Aircraft, Maritime and Railway Accident Investigation Unit Directorate (AMRAIU) at the Ministry of Transport, Information Technology and Communications. The materials on the aviation occurrence have been filed in case No 03/30.06.2017 in AAIU archives.

In accordance with the provisions of Article 5, para1 of Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation, Article 142. Para2 of the Civil Aviation Act of the Republic of Bulgaria dated 01.12.1972 and Article 10, para1 of Ordinance No 13 of the Ministry of Transport dated 27.01.1999 on the Investigation of Aviation Occurrences, by Order No RD-08-269 dated 10.07.2017 of the Minister of Transport, Information Technology and Communications, a Commission is appointed for investigation of the serious incident.

Summary: On 30 June 2017, at 07:09 UTC, daylight time, Airbus A321-211 with registration D-AIAC, of CONDOR operator, took off from RWY 22 Burgas Airport performing flight DE1707 from LBBG to EDDP. During initial climb, at altitude 1500 ft. with speed 160 kt, the aircraft impacted a bird, the left engine received a damage to the fan blades which resulted in a loss of thrust. The crew continued climb to 4000 ft, declared emergency and decided to return and land back at LBBG. After performing the appropriate checklist, they were vectored for ILS approach to RWY 22 and landed safely on RWY 22 at 07:30 h. There were no injuries to the flight crew or passengers.

In result of the investigation, the Commission considers that the serious incident is due to the following reason:

The ingestion of a large bird, most probably a Short-toed Eagle, into the left engine during initial climb, causing mechanical damage to the inlet and to the fan rotor, which led to a loss of the left engine thrust.

As the main contributing factor for the realization of the event, the Commission takes the existence of a big bird's natural habitat in the area of Burgas Lake, which is situated along the flight trajectory of the aircraft that take off from RWY22 of Burgas airport.

2. Factual information

2.1. Flight history

2.1.1. Flight number, type of operation, last point of departure, time of departure, destination point of intended landing:

Flight number: DE1707.

Type of operation: Commercial charter flight with passengers.

Last point of departure: Burgas (LBBG).

Time of departure: 7:09:03 h UTC.

Destination point of the intended landing: Leipzig (EDDP).

2.1.2. Flight preparation and description of the flight

The recordings of radio communications and the radar picture, the FDM data, together with the statements of the flight crew, were used for the following description of the flight history:

The flight was operated under instrument flight rules (IFR). It was a Charter flight (Commercial Air Transport) from Burgas (LBBG) to Leipzig (EDDP) on behalf of the Condor Flugdienst GmbH under flight number DE1707

At 7:09:03 h UTC on 30 June the aircraft A321-211, registration D-AIAC, took off from Burgas airport (LBBG) to Leipzig (EDDP), with two pilots, five flight attendants and 155 passengers on board.

At 07:07:50 ATCO - Tower issued a clearance for take-off to flight crew: "*CFG4MD cleared for take-off, runway 22, wind 330° 12 knots"*

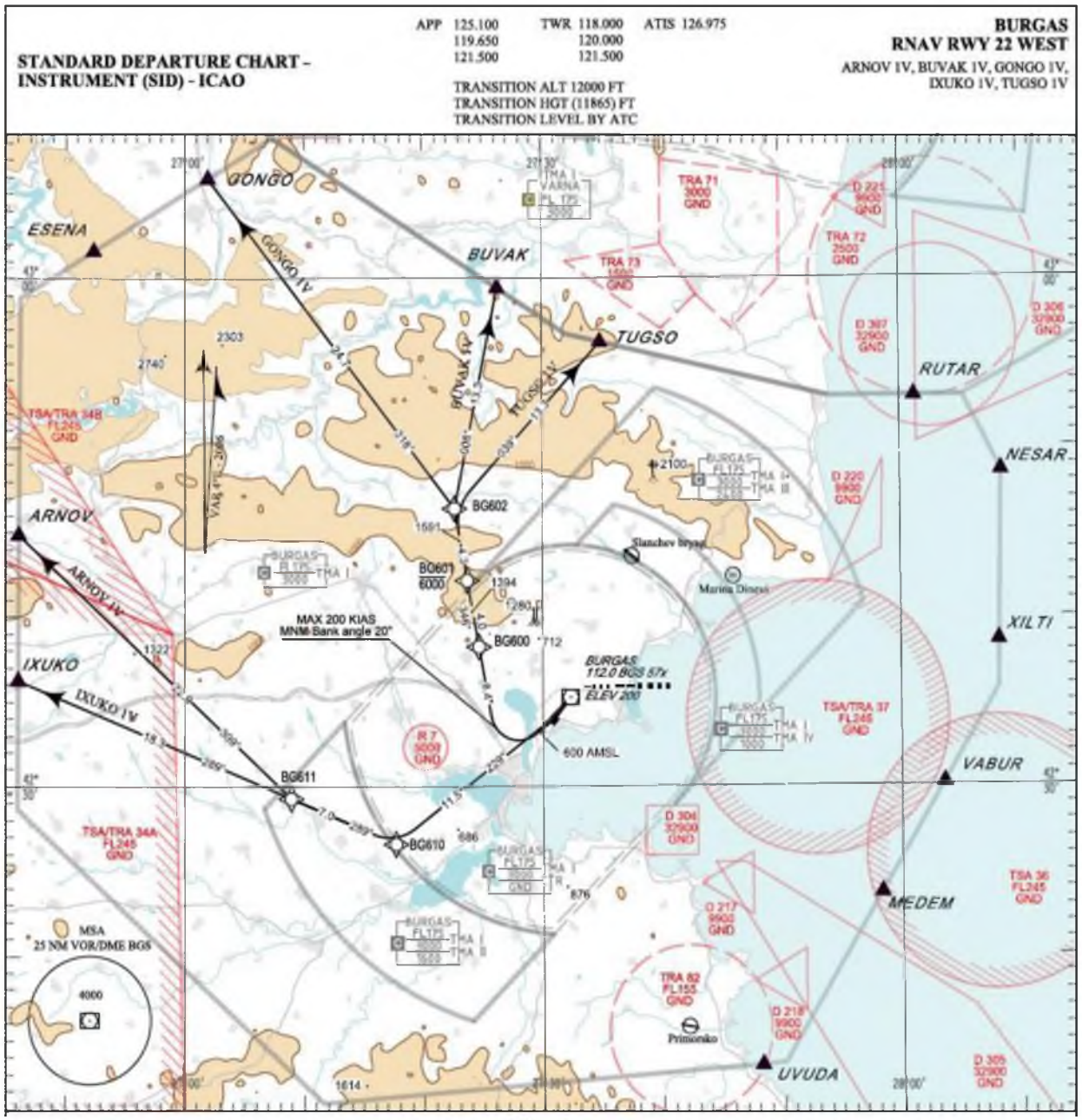


Fig. 1

At 07:09:03 h, the aircraft A321-211 took off from Burgas airport and started initial climb according to a standard instrument departure route of ARNOV1V. (See Fig.1)

At 07:09:27 h, the flight crew of A321-211 established a contact to Burgas APP and informed ATCO that it was climbing to altitude 6000 ft.

At 07:09:34 h, ATCO – Approach identified the aircraft as CFG4MD and issued a clearance for climbing to FL 180. The flight crew confirmed the issued clearance.

According to the data taken from the FDR, at 07:10:08 h high vibration appeared in the left engine at altitude of 1996 ft. In the cabin the flight crew received an ECAM Advisory message: "ENG 1 HIGH VIBRATION (9.9)", there was no ECAM Alert message.

At 07:10:48 h the flight crew of aircraft A321-211 informed ATCO – APP about a bird strike at altitude1500 ft. at about 6 NM from RWY and requested a climb to 4.000 ft. *"We had a bird strike and we would like to climb four thousand feet and I will call you back for further messages"*.

According to the flight crew explanations, after taking off and during the initial climb at altitude 1500 ft. AGL with a speed of 160 kt, when two engines were in take-off thrust, the left engine ingested a white bird with a wingspan of approximately 1-1.5 m. A noticeable odour was felt in the cabin.

At 07:12:23 h, the flight crew stopped the climb at altitude 4000 ft. and continued in level flight.

At 07:12:36 h, at altitude 4056 ft and heading 195° the flight crew declared an aircraft emergency (3 x MAYDAY and set squawk 7700). "CFG4MD MAYDAY MAYDAY MAYDAY CFG4MD"and prepared to return and land at airport Burgas.

At 07:14:26 h, the aircraft continued the flight at altitude 4056 ft heading 040°.

At 07:15:12 h, ATCO - APP provided radar vectors for an ILS approach for RWY 22.

At 07:20:45 h, ATCO - APP asked the flight crew: *"CFG4MD If able report what type of emergency you have on board"*.

At 07:20:52 h the flight crew stated: *"CFG4MD We had a bird strike and hit the left engine and left engine is hibernating, the right engine is operating OK"*.

At 07:22:12 h, the flight crew started to descent from 4000 ft.

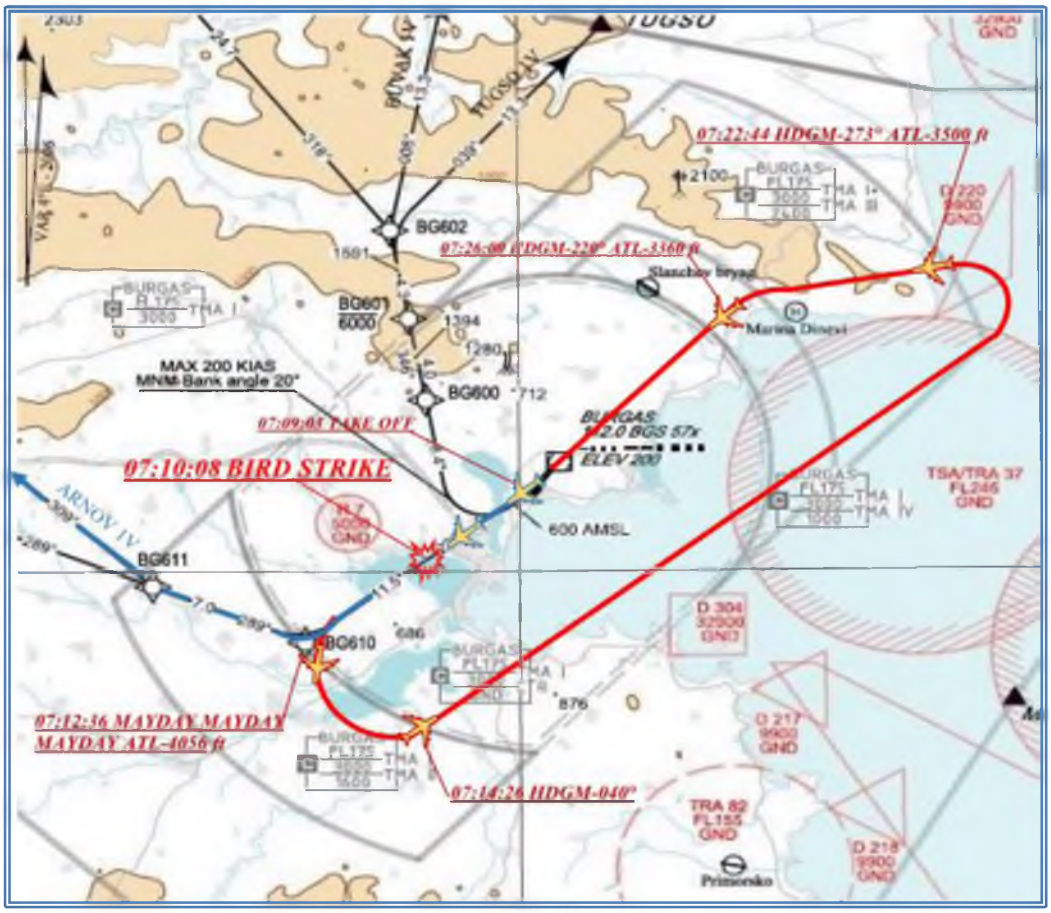


Fig.2

At 07:23:50 h, ATCO - APP issued the clearance to flight crew for an ILS approach for landing on RWY 22.

At 07:23:50 h, the aircraft intercepted landing heading for RWY 22 and start to descent.

At 07:29:46 h, the aircraft performed landing with actual GW of 71633 kg.

2.1.3. Location of aviation occurrence

Location: 6 NM South-West from airport LBBG in the controlled air space of APP-Burgas, over Burgas Lake.

Coordinates: 42°29'40"N 027°23'58"E

Date and hour: 30 June 2017, 07:10:08 h UTC

Airspace: Class C.

2.2. Injuries to persons

2.2.1. Injured persons

Injuries	Crew members	Passenger	Total number of occupants	Others
Fatal	0	0	0	0
Serious	0	0	0	0
None	7	155	162	0
Total	7	155	162	0

No injuries of crews, passengers or other persons in result of the air occurrence.

2.3. Damage to Aircraft

During the inspection carried out, it was found that all damages were localized in the area of the inlet and the fan of the left engine.

Within the engine No 1 inlet, along the entire circle, there were found traces of blood, possibly resulting from a large bird strike (see Figure 3). In some places, there were spots on the abradable liner and breaking of acoustic panels. There are visible deformations and tears of 26 (twenty-six) fan blades.

Fig. 3

The main part of these deformations and tears were located along the tips of the blades (Fig. 4). There were damages to the coating of the fan abredeble shroud. No damages and deformations were observed on other surface of the nacell and the pylon. There were no faults and deformations at the engine exhaust (primary and secondary). There were found damaged blades of the stator vanes of the secondary path. Due to difficult access, it was difficult to determine the number of damaged blades. The fan rotor rotates freely not only by hand but also by the wind. No damages found of the low pressure turbine.

Fig. 4

2.4. Other damages

No other damages.

2.5. Personnel information

2.5.1. Commander

Person:	German, born 1980.	
Licence:	Airline transport pilot licence for airplane (ATPL (A), issued by Deutsche Luftfahrt-Bundesamt.	
Type	A320-PIC, IR.	
ATPL valid:	valid until 31 October 2017.	
Medical Certification:	valid until 17 March 2018.	
Flying experience:	Total FH on the type	5455 hours;
	During the last 90 days	152:15 hours;

	During the last 7 days	04:33 hours;
	During the last 24 hours	04:33 hours

All the information available indicates that the commander was rested and healthy when he came on duty. There are no indications that fatigue played a role at the time of the incident.

2.5.2. Co-pilot

Person:	German, born 1982.	
Licence:	Airline transport pilot licence for airplane (ATPL (A), issued by Deutsche Luftfahrt-Bundesamt.	
Type	A320, COP, IR	
ATPL valid:	valid until 31 May 2018.	
Medical Certification:	valid until 6 October 2017.	
Flying experience:	Total FH on the type	672 hours;
	During the last 90 days	216:00 hours;
	During the last 7 days	18:56 hours
	During the last 24 hours	04:33 hours

All the available information indicates that the co-pilot was rested and healthy when he came on duty. There are no indications that fatigue played a role at the time of the incident.

2.6. Aircraft Information

2.6.1. General

Registration	D-AIAC
Aircraft type:	A321-211
Characteristics:	Twin-engine jet airplane
Manufacture Serial Number:	5969
Manufacturer	Airbus Industries
Produced:	in 2014
Engines:	CFM56-5B3/3;
Operator:	Condor Flugdienst GmbH
Owner:	BANK OF UTAH

Total flying time of the aircraft at the moment of the realization of the occurrence:

- Airframe	11769:16 FH
- TAC	3511 cycles
Certificate of registration	Issued by Deutsche Luftfahrt-Bundesamt on 22 December 2016
Certificate of airworthiness	Issued by Deutsche Luftfahrt-Bundesamt on 13 February 2014
Airworthiness Review Certificate	Issued on 09 February 2016, valid till 12 February.2018, sign by „Condor CAMO“ 058373

On 30 of June 2017 after a pre-flight check, the captain accepted the aircraft and signed in Aircraft Acceptance Sheet № 0706361.

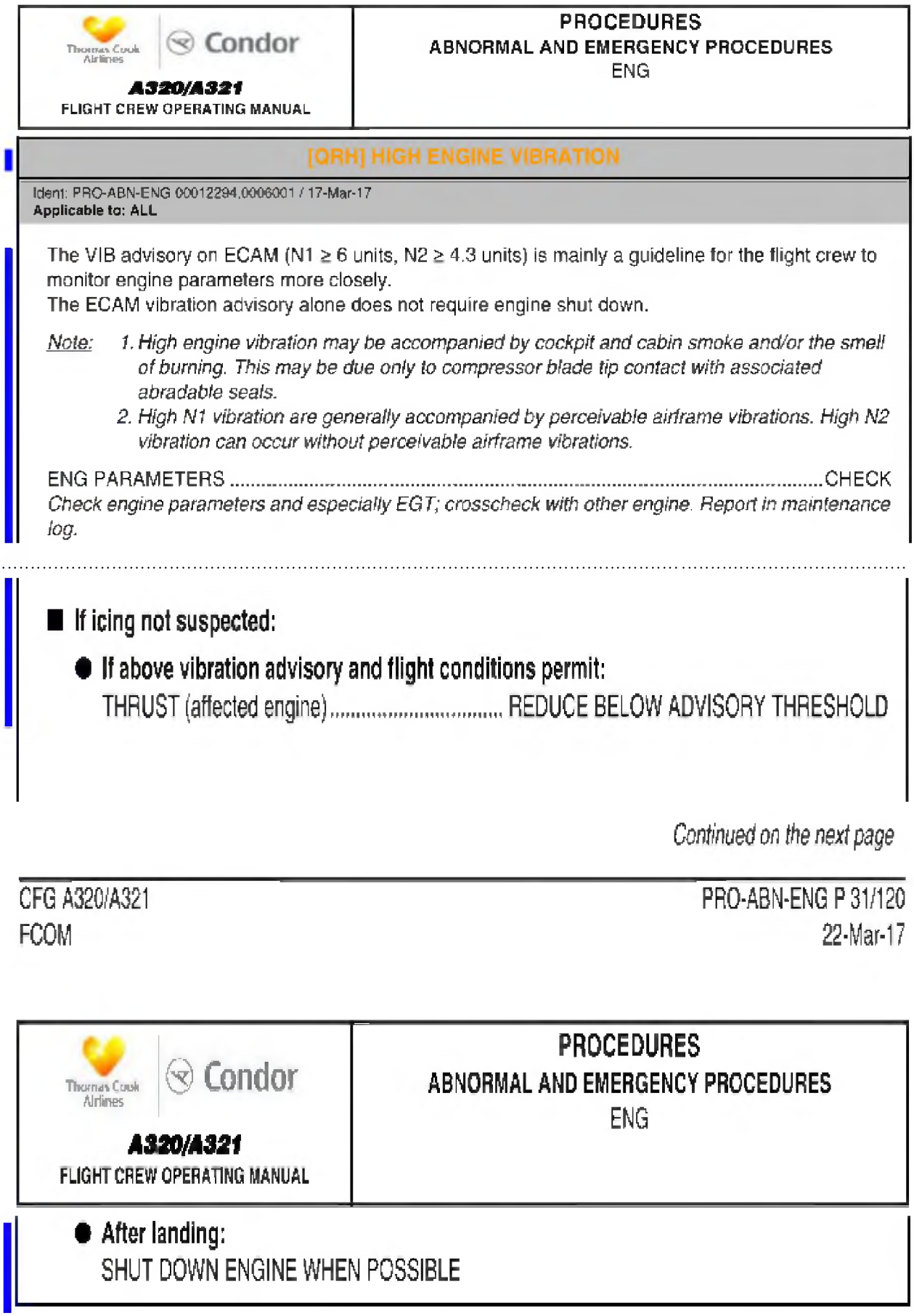
The aircraft A321-211, registration D-AIAC operated by Condor Flugdienst was airworthy and prepared to perform the flight from LBBG to EDDP at the time of the realization of air occurrence;

2.6.2. Aircraft Information

Concerning the flight DE1707 on 30 of June 2017 from LBBG to EDDP, according to the information from the Loadsheet of the aircraft, Actual Take-Off Weight was 72821 kg., the MTOW 93500 kg. The Maximum Landing Weight was 77800 kg. The aircraft landed with a mass of 71633 kg, which was with 6167 kg less than the Maximum Landing Mass. The Commission accepted that the aircraft had not been overloaded and that the distribution of passengers and baggage had been within the operating range.

2.6.2.1 HIGH ENGINE VIBRATION – Procedures

1. The actions of flight crew are described in FCOM C
2. FG A320/A321 PRO-ABN-ENG of the AO „Condor” (See Fig.5)



Thomas Cook Airlines | Condor

A320/A321
FLIGHT CREW OPERATING MANUAL

PROCEDURES
ABNORMAL AND EMERGENCY PROCEDURES
ENG

[QRH] HIGH ENGINE VIBRATION

Ident: PRO-ABN-ENG 00012294.0006001 / 17-Mar-17
Applicable to: ALL

The VIB advisory on ECAM (N1 ≥ 6 units, N2 ≥ 4.3 units) is mainly a guideline for the flight crew to monitor engine parameters more closely.
The ECAM vibration advisory alone does not require engine shut down.

Note: 1. *High engine vibration may be accompanied by cockpit and cabin smoke and/or the smell of burning. This may be due only to compressor blade tip contact with associated abradable seals.*
2. *High N1 vibration are generally accompanied by perceivable airframe vibrations. High N2 vibration can occur without perceivable airframe vibrations.*

ENG PARAMETERS ..... CHECK
Check engine parameters and especially EGT; crosscheck with other engine. Report in maintenance log.

■ **If icing not suspected:**

● **If above vibration advisory and flight conditions permit:**
THRUST (affected engine) ..... REDUCE BELOW ADVISORY THRESHOLD

Continued on the next page

CFG A320/A321
FCOM

PRO-ABN-ENG P 31/120
22-Mar-17

Thomas Cook Airlines | Condor

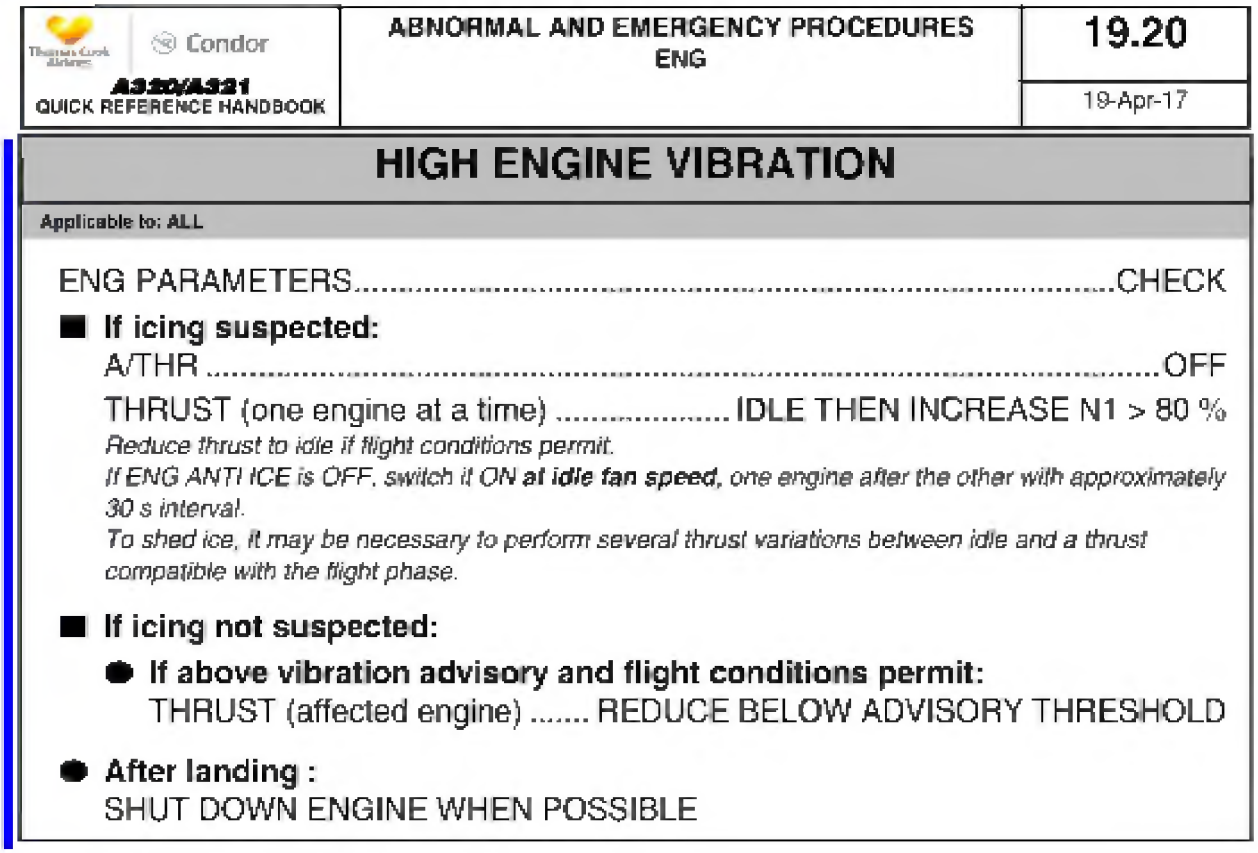
A320/A321
FLIGHT CREW OPERATING MANUAL

PROCEDURES
ABNORMAL AND EMERGENCY PROCEDURES
ENG

● **After landing:**
SHUT DOWN ENGINE WHEN POSSIBLE

Fig. 5

2.6.2.2 QUICK REFERENCE HANDBOOK – High Engine Vibration



Condor
A320/A321
QUICK REFERENCE HANDBOOK

ABNORMAL AND EMERGENCY PROCEDURES
ENG

19.20
19-Apr-17

HIGH ENGINE VIBRATION

Applicable to: ALL

ENG PARAMETERS.....CHECK

■ **If icing suspected:**

A/THR .....OFF

THRUST (one engine at a time) ..... IDLE THEN INCREASE N1 > 80 %

Reduce thrust to idle if flight conditions permit.

*If ENG ANTI ICE is OFF, switch it ON **at idle fan speed**, one engine after the other with approximately 30 s interval.*

To shed ice, it may be necessary to perform several thrust variations between idle and a thrust compatible with the flight phase.

■ **If icing not suspected:**

● **If above vibration advisory and flight conditions permit:**

THRUST (affected engine) ..... REDUCE BELOW ADVISORY THRESHOLD

● **After landing :**

SHUT DOWN ENGINE WHEN POSSIBLE

Fig. 6

2.6.3. Information on the fuel used

Accordingly, to the Loadsheet from 30 of June 2017 on the aircraft A321-211 registration D-AIAC before the flight from LBBG to EDDP the total fuel was 10000 kg of kerosene JET A-1. The planned fuel to be consumed for the flight from Burgas to Leipzig is:

- Taxi fuel - 200 kg.
- Trip fuel from LBBG to the destination aerodrome EDDP - 5950 kg;

The total fuel was sufficient to carry out the flight.

2.7. Meteorological Information

2.7.1. Weather at the time and location of the occurrence

A warm, dry and stable air mass resides over Bulgaria, characterized on the ground surface with low pressure gradient and weak ridge of high pressure with axis oriented SW-NE. Along that ridge on the high levels over the country there was an advection of heat, which leaded to hot and clear sky weather with low surface winds. Along the Black sea site, there was a breeze circulation.

2.7.2. Meteorological conditions at Burgas airport

Weather	CAVOK
Wind	TDZ 320°/13KT Variable between 280°/ and 360°/ and 300°/8KT Variable between/and 320°
Temperature/Dew point	35°C/11°C
Atmospheric pressure	QNH 1011 hPa
Lighting conditions	Daylight.

2.7.3. ATIS – Automatic terminal information service at airport Burgas

(J) 2017-06-30 07:01:27 UTC.
This is Burgas information J.
ATIS Report at 0701Z
ILS approach
Runway in use 22

Flock of birds in VC of the RWY, ALT unknown
Transition Level 140
TDZ - touchdown zone 320/13KT VRB BTN 280/ AND 360/
CAVOK
Temperature 35°
Dew point 11°
QNH 1011 hPa
TREND NOSIG
Inform Burgas Approach - Info J.
The meteorological conditions at the time of the air occurrence realization were of no effect to the serious incident.

2.8. Navigation

The aircraft performed the flight with the standard navigation equipment of the aircraft A321-211. There were no reported about technical failures of the navigation equipment of the aircraft. The approach to RWY 22 at Bourgas airport from flight DE1707 is carried out under the ILS instrumental landing system, which is CAT 1, as described in the Aeronautical Information and Publication (AIP) of the Republic of Bulgaria.
In the day-to-day information of ATS Burgas, there are no refusals of technical means that directly affect the operational activity at the moment of the event.

2.9. Communications

The air-ground radio communication between the flight crew and ATCO-Tower at LBBG was carried out at the frequency of 118,000 MHz.
Bilateral radio communication between the flight crew and ATCO-APP at LBBG was carried out at the frequency of 125,100 MHz.
The Bulgarian Air Traffic Services Authority provided a transcript of the radio-communication of Burgas-Tower, Burgas-APP at frequencies 118,000 MHz. and 125,100 MHz. After hearing the radio conversations at the work frequencies of Burgas-Tower and Burgas-APP, the Investigation Commission found that there had been no loss of radio communication and there had been no interruptions and disturbances of the radio broadcasting.
The records are attached to the investigation materials.

2.10. Aerodrome information

2.10.1. General
Aerodrome Location Indicator and Name – LBBG-BURGAS;
ARP coordinates and site at aerodrome - N42°34'13" E027°30'55", RWY centre;
Elevation - 135 ft. (44 m);
Designations / RWY 04/22 - MAG 040°/220°;
Dimensions of RWY (m) - 3200 x 45 m;

2.10.2. Active control of aerodrome birds
The effective control of living nature requires in case of establishing the presence of even a small number of birds these to be expelled as quickly as possible. This prevents their becoming an attraction for other birds, as their presence is an indication of food availability or a safe place to stay. To achieve this, it must be acted immediately and birds to be expelled as soon as possible.
Burgas Airport has available for the purpose visual, audible and lethal devices to use with the purpose to prevent hazards caused by a presence of birds and other animals along the flight trajectories of aircraft or in the airdrome active area .

1. Visual devices to banish birds
   - 10 - Wind Powered Constantly Revolving Scarecrow;
   - 10 - Flashing Hawkeye with Mirrors;
   - Hand portable laser lantern LEM 50;
   - Shiny bands
2. Acoustic devices to banish birds.

- Electronic acoustic system Phoenix Wailer;
- Electronic acoustic system Bird X Megablaster (2);
- Electronic acoustic system Super Bird X Peller Pro – (3);
- Electronic acoustic devices BR 4 и BR 30 (1);
- Telescopic gas cannons Guardian 2 (4);
- Gas pistols (3);

3. Deadly devices to banish birds.

The use of weapons at airports with a possible deadly effect is important because it helps to ensure that birds and other wild animals do not become accustomed and allows the selective removal of all birds that do not react to the chasing away techniques. This method is only used when it is impossible to banish the birds otherwise.

It is apparent from the operative report of June 30, 2017, that the duty officers at the Aerodrome Coordination Centre at Burgas Airport had controlled the wildlife with visual and audible devices to expel the birds during the serious incident.

2.10.3. Control of wildlife outside the flight field

In 2009, a contract was signed between Burgas Airport and the Bulgarian Bird Protection Society for conducting surveys and establishing an inventory of sites within the ICAO designated 13-kilometre zone around the checkpoint at Burgas Airport, which are attractive to birds.

These areas are included in the Birds and Habitats management programme and recommended measures are taken to reduce their attractiveness for the living nature.

2.11. Flight data recorders

The data from DFDR on aircraft A321-211, registration D-AIAC, provided by AO "CONDOR" is as following:

The record from DFDR on aircraft A321-211, registration D-AIAC for flight DE1707 / 30 of June 2017 started at 07:08:00 (UTC). The aircraft was on the holding point and was preparing for the take off. The temperatures of both engines were within the limit EGT1 = 466 C° and EGT2 = 467 C°. Registered engine vibrations were VIBN11= 0,2 and VIBN21=0,4.

No engine anomalies were recorded during take off run of the aircraft. The exhaust gas temperatures were EGT1 = 569 ... 771 C° and EGT2 =567 ... 779 C°.

The aircraft A321-211 took off from RWY 22 airport LBBG at 07:09:03 h.

During the initial climb at altitude ALT = 1996 ft, the vibration in engine No 1 was recorded above the threshold of 6 units VIBN11=9, the vibration in engine No 2 were in the limit VIBN21 = 0,6. The exhaust gas temperatures were EGT1 = 751 C ° and EGT2 = 747 C °. The average fuel consumption was FF engine №1=3519 kg/h and FF engine №2=3258 kg/h.

At 07:12:23 h. at ALT=4000 ft. the vibration in engine №1 increased to VIB N11=9,9. The temperatures of both engines were in the norm EGT1=604 C° and EGT2=642 C°

At 07:14:26 h. at ALT=4076 ft. and heading 40°, the vibration in engine №1 was VIBN11=9,8.

At 07:22:17 h. at ALT=3972 ft. the flight crew started to descent, the aircraft was at a turn to the left stage (heading 322 °), the engine vibration №1 had been reduced below the threshold of 6 units (VIBN11<6). The temperatures of both engines were in the norm EGT1=523 C° and EGT2=533 C°.

At 07:22:44 h. at ALT=3500 ft. and heading 273° the vibration in engine №1 was VIBN11=1,2. The rotational speed of both engines were N11 - 40,1% and N21 - 77,9% respectively.

At 07:23:04 h, the vibration in engine №1 increased up to units VIBN11>6. The temperatures of both engines were normal - EGT1=526 C° and EGT2=524 C°.

At 07:26:00 h, the aircraft continued to descend and established on the landing heading.. The vibration in engine №1 decreased below 6 units VIBN11 < 6, the temperatures of both engines were in the norms EGT1=551 C° and EGT2=538°C.

The aircraft landed at 07:29:46 h with a speed of CAS=142 kt, GWT=71633 kg and g=1.21. The vibration in engine №1 is less than 6 units. The temperatures of both engines were in the norms EGT1=487 C° и EGT2=482 C°. Immediately after landing at 07:29:47 h during the taxi roll the engine №1 was set in the IDLE mode. Both engines were shut down at 07:35:40 h.

The information from the data recorders of the Air Traffic Control Centre - Burgas for radar picture and radio communication was used as well. The records are attached to the investigation materials in case № 03/30.06 .2017.

2.12. Wreckage and Impact Information

The event was not related to an impact with the ground and aircraft destruction. During the initial climb as described in paragraph 2.1.2, the plane ingested a bird with its No. 1 engine, resulting in increased vibration of the engine over the admissible limits. The crew decided to stop climbing and implement an emergency landing at Burgas airport. Bird strike and during the landing and during the forced landing, there was no separation of debris and parts of the aircraft in the air. The damages detected to the plane during the inspection at Burgas airport are described in paragraph 2.4.

2.13. Medical and Pathological Information

Because of the nature of the air occurrence medical and pathological research was not conducted.

2.14. Fire

No fire initiated during the occurrence

2.15. Survival Aspects

No survival equipment was used by the passengers and the crew.

2.16. Tests and Research

For the purposes of the safety investigation, the Commission carried out and implemented as follows:

1. Inspection of Airbus A321-211 aircraft, registration marks D-AIAC;
2. Discussions with the flight crew of A321-211 aircraft;
3. Discussions with ATCO – Tower, and ATCO – APP who performed air traffic control during the serious incident;
4. Collecting, documenting, studying, listening and analysis of the radar picture and radio communication records between the flight crew and ATCO – Tower, and ATCO – APP;
5. Analysis of the actions of the flight crew and ATCO during the aviation occurrence;
6. Discussed and analysed data from the flight crew report;
7. Studying and analysis of aircraft operating documentation;
8. Assessment of aircraft flight performance characteristics;
9. Analysed flight data from FDR of Airbus A321-211 aircraft, registration marks D-AIAC in regards to the flight and engine parameters.
10. Bird/Wildlife remains identification carried out by Deutscher Ausschuss zur Verhütung von Vogelschlägen im Luftverkehr DAVVL e. V.,
11. Logics & probabilities analysis for possible causes of the aviation occurrence

The results of execution referred to in 1 and 2 are reflected in paragraphs 2.1.2 and 2.1.3.
The results of execution referred to in 3 and 4 are reflected in paragraphs 2.1.2 и 2.12.
The results of the inspection of Airbus A321-211 aircraft are reflected in paragraph 2.3.
The results of studying and analysis of the aircraft flight performance are given in paragraph 2.6.1.
Flight performance characteristics of aircraft relevant to the realized occurrence are assessed in paragraphs 2.6.2 and 2.6.3.
The data from the a/c FDR related to the occurrence are reflected in paragraph 2.1.
Logics & probabilities analysis for possible causes of the aviation occurrence is made in paragraph 3.

2.17. Additional information

2.17.1. Ornithology

According to the received radar information from BULATSA and the explanations of the flight crew the event occurred outside the area of Burgas airport at about 6 NM of the RWY 04 threshold at a height of 1500 ft. overflying Burgas Lake. Since it is related to a collision of an aircraft with a bird, an ornithological information regarding the Burgas Lake (the area over which the collision occurred) is given below.

According to Bulgarian Site "Birds in Bulgaria", Lake Burgas (or Lake Vaya) is described as Protected Area located near the Black Sea at 6 NM south-west from Burgas airport. Its length is 9,6 km, the width of 2,5 to 5 km, the area of which is 28 km^2, Its is one of the three most significant wet land complexes for congregation of waterfowl along the Bulgarian Black Sea coast.

The region of the lake supports 245 bird species, 71 of which are listed in the Red Book of Bulgaria (1985). 105 species of the currently occurring birds are of European concern for protection (SPEC) (Birdlife International, 2004), 9 of them being listed in category SPEC 1 as globally threatened, 26 in SPEC 2 and 69 in SPEC 3 as species threatened in Europe. The area provides suitable habitats for 89 species included in Annex 2 of the Biodiversity Act, which need special protection measures, of which 80 are also listed in Annex I of the Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds. As the lake is located on the Via Pontica migration flyway, it is one of the most important station points in the birds' migration along the Bulgarian Black Sea coast. Especially numerous are the Pelecaniformes, Anseriformes, Charadriiformes and Ardeidae bird species.

According to the explanations of flight crew of flight DE1707, the bird was white with a wingspan of 1 … 1,5 m flying a height of 1,500 ft.

In view of the above and the description of the birds at the Bulgarian Site "Birds in Bulgaria" occupying "Burgas Lake" area and the finding of the Deutscher Ausschuss zur Verhütung von Vogelschlägen im Luftverkehr DAVVL, the Commission suggests that the bird ingested by the left engine of aircraft A321-231 is supposed to be:

1. Short-toed Eagle/Circaetus gallicus is a large bird, 0,62 – 0,69 m long with a 1,8– 1,9 m wingspan and weigh of 1,5–2 kg . They can be recognised in the field by their predominantly white underside, the upper parts being greyish brown. The chin, throat and upper breast are a pale, earthy brown. Only one nest in the southern slopes of the Aitos Mountain is known from the Bourgas region (See Fig. 7) or

Fig.7

2. Ardea alba is a large heron with all-white plumage. Body length 0.9 to 1m, wingspan of 1,4 to 1,9 m and its body mass can be from 0.7 to 1,6kg. (See Fig. 8) or

Fig.8

3. Pelecanus onocrotalus is a large bird with white plumage. Body length is 1,40 to 1,75 m, wingspan of 2,45 – 2,85 m and body mass can range from 5 to 8kg. (See Fig. 9)

Fig. 9

3. Analysis

According to the information received from BULATSA, the explanations of the flight crew of flight DE1707, the analysed data from DFDR provided by AO „Condor" and the statement in paragraph 2.1.2 above, the take off was performed according to the prescribed procedure. During the initial climb, the aircraft impacted a bird, which resulted to damage of 26 (twenty-six) fan blades of the left engine.

In the cockpit, the flight crew received ECAM Advisory message of a high vibration in the left engine and they felt the noticeable odour. The flight crew checked the parameters of the left engine comparing them to the right engine parameters. In accordance with the procedures specified by the Airbus manufacturer and the Condor's Aircraft FCOM CFG A320 / A321 PRO-ABN ENG, the flight crew reduced the thrust of the engine, which resulted in reduce of the vibration. The flight crew did not receive an ECAM Alert message, continued to monitor closely the engine parameters and it was found no deviation of the right engine parameters. Also, there were no failure messages recorded on the Post Flight Report. The flight crew informed the ATS about the state of the left and right engines, and then executed a landing approach to RWY22. Immediately after the landing and taxing the engine, No 1 was set to "IDLE" mode.

In view of the above, the Commission accepted the flight crew actions during the occurrence as correct and contributing to the favourable outcome of situation and ensuring flight safety .

In view of the above, the Commission concluded that the serious incident under investigation resulted from:

A collision of a big bird, probably a Short-toed Eagle, a White Heron (Ardea Alba) or a Pelecanus onocrotalus with the aircraft and its subsequent ingestion by the left engine.

Taking into account the crew explanations, the bird remains in engine and the finding of the Deutscher Ausschuss zur Verhütung von Vogelschlägen im Luftverkehr DAVVL, most probably the bird was a Short-toed Eagle.

It was impossible for the flight crew to avoid the impact as it carries a purely random character and the area where it took place was outside the area where the airport authorities at Burgas airport were carrying out activities related to prevention of collisions with birds.

The activity of the Burgas airport authorities related to the establishment of conditions for minimizing the probability of collision with birds is discussed in paragraph 2.10.

Given that the flight path of an aircraft at Burgas airport after take-off from RWY 22 passes over the Burgas Lake, in the territory of which large birds subject to conservation and with a mass of more than 2 kg, it is appropriate that the flight crews taking off in that outbound track are informed of the possibility of a collision with such birds.

4. Conclusion

4.1. Findings

1. The aircraft A321-211, registration D-AIAC, Manufacture Serial Number – 5969 was produced in 2014 by Airbus Industries and operated by Condor Flugdienst GmbH. Total flying time of the aircraft at the time of the realization of air occurrence was 11769:16 FH.
2. The aircraft A321-211, registration D-AIAC, operated by Condor Flugdienst was airworthy at the time of the realization of the occurrence;
3. The aircraft A321-211, registration D-AIAC, was prepared to perform the flight from LBBG to EDDP at the time of the realization of air occurrence;
4. The flight crew of aircraft A321-211, Captain as Pilot Flying and First Officer as Pilot Monitoring, possess the required qualification and medical fitness for flights in accordance with existing regulations
5. There are no indications that fatigue played a role at the time of the incident.
6. The serious incident is not the result of an impact of on adverse weather conditions;
7. The air occurrence is occurred at a distance and a altitude outside the scope of the responsibilities of the Burgas Airport for active control for banishing birds.
8. In the Aeronautical Information and Publication (AIP) of the Republic of Bulgaria, in the part relating to Burgas airport, there is no information on the sites attractive to birds in the area determined by ICAO 13 km (7 NM) around the aerodrome reference point.
9. In the AIP part ENR 5.6 Bird Migration and Areas with Sensitive Fauna does not contain a description of the movement of birds in their migration, rest areas and areas with sensitive fauna.

10. The left engine of aircraft has operated normally until ingesting a large bird (with a mass of about 2 kg) causing mechanical damage, which did not allow the engine to deliver the thrust needed.
11. After the Bird strike the flight crew received a high vibration in the left engine advisory message: "ENG 1 HIGH VIBRATION (9.9)"
12. The flight crew did not receive an ECAM alert message since there were no other problems registered with the left engine
13. The flight crew did not shut down the left engine after the Bird strike.
14. The flight crew declared aircraft emergency "MAYDAY, MAYDAY, MAYDAY, set squawk 7700"and returned towards LBBG for performing forced landing.
15. The flight performed a "Crosscheck" of engine parameters after the determined high vibration in the left engine according to the procedures specified by the Airbus manufacturer and indicated in the Flight Crew Operating-Manual FCOM CFG A320/A321 PRO-ABN-ENG of the "Condor" AO.
16. The landing was performed without complications within the RWY22.
17. ATCO - APP reacted correctly and immediately by timely providing radar vectors for an ILS approach to RWY 22 after the declared aircraft emergency by the flight crew.
18. ATCO - APP provided information about meteorological conditions at Burgas airport
19. ATCO - APP ensured a priority landing for the aircraft.
20. During the landing emergency rescue equipment was not used.

4.2. Causes

Based on the analysis performed, the Commission points out that the serious incident resulted from the following causes:

The ingestion of a large bird, most probably a Short-toed Eagle, into the left engine during initial climb, causing mechanical damage to the inlet and to the fan rotor, which led to a loss of the left engine thrust.

As the main contributing factor for the realization of the event, the Commission takes the existence of a big bird's natural habitat in the area of Burgas Lake, which is situated along the flight trajectory of the aircraft that take off from RWY22 of Burgas airport.

5. Safety Recommendations

In view of the causes for the realized serious incident and the deficiencies found in the course of investigation, the Commission proposes following safety recommendations to be fulfilled:

BG.SIA-2017/03/01. The Civil Aviation Administration General Directorate to publish relevant current information in point ENR 5.6 entitled "Bird Migration and Areas with Sensitive Fauna" of Part 5 "Navigation warnings" of the Aeronautical Information Publication of the Republic of Bulgaria in regards to the areas of the airports of public use.

On the grounds of Art. 18, § 5, of Regulation 996/2010, the radiated safety recommendations will be recorded in the centralized European SRIS (Safety Recommendations Information System) system.

The Investigation Commission reminds all organizations to which safety measures have been sent, that on the basis of Article 18 of Regulation 996/2010 on Investigation and Prevention of Accidents and Incidents in Civil Aviation and Art19, Para7 of Ordinance No. 13 for investigation of aviation accidents, that are obliged to notify in writing the Directorate AMRAIUD of MTITC for the actions taken on the recommendations made.

25 July 2018 ***BULGARIAN AIRCRAFT ACCIDENT INVESTIGATION UNIT***