Havarikommissionen
Accident Investigation Board Denmark

BULLETIN

Serious incident

23-07-2013

involving

LN-BRE

Certain report data are generated via the EC common aviation database

FOREWORD

This bulletin reflects the opinion of the Danish Accident Investigation Board regarding the circumstances of the occurrence and its causes and consequences.

In accordance with the provisions of the Danish Air Navigation Act and pursuant to Annex 13 of the International Civil Aviation Convention, the investigation is of an exclusively technical and operational nature, and its objective is not the assignment of blame or liability.

The investigation was carried out without having necessarily used legal evidence procedures and with no other basic aim than that of preventing future accidents and serious incidents.

Consequently, any use of this bulletin for purposes other than preventing future accidents and serious incidents may lead to erroneous or misleading interpretations.

TABLE OF CONTENTS

BULLETIN

General

File number:	HCLJ510-2013-234
UTC date:	23-07-2013
UTC time:	06:31
Occurrence class:	Serious incident
Location:	800 feet above ground level (AGL) runway (RWY) 04R at Copenhagen Airport Kastrup (EKCH)
Injury level:	None

Aircraft

Aircraft registration:	LN-BRE
Aircraft make/model:	BOEING 737 405
Current flight rules:	Instrument Flight Rules (IFR)
Operation type:	Commercial Air Transport Revenue operations Passenger
Flight phase:	Take-off
Aircraft category:	Fixed wing Airplane
Last departure point:	Denmark EKCH (CPH): Copenhagen/Kastrup
Planned destination:	Norway ENGM (OSL): Oslo/Gardermoen
Aircraft damage:	Minor
Engine make/model:	CFM INTERNATIONAL CFM 56

Notification

All times in this bulletin are UTC.

The Aviation Unit of the Danish Accident Investigation Board (AIB DK) was notified of the serious incident by the Area Control Centre at Copenhagen Airport, Kastrup on 23-07-2013 at 09:10 hrs.

The International Civil Aviation Organization (ICAO), the European Aviation Safety Agency (EASA), the Directorate-General for Mobility and Transport (DG MOVE), the National Transportation Safety Board (NTSB USA), the Accident Investigation Board Sweden, the Accident Investigation Board Norway and the Danish Transport Authority were notified of the serious incident by the AIB DK.

FACTUAL INFORMATION
History of the flight

The serious incident flight was a scheduled flight from Copenhagen Airport Kastrup (EKCH) to Oslo/Gardermoen Airport (ENGM) in Norway.

Following initial take-off from RWY 04R at EKCH, the flight crew noticed a flock of birds in front of the aircraft.
Immediately thereafter – at approximately 800 feet AGL – a "bang" was heard in the aircraft and the flight crew noticed a smell of burned material from the air conditioning system.

One or more birds hit the left engine which resulted in abnormal engine vibrations.

The flight crew advised the aerodrome control tower (TWR) of the bird strike and requested a return for landing at EKCH.

The TWR controller instructed the flight crew to return for landing at EKCH and to remain on the TWR east frequency 119.350 MHz.

Since the left engine developed power and except for the vibration level there was no abnormal engine indications, the commander (CMD) decided to return and perform the final approach and landing with both engines running.

The aircraft landed on RWY 04R and vacated the RWY via taxiway (TWY) B5.

The airport fire and rescue services followed the aircraft and observed fluid leaking from the bottom of the left engine. Therefore, TWR instructed the flight crew to taxi to the deicing TWY A platform.

After approximately two minutes of taxiing, the flight crew shut down the left engine.

On the deicing TWY A platform, the flight crew shut down the right engine.

The fluid leak from the left engine – revealed to be fuel – did not cease until the airframe fuel valve was closed.

The crew and the passengers disembarked the aircraft and were then transported to the airport terminal.

At the terminal, the CMD debriefed the passengers.

The serious incident took place in daylight and in visual meteorological conditions (VMC).

Personnel information

The CMD – male 54 years old – was in possession of a valid Airline Transport Pilot License (ATPL) issued by the Civil Aviation Authority, Norway, on 19-11-2003.

Aircraft information

The twin engine aircraft was manufactured in the USA in1990 by Boeing as 737-405 S/N 24643.

The engines were manufactured by CFM International, a joint venture between GE Aviation, a division of General Electric USA and Snecma, a division of Safran of France as CFM56-3C-1.

Meteorological information

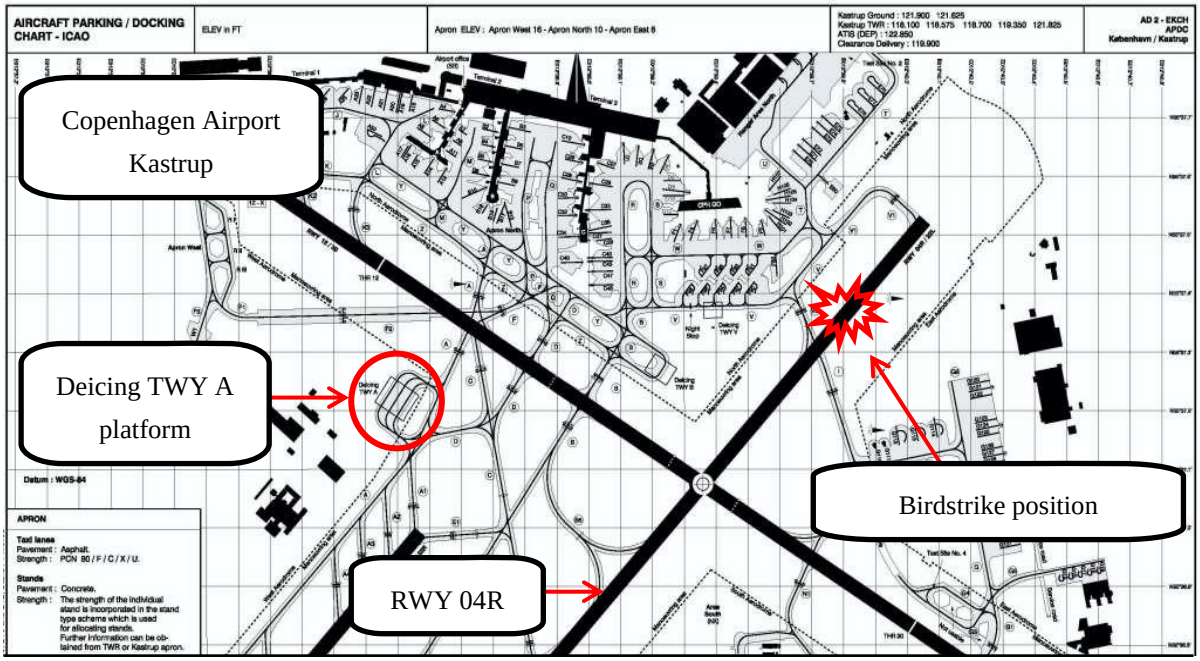
The sky was clear and the wind was calm.

Aerodrome information

The northeastern part of EKCH stretched out toward the Sound (Øresund).

The map section below shows the northern part of the airport.

RWY 04R, deicing TWY A platform and the approximate position of the aircraft – when hit by birds – are marked on the map section below.



The left engine S/N 858-370 examination

Engine damage

The engine air intake duct and the engine fan were damaged.

All the engine fan blades were damaged and bended as seen in the pictures below.

Three fan blade tips were missing. Two of these three fan blade tips were found in the duct.

At the front side of the fan the air intake duct broke up at several places. There was a track of damage all around the duct following the counter clockwise rotation of the fan (pictures below).

Fuel leak

In relation to the fuel leak, the engine was inspected. The airframe fuel valve opened which caused fuel leaking out from the bottom of the engine bay.

There was no sign of fuel in the duct area behind the fan below the core engine.

The core engine and the appurtenant components were inspected and no visible fuel leaks were revealed.

The engine was replaced.
The fuel leak vanished when the new engine was in place and connected to the airframe fuel line.

No further investigation into the engine internal fuel leak was performed.

FDR data and engine vibrations

The FDR data was downloaded and used in the investigation.

In the period before the birdstrike (i.e. the engine N1 fan vibration level was 0.14 units) no FDR abnormal engine parameters were identified.

When the birdstrike occurred, the N1 fan vibration level increased to 5.0 units and stayed at that level during the remaining flight.

Observing the cockpit instruments, the CMD was aware of the abnormal vibration level.

The FDR data revealed no other abnormal engine parameters during the flight.

Bird species information

Immediately after the serious incident, a dead young Common Shelduck was found close to RWY 04R.
The injuries indicated that the bird was struck by an aircraft.

From the damaged engine, DNA samples were secured.

The DNA examination done by the National Wildlife Forensics Facility of the University of Copenhagen revealed a 100 % match to the Common Shelduck, Tadorna tadorna.

Bird species:	Common Shelduck *(Tadorna tadorna) (In Danish: Gravand).*
Weight:	1100 – 1450 g.
Length:	61 cm.
Wing span:	110 – 133 cm.

The picture below was taken at Borreby Mose by Lars Ulrik Rostgaard, Karrebæksminde in 2009.

In Europe, there are two fairly distinct populations of Common Shelducks.

One in North West Europe, from the southern Sweden to the United Kingdom and France, and one in the Mediterranean and eastwards through Central Asia.

The Common Shelduck is present in Denmark, especially along the coast lines.

In the summertime, the species commonly migrate to favored moulting grounds after breeding, such as the Wadden Sea on the North Sea coast of Germany.

Such a moult migration was registered on 23 July, 2013, south of the airport at the southern part of Amager.

Birdstrikes

EKCH Wildlife Control

In the period 2008 – 2012, 101 bird control actions involving Shelducks were performed.

The Wildlife Control Unit hunters scared away a total of 292 Shelducks by use of scare shuts, and claimed 17 individuals shut down.

The actions were performed particular in April, May and June.

The birdstrike on 23 July was thus outside the period during which Shelducks normally roost at the airport.

In April, May and June 2013, 24 Shelducks were scared away in eight actions.

Prior the birdstrike, the last action against Shelducks involving three roosting birds was on 10 June 2013.

The Wildlife Control Unit hunters were only able to scare migrating birds to alter the direction of the migration in cases where the birds flew low and relatively close to the hunters.

In the past (May 1986 & April 2004), EKCH registered two birdstrikes involving Shelducks.

The Wildlife Control Unit did not observe the involved migrating flock of Shelducks flying at approximately 800 feet AGL.

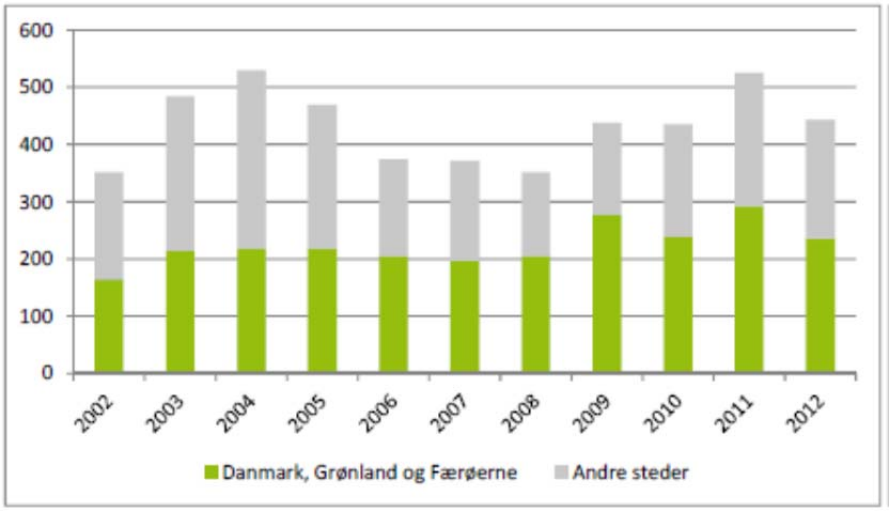
The Danish Transport Authority safety report

The yearly safety report published by the Danish Transport Authority in 2013 contained the following information:

Birdstrikes is a widespread problem. The number of registered birdstrikes in 2012 is lower than in 2011 and is in line with the number in 2009 and 2010.

The figure should be read in relation to the relatively low production in 2012.

The figure below shows the number of birdstrikes in Denmark, Greenland and the Faroe Islands 2002 – 2012.



There are significant differences in the number of birdstrikes at different airports and airfields.

The variation is mainly due to the large difference in the activity of the various airports, therefore Copenhagen Airport Kastrup has many more records of birdstrikes than any other airports in Denmark.

This variation, however, is also a result of the individual airport location in relation to areas that are attractive to birds, such as wetlands, breeding areas, migration routes, etc.

The figure below shows the number of birdstrikes in 2012 divided between airports.

Lufthavn	Total	Pr. 10.000 operationer
Billund	26	5,1
Esbjerg	3	2,0
Karup	3	4,5
Kastrup	141	5,8
Roskilde	1	0,1
Rønne	1	1,4
Sønderborg	1	1,9
Vagar	2	3,8
Aalborg	33	13,9
Aarhus	10	5,1

Birdstrikes EKCH 2013

At EKCH in 2013, the total number and the rate of birdstrikes were:

Total: 105
Rate: 4.29

ANALYSIS

The birdstrike

At an altitude of approximately 800 feet AGL, when the flight crew observed birds in front of the aircraft, it was too late to avoid a birdstrike.

The damage of the left air intake duct, the engine fan and the bird remains confirmed that the engine had suffered from a birdstrike.

The left air intake duct and the engine fan were significantly damaged.

The AIB DK considers the broken fan blade tips – during rotation – as causal factor to the air intake duct damage.

There was a convergence between the birdstrike, the damaged fan and the abnormal vibration level.

The abnormal vibrations were caused by imbalance of the damaged fan disc.

The vibration level increased in a 1 to 35 time ratio.

The AIB DK is of the opinion that in case a birdstrike results in abnormal engine vibrations, it should be considered to shut down the engine to prevent further damage. Obviously considering that the remaining flight – single engine – can safely be performed.

The reason for this is that it is unknown how a damaged engine will behave.
In this case, the birdstrike caused a fuel leak from the damaged engine.

However, the AIB DK finds it appropriate to have the damaged engine running as a safety precaution because except for the vibration level the flight crew did not observe abnormal engine indications.

Common Shelduck

The bird remains in the air intake duct revealed the species to be the Common Shelduck.

Based on the facts that the birds were present at 800 feet AGL and that migrating Common Shelducks was registered south of the airport on the day of the serious incident, it is the opinion of the AIB DK, that the birds were migrating birds.

From the ground and due to the altitude AGL of the birds, the Wildlife Control Unit hunters did not observe the migrating birds.

Based on the history of birdstrikes, the AIB DK does not consider Shelducks as a specific problem at EKCH. However, large numbers of migrating birds in the area could be a threat in the future.

Birdstrike statistics concerning EKCH

According to the recent statistic reports issued by EKCH and the Danish Transport Authority, the total number and the rate of birdstrikes at EKCH has decreased.

The total number of birdstrikes at EKCH decreased from 141 in 2012 to 105 in 2013.

The AIB DK is of the opinion that it is not possible to avoid birdstrikes.

However, in recent years the risk of having a birdstrike at EKCH has been reduced indicating efforts made by the airport are successful.

CONCLUSIONS

The serious incident was caused by a birdstrike to the left engine.

One or more Common Shelducks damaged the left air intake duct and the engine fan which resulted in abnormal vibrations and a fuel leak from the left engine.

A contributing factor to the serious incident was:

As a result of the altitude AGL of the birds, it was not possible for EKCH's Wildlife Control Unit to observe and act against the flock of migrating Common Shelducks.

SAFETY RECOMMENDATIONS

Based on this investigation, the AIB DK did not issue any recommendations.