

FINAL INCIDENT REPORT

HCLJ510-000696	Incident		
Aircraft:	Bombardier CL-600-2D24 (CRJ 900)	Registration:	OY-KFF
Engines:	2 General Electric CF34-8C5	Flight:	Scheduled flight, IFR
Crew:	4 – no injuries	Passengers:	55 – no injuries
Location:	Copenhagen Airport Kastrup (EKCH) RWY 04R	Date and time:	09.10.2009 at 21.03 UTC

The Aviation Division of the Danish Accident Investigation Board received a report of an incident from the operator of the aircraft on 9 October 2009 at 23.00 UTC

1 Factual information

1.1 History of the flight

The incident occurred during a flight from Copenhagen's Kastrup Airport (EKCH) with Aarhus Airport (AKAH) as the planned destination.

Following initial take-off from Runway 04R, the pilots noticed a flock of birds in the beam of the aircraft's searchlights. Immediately thereafter, at an altitude of 256 ft, the aircraft was hit by birds, which resulted in powerful vibrations in the aircraft.

The vibrations made it difficult for the pilots to read the engine instruments, but they were nevertheless able to read the level of vibrations in the right engine which were fluctuating around the maximum values. The pilots were not able to tell whether the left engine had been hit which is why, in the first instance, they were hesitant to stop the right engine. Since the vibrations in the right engine only partially ceased when the pilots pulled the throttle grip back, they decided to stop the engine. The left engine functioned normally throughout the flight.

The incident was observed from the ground and from the control tower (TWR).

EKCH's on-duty Bird and Wildlife Control Unit warden was approximately 800 m east of the intersection between Runway 04R and Taxiway I at the time of the incident. He heard a loud bang from the starting aircraft and then saw shooting flames and sparks come from the right engine as it passed Taxiway I above Runway 04R.

The air traffic controller from TWR also saw flames come from the right engine of the aircraft immediately after it was in the air.

When TWR was informed of the "bird strike" incident by the pilots, the air traffic controller gave the pilots their free choice of landing runway.

The pilots turned the aircraft round and flew visually in a right tailwind to Runway 04R where they landed at 21.17 UTC without further incident.

The incident occurred in darkness under visual meteorological conditions (VMC).

1.2 Injuries to persons

No persons were injured in the incident.

1.3 Damage to the aircraft

There was extensive damage to the aircraft.

The radome, weather radar, left/right cockpit side windows, the right front edge of the wing, the right blade root/fuselage screen, the right motor pylon/screen were all damaged.

The left engine was undamaged.

The picture on the right shows traces of blood from a bird on the right side window.

The two pictures below show traces of blood and feathers on the front of the right-hand side of the aircraft.



The right engine incurred extensive damage, as can be seen from the pictures below.



1.4 Aircraft information

General: Manufactured by Bombardier Aerospace Inc. - designed to carry 86 passengers and five crew members. Developed further from aircraft type CL-600-2C10.

Type: CL-600-2D24 (Regional Jet Series 900 (CRJ 900))

Year built: 2009

Serial No.: 15231

Engines: General Electric CF34-8C5 Turbofan Engines



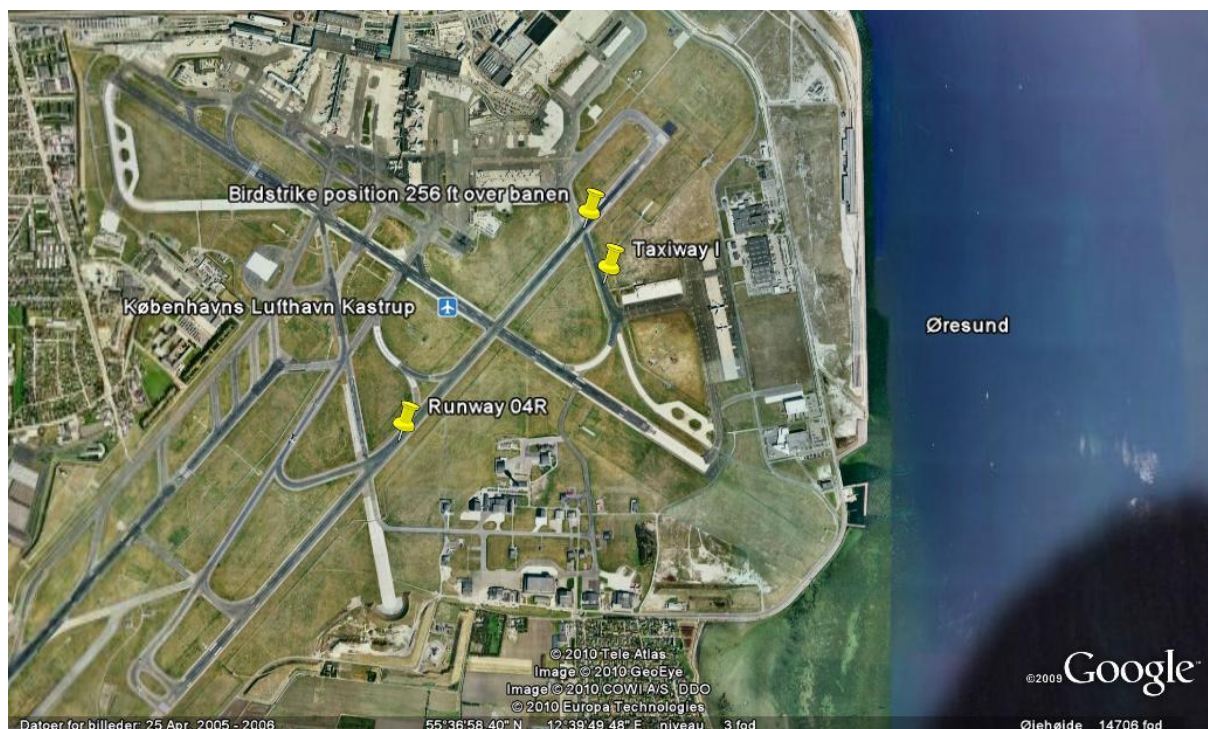
1.5 Meteorological information

METAR EKCH 20.20 UTC: Wind direction and strength 130°/13 knots, temperature and dew point 10°/5° C CAVOK QNH 1023.

1.6 Aerodrome information

The north-eastern part of Copenhagen Airport Kastrup stretches out toward the Sound.

The picture below shows Runway 04R, Taxiway I and the position of the aircraft when it was hit by the birds is marked.



1.7 Determination of bird species

The day after the incident, the grass area around Runaway 04R and Taxiway I was inspected. The remains of geese that had been in a collision were found. The airport biologist was able to identify with certainty that the geese were Barnacle geese.

Feathers from the aircraft were submitted to the biologist. The feathers were not analysed microscopically since their characteristics did not deviate macroscopically from those of Barnacle geese.

1.8 Information on the bird species

Bird species:	Barnacle goose (<i>Branta leucopsis</i>)
Weight:	1500 – 2000 grams
Length:	60 - 70 cm
Wing span:	132 - 145 cm



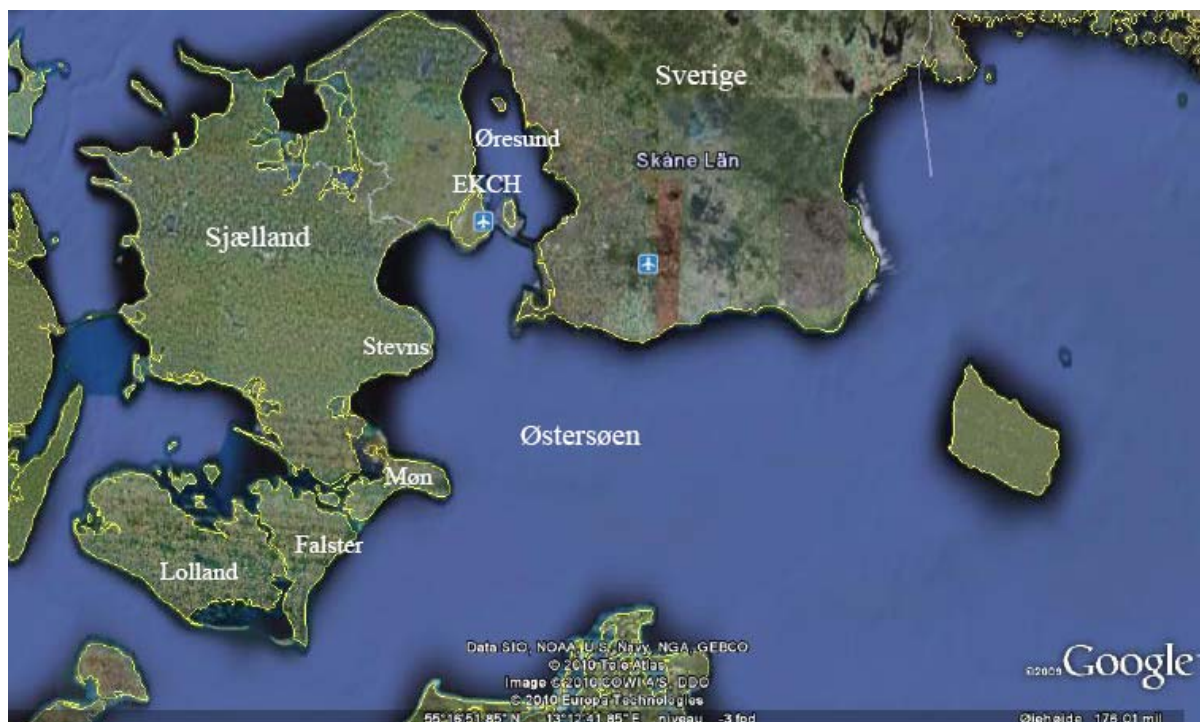
The Barnacle goose is recognisable from its white face, black neck and breast, grey back and light-coloured abdomen. From a distance, the species can be mistaken for the Brant goose, but that has a darker plumage and does not have the white facial 'mask'. The Canada goose (*Branta canadensis*) also has a highly-contrasting black and white plumage but is considerably larger, has less white on its face and has a light-coloured breast under its dark neck. Its voice is similar to a loud bark.

The Barnacle goose is extremely prevalent in the North Atlantic. It occurs mainly in three populations in Greenland (the east coast), on Svalbard and on islands in the White Sea. However, in recent decades, the species has spread to areas around the Baltic Sea and the North Sea where populations have grown significantly.

As a result of the growth in the Barnacle goose population in recent years, it has become commonplace to see large flocks of the North Russian Barnacle geese, especially in the south-westerly parts of Denmark. In particular, the flocks fly to the area around the Wadden Sea where the vast majority of the birds nest.

Consequently, more than 10,000 birds can be seen in Margrethe Kog alone. In the autumn, up to 6,000 birds can rest on Nyord at the northern end of Møn. At the turn of the month in April-May 2003, around 55,000 Barnacle geese were nesting to the south of the Rømø Dam. Most of the birds in the Wadden Sea area spend the winter there, but in harsh winters they migrate further south.

The Danish Ornithological Society (DOF) database of bird observations (www.dofbasen.dk) has registered observations of Barnacle geese as they migrate through Denmark in the period 9th and 10th October 2009. At the end of the day on 9th October 2009, large flocks of Barnacle geese were observed migrating over Stevns, Møn, South Zealand and Lolland-Falster (for example, 811 geese were observed at Højerup on Stevns, 1400 at Stevns lighthouse, and 6125 at Hyllekrog on Lolland).



According to EKCH's biologist, every year the population of breeding Barnacle geese migrate from the White Sea and the Polar Ocean to the overwintering areas of the Wadden Sea (the North Sea) during September, October and November. The population currently amounts to more than 600,000 birds. The migration extends over a broad front, down through the Baltic and across Sweden. A large proportion of the population migrates to the area south of EKCH. The geese migrate further down to South Jutland and North Germany.

The biologist has also informed us that birds can be seen over the EKCH area which would normally fly south of the airport towards South Jutland and Lolland-Falster. There has been talk of large birds which, due to the south-westerly wind, were drifting towards the north-west and thus over EKCH. Consequently, the day after the incident, Barnacle geese flew in a more northerly migratory path over the airport throughout the entire morning. As a result, the Bird and Wildlife Control Unit registered and tried to frighten off several thousand Barnacle geese. It was not until the afternoon that the migration of Barnacle geese over the airport ceased. Barnacle geese have not previously been seen migrating over the airport in such large numbers as was observed on 10th October 2009.

1.9 Measures for reducing the risk of collision between aircraft and birds/mammals.

The provisions for the above appeared in the Danish Civil Aviation Authority's (SLV) regulations for aviation BL 3-16, Version 4 of 31 January 2005.

EKCH has drawn up an "Instruction for bird and wildlife inspection" on the basis of BL 3-16. The applicable version was dated 1 February 2007.

The instruction states, for instance:

"In darkness and in reduced visibility the efforts of the Bird and Wildlife Control Unit are to be concentrated on runways in use. The runways are patrolled for the purposes of detecting birds upon request from TWR or on the warden's own initiative with permission from TWR. Similarly, TWR must be informed of other observations of significance to flight safety.

In so far as the resolution of bird and wildlife inspection tasks make it possible, the wardens will also perform other flight safety tasks at TWR's request.

"Observed birds or wildlife are frightened away from the airport area.

Immediately before the fall of darkness, all flocks of large and medium-sized birds are to be frightened away from the airport area.

In the event of birds entering the area in such large numbers that they cannot be driven away by the on-duty wardens, efforts should be made to involve all other available personnel in frightening the birds away at the request of the on-duty warden.

In the event of grass mowing and ground digging on adjoining areas of ground, monitoring and dispersal, if necessary, should be intensified.

The airport biologist has pointed out that migratory birds cannot be observed in the dark. On the other hand, the Bird and Wildlife Control Unit's wardens will continually inspect the runway and surrounding areas for birds that have settled there and scare them away. If the wardens think that birds are flying through the area their most important function is to warn TWR.

The list below, from EKCH, shows the number of actions carried out by the Bird and Wildlife Control Unit against geese in October 2009.

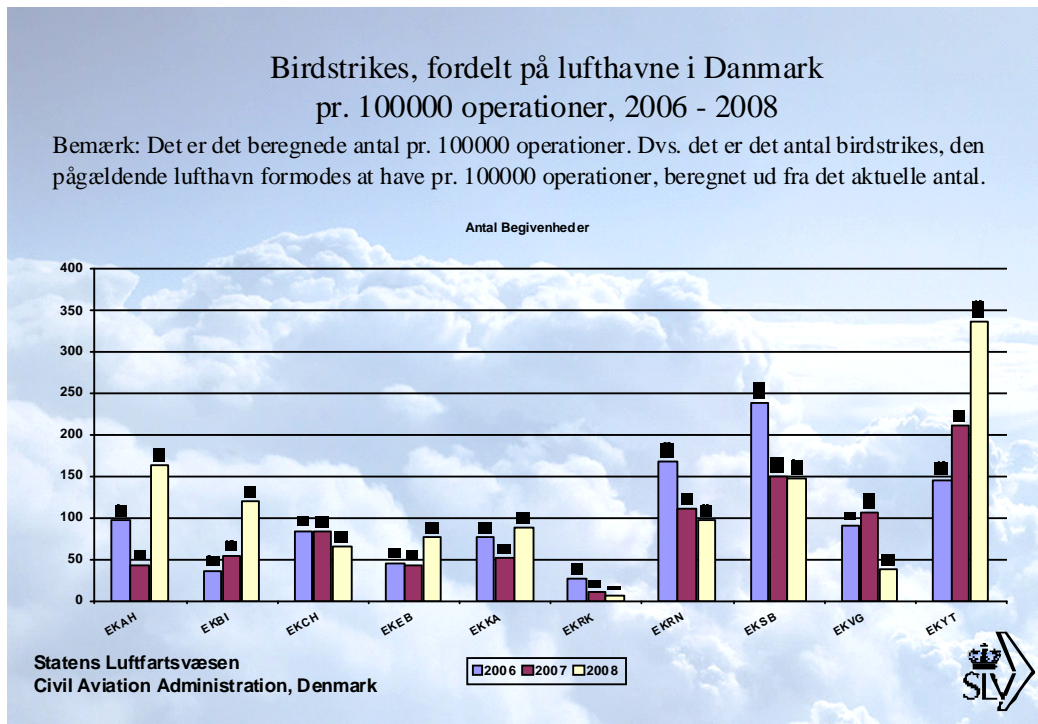
The list shows that 24 actions were taken in the form of firing of deterrent shots against 13,553 geese. The list shows that no actions were taken against geese on the day of the incident, 9 October 2009.

Time (local time)	Date	Number	Actions	Deterrent shots	Sharp shots
07:50	09 10 01	2	1	2	0
09:00	09 10 06	50	1	5	0
06:45	09 10 10	5000	1	80	0
07:10	09 10 10	3000	1	25	0
07:35	09 10 10	1000	1	40	0
07:40	09 10 10	500	1	21	0
07:50	09 10 10	5	1	9	0
07:50	09 10 10	30	1	4	0
07:55	09 10 10	300	1	10	0
07:58	09 10 10	100	1	6	0
08:00	09 10 10	200	1	12	0
08:20	09 10 10	400	1	24	0
08:20	09 10 10	500	1	10	0
08:25	09 10 10	100	1	6	0
08:30	09 10 10	200	1	8	0
08:40	09 10 10	400	1	8	0
08:45	09 10 10	250	1	5	0
09:35	09 10 10	30	1	6	0
10:00	09 10 10	100	1	12	0
10:30	09 10 10	8	1	6	0
12:00	09 10 10	30	1	3	0
12:30	09 10 10	300	1	12	0
12:40	09 10 10	200	1	12	0
12:55	09 10 10	200	1	15	0
13:20	09 10 10	400	1	6	0
13:30	09 10 10	300	1	10	0
15:20	09 10 11	300	1	12	0
15:50	09 10 11	10	1	4	0
06:50	09 10 14	10	1	4	0
07:10	09 10 23	150	1	3	0
07:30	09 10 23	20	1	4	0
11:10	09 10 23	75	1	5	0
13:05	09 10 23	50	1	7	0
14:15	09 10 23	200	1	12	0
08:40	09 10 27	50	1	8	0
10:20	09 10 27	100	1	5	0
07:29	09 10 29	6	1	8	0
06:25	09 10 31	25	1	3	0
07:25	09 10 31	30	1	6	0

1.10 Statistics for collisions between birds and aircraft

Below, you can see the number of “bird strikes” distributed between airports in Denmark in the years 2006, 2007 and 2008.

Note: The graph shows the estimated number of incidents per 100,000 operations, i.e. the number of bird strikes the airport in question is assumed to have had per 100,000 operations, calculated on the basis of the actual number.



More recently (1996 to 2010) EKCH has registered 4 collisions between aircraft and geese. The incidents are listed below with OY-KFF as the most recently registered.

Bird species	Date	Day/night	Aircraft	Runway	Runway	Flight phase
Greylag goose	27.03.1996	Day	Boeing 767	22R	200 ft	Take-off
Barnacle goose	03.10.2002	Day	Airbus 330	22L	200 ft	Landing
Greylag goose	07.03.2003	Day	Unknown	22R	Unknown	Unknown
Barnacle goose	09.10.2009	Night	CRJ 900	04R	250 ft	Take-off


1.11 Supplementary information

As appears in the interim report below from NTSB in the USA, on 15 January 2009, an Airbus A320 was struck by a flock of birds during take-off from La Guardia airport in New York, USA.

Both engines were struck by birds (Canada geese) and stopped. The aircraft was landed successfully on the Hudson River. NTSB Final Report: www.nts.gov/publicctn/2010/AAR1003.pdf

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 National Transportation Safety Board PRELIMINARY REPORT AVIATION		NTSB ID: DCA09MA026		Most Critical Injury: Serious	
		Occurrence Date: 01/15/2009		Investigated By: NTSB	
		Occurrence Type: Accident			
Location/Time					
Nearest City/Place	State	Zip Code	Local Time	Time Zone	
Weehawken	NJ	07086	1530	EST	
Aircraft Information					
Registration Number	Aircraft Manufacturer		Model/Series Number		
N106US	AIRBUS		A320/214		
Type of Aircraft: Airplane	Amateur Built Aircraft? No				
Injury Summary:	Fatal	Serious	5	Minor	None 150
Revenue Sightseeing Flight: No		Air Medical Transport Flight: No			
Narrative					
<p>Brief narrative statement of facts, conditions and circumstances pertinent to the accident/incident:</p> <p>On January 15, 2009, at approximately 1527 eastern standard time, USAirways flight 1549, an Airbus Industrie A320-214, N106US, equipped with CFM engines, incurred multiple bird strikes during initial climb. The airplane subsequently lost thrust to its engines and ditched in the Hudson River at approximately 1530 eastern standard time. The flight was a Title 14 CFR Part 121 scheduled domestic passenger flight from New York's La Guardia Airport (LGA) to Charlotte Douglas International Airport (CLT) in Charlotte, North Carolina. Visual meteorological conditions prevailed, and an instrument flight rules flight plan was filed. To date, of the 5 crewmembers and 150 passengers on board, five serious injuries have been reported. A total of twenty-six people were transported to hospitals, including two emergency response personnel. A final injury count is still to be determined.</p> <p>Updated on May 8 2009 4:04PM</p>					
PRELIMINARY INFORMATION - SUBJECT TO CHANGE					
					Page 1

2 Analysis

The aircraft was struck by birds at an altitude of 256 ft immediately after take-off from Runway 04R. The pilots saw birds in the cone of light in front of the cockpit immediately before they were struck. The incident was also observed by the Bird and Wildlife Control Unit wardens from the ground and by the air traffic controller in the control tower.

The aircraft's right engine was damaged significantly as a result of being struck by one or more birds. The damage to the engine's rotating parts resulted in powerful vibrations which concords with the vibration indications the pilots got on the vibration indicator in the cockpit.

The pilots decided to stop the right engine which the Danish Accident Investigation Board considers to be the right decision in the circumstances. A running damaged motor can fail to such an extent that it can cause further incident which can result in injury to persons and damage to the aircraft. The aircraft was landed without further incident.

The right engine showed clear damage to the foremost rotating parts whereas the left engine was undamaged.

On the basis of the material gathered by EKCH's biologist, it was established that the species of bird was the Barnacle goose (*Branta leucopsis*).

At the end of the day on 9 October and on 10 October 2009, members of the Danish Ornithological Society observed large flocks of migratory Barnacle geese to the south of EKCH.

Barnacle geese have not previously been seen migrating over the airport in such large numbers as was observed on 10th October 2009. The Danish Accident Investigation Board therefore regards the wind direction and strength as the main reasons for the geese flying into the airport area in the dark on 9th October 2009.

In the dark, it was not possible for the Bird and Wildlife Control Unit's wardens to see the migratory geese in the air over the airport.

In darkness the efforts of the Bird and Wildlife Control Unit are concentrated on runways in use. The airport has no means of observing birds in the air during the hours of darkness.

The aircraft was mainly struck by Barnacle geese on its right side which concords with the assertion that the migratory birds were driven towards the northwest in correlation with runway direction 40° northeast. As can be seen in the picture in Chapter 1.3 Information on the aircraft, aircraft type CRJ 900 has engines located on the side of the rearmost part of the fuselage. The Danish Accident Investigation Board cannot exclude the possibility that the left engine's location "in the lee of the fuselage" was the reason that it was not struck by the geese.

The Danish Accident Investigation Board is of the opinion that both engines located under the wings are most vulnerable to being struck in the presence of large flocks of birds. Initial investigations carried out on the wreckage on the Hudson River in the USA established that both engines stopped as a result of being struck by geese.

The Danish Accident Investigation Board analysed the "bird strike" statistics and found that EKCH was not particularly vulnerable to "bird strikes" compared to the other airports in Denmark.

With regard to "bird strikes" caused by geese, this incident was only the fourth since March 1996.

However, the Danish Accident Investigation Board is of the opinion that, in future, EKCH may have problems with geese since the population is growing significantly and, at the same time, is spreading to the Baltic and North Seas.

In darkness or in reduced visibility, the Bird and Wildlife Control Unit has no other option but to inspect the runways and surrounding grass areas for birds that have settled there.

In light of the Airbus accident in the Hudson River, USA, the Danish Accident Investigation Board has assessed that, in the dark or in reduced visibility, migratory geese pose a risk to flights at the airport since it is not possible to observe the birds from the ground.

3 Conclusion

As a result of the darkness, it was not possible for EKCH's Bird and Wildlife Control Unit to see the flock of migratory Barnacle geese that flew into the airspace over the north-western part of the airport.

The aircraft that took off on Runway 04R struck the flock of Barnacle geese at an altitude of 265 ft and as a result, the right engine was struck by one or more geese. The right engine incurred significant damage with the result that powerful vibrations followed.

Since the left engine was not struck by the geese, the pilots were able to stop the right engines, return to Runway 04R and land on one engine without further incident.

4 Recommendations

As a result of the investigation, the Danish Accident Investigation Board put forward the following recommendation to the European Aviation Safety Agency (EASA):

The rapidly increasing population of geese is spreading to the Baltic Sea and the North Sea which may be a problem for flights taking off from and landing at EKCH, which lies close the birds' migratory paths. Given the fact that migratory birds cannot be observed from the ground in darkness or in reduced visibility, the Danish Accident Investigation Board generally regards this as a risk to flight safety.

It is recommended that the authorities evaluate possible technical solutions for the observation of and warning against migratory birds in darkness and in reduced visibility. This includes the option of installing and using radar equipment for this purpose.

DENM-2010-003