

**FATALITIES AND DESTROYED CIVIL AIRCRAFT DUE TO
BIRD STRIKES, 2002 to 2004**

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Abstract

At the 1996 Meeting in London of the International Bird Strike Committee, an illustrated Working Paper was presented that provided brief details of **all** fatalities and destroyed aircraft due to bird strikes during the period 1912 to 1995. The paper was felt to be useful in drawing attention to the scale of the problem, especially when dealing with those who know little about the subject or who are newly appointed to decision-making positions. Since that paper was published, information has come to light on a number of previously unknown accidents, as well as information on subsequent accidents. Thus, a revised paper, published in the Proceedings as WP-SA1, 'Fatalities and Destroyed Civil Aircraft due to Bird Strikes, 1912 to 2002' was presented at IBSC 26, May 2003 in Warsaw, Poland.

This Paper for the Athens Meeting provides an up-date to WP-SA1 covering the years 2002 to 2004.

It is now believed that the number of fatal bird strike accidents has risen to 47 killing 242 people. In addition the total of aircraft destroyed is now 90. These additional accidents are briefly detailed in the Paper so that the totals are now:

- Airliners and Executive Jets – 12 fatal accidents killing 174 and destroying 37 aircraft.
- Aeroplanes 5,700 kg and below – 29 fatal accidents killing 58 and destroying 45 aircraft.
- Helicopters – 6 fatal accidents killing 10 people and destroying 8 helicopters.

The results are broadly unchanged in that the major threat (nearly 80% of accidents) to Airliners and Executive jets is engine ingestion, often due to flocks of gulls (*Larus sp.*). Aircraft of 5,700 kg and below as well as helicopters are most at risk from windshield penetration, mainly the result of collision with birds of prey (*Accipitriformes*). These groups of aircraft mainly fly at heights where birds are most likely to be encountered. Some accidents are the result of pilots attempting to avoid birds.

The new or revised material included since the Athens Meeting is shown with a marginal line. The Appendix on Animal Strikes, which was in the original version of the Athens Paper, has been removed as better information is available in WP Paper VI -3.

Keywords: civil aviation, general aviation, mishap investigation, statistics

1. Introduction

The paper contains brief details of each case of loss of life or destruction of the aircraft divided into three Appendices:

- Appendix 1 - Aeroplanes over 5,700 kg (12,500 lb) and all business jets
- Appendix 2 - Aeroplanes of 5,700 kg and below
- Appendix 3 – Aircraft losses due to Collision with Animals

2. Scale of the Problem

Birds are known to have caused at least:

- 47 fatal accidents
- 242 deaths
- the destruction of 90 civil aircraft

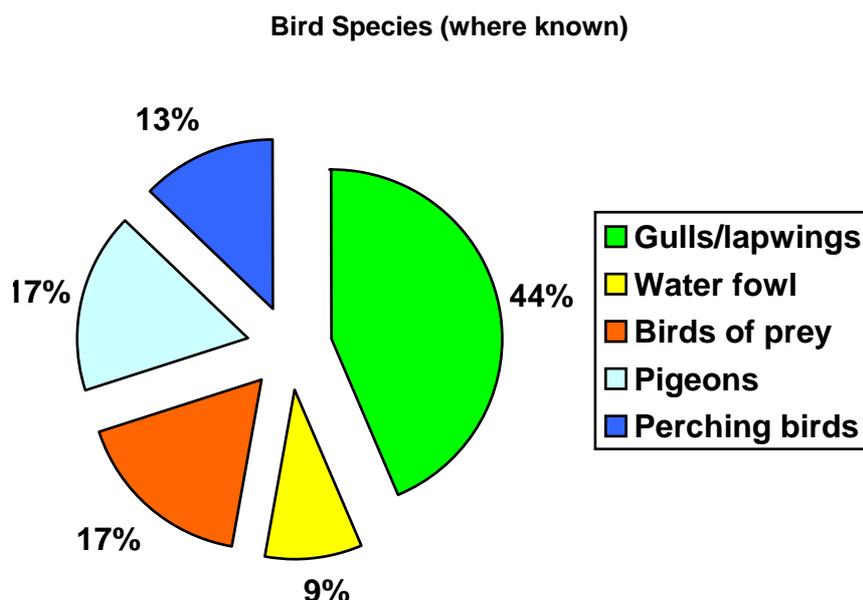
It is very likely there are more, as information is only accurate for the last 25 to 30 years. **The Author would welcome any new or additional information.**

3. Analysis and Discussion

In general sample sizes are too small for in-depth analysis, however a number of points are noteworthy:

3.1 Transport Aircraft & Executive Jets – 12 fatal accidents, 174 deaths and 37 write-offs.

- The 12 fatal accidents to the aircraft above is quite modest however 37 have been destroyed and 174 people killed. Surprisingly, there has only been **one** fatal accident to a jet powered airliner in over 1,000 million flying hours. This may, in part, be due to an improved awareness of the problem, implementation of better airport measures around the world and tougher airworthiness criteria for all but the oldest aircraft and engines. Engine damage was the cause of 76% of the accidents in this group, followed by windshields with 8%. The identified birds were:

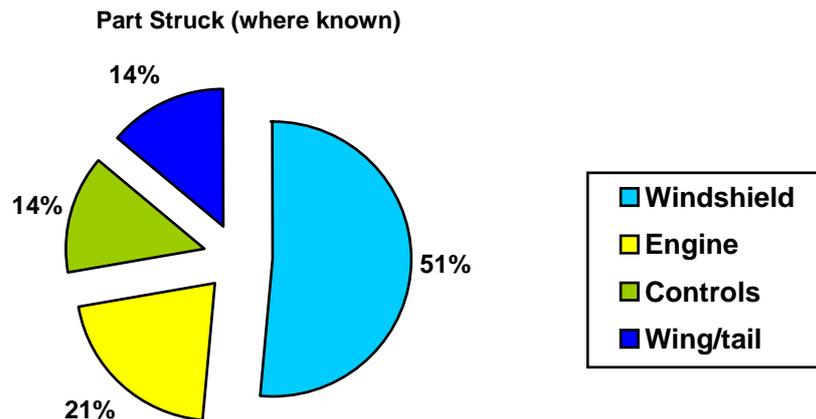


- Although not included in this Paper, there have been many cases of multiple engine damage, fortunately with either enough runway length to abandon take-off, or sufficient power to return. European airlines continue to experience about 20 cases per year where **more** than one engine ingests birds.

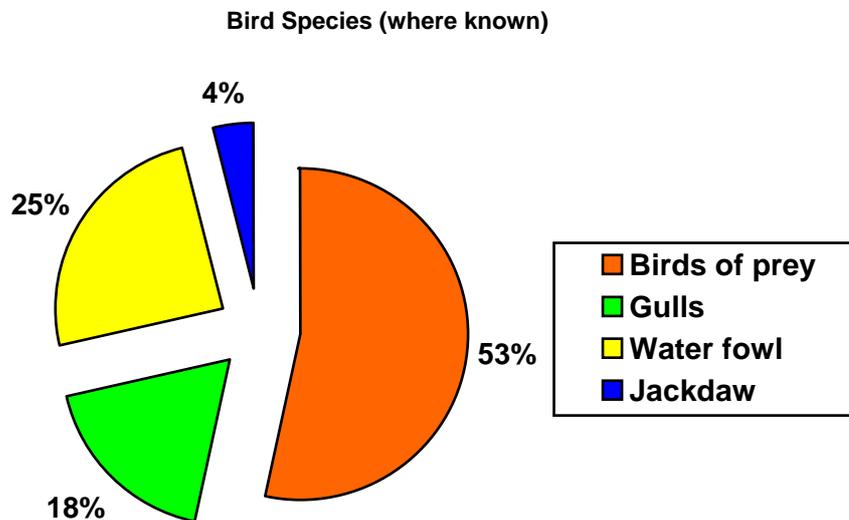
- Business jets comprising 37% of the accidents in this section, often operating from aerodromes with little or nothing in the way of bird control measures, and appear to be vulnerable as in many cases their engines are of an age which pre-dates bird ingestion testing.

3.2 Aeroplanes of 5,700 kg & Less – 29 fatal accidents, 58 deaths, and 45 write-offs.

- General aviation aeroplanes are **not** required to be designed to withstand bird strikes and are therefore more vulnerable, particularly the windshield, holed in 52% of accidents. These can be holed by a bird as small as a Swift (*Apus apus*, 40 gm).



- The birds struck are markedly different from those of transport sized aeroplanes, the major threat is clearly birds of prey (*Accipitriformes*) which have little or no fear of other airspace users.



- Six of the general aviation accidents were the result of pilots attempting to avoid birds by taking evasive action and either losing control or colliding with ground objects.

3.3 Helicopters – 6 fatal accidents, 10 deaths and 8 helicopters destroyed

The accident total is very low considering most helicopters operate low-down where birds fly most frequently. The high proportion in the USA is probably a reflection of the number of helicopters operating in that country. It may be that the relatively slow cruising speed, coupled with rotor noise, acts as sufficient warning for birds to get out of the way. The trend towards faster and quieter

helicopters might result in future problems especially as windshields appear to be vulnerable, having probably been holed in 60% of the fatal helicopter accidents, generally after colliding with heavy birds.

4 Conclusions

- 4.1 Aircraft continue to be destroyed and occupants killed or injured in accidents due to:
 - Striking birds
 - Attempting to avoid birds
 - Birds being the start of a chain of events
- 4.2 Although **not** a major cause of accidents, bird strikes are nevertheless a serious safety and economic hazard. Remedial measures and tougher aircraft/engines appear to have improved airliner safety but twin-engined aircraft have in many cases replaced four-engined aircraft so there is a greater risk of ingestion in all engines. Engine damage is the major risk for this group of aircraft, with flocking gulls (*Larus sp*) the major threat causing 44% of the accidents. This underlines the importance of thorough aerodrome bird control measures.
- 4.3 Business jets appear to be particularly vulnerable especially when operated from aerodromes with little or no bird control measures.
- 4.4 'General aviation' aeroplanes are most vulnerable to the windshield being holed, the cause of 52% of the accidents. Birds of prey (*Accipitriformes*) were responsible for over half of the accidents. This group of aircraft mostly fly at heights where birds are most prevalent.
- 4.5 A high proportion of helicopter accidents were due to the windshield being holed, sometimes by heavy birds. Again, helicopters mainly operate low down where most birds fly and the trend towards faster, quieter helicopters, will provide less time for birds to take avoiding action.
- 4.6 Although animal collisions are not known to have caused any fatalities, significant damage is caused every year as a result of collisions with both domestic and wild animals.
- 4.7 Bird and animal strike accidents are a rare event that can occur out-of-the-blue even at airports which may consider that adequate measures are in place to minimise the risk. It should be borne in mind that **complacency is the enemy of safety**.

Acknowledgements

- Bird weights from 'Average Weight of Birds' - Trevor Brough, UK
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Appendix 1

AMENDMENTS AND ADDITIONS TO FATALITIES & DESTROYED CIVIL AIRCRAFT DUE TO BIRD STRIKES, 1912 – 2002, WP SA-1 from IBSC 26, WARSAW

Text Para 1.1 line 1 – Amend date of first bird strike to **1905**, not 1908. According to US experts, birds were almost certainly Red-winged blackbirds (*Agelaius phoeniceus*, 50 gm)

Section 1 – Airliners & Executive Jets

13.10.92	Antonov 124	Nr Ulyanovsk, Nr. Kiev	Fuselage	9
CCCP-82002	4 Lotarev D18T	Russia	N/K	8 fatal

The second prototype was on a test flight when at about 19,700 ft, during a high speed descent, a bird, believed to be about 1.8 kg, was struck holing the nose. This allowed the area between the nose and the front bulkhead to become pressurised by the ram-air causing failure of the upward opening freight door. Control was lost and the aircraft crashed, one of the crew managed to eject but the others were killed when it crashed in a forest. The aircraft had been flying at a speed of 330 kts and was outside the normal flight envelope.

20.03.99	Yakovlev 40	Bata, Equatorial	Engine	33
RA-87587	3 Ivchenko AI-25 turbine	Guinea	N/K	Nil

At a reportedly late stage in the take off run No 2 engine suffered bird ingestion. Take off was abandoned but the aircraft over-ran into trees and was sufficiently damaged that it was written off.

24.12.02	Swearingen SA227 Metroliner	Aberdeen Airport		2
OY-BPH	2 Garrett TPE331 turboprops	Scotland		Nil

At 07.45 while taking off on a positioning flight to Aalborg, Denmark, handled by the co-pilot, just after lift-off the aircraft yawed to the right and there was smell of smoke. The Commander felt the aircraft roll about 15° to the right and realised there was a problem with the right engine and looking at the EGT gauges he noted that the left indicated about 650°C, the normal maximum, whilst the right indicated about 600. The Commander feathered the right engine but did not raise the landing gear. The aircraft descended and impacted with the ground some 500 metres to the right of the runway slid along a field and onto a public road and collided with a moving car.



The foam covered wreckage of the Metro on the road

The right wing was on fire and the crew left the aircraft via the left door and co-pilot checked that no one was trapped in the car, they then moved well away from the intense fire along with the car driver. Bird remains were found where the aircraft had rotated and were identified as two Herring gulls (*Larus argentatus*, 1.1 kg), one Common gull (*Larus canus*, 420 gm) and one Black-headed gull (*Larus*

ridibundus, 275 gm). Large portions of the Herring gulls were missing. The left engine was found to have ingested at least part of a bird and a first stage impellor blade had been distorted with feather residue in the combustion chamber. There was no ingestion in the right engine. An Operations Officer had inspected the runway at 05.55 and had dispersed some birds which had not returned at the time he completed his next inspection at 07.05. Between then and the departure of OY-BPH there had been four movements. (19 page report in AAIB Bulletin 6/2004, available on www.aaib.gov.uk)

Section 2 – General Aviation Aeroplanes

18.07.96 F-BRVF	Robin DR380 1 piston	Nr Ciriza, Navarre Spain	Wing Griffon vulture	3 3 fatal
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Updated Information since Warsaw Paper:

About 10 minutes after taking off from Pamplona, Spain for the 30 minute flight to Vitoria, the pilot made an emergency call on 121.5. The aircraft had been flying at about 2,300 to 3,300 ft agl when it collided with a Griffon vulture (*Gyps fulvus*, 8kg). Although pilot incapacitation after windshield penetration had been suspected, it was believed the propeller had struck the bird slicing a wing off the bird causing the heavy body to strike the aircraft at the wing root. It is most likely that impact damage caused the wing to come off the wooden structured aircraft rather than the pilot being incapacitated. The aircraft crashed almost vertically into the ground. In 1997 the Spanish AIP was amended to warn pilots of the large colony of Griffon vultures that live in the area.

04.09.97 ZS-MOT	Beech B95 Travel Air 2 piston	Nr Hectorspruit S Africa	Windshield White-backed vulture	2 2 fatal
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While flying from Komatipoort to Nelspruit at low level beneath cloud at about 1,000 to 1,500 ft agl and 170 kts, the aircraft collided with a vulture, believed to be a white-backed (*Gyps africanus*, wt 5.8kg). It penetrated the windshield, the aircraft crashed killing both occupants. First at the scene was a local pilot who reported there were many vultures in the vicinity.

15.11.97	N/K	Nr Pic du Midi, France		4 fatal
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*Enquiries via French and Spanish accident investigators show that this was not a bird strike but a collision with wires. It should be **deleted** from the list.*

25.05.00 N30RA	Cessna 310R 2 Piston	Wolf Point, Montana USA	Windshield Geese	N/K 1 serious
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At about 600 ft agl shortly after taking off the aircraft collided with a number of geese. The pilot heard 3 or 4 loud bangs just before the windshield shattered. The aircraft subsequently collided with the ground and was destroyed by fire. The pilot was unable to recall any other details.

Appendix 2

Fatalities & Destroyed Civil Aircraft due to Birds 2003 & 2004

Section 1 – Airliners and Executive Jets

01.06.03 I-ERJC	Lear 45 2 TFE 731 turbofan	Milan Linate, Italy	Engine(s) Possibly pigeons	2 on board 2 killed
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The aircraft owned by Eurojet Italia, was taking off for Genoa, Italy with two crew on board to collect the famous Italian architect Renzo Piano and take him to Paris. The crew reported a birdstrike stating they were returning. The pilot's voice was reported to be calm and everything seemed under control. A policeman near the accident site reported that the engine was making a strange noise right from take-off. At the end of the downwind leg, approximately 1,000 ft from the threshold it crashed into a warehouse, fortunately unoccupied on a Sunday, and was destroyed by fire. At least six bird fragments were found on the runway. An unconfirmed report suggests that a flock of pigeons (*Columba sp.*) from outside the airport, suddenly crossed the runway during the take-off heading for other off-airport buildings. At least one engine ingested birds and failed, it is not yet known if the remaining engine also failed or if control of the aircraft was lost. The accident was close to the most important cycle race in Italy with thousands of spectators lining the race route through the suburbs, it resulted in extensive TV and press coverage. The State Prosecutor has started a criminal investigation that could lead to charges.



12.11.03 N-	Lear 24 2 GE CL610 turbine	Cahokia, St Louis Downtown, USA	Engine(s) Blackbirds?	4 on board 2 minor
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The charter company aircraft was taking off on a flight to North Platte, Nebraska, with two crew and two passengers. At about 500 ft agl the pilot heard a thump as he flew through a flock of small blackbirds. Both engines lost power, during the forced landing the aircraft skidded across a field and caught fire about four miles from the airport. The pilot was taken to hospital with facial cuts, the others for observation. No bird remains were found on the runway or in adjacent fields. The aircraft was destroyed.

10.09.04 ZS-OLS	SA227 AC Metro 3 2 Garrett TPE331	George Airport South Africa	Engine Spotted thick-knee	2 on board Minor
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The aircraft operated by Skyhaul (converted to cargo), was carrying freight from Bloemfontein Airport and was on final approach at a time when the airport was not yet open, 05.40 hrs. While over-flying at 200ft a Spotted thick-knee (*Burhinus capensis* 425gm) was ingested in engine 2 resulting in the aircraft failing to gain height during the attempted go-around. The aircraft came down in open countryside and was sufficiently damaged that it has been written off. The two crew suffered minor injuries. There was clear evidence of engine fan damage. The aircraft weight at the time of the accident is under scrutiny.



29.11.04	Boeing 737-406	(Barcelona, Spain)	Landing gear	146 on board
PH-BTC	2 CFM56	strike - Amsterdam	Buzzard	10 minor

Shortly after take off from Amsterdam Schipol, the crew of the KLM aircraft experienced a bird strike. They re-cycled the landing gear resulting in normal indications. After consultation with KLM Engineering it was decided that as there were no indications of anything abnormal, the flight continued to its planned destination of Barcelona where an inspection would be made. On landing the pilots were unable to keep the aircraft on the runway by use of rudder, differential reverse or nose wheel steering. The aircraft left the runway at about 100 kts into an area of work-in-progress next to the runway. During the emergency evacuation at about 18.50 hrs local of the 140 passengers and 6 crew, 10 people were treated on the spot for minor injuries with two needing hospital treatment. The bird remains were identified as a buzzard (*Buteo buteo* wt. 800gm) and were found in the nose gear jamming the steering cables to one side. Due to the landing gear damage and engine ingestion of debris from the runway work, the aircraft is likely to be deemed a constructive write off. The accident is under investigation.



Photo of Buzzard in nose gear bay courtesy of Dani Burgas (Minuartia, Estudios Ambientals), with the permission of AENA (Barcelona Airport) and KLM Station Manager Barcelona.

Section 2 – General Aviation Aeroplanes

23.06.03	PZL Wilga 35	N/K	N/K	1 on board
N/K	1 piston	Ukraine	N/K	1 killed

The aircraft was engaged in glider towing during the 51st Open Gliding Championships of Ukraine. A bird collided with the tug aircraft; the pilot was killed. (Further information awaited).

08.07.03	Cessna 172 Skyhawk	McKinney, Frisco	Wing	2 on board
N166ME	1 piston	Texas, USA	Vulture?	2 killed



The aircraft was at about 800 ft on it's way to the training company designated practice area when the 1,100 hour flight instructor made a Mayday call that a bird (most likely a vulture) had impacted with the left wing, could not keep the aircraft straight with power on and they were going down. A witness saw the aircraft flying over at 500 to 1,000 ft and said the wings were pitching up and down and looking uncontrollable with the tail swinging from side to side. Marks at the accident site, about 2 nm from the airport and crush angles were consistent with it stalling prior to impact killing both occupants.

25.02.04	Cessna 182 Skylane	Evansville, Indiana	N/K	1 on board
N5450T1	piston	USA	None	Nil

*The aircraft called when at about 7 nm NE of the airport for a VFR pick-up for low-level pipeline patrol. When at 500 ft and 130 kts the pilot reported that during an emergency landing he had manoeuvred violently to successfully avoid a Red-tailed hawk (*Buteo jamaicensis*, wt 1.1 kg). There was no strike but the aircraft was destroyed due to a mechanical malfunction not related to the bird avoidance. The pilot was uninjured.*

*THIS IS THEREFORE **NOT** A BIRD STRIKE ACCIDENT.*

Section 3 - Helicopters

28.10.03	AS 350 Ecuriel	French Guayana	Windshield	N/K
F-OGUZ	1 turbine	-	N/K	1 killed

The Heli Inter Guayana helicopter was flying low over the jungle when it suffered a bird strike. The bird entered the cabin through the left hand windscreen resulting in the left rear door opening. A passenger fell from the helicopter and was killed.