



European Aviation Safety Agency

Safety Analysis and Research Department
Executive Directorate

Bird population trends and their impact on Aviation safety 1999-2008

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easa

safety report



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Publication Date: 09 January 2009

Publication Status: Active

Classification: Unclassified

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Executive summary

Although bird strikes are an issue as old as aviation, its significance as a hazard has not been diminished. In recent years very few fatal accidents have been caused by this hazard and most of these appear to involve a particular aircraft type. However, the cost of bird strikes to the civil aviation industry is estimated to be more than one billion euros annually.

It appears that the decreasing size of the general bird population is not necessarily a good guide to assess the bird strike hazard. Some bird species constitute a greater hazard to aviation than others. Climatological and other environmental changes affect bird populations and their biological behaviour. This change is not reflected throughout aircraft certification requirements.

So far bird strike certification requirements appear to have been reactive to past occurrences, however new occurrences have shown that there are particular areas of concern. For example in several occurrences aircraft fuel tanks have been penetrated resulting in fuel leakage. There are no particular certification requirements for fuel tanks and this needs to be assessed.

Furthermore, there are no bird strike related certification requirements for light non-commuter aeroplanes and light helicopters although this category of aircraft is most likely to operate continuously under 8,000ft amsl where almost all bird strikes occur. The high proportion of accidents involving slow moving aircraft (turboprop aeroplanes and helicopters) resulting in damage to the windshield may also justify a review of the bird strike requirements for light aircraft.

If any improvement is to be realised in better assessing, mitigating or controlling bird strike effects on aviation safety, then it is of outmost importance that reporting of such occurrences improves significantly. Some EASA MS, most notably the UK CAA, have undertaken several steps to this direction. However there appears to be no combined effort in Europe to collect all relevant occurrences, even those that did not lead to a bird strike.

The next release of ECCAIRS (due in 2009) will be able to capture data based on the IBIS framework. It is expected that this will significantly improve the capture and dissemination of bird strike related reports among the system users.



Introduction

Bird strikes have been a concern to aviation safety from the early days of powered flight. The first fatality due to a bird strike was caused in 1912 when a Wright Flyer encountered a flock of gulls whilst conducting a demonstration flight along a beach. The investigation found that one of the gulls had jammed the rudder control causing the aeroplane to dive into the surf, breaking the pilot's neck.

Since 1912 it is estimated that 47 fatal accidents have occurred due to a bird strike involving commercial air transport. The total number of fatalities is 242 people and 90 hull losses. The total number of fatal accidents in military aviation is believed to be much higher.

This report does not aim to be an exhaustive review of the subject of bird strikes in aviation. There is a rich literature available in the public domain and this is highlighted by the fact that internet search engines will return more than 143,000 web pages on this subject. For this reason, this report aims to provide an overview of the problem, some estimates on the factors affecting future trends and also highlight particular issues related to accidents in aviation and bird strikes.

As aircraft and birds share the same airspace the hazard of a bird strike will always exist. In Section 1 background information is provided on the characteristics of birds related to aviation safety.

1 Background

Although in recent years the overall bird population has declined in Europe by over 10% (as shown in Figure 1), the bird strike hazard for aviation has not reduced proportionally.

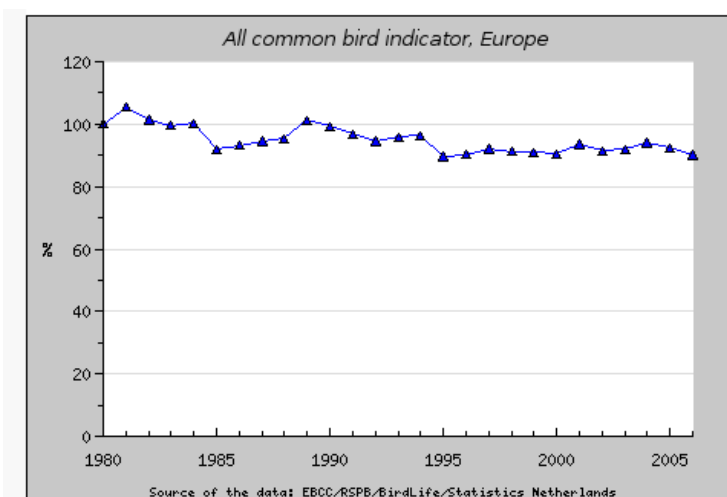


Figure 1: Common bird population in Europe (Base 1980). Source: EBCC



The reason is that not all birds pose the same hazard to aviation safety, as this depends on the size of the birds and their foraging or migratory patterns. Birds may pose a threat to aviation due to their individual size or due to their tendency to fly in large flocks. It is likely that the smaller the birds are, the greater their need to travel in flocks in order to avoid predators. For this reason birds are mainly divided into small/medium flocking birds, large birds and large flocking birds.

1.1 Bird population trends and patterns

In the category of flocking birds, some of the most hazardous are considered to be the gulls and the starlings. The gulls are considered of high risk because of their tendency to feed on soil invertebrates on aerodromes, farmland etc; and on landfill sites. It has been observed that flightlines of gulls are most likely to occur between landfill sites and roost sites and it is these movements that frequently cause great concern. The starlings (*Sturnus vulgaris*) are another bird species considered a hazard to aviation activities as they usually fly in dense flocks of up to 100,000 individuals¹. With a mass density 27% greater than that of gulls, they are considered a great bird strike risk, albeit they are involved in a small percentage of bird strikes². In the past 35 years the general population of European starling birds is believed to have decreased by almost 50%. Changes in their population might not reflect a proportional decrease of the risk to aviation.

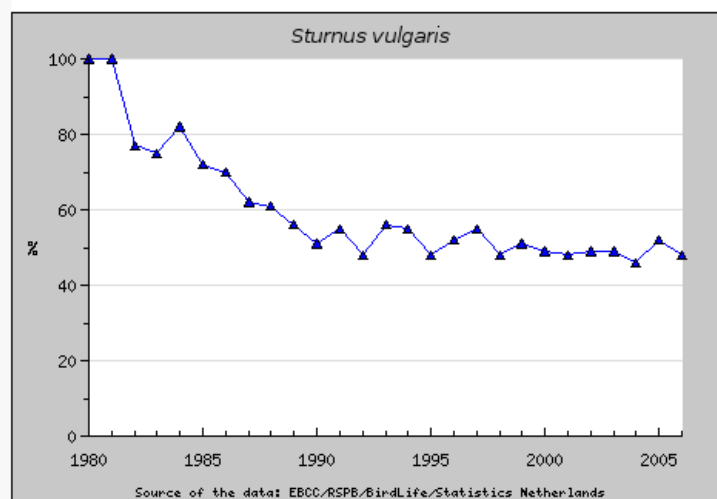


Figure 2: The population of starling birds in Europe has declined by almost 50% in the past 35 years (Base 1980). Source: EBCC.

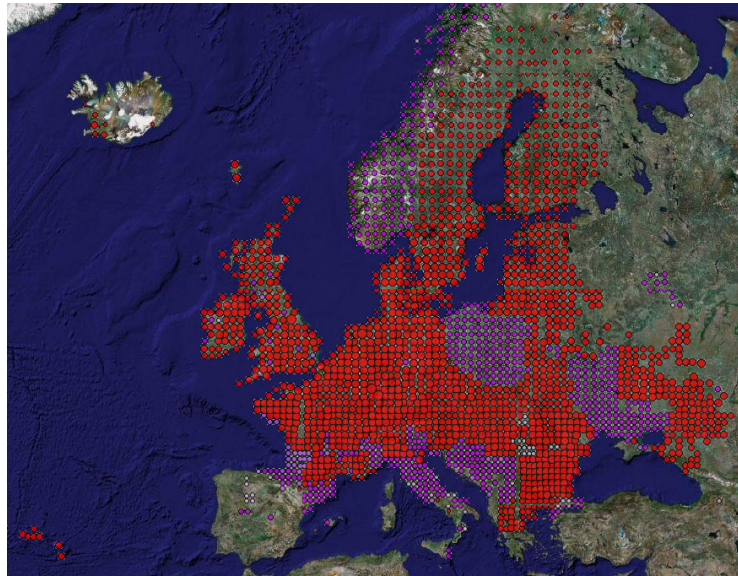


Figure 3: Geographic dispersal of starling bird population in Europe. A significant part of the population is located in Central and Western Europe, while most of the breeding grounds are located in South Europe (Source: European Bird Atlas).

Large birds pose a risk primarily due to their individual size. In this category belong birds such as waterfowl (loons, ducks, geese and swans), or wild predatory birds such as raptors or eagles. One particular case for Europe is the Canadian Goose (*Branta Canadensis*), the population of which, in recent years, has increased by more than 100% in northwest Europe³ (see Figure 4). The interest of aviation organisations⁴ has been attracted to this particular species because of their large size (2.3kgs – 7.3kgs) and tendency to fly in flocks. It is feared that in case of a bird strike their in-flight separation of 3 to 4 meters may potentially lead to strikes on multiple engines.

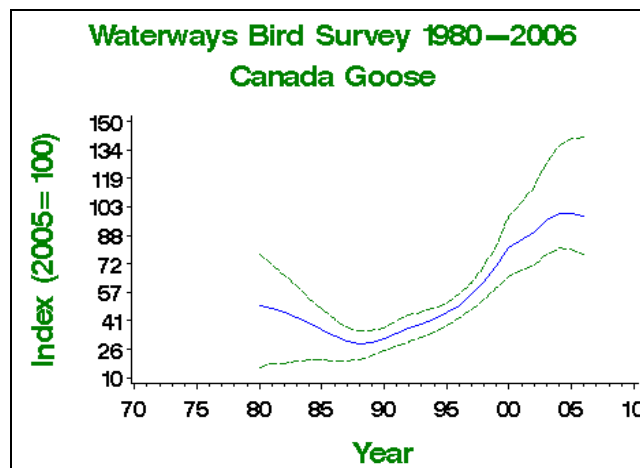


Figure 4: Estimated growth of Canada Goose population in the UK (Source: The Breeding Bird Survey- UK)

Although the Canada Goose is a migratory species, in recent years a non-migratory trend has been observed, as the species has adapted to urban environments⁵. Because of the species habitat preference, near standing water and/or conurbation areas, it has become of primary concern for airport avifauna management in north-western Europe.

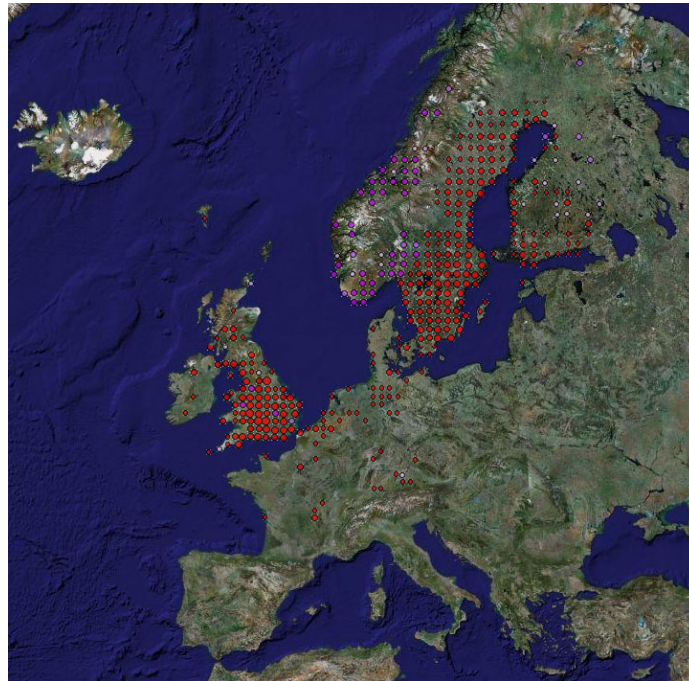


Figure 5: Location of Canadian Goose population in Europe. Population pockets of this species are mainly located in the southern part of the UK and southern part of Sweden (Source: European Bird Atlas).

In conclusion, in recent decades there has been a change in the number and the composition of the bird population as well as in the habitat of some of the species. Some bird species have adjusted to the urban environment while others have experienced a significant increase in their population. Furthermore, climatological changes have allowed new species to forage and breed in geographic areas which were not particularly suitable to them several decades ago. The ban of organochloride pesticides has also enabled some bird species population to increase from their low levels in the 1970's. Finally it is also interesting to note that some of the wildlife protection programs have introduced a population increase of some large bird species which were almost extinct a few decades ago. For example, 24 of the 36 largest bird species (weight greater than 2 kg) in North America have shown significant population increases in the past 30 years and only 3 species have shown declines⁶. One such example is the golden eagle in the US, the population of which has increased from a few tens of pairs to several hundreds in 2007.

1.2 Birds from a Regulatory Perspective

From an aviation regulatory perspective, birds are divided into three categories; classified as large, medium and small birds. These bird categories are used to describe the various certification criteria for airframe and engines. Recently many researchers have raised their concern that past airworthiness standards have been outpaced by changes in bird population and species (avifauna). Evidence of this has been found at least in North America, where the population of large birds has significantly increased in the past 20 years⁷.

To this end, large bird certification requirements have recently been extended to include provision for large flocking bird tests, in order to take into account recent concerns about changes in the European avifauna, as it has also been highlighted by the UK CAA⁸.



In more detail according to the CS-E certification requirements (CS-E 800) it must be proven that the ingestion of a single large bird (1.85 kg-3.65 kg depending on engine inlet throat diameter) will not lead to a "hazardous engine effect"⁽ⁱ⁾.



Picture 1: Engine damage from bird ingestion (Source ATSB)

To prove capability of engine ingestion of a large flocking bird, it is required that a single such bird (mass between 1.85 kg and 2.50 kg depending on engine inlet throat area) is ingested without the thrust reducing below 50% of take-off rated thrust. It should be noted that this particular requirement also demands the capability of specific thrust adjustments for a period greater than 20 minutes (i.e. test schedule).

For medium flocking birds it must be proven that a multiple number of birds of various mass can be ingested without a reduction of less than 75% of take-off rated thrust. The number of birds and mass varies according to the engine inlet throat diameter. Finally for small birds it must be proven that the ingestion of a number of birds with mass of 0.85 kg each does not cause a power reduction of less than 25%. The number of birds ingested is proportional to the engine inlet throat area. It should be noted that the mass requirement of 0.85 kg covers that of most small birds deemed a hazard to aviation such as the starlings (mean weight 0.72-0.83 kg)⁹. All the certification requirements mentioned above have been progressively updated after a number of bird strike accidents changed the perception of the hazard. The requirements briefly described above are also illustrated in the diagrams below:

ⁱ According to CS-E 510 a Hazardous Engine Effect is any of the following:

- (i) Non-containment of high-energy debris,
- (ii) Concentration of toxic products in the Engine bleed air for the cabin sufficient to incapacitate crew or passengers,
- (iii) Significant thrust in the opposite direction to that commanded by the pilot,
- (iv) Uncontrolled fire,
- (v) Failure of the Engine mount system leading to inadvertent Engine separation,
- (vi) Release of the propeller by the Engine, if applicable,
- (vii) Complete inability to shut the Engine down.

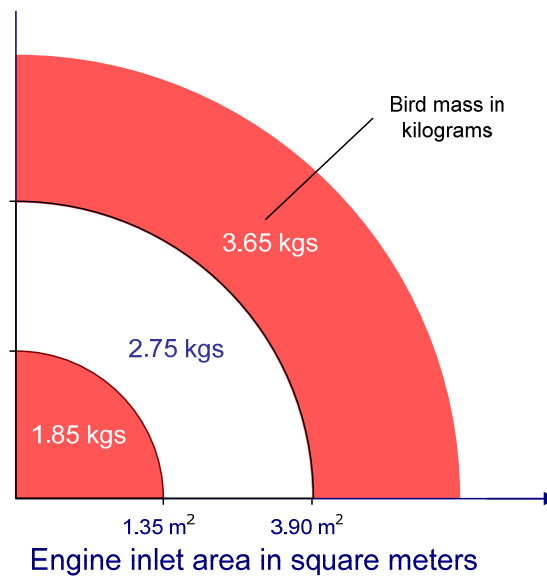


Figure 6: Certification requirements for single large bird ingestion. (Not in scale; illustrative purposes only)

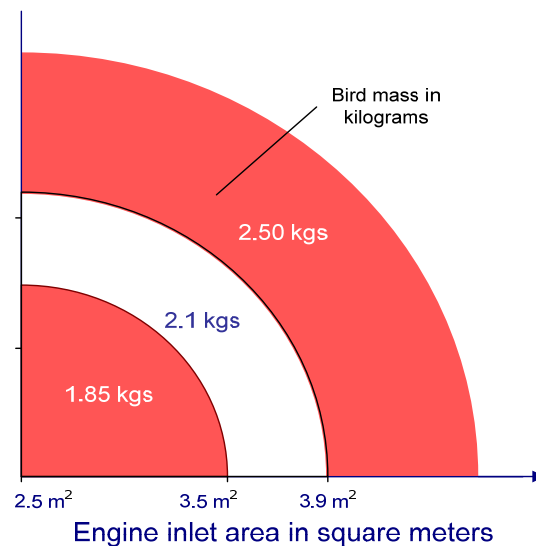


Figure 7: Certification requirements for large flocking bird ingestion – applicable only to engines with an engine inlet area greater than 2.5 m². (Not in scale; illustrative purposes only)

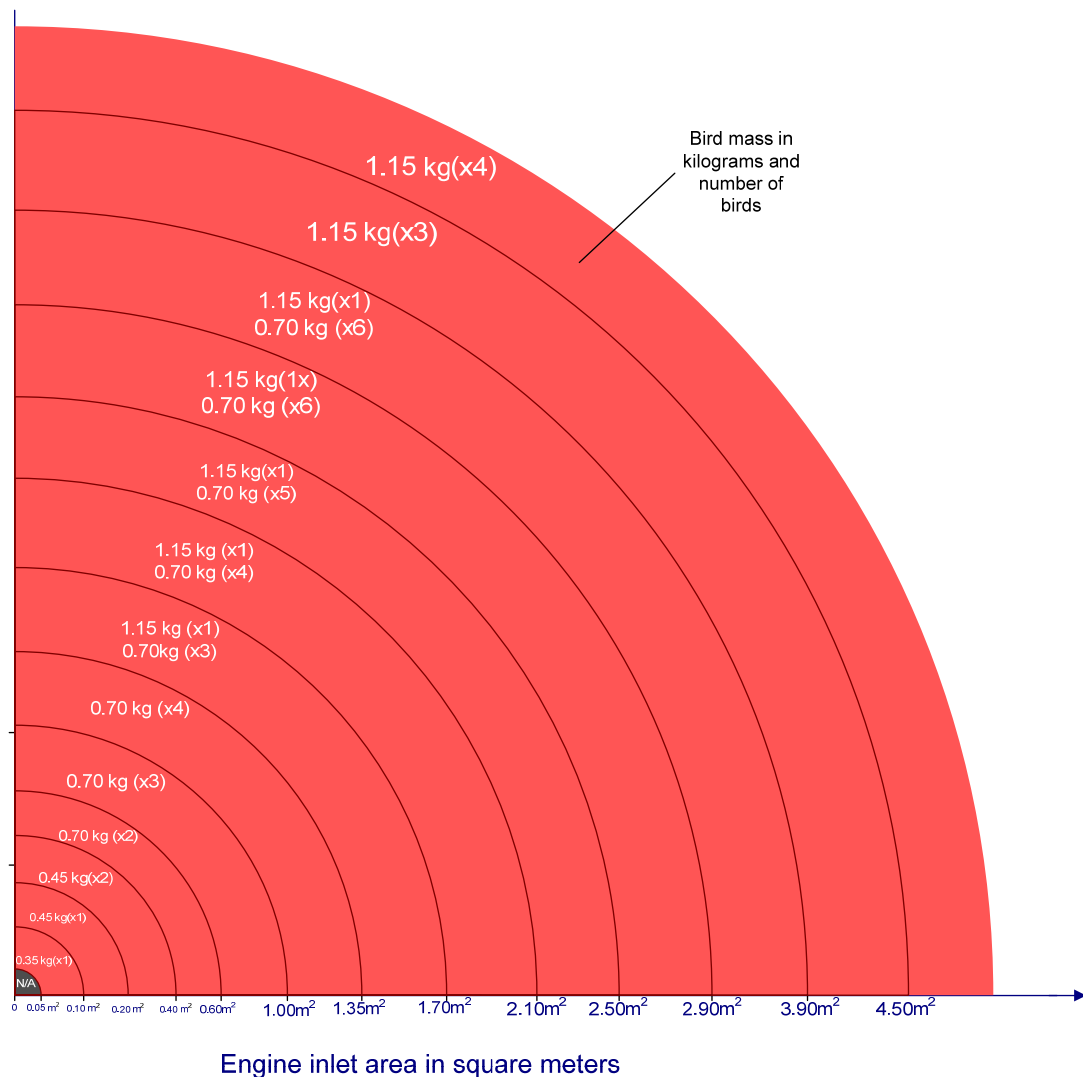


Figure 8: Engine certification requirements for multiple medium flocking birds. (Not in scale; illustrative purposes only)

The airframe certification requirements are not as descriptive as those for engines. Tolerance of windshield and other parts of the aircraft is dependant on the certification category of the aircraft. For non-commuter light aircraft (CS-23) and light rotorcraft (CS-27) there are no such requirements.

Due to their high speed, certification requirements for Very Light Jets follow those of commuter light aircraft (CS-23) requiring the windshield to be able to withstand a strike with a bird of a mass at least 0.9 kg (2lb) at maximum approach flap speed. This requirement was insisted upon by EASA and the related Certification Review Item.

For larger aircraft the airframe certification criteria is that the aircraft should be able to safely continue flying after striking a 1.8 kg bird at design cruise speed (V_c). For the aircraft empennage in particular, this requirement has been increased to 3.6 kg, following an accident of a Vickers Viscount in the 1960's. There are no bird strike certification standards specifically for fuel tank areas, apart from the general 1.8 kg requirement.



Picture 2: Wing damage due to strike with large bird

It is noteworthy that at sea level, the design cruise speed mentioned above is equal to the true airspeed. As the altitude increases the true speed will also increase due to the change in atmospheric pressure, despite the indicated airspeed remaining constant. Therefore a bird strike at a specific indicated airspeed (V_c) will have greater kinetic energy as the atmospheric altitude increases. This change in airspeed is not commented in the regulations as it is also highlighted in a related study¹⁰. In addition, in recent years questions have been raised regarding the degree to which certification test are representative of real bird impact conditions, when these tests are conducted on carbon fibre polymer material¹¹.

The above mentioned factor and the fact that the kinetic energy of a bird strike increases proportionately to the square of increase in velocityⁱⁱ has contributed to the regulatory request for strict adherence to the 250kt restriction at 10,000 feet both in the US and Canada¹².

In the certification requirements there is no comment on shock wave effects, although a related incident has occurred in the past. "In 1989 an A320 aircraft operating at 2,500 feet and 250 knots indicated airspeed (KIAS), collided with a vulture (around 10 lb) just above the cockpit windscreen. Although the windows were not penetrated, sufficient energy was imparted onto the airframe to destroy 4 of the 6 cockpit display units (CRT's) and loosen a fire button, causing the shutdown of one engine"¹³.

For light aircraft and light rotorcraft there are no bird strike requirements, despite these aircraft flying regularly at altitudes below 8,000 feet where most bird flight takes place and where most bird strikes have occurred as is described in Section 2.

Despite all the aircraft and engine certification requirements, there doesn't appear to be any standard training for flight crews regarding bird hazards, nor is such training required by regulators.

ⁱⁱ Kinetic Energy = (Mass/2) x (V)²



CS 25.631 Bird strike damage

The aeroplane must be designed to assure capability of continued safe flight and landing of the aeroplane after impact with a 4 lb bird when the velocity of the aeroplane (relative to the bird along the aeroplane's flight path) is equal to V_c at sea-level or $0.85 V_c$ at 2,438 m (8000 ft), whichever is the more critical. Compliance may be shown by analysis only when based on tests carried out on sufficiently representative structures of similar design. (See AMC 25.631.)

2 Bird Strikes in numbers

There is no straightforward relationship between the number of birds at a particular geographic location and the risk of bird strikes. Location factors (e.g. aerodrome or landfill sites) as well as flock size and flightline patterns play a significant role as it has been shown in past research¹⁴. Using various sources of information (ICAO, UK CAA, EURBASE) it can be derived that most of the bird strikes occur below 2500 feet (90%-93%), and the majority occurs at altitudes below 200 feet (64%-75% depending on data source). The seasonal pattern of bird strikes is confirmed from all sources, indicating that the highest number of bird strikes occurs in the months between April and October. It is not random that this period coincides with the airline summer schedule of increased air traffic activity. However, after using normalised data there appears to be a seasonal pattern for bird strikes in spring time and autumn.

The seasonal pattern may also affect the altitudes with the highest risk of a bird strike. For example, July through November are considered the worst months for damaging strikes in the airport environment (below 500 feet agl). During late summer bird populations are at their highest levels and contain many young birds that are not skilled flyers. Above 500 feet, September-November and March are considered the most dangerous months because these are the peak times of migration¹⁵. Similar observations have also been made by military sources. More information on the altitudes at which bird strikes have been recorded may be found in Section 2.

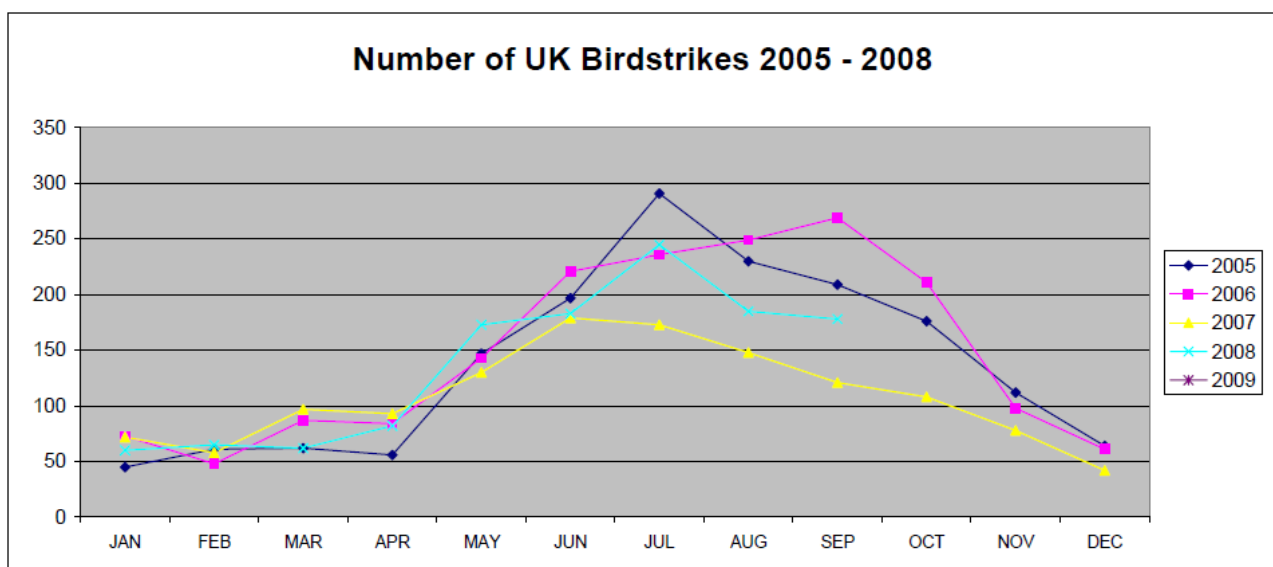


Figure 9: Number of bird strikes per month in the UK between 2005 and 2009 (Source: UK CAA)

It is estimated that bird strikes cost the aviation industry more than 1 billion euros per year¹⁶, as a result from direct damage to aircraft (which account for 12% of the cost) and from delays and their associated costs following bird strikes. Furthermore, a significant part of the total cost is associated to non-damaging bird strikes, which lead to go-around, fuel dumping, passenger



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delays and missed flight connections. Although this cost estimate is not precise as it is based on extrapolation of data available from United Airlines, nevertheless it highlights the economic impact of bird hazard on civil aviation. An example of one such bird strike is provided in the text box below.

November 08, 2000 – SAAB 340:

The aircraft impacted a flock of Geese during an approach for landing. The windshield wiper was torn from the aircraft. Metal fragments from the left propeller punctured the left side of the fuselage and hit a passenger in the leg. The aircraft landed without further incident.

Despite the importance of the hazard of bird strikes, not all such occurrences are being reported. According to the US Bird Strike Committee, studies have indicated that less than 20% of bird strike occurrences involving commercial air transport operations are reported and that this figure drops to 5% for general aviation.

One example of problematic bird strike reporting in civil aviation is the “ICAO Birdstrike Information System” (IBIS). In 1979 ICAO requested that all bird strikes be reported to the system but from the 110 member States only 50 were sending reports to IBIS¹⁷. Currently, for technical and other reasons, IBIS has ceased to operate and the status of bird reporting at a global level is unclear.

It has been only recently (2003) that ICAO has required through Annex 14 the reporting of bird strikes at aerodromes, stating: “the bird strike hazard on or in the vicinity of, an aerodrome *shall* be assessed through the establishment of a national procedure for recording and reporting birds strikes to aircraft” [*italics added*].

The problem of underreporting exists also in military aviation, which has established a bird strike database called EURBASE¹⁸. This database, although quite rich in data, also suffers from reporting discrepancy between different organisations (among which USAF, RAF, RAAF, RNZAF), which is “very much dependant on the reporting of the custodian”. However this does not reduce the effectiveness of the database in identifying key areas of concern. Military aviation organisations have taken a keen interest in this hazard because many aircraft in their fleets are single engined and because they usually operate at high speeds and low altitudes.

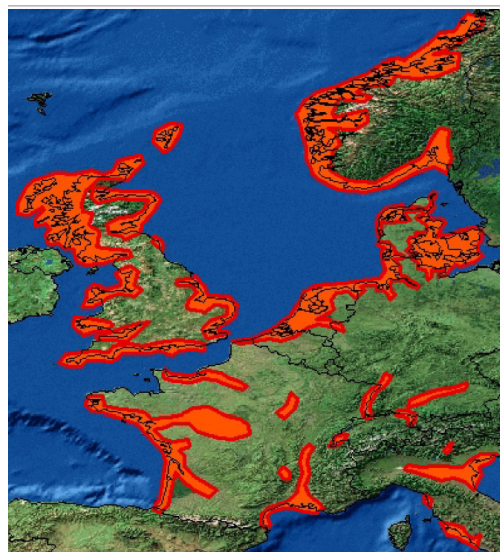


Figure 10: Example of EURBASE data being used- a graph showing areas of greatest bird strike risk (Source: Anonymous).



2.1 Bird Strike Accidents

Due to the limited and biased data available on bird strikes, this report uses only disseminated occurrence reports involving bird strikes which led to accidents. The choice of accidents only, was made because this occurrence class is clearly defined in ICAO Annex 13 regulations and therefore it is believed that most of the fatal and non-fatal accidents have been reported. This ensures that the results have the least bias possible, albeit they are limited in scope.



Figure 11: Number of accidents due to a bird strike worldwide (1999-2008).

During the decade of 1999-2008 in total 71 accidents occurred due to a bird strike. Of these only 6 led to fatal injuries. The highest number of accidents occurred during the take-off phase (48%), followed by the approach (30%) and the en-route phase (15%). In total 84% of bird strike accidents occurred during the take-off, approach and landing phases. It should be noted that in this dataset the en-route phase also includes the phase of climb and descent. The high number of accidents during the take-off phase may be slightly biased by the fact that only accidents were taken into account for these results. During the take-off phase (acceleration and lift-off) an aircraft is more susceptible to partial or total loss of control if a bird strike does occur, compared to other phases of flight. This loss of control together with high speed on or very near the ground may contribute to the significance of the damage or the injuries, thus classifying the occurrence as an accident. This is further highlighted by the fact that the majority of fatal accidents (4 out of 6) have occurred during the take-off phase.

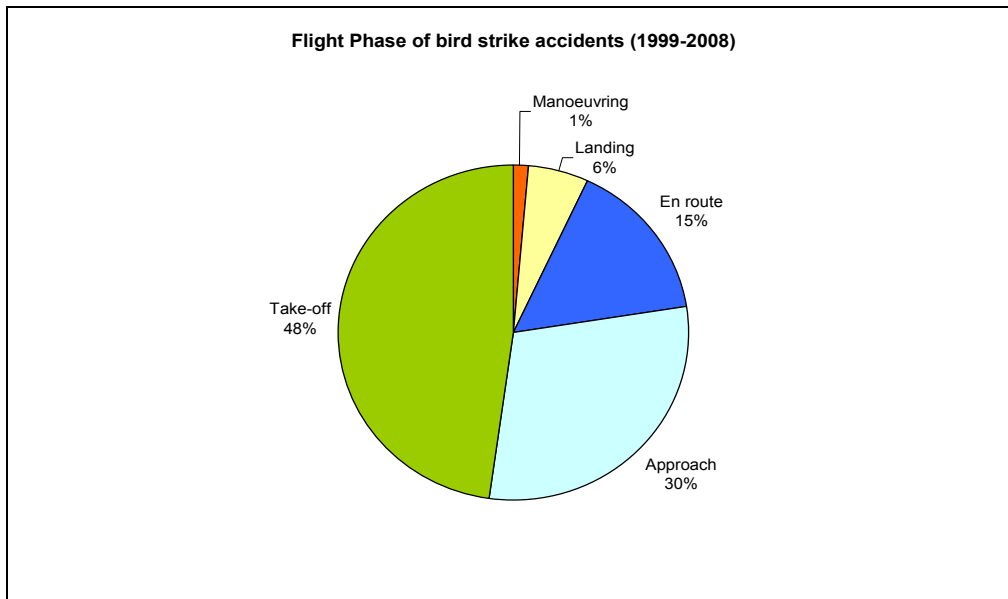


Figure 12: Phase of flight during which bird strike occurred and led to an accident, worldwide (1999-2008)

For all the accidents the location where damage was sustained was analysed and is shown in the figure below.

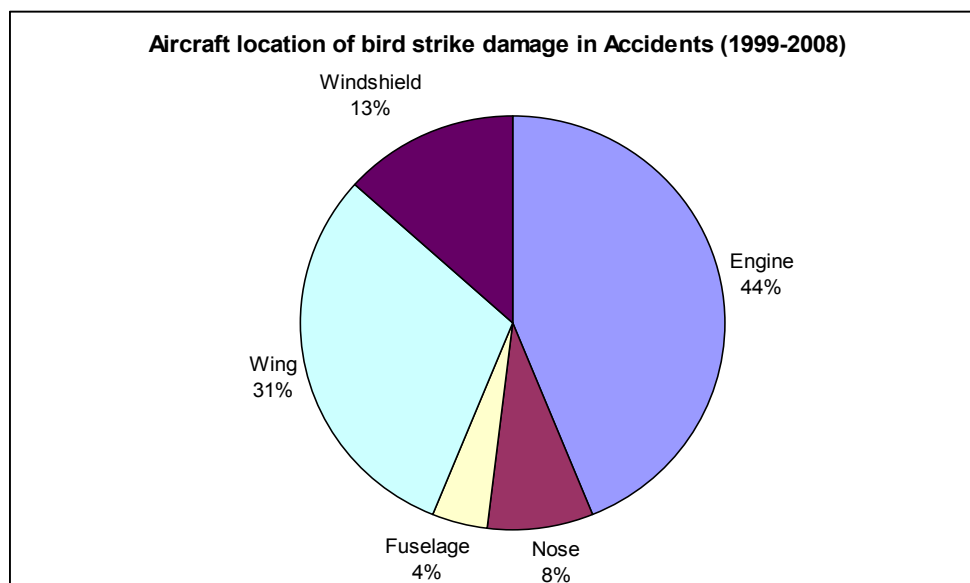


Figure 13: Location on the aircraft which was struck and damaged by bird(s), worldwide (1999-2008)

Damage to the engines was sustained in 44% of all bird strike accidents. For fatal accidents the proportion increases with 4 out of 6 involving damage to the engines; one accident involved fatal injuries from damage to the windshield and one unknown.

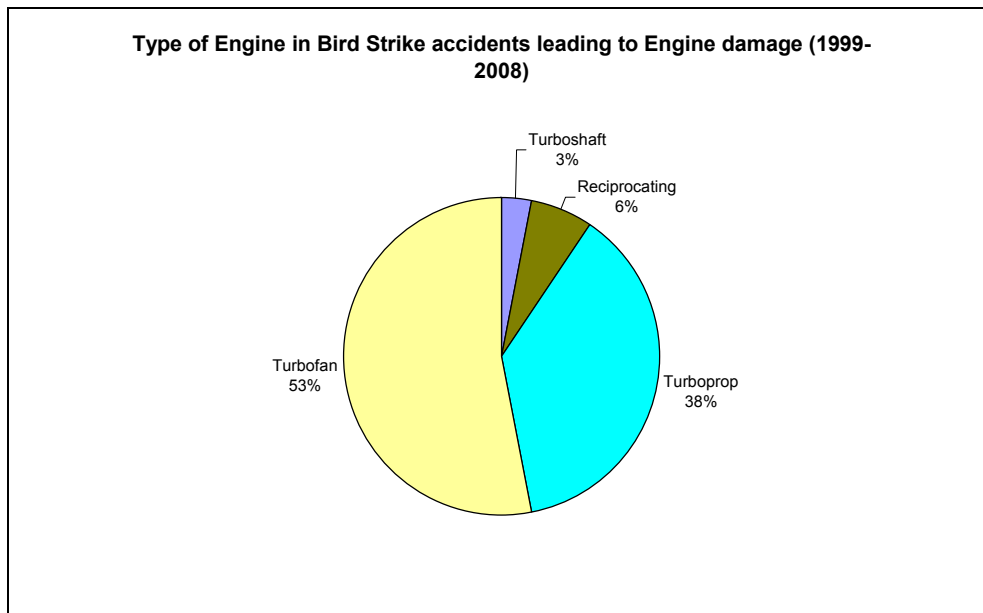


Figure 14: Type of engine in accidents which involved damage to engines and led to an accident, worldwide (1999-2008)

More than half of the aircraft which sustained engine damage had turboprop engines and 38% had turboprop engines. One of the accidents involving bird ingestion by a turboprop, also led to an uncontained engine failure (see related text box). One third of turboprop aircraft (4 out of 12) involved An-12 type aircraft encountering multiple birds and losing power in multiple engines with fatal consequences. In general, this aircraft type has been involved in most fatal accidents caused by bird strikes (4 of the 6) in the decade of 1999-2008.



Picture 3: Engine blade damage due to an ingestion of a small bird.

Some past studies have indicated that aircraft with low noise level engines (noise certification Chapter 3) have a greater risk of a bird strike because the low noise decreases the warning and reaction time of birds¹⁹. No such relationship could be confirmed within the dataset used.



On the other hand engine configuration is understood to play a significant role to the probability of a bird strike damaging the engines, as it has been found that wing mounted engines have five times more probability of being hit by a bird in a bird strike incident than fuselage mounted engines²⁰.

September 4, 2003- Fokker 100 (Rolls Royce Tay 650-15):

The aircraft was substantially damaged during the initial climb after takeoff from La Guardia Airport (LGA), Flushing, New York. There were no injuries to the 2 certificated airline transport pilots, 2 flight attendants, or 34 passengers. The flightcrew reported that the airplane flew through a flock of birds shortly after takeoff. They experienced a vibration in the right engine, and were unable to shut it down by use of the fuel cutoff lever. The fire handle was then pulled, and a fire extinguisher bottle was fired. The engine shut down; however, the vibration continued. The aircraft diverted to JFK. Examination of the airplane revealed a 20 by 36-inch wide depression on the right side of the nose, behind the radome. The maximum depth of the depression was between 3 and 4 inches. Stringers in the depressed area were deformed and cracked. Impact marks were found on the right wing at 15 and 18 feet outboard from the fuselage. There was no visible damage to the wings. Splattered blood was visible on the right side wing root. The right engine cowl ring was splattered with blood. One fan blade was separated from the fan disk at the root. The remaining fan blades were deformed, and had received leading edge impact damage. The containment ring for the fan was penetrated with a 9 inch by 2 inch hole. Additional holes were found in the engine cowling forward of the containment ring. There was an "L" shaped penetration of the fuselage, which started 6 inches above the top of the aft window on the right side. The penetration moved upward for 7 inches and was about 2-3/8 inches wide. The underlying insulation and plastic side panel were not penetrated. The blade that penetrated the fuselage was not recovered.

As mentioned above, the second area having received damage most often in accidents during a bird strike has been the wing structure (31% of all accidents). In most such accidents damage to the wing resulted in skin dents or in damage to the wing spar which led to partial loss of lift, vibrations and in some cases in difficulty controlling the aircraft. In 4 out of the 23 cases, the bird strike led to a puncture of the fuel tank and consequently to fuel leakage. For these cases it was a single large bird or a flock of large birds that hit the aircraft.



Picture 4: Penetration of the airframe due to a bird strike on a Boeing 767

Around 13% of the accidents involved damage to the windshield; of these accidents only one involved aircraft with turbofan engines. All other occurrences involved slow moving aircraft



with turboprop (turboshaft for helicopters) or reciprocating engines. It therefore can be assumed that most of the aircraft were flying at relatively low speed, or at least significantly lower speed than jet powered aircraft. This is reinforced by the fact that most of the aircraft involved are within the "2,251 kg and 5,700 kg" mass group and that 30% of all the accidents with windshield damage involve helicopters. If the speed was not a factor in these accidents, then it is highly likely that other issues such as structure or windshield strength played a role in the severity.

Accidents in which Windshield suffered significant damage (worldwide, 1999-2008)

Aircraft Type	Engine Type	Phase of flight	Aircraft Category	Mass group
DHC8-400	Turboprop	Approach	Fixed wing	27 001 to 272 000 Kg
CL-600	Turboprop	Take-off	Fixed wing	5 701 to 27 000 Kg
SAAB 340	Turboprop	Approach	Fixed wing	5 701 to 27 000 Kg
AT-502	Turboprop	En route	Fixed wing	2 251 to 5 700 Kg
90 KING AIR	Turboprop	Approach	Fixed wing	2 251 to 5 700 Kg
BN-2A ISLANDER	Reciprocating	Take-off	Fixed wing	2 251 to 5 700 Kg
CESSNA 310	Reciprocating	Take-off	Fixed wing	2 251 to 5 700 Kg
CESSNA 402	Reciprocating	Landing	Fixed wing	2 251 to 5 700 Kg
AS 355F TWINSTAR	Turboshaft	Take-off	Helicopter	2 251 to 5 700 Kg
BELL HELICOPTER 222	Turboshaft	En route	Helicopter	2 251 to 5 700 Kg
EUROCOPTER EX 130	Turboshaft	En route	Helicopter	2 251 to 5 700 Kg
BO-105	Turboshaft	En route	Helicopter	2 251 to 5 700 Kg

The relationship between bird strikes, resulting damage and aircraft speed could not be established using the described dataset. However, using extensive occurrence databases available from military sources (limited to military aircraft) it has been proven that damage increases with speed, and that above 250kt the damage can have destructive consequences²¹.

In regard to the type of bird species involved in the accidents, only for 60% of the accidents is the species known. The majority of birds involved were flocks of large birds (45%) followed by strikes from single large birds (31%) [geese, ducks, cormorants, hawks etc.].

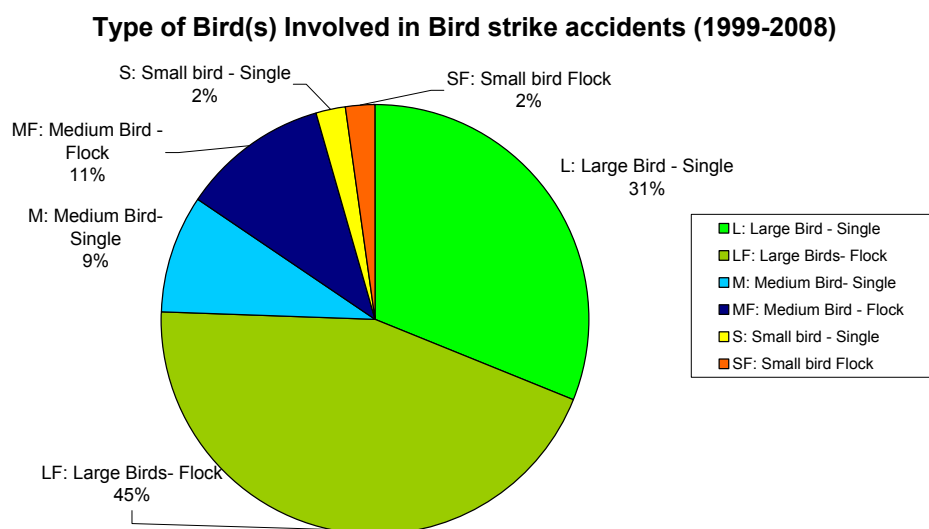


Figure 15: Types of bird species involved in bird strike accidents, worldwide (1998-2008)



2.2 Birdstrikes and altitude

Altitude information was not available in most of the occurrence reports used in this review. Using various other sources of raw and derived data it can be concluded that most of the occurrences (95%) occur below 2500ft amsl and around 70% occur below 200ft²². Various sources quote different percentages for each altitude threshold, but they all concur that most occurrences take place very close to the ground. This highlights the fact that the risk of bird strikes can be mitigated by measures taken primarily at an aerodrome level, such as avifauna assessment and management. An overview of the estimates is provided in Figure 16.

Percentage of bird strike occurrences at different altitude bands (agl)
(according to multiple data sources)

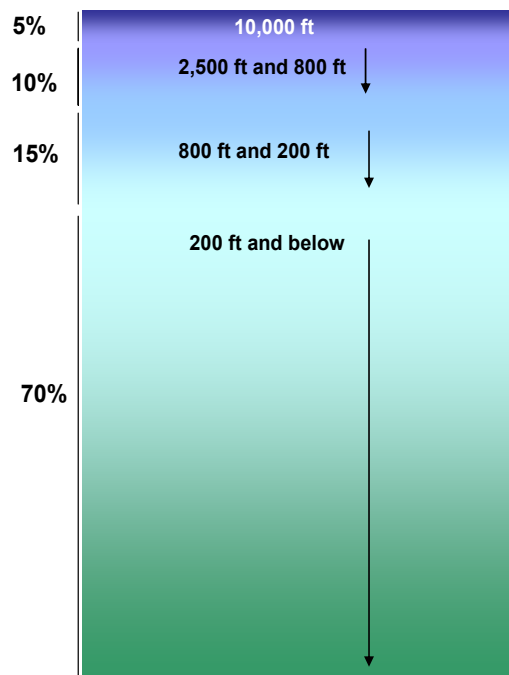


Figure 16: Estimated percentage of bird strikes per different altitude bands above ground level.

January 01, 2003 – Dash 8- 400:

The aircraft, which was on a downwind for a night visual approach, impacted a flock of Lesser Scaups (diving ducks). The nose structure of the aircraft and the windshield directly in front of the captain received multiple bird strikes. Some of the birds penetrated the aircraft's skin, but there was no direct penetration of the windshield. Although the windshield was not penetrated, hundreds of small pieces of glass were ejected from the most inner of the windshield's three panes, and approximately 70 of these pieces imbedded themselves in the face, forehead, and scalp of the captain. The first officer ultimately completed a successful landing, while using backup flight instruments. The investigation determined that the windshield certification process defined in Part 25 of the Federal Aviation Regulations and the Canadian Aviation Regulations does not take into account the effects of multiple bird strikes on the same windshield.

Cause: The fracture and spalling of the inner-most pane of the aircraft's port side windshield while on a downwind for a night visual approach due to an imposed load beyond that required for windshield certification (multiple bird strikes). Factors include a dark night, and a flock of ducks (Lesser Scaups) flying in the location of the visual traffic pattern.



Picture 5: Nose and windshield damage due to a bird strike on a Boeing 737 (Source ATSB).

3 Conclusions

Although bird strikes are an issue as old as aviation, its significance as a hazard has not been diminished. In recent years very few fatal accidents have been caused by this hazard and most of these appear to involve a particular aircraft type (An-12). However, the cost of bird strikes to the civil aviation industry is not negligible, as it is estimated to be more than one billion euros annually.

It appears that the trend of the general bird population is not necessarily a good guide to assess the bird strike hazard. Some bird species constitute a greater hazard to aviation than others. Climatological and other environmental changes affect bird populations and their behaviour. This change is not reflected throughout aircraft certification requirements.

So far bird strike certification requirements appear to have been reactive to past occurrences, however new occurrences have shown that there are particular areas of concern. There appears to be a number of accidents during which the wing was significantly damaged and the fuel tank was ruptured with consequential fuel leakage. There are no fuel tank specific requirements on this subject and this may need to be reviewed.

Furthermore, there are no bird strike related certification requirements for non-commuter light aeroplanes and light helicopters although this category of aircraft is most likely to operate continuously under 8,000ft amsl where almost all bird strikes occur. The high proportion of accidents involving slow moving aircraft (turboprop aeroplanes and helicopters) resulting in damage to the windshield may also justify a review of the bird strike requirements for light aircraft. Occurrences during which broken pieces of a windshield contributed to the severity are an indication that action on further examining this issue needs to be taken.

Recent research has also highlighted the fact that bird strike certification tests used on metal materials, might not be representative of real conditions for composite materials, as the properties of the latter are dependant on various test parameters, which are not specified in the requirements.



High speed flight below 10,000 ft appears to be in risk of destructive bird strike damage, as the kinetic energy may be close or even greater than the certification requirements. These requirements do not comment on shock wave effects, which may be significant as an incident involving an A320 has shown. This might be of particular concern to Air Navigation Service Providers, who may need to assess the risk of bird strikes, before clearing aircraft to fly above 250 kts at low altitudes in a particular area of operations. It therefore appears that approval for high speed flight should be commensurate to the assessed risk of the hazard in the area of operation.

In addition there are no prescribed training requirements for flight crews in regard to bird strikes and bird strike avoidance. It is possible that not all flight crews are aware of the significance or some of the aspects of the problem.

If any improvement is to be realised in better assessing, mitigating or controlling bird strike effects on aviation safety, then it is of outmost importance that reporting of such occurrences improves significantly. Some EASA MS, most notably the UK CAA, have undertaken several steps to this direction. However there appears to be no combined effort to collect all relevant occurrences, even those that did not lead to a bird strike.

The next release of ECCAIRS (due in 2009) will be able to capture data based on the IBIS framework. It is expected that this will significantly improve the capture and dissemination of bird strike related reports among the system users.

It is expected that any future undertaking towards examining the issue of bird hazards takes into account several sources of information among which military ones, such as the EURBASE database. Although the EURBASE has occurrences related to military aircraft with different operational characteristics of civilian aircraft, it is a rich source of information for identifying patterns within which the hazard is exposed.



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