

Bird Strike Case Study at Airport Level to Include Take Off, Landing and Taxiways

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ABSTRACT

The purpose of this research is to carry out a case study regarding bird strike at airport level during aircraft take off, landing and taxiing. This research was conducted in order to research about bird strike occurrence at airport level, and effect of the bird strike to the safety and performance of aircraft. The data was collected by reviewing sources from journals, websites, articles and qualitative approach interviews were carried out. The interviews were conducted at several airports in the United Kingdom such as Gatwick Airport and Cardiff Airport. The data obtained was helpful in order to find the current prevention method, regulation related to bird strike, bird strike data at different airports, procedure for bird control methods and the most effective methods to prevent bird strike at both airports. It is hoped that from these research it will serve as a basis for future studies regarding bird strike case study at airport level.

1 Introduction

The first reported bird strike was recorded by Oliver Wright in his diary on 7 September 1905 when his aircraft hit a bird near Dayton Ohio. On 3 April 1912, Calbraith Rodgers, the first person to fly across the continental United States was the first died as a result of bird strike when his aircraft struck a gull along the coast of Southern California. Since the first bird strike to the present day, bird strike problem have cause damage to aircraft, cost airline industry, and loss of human life. According to Federal Aviation Administration [4], bird strike commonly happen at low altitude flight or when aircraft takeoff and landing. About 92 percent of bird strike occurred at or below 3000 feet height Above Ground Level (AGL).

1.1 Aims and Objectives

The aim of this research is to produce a complete research of bird strike at airport level during aircraft take off, landing and taxiing. In order to achieve the aim of this research, there are several objectives were set as guidance. The objectives of this research are: -

- i. To identify methods currently used at different airport, cost effectiveness and its affectivity.
- ii. To make comparison of recorded bird strike at different airports in United Kingdom.
- iii. To identify new methods in future and more environmental friendly.
- iv. To identify regulations that related to bird strike.
- v. To identify effect of bird strike on aircraft.
- vi. To increase awareness of wildlife hazards at airports.

1.2 Problem Statement

Nowadays the threat to aircraft safety from aircraft collisions with wildlife especially birds has increased. Globally, bird strikes have resulted in loss of human life and cost airline industry. Modern commercial aircraft such as Boeing and Airbus have quieter engines than older aircraft which make birds difficult to detect and prevent bird strike. In Civil Aviation Authority report [1], about 1823 cases of bird strike has occurred in the United Kingdom. In addition, according to International Civil Aviation Organization [5], bird strike has cost 118 000 hours per year of aircraft down time and 123 million Dollars in annual monetary damages. At the same time, in Annex 14 volume 1, International Civil Aviation Organization [5] requires all airport authorities to take action by decrease number of birds in vicinity airport in order to reduce the risk of bird strike.

2 Literature Reviews

2.1 Introduction

This part will provide information regarding aviation authorities and regulations that related to bird strike such as International Civil Aviation Organisation, International Bird Strike Committee, Civil Aviation Authority, and Federal Aviation Administration.

2.2 International Civil Aviation Organisation

International Civil Aviation Organisation (ICAO) is a specialised agency under United Nations which control about planning and development of international air transport. ICAO has long been concerned about bird strike problem to aviation. According to ICAO [5], ICAO has adopted Amendment 23 to Annex 14 which added a new requirement to decrease number of birds at aerodromes. In other word, to reduce number of bird strike at airport area.

In Annex 14 Volume 1 [5], as adopted in March 1990, require that authorities should assess the bird hazard on or in the vicinity of an airport, take necessary action to decrease the number of birds by discouraging their presence, eliminate or prevent the establishment of any site which would be attraction to birds, and establish a procedure for recording and reporting bird strike. This is very detail requirements that ICAO made in order to bring attention to local authority which should be understand and implement to every airport.

At the same time, in order to bring the importance of bird hazard reduction at airports, ICAO provides workshops to the local government authority and gives training materials for the management of bird strike at airports. The training covers major knowledge for management of bird strike at airports and promoting licensing.

2.3 International Bird Strike Committee

International Bird Strike Committee (IBSC) is a voluntary association who aim to improve aviation flight safety by sharing knowledge and understanding concerning bird strike. According to ICAO [5], in 1985 ICAO request IBSC to assist ICAO by identifying measures to reduce bird strike which could be recommended for global application. As a result from IBSC analysis regarding bird strike at airports, ICAO adopted amendment to Annex 14, Volume 1.

In IBSC Standards for Aerodrome [6], IBSC produce standards that are needed to effectively manage bird strike in airports area. The standards should be applied to any aerodrome that carrying regularly schedule commercial air traffic. It guides airport authority about airfield habitat management, risk assessment at airport, bird control equipment and bird strike reporting. But some airport need different technique because the habitat type, bird species present at different airports varies and level of resources available at different airports.

2.4 Civil Aviation Authority

Civil Aviation Authority (CAA) is an independent specialist aviation regulator in United Kingdom. According to CAA [1], it is mandatory reporting of bird strike in UK which came into force on 16 December 2003. Before 2008, all reporting about bird strike can be submitted by completing the SRG 2004 Bird Strike Occurrence Form but since January 2008 CAA introduced online reporting system. From the new online reporting system, there has been 67 percent increase in the number of reports received to CAA. All the data received enables CAA to provide information and advice to aerodrome which can assist them in their habitat management and bird dispersal techniques.

In order to adopt ICAO Annex 14, CAA produces CAP 772 which provides guidance about effective techniques to implement bird strike risk management in vicinity of aerodrome. In CAP 772 [2], there are many methods that can be used to reduce the risk of bird strike such as scaring, distress signals, pyrotechnic bird scaring cartridge and lethal methods. But for shooting certain birds on aerodromes, it require specific license. This is because many species of birds are protected under law through Wildlife and Countryside Act 1981.

In UK Bird Strike Committee Meeting [1], the number of bird strike that reported to CAA start increase from April until June every year between years 2004 until 2009. The increase of bird strike between Aprils to June can be caused by season, weather and time of day. During late winter and early spring, some bird species migrate to exploit seasonal food abundance and to find new habitat.

2.5 Federal Aviation Administration

The Federal Aviation Administration (FAA) is an agency under United States Department of Transportation which regulate and oversee all aspects of civil aviation in United States. The Federal Aviation Act of 1958 created the group under the name of Federal Aviation Agency and adopted its new name in 1967 when became a part of the United States Department of Transportation.

According to Federal Aviation Administration [4], FAA Wildlife Strike Database contains records of reported wildlife strikes since 1990 and all of these data are received from airports, airlines, pilots and other sources. The database has recorded over 108 000 wildlife strikes between years 1990 until 2009. From the data, about 92 percent of bird strikes occur at or below 3000ft above ground level and 72 percent of bird have not been identified to species level. In United States from years 2004 until 2008 there was an average 20 reported wildlife strikes per day.

3 Research Methodology

3.1) Introduction

This part identifies the methods and methodological approach which will be used for this research in order to make sure this research can be conducted successfully.

3.2) Research Stage

Research for bird strike case study has been divided into two stages which are first stage (secondary data) and second stage (primary data). During the initial project, data from the first stage can used to familiarise and understand the key research of this research. So, by using all the information from the first stage, the structure for conducting second stage research has been created. As a result, the second stage was performed in a correct manner to achieve research target.

3.2.1) First Stage (Secondary Data)

During this stage, most of the research relates to main aspect of this research such as bird strike occurrences, regulations that related to bird strike, current methods for bird strike prevention, bird strike management at airport and data of bird strike at different airports. From the research, all of the data were used to develop key questions for interview bird strike committee at several airports in

United Kingdom. This stage became important part for the researcher to get better understanding about the topic before continuing to the second stage.

3.2.2 Second Stage (Primary Data)

For this research, in order to get full information about bird strike at different airport in United Kingdom, several interviews were conducted. These were carried out in order to provide original data from the main sources for this research and also to obtain information that are not available from secondary sources.

4 Bird Strike Occurrences

4.1) Bird Strike Occurrences During Aircraft Take Off, Landing and Taxiing

Although bird strike are became an issue as old as aviation, but its significance as a hazard has not been diminished. In recent years many accidents have been caused by bird strike and most of these appear to involve a particular aircraft type. At the same time, the cost of bird strikes to the civil aviation industry is estimated more than one billion euros annually. The significant part of the total cost is associated to non damaging bird strikes which lead to fuel dumping, go-around, missed flight connections and passenger delays.

According to Ilias Maragakis [7], there is no straight forward relationship between the number of birds at particular geographic location and the risk of bird strikes. Location factors as well as flightline patterns and flock size play a significant role as it has shown in the past research. In addition, by using various sources of information from International Civil Aviation Organisation (ICAO), Civil Aviation Authority (CAA) and European Military Bird Strike Database (EURBASE), it can be derived that most of the bird strikes occur below 2500 feet about 90 to 93 percent and majority of the cases occurs at altitudes below 200 feet about 64 to 75 percent but all of these data will varies depending on data sources. Furthermore, the seasonal pattern of bird strikes is confirmed from all sources which indicated that the highest number of bird strikes occurs in months between April and October every year. The data is not random because during this period, it coincides with the airline summer schedule which increased air traffic activity. On the other hand, after using normalised data there appears to be a seasonal pattern for bird strikes during spring time and autumn.

4.2) Effect of Bird Strike on Aircraft

Even though majority of reported bird strike have little or no effect on continued safe flight but flocks of large birds can damage aircraft so badly. In some cases the aircraft cannot continue to fly and need to do emergency landing at nearest airport. Therefore, current aircraft certification standards include requirements to demonstrate both engine and airframe resistance to bird impact. The standards are those in place at the time of construction of new aircraft type and engine model.

According to Skybrary [10], for any given impact that produced is based on the speed of the impact. This is because the kinetic energy that absorbed by the airframe or engine is the product of mass and the square of the aircraft speed. Commercial aircraft speeds are became slower where most birds are found

especially near ground but aircraft speed increase progressively with altitude until bird hazard disappears at above 20,000 feet. Although the number of recorded bird impacts reduces with altitude but the greater the altitude, the greater damage to the aircraft and also the greater the difference in the speed of the aircraft and the bird, the greater the force of the impact on the aircraft. Even though the weight of bird is one of the factors, but the speed difference is more important factor.

Furthermore, according to Ilias Maragakis [7], about 53 percent of the aircraft which sustained engine damage had turbofan engines and 38 percent had turboprop engines. One of the accidents involving bird ingestion by a turbofan engine led to an uncontained engine failure. One third of turboprop aircraft that involved Antonov An-12 type aircraft encountering multiple birds and losing power in multiple engines with fatal consequences. From data recorded by EASA, this type of aircraft has been involved in most fatal accidents that caused by birds strikes between years 1999 until 2008. Refer to Figure 1. In addition, EASA has analysed the location of damage on aircraft that effected by bird strike. Damage to the aircraft engine was sustained about 44 percent of all bird strike accidents, followed by wing 31 percent, windshield 13 percent, nose 8 percent and fuselage 4 percent. Refer to Figure 2.

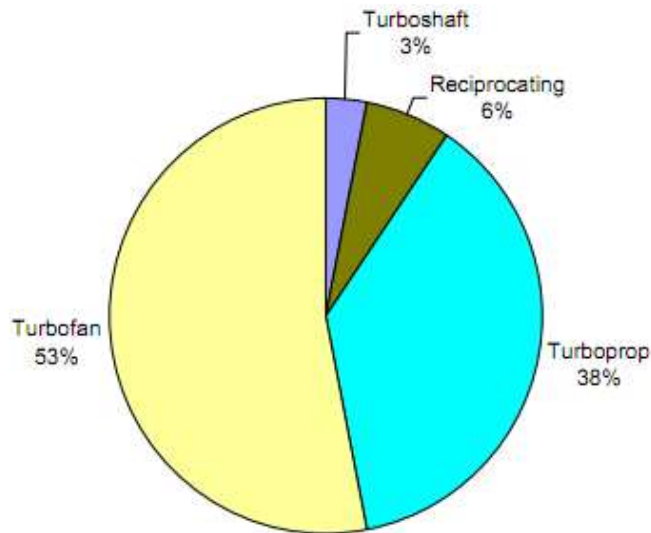


Figure 1- Type of Engine in bird strike accidents which involve damage to engine and led to an accident from year 1999 until 2008.

Source: Bird population trends and their impacts on Aviation Safety 1999-2008, EASA [3]

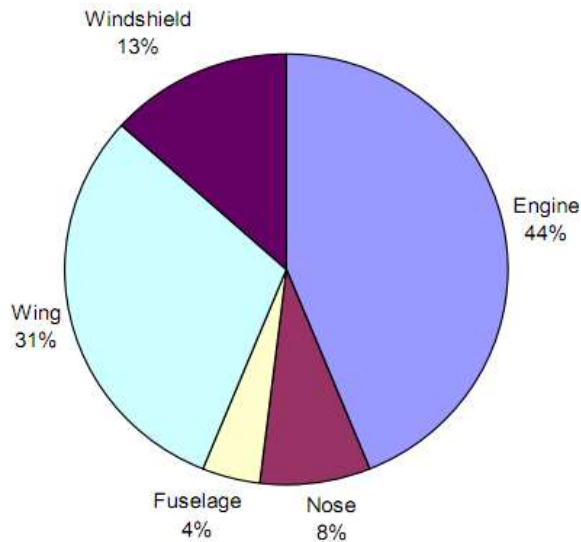


Figure 2 - Aircraft location of bird strike damage (1999 until 2008).

Source: Bird population trends and their impacts on Aviation Safety 1999-2008, EASA [3]

5 Bird Strike Prevention and Control Method

5.1) Introduction

There are documents that can be used as guideline for bird strike prevention at airport area such as Standards and Recommended Practices (SARP) by International Civil Aviation Organisation, Bird Strike Risk Management for Aerodrome or CAP 772 by Civil Aviation Authority (CAA), and Standards For Aerodrome Bird Control by International Bird Strike Committee. All of these documents were produced in order to help airport authorities to implement bird control procedures and to reduce number of bird strike at airport area. These documents are aimed at deterring birds from flying on and in the lower flight paths in the vicinity of aerodromes and primarily include the use of risk assessment, bird control procedures, aerodrome habitat management and safeguarding. But the bird strike risk is not uniform across all types of aerodromes and flight operations and therefore it is important that the most appropriate measures are identified and adopted to suit the local environments.

According to CAA [2], in Annex 14 states that “ *when a bird strike hazard is identified at an aerodrome, the appropriate authority shall take action to decrease the numbers of birds constituting a potential hazard to aircraft operations by adopting measures for discouraging their presence on, or in the vicinity of an aerodrome.*” Annex 14 goes further stating that “ *the appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any such other source attracting bird activity on, or in the vicinity of an aerodrome unless an appropriate aeronautical study indicates that they are unlikely to create conditions conducive to a bird hazard problem.*” The terms “in

the vicinity” means land or water within 13 km from aerodrome reference point and “*aerodrome*” means airport or airfield area.

So from this statement, it clearly explain to airport authorities to take appropriate action to decrease number of birds at airport area by discouraging their presence at airport area and take action to prevent or eliminate the establishment of waste disposal area or any source that can attract bird activity in airport area. Besides that, every airport operator should develop a Bird Control Management Plan (BCMP) to assess the bird strike risk and to implement the appropriate bird control measures to mitigate or reduce the risk. The BCMP should record the results of bird strike risk assessment that are conducted at the individual airport area and specify the bird strike risk mitigation that are in place [2].

In addition aerodrome operator should emphasis to minimise the presence of flocks of birds in aerodrome area and awareness of bird attractant activities outside the aerodrome area such as farmers ploughing fields and construction area. If necessary, airport team management need to make discussion with landowner and farmers to tell them the important to reduce bird attractant activities outside vicinity of aerodrome. Besides that, this chapter will include bird control methods, airport habitat management and bird strike reporting system.

5.2) Bird Control Method

There are several types of bird control method that can be used to control bird populations and to prevent the risk of bird strike such as scaring and distress signal, pyrotechnic bird scaring cartridge (BSC) and lethal methods.

5.2.1) Scaring and Distress Signal

The used of recorded distress calls is considered the most efficient and cost effective method for dispersing birds from vicinity of aerodromes but this type of method will not make the bird to depart immediately. Moreover, this method is species specific and may cause the birds to react defensively rather than disperse. Therefore, a distress signal should be used when no aircraft are operating locally.

5.2.2) Pyrotechnic Bird Scaring Cartridge (BSC)

Bird scaring cartridge is a common means of dispersing birds at aerodromes in UK and commonly known as a shell cracker or cracker shell. There are several types of BSC available and generally for use on aerodrome the BSC should have a range greater than 80 metre when fired at 45 degree elevation, produce a loud sharp with a bright flash, and must not be a potential fire risk. Several types of signal pistol with a 12 bore liner and a few purposes made 12 bore pistols are in use on UK aerodromes.

5.2.3) Lethal Method

Lethal method can be used to reduce number of birds, to enhance the effect of other control techniques and to remove individual birds which do not depart in response to scaring action either of sickness or disability. So if there is no other satisfactory course of action for preserving air safety, shooting birds is an

effective means of control. But special legal provisions exist to license the shooting of certain birds on aerodromes and subject to specified conditions [2].

5.3) Airport Habitat Management

Birds visit places that provide habitats which offer food, security for foraging and breeding depending on the species. Birds will visit as long as the attractions remain and depend by factors such as weather, migration and effectiveness of the control activities. Therefore, habitat management should be aimed at the reduction or removal of these habitats according to the type of birds that are targeted in order to reduce the attractiveness of the site.

5.4) Bird Strike Reporting

According to Civil Aviation Authority [2], in Article 143 of Air Navigation Order which about mandatory of reporting of bird strikes, the commander of an aircraft is required to make a report to CAA if any occurrence that occurs whilst aircraft in flight within United Kingdom airspace. In year 2004, the CAA commissioned a study looking into bird strike reporting for purpose of assisting the CAA in assessing whether UK bird strike reporting system was as effective as possible. The results of the study provided an informed basis from which to develop CAA guidance and policy associated with bird strike risk management and hazard identification, information sharing and improvements to bird strike reporting system.

6 Analysis of Bird Strike at Different Airports in UK

From the research and interview sessions that has been done at Gatwick Airport and Cardiff Airport, both airports are using the same method for bird strike prevention such as bird control methods and habitat management in order to comply with ICAO Annex 14, CAA CAP 772 and Standards for Aerodrome Bird Control IBSC. In addition, both airports are the member of UK Bird Strike Committee (UKBSC) and every year both bird strike committee will meeting and exchange information regarding bird strike.

For bird strike risk reduction, habitat management is one of the most important methods that needs to be implemented by aerodrome operator in order to reduce attractiveness of certain places in vicinity of the aerodrome. Whilst aerodrome habitat management is an important measure to reduce the bird strike risk, effective bird control measures should also be included in the bird control management plan such as scaring, distress calls, Pyrotechnic Bird Scaring Cartridge (BSC), manual dispersal techniques and lethal methods.

From the interview with bird control coordinator at Gatwick Airport and Cardiff Airport, both of the manager are agree that the used of recorded distress calls (bio-acoustics) is considered the most efficient, environmental friendly and cost effective method for dispersing birds from aerodromes. In addition, both airports are fully aware to decrease number of birds at airport area by discouraging their presence at airport area and take action to prevent or eliminate the establishment of waste disposal area or any source that can attract bird activity in airport area. Besides that, both of the airport work together with UK Bird Strike Committee to develop a Bird Control Management Plan (BCMP) which to assess the bird strike risk and to implement the appropriate bird control measures to mitigate or reduce the risk. The BCMP should record the

results of bird strike risk assessment that are conducted at the individual airport area and specify the bird strike risk mitigation that are in place.

7 Conclusion and Recommendation

7.1 Conclusion

The major objective of this project was to research about bird strike at airport level during aircraft take off, landing, and taxiing. It also includes research about methods that currently used at different airports in United Kingdom, comparison of recorded bird strike at different airport in UK, effect of bird strike on aircraft, aviation regulations that related to bird strike and new method that can be used in UK. By considering the achievement of results and information which were obtained throughout this project, it was felt that this project met its aims and objectives. Towards obtaining information of this project, two phases of data finding has been accomplished namely the secondary research and primary research. Both of the researches were the main methods of obtaining the information.

From the research that has been done at Gatwick Airport and Cardiff Airport, both airports are using same methods to prevent birds strike such as bird control methods and habitat management. Both of the airports follow all the regulations and guideline from ICAO Annex 14, CAA CAP 772 and IBSC Standards for Aerodrome Bird Control. In addition, both of the airports have their own Bird Control Management Plan (BCMP) which contained all the procedure to prevent bird strike at airport area, risk identification, roles and responsibility, recording of bird activities, and bird strike reporting.

7.2 Recommendation

There are some recommendations that can be used in order to reduce number of bird strike at airport area. It is important for all airports in United Kingdom and other countries in the world to work together and exchange information regarding the best control method to prevent bird strike in vicinity of aerodrome. In addition, for airports that already implement bird control methods and habitat management, they can share information and provide guidance with other airports that still not implement it.

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