

## **Airport Wildlife Strike Summary and Risk Analysis Report: a new addition to the FAA's Wildlife Hazard Mitigation Website**

RICHARD A. DOLBEER, U.S. Department of Agriculture, Wildlife Services, 6100 Columbus Avenue, Sandusky, OH 44870, USA

HEATHER MARRIOTT, Embry-Riddle Aeronautical University, 3700 Willow Creek Road, Prescott, AZ 86301 USA

ALLEN NEWMAN, Embry-Riddle Aeronautical University, 3700 Willow Creek Road, Prescott, AZ 86301 USA

**Abstract.** Aircraft collisions with birds and other wildlife are an increasing concern for the aviation industry. The U.S. Federal Aviation Administration (FAA), through agreements with the U.S. Department of Agriculture, Wildlife Services and Embry-Riddle Aeronautical University, developed a National Wildlife Strike Database to better define the wildlife strike problem. Annual reports that summarize the data (about 72,500 strike records for civil aircraft in USA, 1990-2006) provide a foundation for FAA national policies and guidance regarding research and management efforts to reduce wildlife strikes. However, these national analyses do not provide specific information regarding strikes at individual airports or for other specific user groups. Our objective was to expand the utility of the database by providing an automatically generated Airport Wildlife Strike Summary and Risk Analysis Report for airports. Each report, updated annually and accessible on-line with a password, provides an airport with total and damaging strike numbers and strike rates per 100,000 aircraft movements for the past year and with mean numbers for the past 5 years. The report then compares these rates with regional and national averages for airports in the same size class. The report also documents the wildlife species that, based on past damaging strike records, need to be emphasized in risk management activities. This information provides airports with an objective baseline to aid in the evaluation of their wildlife risk mitigation programs. Such evaluations are required annually in the USA under 14CFR.139.337. This report presently is available for each of the 434 Part 139-certificated USA airports that have strike records included in the database for the last five years.

### **1.0. Introduction**

Aircraft collisions with birds and other wildlife are an increasing concern for the aviation industry worldwide (Dolbeer 2006). In the USA, the Federal Aviation Administration (FAA) has initiated several research and management programs to mitigate the risk of wildlife strikes. Among the various programs is the collection and analysis of data from wildlife strikes. The FAA began collecting wildlife strike data for civil aviation in 1965. However, except for cursory examinations of the strike reports to determine general trends, the data were never submitted to rigorous analysis until 1995.

### **2.0. Development of FAA National Wildlife Strike Database**

In 1995, the FAA, through an interagency agreement with the U.S. Department of Agriculture, Wildlife Services (USDA/WS), initiated a project to obtain more objective estimates of the magnitude and nature of the national wildlife strike problem for civil aviation. This project involves having specialists from USDA/WS: (1) review and edit all strike reports (FAA Form 5200-7, *Birds/Other Wildlife Strike Report*) received by the FAA since 1990 to ensure consistent,

error-free data; (2) enter all edited strike reports into a database, hereafter referred to as the FAA National Wildlife Strike Database; (3) supplement FAA-reported strikes with additional, non-duplicated strike reports from other sources; (4) provide the FAA with an updated computer file each month containing all edited strike reports; and (5) assist the FAA with the production of annual reports summarizing the results on a national basis of analyses of data from the database.

Such analyses (see Cleary et al. 2007 for the latest report covering 73,526 strike records from 1990-2006) are critical to estimating the economic cost of wildlife strikes, the magnitude of safety issues, and most important, the nature of the problems (e.g., wildlife species involved, types of damage, height and phase of flight during which strikes occur, and seasonal patterns). The information obtained from these general analyses provides a foundation for FAA national policies and guidance regarding integrated research and management efforts to reduce wildlife strikes. However, a limitation of these national analyses is that they do not provide specific information regarding strikes at individual airports or for other specific user groups.

### **3.0. On-line access of Strike Database via FAA Wildlife Hazard Mitigation Website**

To enhance the utility of the database and facilitate the transfer of information and reporting of strikes, the FAA awarded a grant to Embry-Riddle Aeronautical University (ERAU) in Prescott, Arizona in 1999 to establish a Wildlife Hazard Mitigation website (<http://wildlife-mitigation.tc.faa.gov>). The goals of the website were to 1) provide a focal point for information about wildlife hazard mitigation at airports, 2) establish an on-line system for reporting strikes, and 3) maintain the National Wildlife Strike Database on-line to allow access to the data by various user groups in the aviation industry. This latter feature allows selected wildlife strike information from 1990 to present to be accessed and analyzed by the general public, and with an FAA-issued password, by airports, airlines, USDA/WS specialists, aircraft and aircraft engine manufacturers, and FAA Airport Certification Inspectors.

The intent of the selective access to the database was to allow various groups to do more detailed analyses of strikes of interest to them without compromising access to the broader database where misinterpretations of data might occur or proprietary information be revealed. The database has certain limitations because strike reporting for civil aviation is voluntary in the USA. As discussed in Cleary et al. (2006), the FAA estimates that only 11-21% of strikes are reported (Wright et al. 2005). The current password-controlled system allows an airport to access all the strike reports for their airport but no other airport. Likewise, an engine manufacturer can access all strike reports for aircraft with their engines but not other engine manufacturers. The general public can obtain statistics on number of strikes by year, month, state and wildlife species, but not by airport, engine manufacturer, aircraft operator etc.

The Wildlife Hazard Mitigation website has been highly successful in disseminating information about wildlife strike mitigation in general and in allowing various groups to access and use strike data from the National Wildlife Strike Database. From June 2002 through June 2007, over 42,000 queries to the database have been processed.

With on-line access available, many airports now access their strike data for use in wildlife hazard assessments and development or refinement of wildlife hazard management plans. However, airports have no standard means to calculate strike rates (strikes adjusted by number of aircraft movements) or no ability to compare their strike numbers or strike rates with values from

other airports. Furthermore, airports have no standard means to rank wildlife species posing the greatest risk or to determine if the strike rate is increasing or decreasing. Many airports are expending considerable resources in an attempt to mitigate wildlife risks, and under federal regulations in 14CFR Part 139.337, airports certificated for passenger traffic are required to evaluate their management plans annually. These airports are requesting a means to better evaluate their wildlife strike statistics and the effectiveness of their wildlife risk management plans. Our objective therefore was to expand the utility of the database for airports by providing an automatically generated Airport Wildlife Strike Summary and Risk Analysis Report that provides this information, updated annually, without revealing the strike data for specific other airports.

The strategy was to provide airports with strike numbers and strike rates for the past year and mean numbers for the past 5 years (which inherently gives some trend information) without making direct comparisons with specific other airports. Instead, comparisons of strike rates for each airport are made with regional and national averages for all airports in their size class. Importantly, the report also documents the wildlife species that, based on past strike records, need to be emphasized in risk management activities.

#### **4.0. Airport Wildlife Strike Summary and Risk Analysis Report**

In 2006, ERAU was authorized to add a new report feature to the website to summarize wildlife strikes at each airport. A Wildlife Strike Summary and Risk Analysis Report has been created for all Part 139-certificated airports with strikes in the database for the previous five years. Through year 2006, there were 434 Part 139-certificated airports in the database (out of 575 Part 139-certificated airports in USA) that had wildlife strikes reported from 2002-2006. New reports will be generated yearly using data from the most recent 5 years.

##### **4.1. Authorized Airport Personnel Access to Report**

As noted above, the current system allows any airport to request a login and password that allows them to access their strike data since 1990. The new feature allows these airports also to access their custom Wildlife Strike Summary and Risk Analysis Report which summarizes data for the most recent 5 years. A link to the new report was placed on the existing web page each airport sees after log-in. Figure 1 shows a yellow button that links users to the Wildlife Strike Summary and Risk Analysis Report.

For Selected Airport: [Redacted]

Earliest Report: 02-08-1990    Latest Report: 09-26-2006

Last Update: 01-10-2007

Reports in Database: 1,446

Aircraft Types in Database: 72

Map Strikes on State Map or    Map Strikes on Airport Map

Go to State Mapping    Go to Airport Mapping

Airport Wildlife Strike Summary and Risk Analysis Report **NEW**

Show the Report

Select Only Those Criteria of Interest:

Airport [Redacted]    Airport Code [Redacted]

Date(s)

From: Month [Select] Day [Select] Year [Select]

To: Month [Select] Day [Select] Year [Select]

Figure 1 – Link to Airport’s Wildlife Strike Summary and Risk Analysis Report (airport name blacked out for privacy purposes).

#### 4.2. Part 1 of Report--Overview and Basic Statistics used in Report

Part I provides a short overview of the report structure in the context of the National Wildlife Strike Database. The basic statistics used in the report are then provided in a simple table. These statistics allow the airport to evaluate their wildlife management program by comparing the number of strikes and damaging strikes in the past year with that airport's most recent 5-year annual averages. Because the number of strikes will be affected by the amount of aircraft activity at an airport, the air carrier and GA aircraft movements<sup>1</sup> are shown for the past year and for the most recent 5-year annual average. These values are used in Part 2 of the report (described in section 4.3 below) to calculate strike rates. Figure 2 shows Part 1 of a Wildlife Strike Summary and Risk Analysis Report.

<sup>1</sup> Aircraft enplanement and movement data was obtained from the FAA’s APO Terminal Area Forecast Detail Reports <http://www.apo.data.faa.gov/wtaf>

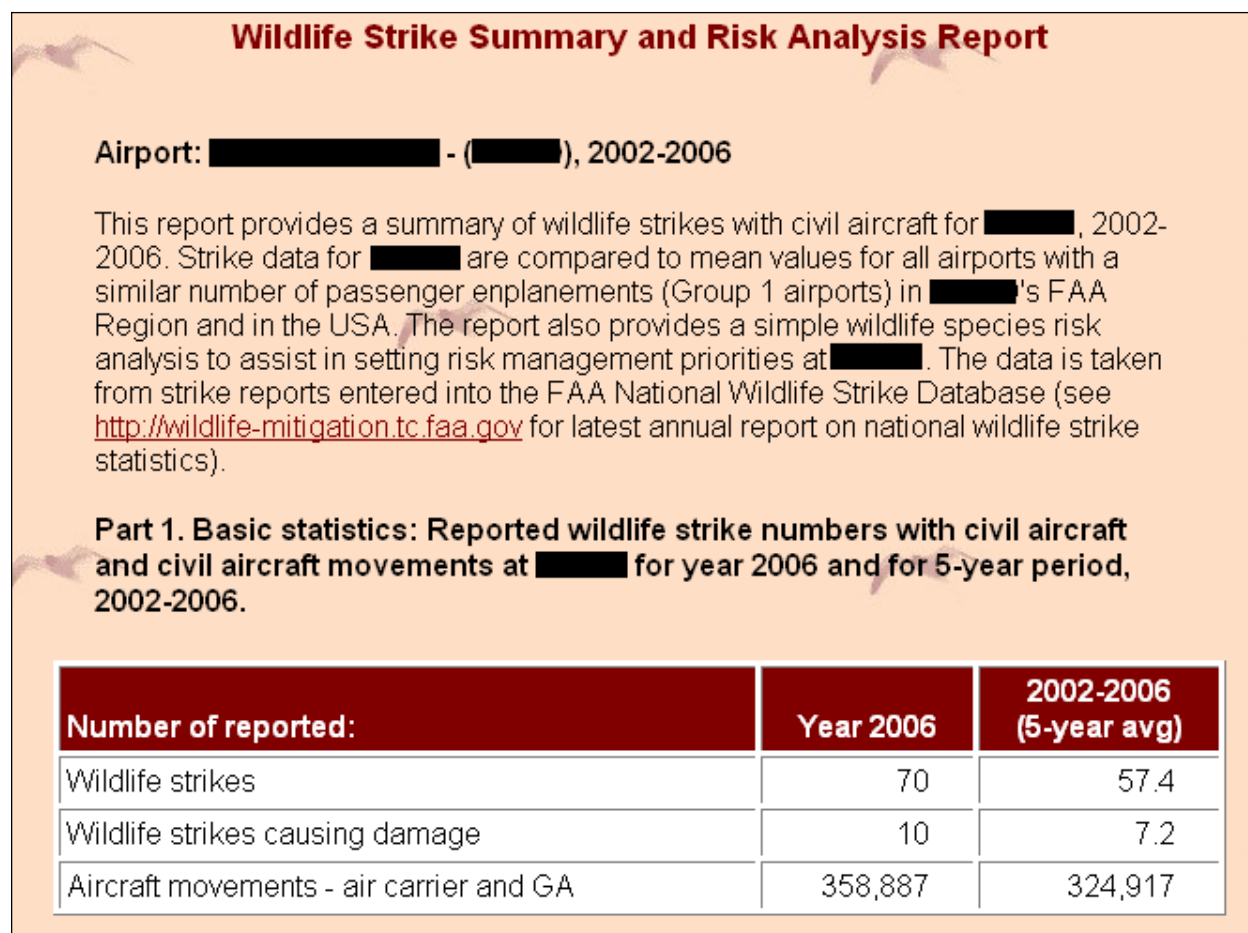


Figure 2 – Part I of the Airport’s Wildlife Strike Summary and Risk Analysis Report (airport name blacked out for privacy purposes).

#### **4.3. Part 2 of Report--Strike Rates per 100,000 Movements**

In Part 2 of the report, the number of strikes and number of damaging strikes at the airport in the most recent year are divided by the number of aircraft movements (in 100,000 movement units) to obtain strike rates per 100,000 movements. The same calculations are done for the average number of strikes and movements over the past 5 years to compare strike rates in the most recent year with the 5-year average. The airport then can compare their strike rates for all strikes and damaging strikes with the average rates for all airports of similar size in the same FAA region and all airports of a similar size in the USA.

Total enplanements at an airport in the most recent year are used to classify the airport into one of four size groups. Airports that handle 1% or more of all USA passenger enplanements at Part 139-certificated airports are considered Large Hub Primary Airports (Group 1)<sup>2</sup>. The airports handling less than 1% and at least 0.25% of all USA passenger enplanements are considered Medium Hub Primary Airports (Group 2)<sup>2</sup>. Airports handling less than 0.25% and at least 0.05% of USA passenger enplanements are considered Small Hub Primary Airports (Group 3)<sup>2</sup>. If an

<sup>2</sup> Federal Aviation Administration, National Plan of Integrated Airport Systems (2007-2011) pages 6-7

airport handles less than 0.05% of the total USA passenger enplanments, it is considered a Non-Hub Primary Airport (Group 4)<sup>2</sup>.

Comparisons are shown as the average of other airports within a similar enplanement category within the USA and the FAA region. The website protects each airport's strike history by only allowing an airport to access its own wildlife summary report. FAA administrators are allowed to view the reports for any of the airports and have access to additional pages that allow them to query for a given FAA region or USA state (see section 4.5 below). The general public is not given access to any of the wildlife summary reports. Figure 3 shows Part 2 of the Wildlife Summary Report.

**Part 2. Strike rates per 100,000 aircraft movements for [redacted] (a Group 1 airport) compared to strike rates for all Group 1 airports (i.e., airports with similar number of enplanements) in the FAA Region and in the USA.**

Strike category	Airport(s)	Strikes/100K movements		Comments
		Year 2006	2002-2006 (5-yr avg)	
All strikes	[redacted]	19.50	17.67	Strike rate at [redacted] in 2006 (19.50) was 10% above 5-year average at [redacted] (17.67)
All strikes	Group 1 airports in region	12.74	11.72	Strike rate at [redacted] in 2006 (19.50) was 53% above Group 1 average for region (12.74)
All strikes	Group 1 airports in USA	18.26	16.79	Strike rate at [redacted] in 2006 (19.50) was 7% above Group 1 average for the USA (18.26)
Damaging strikes	[redacted]	2.79	2.22	Damaging strike rate at [redacted] in 2006 (2.79) was 26% above 5-year average at [redacted] (2.22)
Damaging strikes	Group 1 airports in region	0.98	1.01	Damaging strike rate at [redacted] in 2006 (2.79) was 185% above Group 1 average for region (0.98)
Damaging strikes	Group 1 airports in USA	1.22	1.15	Damaging strike rate at [redacted] in 2006 (2.79) was 129% above Group 1 average for USA (1.22)

Figure 3 – Part II of the airport’s Wildlife Strike Summary and Risk Analysis Report (airport 3-letter ID blacked out for privacy purposes).

#### **4.4. Part 3 of Report—Wildlife Species Risk Analysis**

Part 3 of the Wildlife Summary Report looks at the wildlife species involved in damaging strikes at the airport during the most recent 5-year period. The species involved in damaging strikes are ranked according to the number of damaging strike incidents they caused. If a bird causing the damage was not identified to species or species group, the species was classified as “Unknown bird” in the database and in Part 3 of the Wildlife Summary Report.

This ranking is intended to assist an airport in prioritizing management activities and in developing or refining the airport's Wildlife Hazard Management Plan by focusing on those species known to pose a risk at the airport. However, this ranking is not meant to imply that all other wildlife species observed on or near the airport can be ignored. Some of these other species, because of their size or flocking behavior, may pose a risk that has not been identified in the database as damaging strikes at the specific airport. For example, a species actually may have caused a damaging strike at the airport that was not reported, or the species may have caused a damaging strike but was identified as "unknown bird". In addition, an airport simply may have been fortunate in that a hazardous species regularly observed on the airport over the past 5 years has not manifested itself yet in a damaging strike. Dolbeer et al. (2000) provide a ranking of wildlife species that are hazardous to aviation because of likelihood of causing damage when struck. Those species observed on an airport that have a high hazard ranking (e.g., deer, geese, ducks, large birds of prey), should be an important component of the airport's wildlife risk management program, even if they have not been reported as a damaging strike in the past 5 years.

Figure 4 shows an example ranking of species involved in damaging strikes at an airport. As noted in this example, the majority of bird species were identified as unknown species. Unfortunately, this is typical of many airports in the USA. The bird was identified to species or species group in only 48% of the 8,443 damaging bird strikes in the National Wildlife Strike Database from 1990-2006 (Cleary et al. 2007). Obviously, a problem that is not identified or measured cannot be solved. Appendix A describes procedures that airports and engine manufacturers can implement to improve bird species identification.

**Part 3. Wildlife species risk analysis based on damaging strikes at [REDACTED], 2002-2006<sup>a</sup>.**

Ranking of risk (2002-2006)	Species causing damaging strikes at [REDACTED]	2002-2006		2006 only	
		No. of damaging strikes	% of total	No. of damaging strikes	% of total
1	UNKNOWN BIRD	11	31	3	30
2	TURKEY VULTURE	5	14	1	10
3	SANDHILL CRANE	4	11	1	10
3	VULTURES	4	11	1	10
5	CATTLE EGRET	3	8	1	10
6	RED-TAILED HAWK	2	6		
7	BALD EAGLE	1	3	1	10
7	GREAT BLUE HERON	1	3		
7	GREAT HORNED OWL	1	3		
7	GULLS	1	3		
7	LESSER SCAUP	1	3	1	10
7	RING-BILLED GULL	1	3		
7	WHITE-TAILED DEER	1	3	1	10
	Total	36	100	10	100

<sup>a</sup>This ranking of wildlife species as to their risk to aviation safety at [REDACTED] is based on the species reported as causing damage to aircraft at and in the vicinity of [REDACTED] during the past 5 years. This ranking is intended to assist in prioritizing management activities and refining the airport's Wildlife Hazard Management Plan. However, this ranking is not meant to imply that all other wildlife species observed on or near [REDACTED] can be ignored. Some of these other species, because of their size or flocking behavior, may pose a risk that has not been identified (e.g., the species has caused a damaging strike that was not reported, the species has caused a damaging strike but was identified as "unknown bird"), or the species has not manifested itself yet in a damaging strike.

For questions and/or interpretation of the statistics presented in the above tables, please contact [Dr. Richard Dolbeer](#), USDA/Sandusky Field Station (OH).

Figure 4 – Ranking of species causing damaging strikes at an airport during the most recent 5 years (airport 3-letter ID blacked out for privacy purposes).

#### 4.5. Authorized FAA Personnel Access

Authorized FAA personnel are given an interface that allows them to view summary data about all the airports in a given FAA Region and State. This view of the data for all airports in a

geographical region would be inappropriate for non-FAA personnel as discussed above in Section 3.

After logging on to the wildlife hazard mitigation website, authorized FAA personnel are presented with a new link to the Wildlife Strike Summary and Risk Analysis Report (Figure 5). If a user selects an individual airport from the first pull-down menu, they will be presented with the same report that airports are shown. Figure 6 shows the page that will be presented to the user if they select one of the nine FAA Regions. The airports in the selected region are shown along with their strike and damaging strike statistics. All of the information on the page can be downloaded into Microsoft Excel for evaluation. If the FAA user selects one of the U.S. States, they will be presented with a page showing all the airports in that state with the strike statistics.

• **NEW** [Airport Wildlife Strike Summary and Risk Analysis Report](#) This report provides a summary of strike data for any selected Part 139 Certified airport for 2006 compared to mean values for that airport and for all Part 139 airports of the same group in the same FAA Region and in the USA for the 5-year period, 2002-2006. The report also provides a simple wildlife species risk analysis to assist in setting risk management priorities at the selected airport.

Please select from one of the 3 choices below:

All US  or FAA Region  or State

Figure 5 – Authorized FAA Personnel interface to the Airport Wildlife Strike Summary and Risk Analysis Reports.

**Airport Wildlife Strike Summary and Risk Analysis Report**

Group:      Region: ACE      State:

[Download Data File](#) (download a tab-delimited file suitable for importing into EXCEL)

A=2006 strikes/100,000 enplanements      B=2002-2006 strikes/100,000 enplanements  
 C=2006 damaging strikes/100,000 enplanements      D=2002-2006 damaging strikes/100,000 enplanements

Airport Id	Airport	Group	State	A	B	C	D
<a href="#">ID1</a>	AIRPORT1	4	IA	10.57	2.31	0	0
<a href="#">ID2</a>	AIRPORT2	4	IA	4.24	6.96	0	0.88
<a href="#">ID3</a>	AIRPORT3	4	NE	0	2.14	0	1.07

Figure 6. Authorized FAA Personnel view of airport wildlife strike statistics for 3 airports within FAA Eastern Region (AEA). In addition, a complete Wildlife Strike Summary and Risk Analysis report can be viewed and printed for each airport (airport 4-letter IDs and names not listed for privacy purposes).

## 5.0. Conclusions

Birds and other wildlife pose a dynamic risk problem for airports that must be continuously monitored so that efforts to manage the risk can be periodically evaluated and adjusted (Cleary and Dolbeer 2005). Wildlife populations may change seasonally and annually at an airport in response to weather, on- and off-airport land-use changes, adaptations to new food sources or resting sites, and other factors. As required by 14CFR Part 139.337, certificated airports experiencing wildlife-related risks to aviation must develop a wildlife hazard management plan and then annually evaluate the plan. The Wildlife Strike Summary and Risk Analysis Report, based on data from the National Wildlife Strike Database, provides airports with a new tool to aid in developing these management plans and with yearly evaluations of the plans' effectiveness. We encourage airports to provide feedback on the utility of the report and suggested improvements. Two keys to improving the quality of data in the reports are 1) improved reporting rates of wildlife strike incidents to the FAA for entering into the National Wildlife Strike Database, and 2) improved identification of birds involved in strikes to species level (see Appendix A).

## 6.0. Literature cited

Cleary, E. C. and R. A. Dolbeer. 2005. Wildlife hazard management at airports: A manual for airport personnel. 2<sup>nd</sup> edition. Federal Aviation Administration, Office of Airport Safety and Standards, Washington, D.C. USA. 348 pages.

Cleary, E. C., R. A. Dolbeer, and S. E. Wright. 2006. Wildlife strikes to civil aircraft in the United States, 1990-2005. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Serial Report No. 12, Washington, D.C. USA. 63 pages.

Cleary, E. C., R. A. Dolbeer, and S. E. Wright. 2007. Wildlife strikes to civil aircraft in the United States, 1990-2006. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Serial Report No. 13, Washington, D.C. USA. 60 pages.

Dolbeer, R. A., S. E. Wright, and E. C. Cleary. 2000. Ranking the hazard level of wildlife species to aviation. *Wildlife Society Bulletin* 28:372-378.

Dolbeer, R. A. 2006. Birds and aircraft compete for space in crowded skies. *ICAO Journal*. 61(3):21-24. International Civil Aviation Organization. Montreal, Canada.

Wright, S. E. and R. A. Dolbeer. 2005. Percentage of wildlife strikes reported and species identified under a voluntary system. *In Proceedings of Bird Strike Committee USA/Canada meeting*, Vancouver, B.C. Canada ([www.birdstrikecanada.com](http://www.birdstrikecanada.com)).

## **Appendix A. Reporting a wildlife strike to civil aircraft in USA and instructions to obtain identification of bird species involved in strike.**

Pilots, airport operations, aircraft maintenance personnel, and anyone else having knowledge of a bird or other wildlife strike should report the incident to the FAA using FAA Form 5200-7. Strikes can be reported electronically via the internet (<http://wildlife-mitigation.tc.faa.gov>) or Form 5200-7 can be accessed at the above website and printed for mailing in reports.

It is important to include as much information as possible on FAA Form 5200-7. All reports are carefully screened to identify duplicate reports prior to being entered into the database. Reports of the same incident filed by different people are combined and often provide a more complete record of the strike event than would be possible if just one report were filed.

The identification of the exact species of wildlife struck (e.g., ring-billed gull, Canada goose, mallard, mourning dove, red-tailed hawk, or white-tailed deer as opposed to gull, goose, duck, dove, hawk, or deer) is particularly important. This species information is critical for biologists developing and implementing wildlife risk management programs at airports. A problem that cannot be measured or defined cannot be solved. While the identification of the species involved in most terrestrial wildlife strikes, such as white-tailed deer or coyotes, is usually straightforward, species identification of strikes caused by birds can be challenging. There are over 600 species of birds in the USA. Furthermore, feather coloration and pattern vary with age, sex, and season for many species. Finally, only fragmentary remains often are available after a bird strike. Bird strike remains that cannot be identified by airport personnel can often be identified by a local biologist skilled in bird identification. If there is any question about the species identification, feather and other remains can be sent in a sealed plastic bag (with FAA Form 5200-7) to the Smithsonian Institution for identification, free-of-charge. Material should be sent to:

<b>Material sent via Express Mail Service:</b>	<b>Material sent via U.S. Postal Service:</b>
Feather Identification Laboratory Smithsonian Institution NHB, E610, MRC 116 10 <sup>th</sup> & Constitution Ave. NW Washington, D.C. 20560-0116 (Identify as “safety investigation material”) Phone# 202-633-0787 or 202-633-0791	Feather Identification Laboratory Smithsonian Institution, Division of Birds PO Box 37012 NHB, E610, MRC 116 Washington, D.C. 20013-7012 (Not recommended for priority cases)

Please send whole feathers whenever possible as diagnostic characteristics are often found in the downy barbules at the feather base. Wings, as well as breast and tail feathers should be sent whenever possible. Beaks, feet, bones, and talons are also useful diagnostic materials. Even blood smears or other body tissue can provide mitochondrial DNA for analysis. Do not send entire bird carcasses through the mail. However, photographs of the carcasses (from which the feathers or other parts will be removed and sent to Smithsonian) can be very useful supplemental documentation.