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Animal and Plant Health  
Inspection Service  
Wildlife Services



**Federal Aviation  
Administration**

# Wildlife Strikes to Civil Aircraft in the United States

1990-2006



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National Wildlife Strike Database  
Serial Report Number 13  
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Washington, DC  
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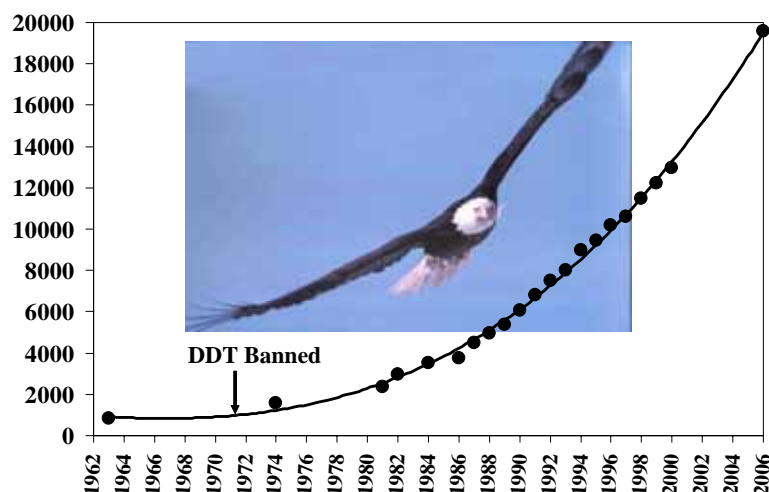
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## Cover

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An Embraer RJ 145 struck an American bald eagle at 600 feet AGL on final approach to an airport in Florida on 22 March 2006. The eagle penetrated the radome. Parts of the eagle also were ingested into one engine and struck the leading edge of wing. The aircraft landed safely and was taken out of service for inspection and repairs.

**Nesting Bald Eagle Population in Contiguous USA (1963-2006)**



The American bald eagle population has shown a remarkable recovery in the USA since the banning of DDT and other chlorinated-hydrocarbon pesticides in 1972. The nesting population of bald eagles in the 48 contiguous states has increased from less than 500 pairs in 1970 to an estimated 9,789 pairs (19,578 nesting adults) in 2006 (U.S. Fish and Wildlife Service, unpublished data).

Anyone with quality photographs of aircraft damage resulting from wildlife strikes or of wildlife at airports is encouraged to submit them to one of the authors for consideration in future wildlife strike publications.

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## Acknowledgments

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The database files and support programs used to enter and organize strike data initially were established by **E. LeBoeuf** and **J. Rapol**, Federal Aviation Administration (FAA), Office of Airport Safety and Standards, Washington, DC, and were subsequently updated by **A. M. Dickey** and **A. Newman**, Embry-Riddle Aeronautical University, Prescott, AZ. We greatly appreciate the assistance provided by these above-acknowledged professionals. **S. Agrawal** and **R. King**, FAA William J. Hughes Technical Center, Atlantic City, NJ, also provided critical support and advice. Finally, we acknowledge and thank all of the people who took the time and effort to report wildlife strikes — pilots, mechanics, control tower personnel, airport operations personnel, airline flight safety officers, U.S. Department of Agriculture Wildlife Services biologists, and many others.

Sponsorship and funds for the ongoing maintenance and analysis of the FAA Wildlife Strike Database are provided by the FAA, Office of Airport Safety and Standards, Washington, DC, and Airports Division, Airport Technology Branch, FAA William J. Hughes Technical Center, Atlantic City, NJ.

## **A short farewell from the senior author**

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A person much wiser than I once said, “If you cannot measure the problem, you cannot solve the problem.” I leave to the reports’ co-authors and my successors the responsibility of analyzing and publishing wildlife aircraft strike data for the civil aviation



This is my last annual report. I retired 3 August 2007. (Jomo Kenyatta International Airport, Nairobi, Kenya, September 2004)

community in the future — to help measure and to help solve the problem. Judging from the response to these reports, the civil aviation community has benefited from the past analyses and will continue to benefit from future efforts.

My last 12 years as the FAA’s Staff Wildlife Biologist have been the highlight of my 33 years of Federal service; 29 of which were spent dealing with human-wildlife conflicts. Dealing with wildlife aircraft strike problems is truly a specialty (aviation safety) within a specialty (human-wildlife conflicts) within a specialty (wildlife management) and involves both human management and wildlife

management. Working to protect human health, safety, and property — while at the same time preserving the natural and varied wildlife habitats and wildlife populations for the benefit and enjoyment of all — is always challenging, interesting, and rewarding. In no other area of wildlife management is the price of failure as high as when dealing with wildlife on airports. The potential for catastrophic loss of human life and property is staggering. In the United States, we have been successful and lucky. Since 1960, 82 civil aircraft have been destroyed and 125 people have died as a result of wildlife strikes. Seventy-nine of those deaths occurred with the loss of two commercial aircraft in the 1960s. Only 9 of the 125 deaths have occurred since 1990, all involving strikes with General Aviation aircraft. I believe my work, and that of others like me, has contributed to this success. I hope this success, and luck, continue.

I’ll not go gentle into that good night; nor rage against the dying of the light. It’ll be as one door closing and another opening. My wife and I will relocate to Indiana. I’ll do some consulting work, grow a few grapes, sit in the shade of my vineyard, and enjoy the fruits of my labors.

Ed Cleary  
FAA Staff Wildlife Biologist



## Preface

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A Beechcraft King Air departing a General Aviation airport in the Midwestern USA on 4 October 2006 struck a flock of ring-billed gulls during the take-off run. The pilot aborted the take-off and brought the aircraft to a safe stop. The aircraft suffered damage to multiple parts, including the engine nacelle, wing-root, leading edge of wings, and lights. Over 30 dead gulls were removed from the runway. Gulls are the group of birds most commonly struck by civil aircraft in USA. At least fourteen species of gulls were involved in strikes from 1990–2006, and multiple birds were involved in 25% of these reported strikes (Table 13).

The civil and military aviation communities widely recognize the threat to human health and safety from aircraft collisions with wildlife (wildlife strikes) is increasing (Dolbeer 2000, MacKinnon et al. 2001). Globally, wildlife strikes have killed more than 200 people and destroyed over 186 aircraft since 1988 (Richardson and West 2000; Thorpe 2003; 2005; Dolbeer, unpublished data). Several factors contribute to this increasing threat:

1. Commercial air carriers are replacing their older three- or four-engine aircraft fleets with more efficient and quieter, two-engine aircraft. In 1969, 75 percent of the 2,100 USA passenger aircraft had three or four engines. In 1998, the USA passenger fleet had grown to about 5,400 aircraft, and only 30 percent had three or four engines. It is estimated that by 2008 the fleet will contain about 7,000 aircraft, and only 10 percent will have three or four engines (Cleary and Dolbeer 2005). This reduction in engine redundancy increases the probability of life-threatening situations resulting from aircraft collisions with wildlife, especially with flocks of birds. In addition, previous research has indicated that birds are less able to detect and avoid modern jet aircraft with quieter engines (Chapter 3, International Civil Aviation Organization

1993) than older aircraft with noisier (Chapter 2) engines (Burger 1983, Kelly et al. 1999).

2. Many populations of wildlife species commonly involved in strikes have increased markedly in the last few decades. For example, from 1980 to 2005, the resident



A Canada goose feeds on bread at a park within ½ mile of an airport in the Great Lakes region of USA. Note the denuded vegetation and large accumulation of goose feces that has resulted from the public feeding birds in this park. Airports should work with local municipalities and nearby landowners to prohibit feeding of waterfowl and pigeons. Feeding waterfowl and pigeons near airports not only compromises aviation safety, but may create human health hazards associated with the feces (Photo by USDA).

(non-migratory) Canada goose population in the USA and Canada increased at a mean rate of 7.9 percent per year. Other species showing significant mean annual rates of increase included red-tailed hawks (1.9 percent), wild turkeys (12.7 percent), turkey vultures (2.2 percent), double-crested cormorants (4.9 percent), and sandhill cranes (4.3 percent) (Sauer et al. 2006). Thirteen of the 14 bird species in North America with mean body masses greater than 8 pounds have shown significant population increases over the past three decades (Dolbeer and Eschenfelder 2003). The white-tailed deer population increased from a low of about 350,000 in 1900 to at least 17 million by 1997 (McCabe and McCabe 1997).

3. Air traffic has increased substantially since 1980. Passenger enplanements in the USA increased from about 310 million in 1980 to 734 million in 2006 (3.4 percent per year), and commercial air traffic increased from about 18 million aircraft movements in 1980 to over 28 million in 2006 (1.8 percent per year) (Federal Aviation Administration 2007). USA commercial air traffic is predicted to continue growing at a rate of at least 2 percent per year to over 37 million movements by 2020.

As a result of these factors, experts within the Federal Aviation Administration (FAA), U.S. Department of Agriculture (USDA), and U.S. Air Force expect the risk, frequency, and potential severity of wildlife-aircraft collisions to escalate over the next decade.

The FAA has initiated several programs to address this important safety issue. Among the various programs is the collection and analysis of data from wildlife strikes. The FAA began collecting wildlife strike data in 1965. However, except for cursory examinations of the strike reports to determine general trends, the data were never submitted to rigorous analysis. In 1995, the FAA, through an interagency agreement

with the USDA, 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 the USDA/WS (1) edit all strike reports (FAA Form 5200-7, *Bird/Other Wildlife Strike Report*) received by the FAA since 1990 to ensure consistent, error-free data; (2) enter all edited strike reports in 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



On final approach at sunset into an eastern USA airport on 1 October 2006, a Gulfstream V corporate jet struck a flock of 16 Canada geese at 50 feet AGL. The aircraft was able to land safely, but sustained \$5 million in damage to #1 engine and right wing. Aircraft was out of service for 1 week. The resident Canada goose population in USA increased from about 1 million to 3.5 million birds, 1990-2006.

the production of annual reports summarizing the results of analyses of the data from the National Wildlife Strike Database. Such analyses are critical to determining 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 analyses provides the foundation for refinements in the development, implementation, and justification of integrated research and management efforts to reduce wildlife strikes.

The first annual report on wildlife strikes to civil aircraft in the USA, covering 1994, was completed in

November 1995 (Dolbeer et al. 1995). Since then we have published subsequent reports covering the years 1993–1995, 1992–1996, 1991–1997, 1990–1998, 1990–1999, 1990–2000, 1990–2001, 1990–2002, 1990–2003, 1990–2004, and 1990–2005 (Cleary et al. 1996, 1997, 1998, 1999, 2000, 2002a, 2002b, 2003, 2004, 2005, 2006). This is the 13<sup>th</sup> report in the series and covers the 17-year period, 1990–2006.

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# Wildlife Strikes to Civil Aircraft in the United States, 1990–2006

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A great horned owl was ingested into the #2 engine of a Boeing-737 departing a western USA airport on 26 November 2006 at 0048 hours. The pilot had to shut the damaged engine down and make an emergency landing with 1 engine.

## Introduction

This report presents a summary analysis of data from the FAA's National Wildlife Strike Database for the 17-year period 1990 through 2006. Unless noted, all totals are for the 17-year period, and percentages are of the total known. Because of the large amount of data, Tables 2 through 16 present 17-year totals only and do not display data for individual years from 1990 through 2006.

A sample of significant wildlife strikes to civil aircraft in the USA during 2006 is presented in Appendix A. These recent strike examples demonstrate the widespread and diverse nature of the problem.



## Results

### Number of Reported Strikes

For the 17-year period (1990–2006), 73,526 strikes were reported to the FAA. Birds were involved in 97.5 percent of the reported strikes, terrestrial mammals in 2.2 percent, bats in 0.2 percent, and reptiles in 0.1 percent (Table 1).



An American bald eagle perches on small hill at an eastern USA airport in April 2007. As with many other species of large birds whose populations have increased, bald eagles are adapting to urban areas and increasingly found in airport environments. The U. S. Fish and Wildlife Service declared in July 2007 the bald eagle to be no longer threatened or endangered in the USA. Photo by J. Smith, USDA

The number of strikes annually reported quadrupled from 1,743 in 1990 to 7,089 in 2006 (Table 1, Figure 1). We suggest this increase in strike reports is the results of several factors: an increased awareness of the wildlife strike issue, an increase in aircraft operations, an increase in populations of hazardous wildlife species, and an increase in the number of strikes (Dolbeer 2000, Dolbeer and Eschenfelder 2003). The temporary plateau in reported strikes from 2000–2003 may be related to a slight (less than 6 percent) decline in air traffic after the events of September 2001.

### Methods of Reporting Strikes

Most (65 percent) of the 73,526 strike reports were filed using the paper (50 percent) or electronic (15 percent) version of FAA Form 5200-7, *Bird/Other Wildlife Strike Report*. Since the online version of this form became available in April 2001, use of the electronic reporting system has climbed dramatically. In 2006, 47 percent of the strike reports were submitted electronically (Table 2).

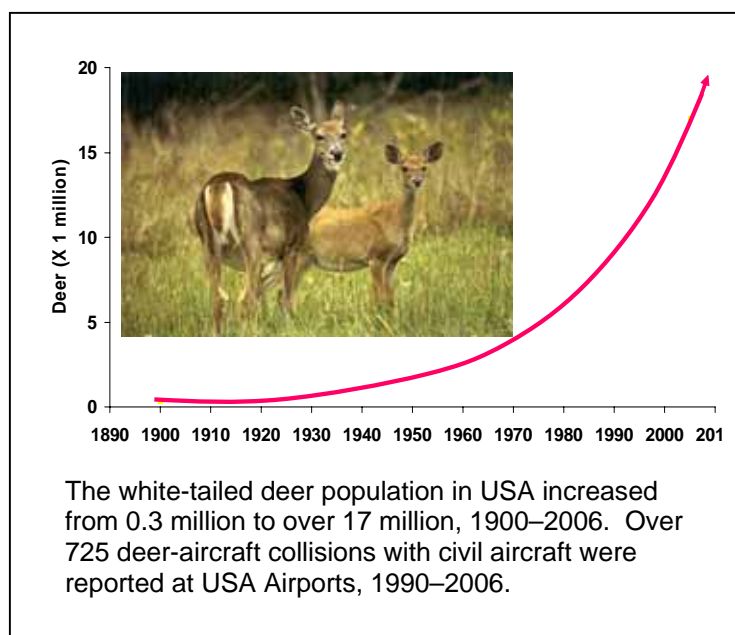
### Source of Reports

Airline personnel and pilots filed 31 percent and 25 percent of the strike reports, respectively (Table 3). About 85 percent of the reported strikes involved commercial aircraft; the remainder involved business, private, and government aircraft (Table 4). Reports were received from all 50 states, from some USA territories, and from foreign countries when USA-registered aircraft were involved (Table 5). California, Florida, and Texas had the most (6,184, 4,710, and 4,608, respectively) bird strike reports. Eighteen other states each had more than 1,000 bird strikes reported. New York, California,

Illinois, New Jersey, Texas, Michigan, and Colorado each had 70 or more terrestrial mammal strikes. In all, strikes were reported at 1,569 airports (1,365 airports in the USA and 204 foreign airports where USA-registered aircraft were involved).

## Timing of Occurrence of Strikes

Most bird strikes (51 percent) occurred between July and October (Table 6); 63 percent occurred during the day (Table 7); 60 percent occurred during the landing (descent, approach, or landing roll) phase of flight; and 37 percent occurred during takeoff and climb (Table 8). About 60 percent of the bird strikes occurred when the aircraft was at a height of 100 feet or less above ground level (AGL), 73 percent occurred at 500 feet or less AGL, and 93 percent occurred at or below 3,000 feet AGL (Table 9).



Most terrestrial mammal strikes (58 percent) occurred between July and November with 33 percent of deer strikes concentrated in October–November (Table 6). Most terrestrial mammal strikes (64 percent) occurred at night (Table 7), 55 percent occurred during the landing roll, and 34 percent occurred during the takeoff run. About 8 percent of the reported terrestrial mammal strikes occurred while the aircraft was in the air, e.g., when the aircraft struck deer with the landing gear (Table 8).

## Aircraft Components Damaged

The aircraft components most commonly reported as struck by birds were the nose/radome, windshield, engine, wing/rotor, and fuselage (Table 10). Aircraft engines were the component most frequently reported as being damaged by bird strikes (32 percent of all damaged components). There were 9,448 strike events in which a total of 9,938 engines were reported as struck (8,979 events with one engine struck, 453 with two engines struck, 11 with three engines struck, and 5 with four engines struck). In 3,087 damaging bird strike events involving engines, a total of 3,185 engines were damaged (2,990 events with one engine damaged, 96 with two engines damaged, and 1 with three engines damaged).

Aircraft components most commonly reported as struck by terrestrial mammals were the landing gear, propeller, and wing/rotor. These same components ranked highest for the parts most often reported as damaged by mammals (Table 10).

## Reported Damage and Effect-on-Flight

Of the 71,670 bird strikes reported, 58,303 provided some indication as to the nature and extent of any damage. Of these 58,303 reports, 49,884 (86 percent) indicated the strike did not damage the aircraft; 4,505 (8 percent) indicated the aircraft suffered minor damage; 2,249 (4 percent) indicated the aircraft suffered substantial damage; 1,650 (3 percent) reported an uncertain level of damage; and 15 reports (less than 1 percent) indicated the aircraft was destroyed as a result of the strike (Table 11).

Of the 1,569 terrestrial mammal strikes reported, 1,094 reports provided some indication as to the nature and extent of any damage. Of these 1,094 reports, 410 (37 percent) indicated the strike did not damage the aircraft; 303 (28 percent) indicated the aircraft suffered minor damage; 308 (28 percent) indicated the aircraft suffered substantial damage; 52 (5 percent) reported an uncertain level of damage; and 21 (2 percent) indicated the aircraft was destroyed as a result of the strike (Table 11). Not surprisingly, a much

higher percentage of terrestrial mammal strikes (63 percent) resulted in aircraft damage than did bird strikes (14 percent). Deer (729 strikes) were involved in 46 percent of the 1,569 terrestrial mammal strikes.



A flock of European starlings descends toward a grassy area at an eastern USA airport in December 2006 to feed on insects and weed seeds. Maintaining grass at 6-10 inches may help deter starlings by making it more difficult to forage and to maintain inter-flock communication. Photo by J. Smith, USDA.

In 13 percent and 55 percent of the bird and terrestrial mammal strike reports, respectively, an adverse effect-on-flight was reported (Table 12). Three percent of bird strikes resulted in an aborted takeoff compared to 18 percent of terrestrial mammal strikes.



## Wildlife Species Involved in Strikes

Table 13 shows the number of reported strikes, strikes causing damage, strikes having a negative effect-on-flight, strikes involving more than 1 animal, the reported aircraft down time, and the reported costs by identified wildlife species for the 17-year period, 1990 through 2006.

Only 30,449 (42 percent) of the 71,670 bird strike reports provided information on the type of bird (e.g., gull or hawk). Furthermore, only 18,127 (60 percent) of these 30,449



An Airbus 320 on final approach at an eastern USA airport on 1 March 2006 flew through a large flock of European starlings at 100 feet AGL, resulting in multiple strikes to the front of aircraft including both engines. Over 270 starling carcasses were removed from the runway threshold. The #1 engine was removed to repair damage. The aircraft was out of service for 24 hours.

reports provided identification to species level (e.g., ring-billed gull or red-tailed hawk; Table 13). Thus, birds were identified to species level in only 25 percent of the 71,670 reported bird strikes. In all, 355 identified species of birds were struck; 161 identified species were reported as causing damage.

Gulls (22 percent), doves/pigeons (14 percent), raptors (13 percent), and waterfowl (9 percent) were the most frequently struck bird groups (Table 14). Gulls were involved in 2.4 times more strikes than waterfowl (6,587 and 2,775, respectively). Waterfowl, however, were involved in more damaging

strikes (1,255 or 31 percent of all damaging strikes in which the bird type was identified) than were gulls (1,059 or 26 percent of all damaging strikes in which the bird type was identified). Gulls were responsible for the greatest number of bird strikes (842 or 28 percent) that had a negative effect-on-flight.

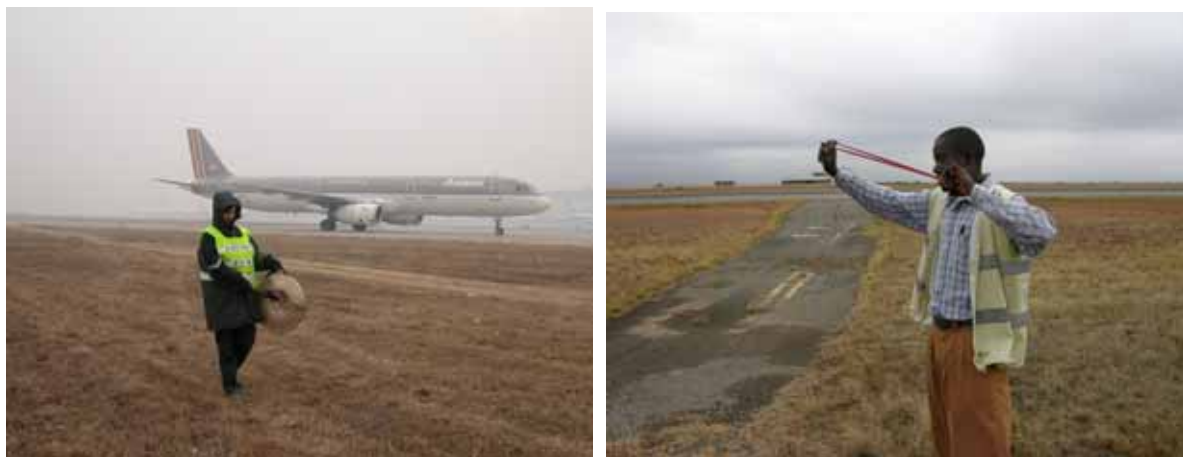
The most frequently struck terrestrial mammals were Artiodactyls — primarily deer (49 percent) — and Carnivores — primarily coyotes (31 percent) (Tables 13, 14). Artiodactyls were responsible for 93 percent of the mammal strikes that resulted in damage and 82 percent of the mammal strikes that had a negative effect-on-flight. In all, 35 identified species of terrestrial mammals and 5 identified species of bats were reported struck; 18 identified species of terrestrial mammals and 1 identified species of bat caused damage (Table 13).

## Human Fatalities and Injuries Due to Wildlife Strikes

For the 17-year period, reports were received of 7 wildlife strikes that resulted in 9 human fatalities (Table 15). Five of these strikes resulting in 7 fatalities involved unidentified species of birds. White-tailed deer and a brown-pelican each caused 1 fatality. Reports were received of 147 strikes that resulted in 185 human injuries. Waterfowl (36 strikes), vultures (21 strikes), and large mammals — primarily deer (20 strikes) caused 65 percent of the 119 strikes resulting in injuries in which the species was identified (Table 15).

## Economic Losses Due to Wildlife Strikes

For the 17-year period, reported losses from bird strikes totaled 330,349 hours of aircraft downtime and \$257.6 million in monetary losses. Reported losses from terrestrial mammal strikes totaled 204,157 hours of aircraft downtime and \$35.5 million



**Left.** A member of the bird patrol team at Beijing International Airport, China uses a gong to scare flocks of migrating birds attempting to feed on the airport in January 2006. Photo by R. Dolbeer, USDA. **Right.** A wildlife control specialist at Nairobi International Airport, Kenya, uses a slingshot to repel birds, September 2004. Photo by E. Cleary, FAA. Such simple techniques deployed by trained and dedicated personnel can be effective in dispersing birds from an airport. U.S. air carriers reported 1,480 wildlife strikes at 204 foreign airports from 1990-2006

in monetary losses. Bat strikes resulted in 100 hours of aircraft downtime and \$3.2 million in losses. Reptile strikes resulted in 3 hours of aircraft downtime (Table 13).

Of the 13,150 reports that indicated the strike had an adverse effect on the aircraft and/or flight, 3,579 provided an estimate of the aircraft down time ( $\Sigma = 534,609$  hours, avg. = 149.4 hours down time/incident, Table 16). Of the reports providing a damage cost estimate for the incident, 2,258 gave an estimate of the direct aircraft damage cost ( $\Sigma = \$260$  million, avg. = \$115,000 damage/incident), and 883 gave an estimate of other monetary losses ( $\Sigma = \$36$  million, avg. = \$41,000 lost/incident). Other monetary losses include such expenses as lost revenue, the cost of putting passengers in hotels, re-scheduling aircraft, and flight cancellations.

Analysis of strike reports from USA airports and airlines indicated that less than 20 percent of all strikes were reported to the FAA (Cleary et al. 2005, Wright and Dolbeer 2005). Additionally, only 17 percent of reports indicating an adverse effect provided estimates of direct costs, and only 7 percent provided estimates of other (indirect) costs. Furthermore, many reports providing cost estimates were filed before aircraft damage and downtime had been fully assessed. As a result, the information on the number of strikes and associated costs compiled from the voluntary reporting program (summarized in Table 13) is believed to severely underestimate the magnitude of the problem.



This SA227 Metroliner struck a common goldeneye (a 2.2-lb duck) at 600 feet AGL on departure from a western USA airport on 2 March 2006. The bird penetrated right wing of aircraft. Pilot declared an emergency, returned to airfield and landed without incident. Aircraft required extensive repair. Feather remains were sent to the Smithsonian Institution where the species was identified.

Assuming (1) all 13,150 reported wildlife strikes that had an adverse effect on the aircraft and/or flight engendered similar amounts of downtime and/or monetary losses and (2) these reports are all of the damaging strikes that occurred, then at a minimum, wildlife strikes cost the USA civil aviation industry 115,545 hours per year of aircraft downtime and \$121 million in monetary losses (\$89 million per year in direct costs and \$32 million per year in associated costs, Table 16).

Further, assuming a 20-percent reporting rate, the annual cost of wildlife strikes to the USA civil aviation industry is estimated to be in excess of 577,725 hours of

aircraft downtime and \$603 million in monetary losses (\$455 million per year in direct costs and \$158 million per year in associated costs, Table 16).

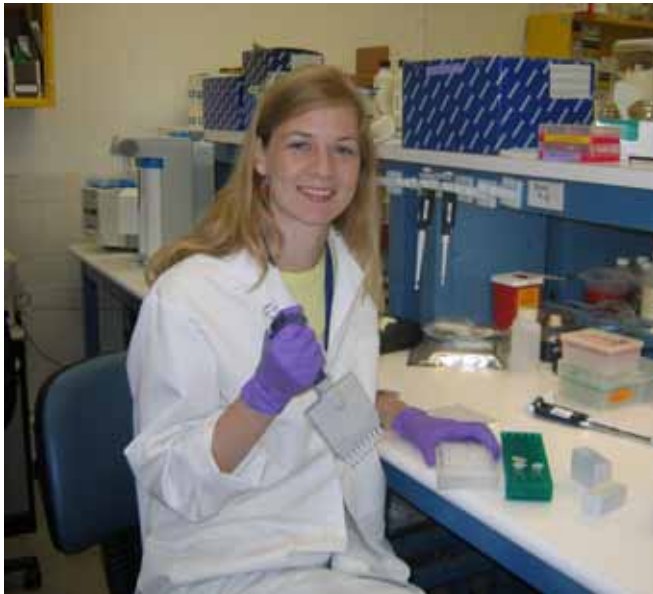
## Conclusions

An analysis of 17 years of strike data reveals the magnitude and severity of the wildlife-aircraft strike problem for civil aviation in the USA. Wildlife strikes continue to pose a significant economic and safety risk. Management actions to reduce wildlife strikes are being implemented at many airports (e.g., Wenning et al. 2004, DeFusco et al. 2005), but much work remains to be done to reduce wildlife strikes.

To address the problem, airport managers first need to assess the wildlife hazards on their airports (Dolbeer et al. 2000). They then must take appropriate actions, under the guidance of professional biologists trained in wildlife damage management, to minimize

the problems. The aviation community must also widen its view of airport wildlife management needs to consider habitats and land uses in proximity to the airport. Wetlands, dredge spoil containment areas, waste-disposal facilities, and wildlife refuges can attract hazardous wildlife. Such land uses are often incompatible with aviation safety and should either be prohibited near airports or designed and operated in a manner that minimizes the attraction of hazardous wildlife.

The manual *Wildlife Hazard Management at Airports* (Cleary and Dolbeer 2005) provides guidance to airport personnel in developing and implementing wildlife hazard management plans. Adobe Acrobat® PDF versions of the manual are available online in English, Spanish, and French (<http://wildlife-mitigation.tc.faa.gov/>).



A molecular biologist at the Smithsonian Feather Lab uses DNA 'barcoding' to identify bird strike remains from blood or tissue samples. DNA analysis provides an additional means for accurate identification of bird strike remains, especially when no feathers are present in the sample. About half of the bird strike remains received at the Smithsonian are submitted for DNA testing with some 68% resulting in identification to the species level. Enhancements in field collecting techniques will improve the identification rate. Photo by C. Dove, Smithsonian

Finally, there is a need for increased and more detailed reporting of wildlife strikes. For example, our previous analyses (Cleary et al. 2005, Wright and Dolbeer 2005) indicated less than 20 percent of all wildlife strikes involving USA civil aircraft are reported. Further, only about 42 percent of all reported bird strikes for 1990 through 2006 provided information on the type of bird struck, and only about 25 percent of the reports identified the birds struck to species level. In addition, only 17 percent of strike reports indicating an adverse effect on the aircraft or flight provided at least a partial estimate of economic losses resulting from the strike.

### **Reporting a Strike and Identifying Species of Wildlife Struck**

Pilots, airport operations, aircraft maintenance personnel, and anyone

else having knowledge of a 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 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, or red-tailed hawk as opposed to gull, goose, duck, dove, or hawk) is particularly important. This species information is critical for biologists developing and implementing wildlife risk management programs at airports because a problem that cannot be measured or defined cannot be solved. Bird strike remains that cannot be identified by airport personnel can often be identified by a local biologist trained in ornithology or by sending feather and other remains in a sealed plastic bag (with FAA Form 5200-7) to the Smithsonian:

| <b>Material sent via Express Mail Service:</b>                                                                                                                                                                                                    | <b>Material sent via U.S. Postal Service:</b>                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Feather Identification Laboratory<br>Smithsonian Institution<br>NHB, E610, MRC 116<br>10 <sup>th</sup> & Constitution Ave. NW<br>Washington DC 20560-0116<br>(Identify as "safety investigation material")<br>Phone# 202-633-0787 or 202-633-0791 | Feather Identification Laboratory<br>Smithsonian Institution, Division of Birds<br>PO Box 37012<br>NHB, E610, MRC 116<br>Washington DC 20013-7012<br>(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 can provide material for DNA 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. Additional information on sending bird remains to the Smithsonian is available at <http://wildlife-mitigation.tc.faa.gov>.

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## Tables

Table 1. Number of reported wildlife strikes to civil aircraft by wildlife group, USA, 1990–2006 (see Figure 1).

| Year         | Number of reported strikes—all aircraft |            |                     |           |                    | Commercial aircraft only <sup>1</sup> |                                      |                          |
|--------------|-----------------------------------------|------------|---------------------|-----------|--------------------|---------------------------------------|--------------------------------------|--------------------------|
|              | Birds                                   | Bats       | Terrestrial mammals | Reptiles  | Total              | Total                                 | Movements (x 1 million) <sup>2</sup> | Strikes/10,000 movements |
| 1990         | 1,722                                   | 4          | 17                  | 0         | 1,743              | 1,317                                 | 25.11                                | 0.524                    |
| 1991         | 2,127                                   | 3          | 36                  | 0         | 2,166              | 1,648                                 | 24.82                                | 0.664                    |
| 1992         | 2,260                                   | 2          | 56                  | 1         | 2,319              | 1,709                                 | 25.22                                | 0.678                    |
| 1993         | 2,284                                   | 6          | 53                  | 0         | 2,343              | 1,670                                 | 25.61                                | 0.652                    |
| 1994         | 2,339                                   | 2          | 73                  | 1         | 2,415              | 1,784                                 | 26.63                                | 0.670                    |
| 1995         | 2,497                                   | 5          | 69                  | 8         | 2,579              | 1,874                                 | 27.13                                | 0.691                    |
| 1996         | 2,688                                   | 1          | 91                  | 3         | 2,783              | 1,935                                 | 27.62                                | 0.700                    |
| 1997         | 3,351                                   | 1          | 92                  | 14        | 3,458              | 2,456                                 | 27.80                                | 0.883                    |
| 1998         | 3,658                                   | 3          | 105                 | 7         | 3,773              | 2,522                                 | 28.05                                | 0.899                    |
| 1999         | 5,002                                   | 7          | 89                  | 1         | 5,099              | 3,851                                 | 28.81                                | 1.337                    |
| 2000         | 5,872                                   | 16         | 120                 | 3         | 6,011              | 4,483                                 | 29.57                                | 1.516                    |
| 2001         | 5,645                                   | 8          | 136                 | 8         | 5,797 <sup>3</sup> | 4,162                                 | 29.22                                | 1.424                    |
| 2002         | 6,044                                   | 19         | 119                 | 15        | 6,197              | 4,401                                 | 27.65                                | 1.592                    |
| 2003         | 5,855                                   | 20         | 126                 | 5         | 6,006              | 4,286                                 | 27.94                                | 1.534                    |
| 2004         | 6,398                                   | 27         | 118                 | 6         | 6,549              | 4,689                                 | 28.94                                | 1.620                    |
| 2005         | 7,035                                   | 27         | 130                 | 7         | 7,199              | 5,173                                 | 29.23                                | 1.770                    |
| 2006         | 6,893                                   | 48         | 139                 | 9         | 7,089 <sup>4</sup> | 4,879                                 | 28.32                                | 1.723                    |
| <b>Total</b> | <b>71,670</b>                           | <b>199</b> | <b>1,569</b>        | <b>88</b> | <b>73,526</b>      | <b>52,839</b>                         | <b>467.67</b>                        | <b>1.130</b>             |

<sup>1</sup> See Table 4.

<sup>2</sup> Departures and arrivals by air carrier, commuter, and air taxi service (FAA 2006).

<sup>3</sup> The decline in reported strikes in 2001 was likely related to the decrease in air travel after 11 September. There was a 9-percent increase in the number of reported strikes for January–August 2001 compared to the same months in 2000; there was a 24 percent decline in reported strikes for September–December 2001 compared to the same months in 2000.

<sup>4</sup> The slight decline in strikes reported to the FAA for 2006 may be due to a major air carrier's reduced strike reporting because of personnel reductions.

Table 2. Source of information for reported wildlife strikes to civil aircraft, USA, 1990–2006.

| Source                                     | 17-year total | % of total known |
|--------------------------------------------|---------------|------------------|
| FAA Form 5200-7 <sup>1</sup> (Paper)       | 36,707        | 50               |
| FAA Form 5200-7E <sup>2</sup> (Electronic) | 11,037        | 15               |
| Airline report                             | 11,203        | 15               |
| Multiple <sup>3</sup>                      | 6,530         | 9                |
| Airport report                             | 3,860         | 5                |
| Other <sup>4</sup>                         | 1,402         | 2                |
| Preliminary Aircraft Incident Report       | 882           | 1                |
| Engine manufacturer                        | 818           | 1                |
| Aircraft Incident Report                   | 771           | 1                |
| Aviation Safety Reporting System           | 179           | <1               |
| National Transportation Safety Board       | 71            | <1               |
| Aircraft Incident Preliminary Notice       | 66            | <1               |
| <b>Total</b>                               | <b>73,526</b> | <b>100</b>       |

<sup>1</sup> Bird/Other Wildlife Strike Report

<sup>2</sup> Electronic filing of reports (<http://wildlife-mitigation.tc.faa.gov>) began in April 2001. In 2001, 0.4 percent of reports were filed electronically compared to 20 percent in 2002, 28 percent in 2003, 32 percent in 2004, 38 percent in 2005, and 47 percent in 2006.

<sup>3</sup> More than one type of report was filed for the same strike.

<sup>4</sup> Various sources, such as news media and Commercial Incident Reports.

Table 3. Person filing report of wildlife strike to civil aircraft, USA, 1990–2006.

| Person filing report       | 17-year total | % of total known |
|----------------------------|---------------|------------------|
| Airline Operations         | 17,791        | 31               |
| Pilot                      | 14,302        | 25               |
| Carcass Found <sup>1</sup> | 9,759         | 17               |
| Tower                      | 8,031         | 14               |
| Airport Operations         | 6,383         | 11               |
| Other                      | 1,794         | 3                |
| <b>Total known</b>         | <b>58,060</b> | <b>100</b>       |
| <b>Unknown</b>             | <b>15,466</b> |                  |
| <b>Total</b>               | <b>73,526</b> |                  |

<sup>1</sup> Airport personnel found wildlife remains within 200 feet of a runway centerline that appeared to have been struck by aircraft and no strike was reported by pilot, tower, or airline.

Table 4. Number of reported wildlife strikes to civil aircraft by type of operator, USA, 1990–2006.

| Type of operator   | 17-year total | % of total known |
|--------------------|---------------|------------------|
| Commercial         | 52,839        | 85               |
| Business           | 7,228         | 12               |
| Private            | 1,850         | 3                |
| Government/Police  | 378           | <1               |
| <b>Total known</b> | <b>62,295</b> | <b>100</b>       |
| <b>Unknown</b>     | <b>11,231</b> |                  |
| <b>Total</b>       | <b>73,526</b> |                  |

Table 5. Number of reported bird, bat, terrestrial mammal, and reptile strikes to civil aircraft by USA state, including the District of Columbia (DC), Puerto Rico (PR), USA-possessed Pacific Islands (PI), and the U.S. Virgin Islands (VI), 1990–2006.

| State | Reported strikes (17-year total) |      |                 |               |       | State                          | Reported strikes (17-year total) |      |                 |               |       |
|-------|----------------------------------|------|-----------------|---------------|-------|--------------------------------|----------------------------------|------|-----------------|---------------|-------|
|       | Birds                            | Bats | T. mam-<br>mals | Rep-<br>tiles | Total |                                | Birds                            | Bats | T. mam-<br>mals | Rep-<br>tiles | Total |
| AK    | 512                              | 1    | 24              | 0             | 537   | NC                             | 1,246                            | 2    | 28              | 0             | 1,276 |
| AL    | 610                              | 2    | 11              | 0             | 623   | ND                             | 212                              | 0    | 11              | 0             | 223   |
| AR    | 278                              | 1    | 15              | 0             | 294   | NE                             | 741                              | 5    | 14              | 0             | 760   |
| AZ    | 1,081                            | 23   | 49              | 0             | 1,153 | NH                             | 406                              | 7    | 7               | 0             | 420   |
| CA    | 6,184                            | 0    | 85              | 0             | 6,269 | NJ                             | 1,913                            | 2    | 80              | 9             | 2,004 |
| CO    | 2,097                            | 5    | 75              | 0             | 2,177 | NM                             | 166                              | 0    | 15              | 0             | 181   |
| CT    | 736                              | 1    | 17              | 0             | 754   | NV                             | 354                              | 0    | 4               | 0             | 358   |
| DC    | 1,718                            | 2    | 37              | 0             | 1,757 | NY                             | 3,912                            | 4    | 113             | 21            | 4,050 |
| DE    | 61                               | 0    | 1               | 0             | 62    | OH                             | 2,268                            | 4    | 69              | 0             | 2,341 |
| FL    | 4,710                            | 6    | 58              | 46            | 4,820 | OK                             | 604                              | 0    | 26              | 2             | 632   |
| GA    | 1,136                            | 2    | 23              | 0             | 1,161 | OR                             | 1,165                            | 1    | 8               | 0             | 1,174 |
| HI    | 1,588                            | 0    | 8               | 0             | 1,596 | PA                             | 2,410                            | 4    | 65              | 0             | 2,479 |
| IA    | 477                              | 0    | 17              | 0             | 494   | PI                             | 135                              | 0    | 0               | 0             | 135   |
| ID    | 180                              | 0    | 7               | 0             | 187   | PR                             | 125                              | 2    | 0               | 5             | 132   |
| IL    | 3,346                            | 4    | 82              | 1             | 3,433 | RI                             | 313                              | 1    | 9               | 0             | 323   |
| IN    | 868                              | 2    | 21              | 0             | 891   | SC                             | 330                              | 0    | 17              | 0             | 347   |
| KS    | 217                              | 1    | 6               | 0             | 224   | SD                             | 121                              | 0    | 11              | 0             | 132   |
| KY    | 1,851                            | 4    | 17              | 0             | 1,872 | TN                             | 2,051                            | 1    | 19              | 0             | 2,071 |
| LA    | 1,174                            | 3    | 19              | 2             | 1,198 | TX                             | 4,608                            | 60   | 77              | 0             | 4,745 |
| MA    | 939                              | 0    | 20              | 0             | 959   | UT                             | 911                              | 2    | 14              | 0             | 927   |
| MD    | 795                              | 5    | 53              | 0             | 853   | VA                             | 945                              | 0    | 55              | 0             | 1,000 |
| ME    | 211                              | 0    | 11              | 0             | 222   | VI                             | 89                               | 0    | 0               | 0             | 89    |
| MI    | 1,709                            | 10   | 76              | 1             | 1,796 | VT                             | 69                               | 0    | 2               | 0             | 71    |
| MN    | 648                              | 5    | 20              | 0             | 673   | WA                             | 1,075                            | 1    | 13              | 0             | 1,089 |
| MO    | 1,499                            | 4    | 29              | 0             | 1,532 | WI                             | 580                              | 1    | 46              | 0             | 627   |
| MS    | 232                              | 0    | 7               | 0             | 239   | WV                             | 169                              | 0    | 49              | 0             | 218   |
| MT    | 98                               | 0    | 8               | 0             | 106   | WY                             | 64                               | 0    | 5               | 0             | 69    |
|       |                                  |      |                 |               |       | <b>Total known<sup>1</sup></b> |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>Foreign<sup>2</sup></b>     |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>Unknown</b>                 |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>Total</b>                   |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>61,937</b>                  |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>178</b>                     |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>1,553</b>                   |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>87</b>                      |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>63,755</b>                  |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>1,465</b>                   |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>7</b>                       |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>8</b>                       |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>0</b>                       |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>1,480</b>                   |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>8,268</b>                   |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>14</b>                      |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>8</b>                       |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>1</b>                       |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>8,291</b>                   |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>71,670</b>                  |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>199</b>                     |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>1,569</b>                   |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>88</b>                      |                                  |      |                 |               |       |
|       |                                  |      |                 |               |       | <b>73,526</b>                  |                                  |      |                 |               |       |

<sup>1</sup> Strikes were reported at 1,365 airports in the USA.

<sup>2</sup> Strikes to USA air carriers were reported at 204 foreign airports.

Table 6. Number of reported bird and terrestrial mammal strikes to civil aircraft by month, USA, 1990–2006<sup>1</sup>.

| Month        | All birds     |                  | All terrestrial mammals |                  | Deer only <sup>2</sup> |                  |
|--------------|---------------|------------------|-------------------------|------------------|------------------------|------------------|
|              | 17-year total | % of total known | 17-year total           | % of total known | 17-year total          | % of total known |
| Jan          | 2,722         | 4                | 86                      | 5                | 34                     | 5                |
| Feb          | 2,447         | 3                | 72                      | 5                | 30                     | 4                |
| Mar          | 3,814         | 5                | 95                      | 6                | 39                     | 5                |
| Apr          | 5,015         | 7                | 98                      | 6                | 44                     | 6                |
| May          | 6,792         | 9                | 83                      | 5                | 30                     | 4                |
| Jun          | 5,429         | 8                | 134                     | 9                | 52                     | 7                |
| Jul          | 8,039         | 11               | 153                     | 10               | 65                     | 9                |
| Aug          | 9,663         | 14               | 180                     | 12               | 72                     | 10               |
| Sep          | 9,707         | 14               | 167                     | 10               | 73                     | 10               |
| Oct          | 9,228         | 13               | 207                     | 13               | 97                     | 13               |
| Nov          | 5,534         | 8                | 207                     | 13               | 141                    | 19               |
| Dec          | 3,280         | 5                | 87                      | 6                | 52                     | 7                |
| <b>Total</b> | <b>71,670</b> | <b>100</b>       | <b>1,569</b>            | <b>100</b>       | <b>729</b>             | <b>100</b>       |

<sup>1</sup> In addition, 199 strikes with bats were reported, of which 56 percent occurred in July–September; 88 strikes with reptiles were reported, of which 55 percent occurred in April–June.

<sup>2</sup> Deer strikes were comprised of 684 white-tailed deer, 34 mule deer, and 11 deer not identified to species. Other wild artiodactyls struck (but not included in this column of the table) were 9 wapiti (elk), 7 pronghorns, 3 moose, 2 caribou, 1 swine (feral hog), and 1 collared peccary (Table 13).

Table 7. Reported time of occurrence of wildlife strikes to civil aircraft, USA, 1990–2006<sup>1</sup>.

| Time of day              | Birds         |                  | Terrestrial mammals |                  |
|--------------------------|---------------|------------------|---------------------|------------------|
|                          | 17-year total | % of total known | 17-year total       | % of total known |
| Dawn                     | 2,116         | 4                | 33                  | 3                |
| Day                      | 29,927        | 63               | 237                 | 23               |
| Dusk                     | 2,585         | 5                | 102                 | 10               |
| Night                    | 13,260        | 28               | 654                 | 64               |
| <b>Total known</b>       | <b>47,888</b> | <b>100</b>       | 1,026               | 100              |
| <b>Unknown</b>           | <b>23,782</b> |                  | 543                 |                  |
| <b>Total<sup>1</sup></b> | <b>71,670</b> |                  | 1,569               |                  |

<sup>1</sup> In addition, 199 strikes with bats were reported: time not reported (146), night (41), dusk (6), day (5), and dawn (1). Also, 88 strikes with reptiles were reported: time not reported (74), day (7), night (4), dusk (2), and dawn (1).



Table 8. Reported phase of flight at time of wildlife strikes to civil aircraft, USA, 1990–2006<sup>1</sup>.

| Phase of flight          | Birds         |                  | Terrestrial mammals |                  |
|--------------------------|---------------|------------------|---------------------|------------------|
|                          | 17-year total | % of total known | 17-year total       | % of total known |
| Parked                   | 30            | <1               | 1                   | <1               |
| Taxi                     | 215           | <1               | 26                  | 2                |
| Takeoff run              | 10,381        | 19               | 397                 | 34               |
| Climb                    | 9,737         | 18               | 26                  | 2                |
| En route                 | 1,383         | 3                | 0                   | 0                |
| Descent                  | 1,974         | 4                | 0                   | 0                |
| Approach                 | 20,776        | 39               | 74                  | 6                |
| Landing roll             | 8,800         | 17               | 633                 | 55               |
| <b>Total known</b>       | 53,296        | <b>100</b>       | 1,157               | 100              |
| <b>Unknown</b>           | 18,374        |                  | 412                 |                  |
| <b>Total<sup>1</sup></b> | 71,670        |                  | 1,569               |                  |

<sup>1</sup> In addition, 199 strikes with bats were reported: phase of flight not reported (143), approach (36), climb (6), descent (4), landing roll (6), en route (1), and takeoff run (3). Also, 88 strikes with reptiles were reported: phase of flight not reported (66), taxi (5), takeoff run (8), approach (4), and landing roll (5).

Table 9. Number of reported bird strikes to civil aircraft by height (feet) above ground level (AGL), USA, 1990–2006<sup>1</sup>.

| Height of strike (feet AGL) | All reported strikes |                  |                    | Strikes with damage |                  |                    |
|-----------------------------|----------------------|------------------|--------------------|---------------------|------------------|--------------------|
|                             | 17-year total        | % of total known | % cumulative total | 17-year total       | % of total known | % cumulative total |
| 0                           | 19,461               | 41               | 41                 | 1,696               | 27               | 27                 |
| 1-100                       | 8,714                | 19               | 60                 | 1,051               | 17               | 44                 |
| 101-200                     | 2,314                | 5                | 65                 | 293                 | 5                | 49                 |
| 201-300                     | 1,489                | 3                | 68                 | 195                 | 3                | 52                 |
| 301-400                     | 900                  | 2                | 70                 | 137                 | 2                | 54                 |
| 401-500                     | 1,628                | 3                | 73                 | 244                 | 4                | 58                 |
| 501-600                     | 470                  | 1                | 74                 | 89                  | 1                | 59                 |
| 601-700                     | 368                  | <1               | 75                 | 71                  | 1                | 60                 |
| 701-800                     | 751                  | 2                | 77                 | 157                 | 2                | 62                 |
| 801-900                     | 243                  | <1               | 78                 | 65                  | 1                | 63                 |
| 901-1,000                   | 1,397                | 3                | 81                 | 286                 | 5                | 68                 |
| 1,001-2,000                 | 3,450                | 7                | 88                 | 810                 | 13               | 81                 |
| 2,001-3,000                 | 2,127                | 5                | 93                 | 476                 | 8                | 89                 |
| 3,001-4,000                 | 1,109                | 2                | 95                 | 204                 | 3                | 92                 |
| 4,001-5,000                 | 815                  | 2                | 97                 | 144                 | 2                | 94                 |
| 5,001-10,000                | 1,495                | 3                | >99                | 299                 | 5                | 99                 |
| 10,001-20,000               | 294                  | <1               | >99                | 93                  | 1                | >99                |
| 20,001-30,000               | 13                   | <1               | >99                | 8                   | <1               | >99                |
| >30,000                     | 1                    | <1               | 100                | 1                   | <1               | 100                |
| <b>Total known</b>          | <b>47,039</b>        | <b>100</b>       |                    | <b>6,319</b>        | <b>100</b>       |                    |
| <b>Unknown height</b>       | <b>24,631</b>        |                  |                    | <b>2,124</b>        |                  |                    |
| <b>Total</b>                | <b>71,670</b>        |                  |                    | <b>8,443</b>        |                  |                    |

<sup>1</sup> A more detailed analysis of bird strikes by height AGL is provided by Dolbeer (2006).

Table 10. Civil aircraft components reported as being struck and damaged by wildlife, USA, 1990–2006.

| Aircraft component       | Birds (17-year total) |            |                |            | Terrestrial mammals (17-year total) |            |                |            |
|--------------------------|-----------------------|------------|----------------|------------|-------------------------------------|------------|----------------|------------|
|                          | Number struck         | % of total | Number damaged | % of total | Number struck                       | % of total | Number damaged | % of total |
| Windshield               | 11,337                | 17         | 586            | 6          | 6                                   | <1         | 13             | 1          |
| Engine(s) <sup>1</sup>   | 9,938                 | 15         | 3,185          | 32         | 118                                 | 8          | 127            | 10         |
| Nose                     | 9,240                 | 14         | 567            | 6          | 72                                  | 5          | 73             | 6          |
| Radome                   | 8,380                 | 13         | 987            | 10         | 12                                  | 1          | 13             | 1          |
| Wing/rotor               | 8,160                 | 12         | 2,253          | 23         | 176                                 | 11         | 185            | 14         |
| Fuselage                 | 8,785                 | 13         | 355            | 4          | 98                                  | 6          | 112            | 9          |
| Other                    | 3,926                 | 6          | 751            | 8          | 181                                 | 12         | 174            | 14         |
| Landing gear             | 3,072                 | 5          | 311            | 3          | 604                                 | 39         | 297            | 23         |
| Propeller                | 1,825                 | 3          | 178            | 2          | 206                                 | 13         | 196            | 15         |
| Tail                     | 932                   | 1          | 397            | 4          | 44                                  | 3          | 57             | 4          |
| Light                    | 509                   | <1         | 398            | 4          | 24                                  | 2          | 31             | 2          |
| <b>Total<sup>2</sup></b> | <b>66,104</b>         | <b>100</b> | <b>9,968</b>   | <b>100</b> | <b>1,541</b>                        | <b>100</b> | <b>1,278</b>   | <b>100</b> |

<sup>1</sup> For birds, 9,938 engines were reported as struck in 9,448 strike events (8,979 events with one engine struck, 453 with two engines struck, 11 with three engines struck, and 5 with four engines struck). In 3,087 bird strike events, a total of 3,185 engines were damaged (2,990 events with one engine damaged, 96 with two engines damaged, and 1 with three engines damaged). For terrestrial mammals, 118 engines were reported as struck in 111 strike events (104 events with one engine struck and 7 with two engines struck). In 112 terrestrial mammal strike events, a total of 127 engines were reported as damaged (97 events with one engine damaged and 15 with two engines damaged). Some engines were damaged without being struck when the landing gear collapsed.

<sup>2</sup> In addition, bat strikes had 61 and 7 components reported as struck and damaged, respectively: radome/nose (12, 0), windshield (17, 0), engine (7, 3), propeller (1, 0), wing/rotor (8, 3), fuselage (7, 0), tail (2, 0), other (4, 0), landing gear (2, 0), and light (1, 1). For reptiles strikes, there were 18 and 5 components reported struck and damaged, respectively: windshield (1, 1), wing/rotor (1, 1), fuselage (1, 1), landing gear (13, 0), tail (1, 1), and other (1, 1).

Table 11. Number of civil aircraft with reported damage resulting from wildlife strikes, USA, 1990–2006.

| Damage category <sup>2</sup> | Reported strikes |                  |                     |                  |                    |                  |
|------------------------------|------------------|------------------|---------------------|------------------|--------------------|------------------|
|                              | Birds            |                  | Terrestrial mammals |                  | Total <sup>1</sup> |                  |
|                              | 17-year total    | % of total known | 17-year total       | % of total known | 17-year total      | % of total known |
| <b>None</b>                  | <b>49,884</b>    | <b>86</b>        | <b>410</b>          | <b>37</b>        | <b>50,367</b>      | <b>85</b>        |
| <b>Damage</b>                | <b>8,419</b>     | <b>14</b>        | <b>684</b>          | <b>63</b>        | <b>9,111</b>       | <b>15</b>        |
| Minor                        | 4,505            | 8                | 303                 | 28               | 4,811              | 8                |
| Uncertain                    | 1,650            | 3                | 52                  | 5                | 1,703              | 3                |
| Substantial                  | 2,249            | 4                | 308                 | 28               | 2,561              | 4                |
| Destroyed                    | 15               | <1               | 21                  | 2                | 36                 | <1               |
| <b>Total known</b>           | <b>58,303</b>    | <b>100</b>       | <b>1,094</b>        | <b>100</b>       | <b>59,478</b>      | <b>100</b>       |
| <b>Unknown</b>               | <b>13,367</b>    |                  | <b>475</b>          |                  | <b>14,048</b>      |                  |
| <b>Total</b>                 | <b>71,670</b>    |                  | <b>1,569</b>        |                  | <b>73,526</b>      |                  |

<sup>1</sup> Included in totals are 199 and 88 strikes involving bats and reptiles, respectively. For bats, 60 reports indicated no damage, 132 failed to report if damage occurred, 3 reported minor damage, 1 reported uncertain level of damage, and 3 reported substantial damage. For reptiles, 13 reports indicated no damage, 74 failed to report if damage occurred, and 1 reported substantial damage.

<sup>2</sup> The damage codes and descriptions follow the *International Civil Aviation Organization Bird Strike Information System (1989)*: Minor = the aircraft can be rendered airworthy by simple repairs or replacements and an extensive inspection is not necessary; Uncertain = the aircraft was damaged, but details as to the extent of the damage are lacking; Substantial = the aircraft incurs damage or structural failure that adversely affects the structure strength, performance, or flight characteristics of the aircraft and that would normally require major repair or replacement of the affected component (specifically excluded are bent fairings or cowlings; small dents or puncture holes in the skin; damage to wing tips, antenna, tires, or brakes; and engine blade damage not requiring blade replacement); Destroyed = the damage sustained makes it inadvisable to restore the aircraft to an airworthy condition.

Table 12. Reported effect-on-flight (EOF) of wildlife strikes to civil aircraft, USA, 1990–2006.

| Effect-on-flight <sup>2</sup> | Reported strikes |                  |                     |                  |                    |                  |
|-------------------------------|------------------|------------------|---------------------|------------------|--------------------|------------------|
|                               | Birds            |                  | Terrestrial mammals |                  | Total <sup>1</sup> |                  |
|                               | 17-year total    | % of total known | 17-year total       | % of total known | 17-year total      | % of total known |
| <b>None</b>                   | <b>37,139</b>    | <b>87</b>        | <b>391</b>          | <b>45</b>        | <b>37,594</b>      | <b>86</b>        |
| <b>Negative effect</b>        | <b>5,527</b>     | <b>13</b>        | <b>481</b>          | <b>55</b>        | <b>6,017</b>       | <b>14</b>        |
| Precautionary landing         | 2,849            | 7                | 72                  | 8                | 2,924              | 7                |
| Aborted takeoff               | 1,343            | 3                | 156                 | 18               | 1,499              | 3                |
| Engine shutdown               | 300              | <1               | 24                  | 3                | 324                | <1               |
| Other                         | 1,035            | 2                | 229                 | 26               | 1,270              | 3                |
| <b>Total known</b>            | <b>42,666</b>    | <b>100</b>       | <b>872</b>          | <b>100</b>       | <b>43,611</b>      | <b>100</b>       |
| <b>Unknown</b>                | <b>29,004</b>    |                  | <b>697</b>          |                  | <b>29,915</b>      |                  |
| <b>Total</b>                  | <b>71,670</b>    |                  | <b>1,569</b>        |                  | <b>73,526</b>      |                  |

<sup>1</sup> Included in totals are 199 and 88 strikes involving bats and reptiles, respectively. For bats, 48 reports indicated no effect-on-flight, 149 failed to report if an effect-on-flight occurred, and 2 reported a precautionary landing. For reptiles, 16 reports indicated no effect-on-flight, 65 failed to report if an effect-on-flight occurred, 1 reported a precautionary landing, and 6 reported “other”.

<sup>2</sup> Effect-on-flight: None = flight continued as scheduled, although delays and other cost caused by inspections or repairs may have been incurred after landing; Aborted takeoff = pilot aborted the takeoff; Precautionary landing = pilot landed at other-than-destination airport after strike; Engine shut down = pilot shut down the engine or the engine stopped running because of strike; Other = miscellaneous effects, such as reduced speed because of shattered windshield, emergency landing at destination airport, or crash landing; Unknown = report did not give sufficient information to determine an effect-on-flight (Dolbeer et al. 2000).

Table 13. Total reported strikes, strikes causing damage, strikes having a negative effect-on-flight (EOF), strikes involving more than 1 animal, aircraft downtime, and costs by identified wildlife species for civil aircraft, USA, 1990–2006 (page 1 of 15).

| Wildlife group or species      | 17-year totals             |             |               |                                    |                                       |                     |
|--------------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                                | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                                | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| <b>Birds</b>                   |                            |             |               |                                    |                                       |                     |
| <b>Loons</b>                   | <b>13</b>                  | <b>9</b>    | <b>6</b>      |                                    | <b>2,807</b>                          | <b>1,754,200</b>    |
| Loons                          | 3                          | 3           | 2             |                                    | 557                                   | 251,200             |
| Common loon                    | 10                         | 6           | 4             |                                    | 2,250                                 | 1,503,000           |
| <b>Grebes</b>                  | <b>38</b>                  | <b>5</b>    | <b>4</b>      | <b>4</b>                           | <b>82</b>                             | <b>209,470</b>      |
| Grebes                         | 7                          |             |               | 1                                  |                                       |                     |
| Eared grebe                    | 6                          | 1           |               | 1                                  | 10                                    | 100,000             |
| Western grebe                  | 9                          | 2           | 2             | 2                                  |                                       |                     |
| Pied-billed grebe              | 8                          |             | 1             |                                    |                                       |                     |
| Horned grebe                   | 5                          | 2           | 1             |                                    | 72                                    | 109,470             |
| Red-necked grebe               | 2                          |             |               |                                    |                                       |                     |
| Clark's grebe                  | 1                          |             |               |                                    |                                       |                     |
| <b>Albatrosses/shearwaters</b> | <b>38</b>                  | <b>6</b>    | <b>5</b>      |                                    | <b>147</b>                            | <b>62,500</b>       |
| Laysan albatross               | 26                         | 6           | 4             |                                    | 147                                   | 62,500              |
| Black-footed albatross         | 1                          |             |               |                                    |                                       |                     |
| Bonin petrel                   | 1                          |             | 1             |                                    |                                       |                     |
| Wedge-tailed shearwater        | 7                          |             |               |                                    |                                       |                     |
| Townsend's shearwater          | 2                          |             |               |                                    |                                       |                     |
| Fork-tailed storm-petrel       | 1                          |             |               |                                    |                                       |                     |
| <b>Tropicbirds</b>             | <b>9</b>                   | <b>6</b>    | <b>5</b>      |                                    | <b>124</b>                            | <b>45,800</b>       |
| Tropicbirds                    | 5                          | 5           | 4             |                                    | 124                                   | 40,200              |
| White-tailed tropicbird        | 1                          |             |               |                                    |                                       |                     |
| Red-tailed tropicbird          | 3                          | 1           | 1             |                                    |                                       | 5,600               |
| <b>Pelicans</b>                | <b>45</b>                  | <b>21</b>   | <b>16</b>     | <b>4</b>                           | <b>422</b>                            | <b>151,123</b>      |
| Pelicans                       | 2                          | 1           |               |                                    | 80                                    |                     |
| Australian pelican             | 1                          | 1           | 1             |                                    |                                       |                     |
| Brown pelican                  | 39                         | 17          | 14            | 4                                  | 318                                   | 51,123              |
| American white pelican         | 3                          | 2           | 1             |                                    | 24                                    | 100,000             |
| <b>Red-footed booby</b>        | <b>1</b>                   |             |               |                                    |                                       |                     |
| <b>Cormorants</b>              | <b>50</b>                  | <b>21</b>   | <b>14</b>     | <b>10</b>                          | <b>238</b>                            | <b>2,202,370</b>    |
| Cormorants                     | 1                          |             |               |                                    |                                       |                     |
| Great cormorant                | 2                          | 1           |               | 2                                  |                                       |                     |
| D.-crested cormorant           | 46                         | 20          | 14            | 8                                  | 238                                   | 2,202,370           |
| Pelagic cormorant              | 1                          |             |               |                                    |                                       |                     |

Table 13. Continued (page 2 of 15).

| Wildlife group or species | 17-year totals             |              |               |                                    |                                       |                     |
|---------------------------|----------------------------|--------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                           | Number of reported strikes |              |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                           | Total                      | With damage  | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| <b>Anhinga</b>            | <b>11</b>                  | <b>4</b>     | <b>4</b>      | <b>2</b>                           | <b>116</b>                            | <b>4,300</b>        |
| <b>Frigatebirds</b>       | <b>11</b>                  | <b>4</b>     | <b>2</b>      |                                    | <b>21</b>                             | <b>18,400</b>       |
| Frigatebirds              | 2                          | 1            | 1             |                                    | 18                                    | 13,500              |
| Great frigatebird         | 7                          | 2            | 1             |                                    | 3                                     | 4,900               |
| Magnificent frigatebird   | 2                          | 1            |               |                                    |                                       |                     |
| <b>Hérons/bitterns</b>    | <b>294</b>                 | <b>55</b>    | <b>38</b>     | <b>12</b>                          | <b>3,229</b>                          | <b>3,204,815</b>    |
| Hérons                    | 42                         | 13           | 8             | 4                                  | 99                                    | 3,200               |
| Great blue heron          | 172                        | 37           | 28            | 4                                  | 2,540                                 | 3,162,415           |
| Blk.-crowned night-heron  | 22                         | 2            |               | 2                                  | 14                                    | 31,000              |
| Little blue heron         | 2                          |              |               |                                    |                                       |                     |
| Green heron               | 5                          |              |               |                                    |                                       |                     |
| Yel.-crowned night heron  | 3                          |              |               |                                    |                                       |                     |
| American bittern          | 5                          | 3            | 2             |                                    | 576                                   | 8,200               |
| Yellow bittern            | 43                         |              |               | 2                                  |                                       |                     |
| <b>Egrets</b>             | <b>437</b>                 | <b>51</b>    | <b>61</b>     | <b>118</b>                         | <b>3,657</b>                          | <b>5,309,940</b>    |
| Egrets                    | 259                        | 30           | 38            | 75                                 | 3,455                                 | 3,465,140           |
| Cattle egret              | 130                        | 13           | 17            | 36                                 | 81                                    | 4,000               |
| Great egret               | 34                         | 6            | 6             | 6                                  | 97                                    | 1,840,800           |
| Snowy egret               | 14                         | 2            |               | 1                                  | 24                                    |                     |
| <b>Storks/ibises</b>      | <b>27</b>                  | <b>6</b>     | <b>4</b>      | <b>4</b>                           | <b>1</b>                              |                     |
| White stork               | 1                          | 1            |               |                                    |                                       |                     |
| Wood stork                | 6                          | 1            |               |                                    |                                       |                     |
| Ibises                    | 10                         | 1            | 2             | 1                                  |                                       |                     |
| Glossy ibis               | 1                          |              |               | 1                                  |                                       |                     |
| White ibis                | 4                          | 1            | 1             |                                    |                                       |                     |
| White-faced ibis          | 4                          | 2            |               | 2                                  |                                       |                     |
| Roseate spoonbill         | 1                          |              | 1             |                                    | 1                                     |                     |
| <b>Waterfowl</b>          | <b>2,775</b>               | <b>1,255</b> | <b>601</b>    | <b>1,036</b>                       | <b>89,587</b>                         | <b>90,199,134</b>   |
| Ducks, geese, swans       | 128                        | 64           | 29            | 53                                 | 763                                   | 763,275             |
| Ducks                     | 618                        | 211          | 96            | 210                                | 4,666                                 | 3,877,292           |
| American wigeon           | 20                         | 11           | 5             | 7                                  | 327                                   | 888,089             |
| Northern pintail          | 39                         | 26           | 15            | 19                                 | 1,289                                 | 1,139,044           |
| Green-winged teal         | 15                         | 5            | 5             | 3                                  | 180                                   | 355,250             |
| Blue-winged teal          | 11                         | 7            | 2             | 7                                  | 105                                   | 601,440             |
| European wigeon           | 1                          |              |               | 1                                  |                                       |                     |
| Mallard                   | 377                        | 98           | 51            | 87                                 | 8,154                                 | 4,741,261           |
| Common eider              | 2                          | 2            | 1             | 1                                  |                                       |                     |

Table 13. Continued (page 3 of 15).

| Wildlife group or species  | 17-year totals             |             |               |                                    |                                       |                     |
|----------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                            | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                            | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Ring-necked duck           | 5                          | 3           | 2             | 2                                  | 72                                    | 9,568               |
| Greater scaup              | 4                          | 1           | 1             | 1                                  |                                       |                     |
| Wood duck                  | 14                         | 6           | 2             | 2                                  | 102                                   | 77,704              |
| Muscovy duck               | 1                          | 1           |               |                                    | 120                                   | 443,332             |
| Common goldeneye           | 1                          | 1           | 1             |                                    |                                       | 2,000               |
| Red-breasted merganser     | 1                          | 1           |               | 1                                  |                                       |                     |
| Hooded merganser           | 3                          | 1           |               | 1                                  |                                       |                     |
| Common merganser           | 1                          | 1           | 1             |                                    | 72                                    | 2,500               |
| Northern shoveler          | 17                         | 9           | 2             | 8                                  | 624                                   | 1,043,300           |
| Gadwall                    | 14                         | 2           | 1             | 4                                  |                                       |                     |
| Canvasback                 | 7                          | 3           |               | 3                                  | 60                                    | 45,000              |
| American black duck        | 17                         | 4           | 1             | 7                                  | 36                                    | 1,500               |
| Mottled duck               | 7                          | 2           | 3             | 2                                  | 24                                    |                     |
| Lesser scaup               | 11                         | 8           | 5             | 5                                  | 984                                   | 101,000             |
| Ruddy duck                 | 11                         | 3           |               |                                    | 24                                    | 8,446               |
| Redhead                    | 2                          | 1           |               | 1                                  |                                       |                     |
| Bufflehead                 | 2                          |             |               |                                    |                                       |                     |
| Long-tailed duck           | 1                          | 1           |               |                                    |                                       |                     |
| Philippine duck            | 1                          | 1           | 1             | 1                                  | 96                                    | 9,456,000           |
| Bk.-bellied whistling duck | 1                          |             |               |                                    |                                       |                     |
| Cinnamon teal              | 1                          |             |               |                                    |                                       |                     |
| Geese                      | 330                        | 191         | 83            | 116                                | 17,121                                | 2,211,396           |
| Snow goose                 | 61                         | 46          | 21            | 32                                 | 3,605                                 | 16,821,986          |
| Canada goose               | 1,018                      | 526         | 266           | 446                                | 50,519                                | 46,258,003          |
| Brant                      | 13                         | 6           | 3             | 6                                  | 40                                    | 1,271               |
| Grtr. white-fronted goose  | 7                          | 6           | 1             | 5                                  | 268                                   | 755,887             |
| Emperor goose              | 1                          | 1           |               |                                    |                                       |                     |
| Swans                      | 2                          | 1           |               |                                    |                                       |                     |
| Mute swan                  | 4                          |             |               | 1                                  |                                       |                     |
| Tundra swan                | 5                          | 4           | 2             | 3                                  | 336                                   | 144,790             |
| Trumpeter swan             | 1                          | 1           | 1             | 1                                  |                                       | 450,000             |
| <b>Raptors</b>             | <b>3,998</b>               | <b>706</b>  | <b>473</b>    | <b>149</b>                         | <b>66,823</b>                         | <b>30,086,519</b>   |
| Hawks, eagles, vultures    | 28                         | 15          | 6             | 1                                  | 255                                   | 9,050               |
| Vultures                   | 227                        | 133         | 64            | 25                                 | 19,392                                | 8,977,465           |
| Black vulture              | 32                         | 17          | 16            | 5                                  | 4,681                                 | 1,115,987           |
| Turkey vulture             | 256                        | 137         | 90            | 10                                 | 17,488                                | 2,555,178           |
| Osprey                     | 115                        | 28          | 17            | 2                                  | 2,198                                 | 229,803             |



Table 13. Continued (page 4 of 15).

| Wildlife group or species | 17-year totals             |             |               |                                    |                                       |                     |
|---------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                           | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                           | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| White-tailed kite         | 9                          | 3           | 1             |                                    | 40                                    | 5,000,000           |
| Black kite                | 2                          | 1           | 1             |                                    |                                       |                     |
| Swallow-tailed kite       | 1                          |             |               |                                    |                                       |                     |
| Eagles                    | 6                          | 3           | 2             | 1                                  |                                       |                     |
| Bald eagle                | 84                         | 36          | 20            | 8                                  | 5,300                                 | 301,724             |
| W.-breasted sea eagle     | 1                          | 1           | 1             |                                    |                                       |                     |
| Golden eagle              | 4                          | 1           | 1             |                                    | 72                                    | 1,000               |
| Hawks                     | 862                        | 171         | 116           | 24                                 | 8,715                                 | 924,539             |
| Red-tailed hawk           | 744                        | 129         | 98            | 11                                 | 7,693                                 | 5,236,930           |
| Rough-legged hawk         | 12                         |             |               |                                    |                                       |                     |
| Red-shouldered hawk       | 13                         | 1           | 2             |                                    | 41                                    | 900                 |
| Swainson's hawk           | 32                         | 3           | 3             | 1                                  | 4                                     |                     |
| Sharp-shinned hawk        | 7                          |             |               |                                    |                                       |                     |
| Cooper's hawk             | 13                         | 1           |               |                                    |                                       |                     |
| Ferruginous hawk          | 4                          |             |               |                                    |                                       |                     |
| Broad-winged hawk         | 5                          |             |               |                                    |                                       |                     |
| Harris' hawk              | 1                          |             |               |                                    |                                       |                     |
| Common buzzard            | 1                          |             |               |                                    | 24                                    |                     |
| Northern harrier          | 53                         | 1           | 1             | 1                                  |                                       | 200,000             |
| Lappet-faced vulture      | 1                          | 1           | 1             |                                    | 240                                   | 4,000,000           |
| Falcons                   | 31                         | 2           | 3             | 1                                  | 80                                    | 30,000              |
| Peregrine falcon          | 102                        | 7           | 2             | 4                                  | 30                                    | 235,500             |
| Gyrfalcon                 | 1                          |             |               |                                    |                                       |                     |
| Merlin                    | 28                         |             | 2             |                                    | 3                                     | 130                 |
| Crested caracara          | 3                          | 1           | 1             |                                    |                                       |                     |
| Prairie falcon            | 7                          |             |               |                                    |                                       |                     |
| American kestrel          | 1,312                      | 14          | 25            | 55                                 | 567                                   | 1,268,313           |
| Eurasian kestrel          | 1                          |             |               |                                    |                                       |                     |
| <b>Gallinaceous birds</b> | <b>127</b>                 | <b>33</b>   | <b>28</b>     | <b>23</b>                          | <b>975</b>                            | <b>527,287</b>      |
| Grouse                    | 6                          | 2           |               | 2                                  | 2                                     |                     |
| Greater sage grouse       | 5                          | 3           | 4             | 1                                  | 337                                   | 256,077             |
| Sharp-tailed grouse       | 1                          | 1           | 1             |                                    | 24                                    | 500                 |
| Ptarmigans                | 6                          | 4           | 1             | 2                                  | 57                                    | 57,500              |
| Black francolin           | 2                          |             |               |                                    |                                       |                     |
| Quails                    | 8                          |             | 2             | 2                                  |                                       |                     |
| Northern bobwhite         | 6                          | 2           | 3             | 1                                  | 73                                    | 800                 |
| Scaled quail              | 3                          |             |               |                                    |                                       |                     |
| Ring-necked pheasant      | 48                         | 10          | 8             | 5                                  | 15                                    | 2,000               |

Table 13. Continued (page 5 of 15).

| Wildlife group or species | 17-year totals             |             |               |                                    |                                       |                     |
|---------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                           | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                           | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Gray partridge            | 5                          | 2           | 1             | 3                                  | 24                                    | 120                 |
| Chukar                    | 1                          |             |               |                                    |                                       |                     |
| Grey francolin            | 1                          |             |               |                                    |                                       |                     |
| Guineafowl                | 1                          | 1           |               | 1                                  |                                       |                     |
| Wild turkey               | 34                         | 8           | 8             | 6                                  | 443                                   | 210,290             |
| <b>Cranes</b>             | <b>77</b>                  | <b>27</b>   | <b>21</b>     | <b>25</b>                          | <b>2,316</b>                          | <b>382,760</b>      |
| Cranes                    | 12                         | 3           | 5             | 2                                  | 31                                    | 250,000             |
| Sandhill crane            | 65                         | 24          | 16            | 23                                 | 2,285                                 | 132,760             |
| <b>Rails/gallinules</b>   | <b>58</b>                  | <b>12</b>   | <b>4</b>      | <b>4</b>                           | <b>831</b>                            | <b>882,476</b>      |
| Rails                     | 1                          | 1           |               | 1                                  |                                       |                     |
| Sora                      | 1                          |             |               |                                    |                                       |                     |
| Common moorhen            | 2                          | 1           | 1             |                                    | 24                                    | 990                 |
| American coot             | 47                         | 10          | 3             | 3                                  | 807                                   | 881,486             |
| Purple gallinule          | 2                          |             |               |                                    |                                       |                     |
| Virginia rail             | 2                          |             |               |                                    |                                       |                     |
| Clapper rail              | 3                          |             |               |                                    |                                       |                     |
| <b>Shorebirds</b>         | <b>1,713</b>               | <b>58</b>   | <b>81</b>     | <b>334</b>                         | <b>1,175</b>                          | <b>2,823,556</b>    |
| Shorebirds                | 16                         |             |               | 8                                  |                                       |                     |
| American oystercatcher    | 17                         |             |               | 2                                  |                                       |                     |
| Plovers                   | 43                         | 3           | 4             | 10                                 | 24                                    |                     |
| European golden-plover    | 3                          |             |               |                                    |                                       |                     |
| American golden-plover    | 27                         |             | 2             | 7                                  | 2                                     |                     |
| Black-bellied plover      | 29                         | 2           | 2             | 5                                  | 12                                    | 38,622              |
| Snowy plover              | 1                          |             |               | 1                                  |                                       |                     |
| Killdeer                  | 842                        | 27          | 32            | 112                                | 230                                   | 2,332,453           |
| Pacific golden-plover     | 350                        | 1           | 4             | 57                                 | 15                                    | 1,200               |
| Semipalmated plover       | 17                         |             |               | 10                                 |                                       |                     |
| Northern lapwing          | 1                          | 1           | 1             | 1                                  | 25                                    |                     |
| Southern lapwing          | 1                          | 1           | 1             |                                    |                                       | 8,000               |
| Sandpipers                | 139                        | 8           | 18            | 57                                 | 168                                   | 106,560             |
| Upland sandpiper          | 61                         | 4           | 5             | 6                                  | 12                                    | 1,000               |
| Spotted sandpiper         | 4                          |             |               | 2                                  |                                       |                     |
| Willet                    | 4                          |             |               | 2                                  |                                       |                     |
| Common snipe              | 21                         | 2           | 1             | 2                                  |                                       | 12,615              |
| American woodcock         | 16                         | 1           | 2             | 2                                  |                                       |                     |
| Dunlin                    | 13                         | 3           | 2             | 5                                  | 504                                   | 205,300             |
| Baird's sandpiper         | 7                          |             |               | 1                                  |                                       |                     |
| Western sandpiper         | 22                         | 1           | 1             | 13                                 | 60                                    | 94,311              |

Table 13. Continued (page 6 of 15).

| Wildlife group or species | 17-year totals             |              |               |                                    |                                       |                     |
|---------------------------|----------------------------|--------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                           | Number of reported strikes |              |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                           | Total                      | With damage  | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Pectoral sandpiper        | 2                          | 1            |               | 1                                  |                                       |                     |
| Sanderling                | 8                          |              | 1             | 6                                  |                                       |                     |
| Buff-breasted sandpiper   | 7                          |              |               | 2                                  |                                       |                     |
| Ruddy turnstone           | 4                          |              |               |                                    |                                       |                     |
| Least sandpiper           | 21                         |              | 3             | 10                                 | 3                                     |                     |
| Semipalmated sandpiper    | 12                         |              |               | 4                                  |                                       |                     |
| Lesser yellowlegs         | 2                          |              |               | 1                                  |                                       |                     |
| Short-billed dowitcher    | 3                          | 1            |               | 1                                  |                                       |                     |
| Hudsonian godwit          | 1                          | 1            | 1             | 1                                  | 96                                    | 23,495              |
| Solitary sandpiper        | 2                          |              |               | 1                                  |                                       |                     |
| Greater yellowlegs        | 1                          |              |               |                                    |                                       |                     |
| Long-billed dowitcher     | 2                          |              |               |                                    |                                       |                     |
| Red knot                  | 1                          |              |               |                                    |                                       |                     |
| White-rumped sandpiper    | 1                          |              |               |                                    |                                       |                     |
| Whimbrel                  | 5                          | 1            | 1             | 1                                  | 24                                    |                     |
| Long-billed curlew        | 3                          |              |               |                                    |                                       |                     |
| American avocet           | 3                          |              |               | 2                                  |                                       |                     |
| Black-necked stilt        | 1                          |              |               | 1                                  |                                       |                     |
| <b>Gulls</b>              | <b>6,587</b>               | <b>1,059</b> | <b>842</b>    | <b>1,631</b>                       | <b>44,497</b>                         | <b>24,784,666</b>   |
| Gulls                     | 4,959                      | 875          | 680           | 1,343                              | 34,273                                | 18,463,891          |
| Herring gull              | 547                        | 65           | 61            | 71                                 | 579                                   | 1,442,845           |
| Mew gull                  | 23                         | 4            | 2             | 3                                  | 2                                     | 1,200               |
| Ring-billed gull          | 632                        | 64           | 59            | 136                                | 3,642                                 | 2,644,380           |
| Glaucous-winged gull      | 38                         | 12           | 6             | 8                                  | 290                                   | 346,545             |
| Great black-backed gull   | 58                         | 7            | 5             | 4                                  | 27                                    | 250,000             |
| Franklin's gull           | 27                         | 3            | 3             | 14                                 | 18                                    | 139,000             |
| Laughing gull             | 197                        | 12           | 13            | 32                                 | 715                                   | 529,000             |
| Bonaparte's gull          | 16                         | 2            | 2             | 5                                  |                                       | 65,000              |
| Lesser black-backed gull  | 1                          |              |               |                                    |                                       |                     |
| Western gull              | 51                         | 7            | 4             | 7                                  | 92                                    | 540,857             |
| California gull           | 33                         | 7            | 6             | 6                                  | 4,859                                 | 361,948             |
| Heermann's gull           | 1                          |              |               | 1                                  |                                       |                     |
| Thayer's gull             | 3                          |              |               |                                    |                                       |                     |
| Yellow-legged gull        | 1                          | 1            | 1             | 1                                  |                                       |                     |
| <b>Terns</b>              | <b>92</b>                  | <b>4</b>     | <b>3</b>      | <b>24</b>                          | <b>4</b>                              |                     |
| Terns                     | 37                         | 2            |               | 12                                 |                                       |                     |
| Caspian tern              | 14                         |              |               | 1                                  |                                       |                     |
| Common tern               | 10                         |              |               | 1                                  |                                       |                     |

Table 13. Continued (page 7 of 15).

| Wildlife group or species | 17-year totals             |             |               |                                    |                                       |                     |
|---------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                           | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                           | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Gull-billed tern          | 1                          |             |               |                                    |                                       |                     |
| Fairy tern                | 1                          |             |               |                                    |                                       |                     |
| White tern                | 1                          |             | 1             | 1                                  |                                       |                     |
| Arctic tern               | 3                          | 1           |               | 2                                  |                                       |                     |
| Roseate tern              | 1                          |             |               |                                    |                                       |                     |
| Forster's tern            | 4                          |             | 1             | 1                                  | 4                                     |                     |
| Least tern                | 6                          |             |               | 2                                  |                                       |                     |
| Black noddy               | 3                          |             |               | 2                                  |                                       |                     |
| Brown noddy               | 5                          |             | 1             | 1                                  |                                       |                     |
| Royal tern                | 1                          |             |               |                                    |                                       |                     |
| Sooty tern                | 1                          |             |               |                                    |                                       |                     |
| Black skimmer             | 4                          | 1           |               | 1                                  |                                       |                     |
| <b>Pigeons/doves</b>      | <b>4,241</b>               | <b>307</b>  | <b>348</b>    | <b>1,191</b>                       | <b>16,875</b>                         | <b>9,602,036</b>    |
| Pigeons, doves            | 11                         | 1           | 1             | 8                                  | 24                                    | 400                 |
| Pigeons                   | 25                         | 4           | 4             | 12                                 | 32                                    | 46,050              |
| Doves                     | 650                        | 39          | 65            | 200                                | 284                                   | 282,460             |
| Rock pigeon               | 1,313                      | 162         | 144           | 482                                | 13,589                                | 4,885,599           |
| Rock (Racing) pigeon      | 14                         | 3           | 2             | 6                                  | 72                                    |                     |
| Mourning dove             | 2,062                      | 94          | 127           | 468                                | 2,740                                 | 4,113,122           |
| Spotted dove              | 49                         | 3           | 3             | 4                                  | 132                                   | 274,405             |
| Zebra dove                | 83                         | 1           | 2             | 11                                 | 2                                     |                     |
| Inca dove                 | 14                         |             |               |                                    |                                       |                     |
| Philippine turtle dove    | 4                          |             |               |                                    |                                       |                     |
| White-winged dove         | 10                         |             |               |                                    |                                       |                     |
| Common ground-dove        | 6                          |             |               |                                    |                                       |                     |
| <b>Parrots</b>            | <b>8</b>                   |             |               | <b>1</b>                           |                                       |                     |
| Parrots                   | 5                          |             |               | 1                                  |                                       |                     |
| Budgerigar                | 2                          |             |               |                                    |                                       |                     |
| Black-hooded parakeet     | 1                          |             |               |                                    |                                       |                     |
| <b>Cuckoos</b>            | <b>8</b>                   | <b>1</b>    |               | <b>2</b>                           |                                       |                     |
| Cuckoos                   | 1                          |             |               | 1                                  |                                       |                     |
| Yellow-billed cuckoo      | 6                          | 1           |               | 1                                  |                                       |                     |
| Common cuckoo             | 1                          |             |               |                                    |                                       |                     |
| <b>Owls</b>               | <b>871</b>                 | <b>69</b>   | <b>43</b>     | <b>6</b>                           | <b>1,438</b>                          | <b>3,988,878</b>    |
| Owls                      | 223                        | 27          | 14            | 3                                  | 958                                   | 296,875             |
| Barn owl                  | 397                        | 21          | 15            | 2                                  | 238                                   | 1,885,900           |
| Snowy owl                 | 43                         | 4           | 4             |                                    | 46                                    | 27,500              |
| Short-eared owl           | 90                         | 2           | 3             |                                    | 14                                    | 1,045               |

Table 13. Continued (page 8 of 15).

| Wildlife group or species | 17-year totals             |             |               |                                    |                                       |                     |
|---------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                           | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                           | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Long-eared owl            | 7                          | 2           | 1             |                                    |                                       |                     |
| Northern saw-whet owl     | 3                          |             |               |                                    |                                       |                     |
| Burrowing owl             | 42                         | 1           |               |                                    | 1                                     |                     |
| Barred owl                | 4                          | 1           | 1             |                                    |                                       |                     |
| Northern pygmy-owl        | 1                          |             |               |                                    |                                       |                     |
| Eastern screech owl       | 2                          | 1           |               |                                    | 24                                    | 7,558               |
| Great horned owl          | 59                         | 10          | 5             | 1                                  | 157                                   | 1,770,000           |
| <b>Nightjars</b>          | <b>117</b>                 | <b>2</b>    |               | <b>8</b>                           |                                       |                     |
| Nightjars                 | 2                          | 1           |               |                                    |                                       |                     |
| Whip-poor-will            | 2                          |             |               |                                    |                                       |                     |
| Common poorwill           | 4                          |             |               |                                    |                                       |                     |
| Lesser nighthawk          | 4                          |             |               |                                    |                                       |                     |
| Chuck-wills-widow         | 1                          |             |               |                                    |                                       |                     |
| Common nighthawk          | 104                        | 1           |               | 8                                  |                                       |                     |
| <b>Swifts</b>             | <b>81</b>                  | <b>2</b>    | <b>1</b>      | <b>6</b>                           |                                       |                     |
| Swifts                    | 7                          | 1           |               | 2                                  |                                       |                     |
| Chimney swift             | 62                         | 1           | 1             | 4                                  |                                       |                     |
| Vaux's swift              | 5                          |             |               |                                    |                                       |                     |
| White-throated swift      | 7                          |             |               |                                    |                                       |                     |
| <b>Anna's hummingbird</b> | <b>1</b>                   |             |               |                                    |                                       |                     |
| <b>Belted kingfisher</b>  | <b>7</b>                   |             |               |                                    |                                       |                     |
| <b>Woodpeckers</b>        | <b>37</b>                  | <b>2</b>    | <b>4</b>      | <b>1</b>                           | <b>1</b>                              | <b>15,000</b>       |
| Woodpeckers               | 7                          |             | 1             |                                    |                                       |                     |
| Northern flicker          | 21                         | 2           |               |                                    |                                       |                     |
| Yellow-bellied sapsucker  | 4                          |             | 1             | 1                                  |                                       |                     |
| Hairy woodpecker          | 3                          |             |               |                                    |                                       |                     |
| Red-naped sapsucker       | 1                          |             | 1             |                                    |                                       | 15,000              |
| Downy woodpecker          | 1                          |             | 1             |                                    | 1                                     |                     |
| <b>Flycatchers</b>        | <b>70</b>                  | <b>1</b>    | <b>3</b>      | <b>6</b>                           | <b>1</b>                              | <b>9,800</b>        |
| Tyrant flycatchers        | 6                          |             |               | 1                                  | 1                                     |                     |
| Eastern wood-pewee        | 3                          |             |               |                                    |                                       |                     |
| Great crested flycatcher  | 1                          |             |               |                                    |                                       |                     |
| Eastern kingbird          | 6                          | 1           | 1             |                                    |                                       | 9,800               |
| Scissor-tailed flycatcher | 24                         |             | 2             | 2                                  |                                       |                     |
| Acadian flycatcher        | 1                          |             |               |                                    |                                       |                     |
| Say's phoebe              | 1                          |             |               |                                    |                                       |                     |
| Western kingbird          | 23                         |             |               | 2                                  |                                       |                     |
| Ash-throated flycatcher   | 1                          |             |               |                                    |                                       |                     |

Table 13.. Continued (page 9 of 15).

| Wildlife group or species  | 17-year totals             |             |               |                                    |                                       |                     |
|----------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                            | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                            | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Western wood-pewee         | 1                          |             |               |                                    |                                       |                     |
| Sulphur-bellied flycatcher | 1                          |             |               |                                    |                                       |                     |
| Eastern phoebe             | 1                          |             |               |                                    |                                       |                     |
| Yellow-bellied flycatcher  | 1                          |             |               | 1                                  |                                       |                     |
| <b>Larks</b>               | <b>508</b>                 | <b>8</b>    | <b>10</b>     | <b>139</b>                         | <b>11</b>                             | <b>504,625</b>      |
| Larks                      | 5                          |             |               | 1                                  |                                       |                     |
| Eurasian skylark           | 10                         |             |               | 1                                  |                                       |                     |
| Horned lark                | 493                        | 8           | 10            | 137                                | 11                                    | 504,625             |
| <b>Swallows</b>            | <b>1,281</b>               | <b>16</b>   | <b>32</b>     | <b>354</b>                         | <b>141</b>                            | <b>40,597</b>       |
| Swallows                   | 403                        | 4           | 24            | 135                                | 25                                    |                     |
| Purple martin              | 59                         | 2           |               | 15                                 | 2                                     |                     |
| Bank swallow               | 60                         | 2           | 1             | 31                                 | 2                                     |                     |
| Barn swallow               | 487                        | 5           | 2             | 97                                 | 99                                    | 27,282              |
| Cliff swallow              | 145                        | 3           | 2             | 30                                 | 9                                     | 13,250              |
| Tree swallow               | 109                        |             | 3             | 46                                 | 4                                     | 65                  |
| Violet-green swallow       | 8                          |             |               |                                    |                                       |                     |
| N. rough-winged swallow    | 10                         |             |               |                                    |                                       |                     |
| <b>Starlings</b>           | <b>1,722</b>               | <b>81</b>   | <b>106</b>    | <b>694</b>                         | <b>1,255</b>                          | <b>4,222,474</b>    |
| European starling          | 1,686                      | 80          | 105           | 684                                | 1,253                                 | 4,222,474           |
| Mynas                      | 4                          |             |               | 2                                  |                                       |                     |
| Common myna                | 32                         | 1           | 1             | 8                                  | 2                                     |                     |
| <b>Crows/jays/magpies</b>  | <b>460</b>                 | <b>50</b>   | <b>45</b>     | <b>70</b>                          | <b>6,578</b>                          | <b>1,438,158</b>    |
| Crows                      | 206                        | 21          | 20            | 32                                 | 905                                   | 144,000             |
| American crow              | 205                        | 19          | 18            | 30                                 | 5,562                                 | 1,265,113           |
| Carrion crow               | 1                          | 1           |               |                                    |                                       |                     |
| Hooded crow                | 1                          | 1           | 1             |                                    |                                       |                     |
| Northwestern crow          | 1                          |             |               | 1                                  |                                       |                     |
| Blue jay                   | 8                          |             |               |                                    |                                       |                     |
| Ravens                     | 6                          | 3           | 2             | 2                                  | 2                                     | 90                  |
| Common raven               | 16                         | 3           | 2             | 1                                  | 108                                   | 28,400              |
| Yellow-billed magpie       | 8                          |             |               | 2                                  |                                       |                     |
| Black-billed magpie        | 8                          | 2           | 2             | 2                                  | 1                                     | 555                 |
| <b>Chickadees</b>          | <b>13</b>                  | <b>1</b>    |               | <b>3</b>                           |                                       |                     |
| Chickadees                 | 4                          | 1           |               | 2                                  |                                       |                     |
| Black-capped chickadee     | 9                          |             |               | 1                                  |                                       |                     |
| <b>Wrens</b>               | <b>38</b>                  | <b>1</b>    | <b>1</b>      | <b>8</b>                           |                                       |                     |
| Wrens                      | 36                         | 1           | 1             | 8                                  |                                       |                     |
| Carolina wren              | 1                          |             |               |                                    |                                       |                     |

Table 13. Continued (page 10 of 15).

| Wildlife group or species | 17-year totals             |             |               |                                    |                                       |                     |
|---------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                           | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                           | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Rock wren                 | 1                          |             |               |                                    |                                       |                     |
| <b>Mimics</b>             | <b>57</b>                  | <b>1</b>    | <b>2</b>      | <b>1</b>                           |                                       | <b>120</b>          |
| Brown thrasher            | 5                          |             |               |                                    |                                       | 120                 |
| Northern mockingbird      | 39                         | 1           | 2             |                                    |                                       |                     |
| Gray catbird              | 13                         |             |               | 1                                  |                                       |                     |
| <b>Thrushes</b>           | <b>264</b>                 | <b>21</b>   | <b>17</b>     | <b>25</b>                          | <b>1,571</b>                          | <b>2,282,910</b>    |
| Thrushes                  | 14                         | 3           | 1             | 2                                  | 7                                     | 25,500              |
| Western bluebird          | 2                          |             |               |                                    | 3                                     |                     |
| Swainson's thrush         | 8                          | 2           | 1             | 1                                  |                                       | 2,000,000           |
| American robin            | 222                        | 16          | 13            | 21                                 | 1,545                                 | 257,130             |
| Hermit thrush             | 6                          |             |               |                                    | 14                                    |                     |
| Eastern bluebird          | 3                          |             |               |                                    |                                       |                     |
| Gray-cheeked thrush       | 1                          |             |               |                                    |                                       |                     |
| Varied thrush             | 5                          |             | 1             |                                    | 2                                     |                     |
| Wood thrush               | 3                          |             | 1             | 1                                  |                                       | 280                 |
| <b>Vireos</b>             | <b>7</b>                   |             |               | <b>1</b>                           |                                       |                     |
| Vireos                    | 1                          |             |               |                                    |                                       |                     |
| Yellow-throated vireo     | 1                          |             |               |                                    |                                       |                     |
| Warbling vireo            | 1                          |             |               | 1                                  |                                       |                     |
| Red-eyed vireo            | 3                          |             |               |                                    |                                       |                     |
| Cassin's vireo            | 1                          |             |               |                                    |                                       |                     |
| <b>Warblers</b>           | <b>47</b>                  | <b>1</b>    |               | <b>2</b>                           |                                       |                     |
| Wood warblers             | 17                         |             |               |                                    |                                       |                     |
| Canada warbler            | 2                          |             |               |                                    |                                       |                     |
| Yellow-breasted chat      | 3                          |             |               |                                    |                                       |                     |
| Pine warbler              | 1                          |             |               |                                    |                                       |                     |
| Black and white warbler   | 2                          |             |               |                                    |                                       |                     |
| Northern parula warbler   | 1                          |             |               |                                    |                                       |                     |
| Ovenbird                  | 2                          |             |               |                                    |                                       |                     |
| Wilson's warbler          | 1                          |             |               |                                    |                                       |                     |
| Common yellowthroat       | 2                          |             |               |                                    |                                       |                     |
| Yellow-rumped warbler     | 3                          |             |               | 1                                  |                                       |                     |
| Blackpoll warbler         | 1                          |             |               | 1                                  |                                       |                     |
| American redstart         | 2                          |             |               |                                    |                                       |                     |
| Yellow warbler            | 1                          | 1           |               |                                    |                                       |                     |
| Northern waterthrush      | 2                          |             |               |                                    |                                       |                     |
| Nashville warbler         | 3                          |             |               |                                    |                                       |                     |

Table 13. Continued (page 11 of 15).

| Wildlife group or species | 17-year totals             |             |               |                                    |                                       |                     |
|---------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                           | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                           | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Townsend's warbler        | 1                          |             |               |                                    |                                       |                     |
| Palm warbler              | 2                          |             |               |                                    |                                       |                     |
| Magnolia warbler          | 1                          |             |               |                                    |                                       |                     |
| <b>Meadowlarks</b>        | <b>575</b>                 | <b>8</b>    | <b>15</b>     | <b>72</b>                          | <b>191</b>                            | <b>203,452</b>      |
| Meadowlarks               | 80                         | 1           | 3             | 5                                  | 10                                    |                     |
| Eastern meadowlark        | 295                        | 3           | 5             | 28                                 | 4                                     |                     |
| Western meadowlark        | 200                        | 4           | 7             | 39                                 | 177                                   | 203,452             |
| <b>Blackbirds/orioles</b> | <b>1,258</b>               | <b>87</b>   | <b>92</b>     | <b>359</b>                         | <b>1,454</b>                          | <b>1,016,475</b>    |
| Blackbirds                | 998                        | 73          | 75            | 308                                | 583                                   | 862,725             |
| Red-winged blackbird      | 75                         | 1           | 5             | 12                                 | 6                                     | 750                 |
| Yellow-headed blackbird   | 6                          | 1           | 1             | 1                                  |                                       |                     |
| Brewer's blackbird        | 17                         |             |               |                                    |                                       |                     |
| Brown-headed cowbird      | 50                         | 1           | 1             | 18                                 | 1                                     |                     |
| Bobolink                  | 3                          |             | 1             |                                    |                                       |                     |
| Orioles                   | 5                          |             |               |                                    |                                       |                     |
| Baltimore oriole          | 4                          |             |               | 1                                  |                                       |                     |
| Grackles                  | 48                         | 5           | 2             | 11                                 | 720                                   | 108,000             |
| Common grackle            | 39                         | 4           | 5             | 7                                  | 123                                   | 45,000              |
| Boat-tailed grackle       | 4                          | 1           | 1             |                                    | 20                                    |                     |
| Great-tailed grackle      | 6                          |             |               | 1                                  |                                       |                     |
| Scarlet tanager           | 2                          | 1           |               |                                    |                                       |                     |
| Western tanager           | 1                          |             | 1             |                                    | 1                                     |                     |
| <b>Finches</b>            | <b>101</b>                 | <b>1</b>    | <b>8</b>      | <b>19</b>                          | <b>52</b>                             | <b>5,000</b>        |
| Finches                   | 42                         |             | 5             | 11                                 | 4                                     |                     |
| Lapland longspur          | 4                          |             |               | 2                                  |                                       |                     |
| Smith's longspur          | 1                          |             |               |                                    |                                       |                     |
| Dark-eyed junco           | 6                          | 1           | 2             | 1                                  | 48                                    | 5,000               |
| Rose-breasted grosbeak    | 1                          |             |               |                                    |                                       |                     |
| Pine siskin               | 1                          |             |               |                                    |                                       |                     |
| Purple finch              | 1                          |             |               |                                    |                                       |                     |
| American goldfinch        | 17                         |             | 1             |                                    |                                       |                     |
| House finch               | 21                         |             |               | 3                                  |                                       |                     |
| Dickcissel                | 1                          |             |               |                                    |                                       |                     |
| White-winged crossbill    | 1                          |             |               |                                    |                                       |                     |
| Red avadavat              | 2                          |             |               | 1                                  |                                       |                     |
| Red-crested cardinal      | 2                          |             |               | 1                                  |                                       |                     |
| Northern cardinal         | 1                          |             |               |                                    |                                       |                     |



Table 13. Continued (page 12 of 15).

| Wildlife group or species   | 17-year totals             |             |               |                                    |                                       |                     |
|-----------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                             | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                             | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| <b>Buntings</b>             | <b>102</b>                 | <b>3</b>    | <b>12</b>     | <b>62</b>                          | <b>21</b>                             |                     |
| Snow bunting                | 81                         | 2           | 12            | 58                                 | 19                                    |                     |
| Indigo bunting              | 1                          |             |               |                                    |                                       |                     |
| Lazuli bunting              | 1                          |             |               |                                    |                                       |                     |
| Lark bunting                | 19                         | 1           |               | 4                                  | 2                                     |                     |
| <b>Sparrows</b>             | <b>1,982</b>               | <b>36</b>   | <b>81</b>     | <b>514</b>                         | <b>581</b>                            | <b>13,640</b>       |
| Sparrows                    | 1,864                      | 33          | 80            | 503                                | 578                                   | 8,140               |
| Swamp sparrow               | 1                          |             |               |                                    |                                       |                     |
| Savannah sparrow            | 53                         | 1           |               | 3                                  |                                       | 1,000               |
| Fox sparrow                 | 7                          | 1           |               |                                    |                                       | 4,100               |
| White-throated sparrow      | 11                         | 1           | 1             | 1                                  |                                       |                     |
| Golden-crowned sparrow      | 1                          |             |               |                                    |                                       |                     |
| Field sparrow               | 1                          |             |               |                                    |                                       |                     |
| Lark sparrow                | 3                          |             |               |                                    |                                       |                     |
| White-crowned sparrow       | 4                          |             |               |                                    |                                       |                     |
| Grasshopper sparrow         | 5                          |             |               |                                    |                                       |                     |
| Java sparrow                | 1                          |             |               |                                    |                                       |                     |
| Vesper sparrow              | 3                          |             |               | 1                                  |                                       |                     |
| Chipping sparrow            | 2                          |             |               | 1                                  |                                       |                     |
| Lincoln's sparrow           | 2                          |             |               |                                    |                                       |                     |
| Song sparrow                | 21                         |             |               | 5                                  | 3                                     | 400                 |
| Sage sparrow                | 2                          |             |               |                                    |                                       |                     |
| American tree sparrow       | 1                          |             |               |                                    |                                       |                     |
| <b>Towhee</b>               | <b>4</b>                   |             |               |                                    |                                       |                     |
| Rufous-sided towhee         | 3                          |             |               |                                    |                                       |                     |
| Green-tailed towhee         | 1                          |             |               |                                    |                                       |                     |
| <b>Mannikins</b>            | <b>74</b>                  |             | <b>1</b>      | <b>38</b>                          | <b>3</b>                              | <b>2,000</b>        |
| Mannikins                   | 19                         |             |               | 9                                  |                                       |                     |
| Nutmeg mannikin             | 25                         |             |               | 15                                 | 1                                     |                     |
| Chestnut mannikin           | 30                         |             | 1             | 14                                 | 2                                     | 2,000               |
| <b>Misc. Perching birds</b> | <b>114</b>                 | <b>8</b>    | <b>3</b>      | <b>18</b>                          | <b>53</b>                             | <b>87,100</b>       |
| Perching birds              | 42                         | 7           | 2             | 5                                  | 49                                    | 87,100              |
| Red-vented bulbul           | 1                          |             |               | 1                                  |                                       |                     |
| Golden-crowned kinglet      | 1                          |             |               |                                    |                                       |                     |
| Wrentit                     | 1                          |             |               |                                    |                                       |                     |
| American pipit              | 9                          |             |               | 1                                  |                                       |                     |
| Cedar waxwing               | 15                         |             | 1             | 3                                  | 4                                     |                     |

Table 13. Continued (page 13 of 15).

| Wildlife group or species           | 17-year totals             |              |               |                                    |                                       |                     |
|-------------------------------------|----------------------------|--------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                                     | Number of reported strikes |              |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                                     | Total                      | With damage  | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Loggerhead shrike                   | 3                          |              |               |                                    |                                       |                     |
| Japanese white-eye                  | 1                          |              |               |                                    |                                       |                     |
| Common waxbill                      | 1                          |              |               |                                    |                                       |                     |
| Warbling silverbill                 | 1                          |              |               | 1                                  |                                       |                     |
| House sparrow                       | 39                         | 1            |               | 7                                  |                                       |                     |
|                                     |                            |              |               |                                    |                                       |                     |
| <b>Total known birds</b>            | <b>30,449</b>              | <b>4,049</b> | <b>3,037</b>  | <b>6,980</b>                       | <b>247,278</b>                        | <b>186,081,781</b>  |
| <b>Total unknown birds</b>          | <b>41,221</b>              | <b>4,394</b> | <b>2,490</b>  | <b>4,502</b>                       | <b>83,071</b>                         | <b>71,469,387</b>   |
| Unknown birds - ? size              | 19,867                     | 2,254        | 1,082         | 1,217                              | 25,044                                | 28,586,229          |
| Unknown birds - large               | 1,574                      | 689          | 329           | 184                                | 22,215                                | 22,791,762          |
| Unknown birds - medium              | 5,483                      | 908          | 487           | 795                                | 28,217                                | 9,311,663           |
| Unknown birds - small               | 14,297                     | 543          | 592           | 2,306                              | 7,595                                 | 10,779,733          |
| <b>Total birds</b>                  | <b>71,670</b>              | <b>8,443</b> | <b>5,527</b>  | <b>11,482</b>                      | <b>330,349</b>                        | <b>257,551,168</b>  |
|                                     |                            |              |               |                                    |                                       |                     |
| <b><u>Flying mammals (bats)</u></b> |                            |              |               |                                    |                                       |                     |
| Old world fruit bats                | 4                          | 1            | 2             | 1                                  | 72                                    | 3,069,400           |
| Red bat                             | 9                          | 1            |               | 1                                  | 1                                     |                     |
| Hoary bat                           | 2                          |              |               |                                    |                                       |                     |
| E. small-footed myotis              | 1                          |              |               |                                    |                                       |                     |
| Little brown bat                    | 11                         |              |               |                                    |                                       |                     |
| Free-tailed bats                    | 8                          |              |               | 1                                  |                                       |                     |
| Brazilian free-tailed bat           | 11                         |              |               |                                    |                                       |                     |
|                                     |                            |              |               |                                    |                                       |                     |
| <b>Total known bats</b>             | <b>46</b>                  | <b>2</b>     | <b>2</b>      | <b>3</b>                           | <b>73</b>                             | <b>3,069,400</b>    |
| <b>Unknown bats</b>                 | <b>153</b>                 | <b>5</b>     |               | <b>16</b>                          | <b>27</b>                             | <b>106,440</b>      |
| <b>Total bats</b>                   | <b>199</b>                 | <b>7</b>     | <b>2</b>      | <b>19</b>                          | <b>100</b>                            | <b>3,175,840</b>    |
|                                     |                            |              |               |                                    |                                       |                     |
| <b><u>Terrestrial mammals</u></b>   |                            |              |               |                                    |                                       |                     |
| <b>Marsupials (opossum)</b>         | <b>48</b>                  |              |               |                                    |                                       |                     |
| <b>Xenarthyras (armadillo)</b>      | <b>15</b>                  | <b>1</b>     | <b>2</b>      |                                    | <b>8</b>                              | <b>700</b>          |
| <b>Lagomorphs</b>                   | <b>147</b>                 | <b>4</b>     | <b>6</b>      | <b>2</b>                           | <b>6</b>                              | <b>24,384</b>       |
| Black-tailed jackrabbit             | 63                         | 2            | 1             |                                    |                                       | 24,384              |
| White-tailed jackrabbit             | 6                          |              |               | 1                                  |                                       |                     |

Table 13. Continued (page 14 of 15).

| Wildlife group or species | 17-year totals             |             |               |                                    |                                       |                     |
|---------------------------|----------------------------|-------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                           | Number of reported strikes |             |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                           | Total                      | With damage | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Rabbits                   | 41                         | 1           | 2             | 1                                  |                                       |                     |
| Eastern cottontail        | 37                         | 1           | 3             |                                    | 6                                     |                     |
| <b>Rodents</b>            | <b>107</b>                 | <b>2</b>    | <b>2</b>      | <b>1</b>                           | <b>3</b>                              |                     |
| Pocket gophers            | 1                          |             |               |                                    |                                       |                     |
| Prairie dog               | 11                         |             | 1             | 1                                  |                                       |                     |
| Woodchuck                 | 70                         | 2           | 1             |                                    | 3                                     |                     |
| Woodrats                  | 2                          |             |               |                                    |                                       |                     |
| Muskrat                   | 9                          |             |               |                                    |                                       |                     |
| Black rat                 | 2                          |             |               |                                    |                                       |                     |
| Norway rat                | 3                          |             |               |                                    |                                       |                     |
| N. American porcupine     | 9                          |             |               |                                    |                                       |                     |
| <b>Carnivores</b>         | <b>477</b>                 | <b>40</b>   | <b>73</b>     | <b>3</b>                           | <b>12,986</b>                         | <b>3,035,576</b>    |
| Canids                    | 3                          |             | 1             |                                    |                                       |                     |
| Coyote                    | 222                        | 24          | 46            | 1                                  | 10,716                                | 2,699,640           |
| Domestic dog              | 26                         | 8           | 14            |                                    | 96                                    | 300,000             |
| Foxes                     | 50                         | 4           | 3             |                                    | 10                                    | 750                 |
| Red fox                   | 41                         |             | 4             |                                    |                                       |                     |
| Common gray fox           | 4                          | 1           | 1             |                                    | 2                                     | 186                 |
| Raccoon                   | 39                         | 2           | 3             | 1                                  | 2,160                                 | 35,000              |
| White-nosed coati         | 1                          |             |               |                                    |                                       |                     |
| Ringtail                  | 1                          |             |               |                                    |                                       |                     |
| Skunks                    | 21                         |             | 1             |                                    | 2                                     |                     |
| Striped skunk             | 50                         |             |               | 1                                  |                                       |                     |
| River otter               | 2                          | 1           |               |                                    |                                       |                     |
| Badger                    | 2                          |             |               |                                    |                                       |                     |
| House cat                 | 13                         |             |               |                                    |                                       |                     |
| Small Indian mongoose     | 2                          |             |               |                                    |                                       |                     |
| <b>Artiodactyls</b>       | <b>760</b>                 | <b>626</b>  | <b>389</b>    | <b>74</b>                          | <b>190,146</b>                        | <b>32,379,697</b>   |
| Deer                      | 11                         | 11          | 7             |                                    | 696                                   | 197,000             |
| White-tailed deer         | 684                        | 559         | 341           | 64                                 | 160,041                               | 25,679,698          |
| Mule deer                 | 34                         | 29          | 20            | 3                                  | 6,504                                 | 663,695             |
| Wapiti (elk)              | 9                          | 9           | 6             | 2                                  | 11,560                                | 5,496,204           |
| Moose                     | 3                          | 1           | 3             |                                    |                                       |                     |
| Caribou                   | 2                          | 2           | 1             |                                    |                                       |                     |
| Cattle                    | 8                          | 8           | 6             | 2                                  | 6,215                                 | 187,000             |

Table 13. Continued (page 15 of 15).

| Wildlife group or species              | 17-year totals             |              |               |                                    |                                       |                     |
|----------------------------------------|----------------------------|--------------|---------------|------------------------------------|---------------------------------------|---------------------|
|                                        | Number of reported strikes |              |               |                                    | Reported economic losses <sup>1</sup> |                     |
|                                        | Total                      | With damage  | With neg. EOF | With multiple animals <sup>2</sup> | Aircraft down time (hrs)              | Reported costs (\$) |
| Pronghorn                              | 7                          | 6            | 5             | 2                                  | 5,130                                 | 156,100             |
| Swine (pig)                            | 1                          |              |               |                                    |                                       |                     |
| Collared peccary                       | 1                          | 1            |               | 1                                  |                                       |                     |
| <b>Perissodactyls (horses)</b>         | <b>3</b>                   | <b>3</b>     | <b>3</b>      |                                    | <b>1,008</b>                          | <b>23,849</b>       |
|                                        |                            |              |               |                                    |                                       |                     |
| <b>Total known terrestrial mammals</b> | <b>1,557</b>               | <b>676</b>   | <b>475</b>    | <b>80</b>                          | <b>204,157</b>                        | <b>35,464,206</b>   |
| <b>Unknown terrestrial mammals</b>     | <b>12</b>                  | <b>6</b>     | <b>6</b>      | <b>1</b>                           |                                       |                     |
| <b>Total terrestrial mammals</b>       | <b>1,569</b>               | <b>682</b>   | <b>481</b>    | <b>81</b>                          | <b>204,157</b>                        | <b>35,464,206</b>   |
|                                        |                            |              |               |                                    |                                       |                     |
| <b>Reptiles</b>                        |                            |              |               |                                    |                                       |                     |
| <b>Turtles</b>                         | <b>67</b>                  |              | <b>2</b>      | <b>1</b>                           |                                       |                     |
| Turtles                                | 39                         |              | 2             | 1                                  |                                       |                     |
| Florida soft shell turtle              | 4                          |              |               |                                    |                                       |                     |
| Eastern box turtle                     | 4                          |              |               |                                    |                                       |                     |
| Common snapping turtle                 | 3                          |              |               |                                    |                                       |                     |
| Diamondback terrapin                   | 16                         |              |               |                                    |                                       |                     |
| Painted turtle                         | 1                          |              |               |                                    |                                       |                     |
| <b>American alligator</b>              | <b>14</b>                  | <b>1</b>     | <b>2</b>      |                                    | <b>3</b>                              |                     |
| <b>Green iguana</b>                    | <b>7</b>                   |              | <b>3</b>      |                                    |                                       |                     |
|                                        |                            |              |               |                                    |                                       |                     |
| <b>Total reptiles</b>                  | <b>88</b>                  | <b>1</b>     | <b>7</b>      | <b>1</b>                           | <b>3</b>                              |                     |
|                                        |                            |              |               |                                    |                                       |                     |
| <b>Total known (all species)</b>       | <b>32,140</b>              | <b>4,728</b> | <b>3,521</b>  | <b>7,064</b>                       | <b>451,511</b>                        | <b>224,615,387</b>  |
| <b>Total unknown</b>                   | <b>41,386</b>              | <b>4,405</b> | <b>2,496</b>  | <b>4,519</b>                       | <b>83,098</b>                         | <b>71,575,827</b>   |
| <b>Grand total</b>                     | <b>73,526</b>              | <b>9,133</b> | <b>6,017</b>  | <b>11,583</b>                      | <b>534,609</b>                        | <b>296,191,214</b>  |

<sup>1</sup> These reported economic losses by species and species groups should be considered as relative indices of losses and not as actual estimated losses. Only about 20 percent of strikes involving civil aircraft are reported, and only about 44 percent of reported strikes identify the wildlife species or species group responsible. Furthermore, less than 25 percent of reported strikes indicating damage also provided an estimate of the cost of damage or the downtime (see Table 16). Finally, even when cost estimates were provided, many reports were filed before aircraft damage had been fully assessed. See Table 16 for a more detailed projection of actual economic losses.

<sup>2</sup> More than one animal was struck by the aircraft.

Table 14. Number of reported strikes, strikes with damage, and strikes having a negative effect-on-flight (EOF) for the four most commonly struck bird groups and three most commonly struck terrestrial mammal groups, civil aircraft, USA, 1990–2006.

| Species group <sup>1</sup>        | Reported strikes |                  | Strikes with damage |                  | Strikes with EOF |                  |
|-----------------------------------|------------------|------------------|---------------------|------------------|------------------|------------------|
|                                   | 17-year total    | % of total known | 17-year total       | % of total known | 17-year total    | % of total known |
| <b><u>Birds</u></b>               |                  |                  |                     |                  |                  |                  |
| Gulls                             | 6,587            | 22               | 1,059               | 26               | 842              | 28               |
| Pigeons/ doves                    | 4,241            | 14               | 307                 | 8                | 349              | 11               |
| Raptors                           | 3,998            | 13               | 706                 | 17               | 473              | 16               |
| Waterfowl                         | 2,775            | 9                | 1,255               | 31               | 601              | 20               |
| All other known                   | 12,848           | 42               | 722                 | 18               | 772              | 25               |
| <b>Total known birds</b>          | <b>30,449</b>    | <b>100</b>       | <b>4,049</b>        | <b>100</b>       | <b>3,037</b>     | <b>100</b>       |
| <b>Unknown birds</b>              | <b>41,221</b>    |                  | <b>4,394</b>        |                  | <b>2,490</b>     |                  |
| <b>Total birds</b>                | <b>71,670</b>    |                  | <b>8,443</b>        |                  | <b>5,527</b>     |                  |
| <b><u>Terrestrial mammals</u></b> |                  |                  |                     |                  |                  |                  |
| Artiodactyls                      | 760              | 49               | 626                 | 93               | 389              | 82               |
| Carnivores                        | 477              | 31               | 40                  | 6                | 73               | 15               |
| Lagomorphs                        | 147              | 9                | 4                   | <1               | 6                | 1                |
| All other known                   | 173              | 11               | 6                   | <1               | 7                | 1                |
| <b>Total known mammals</b>        | <b>1,557</b>     | <b>100</b>       | <b>676</b>          | <b>100</b>       | <b>475</b>       | <b>100</b>       |
| <b>Unknown mammals</b>            | <b>12</b>        |                  | <b>6</b>            |                  | <b>6</b>         |                  |
| <b>Total mammals</b>              | <b>1,569</b>     |                  | <b>682</b>          |                  | <b>481</b>       |                  |

<sup>1</sup> See Table 13 for listing of species within each species group.

Table 15. Number of strikes to civil aircraft causing human fatality or injury and number of injuries and fatalities by wildlife species, USA, 1990–2006.

| Species of wildlife                      | No. of strikes | No. of humans |  | Species of wildlife                                | No. of strikes | No. of humans |
|------------------------------------------|----------------|---------------|--|----------------------------------------------------|----------------|---------------|
| <b><u>Strikes causing fatalities</u></b> |                |               |  | <b><u>Strikes causing injuries (continued)</u></b> |                |               |
| Unknown bird                             | 5              | 7             |  | <b>Misc. water birds</b>                           | <b>11</b>      | <b>11</b>     |
| White-tailed deer                        | 1              | 1             |  | American coot                                      | 2              | 2             |
| Brown pelican                            | 1              | 1             |  | Anhinga                                            | 1              | 1             |
| <b>Total</b>                             | <b>7</b>       | <b>9</b>      |  | D.-crsted cormorant                                | 1              | 1             |
|                                          |                |               |  | Egrets                                             | 1              | 1             |
| <b><u>Strikes causing injuries</u></b>   |                |               |  | Great frigatebird                                  | 1              | 1             |
| <b>Waterfowl</b>                         | <b>36</b>      | <b>40</b>     |  | Horned grebe                                       | 1              | 1             |
| Canada goose                             | 14             | 16            |  | Red-tailed tropicbird                              | 1              | 1             |
| Ducks                                    | 11             | 13            |  | Sandhill crane                                     | 1              | 1             |
| Geese                                    | 6              | 6             |  | Tropicbirds                                        | 1              | 1             |
| Mallard                                  | 2              | 2             |  | Western grebe                                      | 1              | 1             |
| Lesser scaup                             | 1              | 1             |  | <b>Birds of prey</b>                               | <b>10</b>      | <b>16</b>     |
| Long-tailed duck                         | 1              | 1             |  | Red-tailed hawk                                    | 3              | 4             |
| Snow goose                               | 1              | 1             |  | Hawks                                              | 2              | 3             |
| <b>Vultures</b>                          | <b>21</b>      | <b>23</b>     |  | Osprey                                             | 2              | 2             |
| Turkey vulture                           | 9              | 11            |  | American kestrel                                   | 1              | 5             |
| Vultures                                 | 9              | 9             |  | Golden eagle                                       | 1              | 1             |
| Black vulture                            | 3              | 3             |  | Owls                                               | 1              | 1             |
| <b>Large mammals</b>                     | <b>20</b>      | <b>29</b>     |  | <b>Doves/pigeons</b>                               | <b>5</b>       | <b>8</b>      |
| White-tailed deer                        | 16             | 23            |  | Rock pigeon                                        | 2              | 2             |
| Cattle                                   | 2              | 3             |  | Doves                                              | 1              | 1             |
| Mule deer                                | 1              | 2             |  | Mourning dove                                      | 1              | 1             |
| Horse                                    | 1              | 1             |  | Spotted dove                                       | 1              | 4             |
| <b>Gulls</b>                             | <b>12</b>      | <b>19</b>     |  | <b>Misc. birds/mammals</b>                         | <b>4</b>       | <b>6</b>      |
| Gulls                                    | 8              | 9             |  | Domestic dog                                       | 1              | 2             |
| Ring-billed gull                         | 2              | 8             |  | Rabbits                                            | 1              | 1             |
| Herring gull                             | 2              | 2             |  | Sharp-tailed grouse                                | 1              | 2             |
|                                          |                |               |  | Sparrows                                           | 1              | 1             |
|                                          |                |               |  | <b>Unknown bird</b>                                | <b>28</b>      | <b>33</b>     |
|                                          |                |               |  | <b>Total</b>                                       | <b>147</b>     | <b>185</b>    |

Table 16. Number of reported wildlife strikes indicating damage or a negative effect-on-flight (EOF) and reported losses in hours of downtime and U.S. dollars for civil aircraft, USA, 1990–2006.

|                                   | Number of reports |                                   |                                    |                                 | Reported time (hours) aircraft out of service (No. of reports) | Cost in millions of dollars (\$) (Number of reports) |                 |                |
|-----------------------------------|-------------------|-----------------------------------|------------------------------------|---------------------------------|----------------------------------------------------------------|------------------------------------------------------|-----------------|----------------|
|                                   | Total reports     | Reports indicating adverse effect | Reports indicating aircraft damage | Reports indicating negative EOF |                                                                | Direct cost                                          | Other cost      | Total cost     |
| 17-yr total                       | 73,526            | 13,150                            | 9,111                              | 6,017                           | 534,609<br>(3,579)                                             | 260.006<br>(2,258)                                   | 36.185<br>(883) | 296.191        |
| 17-yr avg.                        | 4,325             | 774                               | 536                                | 354                             | 31,448<br>(211)                                                | 15.294<br>(133)                                      | 2.129<br>(52)   | 17.423         |
| Mean losses per incident reported |                   |                                   |                                    |                                 | 149.4                                                          | 0.115                                                | 0.041           | 0.156          |
| <b>Estimated annual losses</b>    |                   |                                   |                                    |                                 |                                                                |                                                      |                 |                |
| <b>Minimum<sup>1</sup></b>        |                   |                                   |                                    |                                 | <b>115,545</b>                                                 | <b>89.071</b>                                        | <b>31.699</b>   | <b>120.774</b> |
| <b>Maximum<sup>2</sup></b>        |                   |                                   |                                    |                                 | <b>577,725</b>                                                 | <b>445.355</b>                                       | <b>158.497</b>  | <b>603.720</b> |

<sup>1</sup> Minimum values are based on the assumption that all 13,150 reported strikes indicating an adverse effect (negative EOF and/or damage) to aircraft (mean of 774/year) incurred similar amounts of damage and/or downtime and that these reports are all of the adverse-effect strikes that occurred.

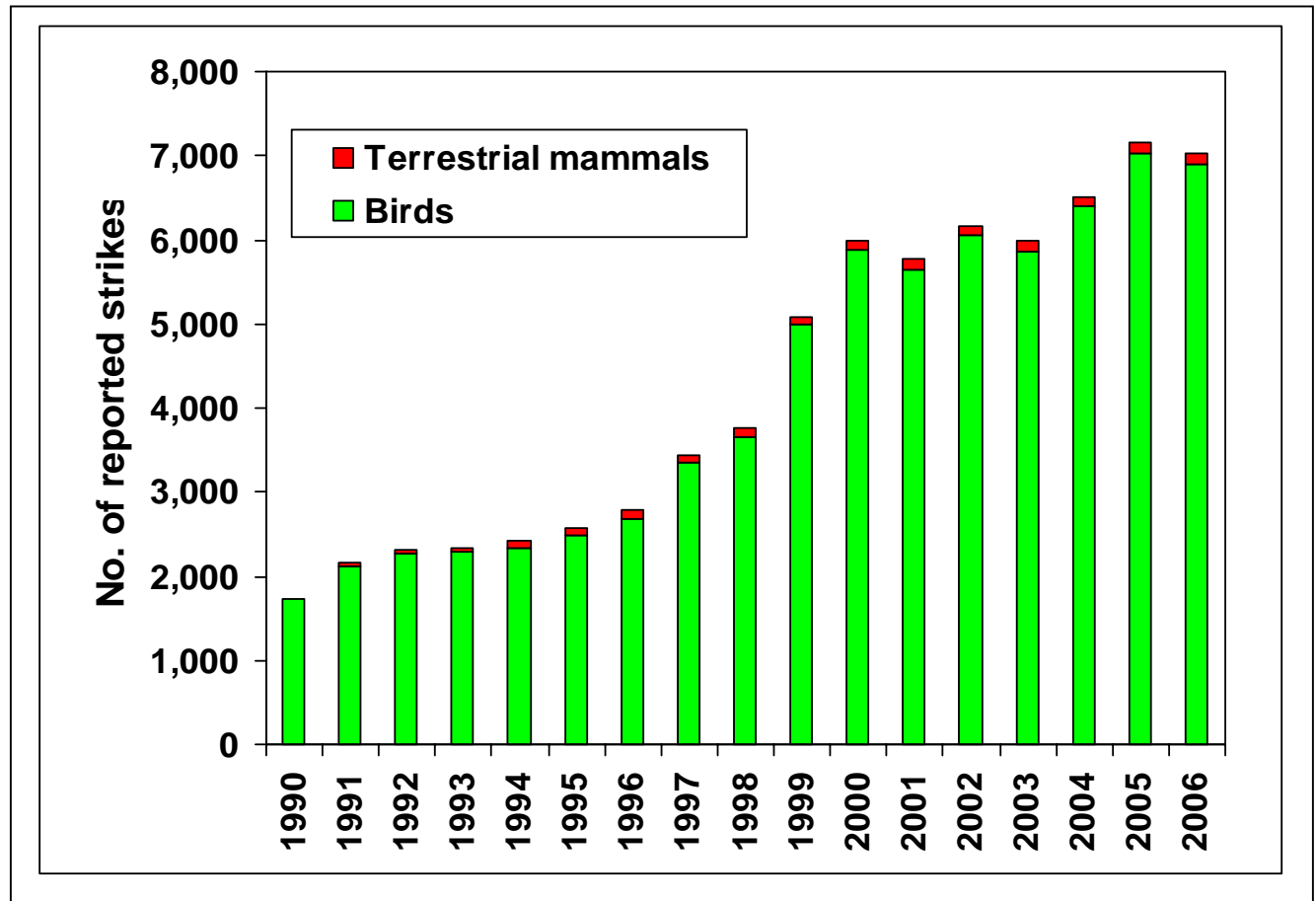
<sup>2</sup> Maximum values are based on the assumption the 13,150 reported strikes indicating an adverse effect represent only 20 percent of the total strikes that occurred (Cleary et al. 2005, Wright and Dolbeer 2005).

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## Figures

Figure 1. Number of reported bird (N = 71,670) and terrestrial mammal (N = 1,569) strikes to civil aircraft, USA, 1990–2006. Additionally, 199 and 88 strikes involving bats and reptiles, respectively, were reported for this 17-year period (see Table 1).



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## Appendix

### Appendix A. Selected Significant Strikes to Civil Aircraft in the United States, 2006



Prairie dogs not only create habitat for burrowing owls and other wildlife at airports, but their burrowing also can undermine runway edges and damage underground electrical cables. Photo by E. Cleary, FAA

The U.S. Department of Agriculture, through an interagency agreement with the Federal Aviation Administration, compiles a database of all reported wildlife strikes to U.S. civil aircraft and to foreign carriers experiencing strikes in the USA. We have compiled 73,526 strike reports from 1,365 USA airports and 204 foreign airports for 1990-2006 (7,089 in 2006), but estimate that this represents only about 20% of the strikes that have occurred (Wright and Dolbeer 2005). The following examples from the database in 2006 are presented to show the serious impact that strikes by birds or other wildlife can have on aircraft. These examples, from throughout the USA, demonstrate the widespread and diverse nature of the problem. The examples are not intended to highlight or criticize individual airports because strikes have occurred on almost every airport in the USA. Some of the strike examples reported here occurred off airport property during approach or departure. For more information on wildlife strikes or to report a strike, visit <http://wildlife-mitigation.tc.faa.gov>.

|       |                |
|-------|----------------|
| Date: | 7 January 2006 |
|-------|----------------|

Aircraft: B-757  
Airport: Portland Intl. (OR)  
Phase of Flight: Takeoff  
Effect on Flight: Precautionary landing  
Damage: Engine  
Wildlife Species: Great blue heron

Comments from Report: Bird was ingested during takeoff. Engine was shut down and a one-engine landing was made. Fan section of the engine was replaced. ID by Smithsonian, Division of Birds. Time out of service was 15 hours. Cost was \$244,000.

|       |                |
|-------|----------------|
| Date: | 9 January 2006 |
|-------|----------------|

Aircraft: C-310  
Airport: near St Charles, MO  
Phase of Flight: En route (1,500' AGL)  
Effect on Flight: Precautionary landing  
Damage: Wing, fuel tank  
Wildlife Species: Mallard

Comments from Report: Bird hit aircraft about 10 miles west of St. Charles County Smartt Airport. The pilot said there were no problems controlling the plane after impact. A fire in the right wing tip tank was noticed by the pilot after landing. The fire department arrived about 20 minutes later but did not have foam and the fire burned for 20 more minutes until an explosion caused the fire to go out. NTSB report found the strobe light assembly electrical short caused the fire. ID by Smithsonian, Division of Birds.

|       |                 |
|-------|-----------------|
| Date: | 21 January 2006 |
|-------|-----------------|

Aircraft: C-210  
Airport: Orlando Executive (FL)  
Phase of Flight: Approach (2,000' AGL)  
Effect on Flight: Precautionary landing  
Damage: Windshield  
Wildlife Species: Black vulture

Comments from Report: Bird crashed through the windshield. The instructor was cut by Plexiglas on head and face. Aircraft landed safely. Time out of service was 24 hours. Cost was \$3,500.

|       |                 |
|-------|-----------------|
| Date: | 1 February 2006 |
|-------|-----------------|

Aircraft: Bombardier de Havilland Dash 8  
 Airport: Boise Air Terminal (ID)  
 Phase of Flight: Approach (1,500' AGL)  
 Effect on Flight: None  
 Damage: Tail  
 Wildlife Species: Bald eagle  
 Comments from Report: Bird strike took out the leading edge of the tail. Aircraft was ferried out for repairs. ID by Smithsonian, Division of Birds.

|       |                  |
|-------|------------------|
| Date: | 17 February 2006 |
|-------|------------------|

Aircraft: B-757-200  
 Airport: Daniel Oduber Quiros Intl. (Costa Rica)  
 Phase of Flight: Takeoff  
 Effect on Flight: Precautionary landing  
 Damage: Engine  
 Wildlife Species: Crested caracara  
 Comments from Report: Bird strike took out the #1 engine. Aircraft landed without incident. ID by Smithsonian, Division of Birds. (U.S. carrier)

|       |                  |
|-------|------------------|
| Date: | 28 February 2006 |
|-------|------------------|

Aircraft: C-172  
 Airport: near Titusville, FL  
 Phase of Flight: En route  
 Effect on Flight: Emergency landing off airport  
 Damage: Windshield  
 Wildlife Species: Ring-billed gull  
 Comments from Report: While on traffic enforcement detail, the windshield was shattered by a gull. The pilot was forced to make an emergency landing in a cow pasture. During the landing, the aircraft clipped a fence. Pilot was taken to the hospital, treated and released. ID by Smithsonian, Division of Birds from photograph.

|                                                                                                                                                                                                                                                                                                                                                            |                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Date:                                                                                                                                                                                                                                                                                                                                                      | 1 March 2006                |
| Aircraft:                                                                                                                                                                                                                                                                                                                                                  | Airbus 320                  |
| Airport:                                                                                                                                                                                                                                                                                                                                                   | Washington Dulles Intl (DC) |
| Phase of Flight:                                                                                                                                                                                                                                                                                                                                           | Approach (100' AGL)         |
| Effect on Flight:                                                                                                                                                                                                                                                                                                                                          | Flight cancelled            |
| Damage:                                                                                                                                                                                                                                                                                                                                                    | Engine                      |
| Wildlife Species:                                                                                                                                                                                                                                                                                                                                          | European starlings          |
| Comments from Report: Over 270 carcasses were removed from the runway threshold. One brown-headed cowbird was in the group. Many parts of the aircraft were struck and both engines ingested birds. Damage was found in the #1 engine and it was removed. The flight was cancelled. Aircraft was out of service for 24 hours. Costs totaled \$1.3 million. |                             |

|                                                                                                                                                                                                                                      |                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Date:                                                                                                                                                                                                                                | 2 March 2006                 |
| Aircraft:                                                                                                                                                                                                                            | SA-227 Metroliner            |
| Airport:                                                                                                                                                                                                                             | Salt Lake City Intl. (UT)    |
| Phase of Flight:                                                                                                                                                                                                                     | Climb (600' AGL)             |
| Effect on Flight:                                                                                                                                                                                                                    | Emergency landing at airport |
| Damage:                                                                                                                                                                                                                              | Wing                         |
| Wildlife Species:                                                                                                                                                                                                                    | Common goldeneye             |
| Comments from Report: Right wing of aircraft was penetrated and badly dented. Pilot declared an emergency, returned to airfield and landed without incident. Aircraft needed extensive repair. ID by Smithsonian, Division of Birds. |                              |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Date:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 8 March 2006                      |
| Aircraft:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | C-172                             |
| Airport:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | near Mina, NV                     |
| Phase of Flight:                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | En route (2,500' AGL)             |
| Effect on Flight:                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Emergency landing at airport      |
| Damage:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Windshield, wings, tail, fuselage |
| Wildlife Species:                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Unknown birds                     |
| Comments from Report: Bird strike caused the windshield to implode, the doors blew open and the plane went into a spin and a spiral. Aircraft recovered at 500ft AGL. Pilot was able to land safely at KTPH. Wings were damaged by the force of the plane in the spin. Aircraft was out of service for 7 months. Costs estimated at \$15,700 plus medical bills for cuts and hypothermia which burned the lungs, throat and eyes of one of the passengers. Injuries reported for three people. |                                   |

|                                                                                                                                                                                                                                                                                                                                                                                              |                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Date:                                                                                                                                                                                                                                                                                                                                                                                        | 22 March 2006               |
| Aircraft:                                                                                                                                                                                                                                                                                                                                                                                    | Airbus 319                  |
| Airport:                                                                                                                                                                                                                                                                                                                                                                                     | General Mitchell Intl. (WI) |
| Phase of Flight:                                                                                                                                                                                                                                                                                                                                                                             | Approach                    |
| Effect on Flight:                                                                                                                                                                                                                                                                                                                                                                            | Engine shut down            |
| Damage:                                                                                                                                                                                                                                                                                                                                                                                      | Engine                      |
| Wildlife Species:                                                                                                                                                                                                                                                                                                                                                                            | Canada geese                |
| Comments from Report: While on 2 mile final, 1 or 2 large birds were ingested. The engine shut down and the pilot called an emergency. Fire trucks inspected and followed aircraft to gate. Pilots did not know they had hit birds as it was dark. There was major damage to the core and the engine was replaced. ID by the Smithsonian, Division of Birds. Cost of repair was \$2,675,600. |                             |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Date:                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 15 April 2006                     |
| Aircraft:                                                                                                                                                                                                                                                                                                                                                                                                                                               | CL-RJ 200                         |
| Airport:                                                                                                                                                                                                                                                                                                                                                                                                                                                | Detroit Metropolitan Airport (MI) |
| Phase of Flight:                                                                                                                                                                                                                                                                                                                                                                                                                                        | Climb (500' AGL)                  |
| Effect on Flight:                                                                                                                                                                                                                                                                                                                                                                                                                                       | Precautionary landing             |
| Damage:                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Engine                            |
| Wildlife Species:                                                                                                                                                                                                                                                                                                                                                                                                                                       | Northern pintail                  |
| Comments from Report: Just after takeoff, aircraft had multiple bird strikes along left side. Left engine ingested a bird and vibration occurred along with burning smell. An emergency was declared and the aircraft landed safely back at the airport. One type of duck found along runway was a scaup. Remains from engine were identified by the Smithsonian, Division of Birds. Time out of service was 43 hours and cost of repairs was \$71,000. |                                   |

|                                                                                                                                                                                                                                                                                         |                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Date:                                                                                                                                                                                                                                                                                   | 17 April 2006         |
| Aircraft:                                                                                                                                                                                                                                                                               | Learjet 60            |
| Airport:                                                                                                                                                                                                                                                                                | Palm Beach Intl. (FL) |
| Phase of Flight:                                                                                                                                                                                                                                                                        | Climb (2,000' AGL)    |
| Effect on Flight:                                                                                                                                                                                                                                                                       | Engine shut down      |
| Damage:                                                                                                                                                                                                                                                                                 | Engine                |
| Wildlife Species:                                                                                                                                                                                                                                                                       | Black vulture         |
| Comments from Report: Black vulture was ingested and the engine was shut down in flight. An uneventful landing was made on one engine. Engine was damaged beyond repair. ID by the Smithsonian, Division of Birds. Time out of service was 3 days and cost of new engine was \$750,000. |                       |

|       |               |
|-------|---------------|
| Date: | 18 April 2006 |
|-------|---------------|

Aircraft: B-737-300  
 Airport: Cincinnati/Northern Kentucky Intl. (KY)  
 Phase of Flight: Landing roll  
 Effect on Flight: None  
 Damage: Engine  
 Wildlife Species: Unknown  
 Comments from Report: Medium sized black bird was ingested during landing roll. Two fan blades damaged. Remains exited thru bypass section. Borescope inspection found distress and engine was removed. Cost of repairs estimated at \$1.1 million.

|       |               |
|-------|---------------|
| Date: | 24 April 2006 |
|-------|---------------|

Aircraft: C-560  
 Airport: Little Rock Adams Field (AR)  
 Phase of Flight: Approach (800' AGL)  
 Effect on Flight: None  
 Damage: Wing  
 Wildlife Species: Unknown  
 Comments from Report: Large area of wing leading edge dented. Removed and replaced outer section of wing leading edge. Aircraft out of service for 1 week. Cost \$19,000 for repairs.

|       |            |
|-------|------------|
| Date: | 6 May 2006 |
|-------|------------|

Aircraft: A-319  
 Airport: Portland Intl. (OR)  
 Phase of Flight: Takeoff  
 Effect on Flight: Precautionary landing  
 Damage: Engine  
 Wildlife Species: Red-tailed hawk  
 Comments from Report: The #1 engine ingested a hawk during takeoff causing vibration. An Alert 1 landing was made. Three fan blades were replaced. Flight was cancelled. Cost of repairs was \$83,200.



|       |             |
|-------|-------------|
| Date: | 14 May 2006 |
|-------|-------------|

Aircraft: B-747  
 Airport: Sydney Intl. (Australia)  
 Phase of Flight: Takeoff  
 Effect on Flight: Aborted takeoff  
 Damage: Engine, radome  
 Wildlife Species: White-breasted sea eagle  
 Comments from Report: Bird was ingested during takeoff causing the engine to surge. Takeoff was aborted. There was extensive fan blade damage. Replaced #1 engine 1<sup>st</sup> stage fan blades and radome. Flight was cancelled. (U.S. carrier)

|       |             |
|-------|-------------|
| Date: | 16 May 2006 |
|-------|-------------|

Aircraft: Bell 206  
 Airport: Near Sweetwater, TX  
 Phase of Flight: En route (3,000' AGL)  
 Effect on Flight: Emergency Landing  
 Damage: Windshield, rotor, antennas  
 Wildlife Species: Ducks  
 Comments from report: During a patient transfer to Abilene Regional Hospital, a helicopter hit a flock of 5-6 ducks, breaking the windshield. A large piece of the windshield fell in the pilot's lap. Because of severe vibration, an emergency was declared and the aircraft landed at the nearest airport. Remains were found in the cowlings, cross tubes, flight steps and antennas. The main rotor blade was damaged by the windshield. Time out of service was 1 week. Cost of repairs was estimated at \$48,100.

|       |             |
|-------|-------------|
| Date: | 18 May 2006 |
|-------|-------------|

Aircraft: DA-10  
 Airport: John H. Batten (WI)  
 Phase of Flight: Takeoff  
 Effect on Flight: Aborted takeoff  
 Damage: Engine  
 Wildlife Species: Gull  
 Comments from Report: Front fan on the right engine was damaged. Twelve fan blades were replaced. Aircraft was out of service for 6 days. Costs totaled \$60,000.

|       |             |
|-------|-------------|
| Date: | 22 May 2006 |
|-------|-------------|

Aircraft: A-320  
 Airport: John F. Kennedy Intl. (NY)  
 Phase of Flight: Takeoff  
 Effect on Flight: Aborted takeoff  
 Damage: Engine  
 Wildlife Species: Osprey  
 Comments from Report: Bird was ingested into left engine. Several blades were damaged.

|       |             |
|-------|-------------|
| Date: | 23 May 2006 |
|-------|-------------|

Aircraft: BE-60  
 Airport: Camdenton Memorial (MO)  
 Phase of Flight: Takeoff  
 Effect on Flight: Aborted takeoff, departed end of rwy  
 Damage: Aircraft damaged beyond repair  
 Wildlife Species: White-tailed deer  
 Comments from Report: Just prior to rotation at 110 kts, the aircraft hit a deer with the nose, then left main gear causing it to twist. Pilot pulled the power to idle, swerved sharply left and ran off the runway down an embankment. Damaged parts included, nose, radome, radar, both engines and propellers, and landing gear. Cost of aircraft was \$175,000.

|       |             |
|-------|-------------|
| Date: | 26 May 2006 |
|-------|-------------|

Aircraft: BE-55  
 Airport: Near Casa Grande, AZ  
 Phase of Flight: En route (2,500' AGL)  
 Effect on Flight: Emergency landing  
 Damage: Windshield  
 Wildlife Species: Red-tailed hawk  
 Comments from Report: The hawk shattered the windshield and hit the pilot in the right eye, knocking his headset and glasses off. The pilot had difficulty seeing due to swollen right eye and need for glasses in his left eye. Wind and engine noise made it almost impossible to hear the tower when he called for an emergency landing. Pilot was treated and released from the hospital.

|       |             |
|-------|-------------|
| Date: | 26 May 2006 |
|-------|-------------|

Aircraft: MU-2  
 Airport: Houston-Hobby (TX)  
 Phase of Flight: Approach (100' AGL)  
 Effect on Flight: Engine shut down  
 Damage: Engine  
 Wildlife Species: Rock pigeons  
 Comments from Report: Bird hit the #2 engine, propeller, wing, fuselage and tail. Cost to repair engine was \$200,000. Other costs totaled \$5,000.

|       |              |
|-------|--------------|
| Date: | 18 June 2006 |
|-------|--------------|

Aircraft: MD-11  
 Airport: Subic Bay Intl. (Philippines)  
 Phase of Flight: Climb (400' AGL)  
 Effect on Flight: None  
 Damage: Engine  
 Wildlife Species: Fruit bat suspected  
 Comments from Report: Maintenance found 8 damaged fan blades and fan case liner segment damage. Engine was borescoped. Aircraft was out of service for 27 hours. Cost of repairs was \$99,800. (U.S. carrier)

|       |              |
|-------|--------------|
| Date: | 22 June 2006 |
|-------|--------------|

Aircraft: C-172  
 Airport: Mount Olive Muni (NC)  
 Phase of Flight: Takeoff  
 Effect on Flight: Aborted takeoff  
 Damage: Nose, propeller, landing gear, engine  
 Wildlife Species: White-tailed deer  
 Comments from Report: Deer ran into front of plane. It was not seen until the shadows appeared in the landing lights. Aircraft was out of service for 2 weeks. Cost of repairs was \$8,000, other costs totaled \$1,000.

|       |              |
|-------|--------------|
| Date: | 26 June 2006 |
|-------|--------------|

Aircraft: B-757  
 Airport: Dallas-Fort Worth (TX)  
 Phase of Flight: Takeoff  
 Effect on Flight: Engine shut down, precautionary landing  
 Damage: Engine  
 Wildlife Species: Rock pigeon  
 Comments from Report: Initial inspection showed 9 bent compressor blades. Aircraft was taken out of service for closer inspection.

|       |                |
|-------|----------------|
| Date: | 03 August 2006 |
|-------|----------------|

Aircraft: Cessna Citation 560  
 Airport: Angola Tri-State Airport (IN)  
 Phase of Flight: Takeoff  
 Effect on Flight: Aborted takeoff, ran off end of runway  
 Damage: Engine, brake line  
 Wildlife Species: Canada goose  
 Comments from Report: Left engine ingested birds causing an uncontained failure. Aircraft went off the runway during the aborted takeoff. Top cowling and fan were replaced. ID by the Smithsonian, Division of Birds. Aircraft was out of service for 13 days and costs were estimated at \$750,000.

|       |                |
|-------|----------------|
| Date: | 13 August 2006 |
|-------|----------------|

Aircraft: B-737-800  
 Airport: Salt Lake City Intl. (UT)  
 Phase of Flight: Climb (1,300' AGL)  
 Effect on Flight: Precautionary landing  
 Damage: Nose, engine, cowling  
 Wildlife Species: American white pelican  
 Comments from Report: Bird was hit while turning over the Great Salt Lake. Pilot saw about 8 birds flying in front of the aircraft. One hit the AOA sensor then hit the #2 engine cowling causing a large gash. A fan blade was also damaged. ID by the Smithsonian, Division of Birds. Aircraft was out of service for 12 hours and costs were estimated at \$100,000.

|       |                |
|-------|----------------|
| Date: | 18 August 2006 |
|-------|----------------|

Aircraft: CL-RJ 200  
 Airport: Salt Lake City Intl. (UT)  
 Phase of Flight: Climb (500' AGL)  
 Effect on Flight: Precautionary landing  
 Damage: Both engines  
 Wildlife Species: Northern pintail  
 Comments from Report: Pilot saw 2 birds on takeoff/climb and felt them hit the engines. Engines began to vibrate. Aircraft landed without incident and was towed to the hanger. ID by the Smithsonian, Division of Birds. Time out of service was over 24 hours and costs to repair engines totaled \$811,825.

|       |                  |
|-------|------------------|
| Date: | 6 September 2006 |
|-------|------------------|

Aircraft: Cessna 206  
 Airport: The Eastern Iowa Airport (IA)  
 Phase of Flight: Climb (2,130' AGL)  
 Effect on Flight: Precautionary landing  
 Damage: Wing, light  
 Wildlife Species: Red-tailed hawk  
 Comments from Report: Bird strike pushed the leading edge of the left wing into the spar. ID by the Smithsonian, Division of Birds. Time out of service was one month. Costs totaled \$61,500.

|       |                |
|-------|----------------|
| Date: | 1 October 2006 |
|-------|----------------|

Aircraft: Gulfstream V  
 Airport: Martin State (MD)  
 Phase of Flight: Approach (50' AGL)  
 Effect on Flight: None  
 Damage: Engine, wing  
 Wildlife Species: Canada goose  
 Comments from Report: Ingestion caused need to rebuild the #1 eng. Right wing was also damaged. Time out of service was one week. Costs totaled \$5 million.

|       |                 |
|-------|-----------------|
| Date: | 1 November 2006 |
|-------|-----------------|

Aircraft: B-767  
Airport: San Francisco Intl. (CA)  
Phase of Flight: Climb (35' AGL)  
Effect on Flight: Precautionary landing  
Damage: Engine  
Wildlife Species: White-tailed kite

Comments from Report: Bird hit spinner cap. Eleven nonconsecutive fan blade tips damaged. ID by the Smithsonian, Division of Birds. Time out of service was 24 hours. Costs totaled \$500,000.

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|-------|------------------|
| Date: | 26 November 2006 |
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Aircraft: B-737-500  
Airport: Denver Intl. (CO)  
Phase of Flight: Takeoff  
Effect on Flight: Precautionary landing  
Damage: Engine  
Wildlife Species: Great horned owl

Comments from Report: Aircraft made an emergency landing after ingesting a "coyote" into the #2 engine. The engine was shut down due to severe vibration. All first stage fan blades were replaced. Cost estimated at \$50,000. Aircraft out of service for 13 hours. The remains looked more like feathers than fur according to WS biologist. Correct ID by Smithsonian, Division of Birds.

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|-------|-----------------|
| Date: | 8 December 2006 |
|-------|-----------------|

Aircraft: B-767  
Airport: John F. Kennedy Intl. (NY)  
Phase of Flight: Climb (1,000' AGL)  
Effect on Flight: Precautionary landing  
Damage: Engine  
Wildlife Species: Great blue heron

Comments from Report: Captain saw 2 birds on take off. Aircraft returned to JFK on Alert 3-3. One badly damaged great blue heron was recovered from the runway. Carcass appears to have gone through the #2 engine. The engine was replaced and passengers were put on a replacement aircraft.

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| Date:                                                                                                                                                                                                                                                                                                                                                                                                 | 14 December 2006      |
| Aircraft:                                                                                                                                                                                                                                                                                                                                                                                             | Hughes 369            |
| Airport:                                                                                                                                                                                                                                                                                                                                                                                              | Near Fresno, CA       |
| Phase of Flight:                                                                                                                                                                                                                                                                                                                                                                                      | En route              |
| Effect on Flight:                                                                                                                                                                                                                                                                                                                                                                                     | Precautionary landing |
| Damage:                                                                                                                                                                                                                                                                                                                                                                                               | Windshield            |
| Wildlife Species:                                                                                                                                                                                                                                                                                                                                                                                     | Gull                  |
| Comments from Report: Bird strike occurred about 6 miles away from Fresno Airport. The sheriff was in pursuit of a theft in progress. The gull shattered the windshield on the observer's side. The observer had minor bruises and was flown to a medical center. Then the aircraft was put on a flatbed and taken to the Fresno Airport. Gull was either a ring-billed or California based on photo. |                       |

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| Date:                                                                                                                                                                                                                                                                                                                                                        | 26 December 2006                        |
| Aircraft:                                                                                                                                                                                                                                                                                                                                                    | Airbus 320                              |
| Airport:                                                                                                                                                                                                                                                                                                                                                     | Long Beach (CA)                         |
| Phase of Flight:                                                                                                                                                                                                                                                                                                                                             | Climb                                   |
| Effect on Flight:                                                                                                                                                                                                                                                                                                                                            | Engine shut down, Precautionary landing |
| Damage:                                                                                                                                                                                                                                                                                                                                                      | Engine                                  |
| Wildlife Species:                                                                                                                                                                                                                                                                                                                                            | Unknown                                 |
| Comments from Report: Bird was ingested into the number 1 engine. Pilot heard a loud noise during take off and shut the engine down. They landed about ½ hour later after burning off fuel. Emergency crews were standing by but were not needed. Bird carcasses were found on the airfield. Cost for repair was \$15,500. Time out of service was 14 hours. |                                         |

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| Date:                                                                                                                                                                                                                                                                                                                                                                                            | 29 December 2006                         |
| Aircraft:                                                                                                                                                                                                                                                                                                                                                                                        | Vans RV-4                                |
| Airport:                                                                                                                                                                                                                                                                                                                                                                                         | Grants Pass Airport (OR)                 |
| Phase of Flight:                                                                                                                                                                                                                                                                                                                                                                                 | Climb (1,220' AGL)                       |
| Effect on Flight:                                                                                                                                                                                                                                                                                                                                                                                | Impacted terrain during landing attempt  |
| Damage:                                                                                                                                                                                                                                                                                                                                                                                          | Prop, wing, fuselage, landing gear, tail |
| Wildlife Species:                                                                                                                                                                                                                                                                                                                                                                                | Canada goose                             |
| Comments from Report: Bird hit the propeller and the aircraft began to shake violently. Pilot returned to the airport and was coming in high and fast on final approach, so he attempted a go-around. He lost control of the aircraft and hit the ground 500 feet beyond the departure end of the runway. Both passenger and the pilot received serious injuries. Cost was reported as \$30,000. |                                          |

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