



**U. S. DEPARTMENT  
OF TRANSPORTATION  
FEDERAL AVIATION  
ADMINISTRATION**

# **WILDLIFE STRIKES TO CIVIL AIRCRAFT IN THE UNITED STATES 1990-2001**



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**FEDERAL AVIATION ADMINISTRATION  
NATIONAL WILDLIFE STRIKE DATABASE  
SERIAL REPORT NUMBER 8**

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**REPORT PREPARED BY  
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**REPORT OF THE ASSOCIATE ADMINISTRATOR OF AIRPORTS  
OFFICE OF AIRPORT SAFETY AND STANDARDS  
AIRPORT SAFETY & CERTIFICATION  
WASHINGTON, DC**

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**JUNE 2002**

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## **COVER**

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A Canada goose was ingested into #2 engine of an Airbus 300 at 200 feet AGL during lift off from an airport in Ohio, June 2001. The engine had an uncontained failure, and a precautionary landing was made. Cost to replace engine was \$2 million, and the aircraft was out of service for 4 days.

Future reports will feature photographs of aircraft damage resulting from wildlife strikes. Anyone with quality photographs of wildlife-aircraft strike damage is encouraged to submit them to one of the authors for consideration.

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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, Arizona. The assistance provided by these above-acknowledged professionals is greatly appreciated. **S. Agrawal**, and **M. Hoven**, FAA William J. Hughes Technical Center, Atlantic City, New Jersey, also provided critical support and advice. Finally, we acknowledge and thank all of the people who take the time and effort to report wildlife strikes -- pilots, mechanics, control tower personnel, airport operations personnel, airline flight safety offices, and USDA Wildlife Services biologists – to name but a few. 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 International Airport, New Jersey.



## PREFACE

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It is widely recognized throughout the civil and military aviation communities that 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 400 people (over 130 since 1995) and destroyed over 420 aircraft (Richardson 1994, 1996, Richardson and West 2000, Thorpe 1996, 1998, Dolbeer unpublished data). Several factors are contributing 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% 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, only 30% had three or four engines. It is estimated that by 2008 the fleet will contain about 7,000 aircraft, only 10% of which will have three or four engines (Cleary and Dolbeer 1999). This reduction in engine redundancy increases the probability of life-threatening situations resulting from aircraft collisions with wildlife, especially with flocks of birds.
2. Many populations of wildlife species commonly involved in strikes have increased markedly in the last few decades. For example, in the USA, from 1980 to 2000, the resident (non-migratory) Canada goose population increased at a mean rate of 10% per year; the ring-billed gull population increased at an annual rate of about 4%; the red-tailed hawk population increased at an annual rate of 3%; and the turkey vulture population increased at an annual rate of 2% (Sauer et al. 2001). Thirteen of the 14 bird species in North America with mean body masses greater than 8 lbs have shown significant population increases over the past 3 decades (Dolbeer and Eschenfelder 2002). The white-tailed deer population increased from a low of about 350,000 in 1900 to about 24 million in 1994 (Jacobson and Kroll 1994).
3. In the USA, air traffic has increased substantially since 1980. Passenger enplanements increased from about 310 million in 1980 to 700 million in 2000, and USA commercial air traffic increased from about 18 million aircraft movements in 1980 to 30 million in 2000 (3% per year, FAA 2002).

As a result of these factors, experts within the Federal Aviation Administration (FAA), U.S. Department of Agriculture, 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, other than 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 U. S. Department of Agriculture, Wildlife Services, National Wildlife Research Center, initiated a project to obtain more objective estimates of the magnitude and

nature of the wildlife strike problem nationwide for civil aviation. This project includes 1) editing all strike reports (FAA Form 5200-7) sent to the FAA since 1990 to ensure consistent, error-free data; 2) entering all edited strike reports since 1990 in a Wildlife Strike Database; 3) supplementing FAA-reported strikes with additional, non-duplicated strike reports from other sources; 4) providing FAA with an updated computer file each quarter containing all edited strike reports; and 5) assisting the FAA with the production of annual reports summarizing the results of the analyses. Such analyses are critical to determine the economic cost of wildlife strikes, the magnitude of safety issues, and most importantly, the nature of the problems (e.g., wildlife species, types of damage, altitude and phase of flight, and seasonal patterns) so that corrective actions can be taken.

The first annual report on wildlife strikes to civil aircraft in the USA, covering 1994, was completed in November 1995 (Dolbeer et al. 1995). Subsequent reports covering the years 1993-1995, 1992-1996, 1991-1997, 1990-1998, 1990-1999, and 1990-2000 have been published (Cleary et al. 1996, 1997, 1998, 1999, 2000, 2002). This is the eighth report in the series and covers the 12-year period, 1990-2001.



An MD-11 with 217 passengers ingested a herring gull into the #3 engine on departure from a west coast airport in January 2001. The engine stall blew off the nose cowl that was sucked back into the engine and shredded. The engine had an uncontained failure. The pilot aborted take off and blew two tires.

# **WILDLIFE STRIKES TO CIVIL AIRCRAFT IN THE UNITED STATES, 1990-2001**

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## **INTRODUCTION**

This report presents a summary analysis of data from the Federal Aviation Administration's National Wildlife Strike Database for the 12-year period, 1990-2001. A more detailed publication covering the 10-year period, 1990-1999, was published in September 2000 (Cleary et al. 2000). Subsequent detailed reports will be produced at 5-year intervals. In interim years such as this, annual reports summarizing data in tabular form for all available years will be produced. Unless noted, all totals are for the 12-year period, and percentages are of the total known. Because of the large amounts of data, Tables 2-12 and 14-18 present 12-year totals only. Tables in Excel 2000<sup>®</sup> format containing wildlife aircraft strike data for individual years, 1990-2001, can be found at: <http://wildlife-mitigation.tc.faa.gov>.

## **RESULTS**

Between 1990 and 2001, 40,206 ( $x = 3,351/\text{year}$ ) strikes were reported to the FAA. There was a 4% decrease in the number of wildlife strikes reported in 2001 over 2000, the first year since 1990 that the number of reported strikes has declined. This decline was apparently related to the terrorist acts on 11 September 2001 (Table 1, Figure 1). There was a 3.3-fold increase in the number of strikes reported in 2001 compared to 1990 (Table 1, Figure 1). We suggest that the steady increase in reports from 1990 to 2000-2001 is the result 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 2002).

Most (66%) of the 40,206 strike reports were filed using FAA Form 5200-7 (Table 2). Pilots and airline personnel filed 30% and 24% of these 40,206 reports, respectively (Table 3). About 83% of the reported strikes involved commercial aircraft; the remainder involved business, private, and miscellaneous 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). CA, FL, TX, NY, and IL reported the most bird strikes. NY, IL, MI, PA, and TX reported the most mammal strikes.

Most bird strikes (51%) occurred between July and October (Table 6); 64% occurred during the day (Table 7); 54% occurred when the aircraft was on approach or during the landing roll; and 39% occurred during take off and climb (Table 8). About 56% of the bird strikes occurred when the aircraft was at an altitude of less than 100 ft. above ground level (AGL); 78% occurred under 1,000 ft. AGL; and 86% occurred under 2,000 ft. AGL (Table 9, Figure 2).

Most mammal strikes (41%) occurred between September and November (Table 6); 63% occurred at night (Table 7); 52% occurred during the landing roll; and 34% occurred during the take-off run. About 11% of the reported mammal strikes occurred while the aircraft was still in the air, when the aircraft struck deer with the landing gear or encountered bats (Table 8).

The aircraft components most commonly reported as struck by birds were nose/radome, windshield, engine, wing/rotor, and fuselage. Aircraft engines were the component most frequently (34% of all damaged components) reported as being damaged by bird strikes. Of the 5,947 aircraft engines reported as being struck by birds, 36% (2,118) were damaged (Table 10). There were 279 incidents in which two or more engines on a single aircraft were struck by birds.

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

Of the 39,177 bird strikes reported, 33,251 provided some indication as to the nature and extent of any damage. Of these 33,251 reports, 27,806 (84%) indicated the strike did not damage the aircraft; 2,920 (9%) indicated the aircraft suffered minor damage; 1,613 (5%) indicated the aircraft suffered substantial damage; 902 (3%) reported an uncertain level of damage, and 10 reports (<1%) indicated the aircraft was destroyed as a result of the strike (Tables 11, 12). Reports were received detailing 93 bird strikes that resulted in 101 human injuries and 6 fatalities (Table 13). Waterfowl (geese and ducks) were responsible for 31 (47%) of the 66 bird strikes causing injury or death in which the bird type was identified (Table 14).

Of the 983 mammal strikes reported, 743 provided some indication as to the nature and extent of any damage. Of these 743 reports, 257 (35%) indicated the strike did not damage the aircraft; 240 (32%) indicated the aircraft suffered minor damage; 206 (28%) indicated the aircraft suffered substantial damage; 27 (4%) reported an uncertain level of damage, and 13 reports (2%) indicated the aircraft was destroyed as a result of the strike (Tables 11, 12). Not surprisingly, a much higher percentage of mammal strikes (65%) resulted in aircraft damage than did bird strikes (16%). Reports were received of 18 mammal strikes that resulted in 24 human injuries and 1 fatality (Table 13). Deer were responsible for 89% of these mammal strikes that resulted in death or injury (Table 14).

Fifteen and 58% of the bird and mammal strike reports, respectively, indicated the strike had an adverse effect-on-flight (Table 15). Four percent of the bird strikes resulted in an aborted take off compared to 18% of mammal strikes.

Birds were involved in 97.4% of the reported strikes, mammals in 2.4%, and 0.1% involved reptiles (Table 1). Table 16 shows the number of reported strikes, the number of strikes that damaged 1 or more aircraft components, the number of strikes that had a

negative effect-on-flight, the reported aircraft down time, and reported costs by identified wildlife species, 1990-2001. Only 16,899 (43%) of the 39,177 bird strikes provided information on the type of bird (e.g., gull, hawk). Furthermore, only 7,735 (20%) of the reports provided identification to species (e.g., ring-billed gull, red-tailed hawk; Table 16).

Gulls (27%), doves (13%), raptors (12%), and waterfowl (11%) were the most frequently struck bird groups (Tables 16, 17). Gulls were involved in 2.5 times as many strikes as waterfowl, but waterfowl were involved in more damaging strikes (837, 31% of all damaging strikes in which the bird type was identified) than were gulls (782, 29% of damaging strikes). Gulls were responsible for the greatest number of bird strikes (624, 33%) that had a negative effect-on-flight. The most frequently struck mammals were Artiodactyls (57%) and Carnivores (24%, Tables 16, 17). Artiodactyls were responsible for 94% and 86% of the mammal strikes that resulted in damage and a negative effect-on-flight, respectively.

For the 12-year period, reported losses from bird strikes totaled 193,624 hours of aircraft down time and \$125.5 million in monetary losses. Reported losses from mammal strikes totaled 121,272 hours of aircraft down time and \$23.3 million in monetary losses (Table 16).

Of the 7,749 reports that indicated the strike had an adverse effect on the aircraft and/or flight, 1,889 provided an estimate of the aircraft down time ( $\Sigma = 314,896$  hours,  $\bar{x} = 167$  hours down time/incident), and 1,370 provided an estimate of the direct and/or other cost ( $\Sigma = \$148.7$  million,  $\bar{x} = \$108,560$  damage/incident). Of the 1,370 reports providing a damage cost estimate, 1,251 gave an estimate of direct aircraft damage ( $\Sigma = \$128.3$  million,  $\bar{x} = \$102,541$  damage/incident), and 476 gave an estimate of other monetary losses ( $\Sigma = \$20.4$  million,  $\bar{x} = \$42,958$  lost/incident, Table 18).

Analysis of strike reports from three major USA airports showed that less than 20% of all strikes occurring at these airports were reported to the FAA (Cleary et al. 1996, 1997, 1998; Dolbeer et al. 1995). Additionally, many reports received by the FAA were filed before aircraft damage had been fully assessed. For these reasons, the information on the number of strikes and their associated costs compiled from the voluntary reporting program is believed to severely underestimate the magnitude of the problem.

Assuming all 7,749 reported wildlife strikes that had an adverse effect on the aircraft and/or flight engendered similar amounts of down time and/or monetary losses, and that these reports are all of the damaging strikes that occurred, then at a minimum, wildlife strikes cost the USA civil aviation industry 106,872 hours/year of aircraft down time and \$94.0 million in monetary losses (\$66.2 million/year in direct costs and \$27.7 million/year in associated costs, Table 18).

Further, assuming a 20% reporting rate, the cost of wildlife strikes to the USA civil aviation industry is estimated to be in excess of 534,361 hours/year of aircraft down time

and \$469.8 million in monetary losses (\$331.1 million/year in direct costs and \$138.7 million/year in associated costs, Table 18).

## **CONCLUSIONS**

With the analysis of 12 years of strike data, the magnitude and severity of the wildlife-aircraft strike problem is obvious. Two important points need to be made. First, airport managers need to be aware of the wildlife hazards on their airports (Dolbeer et al. 2000) and take appropriate actions, under the guidance of professional biologists trained in wildlife damage management, to minimize the problems. Second, the focus of airport wildlife management needs to be widened to consider habitats and land-uses in proximity to the airport, such as wetlands, waste-disposal facilities, and wildlife refuges, all of which can attract wildlife hazardous to aviation. Such land uses and activities are often incompatible with aviation safety and should be prohibited near airports or designed and operated in a manner that minimizes the attraction of hazardous wildlife.

A recently published manual, *Wildlife Hazard Management at Airports* (Cleary and Dolbeer 1999), was prepared to assist airport personnel in developing and implementing wildlife hazard management plans. Copies of this manual (stock number 050-007-012837) can be ordered from the Superintendent of Documents, P.O. Box 321954, Pittsburgh, PA 15720-7954 or are available online in English, Spanish and French at <http://wildlife-mitigation.tc.faa.gov>.

Finally, there is a need for increased and more detailed reporting of wildlife strikes. For example, our previous analysis indicated <20% of all wildlife strikes involving USA civil aircraft are reported. Furthermore, only about 43% of all reported bird strikes, 1990-2001, provided information on the type of bird struck, and only about 20% of the reports identified the birds struck to species level. Only 18% of strike reports indicating an adverse effect on the aircraft or flight provided an estimate of economic costs resulting from the strike.

Pilots, airport operations and aircraft maintenance personnel, or anyone else having knowledge of a strike should report the incident. 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 than would be possible if just one report were filed.

The identification of the species of wildlife struck is particularly important. Bird strike remains that cannot be identified by airport personnel can often be identified by a local biologist or by sending feather remains in a sealed plastic bag (with FAA Form 5200-7) to:

Smithsonian Institution  
Natural History Building, E607  
10<sup>th</sup> and Constitution NW  
Washington, DC 20560  
Attn: Carla Dove

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. Do not send entire bird carcasses through the mail.

Strikes can also be reported via the Internet (<http://wildlife-mitigation.tc.faa.gov>), in addition to the traditional means of filling out and mailing FAA Form 5200-7. FAA Form 5200-7 can be accessed and printed from the above internet site.



A Boeing 767 operated by a U.S. air carrier struck a flock of migrating northern shovelers while climbing through 14,000 feet on departure from an airport in France, April 2001. The strike caused 11 punctures to the aircraft. One bird penetrated the cockpit, causing depressurization and splattering crew with bird debris and insulation. The pilot had to use an oxygen mask. Aircraft returned safely to airport. Cost of repairs was over \$1 million. Photo courtesy of the airline.

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## TABLES

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Table 1. Number of reported wildlife strikes to civil aircraft by wildlife group, USA, 1990-2001 (See Figure 1).

Year	Birds	Mammals	Reptiles	Total
1990	1,719	20	0	1,739
1991	2,120	39	0	2,159
1992	2,252	57	1	2,310
1993	2,271	59	0	2,330
1994	2,313	74	1	2,388
1995	2,485	73	8	2,566
1996	2,682	92	3	2,777
1997	3,340	92	15	3,447
1998	3,648	109	7	3,764
1999	4,980	96	1	5,077
2000	5,820	135	2	5,957
2001	5,547	137	8	5,692 <sup>1</sup>
<b>Total</b>	<b>39,177</b>	<b>983</b>	<b>46</b>	<b>40,206</b>

<sup>1</sup> There was a 9% increase in the number of reported strikes for January-August 2001 compared to the same months in 2000; there was a 24% decline in reported strikes for September-December 2001 compared to the same months in 2000.

Table 2. Source of information for reported wildlife strikes to civil aircraft, USA, 1990-2001.

Source	12-year total	% of total known
FAA Form 5200-7	26,556	66
Airline report	4,759	12
Multiple <sup>1</sup>	3,543	9
Airport report	2,263	6
Other <sup>2</sup>	809	2
Engine manufacturer	765	2
Aircraft Incident Report	712	2
Preliminary Aircraft Incident Report	529	1
Aviation Safety Reporting System	155	<1
Aircraft Incident Preliminary Notice	61	<1
National Transportation Safety Board	54	<1
<b>Total</b>	<b>40,206</b>	<b>100</b>

<sup>1</sup>. More than one report is filed for the same strike.

<sup>2</sup>. Various sources such as news media and Commercial Incident Reports.

Table 3. Person filing report of wildlife strike to civil aircraft, USA, 1990-2001.

Person filing report	12-year total	% of total known
Pilot	8,916	30
Airline Operations	7,252	24
Tower	5,604	19
Carcass found <sup>1</sup>	3,882	13
Airport Operations	2,822	9
Other	1,401	5
<b>Total known</b>	<b>29,877</b>	<b>100</b>
<b>Unknown</b>	<b>10,329</b>	
<b>Total</b>	<b>40,206</b>	

<sup>1</sup> Airport operations 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, 1990-2001.

Type of Operator	12-year total	% of total known
Commercial	29,344	83
Business	4,422	13
Private	1,347	4
Government/Police	177	<1
<b>Total known</b>	<b>35,290</b>	<b>100</b>
<b>Unknown</b>	<b>4,916</b>	
<b>Total</b>	<b>40,206</b>	

Table 5. Number of reported bird and mammal strikes to civil aircraft by USA state, including Puerto Rico (PR) and the U.S. Virgin Islands (VI), 1990-2001.

Reported strikes					Reported strikes				
State	Birds	Mammals	Total	% of total known	State	Birds	Mammals	Total	% of total known
AK	313	7	320	1	NC	836	18	854	2
AL	413	10	423	1	ND	83	2	85	<1
AR	171	12	183	1	NE	339	8	347	1
AZ	483	34	517	1	NH	200	6	206	1
CA	3,311	37	3,348	9	NJ	1,106	47	1,153	3
CO	820	39	859	2	NM	74	2	76	<1
CT	463	15	478	1	NV	194	3	197	1
DC	1,019	24	1,043	3	NY	2,342	74	2,416	7
DE	19	1	20	<1	OH	1,248	38	1,286	4
FL	2,926	39	2,965	8	OK	408	18	426	1
GA	718	14	732	2	OR	618	6	624	2
HI	755	1	756	2	PA	1,611	54	1,665	5
IA	278	10	288	1	PR	64	0	64	<1
ID	84	4	88	<1	RI	151	3	154	<1
IL	2,009	62	2,071	6	SC	201	7	208	1
IN	410	7	417	1	SD	62	6	68	<1
KS	115	4	119	<1	TN	953	13	966	3
KY	980	10	990	3	TX	2,697	53	2,750	8
LA	773	14	787	2	UT	354	5	359	1
MA	536	11	547	2	VA	609	31	640	2
MD	402	27	429	1	VI	45	0	45	<1
ME	130	7	137	<1	VT	31	0	31	<1
MI	908	55	963	3	WA	594	8	602	2
MN	337	10	347	1	WI	359	32	391	1
MO	705	23	728	2	WV	102	41	143	<1
MS	146	4	150	<1	WY	24	4	28	<1
MT	54	2	56	<1					
					<b>Total known</b>	<b>34,583</b>	<b>962</b>	<b>35,545</b>	<b>100</b>
					<b>Foreign<sup>1</sup></b>	<b>715</b>	<b>5</b>	<b>720</b>	
					<b>Unknown</b>	<b>3,879</b>	<b>16</b>	<b>3,895</b>	
					<b>Total<sup>2</sup></b>	<b>39,177</b>	<b>983</b>	<b>40,160</b>	

<sup>1</sup> Reported strikes to USA air carriers at foreign airports.

<sup>2</sup> In addition, 46 strikes with reptiles were reported.

Table 6. Number of reported wildlife strikes to civil aircraft by month, USA, 1990-2001.

Month	Birds		Mammals	
	12-year total	% of total known	12-year total	% of total known
January	1,518	4	48	5
February	1,446	4	39	4
March	2,159	6	58	6
April	2,695	7	56	6
May	3,526	9	50	5
June	2,818	7	71	7
July	4,274	11	88	9
August	5,269	13	109	11
September	5,325	14	121	12
October	5,146	13	139	14
November	3,133	8	141	14
December	1,868	5	63	6
<b>Total<sup>1</sup></b>	<b>39,177</b>	<b>100</b>	<b>983</b>	<b>100</b>

<sup>1</sup> In addition, 46 strikes with reptiles were reported.



Table 7. Reported time of occurrence of wildlife strikes to civil aircraft, USA, 1990-2001.

Time of day	Birds		Mammals	
	12-year total	% of total known	12-year total	% of total known
Dawn	1,205	4	18	3
Day	18,214	64	165	24
Dusk	1,500	5	64	9
Night	7,574	27	429	63
<b>Total known</b>	<b>28,493</b>	<b>100</b>	<b>676</b>	<b>100</b>
<b>Unknown</b>	<b>10,684</b>		<b>307</b>	
<b>Total<sup>1</sup></b>	<b>39,177</b>		<b>983</b>	

<sup>1</sup> In addition, 46 strikes with reptiles were reported.

Table 8. Reported phase of flight at time of wildlife strikes to civil aircraft, USA, 1990-2001.

Phase of flight	Birds		Mammals	
	12-year total	% of total known	12-year total	% of total known
Parked	18	<1	0	0
Taxi	138	<1	22	3
Take-off run	6,183	20	262	34
Climb	5,807	19	19	2
En route	1,019	3	1	<1
Descent	1,142	4	2	<1
Approach	11,789	38	63	8
Landing roll	5,081	16	407	52
<b>Total known</b>	<b>31,177</b>	<b>100</b>	<b>776</b>	<b>100</b>
<b>Unknown</b>	<b>8,000</b>		<b>207</b>	
<b>Total<sup>1</sup></b>	<b>39,177</b>		<b>983</b>	

<sup>1</sup> In addition, 46 strikes with reptiles were reported.

Table 9. Number of reported bird strikes to civil aircraft by altitude (feet) above ground level (AGL), USA, 1990-2001 (See Figure 2).

Altitude of strike (Feet AGL)	Reported strikes		
	12-year total	% of total known	% cumulative total
0	11,443	41	41
1- 99	4,001	14	56
100- 199	1,796	6	62
200- 299	1,166	4	66
300- 399	842	3	69
400- 499	514	2	71
500- 599	953	3	74
600- 699	278	1	75
700- 799	216	1	76
800- 899	409	1	78
900- 999	155	1	78
1000- 1499	1,328	5	83
1500- 1999	894	3	86
2000- 2499	770	3	89
2500- 2999	424	2	91
3000- 3999	821	3	93
4000- 4999	505	2	95
5000- 9999	1,033	4	99
10000- 19999	263	1	100
20000- 29999	12	<1	100
>30000	1	<1	100
<b>Total known</b>	<b>27,824</b>	<b>100</b>	
<b>Unknown</b>	<b>11,353</b>		
<b>Total</b>	<b>39,177</b>		

Table 10. Civil aircraft components reported as being struck and damaged by wildlife, USA, 1990-2001.

Aircraft component	Birds (12-year total)				Mammals (12-year total)			
	Number struck	% of total	Number damaged	% of total	Number struck	% of total	Number damaged	% of total
Radome/nose	8,885	26	922	15	54	6	47	6
Windshield	6,217	18	411	7	11	1	6	1
Engine	5,947	17	2,118	34	73	8	73	10
Wing/rotor	4,715	14	1,392	22	111	12	114	15
Fuselage	4,192	12	212	3	67	7	69	9
Landing gear	1,726	5	202	3	349	38	200	26
Propeller	1,164	3	124	2	140	15	125	17
Tail	524	2	231	4	32	3	37	5
Light	316	1	250	4	11	1	13	2
Other	815	2	414	7	69	8	71	9
<b>Total</b>	<b>34,501</b>	<b>100</b>	<b>6,276</b>	<b>100</b>	<b>917</b>	<b>100</b>	<b>755</b>	<b>100</b>

Table 11. Number of civil aircraft with reported damage resulting from wildlife strikes, USA, 1990-2001.

Damage category <sup>2</sup>	Birds		Mammals		Total <sup>1</sup>	
	12-year total	% of total known	12-year total	% of total known	12-year total	% of total known
None	27,806	84	257	35	28,067	83
Minor	2,920	9	240	32	3,160	9
Uncertain	902	3	27	4	929	3
Substantial	1,613	5	206	28	1,820	5
Destroyed	10	<1	13	2	23	<1
<b>Total known</b>	<b>33,251</b>	<b>100</b>	<b>743</b>	<b>100</b>	<b>33,999</b>	<b>100</b>
<b>Unknown</b>	<b>5,926</b>		<b>240</b>		<b>6,207</b>	
<b>Total</b>	<b>39,177</b>		<b>983</b>		<b>40,206</b>	

<sup>1</sup> Included in totals are 46 strikes involving reptiles in which 4 reported no damage, 41 failed to report damage (if any), 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 which adversely affects the structure strength, performance or flight characteristics of the aircraft and which 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; engine blade damage not requiring blade replacement); Destroyed = The damage sustained makes it inadvisable to restore the aircraft to an airworthy condition.

Table 12. Identified wildlife species groups involved in reported strikes with civil aircraft that resulted in damage, USA, 1990-2001 (page 1 of 2).

Species group	Number of strikes by damage category <sup>1</sup>				Total	% of total known
	De- stroyed	Sub- stantial	Minor	Un- certain		
<b>Birds</b>						
Loons	1	1	2	0	4	0.2
Grebes	0	2	0	0	2	0.1
Albatrosses	0	0	1	0	1	<0.1
Tropicbirds	0	1	1	0	2	0.1
Pelicans	1	4	8	2	15	0.6
Cormorants	0	4	3	1	8	0.3
Anhingas	0	1	1	0	2	0.1
Frigatebirds	0	1	0	0	1	<0.1
Hérons, bitterns	0	6	18	5	29	1.1
Egrets	0	10	15	6	31	1.2
Storks, ibises	0	1	0	1	2	0.1
Waterfowl	2	261	433	141	837	31.5
Raptors	2	136	238	67	443	16.7
Grouse, pheasants, turkey	0	8	14	2	24	0.9
Rails, gallinules	0	1	1	1	3	0.1
Shorebirds	0	8	12	9	29	1.1
Gulls	0	272	389	121	782	29.5
Terns	0	0	4	0	4	0.2
Doves	0	81	71	36	188	7.1
Owls	0	18	19	5	42	1.6
Nightjars	0	1	1	0	2	0.1
Swifts	0	0	2	0	2	0.1
Larks	0	3	1	0	4	0.2
Swallows	0	2	5	2	9	0.3
Starlings	0	13	22	6	41	1.5
Crows, jays	0	12	18	3	33	1.2
Wrens	0	0	0	1	1	<0.1
Mockingbirds	0	0	1	0	1	<0.1
Thrushes	0	3	7	1	11	0.4
Meadowlarks	0	4	0	0	4	0.2
Blackbirds	0	15	38	13	66	2.5
Buntings	0	2	0	1	3	0.1
Sparrows	0	3	19	5	27	1.0
<b>Total known birds</b>	<b>6</b>	<b>874</b>	<b>1,344</b>	<b>429</b>	<b>2,653</b>	<b>100.0</b>
<b>Unknown birds</b>	<b>4</b>	<b>739</b>	<b>1,576</b>	<b>473</b>	<b>2,792</b>	
<b>Total birds</b>	<b>10</b>	<b>1,613</b>	<b>2,920</b>	<b>902</b>	<b>5,445</b>	

Table 12 continued (page 2 of 2).

Species group	Number of strikes by damage category <sup>1</sup>					% of total known
	De- stroyed	Sub- stantial	Minor	Un- certain	Total	
<b><u>Mammals</u></b>						
Artiodactyls (deer etc.)	13	195	217	25	450	93.6
Chiropteras (bats)	0	2	2	0	4	0.8
Carnivores (coyotes etc.)	0	5	15	1	21	4.4
Lagomorphs (rabbits, hares)	0	0	1	0	1	0.2
Paracidactyls (horses)	0	3	0	0	3	0.6
Rodents	0	0	2	0	2	0.4
<b>Total known mammals</b>	<b>13</b>	<b>205</b>	<b>237</b>	<b>26</b>	<b>481</b>	<b>100.0</b>
<b>Unknown mammals</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>5</b>	
<b>Total mammals</b>	<b>13</b>	<b>206</b>	<b>240</b>	<b>27</b>	<b>486</b>	
<b><u>Reptiles</u></b>						
Alligators	0	1	0	0	1	100.0
<b>Total known (all species)</b>	<b>19</b>	<b>1,080</b>	<b>1,581</b>	<b>455</b>	<b>3,135</b>	
<b>Total unknown</b>	<b>4</b>	<b>740</b>	<b>1,579</b>	<b>474</b>	<b>2,797</b>	
<b>Total</b>	<b>23</b>	<b>1,820</b>	<b>3,160</b>	<b>929</b>	<b>5,932</b>	

<sup>1</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 which adversely affects the structure strength, performance or flight characteristics of the aircraft and which 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; engine blade damage not requiring blade replacement); Destroyed = The damage sustained makes it inadvisable to restore the aircraft to an airworthy condition.

Table 13. Number of reported wildlife strikes to civil aircraft resulting in human injuries or fatalities, and number of injuries and fatalities resulting from these strikes, USA, 1990-2001.

Year	Birds			Mammals			Totals		
	Strikes	Injuries	Fatalities	Strikes	Injuries	Fatalities	Strikes	Injuries	Fatalities
1990	3	4	0	0	0	0	3	4	0
1991	7	7	0	2	3	0	9	10	0
1992	8	7	1	1	1	0	9	8	1
1993	4	3	1	1	2	0	5	5	1
1994	11	11	2	3	5	0	14	16	2
1995	5	6	0	0	0	0	5	6	0
1996	5	9	0	3	4	0	8	13	0
1997	13	13	0	2	3	0	15	16	0
1998	12	12	2	4	4	0	16	16	2
1999	3	4	0	0	0	0	3	4	0
2000	11	12	0	1	0	1	12	12	1
2001	11	13	0	1	2	0	12	15	0
<b>Total</b>	<b>93</b>	<b>101</b>	<b>6</b>	<b>18</b>	<b>24</b>	<b>1</b>	<b>111</b>	<b>125</b>	<b>7</b>



Table 14. Wildlife species involved in strikes with civil aircraft causing human injury or fatality, USA, 1990-2001.

Wildlife group	Species or species group	No. of strikes causing injury or fatality	Number of injuries	Number of fatalities
<b>Birds</b>	Bird (unknown species)	27	25	5
	Duck (unknown species)	12	14	0
	Canada goose	8	8	0
	Goose (unknown species)	8	9	0
	Gull (unknown species)	7	8	0
	Turkey vulture	4	5	0
	Vulture (unknown species)	3	3	0
	Hawk (unknown species)	2	3	0
	Mallard	2	2	0
	Osprey	2	2	0
	Red-tailed hawk	2	2	0
	Rock dove	2	2	0
	Black vulture	1	2	0
	Brown pelican	1	0	1
	American coot	1	1	0
	Double-crested cormorant	1	1	0
	Dove (unknown species)	1	1	0
	Egret (unknown species)	1	1	0
	Great frigatebird	1	1	0
	Golden eagle	1	1	0
	Owl (unknown species)	1	1	0
	Red-tailed tropicbird	1	1	0
	Sandhill crane	1	1	0
	Snow goose	1	1	0
	Western grebe	1	1	0
	American kestrel	1	5	0
	<b>Total birds</b>	<b>93</b>	<b>101</b>	<b>6</b>
<b>Mammals</b>	White-tailed deer	11	13	1
	Deer (unknown species)	5	8	0
	Cattle	1	2	0
	Horse	1	1	0
		<b>Total mammals</b>	<b>18</b>	<b>24</b>
<b>All species</b>	<b>Total</b>	<b>111</b>	<b>125</b>	<b>7</b>

Table 15. Reported effect-on-flight of wildlife strikes to civil aircraft, USA, 1990-2001.

Effect-on-flight <sup>2</sup>	Birds		Mammals		Total <sup>1</sup>	
	12-year total	% of total known	12-year total	% of total known	12-year total	% of total known
None	20,473	86	234	41	20,718	85
Precautionary landing	1,811	8	57	10	1,869	8
Aborted take off	867	4	105	18	972	4
Engine shut down	207	1	14	2	221	1
Other	578	2	159	28	738	3
<b>Total known</b>	<b>23,936</b>	<b>100</b>	<b>569</b>	<b>100</b>	<b>24,505</b>	<b>100</b>
<b>Unknown</b>	<b>15,241</b>		<b>414</b>		<b>15,688</b>	
<b>Total</b>	<b>39,177</b>		<b>983</b>		<b>40,206</b>	

<sup>1</sup> Included in totals are 46 strikes involving reptiles in which 11 reported no effect-on-flight, 33 failed to report the effect-on-flight (if any), 1 reported precautionary landing and 1 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 take off = Pilot aborted the take off; Precautionary landing = Pilot landed at other-than-destination airport after strike; Engine shut down = Engine was shut down by pilot or 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 if effect-on-flight occurred (Dolbeer et al. 2000).

Table 16. Number of reported strikes, strikes causing damage, strikes having a negative effect-on-flight (EOF), total reported aircraft down time, and total reported costs by identified wildlife species for civil aircraft, USA, 1990-2001 (page 1 of 9).

Species	12-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
<b>Birds</b>					
<b>Loons</b>	<b>7</b>	<b>4</b>	<b>2</b>	<b>543</b>	<b>11,200</b>
Loons	2	2	1	543	11,200
Common loon	5	2	1		
<b>Grebes</b>	<b>14</b>	<b>2</b>	<b>2</b>	<b>10</b>	<b>100,000</b>
Grebes	4				
Eared grebe	4	1		10	100,000
Western grebe	3	1	1		
Pied-billed grebe	2		1		
Horned grebe	1				
<b>Albatrosses/shearwater</b>	<b>2</b>	<b>1</b>			
Albatrosses	1	1			
Wedge-tailed shearwater	1				
<b>Tropicbirds</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>10</b>	<b>10,800</b>
Tropicbirds	1	1	1	10	5,200
Red-tailed tropicbird	1	1			5,600
<b>Pelicans</b>	<b>26</b>	<b>15</b>	<b>10</b>	<b>117</b>	<b>36,000</b>
Pelicans	4	3		95	25,500
Australian pelican	1	1	1		
Brown pelican	21	11	9	22	10,500
<b>Cormorants</b>	<b>20</b>	<b>8</b>	<b>3</b>	<b>24</b>	<b>413,600</b>
Cormorants	1				
Great cormorant	2	1			
Double-crested cormorant	17	7	3	24	413,600
<b>Anhingas</b>	<b>8</b>	<b>2</b>	<b>2</b>	<b>20</b>	<b>1,800</b>
<b>Frigatebirds</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>4,900</b>
<b>Herons</b>	<b>187</b>	<b>29</b>	<b>20</b>	<b>709</b>	<b>700,492</b>
Herons, bitterns	37	11	6	1	
Great blue heron	95	15	13	190	666,292
Black-crowned night-heron	10	2		14	31,000
Little blue heron	1				
American bittern	1	1	1	504	3,200
Yellow bittern	43				
<b>Egrets</b>	<b>261</b>	<b>31</b>	<b>34</b>	<b>1,515</b>	<b>223,040</b>
Egret	184	24	28	1,488	223,040
Cattle egret	57	5	6	3	
Great egret	13				
Snowy egret	7	2		24	
<b>Storks/ibis</b>	<b>9</b>	<b>2</b>	<b>1</b>		
White stork	1	1			

Table 16 continued (page 2 of 9).

Species	12-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Wood stork	2				
Ibises	2				
Glossy ibis	1				
White ibis	3	1	1		
<b>Waterfowl</b>	<b>1,834</b>	<b>837</b>	<b>395</b>	<b>48,798</b>	<b>47,352,796</b>
Ducks, geese, swans	98	54	24	639	247,775
Ducks	470	165	71	3,724	1,946,378
American wigeon	6	5	3	44	865,229
Northern pintail	6	4			14,000
Green-winged teal	3	2	2	6	214,500
Blue-winged teal	4	1	1		
European wigeon	1				
Mallard	224	56	30	2,601	1,211,059
Common eider	2	2	1		
Ring-necked duck	2	1	1		
Wood duck	6	1		30	30,000
Hooded merganser	1	1			
Common merganser	1	1	1	72	2,500
Northern shoveler	4	2	2	72	1,000,000
Gadwall	3				
Canvasback	1	1			
American black duck	3	2			
Mottled duck	2	1	1	24	
Lesser scaup	1	1			
Ruddy duck	2	1			8,446
Redhead	1	1			
Geese	330	187	84	18,573	2,925,598
Snow goose	39	29	13	2,701	8,864,564
Canada goose	606	309	159	20,512	29,891,686
Brant	10	5	2	4	1,271
Greater white-fronted goose	1	1			
Swans	2	1			
Mute swan	2				
Tundra swan	3	3	1	336	129,790
<b>Raptors</b>	<b>1,996</b>	<b>443</b>	<b>274</b>	<b>47,032</b>	<b>11,603,164</b>
Hawks, eagles, vultures	20	11	5	255	9,050
Vultures	152	91	44	17,415	558,715
Black vulture	11	4	7	97	10,000
Turkey vulture	145	86	50	11,979	2,045,166
Osprey	53	16	9	1,579	183,700
Kites, eagles, hawks	3	1	1		
Kites	3	2			
Eagles	7	4	3	2,884	40,000
Bald eagle	42	16	10	1,349	64,500
Golden eagle	2	1	1	72	1,000
Hawks	587	134	78	9,488	544,968

Table 16 continued (page 3 of 9).

Species	12-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Red-tailed hawk	332	60	47	1,060	3,509,622
Rough-legged hawk	5				
Red-shouldered hawk	4				
Swainson's hawk	4				
Sharp-shinned hawk	3				
Cooper's hawk	2				
Ferruginous hawk	1				
Broad-winged hawk	2				
Common buzzard	1			24	
Northern harrier	26	1			20,000
Lappet-faced vulture	1	1	1	240	4,000,000
Falcons	21	2	1	80	30,000
Peregrine falcon	34	3	1	24	220,000
Gyr falcon	1				
Merlin	12		2	3	130
American kestrel	522	10	14	483	366,313
<b>Grouse/pheasants/turkey</b>	<b>85</b>	<b>24</b>	<b>17</b>	<b>159</b>	<b>55,920</b>
Grouse	6	2	1	2	
Sharp-tailed grouse	1	1	1	24	500
Ptarmigans	4	3	1	33	54,500
Quails, pheasants	1				
Black francolin	1				
Quails	4		1		
Northern bobwhite	5	2	3	73	800
Pheasants	1				
Ring-necked pheasant	39	9	7	3	
Gray partridge	3	2	1	24	120
Guineafowl	1	1			
Wild turkey	19	4	2		
<b>Cranes</b>	<b>48</b>	<b>20</b>	<b>15</b>	<b>2,149</b>	<b>309,760</b>
Cranes	10	5	5	34	250,300
Sandhill crane	38	15	10	2,115	59,460
<b>Rails/gallinule</b>	<b>20</b>	<b>3</b>	<b>1</b>	<b>48</b>	<b>2,000</b>
Rails	1	1			
Sora	1				
Common moorhen	1				
American coot	12	2	1	48	2,000
Purple gallinule	2				
Virginia rail	1				
Clapper rail	2				
<b>Shorebirds</b>	<b>672</b>	<b>29</b>	<b>38</b>	<b>436</b>	<b>397,877</b>
Shore birds	13				
American oystercatcher	11				
Plovers	16		1		
European golden-plover	3				

Table 16 continued (page 4 of 9).

Species	12-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
American golden-plover	12		1		
Black-bellied plover	8	1	1	12	38,622
Killdeer	338	13	15	105	150,421
Pacific golden-plover	101		2	3	
Semipalmated plover	4				
Northern lapwing	1	1	1	25	
Sandpipers	81	7	9	123	80,030
Upland sandpiper	39	3	4	11	1,000
Spotted sandpiper	2				
Willet	2		1		
Common snipe	9	1			
American woodcock	4				
Dunlin	3				
Baird's sandpiper	1				
Western sandpiper	5	1		60	94,311
Buff-breasted sandpiper	1				
Least sandpiper	4		1	1	
Semipalmated sandpiper	3				
Lesser yellowlegs	2				
Short-billed dowitcher	1				
Hudsonian godwit	1	1	1	96	23,495
Whimbrel	4	1	1		10,000
American avocet	3				
<b>Gulls</b>	<b>4,501</b>	<b>782</b>	<b>624</b>	<b>30,948</b>	<b>17,655,161</b>
Gulls	3,824	696	548	28,877	14,933,453
Herring gull	227	36	35	247	1,313,800
Mew gull	9	2	1		1,000
Ring-billed gull	250	21	20	1,323	122,771
Glaucous-winged gull	10	4		180	46,280
Great black-backed gull	26	5	4	27	250,000
Franklin's gull	5	1	1		
Laughing gull	118	6	7	102	247,000
Bonaparte's gull	9	2	2		65,000
Western gull	12	6	4	92	540,857
California gull	7	2	1	100	135,000
Heermann's gull	1				
Thayer's gull	1				
Yellow-legged gull	2	1	1		
<b>Terns</b>	<b>46</b>	<b>4</b>	<b>1</b>	<b>4</b>	
Terns	29	2			
Caspian tern	2				
Common tern	4				
Gull-billed tern	1				
Arctic tern	4	1			
Forster's tern	3		1	4	
Least tern	1				

Table 16 continued (page 5 of 9).

Species	12-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Black noddy	1				
Black skimmer	1	1			
<b>Doves</b>	<b>2,198</b>	<b>188</b>	<b>199</b>	<b>11,843</b>	<b>5,381,362</b>
Pigeons, doves	11	1	1	24	400
Pigeons	12	2	3	2	50
Doves	521	32	50	350	435,413
Rock dove	783	108	90	10,962	3,524,100
Mourning dove	831	43	54	505	1,421,399
Spotted dove	5	2	1		
Zebra dove	17				
Inca dove	11				
Philippine turtle dove	4				
White-winged dove	3				
<b>Parrots</b>	<b>3</b>				
<b>Cuckoos</b>	<b>2</b>				
Cuckoos	1				
Yellow-billed cuckoo	1				
<b>Owls</b>	<b>368</b>	<b>42</b>	<b>20</b>	<b>1,082</b>	<b>1,004,683</b>
Owls	173	19	11	941	296,875
Common barn-owl	105	10	4	88	636,750
Snowy owl	26	3	2	18	27,500
Short-eared owl	24	1	1	11	
Long-eared owl	2				
Northern saw-whet owl	3				
Burrowing owl	9	1			
Barred owl	2	1	1		
Eastern screech owl	2	1		24	7,558
Great horned owl	22	6	1		
<b>Nightjars</b>	<b>37</b>	<b>2</b>			
Common nighthawk	32				
Nightjars	1	1			
Whip-poor-will	2	1			
Common poorwill	1				
Lesser nighthawk	1				
<b>Swifts</b>	<b>33</b>	<b>2</b>			
Swifts	7	1			
Chimney swift	20	1			
Vaux's swift	1				
White-throated swift	5				
<b>Kingfisher</b>	<b>6</b>				
Belted kingfisher	6				
<b>Woodpeckers</b>	<b>17</b>		<b>2</b>		
Woodpeckers	5		1		
Northern flicker	10				
Yellow-bellied sapsucker	2		1		

Table 16 continued (page 6 of 9).

Species	12-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
<b>Flycatchers</b>	<b>15</b>		<b>2</b>		
Tyrant fly-catchers	1				
Great crested flycatcher	1				
Eastern kingbird	1				
Scissor-tailed flycatcher	12		2		
<b>Larks</b>	<b>89</b>	<b>4</b>	<b>2</b>		
Larks	12	1			
Eurasian skylark	1				
Horned lark	76	3	2		
<b>Swallows</b>	<b>513</b>	<b>9</b>	<b>16</b>	<b>127</b>	<b>40,532</b>
Swallows	230	3	13	17	
Purple martin	33	2			
Bank swallow	20				
Barn swallow	147	3	2	99	27,282
Cliff swallow	29	1	1	8	13,250
Tree swallow	54			3	
<b>Starlings</b>	<b>876</b>	<b>41</b>	<b>55</b>	<b>451</b>	<b>738,746</b>
European starling	860	40	54	449	738,746
Myna	8	1	1		
Common myna	8			2	
<b>Crows/jays</b>	<b>310</b>	<b>33</b>	<b>28</b>	<b>671</b>	<b>337,958</b>
Crows	150	13	11	77	82,400
American crow	136	15	13	519	230,013
Blue jay	4				
Ravens	4	2	1	74	24,990
Common raven	7	1	2		
Black-billed magpie	2	2	1	1	555
Yellow-billed magpie	7				
<b>Chickadees</b>	<b>6</b>				
<b>Wrens</b>	<b>26</b>	<b>1</b>	<b>1</b>		
<b>Mockingbirds/mimidaes</b>	<b>32</b>	<b>1</b>	<b>2</b>		<b>120</b>
Mockingbirds	1				
Northern mockingbird	24	1	2		
Gray catbird	3				
Brown thrasher	4				120
<b>Thrushes</b>	<b>143</b>	<b>11</b>	<b>8</b>	<b>36</b>	<b>47,930</b>
Thrushes	6	2			
Swainson's thrush	4	1			
American robin	128	8	7	36	47,930
Hermit thrush	1				
Eastern bluebird	2				
Gray-cheeked thrush	1				
Varied thrush	1		1		



Table 16 continued (page 7 of 9).

Species	12-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
<b>Pipits</b>	<b>1</b>		<b>1</b>		
American pipit	1		1		
<b>Waxwings</b>	<b>4</b>				
Cedar waxwing	4				
<b>Shrikes/white-eyes</b>	<b>3</b>				
Shrikes	1				
Loggerhead shrike	1				
Japanese white-eye	1				
<b>Warblers</b>	<b>18</b>				
Wood warblers	13				
Canada warbler	1				
Yellow-breasted chat	2				
Black and white warbler	1				
Ovenbird	1				
<b>Meadowlark</b>	<b>227</b>	<b>4</b>	<b>9</b>	<b>29</b>	<b>136,952</b>
Meadowlark	30		2	9	
Eastern meadowlark	139	2	3	4	
Western meadowlark	58	2	4	16	136,952
<b>Blackbirds/Orioles</b>	<b>873</b>	<b>66</b>	<b>69</b>	<b>1,309</b>	<b>873,571</b>
Blackbirds	772	55	57	445	719,821
Bobolink	1				
Brown-headed cowbird	13	1	1		
Red-winged blackbird	24	1	3	2	750
Yellow-headed blackbird	4	1	1		
Brewer's blackbird	1				
Grackles	34	4	2	722	108,000
Common grackle	11	3	4	120	45,000
Boat-tailed grackle	4	1	1	20	
Great-tailed grackle	4				
Orioles	4				
Baltimore oriole	1				
<b>Finches</b>	<b>36</b>		<b>2</b>	<b>2</b>	
Finches	21		2	2	
Lapland longspur	1				
Dark-eyed junco	1				
Rose-breasted grosbeak	1				
Pine siskin	1				
Purple finch	1				
American goldfinch	6				
House finch	2				
Red-crested cardinal	2				
<b>Buntings</b>	<b>58</b>	<b>3</b>	<b>8</b>	<b>12</b>	
Buntings	1	1			
Snow bunting	55	2	8	12	
Lazuli bunting	1				

Table 16 continued (page 8 of 9).

Species	12-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Lark bunting	1				
<b>Sparrows</b>	<b>1,204</b>	<b>27</b>	<b>48</b>	<b>34</b>	<b>7,250</b>
Sparrows	1,170	26	48	34	3,150
Savannah sparrow	22				
Fox sparrow	2	1			4,100
White-throated sparrow	4				
Golden crowned sparrow	1				
Field sparrow	1				
Lark sparrow	1				
White-crowned sparrow	1				
Grasshopper sparrow	2				
<b>Towhee</b>	<b>4</b>				
Rufous-sided towhee	3				
Green-tailed towhee	1				
<b>Mannikins</b>	<b>42</b>		<b>1</b>	<b>3</b>	<b>2,000</b>
Mannikins	16				
Nutmeg mannikin	9			1	
Chestnut mannikin	17		1	2	2,000
<b>House sparrow</b>	<b>13</b>				
<b>Total known birds</b>	<b>16,899</b>	<b>2,673</b>	<b>1,915</b>	<b>148,124</b>	<b>87,449,616</b>
<b>Unknown</b>	<b>22,278</b>	<b>2,772</b>	<b>1,549</b>	<b>45,500</b>	<b>38,001,074</b>
<b>Total birds</b>	<b>39,177</b>	<b>5,445</b>	<b>3,464</b>	<b>193,624</b>	<b>125,450,690</b>
<b>Mammals</b>					
<b>Artiodactyls</b>	<b>551</b>	<b>450</b>	<b>286</b>	<b>108,625</b>	<b>19,479,725</b>
Deer, moose, wapiti, caribou	86	76	45	22,316	1,520,580
White-tailed deer	427	343	213	76,700	17,251,333
Mule deer	15	10	11	384	311,000
Wapiti (elk)	7	7	5	8,680	78,012
Moose	2	2	2		
Caribou	1	1	1		
Cattle	6	6	5	455	187,000
Pronghorn	5	4	4	90	131,800
Swine	1				
Collared peccary	1	1			
<b>Chiropteras (bats)</b>	<b>58</b>	<b>4</b>	<b>2</b>	<b>72</b>	<b>3,076,015</b>
<b>Carnivores</b>	<b>231</b>	<b>21</b>	<b>37</b>	<b>11,567</b>	<b>696,564</b>
Canids	3		1		
Coyote	115	12	22	9,395	660,628
Domestic dog	15	3	10		
Fox	30	3		10	750
Red fox	7		1		
Common gray fox	2	1	1	2	186
Raccoon	20	1	2	2,160	35,000
White-nosed coati	1				

Table 16 continued (page 9 of 9).

Species	12-year totals				
	No. of strikes	No. with damage	No. with neg. EOF	Aircraft down time (hrs)	Reported costs (\$)
Ringtail	1				
Striped skunk	30				
River otter	1	1			
Badger	1				
House cat	5				
<b>Edentates (armadillo)</b>	<b>12</b>				
<b>Lagomorphs</b>	<b>50</b>	<b>1</b>	<b>2</b>		
Rabbits	10				
Eastern cotton tail rabbit	23	1	2		
Black-tailed jackrabbits	17				
<b>Marsupial (opossum)</b>	<b>22</b>				
<b>Paracidactlys (horses)</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>1,008</b>	<b>23,849</b>
<b>Rodents</b>	<b>46</b>	<b>2</b>	<b>2</b>		
Rodents	1				
Prairie dog	1				
Woodchuck	33	2	2		
Woodrats	2				
Muskrat	5				
Black rat	1				
Porcupine	3				
<b>Total known mammals</b>	<b>973</b>	<b>481</b>	<b>331</b>	<b>121,272</b>	<b>23,276,153</b>
<b>Unknown</b>	<b>10</b>	<b>5</b>	<b>4</b>	<b>0</b>	<b>0</b>
<b>Total mammals</b>	<b>983</b>	<b>486</b>	<b>335</b>	<b>121,272</b>	<b>23,276,153</b>
<b>Reptiles</b>					
<b>Turtles</b>	<b>34</b>		<b>1</b>		
Turtle	28				
Florida soft shell turtle	3				
Box turtle	3				
<b>Alligators</b>	<b>11</b>	<b>1</b>	<b>1</b>		
<b>Iguanas</b>	<b>1</b>				
<b>Total reptiles</b>	<b>46</b>	<b>1</b>	<b>2</b>		
<b>Total known (all species)</b>	<b>17,918</b>	<b>3,155</b>	<b>2,248</b>	<b>269,396</b>	<b>110,725,769</b>
<b>Total unknown</b>	<b>22,288</b>	<b>2,777</b>	<b>1,553</b>	<b>45,500</b>	<b>38,001,074</b>
<b>Total</b>	<b>40,206</b>	<b>5,931</b>	<b>3,801</b>	<b>314,896</b>	<b>148,726,843</b>

Table 17. Number of reported strikes, strikes with damage, and strikes having a negative effect-on-flight (EOF) for the four most commonly struck bird species groups and two most commonly struck mammal groups, USA, 1990-2001.

Species group <sup>1</sup>	Reported strikes		Strikes w/ damage		Strikes w/ EOF	
	12-year total	% of total known	12-year total	% of total known	12-year total	% of total known
<b><u>Birds</u></b>						
Gulls	4,501	27	782	29	624	33
Doves	2,198	13	188	7	199	10
Raptors	1,996	12	443	17	274	14
Waterfowl	1,834	11	837	31	395	21
All other known	6,370	37	423	16	423	22
<b>Total known</b>	<b>16,899</b>	<b>100</b>	<b>2,673</b>	<b>100</b>	<b>1,915</b>	<b>100</b>
<b>Unknown</b>	<b>22,278</b>		<b>2,772</b>		<b>1,549</b>	
<b>Total birds</b>	<b>39,177</b>		<b>5,445</b>		<b>3,464</b>	
<b><u>Mammals</u></b>						
Artiodactyls	<b>551</b>	57	450	94	286	86
Carnivores	<b>231</b>	24	21	4	37	11
All other known	<b>191</b>	19	10	2	8	3
<b>Total known</b>	<b>973</b>	<b>100</b>	<b>481</b>	<b>100</b>	<b>331</b>	<b>100</b>
<b>Unknown</b>	<b>10</b>		<b>5</b>		<b>4</b>	
<b>Total mammals</b>	<b>983</b>		<b>486</b>		<b>335</b>	

<sup>1</sup> See Table 16 for listing of species within each species group.

Table 18. Number of reported wildlife strikes indicating damage or a negative effect-on-flight (EOF), and reported losses in hours of down time and U. S. dollars, for civil aircraft, USA, 1990-2001.

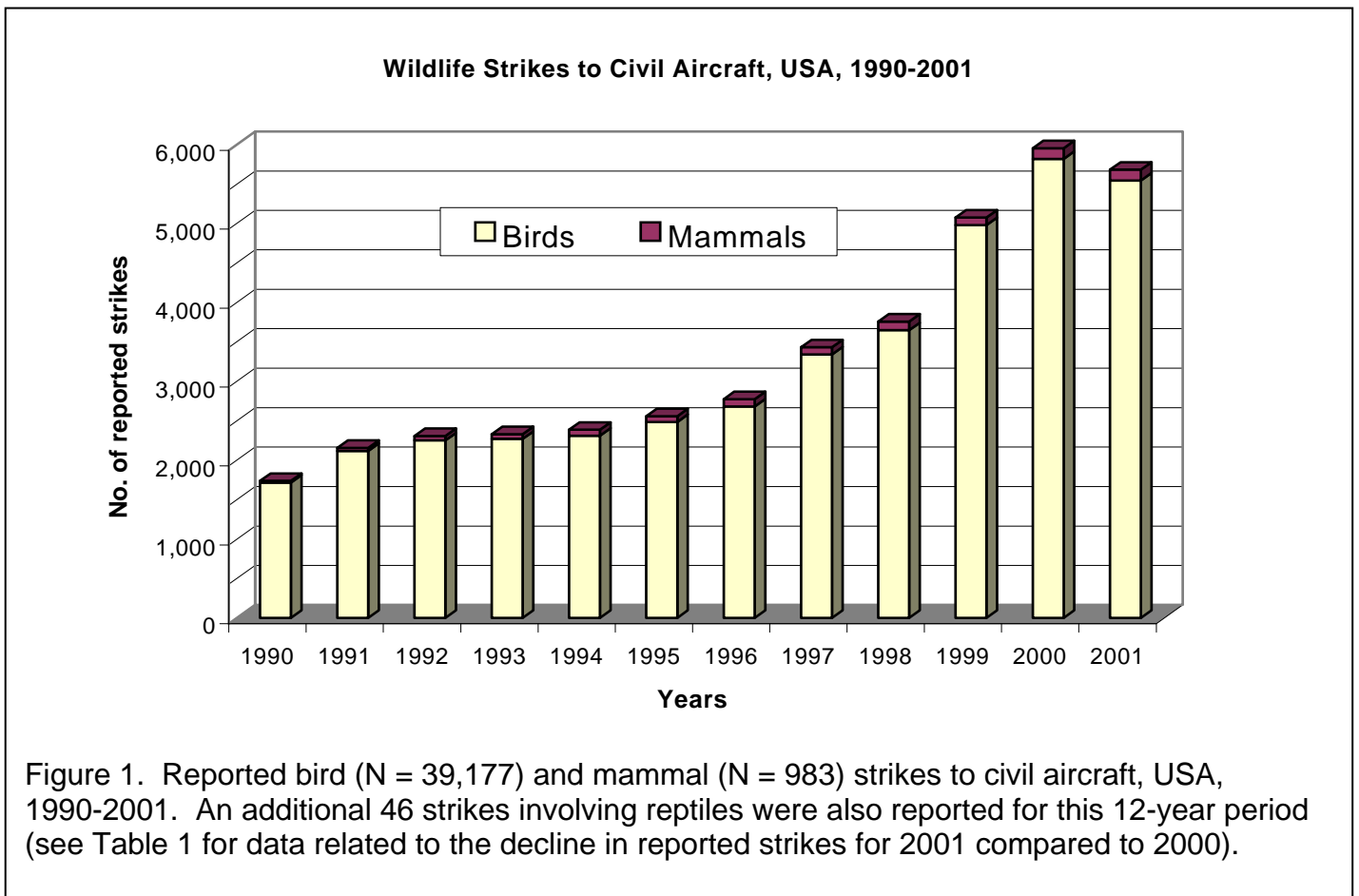
	Number of reports				Reported time aircraft out of service in hours (No. of reports)	Cost in millions of dollars (No. of reports)		
	Total reports	Reports indicating adverse effect (% of all reports)	Reports indicating aircraft damage	Reports indicating negative EOF		Direct cost	Other cost	Total cost
12-yr total	40,206	7,749 (19)	5,933	3,801	314,896 (1,889)	128.279 (1,251)	20.448 (476)	148.727 (1,370)
12-yr avg.	3,351	646 (19)	494	317	26,241 (157)	10.690 (104)	1.704 (40)	12.394 (114)
<b>Mean losses per incident reported</b>					<b>166</b>	<b>0.103</b>	<b>0.043</b>	<b>0.109</b>
<b>Estimated mean annual losses</b>								
<b>Minimum<sup>1</sup></b>					<b>106,872</b>	<b>66.216</b>	<b>27.740</b>	<b>93.956</b>
<b>Maximum<sup>2</sup></b>					<b>534,361</b>	<b>331.080</b>	<b>138.699</b>	<b>469.779</b>

<sup>1</sup> Minimum values are based on the assumption that all 7,749 reported strikes having an adverse effect-on-flight and/or the aircraft engendered similar amounts of damage and/or down time, and that these reports are all of the damaging strikes that occurred.

<sup>2</sup> Maximum values are based on the assumption that the 7,749 reported strikes having an adverse effect represent only 20% of the total strikes that occurred.

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## FIGURES



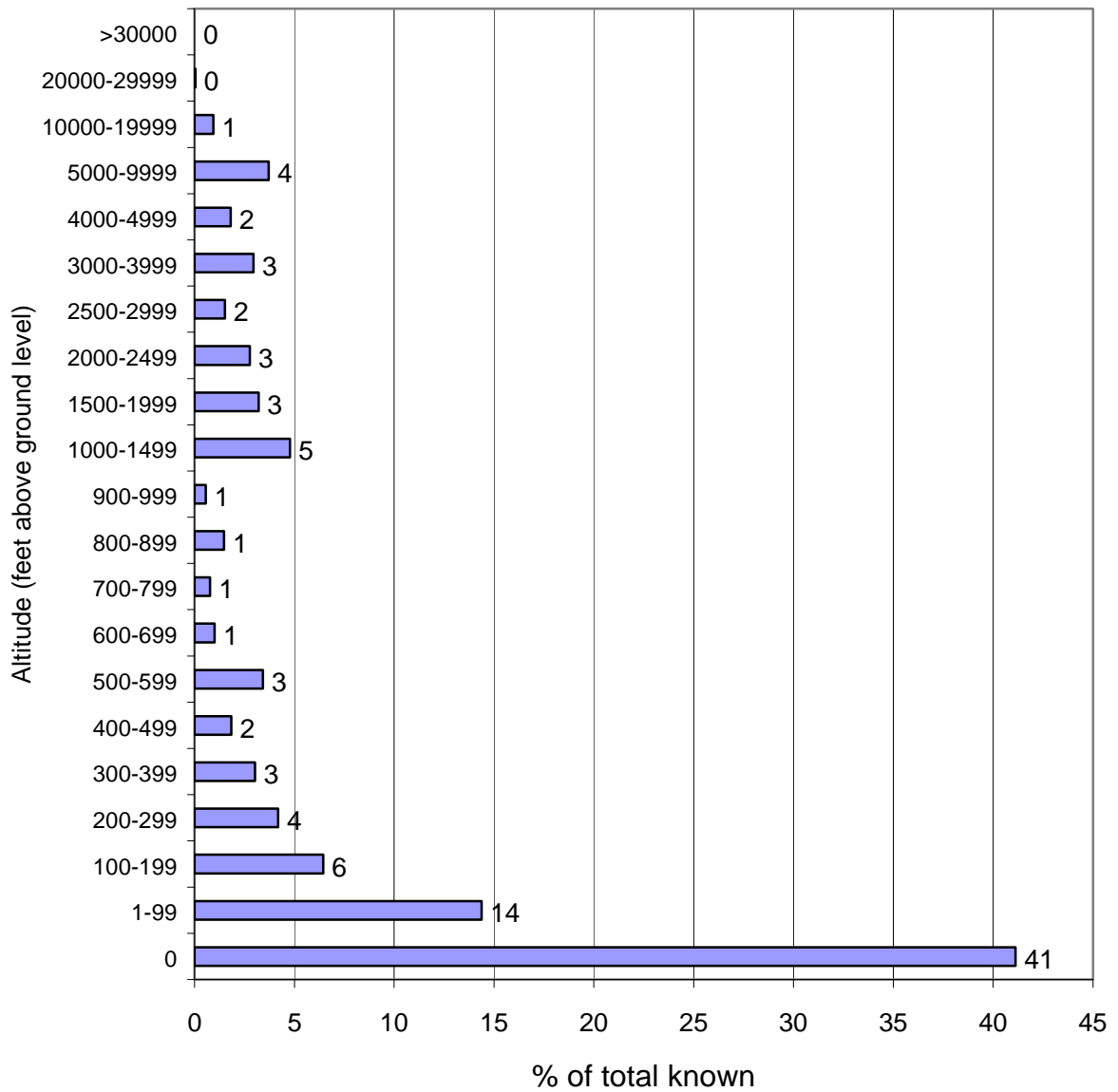


Figure 2. Percent of reported bird strikes (N = 27,824) to civil aircraft by altitude of occurrence, USA, 1990-2001. There were 11,353 reports that did not indicate the altitude of the strike.



## **SELECTED SIGNIFICANT STRIKES TO CIVIL AIRCRAFT IN THE UNITED STATES, 1990-2001**

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The following examples, two from each year, 1990-1999, six from 2000, and eight from 2001, have been selected from the FAA National Wildlife Strike Database to demonstrate the serious impact that strikes by wildlife can have on aircraft and 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. Some of the strike examples reported here occurred off airport property during approach or departure. A more complete listing of significant strikes to civil aircraft is available at the FAA's Wildlife Hazard website: <http://wildlife-mitigation.tc.faa.gov>.



A Learjet 60 landing at Troy, Alabama Municipal Airport on 14 January 2001 collided with two white-tailed deer which disabled the thrust reversers. The aircraft ran off the end of the runway into a ditch and burst into flames. The pilot and first officer had serious injuries and were flown to a hospital. Cost to replace aircraft was \$9.5 million. Other costs totaled \$25,000. Photo courtesy The Messenger, Troy, Alabama.

**Date:** 11 January 1990  
**Aircraft:** Hawker Siddeley  
**Airport:** John Tune (TN)  
**Phase of Flight:** Take off  
**Effect on Flight:** Aborted take off  
**Damage:** Engine  
**Wildlife Species:** White-tailed deer  
**Comments from Report:** Several deer were struck during take off. One was completely ingested in the left engine. The impact tore the engine loose from the aircraft. The aircraft was replaced at a cost of \$1.4 million.

**Date:** 9 October 1990  
**Aircraft:** Cessna 550  
**Airport:** DeKalb Peachtree (GA)  
**Phase of Flight:** Take off  
**Effect on Flight:** Precautionary landing, engine shut down  
**Damage:** Engine  
**Wildlife Species:** Unknown bird  
**Comments from Report:** Ingested a bird in #1 engine during take off. Vibration increased and the engine was shut down. Fan and inlet guide vanes were destroyed. Time out of service was 65 hours. Cost of repairs estimated at \$105,000.

**Date:** 28 August 1991  
**Aircraft:** Cessna 550  
**Airport:** Person County (NC)  
**Phase of Flight:** Take off  
**Effect on Flight:** Aborted take off  
**Damage:** Engine  
**Wildlife Species:** Doves  
**Comments from Report:** Right engine inlet was damaged due to the temperature probe being tossed back and forth prior to going through the fan. All 28 fan blades were bent, torn and chipped. Stator behind fan was damaged. Time out of service was 70 hours. Cost of repairs was \$160,000.

**Date:** 30 December 1991  
**Aircraft:** Cessna 550  
**Airport:** Angelina County (TX)  
**Phase of Flight:** Take off  
**Effect on Flight:** Aborted take off  
**Damage:** Engine  
**Wildlife Species:** Turkey vulture  
**Comments from Report:** Ingested 1-2 vultures in #1 engine during take off. Engine had an uncontained failure, fire and vibration with 100% thrust loss. Wing and fuselage received damage from engine shrapnel. Time out of service was 2 weeks. Cost of repairs was \$552,500.

**Date:** 2 February 1992  
**Aircraft:** Piper 28  
**Airport:** Sandstone (MN)  
**Phase of Flight:** Approach  
**Effect on Flight:** Impacted trees and ground  
**Damage:** Aircraft destroyed  
**Wildlife Species:** Deer  
**Comments from Report:** Just prior to touchdown, a deer ran toward and collided with the aircraft. The pilot added power and aborted the landing. Loss of engine power was experienced during the climb and the aircraft crashed into trees then the ground ¼ mile south of airport. Pilot was seriously injured and the aircraft was destroyed. The NTSB found that the deer had damaged the gascolator and fuel starvation resulted.

**Date:** 10 August 1992  
**Aircraft:** Cessna 441  
**Airport:** Lee Gilmer Memorial (GA)  
**Phase of Flight:** Climb  
**Effect on Flight:** Impacted ground  
**Damage:** Aircraft destroyed  
**Wildlife Species:** Unknown birds  
**Comments from Report:** Immediately after take off, aircraft hit birds. Right engine lost power and aircraft would not maintain altitude. Pilot was forced to land in a residential area ¼ mile from Gainesville Airport. Pilot was seriously injured. NTSB reported that pilot shut down wrong engine and did not follow emergency checklist. Aircraft worth \$690,000-\$1.7 million.

**Date:** 24 March 1993  
**Aircraft:** Bell BHT-47  
**Airport:** En route  
**Phase of Flight:** En route  
**Effect on Flight:** Impacted water  
**Damage:** Aircraft destroyed  
**Wildlife Species:** Unknown bird  
**Comments from Report:** During cruise, pilot heard a loud bang and felt vibration in rudder pedals then lost all yaw control. Pilot thought the tail rotor struck a large sea bird as many were in the area. He maintained directional control and tried to lower the helicopter so that the passenger (a ship's captain) could reach small boats being lowered by his ship nearby. The passenger jumped before the pilot gave the okay and was killed. The pilot subsequently made a running landing on the water and was hoisted on board the ship.

**Date:** 3 December 1993  
Aircraft: Cessna 550  
Airport: DuPage (IL)  
Phase of Flight: Climb  
Effect on Flight: Diverted, emergency landing  
Damage: Engine  
Wildlife Species: Geese  
Comments from Report: Struck a flock of geese. Loud bang, followed by unstable flight. Lost power to #2 engine and had a substantial fuel leak on left side. Emergency was declared and aircraft landed safely at Midway. Both engines had to be replaced. Time out of service was 90 days. Cost of repairs was \$800,000.

**Date:** 16 May 1994  
Aircraft: Bell BHT-47  
Airport: En route (OK)  
Phase of Flight: En route  
Effect on Flight: Impacted ground  
Damage: Aircraft destroyed  
Wildlife Species: Unknown bird  
Comments from Report: Witnesses heard a loud noise and saw an object separate from the second of two helicopters. The helicopter then impacted inverted in the back yard of a residence. The pilot of the first helicopter said he had warned the second pilot of a flock of birds and that he had to bank sharply to avoid them. NTSB said probable cause was loss of control due to pilot's improper use of the cyclic and collective controls when he maneuvered abruptly to avoid colliding with a flock of birds. One fatality.

**Date:** 15 July 1994  
Aircraft: Cessna 172  
Airport: En route (FL)  
Phase of Flight: En route  
Effect on Flight: Impacted water  
Damage: Aircraft destroyed  
Wildlife Species: Pelican  
Comments from Report: Aircraft was seen flying about 200 ft above the water along the beach. A large bird collided with the windshield. The aircraft rolled inverted and hit the water. The pilot was killed.

**Date:** 3 June 1995  
**Aircraft:** Concorde  
**Airport:** John F. Kennedy (NY)  
**Phase of Flight:** At touchdown  
**Effect on Flight:** Aircraft was towed to gate  
**Damage:** Engines  
**Wildlife Species:** Canada geese  
**Comments from Report:** Aircraft ingested a Canada goose into the #3 engine which had an uncontained failure causing parts to go into the #4 engine. Both engines were destroyed. Flames and smoke were seen coming from both engines. Cost was over \$9 million. Aircraft was out of service for 5 days. The NY Port Authority paid \$5.3 million in compensation for losses.

**Date:** 10 December 1995  
**Aircraft:** Boeing 747  
**Airport:** John F. Kennedy (NY)  
**Phase of Flight:** Approach  
**Effect on Flight:** Not reported  
**Damage:** Engines, cowling, wing, fuselage  
**Wildlife Species:** Snow geese  
**Comments from Report:** As the aircraft broke through a cloud bank at 7500 feet, it struck a flock of snow geese, which sounded like sandbags hitting the aircraft. The impact destroyed one engine, damaged several fan blades on another and extensively damaged the airframe. Repairs cost approximately \$6 million.

**Date:** 2 June 1996  
**Aircraft:** Boeing 737  
**Airport:** Chicago Midway (IL)  
**Phase of Flight:** Climb  
**Effect on Flight:** Precautionary landing  
**Damage:** Engine  
**Wildlife Species:** Gull  
**Comments from Report:** Ingested a gull during climb out. Tower observed flames from #2 engine and advised pilot who declared an emergency and returned to land without incident. Emergency equipment was on the runway. Aircraft landed using single engine landing procedures. Core and all fan blades were damaged. Engine was rebuilt.

**Date:** 13 December 1996  
Aircraft: Beechcraft 1900  
Airport: Arnold Palmer Regional Airport (PA)  
Phase of Flight: Landing roll  
Effect on Flight: Skidded to stop on runway  
Damage: Left main landing gear  
Wildlife Species: White-tailed deer  
Comments from Report: Struck deer on landing causing left main gear to collapse, underside of fuselage, wing tip and aileron flaps damaged, prop blades broken. No injuries.

**Date:** 7 January 1997  
Aircraft: MD-80  
Airport: Dallas-Fort Worth (TX)  
Phase of Flight: Climb  
Effect on Flight: Precautionary landing  
Damage: Engine, wing & radome  
Wildlife Species: Blackbirds (437)  
Comments from Report: Aircraft struck over 400 birds just after take-off. Almost every part of the plane was hit. Pilot declared an emergency and returned to land without event. Substantial damage was found on various parts of the aircraft. #1 engine had to be replaced. Runway was closed for an hour. Personnel were sent to disperse another large flock on the airfield. Cost estimated at \$219,000.

**Date:** 15 November 1997  
Aircraft: Airbus 320  
Airport: John Wayne (CA)  
Phase of Flight: Take off  
Effect on Flight: Precautionary landing  
Damage: Engine  
Wildlife Species: Large bird  
Comments from Report: A large bird was ingested into one of the two engines causing a fire. Passengers heard a loud boom, then the aircraft dropped momentarily before recovering altitude. The aircraft circled for 30 minutes before making an emergency landing. There were no injuries. Bird hit blades on starboard fan that broke or bent all blades causing damage to cowling and to system behind the fan. Engine changed. Time out of service 30+ hrs. Cost of repairs \$300,000 and other cost \$800,000

**Date:** 9 January 1998  
**Aircraft:** Boeing 727  
**Airport:** George Bush Intercontinental (TX)  
**Phase of Flight:** Climb  
**Effect on Flight:** Precautionary landing  
**Damage:** Engine, radome, right wing  
**Wildlife Species:** Snow geese  
**Comments from Report:** Aircraft was climbing through 6,000' when a flock of snow geese was encountered. Three to five birds were ingested. Engine lost all power and was destroyed, radome was torn from the aircraft and leading edges of both wings were damaged, pitot tube for first officer was torn off. Intense vibration in airframe and noise level in cockpit increased to the point that communication between crew members became difficult. Emergency was declared. Flight returned safely to Houston. Time out of service was 216 hours and cost was \$468,000.

**Date:** 7 May 1998  
**Aircraft:** Boeing 727  
**Airport:** Colorado Springs Muni (CO)  
**Phase of Flight:** Climb  
**Effect on Flight:** Engine shut down, precautionary landing  
**Damage:** Radome, wing, fuselage and engine  
**Wildlife Species:** Canada geese (6 or more)  
**Comments from Report:** Aircraft had severe damage to #3 engine, all inlet guide vanes, all 1<sup>st</sup> and 2<sup>nd</sup> stage compressor blades, 1<sup>st</sup> stage stator vanes, hole in anti-ice bleed air duct, wire harness, blade exited engine case, oil cooler broke due to vibration. Radome cracked, wing-tip had minor damage. Time out of service was 98 hrs. NTSB investigated. Cost was \$1.4 million.

**Date:** 4 March 1999  
**Aircraft:** McDonnell Douglas DC-9  
**Airport:** Kansas City Intl. (MO)  
**Phase of Flight:** Approach  
**Effect on Flight:** Engine shut down  
**Damage:** Both engines  
**Wildlife Species:** Snow geese  
**Comments from Report:** Aircraft struck a flock of snow geese. Geese were ingested in both engines. One engine shut down and the other was severely damaged but continued working. Aircraft landed without incident. NTSB investigated.

**Date:** 12 June 1999  
Aircraft: Beechcraft 90  
Airport: Westchester County (NY)  
Phase of Flight: Take off  
Effect on Flight: Aborted take off  
Damage: Landing gear, nose, engines, props, wings, fuselage, lights  
Wildlife Species: Coyote  
Comments from Report: Nose gear was torn from aircraft causing other parts of plane to be damaged. Time out of service 5 months, lost revenue \$55,000 and cost of repairs \$550,000.

**Date:** 7 February 2000  
Aircraft: McDonnell Douglas DC-10-30  
Airport: Subic Bay (Philippines)  
Phase of Flight: Climb (250' AGL)  
Effect on Flight: Precautionary landing  
Damage: Engine  
Wildlife Species: Fruit bats  
Comments from Report: USA Air Freight Carrier. Engine ingested at least 1 bat. Vibration was felt. Five damaged fan blades had to be replaced. Time out of service was 3 days. Cost of repairs was \$61,000. Other related costs totaled \$3,008,400.

**Date:** 14 July 2000  
Aircraft: Fokker 100  
Airport: Chicago O'Hare Intl. (IL)  
Phase of Flight: Take off  
Effect on Flight: Precautionary landing  
Damage: Engine  
Wildlife Species: American crow  
Comments from Report: Pilot heard thump and felt aircraft yaw slightly to the right. Foul odor in cabin, caution light for engine came on. Pulled back power on engine and returned to land. Emergency equipment was standing by. Engine was destroyed.

**Date:** 23 August 2000  
Aircraft: Boeing 747  
Airport: Philadelphia Intl. (PA)  
Phase of Flight: Take off  
Effect on Flight: Aborted take off  
Damage: Engine, wing,  
Wildlife Species: Canada geese  
Comments from Report: The aircraft flew through a flock of about 30 Canada geese and ingested 1 or 2 in the #1 engine. The high-speed aborted take off resulted in 9 flat tires. The aircraft was towed to the ramp. Time out of service was 72 hours. Engine was a total loss. Cost was \$3 million.



**Date:** 27 August 2000  
**Aircraft:** Boeing 747  
**Airport:** Los Angeles Intl. (CA)  
**Phase of Flight:** Climb (500' AGL)  
**Effect on Flight:** Emergency landing  
**Damage:** Engine  
**Wildlife Species:** Western gull  
**Comments from Report:** At least one western gull was ingested just after take off. Bystanders on a beach heard a giant backfire and saw the jet spewing 8 to 10-ft flames. Three pieces of the engine fell to the ground, one 5-ft piece landed on a beach where people were having a cookout. No one was injured. The pilot dumped 83 tons of fuel over the ocean for over an hour and then made an emergency landing. The flight had 449 people who were not able to get another flight to Amsterdam until the next day. The costs reported do not include room and board. Time out of service was 72 hours and cost of repairs was \$400,000.

**Date:** 8 November 2000  
**Aircraft:** Saab 340  
**Airport:** Aberdeen Regional (SD)  
**Phase of Flight:** Approach (400' AGL)  
**Effect on Flight:** Aircraft was grounded  
**Damage:** Fuselage, wiper, propeller  
**Wildlife Species:** Snow geese  
**Comments from Report:** A flock snow geese was struck. The windshield wiper broke off, hit the prop which slung the wiper blade in several pieces through the fuselage. One piece of wiper blade lodged in a passenger's thigh, requiring emergency trip to the hospital.

**Date:** 6 December 2000  
**Aircraft:** Embraer 120  
**Airport:** Yeager Airport (WV)  
**Phase of Flight:** Landing roll  
**Effect on Flight:** None  
**Damage:** Prop and fuselage  
**Wildlife Species:** White-tailed deer  
**Comments from Report:** Aircraft collided with 2 deer just after landing. The tip of a propeller blade (4" x 3") had separated and punctured the fuselage, injuring a passenger, who later died.

**Date:** 14 January 2001  
**Aircraft:** Learjet 60  
**Airport:** Troy Municipal (AL)  
**Phase of Flight:** Landing  
**Effect on Flight:** Lost control, left runway  
**Damage:** Aircraft destroyed  
**Wildlife Species:** White-tailed deer  
**Comments from Report:** The Learjet collided with two deer and ran off the end of the runway into a ditch because the thrust reversers would not operate. The aircraft burst into flames. Rescuers kept the fire from reaching the pilots for about 40 minutes until they could be removed. The pilot and first officer had serious injuries and were flown to a hospital. Cost to replace aircraft \$9.5 million. Other costs \$25,000.

**Date:** 21 January 2001  
**Aircraft:** MD-11  
**Airport:** Portland Intl. (OR)  
**Phase of Flight:** Take off  
**Effect on Flight:** Aborted take off, engine shut down  
**Damage:** Engine, landing gear  
**Wildlife Species:** Herring gull  
**Comments from Report:** The #3 engine ingested a herring gull. The engine stall blew off the nose cowl that was sucked back into the engine and shredded. The engine had an uncontained failure. The pilot aborted take off and blew two tires. 217 passengers were safely deplaned and rerouted to other flights. Bird ID by Smithsonian.

**Date:** 2 April 2001  
**Aircraft:** B-767-300  
**Airport:** Charles de Gaule  
**Phase of Flight:** Climb (14,000' AGL)  
**Effect on Flight:** Precautionary landing  
**Damage:** Nose, radome, wing, fuselage, tail  
**Wildlife Species:** Northern shoveler  
**Comments from Report:** A U.S. Air Carrier struck a flock of shovelers causing dents and 11 punctures to the aircraft. One bird penetrated the cockpit, causing depressurization and splattering crew with bird debris and insulation. The pilot had to use an oxygen mask. Windshield was covered with blood. Aircraft returned safely to airport. Cost of repairs was over \$1 million. Bird ID by Smithsonian.

**Date:** 9 June 2001  
Aircraft: Airbus 300  
Airport: Dayton Intl. (OH)  
Phase of Flight: Climb (200' AGL)  
Effect on Flight: Precautionary landing  
Damage: Engine  
Wildlife Species: Canada goose  
Comments from Report: A Canada goose was ingested into the #2 engine shortly after lift off. Engine had an uncontained failure, and a precautionary landing was made. Parts of the engine were found on the runway. Cost to replace engine was \$2 million and time out of service was 4 days.

**Date:** 31 July 2001  
Aircraft: B-737-500  
Airport: Washington Dulles Intl. (DC)  
Phase of Flight: Approach (100' AGL)  
Effect on Flight: None  
Damage: Engine  
Wildlife Species: Canada goose  
Comments from Report: A Canada goose was ingested during approach. The oil cooler was plugged with bird remains. A set of fan blades and the oil cooler were replaced. Time out of service was 144 hours and cost was \$430,000. Bird ID by Smithsonian.

**Date:** 20 November 2001  
Aircraft: B-727  
Airport: Memphis Intl. (TN)  
Phase of Flight: Approach (1700' AGL)  
Effect on Flight: None  
Damage: Windshield, nose, wing  
Wildlife Species: Snow geese (4-5)  
Comments from Report: Approximately 25 birds were seen. One bird penetrated the cockpit. The pilot was sprayed with blood and bird remains. Nose was damaged below the captain's windshield. Two other birds penetrated the right wing. Cost of repairs and down time was \$700,000. Time out of service was 7 days.

**Date:** 30 November 2001  
Aircraft: Airbus 300  
Airport: Logan Intl. (MA)  
Phase of Flight: Take off  
Effect on Flight: Diverted to JFK  
Damage: Engine  
Wildlife Species: Herring gull  
Comments from Report: Aircraft ingested a herring gull on take off from Boston. One engine has bent fan blades. Flight was diverted to JFK due to bad weather in Boston. Bird ID by Smithsonian.

**Date:** 6 December 2001  
Aircraft: B-737  
Airport: Detroit Metropolitan (MI)  
Phase of Flight: Climb  
Effect on Flight: Precautionary landing  
Damage: Engine  
Wildlife Species: Gulls  
Comments from Report: Aircraft struck a flock of gulls and ingested one after take off. Engine rolled back, then started compressor stalls. Pilot pulled throttle back to idle. An emergency landing was made due to engine flameout. The engine was replaced. Cost estimated at \$2.3 million.

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