U. S. DEPARTMENT
OF TRANSPORTATION
FEDERAL AVIATION
ADMINISTRATION

WILDLIFE STRIKES TO CIVIL AIRCRAFT IN THE UNITED STATES 1992-1996

AUGUST, 1997

FEDERAL AVIATION ADMINISTRATION	**REPORT PREPARED BY**	**REPORT OF THE ASSOCIATE ADMINISTRATOR OF AIRPORTS**
WILDLIFE AIRCRAFT STRIKE DATABASE	**Edward C. Cleary**	**OFFICE OF AIRPORT SAFETY AND STANDARDS**
Serial Report - Number 3	**Sandra E. Wright**	**AIRPORT SAFETY/OPERATIONS DIVISION**
	Richard A. Dolbeer	**WASHINGTON, DC**

AUTHORS:

Edward C. Cleary, Staff Wildlife Biologist, Office of Airport Safety and Standards, Federal Aviation Administration, 800 Independence Ave. SW, Washington, DC 20591.

Sandra E. Wright, Wildlife Technician, US Department of Agriculture, Animal Damage Control, National Wildlife Research Center, 6100 Columbus Ave., Sandusky, OH 44870

Richard A. Dolbeer, Project Leader, US Department of Agriculture, Animal Damage Control, National Wildlife Research Center, 6100 Columbus Ave., Sandusky, OH 44870

COVER:

This Beechcraft-1900 struck a deer when landing at Latrobe, PA, December, 1996, causing the collapse of the left landing gear. All 19 passengers and crew safely deplaned. Photo courtesy of Jerry Wright, Air Line Pilots Association (ALPA).

All future reports will feature one or more pictures of aircraft damage resulting from a wildlife strike. Those with quality pictures of wildlife aircraft damage are encouraged to submit them to one of the authors for consideration. No slides, please, as they are too difficult to reproduce in this format. Full credit will be given for all pictures used.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGMENTS

The dBase file and support programs used to enter and organize strike data were established by ***J. Rapol*** and ***E. LeBoeuf***, Federal Aviation Administration (FAA), Office of Airport Safety and Standards, Washington, DC. The assistance provided by the above acknowledged professionals is greatly appreciated. ***T. H. Hupf*** and ***S. Agrawal***, FAA Technical Center, Atlantic City, New Jersey, also provided critical support and advice as did USDA biologists ***H. A. Bolte***, and ***C. P. Dwyer***. Finally, we acknowledge the pilots, mechanics, tower control personnel, and other members of the aviation community who reported wildlife strikes. Sponsorship and funds for the ongoing maintenance 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 Technical Center, Atlantic City International Airport, New Jersey.

WILDLIFE STRIKES TO CIVIL AIRCRAFT IN THE UNITED STATES 1992-1996

SYNOPSIS

Wildlife strikes to civil aircraft are a serious economic and safety problem in the United States. The Federal Aviation Administration (FAA) has a standard form (5200-7) for the voluntary reporting of bird and other wildlife strikes with aircraft. Although FAA personnel have monitored these reports since 1965 to determine general patterns in wildlife strikes, no quantitative analyses of these data were conducted until 1995.

The United States Department of Agriculture's (USDA) National Wildlife Research Center, through an interagency agreement with the FAA, initiated a project to obtain more objective estimates of the magnitude and nature of the wildlife strike problem nationwide for civil aviation in April, 1995. 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-duplicating 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., bird species, aircraft and engine types, airports, seasonality) 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). A second report, summarizing data for the 3-year period, 1993-1995, was completed in December, 1996 (Cleary et al., 1996). It is the intention of the FAA to publish a detailed report covering the 10-year period, 1990-1999, in the year 2000. Subsequent detailed reports will be produced at 5-year intervals. In the interim years, annual reports summarizing data in tabular and graphic form for all available years will be produced.

This publication presents a synopsis of data on wildlife strikes to United States civil aircraft for the years 1992-1996. Unless noted, all numbers are totals for the 5-year period, and percentages are of the known total. For the 5-year period, 11,571 (avg. 2,314/year) strikes were reported to the FAA. Most reports were filed using FAA Form 5200-7 (Table 1). Pilots and tower personnel filed 28% and 17% of the reports, respectively (Table 2). About 75% of the reported strikes involved commercial aircraft; the remainder involved business, private and miscellaneous aircraft (Table 3).

Reports were received from all 50 States, some US territories, and from foreign countries when US registered aircraft were involved. Tables 4A and 4B show the

distribution of reported bird and mammal strikes for the various states and territories.

Most bird strikes (51%) occurred between July and October (Table 5); 63% occurred during the day (Table 6); 34% occurred when the aircraft was on approach; and 21% occurred during take-off (Table 7). Fifty-five percent of the bird strikes occurred when the aircraft was at an altitude of less than 100 ft. above ground level (AGL), 79% occurred under 900 ft. AGL, and 88% occurred under 2,000 ft. AGL (Table 8).

Most mammal strikes (45%) occurred in the fall (Table 5); 58% occurred at night (Table 6); 50% occurred when the aircraft was landing; 30% occurred during take-off; and 9% occurred while the aircraft was still in the air, when the aircraft struck deer with the landing gear or encountered bats (Table 7).

Aircraft types most often involved in strikes that had a negative effect on flight were Boeing 737, McDonnell-Douglas MD-80, British Aerospace Jetstream, Douglas Corp. DC-9, Cessna 172, and Beechcraft-1900 (Table 9A). These aircraft types also headed the list of those most often involved in a strike that damaged one or more aircraft components or caused a loss of time or money (Table 9B).

Aircraft components most commonly reported as struck by birds were windshield, engine, nose, and wing/rotor. Those components most often reported as damaged were engine, wing/rotor, radome, and windshield (Table 10A). Aircraft components most commonly reported as struck by mammals were: landing gear, propeller, wing/rotor, engine, and fuselage. These same components headed the list for the parts most often reported as damaged (Table 10B). Table 11 shows the reported effect-on-flight of wildlife strikes to US civil aircraft. Fourteen percent of the bird, and 47% of the mammal, strike reports indicated the strike had a negative effect on the flight.

Birds were involved in 97% of the reported strikes, mammals in 3%, and <1% involved reptiles. Gulls, blackbirds, waterfowl, doves, and raptors were the most commonly struck bird groups (Table 12A). The most commonly struck mammals were deer and coyotes (Table 12B). Gulls were involved in almost three times as many strikes as waterfowl, but both were involved in essentially the same number of damaging strikes (Table 13).

For the 5-year period, 16% (1,840) of the reported bird, and 51% (161) of the reported mammal strikes caused damage to the aircraft. Of these 2,001 reports, 476 reports estimated aircraft down time (total = 96,593 hours, avg. = 203 hours/report) (Table 14A), and 371 reports estimated the monetary losses (total = $40,083,368, avg. = $108,041/report) (Table 14B).

Analysis of strike reports from three major US airports showed that less than 20% of all strikes occurring at these airports were reported to FAA. Additionally, many reports received by 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 underestimate the magnitude of the problem.

Assuming all 2,001 aircraft reporting strike damage incurred similar amounts of down time and monetary losses, and that these reports represented all of the damaging strikes that occurred, then at a minimum, wildlife aircraft strikes cost the US civil aviation industry 81,241 hours/year of aircraft down time and $43.2 million/year in direct monetary losses.

Further, assuming a 20% reporting rate, the cost of wildlife aircraft strikes to the US civil aviation industry is estimated to be in excess of 406,000 hours/year of aircraft down time and $216 million/year in direct monetary losses.

For the most part, airport wildlife management programs have focused on gulls, because this group of birds is most often involved in wildlife strikes. However, the strike data for 1992-1996 indicate that airports should also focus on species such as waterfowl, raptors, and wading birds, as well as deer.

LITERATURE CITED

Dolbeer, R. A., S. E. Wright, and E. C. Cleary. 1995. Bird and other wildlife strikes to civilian aircraft in the United States, 1994. Interim report, DTFA01-91-Z-02004. US Dept. Agric. For Fed. Aviation Admin., FAA Technical Center, Atlantic City, NJ. 37 pp.

Cleary, E. C., S. E. Wright, and R. A. Dolbeer. 1996. Wildlife strikes to civilian aircraft in the United States, 1993-1995. DOT/FAA/AAS/97-1. Fed. Aviation Admin. Office of Airport Safety and Standards, Washington, DC. 33 pp.

Table 1. Sources of information for reported wildlife strikes to civil aircraft, USA, 1992-1996.

	Number of reported strikes							
	Years							
Source	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
AAIPN[1]	11	17	5	8	5	46	9	<1
AC Incident Report	86	106	77	65	75	409	82	4
Airport Report	22	91	48	67	102	330	66	3
ASRS[2]	14	8	17	13	5	57	11	<1
Daily Alert Bulletin	4	3	1	0	0	8	2	<1
Engine Mfg.	1	2	1	63	24	91	18	1
FAA Form 5200-7	1,895	1,795	1,833	1,843	1,785	9,151	1,830	79
Multiple	129	139	180	190	298	936	187	8
NTSB[3]	3	2	2	1	1	9	2	<1
Other	39	36	39	82	131	327	65	3
PACIR[4]	2	12	22	78	75	189	38	2
Unknown	9	0	0	6	3	18	4	<1
Total	2,215	2,211	2,225	2,416	2,504	11,571	2,314	100

1. Alana Aircraft Incident Preliminary Notice
2. Aviation Safety Reporting Service
3. National Transportation Safety Board
4. Preliminary Aircraft Incident Report

Table 2. Person filing report of wildlife strike to civil aircraft, USA, 1992-1996.

	Number of reported Strikes							
	Year							
Person filing report	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Aircraft Maint.	10	3	12	6	5	36	7	<1
Carcass Found	63	109	50	91	134	447	89	4
Operations	25	36	56	44	47	208	42	2
Other	1,077	1,115	1,156	1,354	1,430	6,132	1,226	53
Pilot	649	555	561	505	518	2,788	558	24
Tower	382	392	387	409	364	1,934	387	17
Unknown	9	1	3	7	6	26	5	<1
Total	2,215	2,211	2,225	2,416	2,504	11,571	2,314	100

Table 3. Number of reported wildlife strikes to civil aircraft by type of operator, USA, 1992-1996.

	Number of reported strikes							
	Year							
Operator	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Commercial	1,660	1,637	1,694	1,822	1,821	8,634	1,727	75
Business	282	227	290	328	388	1,515	303	13
Private	121	155	139	116	96	627	125	5
Gov. / Police	9	6	11	11	6	43	9	<1
Unknown	143	186	91	139	193	752	150	6
Total	2,215	2,211	2,225	2,416	2,504	11,571	2,314	100

Table 4A. Number of reported bird strikes to civil aircraft by US State, including Puerto Rico (PR) and the US Virgin Islands (VI), 1992-1996.

	Number of reported strikes							
	Years							
State	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
AK	21	10	17	22	20	90	18	0.8
AL	22	21	60	30	29	162	32	1.4
AR	20	10	14	16	11	71	14	0.6
AZ	5	12	14	17	30	78	16	0.7
CA	189	209	223	256	211	1,088	218	9.7
CO	19	19	20	18	25	101	20	0.9
CT	43	23	33	29	38	166	33	1.5
DC	42	44	61	56	80	283	57	2.5
DE	1	1	6	1	1	10	2	0.1
FL	146	140	167	186	188	827	165	7.3
GA	47	28	66	49	51	241	48	2.1
HI	41	24	17	35	93	210	42	1.9
IA	22	23	20	24	14	103	21	0.9
ID	4	2	5	10	5	26	5	0.2
IL	96	173	123	147	156	695	139	6.2
IN	23	23	18	31	15	110	22	1.0
KS	6	10	8	11	8	43	9	0.4
KY	65	74	66	54	55	314	63	2.8
LA	63	70	48	71	69	321	64	2.9
MA	32	40	28	29	29	158	32	1.4
MD	31	26	29	33	27	146	29	1.3
ME	15	10	6	17	9	57	11	0.5
MI	50	53	40	33	42	218	44	1.9
MN	18	25	27	13	15	98	20	0.9
MO	32	43	34	50	51	210	42	1.9
MS	7	14	11	6	15	53	11	0.5
MT	7	6	2	4	3	22	4	0.2
NC	61	47	72	73	49	302	60	2.7
ND	0	3	8	8	4	23	5	0.2
NE	26	27	34	25	16	128	26	1.1
NH	4	9	14	8	6	41	8	0.4
NJ	74	75	80	87	80	396	79	3.5
NM	4	3	4	10	6	27	5	0.2
NV	5	2	9	11	14	41	8	0.4
NY	148	139	121	138	176	722	144	6.4
OH	59	83	77	84	95	398	80	3.5
OK	14	14	11	9	9	57	11	0.5
OR	22	27	20	24	31	124	25	1.1
PA	120	101	107	122	110	560	112	5.0
PR	2	4	0	5	8	19	4	0.2
RI	8	7	9	6	2	32	6	0.3
SC	11	12	12	15	14	64	13	0.6
SD	3	0	4	5	10	22	4	0.2
TN	80	62	45	54	62	303	61	2.7
TX	210	194	179	158	172	913	183	8.1
UT	32	32	25	21	23	133	27	1.2
VA	55	42	52	57	55	261	52	2.3
VI	3	4	5	8	4	24	5	0.2
VT	2	1	2	2	1	8	2	0.1
WA	21	57	41	46	63	228	46	2.0
WI	42	21	13	26	22	124	25	1.1
WV	14	10	10	10	8	52	10	0.5
WY	3	1	2	0	0	6	1	0.1
Totals								
US States & territories	2,090	2,110	2,119	2,260	2,330	10,909	2,182	96.9
Fgn/Unk[1]	71	47	36	92	98	344	69	3.1
All reported strikes	2,161	2,157	2,155	2,352	2,428	11,253	2,251	100

[1.] Strikes involving US registered aircraft that occurred outside of US territory, or for which the state where it occurred was not given.

Table 4B. Number of reported mammal strikes to civil aircraft by US State, including Puerto Rico (PR) and the US Virgin Islands, 1992-1996.

	Number of strikes							
	Years							
State	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
AK	0	1	0	1	0	2	<1	0.6
AL	1	1	0	0	1	3	1	1.0
AR	0	0	2	2	4	8	2	2.5
AZ	2	2	1	1	2	8	2	2.5
CA	2	0	1	4	2	9	2	2.9
CO	0	0	1	2	0	3	1	1.0
CT	2	2	0	2	2	8	2	2.5
DC	0	0	0	1	4	5	1	1.6
DE	0	0	1	0	0	1	<1	0.3
FL	0	0	2	2	2	6	1	1.9
GA	1	2	1	1	0	5	1	1.6
HI	1	0	0	0	0	1	<1	0.3
IA	0	2	0	0	0	2	<1	0.6
ID	1	0	0	0	1	2	<1	0.6
IL	3	9	3	8	7	30	6	9.5
IN	1	1	2	1	0	5	1	1.6
KS	1	0	0	0	0	1	<1	0.3
KY	0	0	0	1	0	1	<1	0.3
LA	0	0	0	0	2	2	<1	0.6
MA	2	0	0	0	2	4	1	1.3
MD	0	0	2	4	3	9	2	2.9
ME	1	0	0	1	0	2	<1	0.6
MI	2	0	8	2	3	15	3	4.8
MN	2	0	0	0	2	4	1	1.3
MO	1	1	3	0	0	5	1	1.6
MS	0	0	1	0	1	2	<1	0.6
MT	0	0	0	1	0	1	<1	0.3
NC	1	0	4	1	3	9	2	2.9
ND	0	0	0	0	0	0	0	0.0
NE	2	1	0	0	1	4	1	1.3
NH	0	0	2	1	0	3	1	1.0
NJ	3	3	6	0	6	18	4	5.7
NM	0	0	0	0	1	1	<1	0.3
NV	0	0	0	1	1	2	<1	0.6
NY	5	3	4	5	3	20	4	6.3
OH	3	2	1	1	0	7	1	2.2
OK	0	1	1	0	1	3	1	1.0
OR	0	0	0	1	1	2	<1	0.6
PA	6	7	8	6	2	29	6	9.2
PR	0	1	0	0	0	1	<1	0.3
RI	0	0	0	0	0	0	0	0.0
SC	0	0	0	0	1	1	<1	0.3
SD	0	2	0	0	0	2	<1	0.6
TN	0	0	0	1	2	3	1	1.0
TX	3	6	4	5	4	22	4	7.0
UT	0	1	0	0	0	1	<1	0.3
VA	0	1	0	4	5	10	2	3.2
VI	0	0	0	0	0	0	0	0.0
VT	0	0	0	0	0	0	0	0.0
WA	0	0	0	1	1	2	<1	0.6
WI	1	1	4	0	1	7	1	2.2
WV	6	3	5	2	5	21	4	6.7
WY	0	1	1	0	0	2	<1	0.6
Totals								
US States & territories	53	54	68	63	76	314	63	99.7
Fgn/Unk[1]	0	0	1	0	0	1	<1	0.3
All reported strikes	53	54	69	63	76	315	63	100.0

[1.] Strikes involving US registered aircraft that occurred outside of US territory, or for which the state where it occurred was not given.

Table 5. Number of reported wildlife strikes to civil aircraft by month, USA, 1992-1996. See also Figures 1 and 2.

	Number of reported strikes							
	Years							
Month	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Birds								
Jan.	75	95	89	99	108	466	93	4
Feb.	84	94	74	73	94	419	84	4
Mar.	110	131	119	156	125	641	128	6
Apr.	126	180	147	149	158	760	152	7
May	206	195	172	215	219	1,007	201	9
Jun.	193	157	137	156	165	808	162	7
Jul.	221	227	223	243	250	1,164	233	10
Aug.	353	287	302	296	316	1,554	311	14
Sep.	298	327	312	286	327	1,550	310	14
Oct.	241	248	267	332	326	1,414	283	13
Nov.	152	123	202	215	198	890	178	8
Dec.	99	93	111	132	142	577	115	5
Unk	3	0	0	0	0	3	1	<1
Total	2,161	2,157	2,155	2,352	2,428	11,253	2,251	100
Mammals								
Jan.	2	3	2	2	3	12	2	4
Feb.	1	1	2	1	1	6	1	2
Mar.	1	1	6	10	3	21	4	7
Apr.	2	4	1	3	2	12	2	4
May	3	4	3	0	5	15	3	5
Jun.	5	8	4	5	10	32	6	10
Jul.	5	5	5	5	5	25	5	8
Aug.	2	1	3	5	14	25	5	8
Sep.	9	7	7	9	9	41	8	13
Oct.	8	8	12	8	9	45	9	14
Nov.	12	8	17	9	12	58	12	18
Dec.	3	4	7	6	3	23	5	7
Total	53	54	69	63	76	315	63	100

Table 6. Reported time of occurrence of wildlife strikes to civil aircraft, USA, 1992-1996. See also Figures 3A, 3B, 4A, and 4B.

	Number of reported strikes							
	Year							
Time	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Birds								
Dawn	80	81	71	106	112	450	90	4
Day	1,410	1,346	1,405	1,432	1,464	7,057	1,411	63
Dusk	86	122	137	113	125	583	117	5
Night	534	515	485	558	543	2,635	527	23
Not reported	51	93	57	143	184	528	106	5
Total	2,161	2,157	2,155	2,352	2,428	11,253	2,251	100
Mammals								
Dawn	2	2	0	1	1	6	1	2
Day	8	21	9	14	17	69	14	22
Dusk	10	2	5	7	7	31	6	10
Night	29	25	50	34	44	182	36	58
Not reported	4	4	5	7	7	27	5	9
Total	53	54	69	63	76	315	63	100

Table 7. Reported phase of flight at time of wildlife strikes to civil aircraft, USA, 1992-1996.

	Number of reported strikes							
	Year							
Phase of flight	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Birds								
Parked	3	0	1	3	1	8	2	<1
Taxiing	10	9	9	12	9	49	10	<1
Take-off	366	601	456	450	445	2,318	464	21
Climb	369	143	345	403	403	1,663	333	15
En route	78	75	72	80	75	380	76	3
Descent	72	68	66	92	76	374	75	3
Approach	811	762	713	779	792	3,857	771	34
Landing roll	352	344	399	346	371	1,812	362	16
Not reported	100	155	94	187	256	792	158	7
Total	2,161	2,157	2,155	2,352	2,428	11,253	2,251	100
Mammals								
Parked	0	0	0	0	0	0	0	0
Taxiing	1	0	0	0	0	1	<1	<1
Take-off	15	12	26	20	20	93	19	30
Climb	0	0	0	0	2	2	<1	1
En route	0	0	1	0	0	1	<1	<1
Descent	1	0	0	0	0	1	<1	<1
Approach	4	9	2	6	4	25	5	8
Landing roll	29	25	37	29	38	158	32	50
Not reported	3	8	3	8	12	34	7	11
Total	53	54	69	63	76	315	63	100

Table 8. Number of reported bird strikes to civil aircraft by altitude (feet) above ground level (AGL), USA, 1992-1996. See also Figure 5.

Altitude of strike (feet AGL)	Number of reported strikes: Years 1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total known	Cumul. % of total known
0 to 0	729	627	816	718	822	3,712	742	39	39
1 to 99	340	303	272	309	289	1,513	303	16	55
100 to 199	130	125	140	133	126	654	131	7	62
200 to 299	94	94	94	102	69	453	91	5	67
300 to 399	76	53	65	68	58	320	64	3	70
400 to 499	23	49	29	36	37	174	35	2	72
500 to 599	61	59	57	60	73	310	62	3	76
600 to 699	22	21	18	17	19	97	19	1	77
700 to 799	15	14	16	13	18	76	15	1	77
800 to 899	36	19	33	25	30	143	29	2	79
900 to 999	9	11	4	14	7	45	9	<1	79
1,000 to 1,499	103	97	99	95	96	490	98	5	85
1,500 to 1,999	65	66	53	64	54	302	60	3	88
2,000 to 2,999	80	69	64	112	93	418	84	4	92
3,000 to 3,999	46	47	40	25	59	217	43	2	95
4,000 to 4,999	20	26	25	61	30	162	32	2	96
5,000 to 5,999	21	6	29	14	31	101	20	1	97
6,000 to 6,999	16	30	16	5	19	86	17	1	98
7,000 to 7,999	14	2	7	16	9	48	10	1	99
8,000 to 8,999	8	8	3	9	4	32	6	<1	99
9,000 to 9,999	4	4	6	2	3	19	4	<1	99
10,000 to 14,999	19	10	10	12	17	68	14	1	100
15,000 to 19,999	1	0	0	0	0	1	<1	<1	100
20,000 to 29,999	0	1	0	2	2	5	1	<1	100
30,000 to 33,000	1	0	0	1	0	2	<1	<1	100
Total known	1,933	1,741	1,896	1,913	1,965	9,448	1,890	100	
Total unknown	228	416	259	439	463	1,805	361		
Grand total	2,161	2,157	2,155	2,352	2,428	11,253	2,251		

Table 9A. Number of reported strikes that had a negative effect on flight by most commonly involved aircraft type, USA, 1992-1996.

		Number of reported strikes							
		Years							
Aircraft	Engine[1]	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
B-737	TF/TJ	36	80	61	56	72	305	61	19
MD-80	TF	13	25	15	18	15	86	17	5
DC-9	TF	2	16	16	18	17	69	14	4
B-757	TF	7	16	12	11	3	49	10	3
B-727	TJ	5	17	9	4	11	46	9	3
B-747	TF	11	15	5	10	8	49	10	3
Citation	TF	6	7	8	7	4	32	6	2
FK-100	TF	3	4	7	4	3	21	4	1
BA-Jetstream	TP	14	22	19	15	16	86	17	5
C-172	PS	12	13	14	6	5	50	10	3
BE-1900	TP	3	15	4	11	9	42	8	3
PA-28	PS	4	12	12	8	7	43	9	3
SAAB-340	TP	7	13	10	10	11	51	10	3
BE-55 Baron	PS	4	10	6	4	7	31	6	2
C-152	PS	3	8	3	5	4	23	5	1
ATR-42	TP	3	7	3	7	4	24	5	1
Other/unknown		78	184	113	141	125	641	128	39
Total		211	464	317	335	321	1,648	330	100

[1.] TF = Turbo-fan; TJ = Turbo-jet; TP = Turbo-prop; PS = Piston

Table 9B. Number of reported strikes that damaged one or more aircraft components, or that resulted in lost time or money, by most commonly involved aircraft type, USA, 1992-1996.

		Number of reported strikes							
		Years							
Aircraft	Engine[1]	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
B-737	TF/TJ	52	59	75	101	111	398	80	20
MD-80	TF	21	17	22	23	19	102	20	5
DC-9	TF	10	14	19	25	20	88	18	4
B-757	TF	9	14	12	24	15	74	15	4
B-727	TJ	11	14	14	16	15	70	14	3
B-747	TF	15	13	6	14	10	58	12	3
Citation	TF	8	5	12	15	4	44	9	2
FK-100	TF	4	4	6	8	9	31	6	2
BA-Jetstream	TP	26	19	22	14	14	95	19	5
C-172	PS	16	10	15	11	11	63	13	3
BE-1900	TP	8	12	9	13	14	56	11	3
PA-28	PS	1	10	8	6	14	39	8	2
SAAB-340	TP	6	4	7	9	10	36	7	2
BE-55 Baron	PS	6	9	7	4	6	32	6	2
C-152	PS	6	3	2	9	3	23	5	1
ATR-42	TP	5	5	6	4	2	22	4	1
Other/unknown		123	141	156	176	181	777	155	39
Total		327	353	398	472	458	2,008	402	100

[1.] TF = Turbo-fan; TJ = Turbo-jet; TP = Turbo-prop; PS = Piston

Table 10A. Civil aircraft components reported as being struck and damaged by birds, USA, 1992-1996.

	Number of reported strikes						
	Year						
Parts of aircraft	1992	1993	1994	1995	1996	Total	5-yr. avg.
Radome							
Struck	195	200	225	255	238	1,113	223
Damaged	24	25	40	47	35	171	34
Windshield							
Struck	344	265	405	401	401	1,816	363
Damaged	28	25	38	42	30	163	33
Nose							
Struck	225	253	265	307	300	1,350	270
Damaged	17	26	19	18	30	110	22
Engine							
Struck	267	252	297	391	336	1,543	309
Damaged	100	113	123	154	151	641	128
Propeller							
Struck	86	74	84	97	74	415	83
Damaged	7	12	9	6	8	42	8
Wing/rotor							
Struck	243	244	258	313	282	1,340	268
Damaged	83	86	89	111	78	447	89
Fuselage							
Struck	224	213	230	223	253	1,143	229
Damaged	12	10	10	10	17	59	12
Landing Gear							
Struck	104	90	123	129	111	557	111
Damaged	16	9	15	17	14	71	14
Tail							
Struck	26	25	27	38	41	157	31
Damaged	10	12	13	15	18	68	14
Light							
Struck	11	23	18	18	15	85	17
Damaged	8	21	15	16	11	71	14
Other							
Struck	58	86	92	111	64	411	82
Damaged	24	40	43	47	28	182	36

Table 10B. Civil aircraft components reported as being struck and damaged by mammals, USA, 1992-1996.

	Number of reported strikes						
	Year						
Parts of aircraft	1992	1993	1994	1995	1996	Total	5-yr. avg.
Radome							
Struck	0	0	2	1	0	3	1
Damaged	0	0	2	0	0	2	<1
Windshield							
Struck	1	0	1	3	0	5	1
Damaged	0	1	1	1	0	3	1
Nose							
Struck	1	3	3	4	2	13	3
Damaged	1	3	3	3	2	12	2
Engine							
Struck	3	2	6	4	7	22	4
Damaged	3	2	5	3	6	19	4
Propeller							
Struck	6	2	12	12	15	47	9
Damaged	5	3	12	8	14	42	8
Wing/rotor							
Struck	3	4	12	5	13	37	7
Damaged	3	3	12	5	13	36	7
Fuselage							
Struck	1	3	8	5	5	22	4
Damaged	0	3	7	5	4	19	4
Landing Gear							
Struck	10	15	28	22	19	94	19
Damaged	10	11	15	15	17	68	14
Tail							
Struck	5	0	3	2	6	16	3
Damaged	5	1	4	1	5	16	3
Light							
Struck	0	2	2	0	1	5	1
Damaged	0	1	2	0	1	4	1
Other							
Struck	3	10	18	4	10	45	9
Damaged	3	10	15	4	11	43	9

Table 11. Reported effect-on-flight of wildlife strikes to civil aircraft, USA, 1992-1996.

	Number of reported strikes							
	Year							
Effect on flight	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Birds								
None	1,446	1,540	1,703	1,762	1,475	7,926	1,585	70
Aborted take-off	51	52	64	64	85	316	63	3
Engine shut down	15	8	12	16	11	62	12	1
Precautionary landing	85	117	109	123	156	590	118	5
Other	38	255	97	104	39	533	107	5
Not reported	526	185	170	283	662	1,826	365	16
Total	2,161	2,157	2,155	2,352	2,428	11,253	2,251	100
Mammals								
None	9	12	20	24	14	79	16	25
Aborted take-off	6	3	11	8	9	37	7	12
Engine shut down	1	1	0	1	0	3	1	1
Precautionary landing	1	2	5	7	5	20	4	6
Other	14	26	19	12	16	87	17	28
Not reported	22	10	14	11	32	89	18	28
Total	53	54	69	63	76	315	63	100

Table 12 A. Identified bird groups most commonly involved in reported wildlife strikes to civil aircraft, USA, 1992-1996.

	Number of reported strikes							
	Year							
Bird groups	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Gulls	366	351	314	314	333	1,678	336	31
Waterfowl	107	142	145	131	140	665	133	12
Ducks	51	66	63	46	65	291	58	5
Geese/swans	56	76	82	85	75	374	75	7
Blackbirds	139	144	131	128	140	682	136	13
Blackbirds	85	89	73	85	76	408	82	8
Starling	54	55	58	43	64	274	55	5
Doves	107	111	135	110	132	595	119	11
Rock	49	39	38	52	45	223	45	4
Mourning	58	72	97	58	87	372	74	7
Raptors	94	90	112	124	110	530	106	10
Hawks	46	51	71	82	54	304	61	6
Owls	25	24	15	21	32	117	23	2
Eagles	2	2	6	4	4	18	4	<1
Vultures	21	13	20	17	20	91	18	2
Sparrows[1]	83	89	89	80	82	423	85	8
Corvids	17	22	27	32	14	112	22	2
Shorebirds	19	19	30	26	35	129	26	2
Cormorants	3	1	0	1	5	10	2	<1
Pelicans	4	1	3	3	2	13	3	<1
Plovers	2	1	2	3	9	17	3	<1
Killdeer	8	12	16	13	14	63	13	1
Sandpipers	2	4	9	6	5	26	5	<1
Wading birds	15	26	20	24	35	120	24	2
Egrets	10	17	13	15	18	73	15	1
Herons	3	6	6	5	10	30	6	1
Cranes	2	3	1	4	7	17	3	<1
Swallows	24	31	23	30	24	132	26	2
Misc. birds	20	72	65	56	85	298	60	6
Totals								
Known birds	991	1,097	1,091	1,055	1,130	5,364	1,073	100
Unknown birds	1,170	1,060	1,064	1,297	1,298	5,889	1,178	
Reported strikes	2,161	2,157	2,155	2,352	2,428	11,253	2,251	

1. Some of the birds identified on strike reports as “sparrows” probably belong to other groups such as snow buntings, finches, juncos, etc.

Table 12 B. Identified mammal and reptile groups most commonly involved in reported wildlife strikes to civil aircraft, USA, 1992-1996.

Mammal groups	Number of reported strikes: Years 1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Ungulates	44	36	55	36	54	225	45	72
Deer	42	33	54	34	51	214	43	68
Elk	1	0	1	0	2	4	1	1
Cattle	1	2	0	1	1	5	1	2
Pronghorn	0	1	0	1	0	2	<1	1
Carnivores	5	6	13	19	21	64	13	20
Coyote	1	4	10	11	9	35	7	11
Dog	1	0	1	4	4	10	2	3
Fox	1	0	1	2	4	8	2	3
Raccoon	0	2	1	1	0	4	1	1
Cat	2	0	0	0	0	2	<1	1
Striped skunk	0	0	0	1	4	5	1	2
Rodents	1	4	0	4	0	9	2	3
Muskrat	0	0	0	1	0	1	<1	<1
Woodchuck	1	4	0	3	0	8	2	3
Bats	2	6	1	3	0	12	2	4
Opossum	0	2	0	1	1	4	1	1
Rabbit	1	0	0	0	0	1	<1	<1
Total mammal strikes	53	54	69	63	76	315	63	100
Reptiles	1	0	1	1	0	3	1	100
Alligator	0	0	1	0	0	1	<1	33
Turtle	1	0	0	1	0	2	<1	67
Total reptile strikes	1	0	1	1	0	3	1	

Table 13. Number of reported wildlife strikes causing damage to civil aircraft by wildlife group, USA, 1992-1996.

	Number of reported strikes							
	Years							
Wildlife group	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Birds								
Gulls	62	81	57	69	59	328	66	16
Waterfowl	52	68	64	70	57	311	62	16
Blackbirds	7	21	9	8	6	51	10	3
Doves	7	24	15	16	14	76	15	4
Raptors	28	37	41	29	29	164	33	8
Corvids	2	1	6	5	1	15	3	1
Wading birds	2	11	4	3	8	28	6	1
Misc. birds	7	16	12	7	9	51	10	3
Unknown birds	108	184	129	206	189	816	163	41
Total birds	275	443	337	413	372	1,840	368	92
Mammals								
Ungulates	24	24	37	28	41	154	31	8
Carnivores	1	2	1	1	1	6	1	<1
Bats	0	0	1	0	0	1	<1	<1
Total mammals	25	26	39	29	42	161	32	8
Grand total	300	469	376	442	414	2,001	400	100

Table 14A. Reported aircraft down time (hours) resulting from wildlife strikes to civil aircraft, USA, 1992-1996[1]

	Reported down time (hrs)							
	Years							
Wildlife group	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Birds								
Gulls	290	7,864	517	1,370	614	10,655	2,131	11
Waterfowl	2,940	2,504	2,373	3,038	2,970	13,825	2,765	14
Blackbirds	2	83	769	4	150	1,008	202	1
Doves	30	12	24	39	110	215	43	<1
Raptors	1,268	705	4,021	1,394	3,518	10,906	2,181	11
Corvids	0	0	73	3	0	76	15	<1
Wading birds	0	1,387	0	49	326	1,762	352	2
Misc. birds	1,306	8	888	7	51	2,260	452	2
Unknown	93	2,398	173	1,453	2,705	6,822	1,364	7
Total bird	5,929	14,961	8,838	7,357	10,444	47,529	9,506	49
Mammals								
Ungulates	2,920	3,602	25,668	152	8,796	41,138	8,228	43
Carnivores	0	0	5,760	2,160	6	7,926	1,585	8
Total mammal	2,920	3,602	31,428	2,312	8,802	49,064	9,813	51
Grand total	8,849	18,563	40,266	9,669	19,246	96,593	19,319	100

1. For the 5-year period, 16% (1,840) of the reported bird, and 51% (161) of the reported mammal, strikes caused damage to the aircraft. Of these 2,001 reports, 476 estimated aircraft down time and 371 estimated the monetary losses.

Table 14B. Reported monetary losses (cost of damage, lost revenue, and other monetary losses) in US dollars, resulting from wildlife strikes to civil aircraft, USA, 1992-1996[1]

	Reported monetary losses ($)							
	Years							
Wildlife group	1992	1993	1994	1995	1996	Total	5-yr. avg.	% of total
Birds								
Gulls	905,204	434,762	722,440	718,604	547,275	3,328,285	665,657	8
Waterfowl	56,850	63,400	1,453,706	11,445,471	1,122,703	14,142,130	2,828,426	35
Blackbirds	200	7,900	463,000	11,000	29,000	511,100	102,220	1
Doves	155,661	75,100	400	1,509,900	2,500	1,743,561	348,712	4
Raptors	241,259	457,500	2,175,648	269,763	106,275	3,250,445	650,089	8
Corvids	150	0	6,805	950	0	7,905	1,581	<1
Wading birds	0	6,500	0	0	0	6,500	1,300	<1
Misc. birds	1,861,570	64,500	1,008,668	103	4,360	2,939,201	587,840	7
Unknown	3,500	3,069,779	511,000	7,291,302	1,634,562	12,510,143	2,502,029	31
Total bird	3,224,394	4,179,441	6,341,667	21,247,093	3,446,675	38,439,270	7,687,855	96
Mammals								
Ungulates	8,000	192,250	463,342	141,500	685,006	1,490,098	298,020	4
Carnivores	0	0	105,000	35,000	14,000	154,000	30,800	<1
Total mammal	8,000	192,250	568,342	176,500	699,006	1,644,098	328,820	4
Grand total	3,232,394	4,371,691	6,910,009	21,423,593	4,145,681	40,083,368	8,016,674	100

1. For the 5-year period, 16% (1,840) of the reported bird, and 51% (161) of the reported mammal strikes caused damage to the aircraft. Of these 2,001 reports, 476 estimated aircraft down time and 371 estimated the monetary losses.

Error! Not a valid link.

Figure 1. Percent of reported bird strikes to civil aircraft by month, USA, 1992-1996 (N = 11,253).

Error! Not a valid link.

Figure 2. Percent of reported mammal strikes to civil aircraft by month, 1992-1996 (N = 315).

Error! Not a valid link.

Figure 3A. Time of occurrence of reported bird strikes to civil aircraft, USA, 1992-1996.

Error! Not a valid link.

Figure 3B. Mean percentage of bird strikes/hour by time of day to civil aircraft, USA, 1992-1996. (Strikes/hour were calculated using an average day and night length of 11.25 hours, and an average dawn and dusk length of 0.75 hour, each).

Error! Not a valid link.

Figure 4A. Time of occurrence of reported mammal strikes to civil aircraft, USA, 1992-1996.

Error! Not a valid link.

Figure 4B. Mean percentage of mammal strikes/hour by time of day to civil aircraft, USA, 1992-1996. (Strikes/hour were calculated using an average day and night length of 11.25 hours, and an average dawn and dusk length of 0.75 hour, each).

Error! Not a valid link.

Figure 5. Cumulative percentage of reported bird strikes to civil aircraft by altitude (feet) above ground level (AGL).