

BIRD STRIKE DATA ANALYSIS

(TASK 2, PART II)

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BIRD AND OTHER WILDLIFE STRIKES TO CIVILIAN AIRCRAFT IN THE UNITED STATES, 1994

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EXECUTIVE SUMMARY

PART II: BIRD AND OTHER WILDLIFE STRIKES TO CIVILIAN AIRCRAFT IN THE UNITED STATES, 1994

Bird and other wildlife strikes to civilian aircraft are a serious, but largely unquantified, economic and safety problem in the United States. We analyzed all wildlife strike reports for 1994 received by the Federal Aviation Administration (FAA) (Form 5200-7 and miscellaneous sources) after editing the reports and entering the information into a Wildlife Strike Database. Of the 2,220 nonduplicating strike reports, 2,150 (97%) involved birds of which about 50% identified the type of bird. Gulls (*Larus* spp.) were involved in 30% of the identified bird strikes followed by waterfowl, blackbirds/starlings, pigeons/doves, and birds of prey (each 10-13%). The 70 nonbird wildlife strikes involved 57 (81%) ungulates and 9 (13%) coyotes/dogs (*Canis* spp.). Bird strikes occurred most frequently in July-November with September having the highest monthly total (about 15% of 1994 total). About 25% of reported deer strikes were in November. Most bird strikes occurred during day (67%) followed by night (23%) and dawn/dusk (10%). Most other wildlife (primarily deer) strikes occurred at night (82%). Most bird strikes occurred during approach/landing (54%) and take-off (34%) phases of flight. About 77% of reported bird strikes occurred at ≤ 500 ft altitude. The highest elevation for a reported strike was 14,000 ft. Boeing 737 aircraft had the most (559, 27% of total) strikes reported followed by McDonald Douglas DC-9/MD-80 series aircraft (379, 19%).

Of the 2,220 wildlife strike reports, 517 (22% of bird, 71% of other wildlife) indicated some type of damage or other cost. Gulls were the most frequently reported bird type causing damage; however, waterfowl (primarily geese) had the greatest proportion of strikes causing damage. About 81% of reported deer strikes caused damage. Engines were the aircraft component most frequently reported damaged by birds (118, 29% of total damage reports) followed by wings (84, 21%), radomes/noses (61, 15%) and windshields (38, 9%). For other wildlife (primarily deer), the landing gear was the component most frequently reported damaged (17, 22%). There were 507 strike reports that indicated a negative effect on flight including 76 aborted take-offs, 12 engines shut down and 117 precautionary landings for inspection of damage. Total reported costs associated with strikes were \$6,870,170; total reported down time to aircraft was 40,280 hours. However, only 16% of the 517 reports noting damage reported costs, suggesting these numbers are severe underestimates of actual costs. In addition, based on an analysis of independent strike records for a major U. S. airport, we estimate $<20\%$ of all 1994 wildlife strikes were included in the FAA Wildlife Strike Database. Thus, total losses annually to civilian aircraft from wildlife strikes probably exceed the \$112 million estimated for military aircraft in the United States. We encourage reporting of wildlife strikes so that more detailed analyses can be done, ultimately resulting in reduced frequencies of strikes and improved economics and safety in the United States air transport industry.

PART II

BIRD AND OTHER WILDLIFE STRIKES
TO CIVILIAN AIRCRAFT IN THE UNITED STATES, 1994

INTRODUCTION

Bird and other wildlife strikes to aircraft are a serious economic and safety problem in the United States, annually causing millions of dollars in damage and delays to civilian and military aircraft and the occasional loss of human life (Dolbeer and Bucknall 1994). The U.S. Air Force (USAF) maintains a detailed database on wildlife strikes (Arrington 1994); however, the extent and nature of the wildlife strike problem for civilian aircraft is largely unquantified. The Federal Aviation Administration (FAA) has a standard form (5200-7) for the voluntary reporting of bird and other wildlife strikes with aircraft, and over 11,000 reports exist for the years 1989-1994. Although FAA personnel have monitored these reports to determine general patterns in wildlife strikes, no quantitative analyses of these data have been conducted.

The United States Department of Agriculture's (USDA) Denver Wildlife Research Center, through an interagency agreement with the FAA, initiated in April 1995 a project to obtain more objective estimates of the magnitude and nature of the bird and other wildlife strike problem nationwide for commercial aviation. This project includes: 1) editing all strike reports (Form 5200-7) sent to the FAA to ensure consistent, error-free data; 2) entering all edited strike reports into a Wildlife Strike Database established by the FAA; 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 records; and 5) producing annual reports summarizing the results of analyses. Such analyses are critical to determine the economic costs 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.

Our objective was to summarize all wildlife strike reports for 1994 as received by 30 September 1995. We emphasize that this initial analysis provides only an overview of the types of information and relationships available from the FAA Wildlife Strike Database. We are currently editing and entering strike reports for 1989-1993 and 1995. As this database increases, more detailed analyses will be conducted to better define, understand and mitigate the wildlife strike problem in the United States.

METHODS

All wildlife strike reports (Form 5200-7, Appendix 1) received by the FAA Office of Airport Safety and Standards, Washington, DC, were sorted and filed chronologically to ensure that duplicate reports were not entered into the Wildlife Strike Database. In addition to strike reports on form 5200-7,

some strike reports (or additional information for 5200-7 reports) were obtained from other sources (described below) and filed chronologically with the 5200-7 reports. Reports then were edited, with information on a single incident from multiple sources combined, to ensure consistent, nonduplicate entry of data into a dBase file. Codes for bird species, aircraft and engine types followed the International Civil Aviation Organization (ICAO) Bird Strike Information System (IBIS) (ICAO 1989). Because persons reporting wildlife strikes often used vernacular names for species (e.g., turkey buzzard for turkey vulture [*Cathartes aura*]; sea gull for unknown gull [*Larus* spp.]) as well as other nonstandard terminology and date reporting formats, editing of forms and data entry by a person knowledgeable about birds, aircraft and computerized data analysis was critical.

As noted above, the reporting of wildlife strikes to civilian aircraft is voluntary in the United States. To estimate the percent of strikes in 1994 that were reported and entered into the FAA Wildlife Strike Database, we examined the strike record for a major airport (John F. Kennedy International Airport [JFKIA]) where bird control specialists have maintained detailed records of all strikes known to occur since the 1970's (Burger 1985, Dolbeer and Bucknall 1994). Although airport personnel at JFKIA reported all known strikes to the FAA regional office on their own strike report form, they did not fill out the 5200-7 form or send any reports to FAA headquarters in Washington, DC. Thus, a comparison of the strike reports for this airport with the records in the Wildlife Strike Database should provide an estimate of the percent of strikes that are voluntarily reported by pilots, mechanics and others to FAA headquarters and entered into the database.

RESULTS

In 1994, 2,220 nonduplicate reports of wildlife strikes were obtained: 84% from FAA Form 5200-7 and 16% from other sources (Table 1). Most reports (75%) came from commercial air carriers with business and private operators each providing about 9% (Table 2).

Of the 2,220 strike reports, 2,150 (97%) involved birds of which 1,087 (51%) identified the type of bird (Table 3). Gulls were involved in 30% of identified bird strikes followed by waterfowl, blackbirds/starlings, pigeons/doves, and birds-of-prey (each 10-13%). The 70 nonbird wildlife strikes involved 57 ungulates [56 deer (*Odocoileus* spp.) and 1 elk (*Cervus canadensis*)], hereafter referred to as deer, and 9 coyotes/dogs (*Canis* spp.).

Wildlife strikes were reported from all 50 U.S. States (Table 4). California (223), Texas (183), Florida (170) and Illinois (127) had the highest numbers of strikes reported.

Bird strikes occurred most frequently in July-November with September, the peak month, having ≥ 2.8 times the number of strikes reported during winter (Dec-Feb) months (Fig. 1). About 25% of reported deer strikes were in November followed by October (14%), December (12%) and March (11%) (Fig. 2). Most bird strikes occurred during day (67%) followed by night (23%) and

dawn/dusk (10%) (Table 5). Most other wildlife (primarily deer) strikes occurred at night (80%).

Most bird strikes occurred during approach/landing (54%) and take-off (34%) phases of flight (Table 6). About 12% of all reported bird strikes occurred during the climb, en route, or descent phases. About 63% of all reported bird strikes occurred at ≤ 100 -ft elevation and 77% occurred at ≤ 500 ft (Table 7). The highest elevation for a reported strike was 14,000 ft.

Boeing 737 aircraft had the most (559, 27% of total) strikes reported followed by McDonald Douglas DC-9/MD-80 series aircraft (379, 19%) (Table 8). No other aircraft model had $>7\%$ of the reported strikes.

Of the 2,220 wildlife strike reports, 517 (22% of bird, 71% of other wildlife reports) indicated some type of damage to aircraft or other cost (hereafter damage) associated with the strike (Table 3). Gulls were the most frequently reported bird type causing damage (83). However, waterfowl (primarily geese) had the greatest relative proportion of bird strikes causing damage (50%). Although waterfowl comprised only 13% of the total reported bird strikes, they comprised a higher ($P < 0.01$) proportion (27%) of the damaging strikes (Table 3). Birds of prey also comprised a higher ($P < 0.01$) proportion of damaging strikes compared to their proportion of reported bird strikes whereas blackbirds/starlings comprised a lesser ($P < 0.01$) proportion of damaging strikes. Of the 57 reported deer strikes, 81% caused damage.

Engines were the aircraft component most frequently reported damaged by birds (118, 29% of total damage reports) followed by wings (84, 21%), radomes/noses (61, 15%) and windshields (38, 9%). Landing gear was the component most frequently reported damaged (17, 22%) by other wildlife (Table 9).

Of the 2,220 wildlife strike reports, 507 indicated a negative effect on flight including 76 aborted take-offs, 12 engines shut down and 117 precautionary landings for inspection of damage (Table 10).

The greatest cost incurred from a single reported strike was \$2,000,000. Total reported costs associated with all strikes were \$6,870,170; total reported down time to aircraft was 40,280 hours. However, costs were estimated in only 83 (16%) of the 517 reports noting damage, primarily because reports were prepared before estimated costs were known or the person filling out report did not know the costs. Thus, it is likely reported costs greatly underestimated actual costs for wildlife strikes in the United States, especially when combined with the finding that only about 12% of the known strikes in 1994 at our reference airport (JFKIA) were in the FAA Wildlife Strike Database (Table 11). The mean cost for the 84 reports providing cost estimates was \$81,778. If we assume a similar mean cost for the other 433 strikes with damage, then the total costs for all 517 strikes with reported damage would be about \$42,000,000 or about \$19,000 per reported strike in 1994. Appendix 2 presents extracts from a sample of wildlife strike reports as examples of the types of damage incurred.

DISCUSSION

This paper provides a starting point for defining the wildlife strike hazard to civilian aircraft in the United States. Wildlife strikes occurred nationwide with gulls and waterfowl responsible for the majority of bird strikes damaging aircraft. Deer were the most frequently struck nonbird wildlife group. Because most strikes occurred under 500 ft elevation, wildlife management programs to reduce strikes must focus on the areas within and immediately surrounding airports.

One notable finding was that waterfowl, although less frequently struck than gulls, were almost twice as likely as gulls to cause damage when struck. Bird management programs on airports have traditionally focused on frequently struck gull species (e.g., McLaren et al. 1984, Dolbeer and Bucknall 1994). However, with increasing populations of urban waterfowl, especially Canada geese (Rusch et al. 1995, Hestbeck 1995), operations personnel should not overlook the management of these species on and around airports. The importance of waterfowl management at airports was forcibly demonstrated by 2 recent incidents. In June 1995, a Concorde Jet suffered \geq \$5 million damage after Canada geese were ingested in 2 engines on landing at JFKIA (S. D. Garber, Port Authority of New York and New Jersey, Pers. Commun.). In September 1995, a USAF AWAC aircraft (modified Boeing 707) crashed immediately after take-off at Elmendorf Air Force Base, Alaska, killing all 24 personnel aboard. Canada geese, 12 of which were found dead on the runway immediately after take-off, were the suspected cause of the crash (The Plain Dealer, 23 September 1995).

Another important finding was that bird strikes are most frequent in September (when the above described USAF crash occurred). Bird populations are at peak numbers in late summer-autumn, many juvenile (inexperienced) birds are present, and migration is occurring. Thus, airport operations personnel especially need to focus on bird management during this season. Likewise, deer management at airports especially is important during nocturnal hours in November. November is the peak of rutting season when deer movements are highest. Deer collisions with road vehicles also are most frequent in November (Bellis and Graves 1971).

Although an objective estimate of annual costs associated with wildlife strikes to civilian aircraft in the United States is premature, our analyses of 1994 data suggest that costs are substantial. Conover et al. (1995) estimated wildlife strikes to aircraft cost the U.S. military \$112 million/year in damage (\bar{x} = \$14,000/reported strike). From our analyses, assuming a mean cost estimate of \$19,000/reported civilian aircraft strike in 1994 and a probable reporting rate of <20%, civilian costs likely equal or exceed the \$112 million/year estimated for the U.S. military.

We believe these initial analyses demonstrate the usefulness of wildlife strike data in determining the economic costs of strikes, the magnitude of safety issues, and most importantly, the nature of the problems (e.g., wildlife species, time of day, seasonality, altitude) so that corrective actions can be formulated, justified and taken. We encourage people within the aviation community to report all bird and other wildlife strikes so that

more detailed analyses can be done, ultimately resulting in reduced incidents of strikes and improved economics and safety in the United States air transport industry.

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Table 1. Sources of information for reported wildlife strikes to civilian aircraft, USA, 1994.

Source	Number reported	% of total
FAA Form 5200-7	1853	84
FAA Air Carrier Incident Report	80	4
Individual Airports	33	1
FAA Prelim. Aircraft Incident Report	23	1
NASA Aviation Safety Reporting System	18	1
FAA Aircraft Accident/Incident Prelim. Notice	8	<1
Other	41	2
Multiple sources	164	7
Total	2220	100

Table 2. Number of reported wildlife strikes to civilian aircraft by type of operator, USA, 1994.

Operator	Number reported	% of total
Commercial carrier	1673	75
Business	204	9
Private	190	9
Government/Police	10	<1
Unknown	143	6
Total	2220	100

Table 3. Number of reported strikes to civilian aircraft and number of reported strikes causing damage or other costs by type of wildlife struck, USA, 1994.

Wildlife group	Wildlife type ^b	Strikes		Strikes causing damage or other costs ^a	
		No.	% of total	No.	% of total
Birds	Gulls	321	30 ^c	83	30 ^c
	Waterfowl ^d	146	13 ^e	73	27 ^e
	Blackbirds/starlings	132	12 ^e	13	5 ^e
	Pigeons/doves	129	12 ^e	23	8 ^e
	Birds of prey	107	10 ^e	46	17 ^e
	Crows/ravens	35	3 ^e	11	4 ^e
	Hérons/pelicans	24	2 ^e	6	2 ^e
	Misc. known birds	193	18 ^e	18	7 ^e
	Total known birds	1087	100	273	100
	Unknown birds	1063		194	
	Total bird strikes	2150		467	
Other	Deer/elk	57	81 ^e	46	92 ^e
	Coyote/dog	9	13 ^e	3	6 ^e
	Other mammals	3	4	0	0
	Alligator	1	1	1	2
	Total other wildlife	70	99	50	100
Total		2220		517	

^a Includes aborted take-offs, fuel dumps, delays for inspections, etc.

^b Identified to species group (e.g., gull, hawk, waterfowl) but not necessarily to species.

^c Proportion of damaging strikes caused by this wildlife type was similar ($\chi^2 \leq 2.60$, 1 df, $P \geq 0.11$) to proportion of total strikes caused by this wildlife type.

^d Geese, primarily Canada geese (*Branta canadensis*), comprised 55% of waterfowl reported struck and 63% of waterfowl reported causing damage.

^e Proportion of damaging strikes caused by this wildlife type was different ($\chi^2 \geq 10.73$, 1 df, $P < 0.01$) than proportion of total strikes caused by this wildlife type.

Table 4. Number and percent of reported bird and other wildlife (primarily deer) strikes to civilian aircraft by U.S. State, 1994.

State	Bird strikes		Other wildlife strikes	
	Number	%	Number ^a	%
AK	17	0.8	0	0
AL	60	2.8	0	0
AR	14	0.7	2 (1)	2.9
AZ	12	0.6	2	2.9
CA	222	10.4	1	1.5
CO	21	1.0	1 (1)	1.5
CT	33	1.6	0	0
DC	63	3.0	0	0
DE	6	0.3	1	1.5
FL	168	7.9	2(1)	2.9
GA	66	3.1	1	1.5
HI	17	0.8	0	0
IA	20	0.9	0	0
ID	5	0.2	0	0
IL	124	5.8	3 (2)	4.4
IN	18	0.8	2	2.9
KS	8	0.4	0	0
KY	66	3.1	0	0
LA	48	2.3	0	0
MA	29	1.4	0	0
MD	29	1.4	2	2.9
ME	7	0.3	0	0
MI	40	1.9	8	11.8
MN	27	1.3	0	0
MO	36	1.7	3 (2)	4.4
MS	11	0.5	1 (1)	1.5
MT	2	0.1	0	0
NC	74	3.5	6	9.0
ND	8	0.4	0	0
NE	33	1.6	0	0
NH	14	0.7	2	2.9
NJ	80	3.8	6	8.8
NM	4	0.2	0	0
NV	9	0.4	0	0
NY	108	5.1	4 (2)	5.9
OH	78	3.7	0	0
OK	11	0.5	1	1.5
OR	21	1.0	0	0
PA	108	5.1	9	13.2
RI	9	0.4	0	0
SC	12	0.6	0	0

Table 4. (continued)

State	Bird strikes		Other wildlife strikes	
	Number	%	Number ^a	%
SD	4	0.2	0	0
TN	46	2.2	0	0
TX	181	8.5	2 (2)	3.0
UT	24	1.1	0	0
VA	57	2.7	0	0
VI	6	0.3	0	0
VT	2	0.1	0	0
WA	42	2.0	0	0
WI	13	0.6	3	4.4
WV	10	0.5	5	7.4
WY	2	0.1	1	1.5
Total (State known)	2125	100.0	68 (12)	100.0
State not known	25		2 (1)	
Total strikes	2150		70 (13)	

^a Numbers in parentheses refer to non-deer strikes.

Table 5. Reported time of occurrence for wildlife strikes to civilian aircraft, USA, 1994.

Time of strike	Number (%) of strikes		
	Birds	Other wildlife	Total
Dawn	71 (3)	1 (2)	72 (3)
Day	1395 (67)	7 (11)	1402 (65)
Dusk	139 (7)	5 (8)	144 (7)
Night	487 (23)	53 (80)	540 (25)
Total (time reported)	2092 (100)	66 (101)	2158 (100)
Time not reported	58	4	62
Total strikes	2150	70	2220

Table 6. Phase of flight during which wildlife strikes to civilian aircraft occurred, USA, 1994.

Phase of flight	Number (%) of strikes		
	Birds	Other wildlife	Total
Descent	68 (3)	0 (0)	68 (3)
Approach	698 (34)	0 (0)	698 (33)
Landing	413 (20)	42 (62)	455 (21)
Take-off	691 (34)	26 (38)	717 (34)
Climb	114 (6)	0 (0)	114 (5)
En route	71 (3)	0 (0)	71 (3)
Taxi	8 (<1)	0 (0)	8 (<1)
Total (phase reported)	2063 (100)	68 (100)	2131 (100)
Phase not reported.	87	2	89
Total	2150	70	2220

Table 7. Number of reported bird strikes to civilian aircraft by altitude above ground level, USA, 1994.

Reported altitude (ft) at time of strike	Number (%)
0-100	1158 (63)
101-500	262 (14)
501-1000	133 (7)
1001-2000	120 (7)
2001-3000	57 (3)
3001-4000	30 (2)
4001-5000	30 (2)
5001-10000	44 (2)
10000-15000	7 (<1)
Total (altitude reported)	1841 (100)
Altitude not reported	309
Total bird strikes	2150

Table 8. Number and percent of reported bird and other wildlife strikes by type of civilian aircraft, USA, 1994.

Aircraft manufacturer	Model ^b	Reported strikes		Strikes causing damage or other costs ^a	
		Number	%	Number	%
Boeing	B-737	559	27	73	15
McDonald Douglas	DC-9/MD-80	379	19	49	10
Boeing	B-727	138	7	19	4
Fokker	F100	104	5	10	2
British Aerospace	BA 125	86	4	30	6
Boeing	B-757	73	4	11	2
Saab	340	48	2	12	3
Embraer	120 Brasilia	46	2	8	2
Cessna	170	39	2	18	4
deHavilland	DHC8 Dash 8	36	2	6	1
Beech	1900	34	2	11	2
Boeing	B-767	34	2	1	<1
Shorts	360	30	1	8	2
Piper	Cherokee	24	1	12	3
Cessna	152	24	1	4	1
Boeing	B-747	21	1	3	1
Airbus Industries	A320	20	1	4	1
All other		351	17	193	41
Total (aircraft known)		2046	100	472	100
Unknown Aircraft		174		45	
Total strikes		2220		517	

^a Includes aborted take-offs, fuel dumps, delays for engine inspections, etc.

^b Includes all series of model.

Table 9. Number of aircraft components reported damaged by wildlife strikes to civilian aircraft, USA, 1994.

Aircraft component	Number damaged (%)		Total
	Birds	Other wildlife	
Engine	118 (29)	4 (5)	122 (25)
Wing	84 (21)	11 (14)	95 (20)
Radome/nose	61 (15)	5 (6)	66 (14)
Windshield	38 (9)	1 (1)	39 (8)
Landing gear	15 (4)	17 (22)	32 (7)
Propeller	7 (2)	11 (14)	18 (4)
Lights	15 (4)	2 (3)	17 (3)
Fuselage	9 (2)	7 (9)	16 (3)
Tail	13 (3)	3 (4)	16 (3)
Other	45 (11)	17 (22)	62 (13)
Total	405 (100)	78 (100)	483 (100)

Table 10. Reported effect-on-flight caused by wildlife strikes to civilian aircraft, USA, 1994.

Effect on flight	Number (%)		Total
	Birds	Other wildlife	
None	1588 (74)	15 (21)	1603 (72)
Aborted take-off	66 (3)	10 (14)	76 (3)
Engines shut down	12 (1)	0 (0)	12 (1)
Precautionary landing	112 (5)	5 (7)	117 (5)
Other ^a	268 (13)	34 (49)	302 (14)
Not reported	104 (5)	6 (9)	110 (5)
Total	2150 (101)	70 (100)	2220 (100)

^a Normal flight and landing but subsequent miscellaneous expenses incurred such as delay to have engine inspected or parts replaced/repaired.

Table 11. Bird and other wildlife strikes recorded in Federal Aviation Administration Wildlife Strike Database (FAAWS), Office of Airport Safety and Standards, Washington, DC, as percent of total strikes known to occur at John F. Kennedy International Airport (JFKIA), 1994.

Strike report obtained from:				Total	FAAWS as % of total
JFKIA	FAAWS	Both			
103	13	6	110	12	

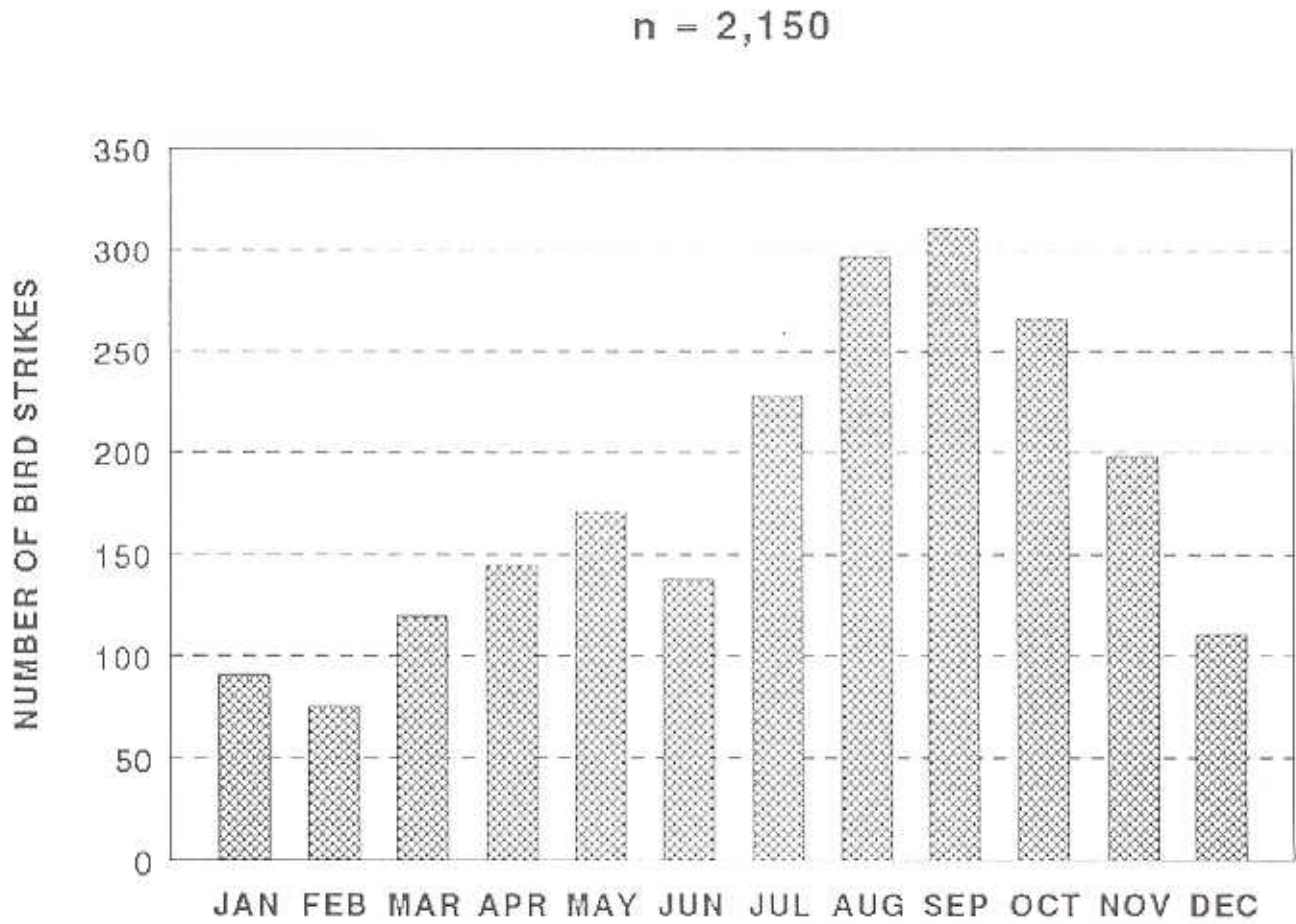


Figure 1. Number of reported bird strikes to civilian aircraft in USA by month, 1994.

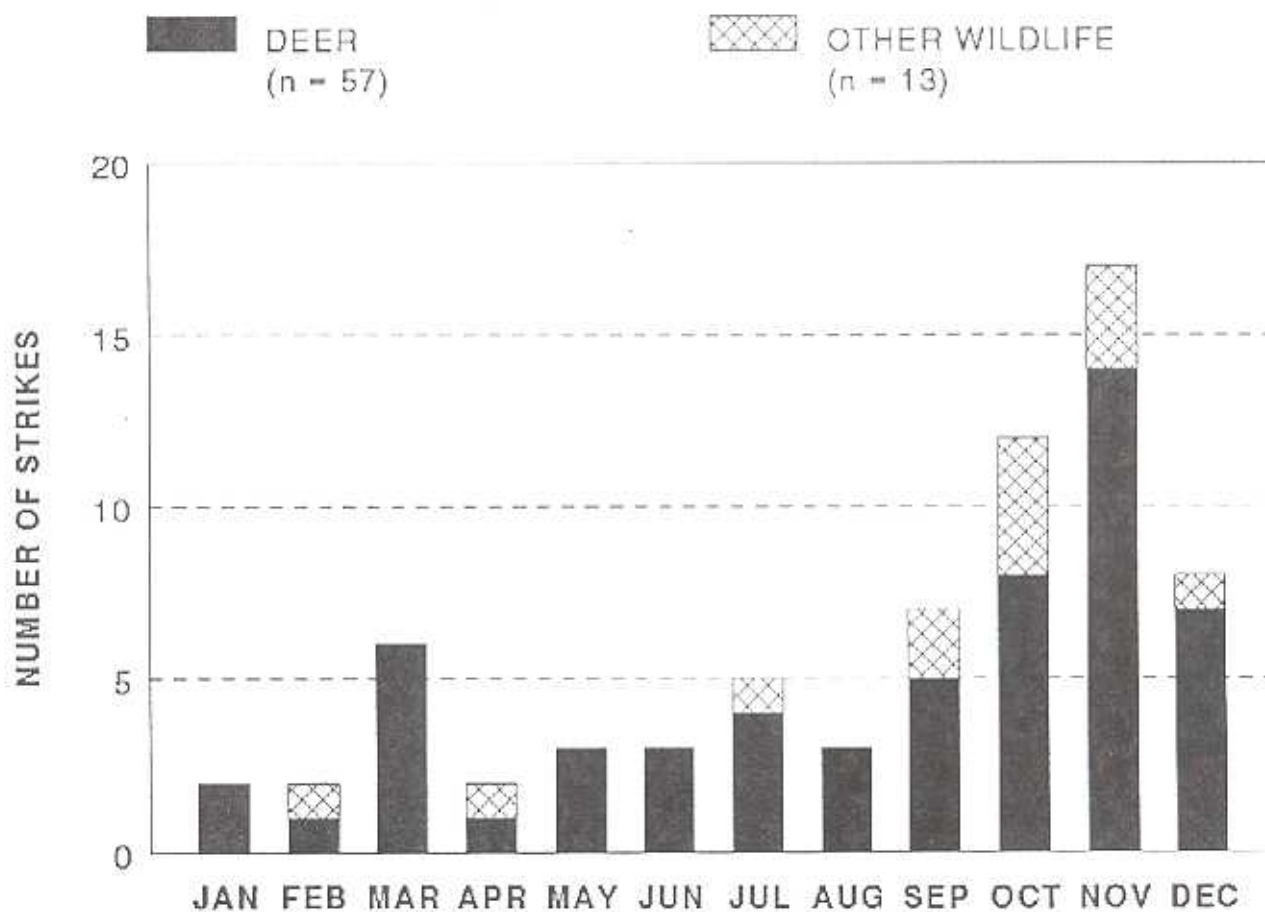


Figure 2. Number of reported strikes by wildlife other than birds to civilian aircraft in USA by month, 1994.

BIRD STRIKE INCIDENT/INGESTION REPORT
Other Wildlife Species May Be Described Here
Operation Cost and Engine Damage Information

1. Name of Operator		2. Aircraft Make/Model		3. Engine Make/Model			
4. Aircraft Registration		5. Date of Incident (DD, MM, YY)		6. Local Time of Incident <input type="checkbox"/> Dawn <input type="checkbox"/> Dusk <input type="checkbox"/> Day <input type="checkbox"/> Night			
7. Aerodrome Name		8. Runway Used		9. Location if En Route (Nearest Town/Reference and State)			
10. Height (AGL) feet		11. Speed (IAS) knots					
12. Phase of Flight <input type="checkbox"/> A. Parked <input type="checkbox"/> B. Taxi <input type="checkbox"/> C. Take-off <input type="checkbox"/> D. Climb <input type="checkbox"/> E. En Route <input type="checkbox"/> F. Descent <input type="checkbox"/> G. Approach <input type="checkbox"/> H. Landing Roll		13. Part(s) of Aircraft Struck or Damaged					
			Struck	Damaged		Struck	Damaged
		A. Radome	<input type="checkbox"/>	<input type="checkbox"/>	H. Propeller	<input type="checkbox"/>	<input type="checkbox"/>
		B. Windshield	<input type="checkbox"/>	<input type="checkbox"/>	I. Wing/Rotor	<input type="checkbox"/>	<input type="checkbox"/>
		C. Nose	<input type="checkbox"/>	<input type="checkbox"/>	J. Fuselage	<input type="checkbox"/>	<input type="checkbox"/>
		D. Engine No. 1	<input type="checkbox"/>	<input type="checkbox"/>	K. Landing Gear	<input type="checkbox"/>	<input type="checkbox"/>
		E. Engine No. 2	<input type="checkbox"/>	<input type="checkbox"/>	L. Tail	<input type="checkbox"/>	<input type="checkbox"/>
		F. Engine No. 3	<input type="checkbox"/>	<input type="checkbox"/>	M. Lights	<input type="checkbox"/>	<input type="checkbox"/>
		G. Engine No. 4	<input type="checkbox"/>	<input type="checkbox"/>	N. Other (specify)	<input type="checkbox"/>	<input type="checkbox"/>
14. Effect on Flight <input type="checkbox"/> None <input type="checkbox"/> Aborted Take-Off <input type="checkbox"/> Precautionary Landing <input type="checkbox"/> Engines Shut Down <input type="checkbox"/> Other (specify)		15. Sky Condition <input type="checkbox"/> No Cloud <input type="checkbox"/> Some Cloud <input type="checkbox"/> Overcast		16. Precipitation <input type="checkbox"/> Fog <input type="checkbox"/> Rain <input type="checkbox"/> Snow			
17. Bird Species		18. Number of birds seen and/or struck		19. Size of Bird(s)			
		Number of Birds	Seen	Struck			
		1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Small		
		2-10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Medium		
		11-100	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> Large		
		more than 100	<input type="checkbox"/>	<input type="checkbox"/>			
20. Pilot Warned of Birds <input type="checkbox"/> Yes <input type="checkbox"/> No							
21. Remarks (describe damage, injuries and other pertinent information)							

ENGINE DAMAGE COST INFORMATION

22. Aircraft time out of service hours		23. Estimated cost of repairs or replacement (\$ U.S. in thousands) \$		24. Estimated other cost (\$ U.S. thousands) (e.g. loss of revenue, fuel, hotels) \$	
Reported by (Optional)			Title		Date

BIRD STRIKE INCIDENT/INGESTION REPORT (Continued)

SPECIAL INFORMATION ON ENGINE DAMAGE STRIKES

Reason for failure/shutdown	Engine 1	Engine 2	Engine 3	Engine 4	Comments
Unconditional Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fire	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Shutdown — Vibration	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Shutdown — Temperature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Shutdown — Fire warning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Shutdown — Other (specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Shutdown — Unknown	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Estimated percentage of thrust loss*					
Estimated number of birds ingested					

*These may be difficult to determine but even estimates are useful.

Agency Display Of Estimated Burden For Bird Strike Incident/Ingestion Report

The public report burden for this collection of information
is estimated to average 5 minutes per response.

If you wish to comment on the accuracy of the estimate or make suggestions for reducing
this burden, please direct your comments to OMB and the FAA at the following addresses:

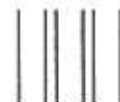
Office of Management and Budget
Paperwork Reduction Project 2120-0045
Washington, D.C. 20503

— and —

U.S. Department of Transportation
Federal Aviation Administration
Program Support Branch, ARP-11
800 Independence Avenue, S.W.
Washington, D.C. 20591

FAA Form 5200-7 (2-80)

Department
of Transportation
**Federal Aviation
Administration**
Independence Ave., S.W.
Washington, D.C. 20591



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UNITED STATES



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OFFICE OF AIRPORT SAFETY AND STANDARDS, AAS-310
800 INDEPENDENCE AVENUE, S.W.
WASHINGTON, D.C. 20591



APPENDIX 2

Extracts from a sample of 1994 wildlife strike reports for civilian aircraft, USA, as found in the Federal Aviation Administration Wildlife Strike Database, Office of Airport Safety and Standards, Washington, DC.

Date: 3 January 1994
Airport: SGT
Aircraft: Cessna C-550
Phase of flight: Approach
Effect on flight: Landed, made repairs
Damage: Engine #1, Wing, Landing gear
Wildlife species: Mallard
Comments from report:

Date: 6 January 1994
Airport: SLE
Aircraft: Cessna 172
Phase of flight: Approach
Effect on flight: Precautionary landing
Damage: Windshield, Nose, Lights
Wildlife species: Canada geese
Comments from report: Facial cuts (minor) to flight instructor, student (left seat) none. Aircraft suffered damaged cowling (firewall forward replacement of sheet metal). Windshield destroyed.

Date: 14 January 1994
Airport: BKL
Aircraft: Cessna 310
Phase of flight: Approach
Effect on flight: Landed, made repairs
Damage: Windshield
Wildlife species: Gull
Comments from report: Cracked windshield, no injuries

Date: 20 January 1994
Airport: SMF
Aircraft: B737-300
Phase of flight: Take-off
Effect on flight: Precautionary landing
Damage: Engine #1
Wildlife species: Snow goose
Comments from report: #1 engine has several bent blades, engine ran very rough.

Date: 23 January 1994
Airport: ATL
Aircraft: B737-200
Phase of flight: Take-off
Effect on flight: Aborted take-off
Damage: Engine #2
Wildlife species: Starlings or pigeons
Comments from report: On take-off roll spotted large flock of birds on left side of runway 27R. The birds flew in front of the aircraft as we were approaching 90kts. The aircraft struck several birds in the right engine, windshield, radome and wings. The take-off was aborted and the aircraft returned to the gate. Post flight inspection revealed 8-9 turbine blades in right engine substantially damaged. The aircraft was removed from service and replaced by another aircraft.

Date: 25 January 1994
Airport: CVG
Aircraft: B727
Phase of flight: Take-off
Effect on flight: None
Damage: #7 Slat
Wildlife species: Unknown bird
Comments from report: #7 leading edge slat damaged 20 inches long 1" deep bent bottom leading edge down 1/2". Replaced slat assembly. Aircraft time out of service was 19 hrs. Estimated damage was \$13,000.

Date: 26 January 1994
Airport: ORF
Aircraft: Fokker F-28 4000
Phase of flight: Take-off
Effect on flight: Flight cancelled
Damage: Landing gear
Wildlife species: Gull
Comments from report: Upon inspection at EWR, maintenance reported a large dent with damage to the stringer. Canceled the outbound portion of flight.

Date: 28 January 1994
Airport: PBI
Aircraft: Cessna C-560
Phase of flight: Take-off
Effect on flight: Other
Damage: Windshield
Wildlife species: Turkey vulture
Comments from report: Windshield, bleedair shroud, rain removal door destroyed.

Date: 29 January 1994
Airport: FLL
Aircraft: Cessna 402B
Phase of flight: Climb
Effect on flight: Precautionary landing
Damage: Windshield
Wildlife species: Turkey vulture
Comments from report: The bird struck the right windshield during climb out at approximately 700 AGL. There were 4 passengers on board and no injuries. The bird made a hole on the top half of the windshield approximately 6" x 18".

Date: 3 February 1994
Airport: RDU
Aircraft: Fokker 100
Phase of flight: Approach
Effect on flight: Landed, made repairs
Damage: Radome
Wildlife species: Goose, buzzard (vulture) or hawk
Comments from report: Radome nose caved in. There was no effect on the flight since landing at Raleigh as scheduled; however, departing flight was canceled because of needed repairs.

Date: 20 February 1994
Airport: RDU
Aircraft: MD-80
Phase of flight: Approach
Effect of flight: Landed, made repairs
Damage: Radome
Wildlife species: Gull
Comments from report: Struck left side of radome, punctured radome and some remains were sticking out of radome crack.

Date: 28 February 1994
Airport: CLT
Aircraft: De Havilland Dash 8
Phase of flight: Approach
Effect on flight: Landed, made repairs
Damage: Landing gear, Brake line
Wildlife species: Unknown bird
Comments from report: Caused the brake line to wedge in landing gear and it ruptured on roll out.

Date: 5 March 1994
Airport: SJC
Aircraft: BAe Jetstream 31
Phase of flight: Approach
Effect on flight: Landed, made repairs
Damage: Engine #1
Wildlife species: Unknown (small, light brown bird)
Comments from report: During the flare, the bird was ingested into the left engine and damaged the compressor. After the bird strike, the left engine made a continuous higher pitched whine sound. Taxied in and shut down both engines. Aircraft time out of service was 13 hrs. Cost of damage estimated to be \$83,000-\$100,000.

Date: 8 March 1994
Airport: PSC
Aircraft: Cessna 402A
Phase of flight: Approach
Effect on flight: Emergency landing
Damage: Windshield
Wildlife species: Mallard
Comments from report: Approximately half of pilot side windshield broke out.
Injuries: facial lacerations.

Date: 12 March 1994
Airport: SJC
Aircraft: Airbus 320
Phase of flight: Take-off
Effect on flight: Aborted take-off
Damage: Engine #2
Wildlife species: Gull
Comments from report: Damaged fan blade, possibly more

Date: 16 March 1994
Airport: MLB
Aircraft: LA-4-200
Phase of flight: Approach
Effect on flight: Precautionary landing
Damage: Windshield
Wildlife species: Unknown bird
Comments from report: Bird went through the pilot window and struck pilot in the left shoulder. The pilot received bruises to the left shoulder and cuts in the face from broken pieces of windshield. Aircraft time out of service was 36 hrs. Cost of damage was \$150.

Date: 27 March 1994
Airport: DAB
Aircraft: B737-400
Phase of flight: Take-off
Effect on flight: Other
Damage: Engine #1
Wildlife species: Gull
Comments from report: Engine vibration indications were within parameters. Damaged sustained to 9 fan blades, pieces missing. Damage sustained to FWD acoustical liner, and engine shroud.

Date: 31 March 1994
Airport: AL15
Aircraft: Cessna 551
Phase of flight: Descent
Effect on flight: Landed, made repairs
Damage: Wing
Wildlife species: Pelican
Comments from report: Damage to outboard portions of left wing. Bird impacted and penetrated the left wing leading edge, resulting in a rupture of the fuel tank. There was no fire or foreign object ingestion into the engine. There were no injuries to persons on board. Aircraft time out of service was 80 hrs.

Date: 2 April 1994
Airport: ILG
Aircraft: Piper 38
Phase of flight: Descent
Effect on flight: Landed, made repairs
Damage: Wing, Cowling, Electric
Wildlife species: Goose
Comments from report: Cowling right top damaged inward. Left wing aft, right wing mid-section. Fuel dripping from right wing. All electrical power destroyed.

Date: 4 April 1994
Airport: ASW
Aircraft: Cessna 550
Phase of flight: Take-off
Effect on flight: Aborted take-off
Damage: Engine #1, Fuselage, Light
Wildlife species: Gulls
Comments from report: Major damage R/H engine.

Date: 12 April 1994
Airport: APF
Aircraft: Cessna C560
Phase of flight: Take-off
Effect on flight: Precautionary landing
Damage: Windshield
Wildlife species: Unknown bird
Comments from report: Co-pilot's windshield broken. Aircraft flying to MCO unpressurized for repairs.

Date: 17 April 1994
Airport: 12Y
Aircraft: Piper 28-140
Phase of flight: Approach
Effect on flight: Precautionary landing
Damage: Windshield
Wildlife species: Gull or duck
Comments from report: Bird struck left side of aircraft windshield destroying approximately 2/3 of the plexiglass.

Date: 21 April 1994
Airport: AUG
Aircraft: Cessna 210
Phase of flight: En route
Effect on flight: Ruptured fuel tank
Damage: Wing
Wildlife species: Eagle
Comments from report: Jammed control cable in left wing. Aircraft time out of service was estimated at 2-6 mos. Cost of damage was \$20,000.

Date: 22 April 1994
Airport: GLA
Aircraft: B737-200
Phase of flight: Landing roll
Effect on flight: Landed, made repairs
Damage: Engine #2
Wildlife species: Herring gull
Comments from report: Bent fan blades #2 engine.

Date: 28 April 1994
Airport: HRL
Aircraft: B737
Phase of flight: Take-off
Effect on flight: Aborted take-off
Damage: Engine #1
Wildlife species: Unknown bird
Comments from report: Bird ingestion caused damage to #1 engine.

Date: 30 April 1994
Airport: RDU
Aircraft: BAe Jetstream 3201
Phase of flight: Take-off
Effect on flight: Engines shut down
Damage: Engine #1, Propeller
Wildlife species: Gull
Comments from report: Replaced engine due to first stage compression damage. Replaced propeller. Aircraft returned to service. Aircraft time out of service was 18 hrs. Cost of damage was \$35,700.

Date: 1 May 1994
Airport: ASH
Aircraft: Piper 28-140
Phase of flight: Take-off
Effect on flight: Aborted take-off
Damage: Engine #1, Wing, Fuselage, Landing gear
Wildlife species: White-tailed deer (doe and fawn)
Comments from report: Prop and engine torn down. No damage to case or crank. Wheel fairings replaced, lower wing skin replaced. Spar was okay. Antennas replaced on belly. Aircraft time out of service was 3 mos. Cost of damage was \$5,500.

Date: 22 May 1994
Airport: MNM
Aircraft: Piper 30 Twin Comanche
Phase of flight: Landing roll
Effect on flight: Other
Damage: Wing, Propeller
Wildlife species: Deer
Comments from report: Hit a deer on runway 14. Left prop, engine and wing were damaged.

Date: 26 May 1994
Airport: ORF
Aircraft: DC-9-50
Phase of flight: Take-off
Effect on flight: Precautionary landing/engine shut down
Damage: Engine #1
Wildlife species: Gull
Comments from report: While on takeoff a/c struck at least 1 gull ingesting it into the #1 engine, there was a compression failure of the engine and the pilot returned to the airport with 1 engine. The a/c landed without incident and upon visualization of the #1 engine bird feathers were present as well as damaged blades. No bird carcasses were found on a r/w sweep and the last bird check was at 1645.

Date: 26 May 1994
Airport: SLC
Aircraft: B737-300
Phase of flight: Climb
Effect on flight: Precautionary landing
Damage: Radome, Fuselage
Wildlife species: Gull
Comments from report: Climbing right turn passing through 9000 turning passed 280 to 090°; bird struck and penetrated radome causing damage to fuselage where radome meets it; completely covered captain. Aircraft time out of service was 16 hrs.

Date: 2 June 1994
Airport: MOB
Aircraft: MD-88
Phase of flight: Take-off
Effect on flight: Aborted take-off
Damage: Engine #1, Tires
Wildlife species: Unknown bird
Comments from report: Caused compressor stall engine #1, unsure of damage. Blew 3 of 4 main gear tires while aborting. Passengers deplaned and bussed to terminal.

Date: 2 June 1994
Airport: SQL
Aircraft: Cessna C500
Phase of flight: Take-off
Effect on flight: Precautionary landing
Damage: Wing
Wildlife species: Geese
Comments from report: Starboard leading edge of wing dented 18" long which ruptured fuel tank. Aircraft landed without incident. Fire department called out as precaution. Strike happened before tower was opened.

Date: 3 June 1994
Airport: OWB
Aircraft: BAe Jetstream 3201
Phase of flight: Take-off
Effect on flight: Aborted take-off
Damage: Engine #1
Wildlife species: Small gray and yellow bird
Comments from report: Lost about 20% thrust on struck engine. Aborted take-off and shut engine down. Post-flight inspection found 3 impeller blades bent 90°. Engine was replaced. Aircraft out of service for 30 hrs. Cost of damage was \$300,000.

Date: 7 June 1994
Airport: CPR
Aircraft: Rockwell Turbo Commander
Phase of flight: Landing
Effect on flight: Landed, made repairs
Damage: Right prop, Nose
Wildlife species: Deer
Comments from report: During landing rollout, aircraft hit numerous deer. Right prop bent and right side of nose caved in. Substantial damage. Time out of service was 90 days. Cost of damage was \$200,000.

Date: 9 June 1994
Airport: RWL
Aircraft: Mooney M-20C
Phase of flight: En Route
Effect on flight: Precautionary Landing
Damage: Tail, Rudder, Vertical stabilizer
Wildlife species: Unknown bird
Comments from report: Aircraft hit phone lines, knocking down pole onto interstate 80 near Wamsutter, WY. Substantial damage to plane included separation of rudder and part of vertical stabilizer. Pilot had claimed to have hit a bird before incident. No injuries.

Date: 9 June 1994
Airport: BDR
Aircraft: Piper 28 Dakota
Phase of flight: Landing roll
Effect on flight: Precautionary landing
Damage: Windshield, antennae
Wildlife species: Canada goose
Comments from report: Bird was struck on landing roll between taxiway and intersecting runways. Major damage to windshield and radio antennae. The bird was tagged with band #868-06278. The pilot received only a minor cut on right thumb. Aircraft was out of service 12 hours. Cost of damage was \$500.

Date: 15 June 1994
Airport: Near Ketchikan
Aircraft: Cessna 185E
Phase of flight: Descent
Effect on flight: Precautionary landing
Damage: Tail and wing strut
Wildlife species: Bald eagle
Comments from report: Hit left wing strut and left side of horizontal stabilizer bending both on impact. Possible wing spar and gear box damage. Aircraft out of service for 10 days. Cost of damage was \$25,000.

Date: 30 June 1994
 Airport: SHV
 Aircraft: Sukhoi 29
 Phase of flight: Approach
 Effect on flight: Landed, made repairs
 Damage: Nose
 Wildlife species: Purple Martins
 Comments from report: Nose plate cracked, remains in/on engine.

Date: 12 July 1994
 Airport: MSY
 Aircraft: B727-200
 Phase of flight: Take-off
 Effect on flight: Precautionary landing
 Damage: Engine #2
 Wildlife species: Laughing gulls
 Comments from report: Struck approximately 2 laughing gulls shortly after take-off on runway 19. The strike was an ingestion by #2 engine. The ingestion did not cause shut down but an approximately 15% reduction in thrust. The pilot executed a precautionary landing. Aircraft out of service 30 hrs.

Date: 18 July 1994
 Airport: MMU
 Aircraft: Dassault Falcon 50
 Phase of flight: Take-off
 Effect on flight: Outbound flight delayed
 Damage: Landing gear
 Wildlife species: Deer
 Comments from report: Damage on leading edge and left flaps. Blood on gear. Plane landed without incident in DCA.

Date: 20 July 1994
 Airport: OKC
 Aircraft: B737-300
 Phase of flight: Take-off
 Effect on flight: Aborted take-off
 Damage: #1 Engine
 Wildlife species: Doves
 Comments from report: Blades shingled on #1 fan. One turbine blade bent at tip beyond limits to continue.

Date: 23 July 1994
 Airport: HTS
 Aircraft: SAAB 340
 Phase of flight: Landing Roll
 Effect on flight: Emergency equipment responded
 Damage: Hydraulic failure, Wing, Brake, Tire
 Wildlife species: Deer
 Comments from report: Emergency equipment responded and aircraft was towed to ramp due to hydraulic failure.

Date: 28 July 1994
Airport: DAB
Aircraft: Swearingen Merlin III
Phase of flight: Landing roll
Effect on flight: None
Damage: Engine #1
Wildlife species: Mourning doves
Comments from report: Possible turbine damage, aircraft experienced vibration.

Date: 28 July 1994
Airport: RDG
Aircraft: Shorts 360
Phase of flight: Landing roll
Effect on flight: Landed, made repairs
Damage: Fuselage, Landing gear access panel, Wing
Wildlife species: Deer
Comments from report: Damage reported to left side leading edge stub wing. Gear access panel, and fuselage fiberglass damage around the left main area.

Date: 3 August 1994
Airport: ORD
Aircraft: B757-200
Phase of flight: Unknown
Effect on flight: Aircraft removed from service
Damage: Engine
Wildlife species: Canada geese
Comments from report: Struck wing. Engine incurred cowling damage and core entry. Cost \$1 million with relocation and rerouting.

Date: 4 August 1994
Airport: MLI
Aircraft: Beechcraft 77 Skipper
Phase of flight: Take-off
Effect on flight: Precautionary landing
Damage: Wing
Wildlife species: Red-tailed hawk
Comments from report: The left wing was dented approximately half way between fuselage and wing-tip. Aircraft operator estimates replacement of left wing in excess of \$5,000.

Date: 28 August 1994
Airport: ACY
Aircraft: Learjet 35
Phase of flight: Take-off
Effect on flight: Engines shut down
Damage: Engine #2
Wildlife species: American kestrel
Comments from report: Aircraft struck bird just after rotating. Small bird bounced off of nose or nose gear into right #2 engine. Engine shut down. Pilot could not abort. Looked for area to ditch straight ahead. Able to control aircraft and enter down wind for runway 22. Landed without incident. Pilot stated he was in serious trouble just after take-off. Damage estimate: \$2,000,000.

Date: 28 August 1994
Airport: ORD
Aircraft: DC-9-80
Phase of flight: Approach
Effect on flight: None
Damage: Engine #1
Wildlife species: Unknown bird
Comments from report: Never saw bird hit just outside the OM on approach to 27L. After parking at the gate, found blood on the left side of the radome and left wing leading edge. Personnel found feathers in the left engine and stated there were scratches on several guide vanes.

Date: 30 August 1994
Airport: RSW
Aircraft: Beechcraft 1900
Phase of flight: Approach
Effect on flight: None
Damage: Radome, Nose, #1 Spinner
Wildlife species: Turkey vulture
Comments from report: The radome and nose sustained major damage with the spinner for the #1 suffering dent damage. Aircraft time out of service was 8 hrs. Cost of damage estimated at \$5,000-\$10,000.

Date: 4 September 1994
Airport: PTK
Aircraft: Beechcraft King Air 100
Phase of flight: Take-off
Effect on flight: Precautionary landing
Damage: Engine #1
Wildlife species: Sandpiper
Comments from report: No power degradation or abnormal engine indications were observed. After insuring no control problems a landing was made at Pontiac Airport. Subsequent investigation revealed ingestion. Garret Service Manual calls for engine disassembly, clean and inspect. Cost of damage \$30,000.

Date: 08 September 1994
Airport: ILN
Aircraft: DC9-32
Phase of Flight: Approach
Effect on Flight: Plane out of service
Damage: Engine #1
Wildlife Species: Gull
Comments from report: Ingested bird in left engine on short final. Engine parameters remained normal. Replaced #1 engine.

Date: 11 September 1994
Airport: LGA
Aircraft: B757-200
Phase of flight: Take-off
Effect on flight: Aborted take-off
Damage: Engine #1
Wildlife species: Pigeons
Comments from report: Boroscope inspected #1 engine. Damage on fan inlet and outlet liners, and rub strip segments. The LPC and HPC sustained damage also with nicks, dents, and tears on the blades 6th, 8th, 9th, 11th stages. Changed #1 engine. Left engine nose cowl acoustic panel damage.

Date: 12 September 1994
Airport: BOS
Aircraft: B727-294
Phase of flight: Take-off
Effect on flight: Aborted take-off
Damage: #2 engine
Wildlife species: Great Blue Heron
Comments from report: Compressor and turbine blade damage through engine, JT8-17. Aircraft out of service 120 hrs. Cost of damage \$507,000.

Date: 12 September 1994
Airport: 15T
Aircraft: Bell 206L-1
Phase of flight: Climb
Effect on flight: Precautionary landing
Damage: Air vent
Wildlife species: Unknown bird
Comments from report: Climbing through 1000' after take-off from HIA-126, saw a couple of small birds in flight path, immediately followed by a "bonk" noise on the front of the helicopter. Feathers and other bird parts began entering the left front of the helicopter but the passenger could see no damage. Returned to HIA-126, shut down and examined the helicopter. Found about one half of a small bird stuck in the inlet louvers of the passengers air vent entrance on the outside of the aircraft. The other half of the bird had somehow come through the louvers; through the air duct, and into the helicopter. The louvers were very slightly dented in one place. No other damage could be found. Cleaned the aircraft of bird "stuff" and continued flight.

Date: 13 September 1994
Airport: ORF
Aircraft: Embraer EMB-120 Brasilia
Phase of flight: Landing roll
Effect on flight: None
Damage: Propeller
Wildlife species: Gull
Comments from report: During round out (flare) noted a bird, heard a thump and noted feathers and blood on leading edge of prop.

Date: 26 September 1994
Airport: IWD
Aircraft: Embraer EMB-120 Brasilia
Phase of flight: Landing roll
Effect on flight: Discontinued flight
Damage: Propeller
Wildlife species: Deer
Comments from report: Deer strike caused propeller damage to two blades on #1 engine. No other damage was observed. Flight was in bound from Rhinelander, Wisconsin and was scheduled to continue to Duluth, Minnesota. However, flight was terminated in Ironwood, Michigan.

Date: 18 October 1994
Airport: SMD
Aircraft: Beechcraft 58 Baron
Phase of flight: Climb
Effect on flight: Substantial damage
Damage: Unknown
Wildlife species: Geese
Comments from report: At 2020 departed Smithfield Airport and hit a flock of geese. Three geese crashed through the windshield. Aircraft banked to avoid houses and skidded across a field, went through a fence and hit 2 trees, knocking a wing off and spilling fuel. Aircraft then slid into the side of a Sam's Shopping Club. There were no injuries on the ground. Damage to building is minor. A passenger was trapped in the aircraft for 2 hrs. Pilot uninjured, but passenger was in serious condition after surgery. Firefighter was treated for heat exhaustion.

Date: 23 October 1994
Airport: FAT
Aircraft: B737-200
Phase of flight: Landing
Effect on flight: Evasive action taken
Damage: Loss of hydraulics
Wildlife species: Sparrow hawk (American kestrel)
Comments from report:

Date: 24 October 1994
Airport: PDX
Aircraft: B757-200
Phase of flight: Take-off
Effect on flight: Precautionary landing
Damage: Engine #1
Wildlife species: Pigeon
Comments from report: On take-off out of PDX, just at rotation, noted a flock of 15-20 pigeons crossing runway from north to south. Ingested approximately 5 to 10 birds into left engine. Returned to PDX for engine inspection. Fan blades were bent in 4 areas; blood noted on left main gear area and left inboard flap, no damage in these areas.

Date: 7 November 1994
Airport: CSG
Aircraft: MD-88
Phase of flight: Unknown
Effect on flight: None
Damage: Engine #2
Wildlife species: Unknown bird
Comments from report: The strike was found during a walk-around after landing. There was a dent in the PT6 bullet dome, with some feathers around the guide vanes.

Date: 14 November 1994
Airport: MSP
Aircraft: DC 9-80
Phase of flight: Take-off
Effect on flight: Precautionary landing
Damage: Wing
Wildlife species: Goose
Comments from report: Extensive damage to both wings and slats. Aircraft time out of service was 24 hrs.

Date: 15 November 1994
Airport: DAL
Aircraft: Mitsubishi MU-2
Phase of flight: Approach
Effect on flight: Precautionary landing
Damage: Windshield, Wing
Wildlife species: Unknown bird
Comments from report: Pilot's windshield shattered. Leading edge right wing inboard of engine flattened. Pilot reported loss of some instrumentation.

Date: 21 November 1994
Airport: FSD
Aircraft: Beechcraft 1900
Phase of flight: Climb
Effect on flight: Precautionary landing
Damage: Radome
Wildlife species: Unknown bird
Comments from report: Strike on right side of radome which pushed in nose cone and bent small bulkhead that radar dish is attached to.

Date: 3 December 1994
Airport: SJC
Aircraft: B737-300
Phase of flight: Landing Roll
Effect on flight: Landed, made repairs
Damage: Engine #1
Wildlife species: Hawk
Comments from report: Substantial damage to #1 engine.

Date: 6 December 1994
Airport: TOL
Aircraft: SA 226 TC Fairchild Metroliner
Phase of flight: Take-off
Effect on flight: Aircraft grounded 2 weeks
Damage: Engine #1, Wing, Tail
Wildlife species: Ring-billed gull
Comments from report: The pilot was aware of the gulls loafing on the runway and reportedly used on-board radar at a distance of 600 yards to move the gulls. The gulls took flight and landed on a nearby cross runway. During the take-off roll, the gulls also took flight and flew into the path of the aircraft, striking the birds at 50-100 feet above ground at a speed of approximately 110 knots. One gull was ingested into the right engine. Gulls also struck the leading edge of both wings, all landing gear, and the tail of the aircraft, knocking out the Stability Augmentation System. The aircraft continued on its flight to Toledo Express with landing gear down. Ground crew sustained injuries after falling off truck en route to retrieve 32 gulls.

Date: 8 December 1994
Airport: FLL
Aircraft: B727-200
Phase of flight: Approach
Effect on flight: Landed, made repairs
Damage: Tail
Wildlife species: Eagle
Comments from report: Leading edge of horizontal stabilizer, left side, approximately 24 inches inboard of vertical stabilizer crushed 11 inches in both directions from impact point. A vertical tear of 8 inches \pm exists at impact point. Cost unknown at this time.

Date: 12 December 1994
Airport: MOB
Aircraft: Beechcraft Baron 58
Phase of flight: Climb
Effect on flight: Precautionary landing
Damage: Windshield
Wildlife species: Unknown bird (large)
Comments from report: When aircraft was approximately 200 feet airborne, the pilot requested an immediate landing. A clearance was issued and the aircraft landed on runway 32. The pilot advised, after landing, that he had struck a large bird on the right side of windshield that resulted in a 1 1/2 foot hole in the windshield. The pilot advised no other apparent damage.

Date: 13 December 1994
Airport: MSY
Aircraft: DC-9
Phase of flight: Climb
Effect on flight: Precautionary landing, engine shut-down
Damage: Engine #1
Wildlife species: Unknown bird
Comments from report: The captain stated that a severe vibration/loss of thrust was encountered on the #1 engine. The inspection revealed that the #1 engine was destroyed. The engine was removed and replaced. No injuries. Aircraft out of service for 36 hours. Cost of damage \$600,000.

Date: 13 December 1994
Airport: PHL
Aircraft: B737-400LR
Phase of flight: Approach
Effect on flight: Landed, made repairs
Damage: Tail
Wildlife species: Unknown bird (large)
Comments from report: The leading edge of the right horizontal stabilizer looks as though it was hit by a bowling ball with feathers. Captain said he was not aware the aircraft had been struck by a bird.

Date: 18 December 1994
Airport: CTJ
Aircraft: Cessna 172
Phase of flight: Landing Roll
Effect on flight: Aircraft totalled
Damage: Substantial
Wildlife species: Deer
Comments from report: Pilot lost directional control while taxiing, when several deer crossed in front of the aircraft. He hit 4 deer then struck trees on west side of taxiway. Plane was totalled. Aircraft time out of service was 4 months. Cost of damage was \$34,000.

Date: 19 December 1994
Airport: FTW
Aircraft: Learjet 35A
Phase of flight: Take-off
Effect on flight: Precautionary landing
Damage: Engine #1, #2
Wildlife species: Grackles
Comments from report: Left and right engine nacelle inlet heat lips had multiple dents. The left engine had several bent fan blades on the outboard end of the blades. In addition, this engine shows that some bird or birds did traverse through the engine. The left engine requires removal for compressor damage. The right engine has no damage. Engine instrument indications remained normal during the flight. A precautionary landing was made without incident. Aircraft time out of service was 30 days. Cost of damage was \$108,000.

Date: 20 December 1994
Airport: F67
Aircraft: Eurocopter AS 365 Dauphin 2
Phase of flight: En route
Effect on flight: Landed, made repairs
Damage: Windshield, Rotor
Wildlife species: Hawk
Comments from report: The pilot looked inside the cockpit for a moment and as he looked back out he saw the hawk too late to take evasive action. The 5-7 pound hawk struck the copilot's windshield, broke through, struck glare shield top and hit the flight mechanic in the face. Pilot was cut on forehead by plexiglas, while the flight mechanic suffered lacerations and bruises to the face and eyes. The helicopter damages include the left windshield broken, leading edge root tape cut and copilot's headset broken. The estimated damage to helicopter was \$11,000.