

DOT/FAA/AR-09/63

Air Traffic Organization
NextGen & Operations Planning
Office of Aviation Research
and Technology Development
Washington, DC 20591

Wildlife Strike Reporting, Part 2— Sources of Data in Voluntary System

December 2009

Final Report

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U.S. Department of Transportation
Federal Aviation Administration

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Technical Report Documentation Page

1. Report No. DOT/FAA/AR-09/63	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle WILDLIFE STRIKE REPORTING, PART 2—SOURCES OF DATA IN VOLUNTARY SYSTEM		5. Report Date December 2009	
		6. Performing Organization Code	
7. Author(s) Richard A. Dolbeer, Ph.D.*	8. Performing Organization Report No.		
9. Performing Organization Name and Address SRA International, Inc. 1201 New Road Linwood, NJ 08221 *Dolbeer Wildlife Consulting 1228 Laguna Drive Huron, OH 44839	10. Work Unit No. (TRAIS)		
	11. Contract or Grant No. DTFACT-05-D-00012		
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration NextGen & Operations Planning Airport Safety and Standards Office of Aviation Research and Technology Development Washington, DC 20591	13. Type of Report and Period Covered Final Report		
	14. Sponsoring Agency Code AAS-300		
15. Supplementary Notes The Federal Aviation Administration Airport and Aircraft Safety R&D Division COTR was Dr. Satish Agrawal.			
16. Abstract A study was conducted in the mid-1990s to determine the level of participation of airports and other aviation safety stakeholders in the Federal Aviation Administration voluntary wildlife strike reporting system. A statistical analysis of reported strikes resulted in findings that only a certain percentage of wildlife strikes were actually being reported. According to data collected since 1990, the number of reported strikes has increased. Researchers are certain that several factors have contributed to that increase, including broader participation in the reporting process, increased number of hazardous species, a steady increase in the number of aircraft in the sky, and changes in reporting statistics. These factors were recently verified by Part 1 of a two-part study into the reporting trends titled "Wildlife Strike Reporting, Part 1—Trends 1990-2008." This report represents Part 2 of that study. The objectives of Part 2 were to (1) summarize trends in persons and other entities that report wildlife strikes and in methods used to report or obtain this strike information, (2) identify sources of data presently not used that might supplement the number of strikes captured, and (3) provide recommendations for enhancing the reporting of strikes or entry of strike information collected in other data sources to correct deficiencies.			
17. Key Words Wildlife strike, Strike report, Wildlife Hazard Management Plan, Wildlife Hazard Assessment, Part 139, Civil aircraft	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service (NTIS), Springfield, Virginia 22161.		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 37	22. Price

ACKNOWLEDGEMENTS

The author thanks S. E. Wright and M. Begier, United States Department of Agriculture/Wildlife Services, for advice in preparing this report. The findings and conclusions expressed in this report do not necessarily reflect current Federal Aviation Administration (FAA) policy decisions regarding the reporting of wildlife strikes or the control of wildlife on or near airports. Data presented regarding specific aviation industry groups, FAA regions, or other entities does not reflect on the quality or adequacy of programs and policies in place to mitigate the risk of wildlife strikes.

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LIST OF ACRONYMS

AC	Advisory Circular
AGL	Above ground level
AIDS	Accident/Incident Data System
ASIAS	Aviation Safety Information Analysis and Sharing
ASRS	Aviation Safety Reporting System
CFR	Code of Federal Regulations
FAA	Federal Aviation Administration
FAA-AAS	Federal Aviation Administration Office of Airport Safety and Standards
GA	General Aviation
NPIAS	National Plan of Integrated Airport Systems
NTSB	National Transportation Safety Board
NWSD	National Wildlife Strike Database
SMS	Safety Management System
U.S.	United States
WHA	Wildlife hazard assessment
WHMP	Wildlife Hazard Management Plan

EXECUTIVE SUMMARY

The reporting of wildlife strikes with civil aircraft in the United States (U.S.) is voluntary but strongly encouraged in Federal Aviation Administration (FAA) Advisory Circulars (AC) and other FAA publications. The National Wildlife Strike Database (NWSD) contained 89,787 strike reports for civil aircraft between 1990 and 2008.

This report is Part 2 of a two-part study to determine if changes are needed in the way wildlife strike data are collected by the FAA, and in particular, if mandatory strike reporting is needed.

Part 1 of the study, “Wildlife Strike Reporting, Part 1—Trends 1990-2008,” concluded that mandatory reporting is not recommended at this time; however, the focus of improved reporting needs to be directed at identifying any new sources of data on strike reports and in developing strategies directed at those specific airports and air carriers that may not be fully participating in the reporting program. The critical need is for those airports that are deficient in reporting to have a more complete record of their strikes so that they can develop and evaluate more effective species-specific wildlife hazard management programs to mitigate the risk of wildlife strikes under a Safety Management System (SMS).

The objectives of the Part 2 study were to (1) summarize trends in persons and other entities that report wildlife strikes to the NWSD and in methods used to report or obtain this strike information, (2) identify sources of data presently not used that might supplement the number of strikes captured by the NWSD, and (3) provide recommendations for enhancing the reporting of strikes or entry of strike information collected in other data sources to the NWSD to correct deficiencies in reporting identified in the Part 1 report.

Several key findings were discovered regarding wildlife strike reporting trends, sources, and gaps. Disparities were found to exist among FAA regions between the wildlife strike information collected from various sources at the regional level and what actually ends up in the NWSD. It is also known that while many air carriers and at least some airports likely maintain some type of databases that include wildlife strike incidents, the information is not necessarily being sent to the NWSD.

The recently developed Accident/Incident Data System (AIDS) database within the FAA Aviation Safety Information Analysis and Sharing (ASIIS) system was also identified as a potentially reliable source of additional wildlife strike report information. However, the AIDS database and the National Transportation Safety Board (NTSB) aviation accident databases often lack species-specific information for incident reports. Other than those presently in use, no other national source of wildlife strike data or existing method of strike reporting was identified.

Finally, effective wildlife hazard mitigation programs at airports rely heavily on wildlife strike report submissions. The lack of strike data could result in airports being uninformed of the extent of the problem, yet major discrepancies remain among commercial air carriers in the reporting of wildlife strikes to the NWSD. There are still a number of Title 14 Code of Federal Regulations (CFR) Part 139 airports and most of the National Plan of Integrated Airport Systems

(NPIAS) general aviation (GA) airports that do not appear to be fully participating in reporting of wildlife strikes reporting program.

Reporting of off-airport strikes in departure and arrival paths can be critical in helping airports work with local governments to minimize wildlife attractants near airports as described in FAA AC 150/5200-33B, "Hazardous Wildlife Attractants on or Near Airports."

Based on these findings, several recommendations have been provided to close the gaps and enhance the overall efficiency and effectiveness of the wildlife strike reporting system. These recommendations are summarized below.

1. Based on the statistical trends measured, mandatory reporting is not recommended at this time to achieve the objectives of the NWSD.
2. The rates of reporting by those airports and air carriers not fully participating in the program and in the transfer of data from miscellaneous FAA and industry databases under the existing voluntary system should be improved.
3. A policy should be developed within the FAA to ensure that wildlife strike events presently documented by the FAA regional offices in various forms or reports are forwarded or made available to the FAA Office of Airport Safety and Standards for inclusion in the NWSD. The AIDS database is a promising mechanism for achieving this objective.
4. Increased emphasis should be placed on training FAA and NTSB accident investigators in collection of remains, identification of species, and other key data, such as number of birds involved in the strike and the height above ground level of the strike event.
5. The development of a memorandum of understanding with the United States Department of Agriculture/Animal and Plant Health Inspection Service Wildlife Services should be explored to provide assistance at accident investigations in recovering wildlife remains.
6. Available leverage should be used in existing regulations under 14 CFR Part 139 and applicable guidance in the ACs to educate airports on the importance of reporting strikes in relation to improving their own SMS programs, especially for those airports accepting Federal grant-in-aid funding.
7. Air carriers and pilots should be educated on the importance of reporting strikes to the NWSD. As users of the airport system, reporting is in the self-interest of the air carriers and pilots because it informs the airports of existing safety risks.
8. The FAA should work with air carriers to develop procedures for the seamless transfer of wildlife strike-related data already collected by air carriers into the NWSD.

9. Continue to publish an annual report that summarizes the data in the NWSD from 1990 through the most recent year. The report should be made available on-line and distributed as a hard copy to all 14 CFR Part 139 airports, air carriers, and relevant industry groups.
10. Conduct a follow-up study in May 2011 (after all 2010 data have been entered into the NWSD) to determine the progress being made in correcting current deficiencies in reporting and if additional measures, such as mandatory reporting, need to be reconsidered.

1. INTRODUCTION.

The reporting of wildlife strikes with civil aircraft in the United States (U.S.) is voluntary but strongly encouraged in Federal Aviation Administration (FAA) Advisory Circulars (AC) and other FAA publications. The National Wildlife Strike Database (NWSD) contained 89,787 strike reports for civil aircraft between 1990 and 2008 [1]. In the aftermath of the ditching of US Airways Flight 1549 in the Hudson River on 15 January 2009 after Canada geese were ingested in both engines on the Airbus 320 [2 and 3], the FAA initiated a two-part study of the national database. The Part 1 study was completed 17 August 2009 [4]. The Part 1 analysis objectives were to (1) examine the trends in strike reporting from 1990-2008 to determine if the percentage of strikes reported to the FAA Office of Airport Safety and Standards (FAA-AAS) for inclusion in the NWSD is increasing, (2) obtain an estimate of percentage of strikes currently being reported, and (3) document trends in the percent of strikes submitted to the NWSD that provide an identification of the wildlife struck to species level (because this is the most critical piece of data in a strike report). Based on the findings of these three objectives, a final objective was to assess if the data presently collected in the NWSD under a voluntary system are adequate for understanding the problem of wildlife strikes in the U.S., or if additional measures, such as mandatory strike reporting, need to be taken. Aircraft movement data for all Title 14 Code of Federal Regulations (CFR) Part 139-certificated airports (hereinafter referred to as Part 139) [5] and general aviation (GA) airports in the National Plan of Integrated Airport System (NPIAS) were used in the analysis [6 and 7]. Additional data on aircraft movements by air carriers and on bird ingestions into turbofan engines were provided by the aviation industry.

The conclusions from the Part 1 study were:

1. Overall trends in the reporting of strikes to the NWSD are significantly positive; numbers and rates of strikes being reported for Part 139 airports are at least three times higher in 2004-2008 compared to 1990-1994. The quality of data being reported is also steadily improving as demonstrated in the tripling in the percentage of reported bird strikes that identify the species.
2. There is a wide disparity in overall reporting rates between Part 139 airports and NPIAS GA airports. Less than 6% of total strike reports come from NPIAS GA airports and reporting rates average less than 1/20 the rates at Part 139 airports. From 2004-2008, 2170 (85%) of the 2560 NPIAS GA airports did not have a single strike reported.
3. Although overall reporting rates are much higher for strikes at Part 139 airports than at NPIAS GA airports, there is also a major disparity in reporting rates among Part 139 airports. Larger Part 139 airports, especially those that have well-established wildlife hazard management programs, have reporting rates about four times higher on average than other Part 139 airports from 2004-2008. There are 84 Part 139 airports that did not have a single strike report from 2004-2008. Based on the assumption that reported strike rates at 27 selected Part 139 airports is representative of the actual strike rates at Part 139 airports nationwide, it is estimated that about 39% of the strikes at all Part 139 airports were reported from 2004-2008 compared to 20% or less during the 1990s.

4. The pattern of disparity in reporting rates among Part 139 airports is also found in reporting rates for commercial air carriers. Reporting rates varied by a factor of 9 for the 13 largest carriers and by an even greater amount for 35 smaller carriers between 2004 and 2008.
5. There is an overall bias toward the reporting of damaging strikes compared to nondamaging strikes, especially for NPIAS GA airports and certain Part 139 airports. The opposing trend at Part 139 airports of an overall continued increase in the numbers and rates for all reported strikes in contrast to a decline or stabilization in the numbers and rates for reported strikes with damage since 2000 is an encouraging finding. This opposing trend indicates that the many wildlife hazard management programs that have been implemented or enhanced at Part 139 airports in recent years are showing success in mitigating some of the risk caused by the more hazardous species (i.e., those species most likely to cause damage). The airports implementing these programs are also doing a better job of reporting all strikes, thus generating the overall increase in reporting rates.
6. Based on (a) the highly significant positive trend observed in overall strike reporting from 1990 to 2008, (b) the decline or stabilization in reporting of damaging strikes since 2000, (c) the implementation of professionally run wildlife hazard programs at many Part 139 airports throughout the U.S. that are reporting all known strikes, and (d) the highly significant improvement in species identification since 2000, it is concluded that the current overall reporting rate, estimated at 39% in this study, is adequate to track national trends in wildlife strikes, determine the hazard level of wildlife species that are being struck, and to provide a scientific foundation for FAA policies and guidance regarding the mitigation of risk from wildlife strikes. The database presently captures over 7,500 strike events per year involving over 240 species of birds and other wildlife (89,727 strikes involving 381 species of birds and 48 species of other wildlife from 1990-2008).
7. The major deficiency in the database at this time is the lack of full participation by some airports and air carriers in reporting strikes to the NWS. Increased reporting by these entities is primarily needed to enable the airports where these strikes are occurring to define their local wildlife issues and to develop species-specific wildlife hazard management plans as part of their Safety Management Systems (SMS).

The Part 1 study recommendations included:

1. The positive trends exhibited in reporting at Part 139 airports can be enhanced by directed efforts through education, training, and leverage contained within existing Part 139 regulations and FAA ACs to improve reporting rates for those Part 139 airports not fully participating in the reporting program. It is in the self interest of these airports to improve reporting because these data are essential to incorporate wildlife risk mitigation into these airports' SMS.
2. Likewise, efforts need to be directed to emphasize the importance of reporting strikes to the NWS for air carriers not fully participating in the reporting program so that the airports where these strikes occur can more effectively develop programs to mitigate the

risk. Also, the reporting by air carriers of off-airport strikes in departure and arrival paths can be critical in helping airports work with local governments to minimize wildlife attractants near airports. Many of these air carriers already maintain strike records in internal databases.

3. The major deficiency in reporting rates for NPIAS GA and other GA airports needs to be addressed. Many of these airports are located in more rural areas with high wildlife population and inadequate fencing to exclude hazardous terrestrial wildlife. As noted above, 67% of the reported strikes from 1990-2008 in which the aircraft was destroyed occurred at GA airports.
4. Given the positive trends in reporting rates and species identification coupled with the decline or stabilization in damaging strikes, mandatory reporting is not recommended at this time. Based on the statistical trends measured in this study, the current collection of over 7500 strike reports annually involving over 240 identified species of wildlife, and the numerous database-generated reports and scientific papers published in recent years, the database appears to be adequate for defining the overall national problem, identifying the species posing the greatest and least hazards, and measuring national and regional trends in strikes. The focus of improved reporting needs to be directed at those specific airports and air carriers that may be not fully participating in the reporting program. The critical need is for those airports that are deficient in reporting to have a more complete record of their strikes so that they can develop and evaluate more effective species-specific wildlife hazard management programs to mitigate the risk of wildlife strikes under SMS.

2. OBJECTIVES OF PART 2 STUDY.

The Part 2 study objectives were to (1) summarize trends in the persons and other entities that report wildlife strikes to the NWSD and in the methods used to report or obtain these strikes, (2) identify data sources presently not used that might supplement the number of strikes captured by the NWSD, and (3) provide recommendations for enhancing the reporting of strikes or the entry of strike information collected in other data sources to the NWSD to correct deficiencies in reporting identified in the Part 1 report.

3. SOURCES OF DATA USED IN PART 2 ANALYSES.

As in the Part 1 study [4], wildlife strike data for civil aircraft from 1990-2008 were obtained from the NWSD [1]. Military aircraft strikes at civil airports were excluded from the analyses. Aircraft movement data for all Part 139-certificated airports and NPIAS GA airports were obtained from the FAA Terminal Area Forecast system [7]. Additional data on wildlife strikes were obtained through the FAA Aviation Safety Information Analysis and Sharing (ASIAS) system by accessing the Accident/Incident Data System [8 and 5].

Strike rates were calculated in terms of number of strikes reported per 1 million civil aircraft movements.

4. DATA ANALYSIS.

4.1 OVERVIEW OF NUMBERS AND TRENDS IN REPORTING OF WILDLIFE STRIKES.

For the 19-year period (1990-2008), 89,727 strikes were reported to or obtained by the FAA-AAS for inclusion in the NWSD. Birds were involved in 97.4% of the reported strikes, terrestrial mammals in 2.1%, flying mammals (bats) in 0.3%, and reptiles in 0.1% (table A-1). The corresponding tables and figures for this study are provided in appendices A and B, respectively. The overall number of reported strikes has steadily increased from 1759 in 1990 to 7516 in 2008 (4.3-fold increase). In contrast, the number of strikes indicating damage to the aircraft increased from 340 in 1990 to a peak of 762 in 2000 but has subsequently declined by 33% to 512 in 2008 (figure B-1). The percent of reported strikes indicating damage ranged from 15% to 19% from 1990-1998 but has subsequently declined to 7% in 2008 (figure B-1).

4.2 PERSONS SUBMITTING STRIKE REPORTS AND TRENDS IN REPORTING BY VARIOUS PERSONS OR GROUPS.

4.2.1 Airline Operations and Pilots.

Overall, airline personnel and pilots have filed 29% and 24%, respectively, of the strike reports entered into the NWSD from 1990-2008 (table A-2). The combined percentage of strikes filed by these groups has declined from about 60% to 40% from 2004 to 2008 (figure B-2).

4.2.2 Tower Personnel.

The percentage of strike reports submitted to the NWSD by tower personnel has declined from about 25% in the early 1990s to <10% since 2003 (table A-2 and figure B-2).

4.2.3 Airport Personnel (Strike and Carcass-Found Reports).

The percentage of reports filed by airport personnel has shown a steady increase from about 5% in 1990 to 50% in 2008 (table A-2 and figure B-2). The major component of increase has come from the filing of carcass-found reports (i.e., airport personnel find wildlife remains within 200 feet of a runway centerline that appeared to have been struck by an aircraft and no strike was reported by the pilot, tower, or airline). This major increase in carcass-found reports is reflective of the increasing number of Part 139 airports that have developed wildlife hazard management programs overseen by qualified biologists in recent years, as documented in the Part 1 report [4]. Carcasses found in the manner described above are officially designated as wildlife strikes by the FAA [9] and provide important data on the species present in the Air Operations Area.

4.3 METHODS OF REPORTING STRIKES AND TRENDS IN METHODS OF REPORTING FROM VARIOUS SOURCES.

The above section described the persons or groups reporting wildlife strikes to the NWSD. This section analyzes the methods these people or groups use to report the strikes.

4.3.1 FAA Form 5200-7.

From 1990-2008, most (66%) of the 89,727 strike reports were filed using the paper (43%) or electronic (23%) version of FAA Form 5200-7 Bird/Other Wildlife Strike Report. Since the online version of this form was activated in April 2001, use of the electronic reporting system has climbed dramatically. In 2008, 68% of all strike reports were submitted electronically compared to 20% in 2002 (table A-3 and figure B-3).

4.3.2 Reports From Airlines, Airports, and Engine Manufacturers.

The second largest method of reporting (overall 15%) has been from airlines that provide information directly to the NWSD manager from their internal databases or by personal communication (not on Form 5200-7). This method of reporting has declined in recent years as more airlines have submitted reports electronically or because of cutbacks in personnel (table A-3 and figure B-3). As with airlines, airports and engine manufacturers sometimes report wildlife strike information directly to the NWSD manager (5% and 1%, respectively) from their internal databases or by personal communication (not on Form 5200-7; table A-3).

4.3.3 Miscellaneous FAA Forms and Reports.

The third method of reporting information about wildlife strikes has come from FAA regional offices via four FAA forms or reports that are sometimes submitted to the FAA-AAS or directly to the NWSD manager. These sources are the Preliminary Aircraft Incident Report (various FAA regional office forms), FAA Form 8020-23 (formerly 8020-5 and 8020-16) FAA Accident/Incident Report, Daily Report, and FAA Form 8020-9 Aircraft Accident/Incident Preliminary Notice. These reporting methods on wildlife strikes to the NWSD have ranged from a high of about 5% of the total strike reports submitted during the mid-1990s to about 2% in recent years (table A-3 and figure B-4).

The number of strikes reported to the NWSD via these FAA sources has varied dramatically by FAA region (table A-4, figures B-5 and B-6). From 2004-2008, the Northwest Mountain Region submitted 371 incidents of wildlife strikes via these four sources (6.5 reports per 1 million aircraft movements in the region) compared to less than 50 reports (0.1 to 0.7 reports per 1 million movements) submitted by each of six other regions.

4.3.4 The Aviation Safety Reporting System, the NTSB, and Other Sources.

A small number of reports of wildlife strikes (<0.2%) were obtained by the NWSD manager through periodic searches of the Aviation Safety Reporting System (ASRS, managed by the National Aeronautics and Space Administration) and the National Transportation Safety Board (NTSB) aviation accident database (table A-3), using search words such as “bird,” “deer,” “goose,” and “wildlife.” Finally, about 1% of the strike reports were obtained by the NWSD manager from other miscellaneous sources, primarily news media and aviation industry publications.

4.3.5 Multiple Methods.

Information about wildlife strikes was obtained from more than one type of reporting method in about 9% of the strike incidents in the NWSD from 1990-2008 (table A-3). For example, a pilot might submit a report on Form 5200-7 detailing the time, location, type of aircraft, and damage, whereas the airport might provide a narrative report to the NWSD manager with information on the number and species of bird that was struck. In addition to receiving strike information from multiple reporting methods, two or more reports filed by different people about the same incident are received in about 13% of the incidents when reports are filed via FAA Form 5200-7.

Information on a single strike event from multiple reporting methods or multiple persons using the same reporting method sometimes allows the NWSD manager to more completely fill in the data fields, which enhances the utility of the report. One challenge of multiple methods of reporting the same event (reports in different formats may be received days or weeks apart) is that the NWSD manager must ensure that a single strike event is not entered as two or more events. A second challenge arises when multiple reports provide conflicting information. The NWSD manager must resolve the discrepancies by contacting the persons submitting the reports.

4.4 ADDITIONAL SOURCES OF WILDLIFE STRIKE REPORTS AND INFORMATION.

4.4.1 Accident/Incident Data System Database.

As noted above, one source of wildlife strike information includes the miscellaneous reports filed by the FAA regional offices on aircraft accidents and incidents (table A-3), which have not been consistently provided to the FAA-AAS or directly to the database manager for inclusion in the NWSD. There has been no protocol or policy to direct accident/incident reports that involve wildlife to FAA-AAS, which explains the wide disparity in reporting among regions. One improvement to this uneven reporting comes from the recently developed FAA Accident/Incident Data System (AIDS). This database contains information from the miscellaneous FAA reports (table A-3) on many aircraft accidents or incidents that occurred between 1978 and the present. The current AIDS is being revised to reflect the full narrative on all 10,000 incident reports with an active event date of 1 January 1995 or later [8].

To test the use of the AIDS database, a search of AIDS (accessed via www.asias.faa.gov/) using the key word “deer” in the narrative text was done. The selected reports were downloaded in Microsoft® Excel®. After filtering to remove non-deer strike events (e.g., airports or cities with the name “deer”) and those events before 1990, the strike events in the AIDS database were compared with the records contained in the NWSD from 1990-2008.

There were 457 deer strikes found in the AIDS database between 1990 and 2008, of which 291 were in the NWSD (table A-5). Thus, there were 166 deer strikes known by the FAA via one of the miscellaneous reporting forms (36% of the 457 incidents in AIDS) that had not been forwarded to FAA-AAS or to the database manager for inclusion in the NWSD.

In comparison to the AIDS database, the NWSD contained 779 deer strikes from 1990-2008, of which 488 (63%) were not found in the AIDS database. Overall, the NWSD contained 82% of

the deer strikes known by the FAA to have occurred based on the combined records in the AIDS and NWSD databases (table A-5). There was a significant positive trend in the percentage of all deer strikes known by the FAA (combined databases) found in the NWSD from 1990-2008. In 1990, the NWSD contained 29% of the strikes compared to 80% to 92% in 2004-2008 (figure B-7).

A separate analysis was performed with the AIDS database to examine strike reporting for wild ungulates other than deer. The key words used in the search were “moose,” “antelope,” “pronghorn,” “elk,” “wapiti,” “caribou,” and “reindeer.” Although sample sizes were much smaller (which precluded a trend analysis over years), the overall results were almost identical to that found for deer. The AIDS database contained ten incidents involving these ungulate species from 1990-2008, of which four were not in the NWSD. In comparison to the AIDS database, the NWSD contained 21 strikes, of which 15 (71%) were not found in the AIDS database. Overall, the NWSD contained 84% (21 of 25) of the non-deer, wild ungulate strikes known by the FAA to have occurred based on the combined records in the AIDS and NWSD databases (table A-6).

4.4.2 Air Carrier, Airport, and Engine Manufacturer Databases.

As documented in the Part 1 study [4], there are major disparities among air carriers and airports in reporting of wildlife strikes to the NWSD. Most, if not all air carriers, maintain databases that contain wildlife strike incidents. A previous study involving one major air carrier revealed that this information often does not get submitted to the NWSD [10]. Likewise, some airports maintain internal databases or log entries of wildlife strike events that are not forwarded to FAA-AAS for entry into the NWSD [10 and 11].

4.4.3 The NTSB Aviation Accident Database.

As noted in section 4.3.4, the NTSB aviation accident database is periodically searched by the NWSD manager to obtain wildlife strike reports or additional information on strikes reported by other methods. A deficiency in the NTSB reports has been a lack of identification of the bird, or other wildlife causing the strike, to the species level. The accidents that are included in the NTSB reports are significant incidents that often result in the loss of the aircraft. Identifying the causal species is essential to developing species-specific wildlife management practices that can greatly reduce strikes by these species in the future. Therefore, it is critical that the wildlife be identified to the species level whenever possible (as discussed in the Part 1 report [4]).

5. DISCUSSION.

5.1 ADDITIONAL SOURCES OF WILDLIFE STRIKE REPORTS.

Wildlife strike events are presently reported to or obtained by the FAA-AAS or NWSD manager for inclusion in the NWSD by various methods from a diversity of sources, as listed in tables A-2 and A-3. A key deficiency identified was the lack of communication between the FAA regional offices (primarily Operations Centers and Flight Standards offices) and the FAA-AAS in Washington, DC. As discussed above (tables A-4, A-5, A-6, and figures B-5 and B-6), there are major disparities among FAA regions in providing known information on wildlife strikes to

FAA-AAS, and there are a significant number of wildlife strike events recorded by the FAA at the regional level that are not entered into the NWSD. A policy is needed within the FAA to ensure that wildlife strike events presently documented by the FAA regional offices in one or more forms or reports (table A-3) are forwarded or made available to FAA-AAS so these events can be entered in the NWSD. Ideally, a protocol and software should be developed so that the data for strike events captured in any of these four reporting mechanisms used by the FAA can be transferred to FAA Form 5200-7 Bird/Other Wildlife Strike Report. This will ensure that the essential and unique information relevant to wildlife strike events is collected efficiently in a more complete, accurate, and standardized format.

An improvement to this problem may be found in the recently developed AIDS database within the FAA ASIAS system [8]. The AIDS database contains many of the incidents/accidents that are documented at the FAA regional level under the miscellaneous forms (especially FAA Form 8020-23 Accident/Incident Report). As discussed above (table A-5), an on-line search of AIDS using the keyword “deer” revealed 166 deer strikes with civil aircraft at U.S. airports from 1990-2008 were known to the FAA but never submitted to FAA-AAS for inclusion in the NWSD. Therefore, the AIDS database can be a useful tool to supplement the NWSD, making it more accurate.

However, while the AIDS database may document the wildlife strike event, the information provided is often incomplete in critical data fields. These data fields are present in FAA Form 5200-7 Bird/Other Wildlife Strike Report but not in the forms or formats of the other FAA reports. For example, the information on the species of wildlife is often incomplete or unknown in the AIDS database. As discussed in the Part 1 report [4], identification of the wildlife involved in the strike to the species level is critical for various technical, legal, and public relations reasons. Other important data fields that may be missing, especially with bird strikes, include the height above ground level (AGL) when the strike occurred, the number of birds involved, and the parts of aircraft struck and damaged.

A major challenge in using AIDS is that, presently, there is no code to separate wildlife strikes from other incidents. In fact, the reason “deer” was used as a keyword to test the AIDS database was that there are only two species of deer in the U.S. (white-tailed deer [*Odocoileus virginianus*] and mule deer [*O. hemionus*]) and the term “deer” is relatively unambiguous (although about 25 selected records had to be discarded that had the word “deer” in the name of the airport or city). Although none of the examined reports identified the deer to species, the species can be determined for most of these records based on the geographic location of the incident. However, searching the AIDS for other less specific wildlife strikes by using keywords such as “bird,” “goose,” “geese,” “gull,” “seagull,” “falcon,” “hawk,” “buzzard,” and “animal” and trying to match these incidents with records in NWSD may be tedious.

With the exception of the AIDS database, no national source of wildlife strike data or existing method of strike reporting for the U.S. was found. However, many air carriers and at least some airports maintain databases (or at the least, log book entries) that include wildlife strike incidents, but do not send the entries to the NWSD. The FAA should work with the air carriers to develop procedures for seamlessly transferring data already collected on wildlife strikes into

the NWSD, and with the airports to submit these local database entries electronically to FAA-AAS via Form 5200-7.

5.2 IMPROVING STRIKE REPORTING BY AIRPORTS, AIR CARRIERS, AND PILOTS UNDER A VOLUNTARY SYSTEM.

5.2.1 Airports.

As documented in the Part 1 report [4], there have been major improvements in reporting wildlife strikes at many airports in the U.S., especially larger Part 139 airports. However, there are still a number of Part 139 airports and most of the NPIAS GA airports that do not appear to be fully participating in reporting wildlife strikes to the NWSD. A recommended strategy for maintaining the momentum in improved reporting and gaining the participation of the under-reporting airports under the current voluntary reporting system is through education, training, enforcement of current regulations in 14 CFR 139.337, and the use of leverage available via existing ACs and FAA publications.

14 CFR 139.337 [5] requires Part 139 airports to conduct a wildlife hazard assessment (WHA) if one or more of four triggering events occur: (1) an air carrier aircraft experiences multiple wildlife strikes; (2) an air carrier aircraft experiences substantial damage from striking wildlife, (3) an air carrier aircraft experiences an engine ingestion of wildlife; or (4) wildlife of a size, or in numbers, capable of causing triggering events 1, 2, or 3 is observed to have access to any airport flight pattern or aircraft movement area. The FAA-AAS is presently reviewing all Part 139 airports to ensure that WHAs are being done where warranted. In reality, almost all airports already meet the criteria of the fourth triggering event at some point in the annual cycle of bird and other wildlife populations in the airport environment. For this reason, the FAA has announced intentions to revise 14 CFR 139.337 to require all Part 139 airports to conduct periodic WHAs, regardless of triggering events.

Based on the findings of the WHA, most airports are required to develop and implement a wildlife hazard management plan (WHMP) that becomes part of the airport's Part 139 certification manual (14 CFR 139.337, see reference 5). Although 14 CFR 139.337 does not specifically address reporting of wildlife strikes as part of the WHMP, there are other aspects of Part 139 regulations and various FAA ACs and publications that the FAA may use to require reporting of strikes as part of the WHMP for those airports accepting Federal grant-in-aid assistance.

One relevant and notable change to 14 CFR Part 139 regulations in 2004 was that airports now are required to provide 8 hours of recurrent training annually to airport staff involved in wildlife risk mitigation (14 CFR 139.303, see reference 5). This training specifically requires coverage of the importance of and methods for reporting strikes to the NWSD [12]. Furthermore, chapter 7 of reference 13 clearly documents the importance of wildlife strike reporting as an essential part of the WHMP. In addition, the FAA published AC 150/5200-32A in 2004, which "actively encourages the voluntary reporting of strikes" [9]. The FAA also has committed in AC 150/5200-37 [14] to implementing the use of SMS at U.S. airports in a way that complements existing safety regulations in 14 CFR Part 139 and complies with standards on SMS adopted by

the International Civil Aviation Organization. The use of SMS for airports is dependent on objective data and requires consistent reporting of safety-related incidents without fear of reprisal [14]. An airport cannot incorporate wildlife strike risk mitigation into its SMS unless it has a consistent record of wildlife strikes maintained in a database [15]. Finally, it is in the airports' self interest to improve reporting because airport operators who fail to collect wildlife strike data and implement effective WHMPs expose themselves to increased legal liability in the aftermath of wildlife strikes [16].

In conclusion, the positive trends exhibited in reporting wildlife strikes at Part 139 airports can be enhanced by directed efforts through education, training, enforcement of existing Part 139 regulations, and use of leverage available in existing ACs and other FAA publications. Efforts need to be especially directed at those Part 139 airports that do not appear to be fully participating in the reporting program. These airports should improve reporting because these data are essential to incorporate wildlife risk mitigation into these airports' SMS and to reduce liability exposure from damaging wildlife strikes. The same efforts need to be directed at the NPIAS GA airports that accept Federal grant-in-aid funding, whose strike reporting rates are generally much lower than Part 139 airports.

5.2.2 Air Carriers and Pilots.

Air carriers and pilots are critical sources of strike reports, generating 40% to 60% of the submissions to the NWSD from 2004-2008 (table A-2 and figure B-2). As documented in the Part 1 study [4], there are major discrepancies among commercial air carriers in the reporting of wildlife strikes to the NWSD. Thus, efforts need to be directed by the FAA to emphasize the importance of reporting strikes to the NWSD for air carriers and pilots not fully participating in the reporting program. This reporting is important because these reports objectively inform the airports of existing safety risks. Failing to document these strike data may cause airports to ignore the problem or to fail to effectively develop programs to mitigate the risk. Also, the reporting by air carriers and pilots of off-airport strikes in departure and arrival paths can be critical in helping airports work with local governments to minimize wildlife attractants near airports as described in FAA AC 150/5200-33B [17].

Most, if not all, air carriers already maintain records of wildlife strike incidents in internal databases. At least one major carrier has worked with the FAA to develop the software and protocols to allow the filing of a single report involving a wildlife strike that fulfills the needs of the air carrier database and is transferred directly to the FAA for final editing and entry into the NWSD. The FAA should continue this work with other air carriers to develop procedures for seamlessly transferring data already collected on wildlife strikes into the NWSD.

5.3 MISCELLANEOUS CONSIDERATIONS REGARDING MANDATORY STRIKE REPORTING.

If strike reporting for civil aviation in the U.S. were to become mandatory, a major issue would be defining the responsible personnel required to report strike events to FAA-AAS for entry into the NWSD database. Wildlife strikes occur under a variety of circumstances, and each strike event may be observed or discovered by one or more entities (e.g., airport, pilot, FAA tower, air

carrier, engine manufacturer). Wildlife strike events, presently, are reported to or obtained by the FAA-AAS or NWSD manager by various methods from a diversity of sources as listed in tables A-2 and A-3. If strike reporting were mandatory, a protocol would be needed to define persons responsible for reporting to ensure an orderly submission of strike data that minimizes redundancy and confusion.

From 2004-2008, about 8% of the strike events were reported via multiple methods (table A-3), and the NWSD manager estimates that multiple Form 5200-7 reports are received on an additional 13% of strike events. Although multiple reports sometimes result in more complete data for a strike event, they also can provide conflicting data that must be resolved by follow-up communication. In addition, the database manager must take care to ensure that multiple reports, often received days or weeks apart, are not entered as separate strike events, especially when conflicting information is provided. On average, about 21 strike events are reported per day under the present system with about 35 per day in the peak months of July-September (table A-1 and [1]).

Another issue to consider is the category of airports and aircraft for which mandatory reporting would be required. As documented in the Part 1 report [4], reporting rates presently are highest at larger Part 139 airports and lowest at GA airports not under the NPIAS. Reporting requirements for categories of airports (Part 139, NPIAS GA, and other GA) and for categories of aircraft (GA and air carrier) would need to be defined.

6. CONCLUSIONS AND RECOMMENDATIONS.

The Part 1 study concluded that mandatory reporting is not recommended at this time to achieve the objectives of the National Wildlife Strike Database (NWSD), based on the positive trends in reporting rates and species identification in recent years. Based on the numerous database-generated reports and scientific papers published in recent years, the database appears to be adequate for defining the overall national problem, identifying the species that pose the greatest and least risks, and measuring national and regional trends in strikes. The information obtained from these analyses provides an adequate foundation for Federal Aviation Administration (FAA) policies and guidance and for refinements in the development, implementation, and justification of integrated research and management efforts to reduce wildlife strikes. The Part 1 study also concluded that the focus of improved reporting needs to be directed at identifying any new sources of data on strike reports and in developing strategies directed at those specific groups that may not be fully participating in the reporting program. The critical need is for those airports that are deficient in reporting to have a more complete record of their strikes so that they can develop and evaluate more effective, species-specific wildlife hazard management programs to mitigate the risk of wildlife strikes under Safety Management Systems (SMS).

The Part 2 study objectives were to (1) summarize trends in persons and other entities that report wildlife strikes to the NWSD and in methods used to report or obtain these strikes, (2) identify sources of data presently not used that might supplement the number of strikes captured by the NWSD, and (3) provide recommendations for enhancing the reporting of strikes or entry of strike information collected in other data sources to the NWSD to correct deficiencies in reporting identified in the Part 1 report. The Part 2 study conclusions are as follows:

1. Wildlife strike events are presently reported to or obtained by the Federal Aviation Administration Office of Airport Safety and Standards (FAA-AAS) or NWSD manager for inclusion in the NWSD from a number of sources. A key deficiency identified was the lack of communication between FAA regional offices and FAA-AAS in Washington, DC. There are major disparities among FAA regions in providing known information on wildlife strikes to FAA-AAS, and there are a significant number of wildlife strike events recorded by the FAA in miscellaneous forms and reports at the regional level that are not being entered into the NWSD.
2. A solution to this problem may be found in the recently developed Accident/Incident Data System (AIDS) database within the FAA Aviation Safety Information Analysis and Sharing (ASIAS) system. The AIDS database contains many of the incidents/accidents that are documented by the FAA under the miscellaneous forms, especially FAA Form 8020-23 Accident/Incident Report. An analysis of incident reports in the AIDS database revealed 170 deer and other wild ungulate strikes with civil aircraft at U.S. airports from 1990-2008 that were known to the FAA but never submitted to FAA-AAS for inclusion in the NWSD.
3. One problem with the AIDS database and with the National Transportation Safety Board (NTSB) aviation accident database (which is also used to obtain wildlife strike reports and information) is that the species of wildlife causing the strike often is not identified or documented in the report.
4. With the exception of the AIDS database, no national source of wildlife strike data or existing method of strike reporting for the United States (U.S.) was found. However, many air carriers and at least some airports likely maintain some type of database that includes wildlife strike incidents that are not sent to the NWSD.
5. As documented in the Part 1 study, there have been major improvements in reporting wildlife strikes at many airports in the U.S., especially at larger Part 139 airports. However, there are still a number of Part 139 airports and most of the NPIAS GA airports that do not appear to be fully participating in reporting wildlife strikes.
6. Air carriers and pilots are critical sources of strike reports, generating 40% to 60% of the submissions to the NWSD from 2004-2008. As documented in the Part 1 study, there are major discrepancies among commercial air carriers in reporting wildlife strikes to the NWSD. Without these strike data being reported, airports may ignore the problem or fail to effectively develop programs to mitigate the risk. Also, air carriers and pilots reporting off-airport strikes in departure and arrival paths can be critical in helping airports work with local governments to minimize wildlife attractants near airports, as described in FAA AC 150/5200-33B.

The recommendations from Part 2 of this study are:

1. Mandatory reporting is not recommended at this time to achieve the objectives of the NWSD. Based on the statistical trends measured, the current collection of over 7500 strike reports annually involving over 240 identified species of wildlife, and the numerous database-generated reports and scientific papers published in recent years, the database appears to be adequate for defining the overall national problem, identifying the species that pose the greatest and least hazards, and measuring national and regional strike trends.
2. The FAA should focus on improving the reporting rates of those airports and air carriers not fully participating in the program and in the transfer of data from miscellaneous FAA and industry databases under the existing voluntary system.
3. An FAA policy is needed to ensure that wildlife strike events presently documented by the FAA regional offices in various forms or reports are forwarded or made available to the FAA-AAS so these events can be entered in the NWSD. The AIDS database is a promising mechanism for achieving this objective. However, protocols and software should be developed so strike event data that are captured in the reporting mechanisms can be transferred electronically to FAA Form 5200-7 Bird/Other Wildlife Strike Report. This will ensure that the essential information is collected efficiently in a more complete, accurate, and standardized format.
4. The FAA and National Transportation Safety Board (NTSB) need to place increased emphasis on the importance of identifying the wildlife species involved in the strike events they investigate. The NTSB and FAA should train accident investigators in the collection of wildlife strike remains for identification by the Smithsonian Institution. Training is needed in the importance of collecting other key data, such as the number of birds involved in the strike and the height above ground level of the strike event. They should also explore the development of a memorandum of understanding with the United States Department of Agriculture/Animal and Plant Health Inspection Service Wildlife Services to provide assistance at accident investigations in recovering the wildlife remains. Accident investigation forms should be modified to include these instructions and data fields.
5. To maintain the momentum in improved reporting by airports and gain the participation of underreporting airports, the FAA should put more emphasis on education and training. The FAA should use the leverage available in existing regulations under Title 14 Code of Federal Regulations (CFR) Part 139 and in Advisory Circulars (AC) related to training, wildlife strike reporting, and SMS for those airports accepting Federal grant-in-aid funding. The emphasis should be the need for airports, in their own self-interest, to report strikes.
6. For air carriers and pilots not fully participating in the reporting program, the FAA needs to emphasize to air carriers and pilots the importance of reporting strikes to the NWSD because it improves the safety of the airports they use.

7. Most, if not all, air carriers already maintain strike records in internal databases. The FAA needs to work with the air carriers to develop procedures for seamlessly transferring data already collected into the NWSD. This is the same challenge that the FAA has in developing a system to transfer wildlife strike data from the FAA AIDS database into the NWSD.
8. The FAA needs to continue publishing a report by August of each year that summarizes the data in the NWSD from 1990 through the most recent year. The report should be made available on-line and distributed as a hard copy to all Part 139 airports, air carriers, and relevant industry groups. These annual publications provide current, objective information on wildlife strikes for the public, news media, and aviation industry, and the reports demonstrate to the aviation industry and public that the information collected via the NWSD is being analyzed and used to improve aviation safety.
9. A follow-up study should be conducted in May 2011 (after all data for 2010 have been entered into the NWSD) to determine the progress made in correcting current reporting deficiencies, and if additional measures, such as mandatory reporting, need to be reconsidered.

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APPENDIX A—TABLES

Table A-1. Number of Reported Strikes—All Civil Aircraft (Federal Aviation Administration (FAA) National Wildlife Strike Database (NWS), 1990–2008^a.
 See figure B-1 for trend analyses.)

Year	Birds	Bats	Terrestrial Mammals ^b	Reptiles ^b	Total	Strikes With Reported Damage
1990	1,738	4	17	0	1,759	340
1991	2,252	3	36	0	2,291	381
1992	2,351	2	56	1	2,410	353
1993	2,395	6	53	0	2,454	386
1994	2,459	2	73	1	2,535	453
1995	2,643	5	69	8	2,725	486
1996	2,840	1	91	3	2,935	504
1997	3,351	1	92	14	3,458	578
1998	3,656	3	105	7	3,771	586
1999	5,001	7	89	1	5,098	697
2000	5,873	16	120	3	6,012	762
2001	5,647	8	137	8	5,801	644
2002	6,047	19	116	15	6,197	668
2003	5,853	20	124	5	6,003	629
2004	6,399	27	118	6	6,550	613
2005	7,076	27	130	7	7,240	607
2006	7,042	49	140	9	7,240	593
2007	7,507	53	167	7	7,734	560
2008	7,286	46	179	5	7,516	512
Total	87,416	299	1912	100	89,727	10,352

^a See [A-1] and [A-2] for more detailed descriptions of NWS.

^b For terrestrial mammals and reptiles, species with body masses <1 kilogram (2.2 lb) are excluded from database [A-3].

Table A-2. Persons Filing Report of Wildlife Strike
 (See figure B-2 for graphic depictions of trends.)

Year	Airline Operations	Pilot	Tower	Airport Operations		Other	Total Known	Unknown	Total
				Carcass Found ^a	Reported Strike				
1990	67	653	192	14	38	163	1,127	632	1,759
1991	181	724	349	33	73	141	1,501	790	2,291
1992	163	738	448	116	73	77	1,615	795	2,410
1993	196	670	478	179	155	28	1,706	747	2,453
1994	228	655	465	122	160	95	1,725	810	2,535
1995	302	620	486	183	124	139	1,854	872	2,726
1996	246	662	499	269	276	145	2,097	838	2,935
1997	377	864	502	357	295	111	2,506	952	3,458
1998	399	792	467	554	409	119	2,740	1,031	3,771
1999	1,825	794	459	539	382	144	4,143	955	5,098
2000	2,081	917	639	748	463	152	5,000	1,012	6,012
2001	1,993	837	627	850	453	134	4,894	906	5,800
2002	2,138	888	567	947	499	85	5,124	1,073	6,197
2003	1,902	970	498	962	584	49	4,965	1,037	6,002
2004	2,099	995	537	1,106	734	109	5,580	970	6,550
2005	2,524	1,119	399	1,341	734	53	6,170	1,070	7,240
2006	1,808	1,411	452	1,570	935	68	6,244	996	7,240
2007	1,504	1,507	512	2,013	1039	79	6,654	1,080	7,734
2008	1,252	1,548	550	2,317	1120	78	6,865	651	7,516
Total	21,285	17,364	9126	14,220	8546	1969	72,510	17,217	89,727

^a Airport personnel found wildlife remains within 200 feet of a runway centerline that appeared to have been struck by aircraft, and no strike was reported by pilot, tower, or airline (FAA Advisory Circular (AC) 150/5200-32A).

Table A-3. Methods of Reporting Wildlife Strikes (See figure B-3 for graphic depictions of trends.)

Year	FAA Form 5200-7 ^a		Airline Report ^b	Airport Report ^b	Engine Mfr ^b	Miscellaneous FAA Forms/Reports ^c				ASRS ^d	NTSB ^e	Multiple Sources ^f	Other ^g	Total
	Paper	Electronic				PACI Report	A/I Report	Daily Report	AA/IP Notice					
1990	1,535		3	6	86						7	61	61	1,759
1991	1,825		121	18	95		40				7	144	41	2,291
1992	1,888	1	93	85	33	3	86		10	12	5	149	45	2,410
1993	1,786		108	198	3	11	104		16	13	6	166	42	2,453
1994	1,799		131	140	62	21	74		4	13	5	241	45	2,535
1995	1,828	1	151	172	94	75	64		4	16	3	237	81	2,726
1996	1,756		160	268	91	69	72		4	18	3	391	103	2,935
1997	2,229		244	287	52	65	52		6	16	4	395	108	3,458
1998	2,550		98	362	70	86	63		1	21	7	413	100	3,771
1999	2,701	4	1,407	268	71	58	41		4	17	3	450	74	5,098
2000	3,335	4	1,597	269	77	52	55	18	6	7	1	543	48	6,012
2001	3,274	26	1,425	233	53	67	54	17	4	11	1	566	69	5,800
2002	2,604	1,255	1,260	243	19	51	8	57		6	4	629	61	6,197
2003	2,309	1,657	981	339	4	63		108	1	14	5	477	44	6,002
2004	2,077	2,085	1,253	364	3	82		57	1	11	1	570	46	6,550
2005	1,678	2,714	1,682	371	1	97	53	44	2	3	6	552	37	7,240
2006	1,528	3,315	1,223	335	9	81	6	71	3	1	3	618	47	7,240
2007	1,301	4,773	693	211	7	7	2	143	1		6	540	50	7,734
2008	907	5,075	490	244			6	144	2	4	1	561	82	7,516
Total	38,910	20,910	13,120	4413	830	888	780	659	69	183	78	7703	1184	89,727

^a Bird/other Wildlife Strike Report submitted to FAA-AAS or to NWSD manager. Electronic form was activated in April 2001.

^b Airline, airport, or engine manufacturer report or data (not on Form 5200-7) submitted directly to NWSD manager.

^c Preliminary Aircraft Incident Report (various FAA regional office forms), FAA Accident/Incident Report (FAA Form 8020-23, formerly 8020-5 and 8020-16), Daily Report, or Aircraft Incident Preliminary Notice (FAA Form 8020-9) submitted to FAA-AAS or to NWSD manager from FAA regional offices.

^d Aviation Safety Reporting System (NASA).

^e National Transportation Safety Board.

^f Miscellaneous sources, primarily news media and aviation industry publications.

^g More than one type of report was filed for the same strike event.

Table A-4. Strikes Reported via Miscellaneous FAA Forms and Reports and Number of Strikes per 1 Million Aircraft Movements (See figure B-4 for graphic depiction of data.)

FAA Region	Strikes Reported via Miscellaneous FAA Forms and Reports ^a					Civil Aircraft Movements (millions) 2004-2008 ^b	Reports per 1 Million Movements
	PACI Report	A/I Report	Daily Report	AA/IP Notice	Total		
ANM	228	2	140	1	371	57.5	6.5
ASW	1	7	130	2	140	67.6	2.1
AWP	0	12	126	0	138	93.9	1.5
AEA	10	11	24	0	45	67.1	0.7
ANE	0	5	10	0	15	23.9	0.6
AGL	16	10	16	1	43	91.3	0.5
ASO	2	15	5	4	26	117.2	0.2
AAL	0	0	0	1	1	9.9	0.1
ACE	1	0	2	0	3	20.9	0.1
All FAA regions	258	62	453	9	782	549.3	1.4
Foreign and unknown	9	5	6	0	20		
Total	267	67	459	9	802		

^aPreliminary Aircraft Incident Report (various FAA regional office forms), FAA Accident/Incident Report (FAA Form 8020-23), Daily Report, or Aircraft Incident Preliminary Notice (FAA Form 8020-9) submitted to FAA-AAS or to database manager from FAA regional offices. See also table A-3.

^bFrom FAA Terminal Area Forecast system [A-4].

Table A-5. Estimate of the Percent of Deer Strikes in U.S. Reported to the FAA-AAS for Inclusion in the NWSD (Based on a comparison of strike reports found in the FAA accident/incident data system (AIDS) with strike reports in the NWSD, 1990-2008.^a See figure B-5 for trend analysis.)

Year	Total Number of Strike Reports					Percent of Strikes in NWSD in Relation to	
	In AIDS Database (A)	In Both AIDS and NWSD (B)	In NWSD but not AIDS Database (C)	In NWSD (B+C)	In Combined Databases (A+C) ^b	AIDS Database (B/A) ^c	Total for Combined Databases (B+C)/(A+C) ^d
1990	35	3	10	13	45	8.6	28.9
1991	25	5	22	27	47	20.0	57.4
1992	41	23	22	45	63	56.1	71.4
1993	30	16	18	34	48	53.3	70.8
1994	30	20	36	56	66	66.7	84.8
1995	29	12	27	39	56	41.4	69.6
1996	28	25	32	57	60	89.3	95.0
1997	27	24	34	58	61	88.9	95.1
1998	36	30	30	60	66	83.3	90.9
1999	22	15	31	46	53	68.2	86.8
2000	26	19	31	50	57	73.1	87.7
2001	18	16	37	53	55	88.9	96.4
2002	15	12	24	36	39	80.0	92.3
2003	15	14	31	45	46	93.3	97.8
2004	22	13	24	37	46	59.1	80.4
2005	20	16	22	38	42	80.0	90.5
2006	17	12	22	34	39	70.6	87.2
2007	14	11	17	28	31	78.6	90.3
2008	7	5	18	23	25	71.4	92.0
Total	457	291	488	779	945	63.7	82.4

^a For NWSD, see [A-2]; for AIDS, see [A-5].

^b The total number of nonduplicating wildlife strike events involving deer that occurred based on the combined AIDS and NWSD databases. The number of additional strike events involving deer not recorded in either database is unknown.

^c Overall, 291 (63.7%) of the 457 deer strikes recorded in the AIDS database had been reported to FAA-AAS for inclusion in the NWSD.

^d Overall, 779 (82.4%) of the 945 total known deer strikes, based on the combined AIDS and NWSD databases, had been reported to the FAA-AAS for inclusion in the NWSD. The AIDS database contained 166 deer strikes not reported to the FAA-AAS.

Table A-6. Estimate of the Percent of Non-deer, Wild Ungulate Strikes in U.S. Reported to the FAA-AAS for Inclusion in the NWSD (Based on a comparison of strike reports found in the FAA Accident/Incident Data System (AIDS) with strike reports in the NWSD, 1990-2008.^{a)}

	Total Number of Strike Reports					Percent of Strikes in NWSD in Relation to	
	In AIDS Database (A)	In Both AIDS and NWSD (B)	In NWSD but not AIDS Database (C)	In NWSD (B+C)	In Combined Databases (A+C) ^b	AIDS Database (B/A) ^c	Total for Combined Databases (B+C)/(A+C) ^d
Elk	4	2	6	8	10	50	80
Pronghorn	4	3	4	7	8	75	88
Moose	1	0	4	4	5	0	80
Caribou	1	1	1	2	2	100	100
Total	10	6	15	21	25	60	84

^aFor NWSD, see [A-2]; for AIDS, [A-5].

^bThe total number of nonduplicating wildlife strike events involving non-deer, wild ungulates that occurred based on the combined AIDS and NWSD databases. The number of additional strike events involving these species not recorded in either database is unknown.

^cOverall, 6 (60%) of the 10 non-deer, wild ungulate strikes recorded in the AIDS database had been reported to the FAA-AAS for inclusion in the NWSD.

^dOverall, 21 (84%) of the 25 total known non-deer, wild ungulate strikes, based on the combined AIDS and NWSD databases, had been reported to the FAA-AAS for inclusion in the NWSD.

REFERENCES.

- A-1. Dolbeer, R.A., "Wildlife Strike Reporting, Part 1—Trends in a Voluntary System 1990-2008," FAA report DOT/FAA/AR-09/62, December 2009.
- A-2. Dolbeer, R.A., Wright, S.E., and Weller, J., "Wildlife Strikes to Civil Aircraft in the United States, 1990–2008," U.S. Department of Transportation, Federal Aviation Administration, Serial Report No. 15 DOT/FAA/AS/00-6(AAS-310), Washington, DC, 2009 (in press).
- A-3. Dolbeer, R.A., Wright, S.E., and Eschenfelder, P., "Animal Ambush at the Airport: The Need to Broaden ICAO Standards for Bird Strikes to Include Terrestrial Wildlife," *International Bird Strike Committee*, Athens, Greece, May 2005.
- A-4. FAA, Terminal Area Forecast (TAF) System, available at <http://aspm.faa.gov/main/taf.asp> (last visited 11/23/09).

- A-5. FAA Accident/Incident Data System (AIDS) in *Aviation Safety Information Analysis and Sharing (ASIAS) System*, Federal Aviation Administration, Washington, DC, 2009 available at <http://www.asias.faa.gov/> (last visited 11/23/09).

APPENDIX B—FIGURES

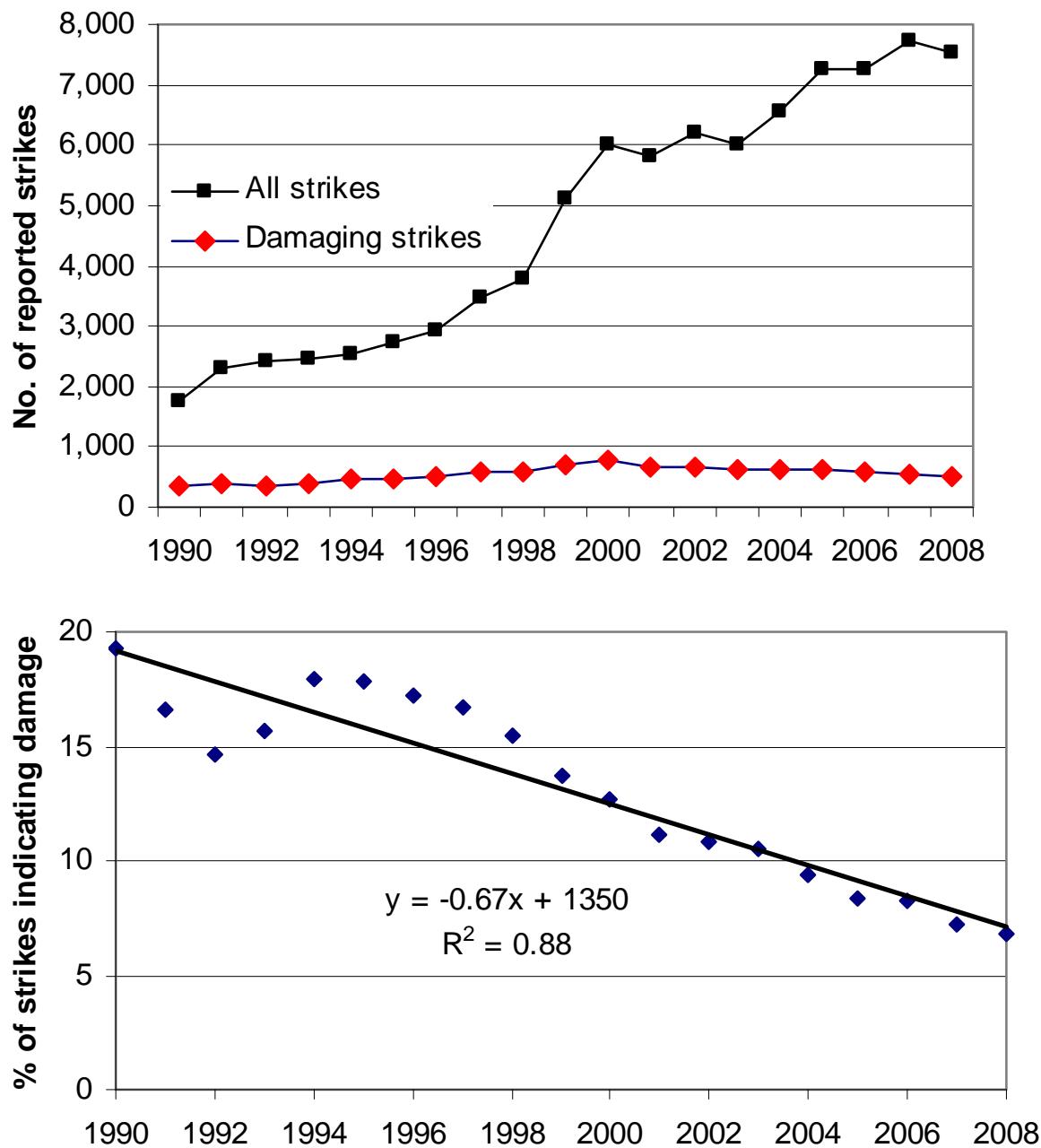


Figure B-1. Number of Reported Wildlife Strikes to Civil Aircraft and Strikes With Reported Damage (top) and Percent of Reported Strikes Indicating Damage (bottom) (Federal Aviation Administration (FAA) National Wildlife Strike Database, 1990–2008. (See table A-1. R^2 values (percent of variation in the dependent variable [y axis] explained by the linear equation) greater than 0.21 are significant at the 0.05 level of probability with 17 degrees of freedom [B-1].)

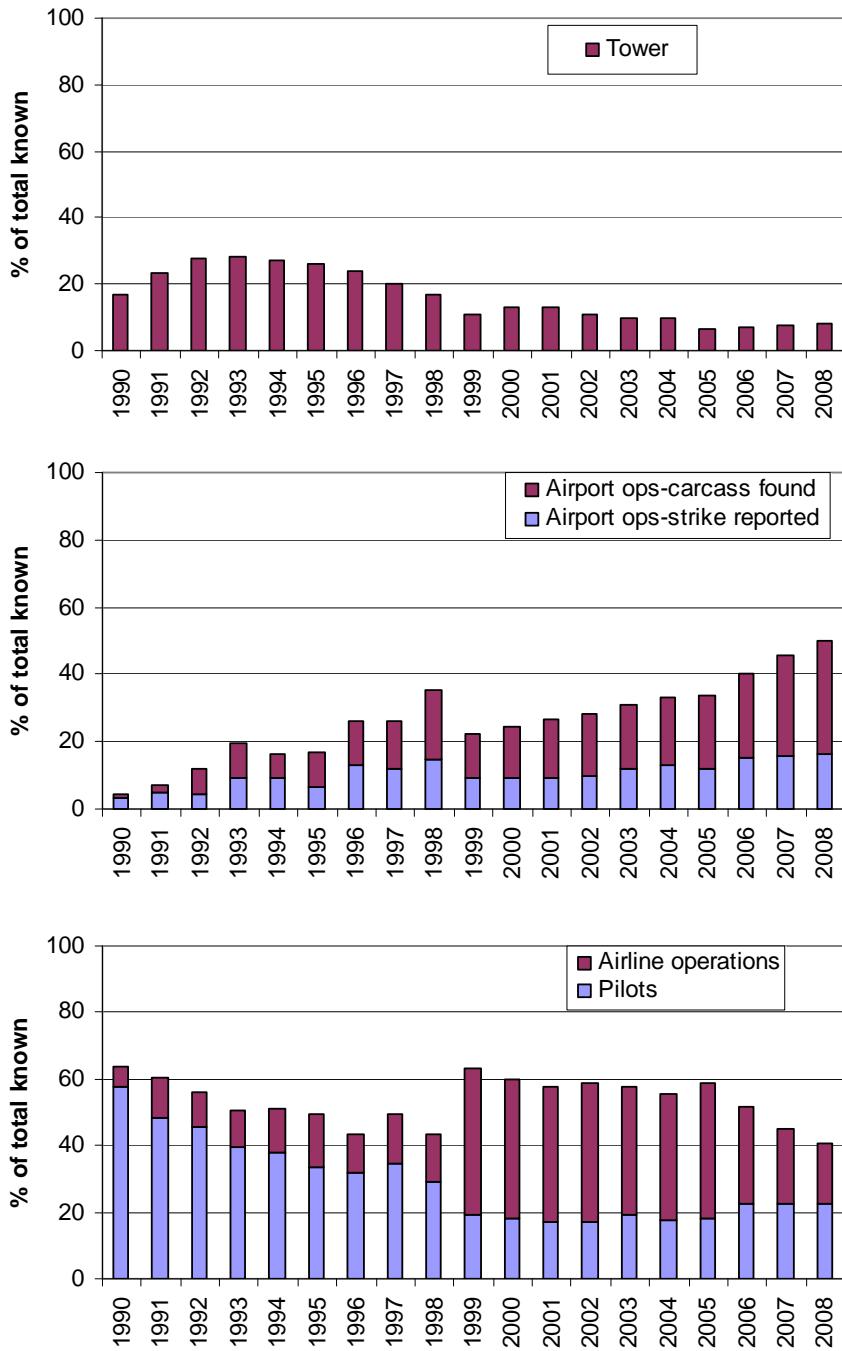


Figure B-2. Persons Filing Wildlife Strike Report to FAA-AAS or to the NWSD Manager
(See table A-2.)

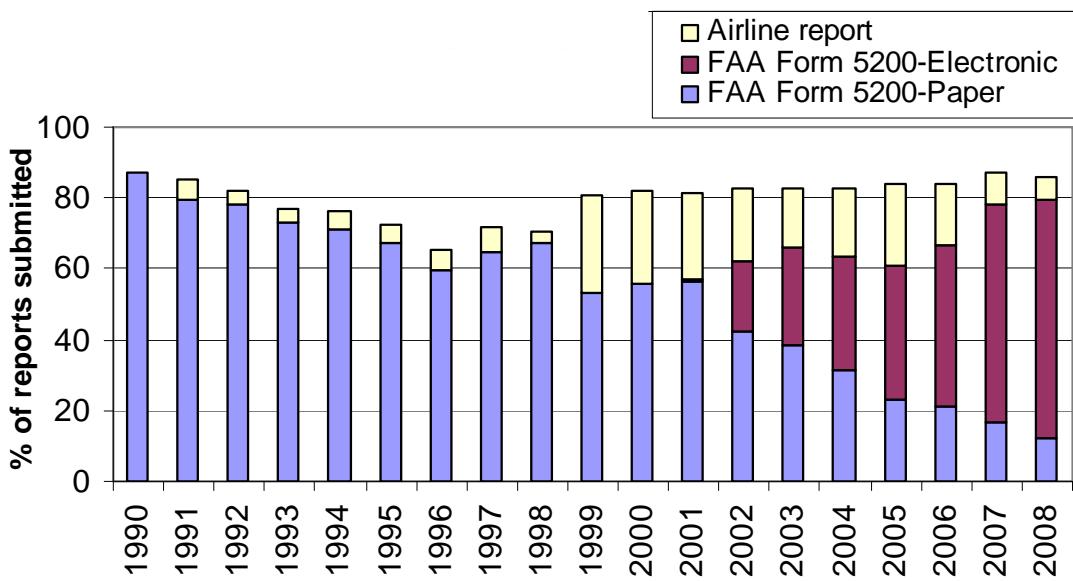


Figure B-3. Percentage of Wildlife Strike Reports Submitted to FAA-AAS on FAA Form 5200-7 (paper or electronic) and by Airlines to the NWSD Manager (See figure B-4 (note difference in scale of y axis) and table A-3 for other methods of reporting strikes to FAA-AAS or to the database manager for entry into the NWSD.)

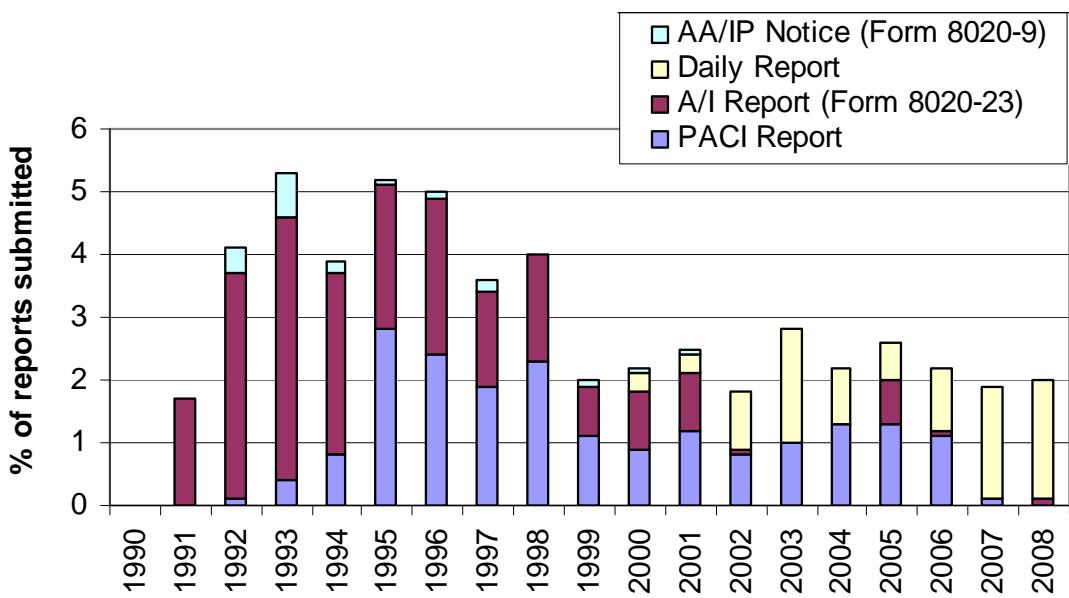


Figure B-4. Percentage of Wildlife Strike Reports Submitted to FAA-AAS or to the NWSD Manager via Four FAA Reporting or Notice Forms by FAA Regional Offices (See figure B-3 (note difference in scale of y axis) and table A-3 for other methods of reporting strikes to FAA-AAS or to the database manager for entry into the NWSD.)

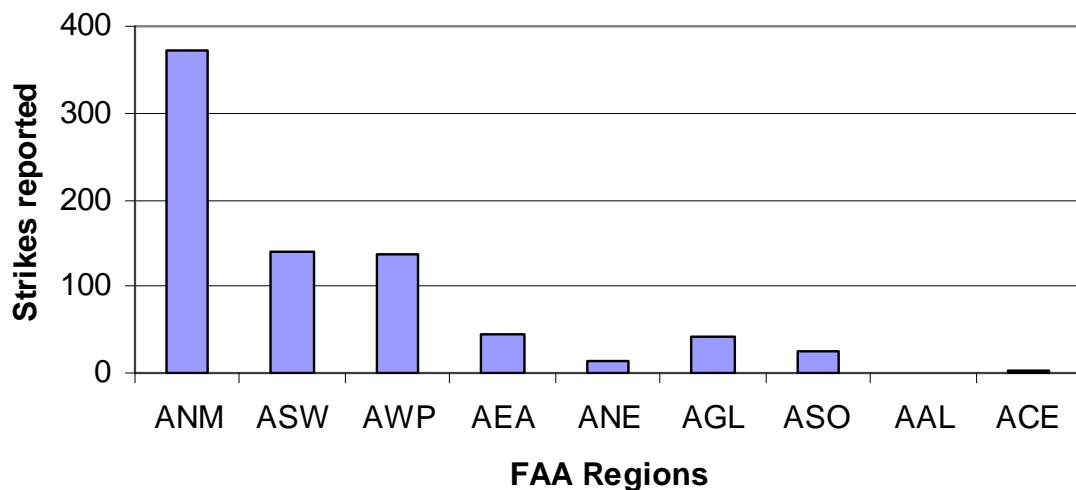


Figure B-5. Total Number of Wildlife Strike Reports Submitted to FAA-AAS or to the NWSD Manager From FAA Regional Offices via Miscellaneous Forms and Reports

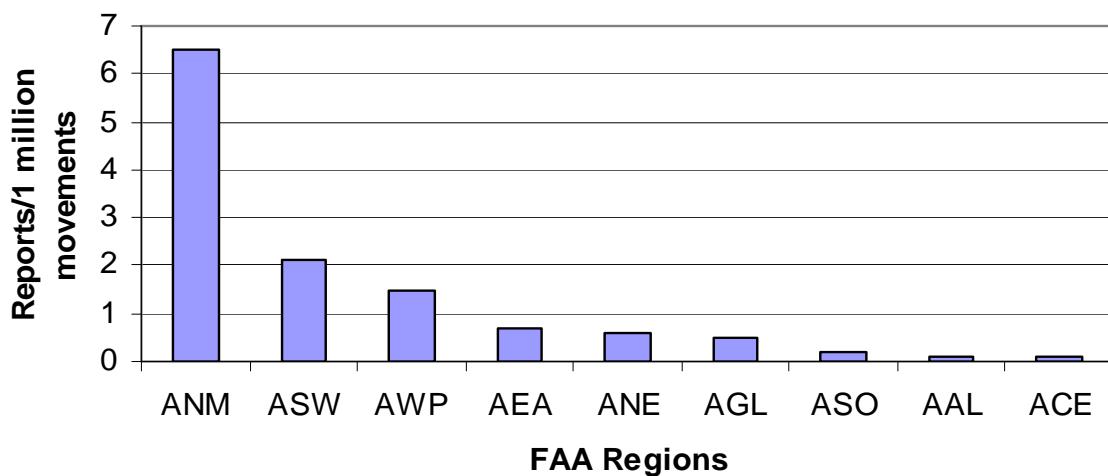


Figure B-6. The Number of Reports Involving Wildlife Strikes per 1 Million Aircraft Movements Submitted to FAA-AAS or to NWSD Manager From FAA Regional Offices via Miscellaneous FAA Forms and Reports (Preliminary Aircraft Incident Report [various FAA regional office forms], FAA Accident/Incident Report [FAA Form 8020-23], Daily Report, or Aircraft Incident Preliminary Notice [FAA Form 8020-9]), 2004-2008. See also table A-4.)

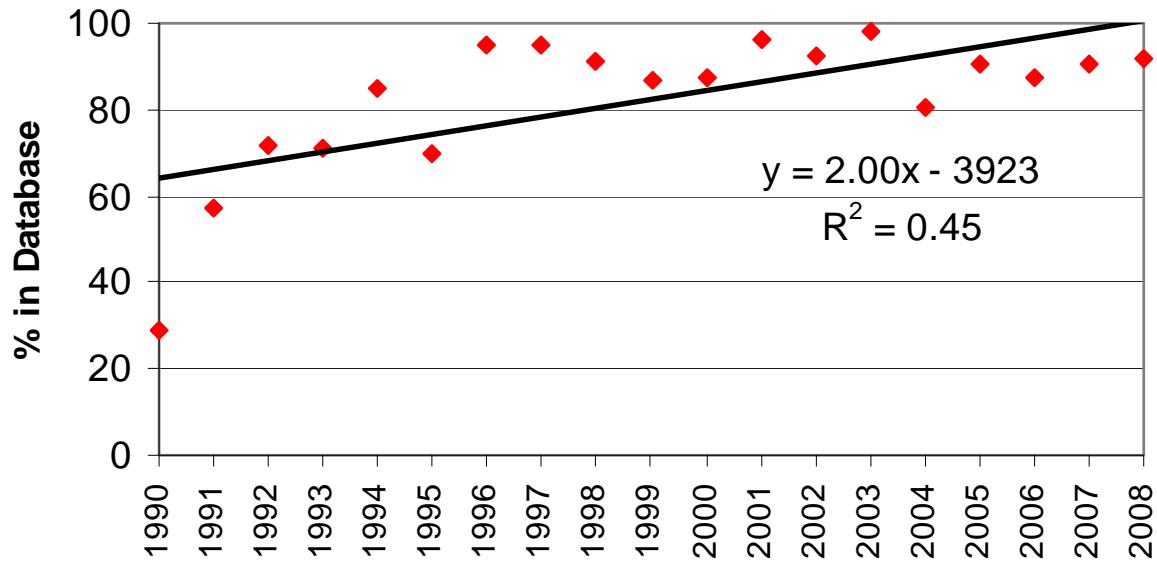


Figure B-7. The Trend in the Estimated Percent of Deer Strikes Reported to the FAA for Inclusion in the NWSD (These estimates are based on a comparison of strike reports found in the FAA Accident/Incident Database System (AIDS) with strike reports in the NWSD, 1990-2008.

Overall, 779 (82%) of the 945 total known deer strikes, based on the combined AIDS and NWSD databases, had been reported to the FAA for inclusion in the NWSD. The number of additional wildlife strike events not recorded in either database is unknown. See table A-5. R^2 values (percent of variation in the dependent variable [y axis] explained by the linear equation) greater than 0.21 are significant at the 0.05 level of probability with 17 degrees of freedom [B-1].)

REFERENCE.

- B-1. Steele, R.G.D. and Torre, J.H., *Principles and Procedures of Statistics*, McGraw-Hill New York, 1960.