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Raising Public Awareness of Bird Strike Risk Issues with an Enhanced Bird Strike Committee USA Web Site

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Abstract

Since 1997, a World Wide Web site managed by a member of Bird Strike Committee USA and a site managed by the Committee leadership were instrumental in supporting Committee efforts to reduce these hazards. Based on insights gained from these two Web sites, a new site was created that contained the most effective elements of the earlier sites and new elements designed to enhance the ability of the Committee to accomplish its mission. The new elements included the acquisition and use of the domain name *birdstrike.org*, the ability to electronically submit bird and other wildlife strike reports directly into the Federal Aviation Administration or Transport Canada strike databases, and a detailed risk assessment for bird strike related jet transport accidents in the U.S. and Canada. The risk assessment estimated that there is a 25% chance of a bird strike related fatal jet transport accident in the next 10 years.

The paper provides an overview of the development process for the new Web site and a review of how the formal risk assessment was used to raise public awareness of this bird hazard issues. Also discussed was how the Web based risk assessment supported the efforts of Bird Strike Committee USA to advocate changes to reduce the risks associated with that hazard. The paper includes two exhibits containing both the risk assessment that is on the site and background information on the techniques of risk assessment.

At the November 1996 at the 25th meeting of Bird Strike Committee Canada, I made a case for using the Web as a communications tool and laid out a basic plan for putting a site on the Web. Since then the Web has grown as a communications medium in ways that could not have been dreamed of two and a half years ago. The FAA, Transport Canada, the Bird Strike Committee of Italy, and several companies and individuals have developed sites devoted to some aspect of bird and other wildlife strikes to aircraft. The growing influence of the Web could no longer be ignored by the wildlife hazard community. One of the key questions for Bird Strike Committee USA was how could the Web be used to further the Committee's goals.

In early 1997, I dedicated a part of my personal Web site, Airsafe.com, to bird hazard issues. That part of my site included a listing of significant bird strikes, basic facts about bird hazards, and a risk assessment that gave an estimated probability of a bird strike related fatal jet transport accident in the U.S. or Canada during the next decade. Bird Strike Committee USA started a Web site that provided an overview of the organization and of bird and other wildlife strike hazards. Both sites were a successfully attracted the attention of airport managers, bird hazard specialists, the media and others with an interest in bird hazard related issues. My personal site often attracted visitors who I immediately directed to more appropriate contacts such as Richard Dolbeer of the USDA, Bruce MacKinnon of Transport Canada, or the U.S. Air Force Bird Aircraft Strike Hazard (BASH) team. Some media contacts led to of articles in major newspapers and a major segment on a national U.S. prime time television news program.

Based on my experiences with the site, last year I proposed to the chair of Bird Strike Committee USA, Richard Dolbeer, that I develop an enhanced Committee Web site that would combine the most successful elements of the two previous sites as well as have additional content. After accepting the proposal, and with funding from the U.S. Department of Agriculture, I worked with the Committee to provide the following capabilities in the new site:

- Allow Online Input of Bird and other wildlife Strike Reports - The FAA estimates that only 20% of all wildlife strikes in the U.S. or to U.S. aircraft are currently reported. There is a link on the home page of the new site that takes a user directly to a page with online input forms for both the FAA and Transport Canada bird and other wildlife strike databases. A user may also print out the FAA form.
- Increase the Public Presence of Bird Strike Committee USA - The Committee does not have a permanent staff to handle the functions of a public affairs office, so the site provides background information for both the media and for aviation professionals with an interest in the work of the Committee. The background information on the site answers basic questions and provides contact information for key committee members and for bird and other wildlife strike resources. A key part of this increased public presence was the acquisition and use of the domain name *birdstrike.org*.
- Promote the Regulatory and Policy Agenda of the Committee - Communicating to the public the risk posed by bird and other wildlife strikes to aircraft is an ongoing challenge. Airport operators, the media, government regulators, the flying public, and aviation professionals have varying concerns about this aviation risk and often turn to the wildlife hazard community for information and insight. The current Web site addresses some of these concerns by providing records of recent wildlife strikes, an overview of wildlife related risks, and a list of key risk reduction.

Overview of the Site

The new site was intended to serve a limited number of functions for Bird Strike Committee USA. Its primary purpose is to inform a user of some of the basic facts about the hazards posed by bird and other wildlife strikes to aircraft. The intended audience included aviation professionals, the media, and those involved with bird and other wildlife strike hazards. The intent of the site is reflected in the site's major components:

- Bird Strike Committee Background Information - The home page provides information on the Committee, its history, meetings, and basic facts about bird and other wildlife strikes to aircraft.
- Bird and other wildlife Strike Reporting - A link on the home page will take a visitor directly to a second page that will allow online reporting to either the FAA or the Transport Canada bird and other wildlife strike databases.
- Bird and other wildlife Strike Hazards to Aircraft - Several pages provide a basic introduction to the potential hazard by providing a general overview of the threat, a list of common misperceptions about the threat, a list of past major bird strike events, and a selection of recent bird and other wildlife strikes from the FAA database.
- Related Resources - One page provides links to Web sites that have a bird or wildlife hazard related news article, military wildlife hazard related sites, and other bird and other wildlife related hazard sites. A second page provides links to online versions of bird and other wildlife hazard related research papers.
- Administrative Information - The site provides contact information for key Bird Strike Committee USA members as well as a copyright notice and a disclaimer. The disclaimer was considered necessary in part to make it clear to any Web site visitors that Bird Strike Committee USA and its members are providing information but are not offering legal or other professional services.
- Meetings - The site provides several pages and related links to support the May 1999 Bird Strike '99 meeting in Vancouver, BC. The registration, schedule, and other information on the site were intended to support those individuals and organizations that were responsible for putting on the meeting.
- Risk Assessment - One page has a detailed risk assessment for the likelihood of a fatal bird strike related accident in the U.S. or Canada in the next ten years. A second page presents a list of key issues related to reducing the overall risk. A third page provides a basic overview of risk assessment. Together, these pages form the core of Bird Strike Committee USA's efforts to use factual data and the basic techniques of risk assessment to affect changes in operational procedures and regulatory policy.

Bird Hazards and Risk Assessment

The risk assessment portion of the site was a key feature because of its central role in both bringing attention to the problem and supporting the Committee's work. Although birds were a well recognized hazard to aircraft, there was an ongoing problem with keeping the attention of the industry on the problem and attracting the resources necessary to deal with the problem. Overcoming this resource restriction is difficult for two reasons: a limited awareness and understanding of the problem on the part of the public and the aviation community, and competition for resources fom multitude of other aviation hazards. Both problems would likely be eliminated if there were a disastrous airline accident involving the loss of hundreds of lives. As Captain Paul Eschenfelder of the Air Line Pilots Association (ALPA) puts it, "We'll be sweeping off the runway with thousand dollar bills if there is a serious airline accident caused by a bird strike."

A serious accident, especially in the United States or Canada, would probably lead to high levels of attention and funding directed at the strike issue. However, the goal of Bird Strike Committee USA and of the wildlife hazard community in general is to address this hazard *before* there is another serious accident. There are two kinds of actions that can lead to a reduction of the risk: applying proven and effective risk

reduction methods or performing the necessary research and development to find other effective methods. This part of the solution to the problem is scientifically and technologically feasible. The more difficult part of the problem is to convince the public and the aviation community that such efforts are worth doing.

Bird Strike Committee USA has effectively used the techniques of risk assessment to focus public attention on wildlife hazards to aircraft and will continue to use risk assessment to illustrate the need to reduce bird and other wildlife strike related risks. This paper will describe the basic concepts of risk assessment and how a risk assessment combined with the use of the World Wide Web was instrumental in focusing media and public attention on this risk.

The Dilemma

Bird and other wildlife hazards to aircraft is an economic and social issue that goes beyond aviation. The key economic issue is that when it comes to dealing with the problem, those responsible for dealing with the problem may not derive any benefit from their risk reduction actions. For example, the majority of bird and other wildlife strikes take place on or near airports. Airport authorities have a responsibility to deal with bird and other wildlife threats, but aircraft operators are the primary beneficiaries of their actions. Airports in the U.S. and Canada may have legal and regulatory impediments that prevent them from directly charging aircraft operators for specific strike reduction activities.

A key social issue is that different groups that affected by bird and wildlife hazards, groups like the airlines, aircraft and engine manufacturers, airport operators, flight crews, and national governments, have different interests. The actions of any one group can change how all of the other groups are affected by the problem. For example, laws and regulations of the U.S. and Canada restrict actions that can be taken against birds that pose a hazard to aircraft. Since isolated efforts are unlikely to lead to a significant reduction in the threat, Bird Strike Committee USA and others in the wildlife hazard community has to communicate the risk to all affected groups as a first step toward coordinating risk reduction efforts.

Bird Strike Committee USA Risk Assessment Objectives

The fatal accident risk assessment results supported a two part approach to reducing the risk: making the public aware of the risk and convincing the aviation community to take positive actions to reduce the risk. The use of a formal risk assessment directly supported both approaches. One of the two goals of the assessment of bird strike related risk for large jet transports in the U.S. and Canada was to use the available data to present a systematic assessment of the probability of serious accidents. The second goal was to make the results of the assessment accessible to the general public and to the wildlife hazard community. Accessibility in this context meant two things: making the assessment widely available and presenting the results in a form that would be easy for the intended audience of to understand.

The first goal was key because the potential hazard reduction actions of many of the groups that are affected by the problem must also adhere to the rules of some of the regulatory agencies of the U.S. federal government. Risk assessment plays a crucial role in the development of regulations at most federal agencies. Guidance on the use of risk assessment comes from the Executive Branch, specifically Executive Order 12866, which was signed by President Clinton in September 1993. This Executive Order was part of the Clinton Administration's efforts to reform and make more efficient the regulatory process for both new and existing regulations. The Administration's regulatory philosophy includes the use of cost benefit analysis and an acknowledgment that qualitative measures of costs and benefits such as economic, environmental, and safety be considered. Principles of regulation include considering the degree and nature of risks posed by various activities within an agency's jurisdiction when setting priorities, designing the most cost effective regulations, and proposing or adopting regulations where the intended benefits justify the costs. (Clinton 1993).

What this means for bird and other wildlife strike hazards is that any change in regulations for organizations such as the Federal Aviation Administration, the U.S. Department of Agriculture (USDA), or the Environmental Protection Agency will likely have to be justified with a cost benefit analysis that includes some kind of formal risk assessment.

To achieve the second goal of making the results of the assessment accessible in the sense of widely available, the entire assessment was placed on the Web to facilitate easy access to the aviation community, the news media, and the general public. While it was important to have the entire analysis available to allow a detailed review of its methods, data, and conclusions, it was equally important to make the results comprehensible to a majority of the intended audience by providing a very short synopsis of the key findings. That short synopsis was designed to be a "sound bite," a concise and informative statement which stood a good chance of being quoted in its entirety by the news media. The basic statement was " In the next ten years, there is about a 25% chance that a large jet will have a fatal bird strike related accident in the U.S. or Canada." Variations on that statement were used in the last year in a number of newspaper articles and television news shows. Several Committee members, including Dr. Richard Dolbeer of the USDA, and Captain Paul Eschenfelder of ALPA have had this "25% risk" statement quoted by the media or have used a similar statement at major aviation gatherings such as the 1997 conference of National Aerospace FOD Prevention, Inc. Although the risk assessment was originally created and placed on the Web in 1997 to support the work of Bird Strike Committee USA, the assessment was part of the author's private site Airsafe.com. The assessment was moved into the revised Committee site in February 1999.

Risk Assessment Fundamentals

Risk assessment is broadly defined as the description of potential losses from a given hazard and consists of a paradigm of four conceptual steps that were first produced by the National Academy of Sciences in 1983 and which have been generally accepted by the U.S. government (Commission on Risk Assessment and Risk Management 1996; Lave 1982; OMB 1997b; Russell and Gruber 1987):
1. Stating objectives and assumptions
2. Hazard identification,
3. Exposure assessment, and
4. Risk characterization.

The first step of stating objectives and assumptions serves to differentiate risk assessments and sets boundaries on the risk assessment. The second step of hazard identification would include the collection of the relevant facts and data about the hazard and identifying what system or organism may be affected. The third step of exposure assessment includes determining factual information such as the relevant exposure patterns or susceptibility of a system or a population to the hazard of interest. Questions at this stage address the route or pattern of exposures, the population exposed, and the characteristics of the exposure to the hazard. This step includes making judgments such as what risks should be considered and what the causal relationship may be between an exposure to a risk and the outcome experienced by the system or population. The fourth step of risk characterization represents the transition between the more objective tasks of risk assessment and the more subjective and value laden tasks of managing risks. It integrates the results of other parts of risk assessment, evaluates the strengths and weaknesses of the assumptions, the data, and the uncertainties in the analysis and the conclusions, and communicates these results to the risk managers, stakeholders, and to others. This task creates a synopsis of all the information that contributes to a conclusion about the nature of the risk and of the assessment of that risk.

In the case of bird strikes to aircraft, the risk assessment that has been used by Bird Strike Committee USA contains all of these elements. A review of risk assessment, in the form of a list of frequently asked questions and their answers, was included on the Bird Strike Committee USA Web site. The content of the site can be reviewed either on the Web at http://www.birdstrike.org/risk/risk_faq.htm or in Exhibit 2. This

overview was presented in the form of a listing of answers to common questions about risk assessment. Together, the two exhibits provide the details and background needed to understand the methods, data, and conclusion of the assessment.

Web Site Planning and Development

While the Web represents a relatively new communications medium with specific and unique technical challenges, planning and designing a Web site shares many of the attributes of other creative and technical projects. As is the case with the building of a large project such as a bridge or a house, there are several specific tasks that have to be accomplished between the initial concept of a Web site and its initial launch on the Web. Maintenance and other tasks have to be accomplished for as long as the site is active. Any organization's Web site, including the Bird Strike Committee USA site, is not an end in itself, but a means to achieve specific goals. Keeping those goals in mind focused all efforts from initial concept to the launch of the site.

In the initial planning of the Web site, two sets of issues were addressed. The first was deciding how a Web site best fit within the mission of Bird Strike Committee USA. The second set of issues included more practical considerations such as how to design and administer the site. The tasks between initial planning and long term administration of a site can be divided into several distinct categories:

1. Getting a plan together,
2. Reserving a domain name,
3. Finding an organization to host the site,
4. Finding the resources for building the site,
5. Creating the site's content,
6. Testing the site,
7. Attracting visitors (advertising and marketing the site), and
8. Launching the site,
9. Maintaining the site,
10. Improving the site.

These activities are not necessarily performed sequentially and some activities have to precede others. For most successful sites, all activities follow the planning stage and those plans are shaped by the organizations goals and resources, and by the technical limitations of the Web. While some of these activities - most notably site maintenance, ongoing improvement, and attracting visitors - are not necessary to keep a site on the Web, not performing these actions puts a Web site at risk of becoming ineffective and irrelevant to the intended audience.

Site Design and Function

Based on the requirements for the site and feedback from Committee members, the site was designed for ease of use with the most commonly used Web browsers. The site was tested on several different hardware and software platforms to ensure that site navigation would not be impeded. The software and hardware combinations for the tests included the following:

- 15", 17", and 20" monitors on computers using Netscape version 3.0,
- 15" monitors on computers using Netscape versions 2.0, 3.0 and 4.5, and
- 15" monitors on computers using Internet Explorer 4.0.

One of the goals for the site was to have a layout and design that would not tax the capability of most personal computers. While the site does make some use of color and graphics, it does not have frames, animation, or other non-textual elements that increase the time needed to load each page. Also, the graphics and background colors were not necessary to view the written content of the site. The size and number of files that make up the site were limited to allow the entire site's contents to fit on one standard 1.4 megabyte capacity floppy disk. This left open the possibility of providing wildlife hazard professionals, especially those in areas where Web access is unavailable, unreliable, or expensive, with the ability to have access to all the site's contents without having to access the Web.

Pre-Launch Activities

The first site development activity of getting a plan together, and the fifth step of creating the site's content were not difficult because much of the content was already online on the Airsafe.com site and the previous Committee site. The general plan for the site was also not very complex - incorporate the content from the two previously existing sites and turn control of the finished site over to the Committee. My intent was to provide the Committee with a "turnkey" system consisting of an active Web site and sufficient documentation to guide the Committee in developing a long term maintenance plan for the site. The third step of choosing a host organization for the Web site was also not difficult. Because the Committee did not have any dedicated computer resources, a commercial Internet Service Provider (ISP) was chosen to host the site and provide several other services such as email forwarding and usage statistics.

No exotic hardware or software resources were required to develop this site. A desktop computer with a standard word processing program, a Web browser, a File Transfer Protocol (FTP) program, and a connection to the Internet were the only hardware and software resources needed during the design and testing phases of the site. Most new desktop computer systems come equipped with most or all of these capabilities. Internet access is available through the information technology departments within many medium or large organizations and is widely available from numerous commercial ISPs. The FTP program allows files to be transferred between separate computers through a telephone or Internet connection. For a Web site developer, the two computers are usually the computer where the site is developed and tested and the computer of the organization that hosts the Web site.

The second step of choosing a domain name was key step for the new Bird Strike Committee USA site. I chose the name of *birdstrike.org* for the site for two reasons: the title is related to the purpose of the organization and it is relatively easy to remember. The second point is especially important for any future actions for getting the Web site more widely known. Having an easily remembered address on the Web is especially important because the Committee does not a permanent physical address. The membership and the leadership may change, but the Web site address will remain constant. The domain name is included in the Web address, called a URL or Uniform Resource Locator, of every page on the site. The URL for the home page is *http://www.birdstrike.org*. The URL *http://birdstrike.org*. will also work for the home page.

The other pre-launch activities were split between myself and Dr. Richard Dolbeer's staff at the USDA. I had

the primary responsibility for developing the site's content, testing the site, launching the site, and coordinating initial marketing and advertising efforts. Dr. Dolbeer was responsible for site maintenance, site improvement, and ongoing administrative activities. The site development effort was accomplished primarily through phone, fax, and email. However, a key factor in the successful development of the site was one face to face meeting between myself and Dr. Dolbeer's staff. This meeting resolved a number of technical issues relating to coordination of effort and other issues related to refining the contents of the site.

Initial Post Launch Activities

As soon as the new site became active in February 1999, several actions were planned: sending an email notice to members of the wildlife hazard community, sending similar notices to members of the media, listing the site on a variety of Web search engines and directories, and incorporating the new home page address of *www.birdstrike.org* into written communications of the Committee. Further changes in the site would depend of feedback from the users and on events that would make changes in the site's information necessary.

Conclusion

The planning, development, and launch of the enhanced site was only the first of many Web related activities for Bird Strike Committee USA. As the Web becomes an even more vital communications medium for the wildlife hazard community, the use of the Web and the other parts of the Internet will become more important to the Committee's mission. The acquisition of a domain name, the launch of the enhanced site, and the initial actions to promote use of the site has given the Committee a firm foundation for using the Web to promote its long term goals.

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Exhibit 1: Risk Assessment Basics

This overview of risk assessment is available at www.birdstrike.org/risk/risk_faq.htm

What is Risk?

A common definition of risk is that it is the combination of a specific hazard and the likelihood that the hazard occurs (probability)x(hazard) = risk. That likelihood may be expressed as a rate or a probability. For example the risk of an aircraft accident (hazard) can be expressed as one accident per million flights (likelihood).

Risk can be objectively defined so that two people can take the same data and come up with a similar result. Risk can be expressed in many ways, so long as it combines a hazard with a likelihood. The concept of risk exists in aviation, finance, human health, and many other areas. One can use the methods of science, engineering, and math in order to define risks.

What is Risk Assessment?

Risk assessment is the process of analyzing potential losses from a given hazard using a combination of known information about the situation, knowledge about the underlying process, and judgment about the information that is not known or well understood. Risk is defined as the product of a hazard (such as damage costs) and the probability that this hazard occurs. In other words, (probability)x(hazard) = risk. The first two values must be known or at least estimated in order to define risk.

What are the Goals of Risk Assessment?

The basic goals of risk assessment include the following:
- Identify potentially hazardous situations,
- Estimating the likelihood that a hazard occurs and the uncertainty in the estimate,
- Provide alternative solutions to reduce the risk,
- Estimate the effectiveness of those solutions,
- Provide information to base a risk management decision, and
- Estimate the uncertainty associated with the analysis.

What is the Procedure for Performing a Risk Assessment?

Risk assessment consists of four general steps:
1. Hazard Identification,
2. Evaluating relationship between exposure to a risk and adverse effects,
3. Exposure assessment - evaluating the conditions that lead to exposure to a risk, and
4. Risk characterization - describe nature of adverse effects, their likelihood, and the strength of the evidence behind these characterizations (often done by using probability and statistics).

How Do I Estimate Risk?

Estimating risk can be done in several ways:
- With historical data,
- By modeling,
- If no data is available, by breaking down the system into known subsystems using techniques such as event trees or fault trees,
- By analogy with similar situations, or
- By comparison with similar activities.

What is the Point of Doing a Risk Assessment?

The risk assessment for a particular issue forms the foundation for making a decision about future actions. That decision may be to perform additional analyses, to perform activities that reduce the risk, or to do nothing at all.

What is Risk Management?

The process of combining a risk assessment with decisions on how to address that risk is called risk management. Risk management is part of a larger decision process that considers the technical and social aspects of the risk situation. Risk assessments are performed primarily for the purpose of providing information and insight to those who make decisions about how that risk should be managed. Judgment and values enter into risk assessment in the context of what techniques one should use to objectively describe and evaluate risk. Judgment and values enter into risk management in the context of what is the most effective and socially acceptable solution

How Do You Combine Risk Assessment with Risk Management?

The combined risk assessment and risk management process can be described as a six step process. The first three steps are associated with risk assessment and the last three with risk management.
1. Formulate problem in a broad context - Do this by answering questions like "What is the problem?", "Who must manage the problem?", and "Who are the stakeholders?" Also, establish relationships among the problems and rely on stakeholders for problem identification and characterization.
2. Perform the risk analysis - Evaluate the risk in order to determine the hazard, the likelihood of the hazard occurring, and any uncertainties in the estimate
3. Define the options - Determine what can be done about the risk issue and the ways that it could be done. Determine potential consequences, costs, and benefits.
4. Make sound decisions - Determine the best solutions and how they could be implemented in ways that are feasible, cost effective, and socially acceptable.
5. Implement decisions - Find out what actions are needed to implement and deal with any objections

or reassessments.
6. <u>Evaluate actions taken</u> - Determine what is an acceptable and effective means of evaluating the effectiveness or appropriateness of the risk management actions.

**Exhibit 2:   Risk Assessment for Fatal Jet Bird Strike Related
Transport Accident in the U.S. or Canada**

This overview of risk assessment is available at www.birdstrike.org/risk/birdrisk.htm

North American Fatal Accident Risk

The following risk assessment shows that in the next 10 years there is about a 25% probability that a large jet transport will be involved in a fatal bird strike related accident in the U.S. or Canada.

Background

Bird strikes to aircraft have been a concern since the first recorded fatal bird strike in 1912. More recently, bird strikes have led to fatal accidents for large military aircraft in both 1995 and 1996 and to a commercial airliner in 1988. Increasing North American populations of birds such as geese and ducks have led to a significant increase in the threat to aircraft, especially in areas on or near airports. The probability of a fatal bird strike accident can be estimated based on the past bird strike record. Specifically, the following analysis will estimate the probability of a fatal accident involving a bird strike to a large jet transport aircraft occurring in the next ten years in the U.S. or Canada.

Risk Assessment Basics

Risk is defined as the combination of a specific hazard and the likelihood of that hazard. The specific hazards in this context are bird strike events that result in:
1. Both fatalities and aircraft hull loss,
2. Aircraft hull loss only, or
3. Other economic losses ($26 million wildlife losses 1993-1995 from FAA reports).

The likelihood of these three hazards can be roughly estimated from the following information:
  1. Fatal and non-fatal worldwide hull losses since 1959 (five total, one fatal),
  2. Total jet transport flights since 1959 (about 300 million),
  3. Estimated U.S. and Canadian large commercial jet transport flights 1999-2008, (80 million),
  4. Average load factor of 54% (60% for airliners, 0% for cargo jet transports, 10% cargo flights),
  5. Average passenger capacity (130),
  6. Probability a passenger dies in a fatal bird strike accident (0.5), and
  7. Cost of average jet transport (30 million 1997 dollars).

Assuming that the historical world hull loss rate is roughly current underlying rate in the U.S. and Canada,
P(Hull Loss From a Bird Strike Event) = 5/300M = 1.67 x 10-8
P(Fatal | Hull Loss) = 0.2
P(Fatal Hull Loss Event) = 3.3 x 10-9
P(Fatal Hull Loss Event in U.S. or Canada) = (3.3 x 10-9)(8 x 10+6) = 0.027/yr
Assuming a binomial distribution of events, this would imply that over the next decade,
P(Zero Fatal Hull Losses) = 0.763
P(One Fatal Hull Loss) = 0.209
P(Two Fatal Hull Losses) = 0.026
P(Three Fatal Hull Losses) = 0.001
Estimated Fatal Hull Losses = 0.209 + 2(0.026) + 3(0.001) = **0.263**
Note: This last figure means that in the next 10 years there is about a 25% chance of a fatal bird strike accident involving a large jet transport in the U.S. or Canada

Estimated Fatalities = 9.2 = (0.263)(130)(0.54)(0.5)
Estimated Non-Fatal Hull Losses = 1.05 = 4(0.263)

Table 1: Cost In Lives and Property Due to Bird Strikes 1999-2008

Hazard	Estimated Number	Estimated Cost
Lives Lost	9.2	$23 million*
Aircraft Hull Losses	1.3	$39 million
Other Losses	-	$87 million
Total	-	$149 million

* Assume $2.5 million in liability claims per life lost
** Based on 1993-1995 FAA figures for wildlife losses, and
may represent only 1/20th of total economic losses

Glossary

Bookmark: An instruction that the user adds to a browser that directs the browser to a particular resource on the Web. Bookmarking selected resources on the Web allows a person to use the browser to jump to frequently used Web resources.

Browser: Software which allows a computer to interpret formatted Web pages, to display those pages, and to navigate to different pages on the Web. Depending on the content of a Web page, a browser may not be able to display the text, graphics, or other information on a Web page. Two of the most common browsers are Netscape and Internet Explorer.

Domain Name: This is the unique combination of numbers and characters that help identify all the resources on a Web site. The structure of the domain name gives a clue about the hierarchy of the resources in that part of the Web. For example the name *birdstrike.org* represents the highest level of resources on the Bird Strike Committee USA Web site. The unique location of all the resources on that site will have *birdsrike.org* somewhere in the URL.

File Transfer Protocol (FTP): A protocol for moving files between two computers. FTP programs are normally used for sending or retrieving files from a Web site.

Home Page: Usually the central or starting point document of a Web site. Because the individual pages or resources on a Web site have a hierarchical relationship, the home page is usually the page on a Web site that has the shortest URL.

HTML: HyperText Markup Language. One of the fundamental computer languages used to control how a browser displays a Web page and how a Web page is linked to other browsers.

Internet: A worldwide collection of interconnected computer networks that use common communications protocols. Email and the Web are two of the capabilities that are made possible through the use of these protocols.

Internet Service Provider (ISP): A company or department within a company that provides access to the Internet. The computer resources of the ISP serve as an interface between a user's computer system and the resources of the Internet. The typical personal computer would have a modem and one or more software programs that allow services such as email and Web access. For an individual accessing the Internet from a personal computer, the ISP is usually a private company and in large organizations, the ISP may be a department in the organization which serves the same function.

Link: Also known as hyperlinks, these are specific HTML codes that contain instructions that allow the browser to seek out some other resource on the Internet. A link typically appears as highlighted, colored, or underlined text, as a button or other graphical element.

URL: Uniform Resource Locator. A combination of characters and numbers that serves as the unique identifier or address for each resource on the Web. Any browser can use this address to find that resource. For most Web pages, the characters http:// usually precede the Web address. Some browsers may not require the characters http:// to recognize the URL.

Web: See World Wide Web.

Web Page: An electronic file that is located on a computer that is connected to the Internet and which can be accessed by other computers connected to the Internet. The Web page provides the formatting for the Web page's content.

Web Site: A set of related Web pages that are organized and maintained by one entity.

World Wide Web: Often called the Web for short, this is a part of the Internet where resources such as Web pages containing text and images are interconnected by HTML links.