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ENHANCEMENT OF THE FAA's ON-LINE WILDLIFE AIRCRAFT STRIKE DATABASE WITH AN INTERACTIVE GRAPHICS CAPABILITY

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Abstract

Embry-Riddle Aeronautical University (Prescott, AZ, USA) was awarded a grant from the William J. Hughes FAA Technical Center in October 1999 to develop and maintain a web site dealing with a wide variety of airport safety wildlife concerns. Initially, the web site enabled users to access related topics such as wildlife management (at/near airports), bird identification information, FAA wildlife management guidelines, education, pictures, current news, upcoming meetings and training, available jobs and discussion/forum sections. In April 2001, the web site was augmented with an on-line wildlife strike report (FAA Form 5200-7). Upon submittal on-line, "quick look" email notifications are sent to concerned government personnel. The distribution of these emails varies as to whether there was damage, human injuries/fatalities, and whether feather remains were collected and will be sent to the Smithsonian Institution for identification. In July 2002, a real-time on-line query system was incorporated to allow federal and local government agencies, airport and operator personnel, and USDA and airport wildlife biologists to access this database (which as of June 2005 contains 68,288 researched strike reports added to at a rate of approximately 500 strike reports/month) to formulate strategies to reduce the hazards wildlife present to aviation. To date (June 2005), over 15,000 on-line real-time queries were processed. In June 2004, ERAU was authorized to develop a graphical interface to this on-line query system. Current capabilities include mapping strikes (by species) on the US map, each of the contiguous 48 state maps (with AK and HI being added), and airport diagrams of the major metropolitan airports as well as the next 46 airports with the most reported strikes The latter capability depicts strikes by runway in plan as well as in elevation view. Currently under development is the ability to view time-sequenced strikes on the US map. This extensive graphical interface will give analysts the ability to view strike patterns with a wide variety of variables including species, seasons, migration patterns, etc. on US and state maps and airport diagrams.

1. Introduction

The FAA's Airport Wildlife Hazard Mitigation Website[1] was established by Embry-Riddle Aeronautical University (ERAU, Prescott, AZ) in October 1999 under grant from the William J. Hughes FAA Technical Center in Atlantic City, NJ.[1] The objectives of the website are:

- To provide the aviation community with a large variety of sources of information concerning the risks that wildlife present to aviation safety and associated topics.

- To provide a user-friendly interface whereby airport, flight, operations, safety, and/or maintenance personnel may report wildlife strikes (in many airports a daily occurrence) on-line.

- To provide users an opportunity to register with the on-line community for electronic dissemination of items of interest, coming events and community news.

- To provide an on-line database of wildlife strike reports for dissemination of data to federal and local government agencies, airport managers, operator safety personnel, biologists, engine and airframe manufacturer personnel to analyze and develop strategies to reduce the risks wildlife present to aviation.

In May 2004, ERAU was authorized to further expand the on-line database query capability from a wide variety of discrete reports to include a graphics capability to allow analysts to view past strike patterns as an aid in predicting future strikes to reduce the risks wildlife present to aviation.[2]

2. Implementation

It was initially decided that graphing of wildlife strikes (hereafter referred to as "mapping of strikes" or briefly, "mapping") would be implemented on 3 levels: (1) on the US map, (2) on the 50 State maps, and (3) on Airport Diagrams for all airports with significant wildlife strike history. For the current implementation, significant wildlife strike history was defined as airports with 200 or more reported strikes since January 1, 1990. It is anticipated this list will be expanded to include those airports with 100 or more reported strikes.

2.1 US Mapping

US strike mapping is available in 2 levels, that available to the general public, and that available to specially authorized individuals designated by the FAA. Both levels show the location of strikes (or more accurately, the location of airports where the strikes occurred). Available to the general public are the total US counts (for the selected species) as well identification of the airports alone. Available to the FAA authorized personnel are also strike counts per identified airport. The general public entrance is shown in Figure 1. FAA Authorized Personnel entrance is shown in Figure 2.

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[1] Airport Wildlife Hazard Mitigation Home Page is located at **http://wildlife-mitigation.tc.faa.gov**. A mirror (redundant) site is located at **http://wildlife.pr.erau.edu**.
[2] Although the primary risks are birds, mammals such as deer, fox, and coyotes also present a significant risk.

Figure 1 – General Public Entrance to Mapping of Strikes on US Map

Figure 2 – FAA Authorized Personnel Entrance to Mapping of Strikes on US Map

Selection of either entrance takes the user to the Query Select Screen where dates of interest may be selected (the default is the time span of the entire database) and species of interest must be selected as shown in Figure 3.

Figure 3 – Query Select Criteria for Mapping of Strikes on US Map

Typical results for the general public are shown in Figure 4. Note the airport identification (with a cursor mouseover) as well as the US Strikes Summary Data in the lower portion of the screen.
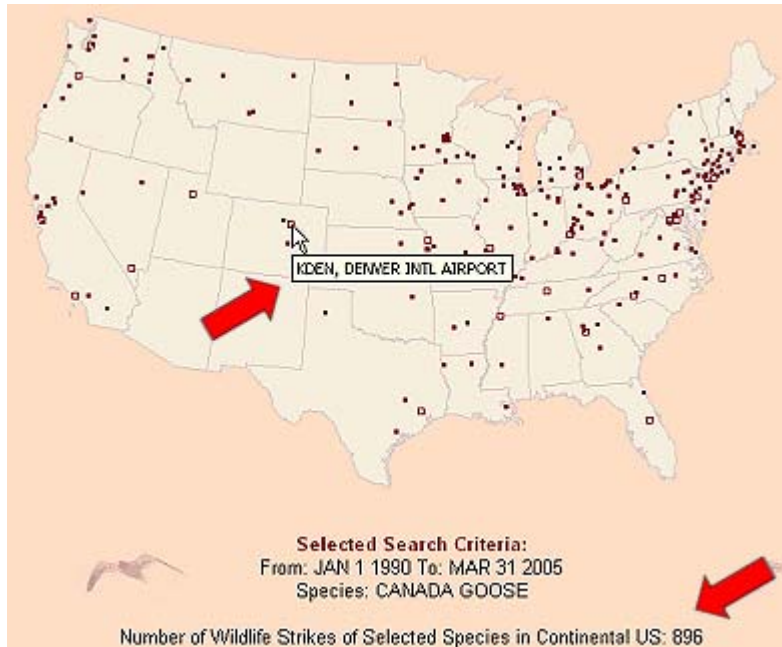
Figure 4 – Typical Results of Mapping of Strikes on US Map for the General Public

Typical results for FAA Authorized Personnel are shown in Figure 5 (following page). Particular attention is called to the following additional features:

- Individual airport strike counts are available with cursor mouseover.

- Airport summary results are available for any individual airport selected (Figure 6).

- High-density areas may be resolved by right clicking any airport in that cluster, for example, the cluster around the Minneapolis-St Paul (MN) area (Figure 7).

- US Summary Strike data are also available (not shown).

Each of the above screens is for some user selected time period. Of perhaps of equal importance is the ability to view strike build-ups over time in some sequential fashion. Currently under development is to select time sequenced US mapping. In this mode, the user would be able to view strike build-ups by time slices. The Query Selection Screen is shown in Figure 8. Current design concept is either user selection of monthly or yearly time sequential slices. For monthly time slices, the user would select a calendar year of interest (January – December) to be presented US mappings by monthly slice in a sequential pattern. For yearly time slices, the user would select a maximum period of 6 calendar years to be presented by yearly slice. In addition, the user would select a species of interest. The Query Selection Screen is shown in Figure 8.
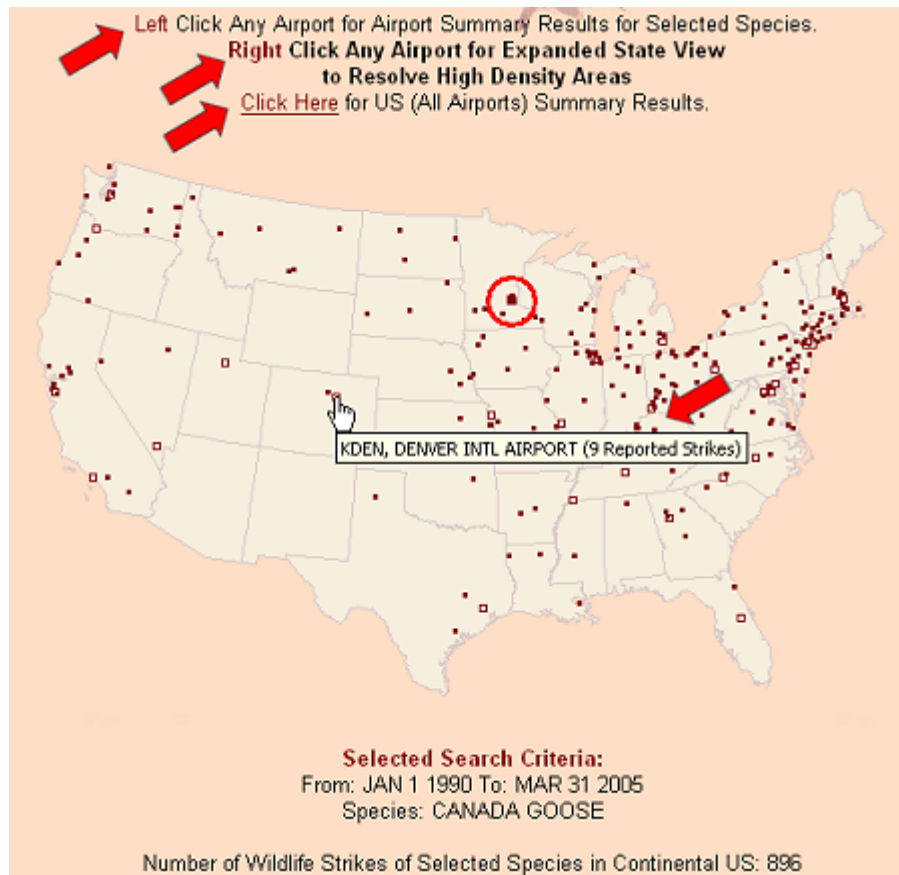
Figure 5 – Typical Results of Mapping of Strikes on US Map for FAA Authorized Personnel

Figure 6 – Typical Selected Strike Summary Results US Mapping for FAA Authorized Personnel

Mouseover Locations for Airport Identification (with Nr of Reported Strikes)
Major Metropolitan Airports Shown in Large Squares
Click Any Airport for Airport Summary Results for Selected Species
Click Here for State Airports Summary Results
Selected Search Criteria
Selected State: MN
From: JAN 1 1990   To: MAR 31 2005
Selected Species: CANADA GOOSE

Number of Wildlife Strikes in State: 36
Number of Locations (Airports) Mapped: 12
Source: FAA National Wildlife Strike Database - Version 6.3 dated 5-13-05
Downloaded - Sun Jun 5 2005 16:35:28 MST

KMSP, MINNEAPOLIS ST PAUL (18 Reported Strikes)

Figure 7 – Resolving High Density Clusters - US Mapping for FAA Authorized Personnel

Figure 8 – Sequential Mapping Query Select - US Mapping for FAA Authorized Personnel

Examples of each of the display modes (Static Multi-Image) and Animated (Single Image) are shown in Figures 9 and 10 respectively.
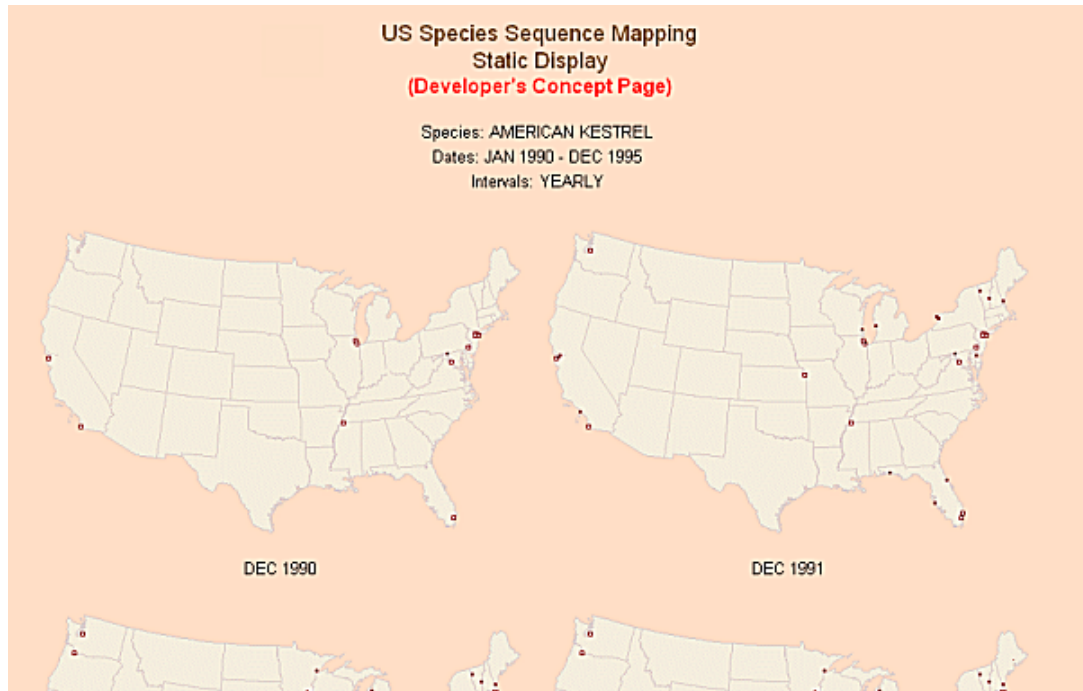
Figure 9 – Sequential Mapping Results (Static Multi-Image Display Mode) - US Mapping for FAA Authorized Personnel
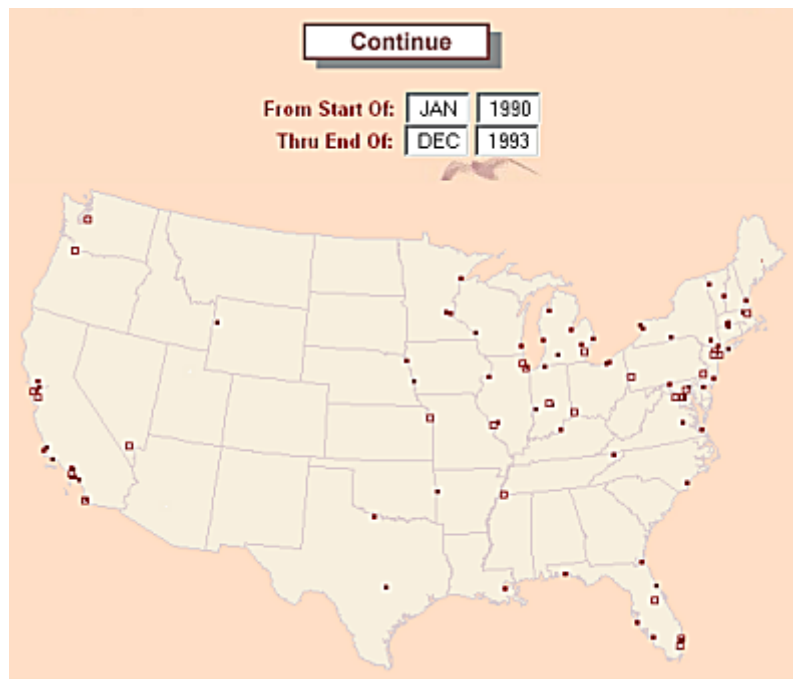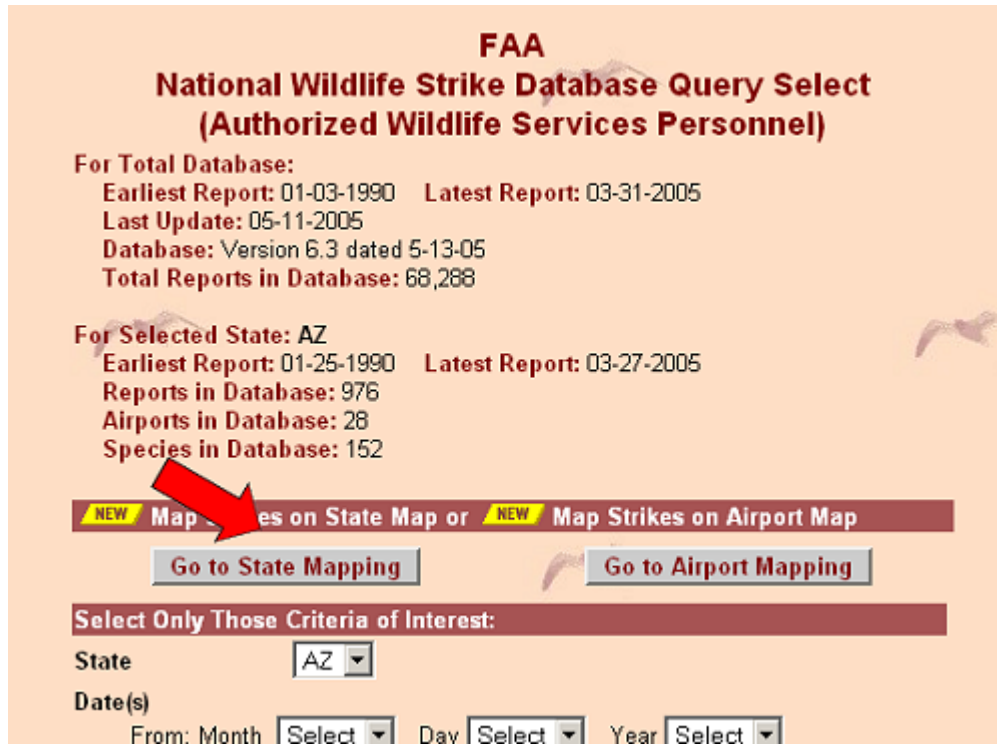

Figure 10 – Sequential Mapping Results (Animated Single Image Display Mode) - US Mapping for FAA Authorized Personnel

2.2 State Mapping

Location of strikes (actually the airports where the strikes occurred) are available for each of the 50 states as well as the Pacific Islands (PI), Puerto Rico (PR) and the Virgin Islands (VI). State views are also available to certain State Governmental Agencies (e.g., state Departments of Aviation and/or Aeronautics). A typical entrance to State Mapping would appear as shown in Figure 11.
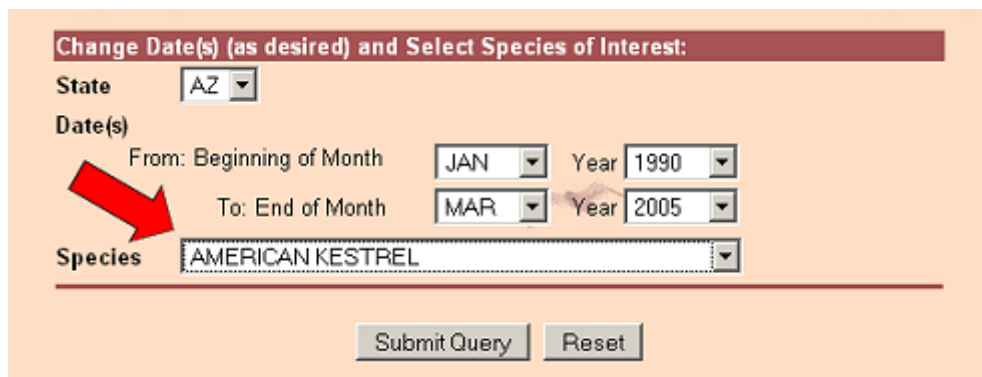
Figure 11 – Entrance to State Mapping of Wildlife Strikes

Once selected, the user may select some specific date interval (note the dates of interest default to the entire range of dates in the database) and must select a species of interest as shown in Figure 12.

Figure 12 – Query Select for State Mapping of a Selected Species

Once submitted, the user is presented a screen as shown in Figure 13 showing airports where strikes occurred as well as the number of strikes for the selected species by mousing over the airport of interest.
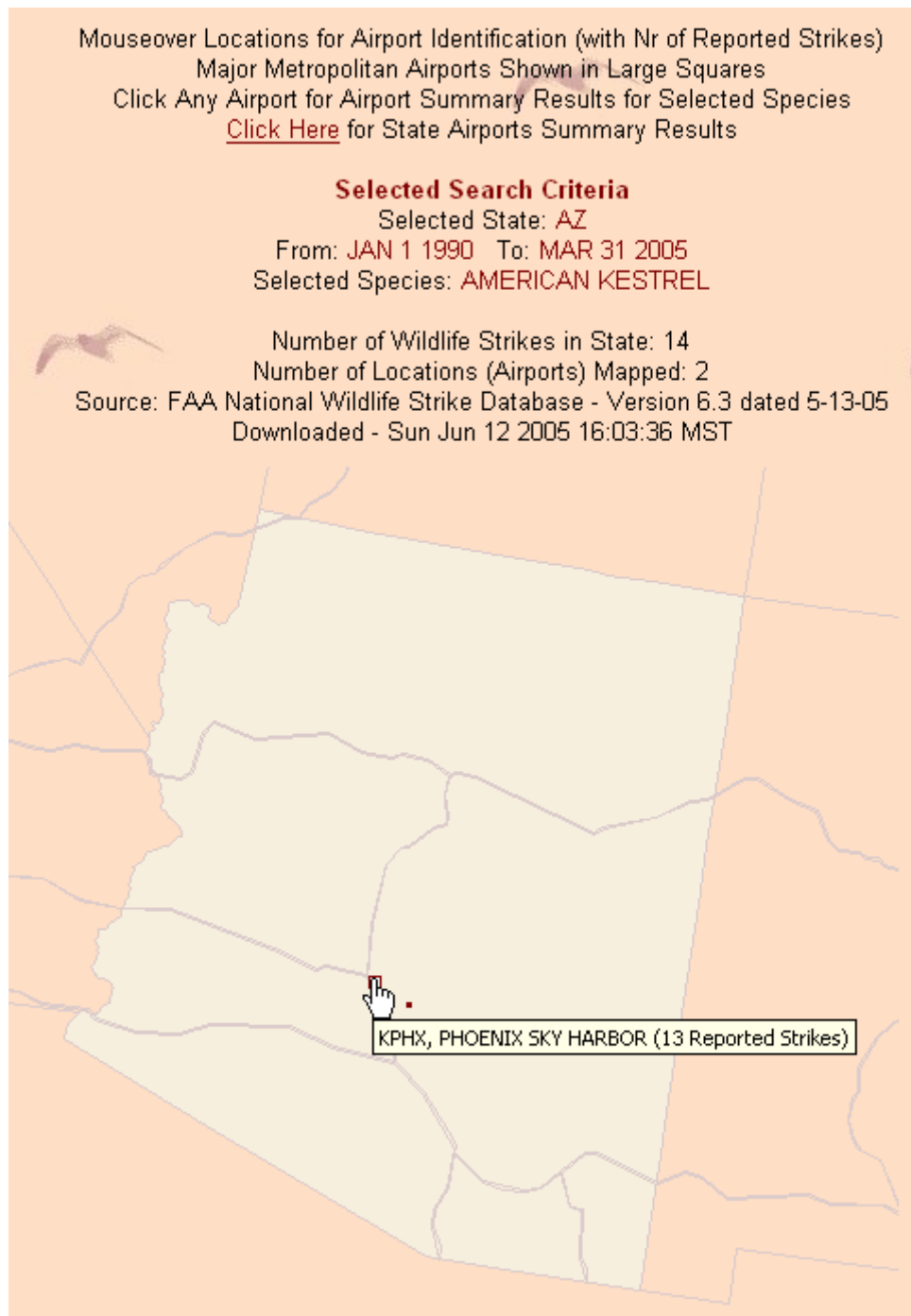
Figure 13 – State Mapping of a Selected Species

If desired, the selected airport can be clicked and the user is presented with a screen of summary strike data as shown in Figure 14.

FAA
National Wildlife Strike Database
US Mapping by Species Summary Results

Selected Grouping by Species Criteria:

Airport: PHOENIX SKY HARBOR   Airport ID: KPHX
Species: AMERICAN KESTREL
From: JAN 1 1990   To: MAR 31 2005

Number of Reports: 13

Click Incident Date to View Individual Strike Report (Bolded Date Indicates Reported Damage on Form 5200-7)

Click For Info to Download Individual Strike Reports into EXCEL for a more detailed Analysis.

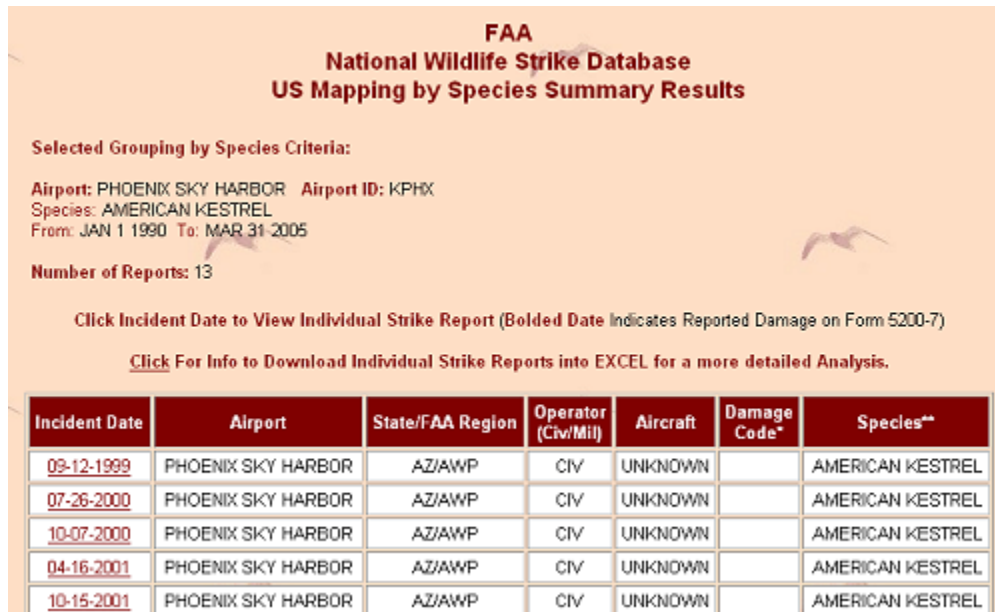| Incident Date	Airport	State/FAA Region	Operator (Civ/Mil)	Aircraft	Damage Code*	Species**
09-12-1999	PHOENIX SKY HARBOR	AZ/AWP	CIV	UNKNOWN		AMERICAN KESTREL
07-26-2000	PHOENIX SKY HARBOR	AZ/AWP	CIV	UNKNOWN		AMERICAN KESTREL
10-07-2000	PHOENIX SKY HARBOR	AZ/AWP	CIV	UNKNOWN		AMERICAN KESTREL
04-16-2001	PHOENIX SKY HARBOR	AZ/AWP	CIV	UNKNOWN		AMERICAN KESTREL
10-15-2001	PHOENIX SKY HARBOR	AZ/AWP	CIV	UNKNOWN		AMERICAN KESTREL

Figure 14 – Airport Strike Summary from State Mapping

The above State Mapping sequence represents mapping available to Wildlife Services personnel and state governmental agencies which are password-protected by state. Authorized FAA personnel may select any of the 50 states, PI, PR or the VI from a US Map by State as shown in Figure 15. Once the state is selected, the remaining screens are the same (user may changes included dates and select the species of interest).
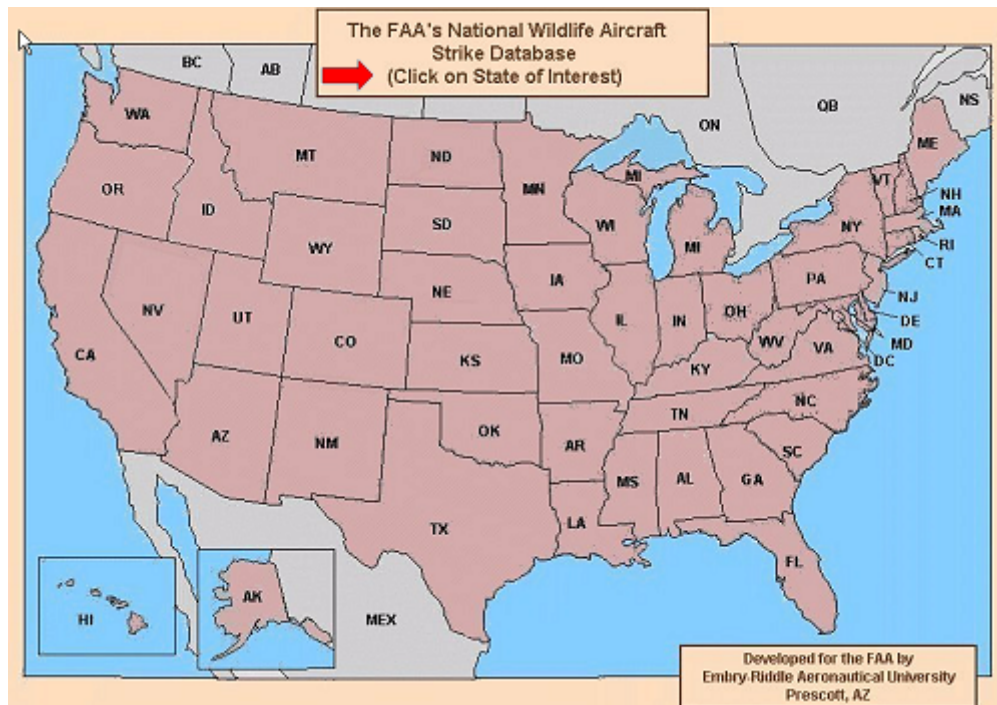

Figure 15 – State Mapping Selection for FAA Authorized Personnel

2.3 Airport Mapping

Strike location mapping is also currently available for 85 US airports. Besides the 39 airports designated Major Metropolitan Airports by the FAA, the next 46 airports with the largest strike count were included. Additional airports are anticipated to be added in the coming months. A typical Airport Mapping Entrance is shown in Figure 16.

Figure 15 – Airport Mapping Selection

Once selected, the user may selects 1 of 2 Airport Mapping Modes available. The first (which is also the default selected mode) allows the user to view strike history by runway in the airport plan view. The user may also select a interval of interest and/or specific species of interest or use the default "All". The query select screen is shown in Figure 16.
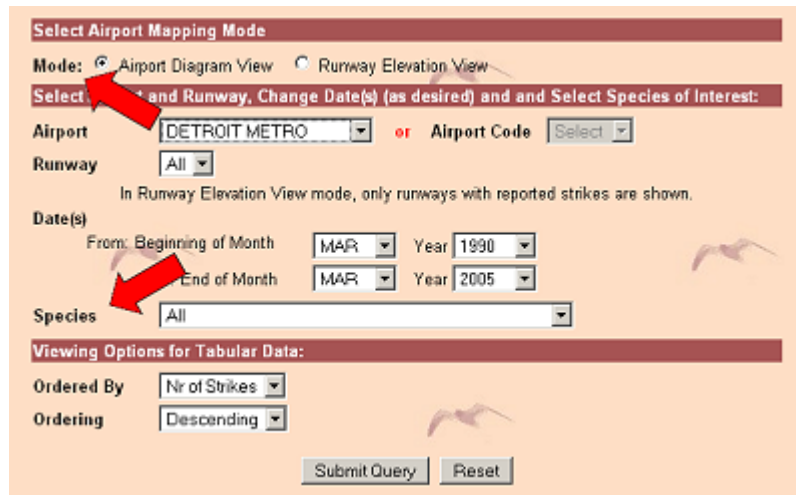

Figure 16 – Airport Mapping Query Selection

In the Airport Diagram View, after submittal the user would be presented a screen as shown in Figure 17.

Selected Mapping Criteria:
From: MAR 1 1990   To: MAR 31 2005
Airport: GERALD R FORD INTL (KGRR)
Species: ALL
Ordered By: STRIKES Ordering: DESCENDING

Click Strikes to View Summary Strike Data

Runway	Strikes**
17	87
26L	75
8R	51
UNK	51
35	50
8L	15
Off Airport*	12
26R	9
17/35	4
8R/26L	1
8L/26R	1
"On Airport" Total Strikes	344 356

Figure 17 – Airport Diagram View Tabular Results

Strikes, which occur at an altitude of greater than 1000 ft AGL, are grouped together as "Off Airport". The user may continue to view the strike counts superimposed on the Airport Diagram (still under development). A Developer's Concept image is shown in Figure 18.

The user is also presented the option to list the strikes by height for a selected runway. A typical selection and results screen are shown in Figures 19 and 20. Although when known, strike altitude is reported on the FAA Form 5200-7, there is no specific entry for distance from the airport or active runway. As a result, the distances to/from the active runway threshold are computed from the reported strike height. A 3-degree approach from the outer marker was assumed with a touchdown point 250 feet from the runway threshold as well as a 10-degree departure angle with rotation 4500 feet from runway threshold.

3.0 Conclusions
The On-Line availability of the FAA's National Wildlife Aircraft Wildlife Strike Database has been enthusiastically received by the aviation community concerned with minimizing the hazard presented by wildlife – mostly thought of as birds, but also including mammals should as deer. Since becoming available on the WWW in July 2002, there have been in excess of 15,000 on-line queries processed as of June 2005 accumulating at a rate of over 1,000 per month. It is expected when these new graphic capabilities become widely known, queries per month processed will further increase.
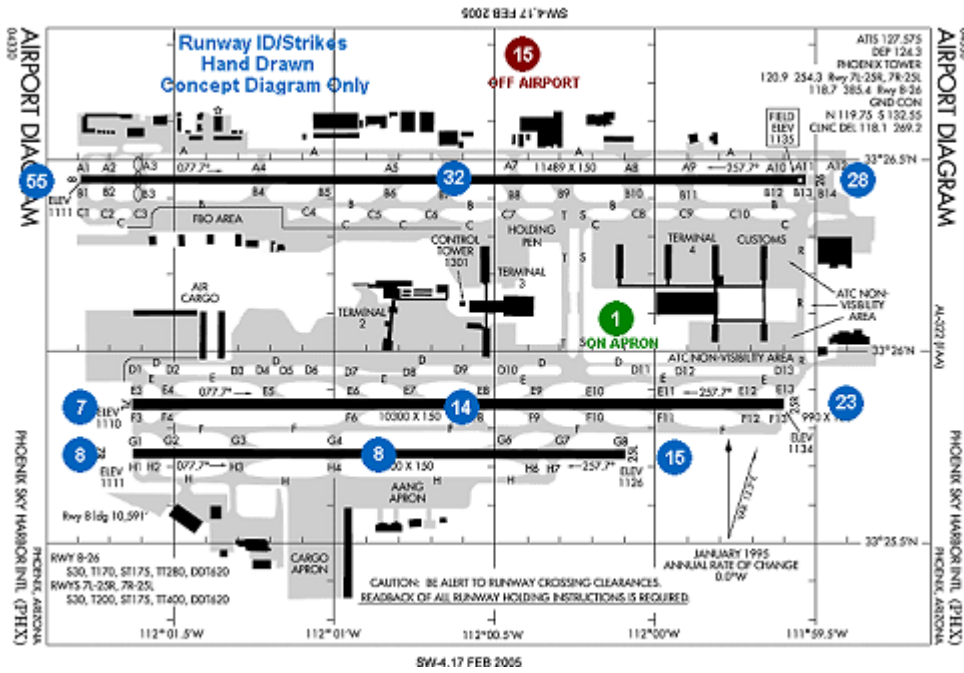
Figure 18 – Airport Diagram with Superimposed Strike Counts (Developer's Concept)

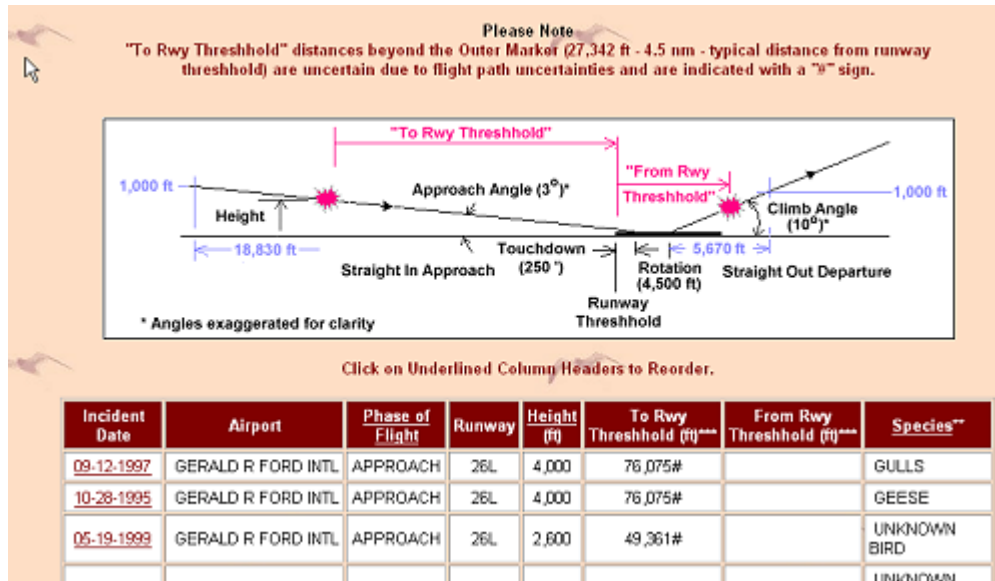Figure 19 – Airport Runway Elevation View Query Selection Screen

Figure 20 – Airport Runway Elevation View Query Results

References: [1] *Collection And Dissemination Of Wildlife Strike Data At Airports For The US Federal Aviation Administration Via The World Wide Web*, Dickey, Newman, and Hovan, I International Birdstrike Committee Conference, Athens, Hellas, May, 2005.