Airport Wildlife Strike Hazard Management

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The FAA will continue to develop technologies that will utilize the United States’ airspace in safer, more efficient, and more environmentally sound ways. We will improve our risk management practices by collecting and analyzing data to identify problems and prevent accidents from occurring. We will continue to partner with industry to reduce the commercial accident rate, improve runway safety, and extend the excellent safety record of commercial space transportation.
The “system” can be defined with an aircraft focus.

Future air traffic management operations will likely exploit a network of ground, airborne, and space-based systems to safely separate a growing number of aircraft.
But we can’t ignore the rest of the system, including wildlife!

*Future air traffic management operations will likely exploit a network of ground, airborne, and space-based systems to safely separate a growing number of aircraft.*
The Wildlife Strike Management Program (WSMP) is developing methods to improve operational safety through a multifaceted program that emphasizes systems integration.
2005 CEAT Wildlife Program

Landside management:

- Systems Development (WHAS) w/ GIS base (AOA to Regional Scale)
- National Scale Integration

Infomatics/Information Technology

Integration of advanced detection and modeling for hazard/risk warnings

Radar

- FOD and Bird radar demonstrations
The “system” is three dimensional, focused on aircraft movement.
The systems approach must consider more than the AOA. With an airport focus, the system considers aircraft and wildlife movement and the potential for interaction regionally.

Approach paths at DFW, 10X vertical exaggeration
Green plane indicates 3,000 feet AGL
To deal with wildlife hazards the systems approach utilizes multiple data resources, uses existing ecological information, and considers modeling to provide a spatial and temporal integration.

In the WHMP, one research area is the development of GIS-based technologies to support efforts to better understand wildlife and provide a platform for 3-d integration of both aircraft and wildlife information.
Why Use GIS?

• **Mapping**
  - Displays information in a visual format that is easier for people to interpret

• **Legal document**
  - Maps and reports can be used as historical and/or legal documents

• **Analysis**
  - Data can be analyzed in a similar method to Excel or Access
Mapping
...but GIS is more than just mapping!
Analysis
Analysis example from JFK
Strike Rate Analysis

• Overall strike rate
• Strike rate per runway
• Annual strike rates per runway
• Monthly / seasonal strike rates per runway
• Species specific strike rates
• Strike locations
Strike rate by runway - 2001
Strike rate with strike location
We have also been working with other airports on GIS development.

- SEA where movement modeling and pilot warning is the focus
- ORD where basic GIS and integration with OMP.
Notice the impact of the Des Plaines River Corridor and analysis at various spatial scales.

Approximately 5 mile Radius of O'hare Airport

Legend
- Parks
- Lakes
- Golf Courses
- O'hare Runways

Approximately 25-mile Radius of O'hare Airport
Analysis of Local and Regional Data

New insights for into water and wetland locations of large bird hazards
Some of the detail has been lost in exporting this photo.

High Resolution Photos for Locating Problem Areas

Notice the pond which already produces wildlife challenges.
All data can be easily identified
We have also been able to relate observations to expert opinion to begin the process of “modeling” movement. This developing capability will support better hazard assessment that is time and location specific.
Integrated with GIS we also use advanced technologies, such as radar.

Using radar detection information we identified typical routes.

The north bird route has been used in simulation. End points are illustrated in the graph.

Starting point (683070, 3637483)

Ending point (682653, 3637933)
Simulated bird movement

Parameters used in the simulation:
Initial location: (683070,3637483,2) meters;
Flight destination: (682653,3637933, Z)*;
*As ending of the flight is not simulated, Z is not set.
Total mass: 500 birds* 0.5kg/bird;
Speed: 8 m/s;
Flying attitude:50m;
Initial dimension: 16*36*4 m³ elliptical-sphere-shaped;
End dimension in the simulation: 20*8*8 m³ elliptical-sphere-shaped;
50sec has been simulated in total while the reconfiguration of the flock takes 20sec.
*Mass distribution is also considered. As will be shown later, larger sized dots are used for denser mass.
Flight phase simulation – take off

2D Results

Green dots illustrate the results in 2 dimension.

Parameters used in the model are listed on the next page.
3D results
Hazard Assessment

The results from the simulation, combined with aircraft and flight information, can provide an approach for hazard assessment.
The red dot shows the center of the plane, and the plane is simplified as a long rectangular block, which is orientated long its velocity.

Blue dots stand for a flock, which is simplified as rectangle. Mass distribution is not considered.
Mass involved in the strike is then predicted. This is illustrated below, the missing part of the flock indicates is the #/mass involved in the collision.

If using several component (e.g. multiple rectangular blocks) to account for aircraft shape and size the mass-based hazard can be predicted!
The continuing challenge of the systems approach is to provide the integration of information over local to national scales to:

- improve AOA wildlife habitat management
- better understand how hazards develop and how hazards can be managed
- To provide adequate warning of hazard in a form that can be readily used by everyone involved in aircraft operations.
To address this issue, the CEAT program is developing a capability to provide real-, or near real-time warnings of wildlife movement based on advanced detection technologies.

The program is developing a radar detection capacity, focused on birds at AOA level.

The program also recognizes that simple detection is inadequate, we must develop a capacity to convey hazard information quickly and effectively!
A recent activity is supporting the USAF/FAA development of a bird specific radar.

BIRDAR is a 94 ghz radar developed by Waveband Corp.
The radar is relatively short range designed to provide information in the critical phases of landing and take-off.

Coverage of a 94 ghz radar developed for the FAA in relation to the glide slope signal that defines expected aircraft path.
Bird Strike Hazard
Radar Requirement

Most Strikes Occur Near Airports!

Cumulative Percent of Strikes

AGL

Radar Volume

3 nm or 9.3 km

1000 ft. AGL
In demonstrations of the radar in 2004 and 2004 BIRDAR detected blackbird flocks, to a range of approximately 1.4 km and for single soaring birds to 1.2 km and Canada geese at > 3 km.
This is what is shown on the screen
This is the radar record displayed to show spatial relationships
To place this in the context of aircraft movement, the following was observed during the test campaign at DFW.
To meet the objective of an integration of national, regional, and local data in a information system to serve the pilot in command the 2005 program is developing new information display approaches.

For example, a partnership is being negotiated with JetBlue Airlines with the intent of achieving a seamless integration of Program elements with their laptop based aircraft management system.
A recent development is a cooperative effort with the USAF GIS GIS Support Center, Institute for Information Technology Applications at the USAF Academy to use Google Earth as a platform for this effort.
We have also supported demonstration and evaluation of other radars.

In January 2005 we supported the demonstration of a FOD detection radar at JFK.
FOD Radar Testing at JFK

• FOD is any substance, debris, or article alien to the vehicle or system would potentially cause damage.

• Foreign object damage is any damage attributed to a foreign object that can be expressed in physical or economic terms which may or may not degrade the required safety and/or performance characteristics of aircraft.
• FOD items placed on runway to evaluate the radars ability to detect them
• Both winter pavement (ice and snow) and normal conditions were tested
Tests were conducted at different distances to complete an evaluation matrix.
FUTURES?

CEAT will continue to provide research support to the FAA in the WMHP. Expected areas of emphasis will be radar, radar integration with modeling, developing GIS technologies, and regional/national scale integration of WHMP.
Questions?