



United States Department of Agriculture

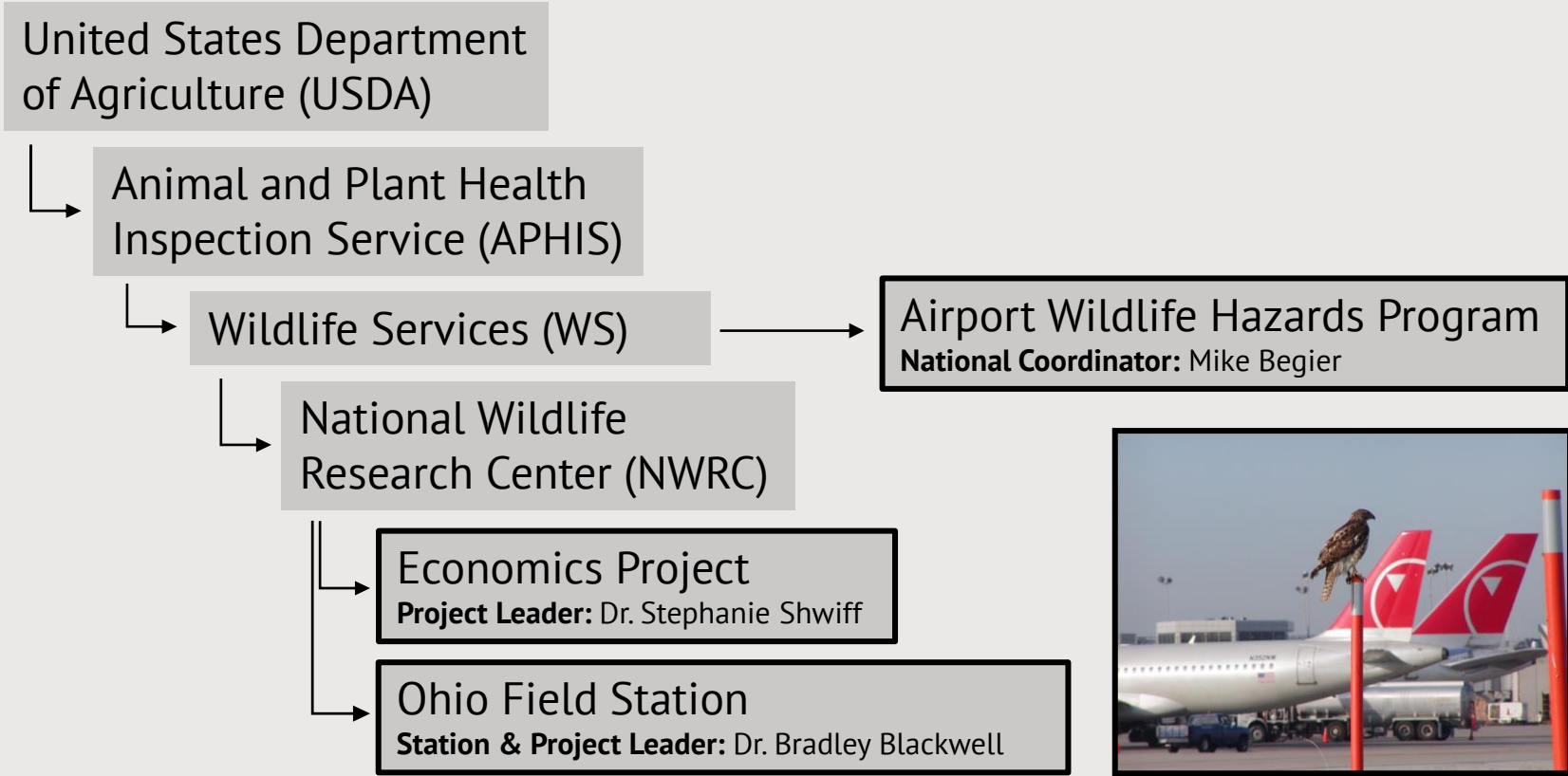
The Immediate Spillover Delay Effects of Wildlife-Aircraft Collisions

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Introductions



Why manage wildlife hazards at airports?



Air Force Boeing E-3 crash that claimed 24 lives on Sept. 22, 1995.



On November 17, 2012, a Cessna Citation II struck a deer during landing rollout.



US Airways Flight 1549 "Miracle on the Hudson" incident on January 15, 2009.

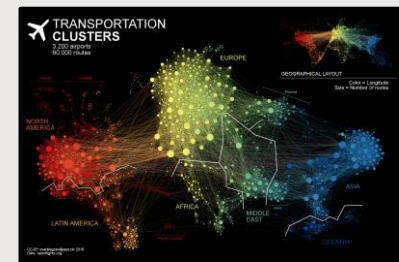


Spirit Airlines flight ingests a bald eagle into an engine on October 2, 2021.

BREAKING NEWS
PLANE ENGINE CATCHES FIRE FROM BIRD STRIKE AFTER ABORTED TAKEOFF AT ATLANTIC CITY INT'L AIRPORT

**Protect human lives.
Protect aircraft.**

What else?



Promote network efficiency.

Who cares about cancellations & delay?

- Passengers
- Airlines
- The FAA & BTS

Total Cost of Delay in the U.S. (dollars, billion)

	2016	2017	2018	2019
Airlines	5.6	6.4	7.7	8.3
Passengers	13.3	14.8	16.4	18.1
Lost Demand	1.8	2.0	2.2	2.4
Indirect	3.0	3.4	3.9	4.2
Total	23.7	26.6	30.2	33.0

SOURCE: FAA APO-100 "Cost of Delay Estimates" 2019.

Promotion of network efficiency as one of the many benefits of management.



This work is both completed and ongoing...



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Spillover delay effects of damaging wildlife strike events at U.S. airports

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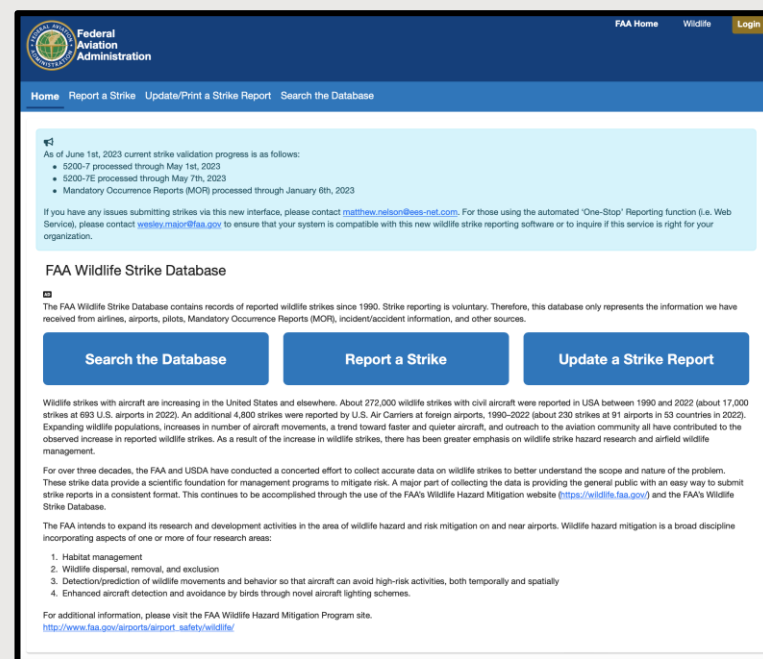
ABSTRACT

In this paper, we investigate the spillover departure delay effects of damaging wildlife strike events that occur to commercial passenger airlines on flights scheduled to depart in the 24 h following a damaging wildlife strike event. Employing multiple empirical approaches, and investigating various differential effects, we identify significant excess departure delays in the 24-hour post-strike period. Our results suggest that the spillover delay effects of wildlife strike events are largely contained within the airline to which the strike occurred. The estimated effects are particularly large—5.4 to 8.3 times higher than expectation—for immediate within-airline, same-leg flights. Further, the behavior of the estimated spillover delay effects also depend on whether a strike flight's destination airport is an airline hub or not. Our estimated average treatment effects indicate that, during the 24-hour post-strike period, the average damaging wildlife strike event generates a minimum of 570 aircraft minutes and roughly 40,000 passenger minutes of within-airline excess departure delay. From this, we estimate that damaging wildlife strike events generate around \$25 million (2020 U.S. \$) in spillover delay costs each year—an external cost borne by *airlines, passengers, and the economy at large*.

How could we measure spillover effects?

Data Sources:

- Wildlife strikes com from *National Wildlife Strike Database* (FAA & USDA)
- Flight-level performance data come from *Airline On-Time Detailed Arrival & Departure Statistics* (BTS)
- Hourly weather data come from *Visual Crossing*.



The screenshot shows the FAA Wildlife Strike Database website. At the top, there is a navigation bar with the FAA logo, 'Federal Aviation Administration', and links for 'Home', 'Report a Strike', 'Update/Print a Strike Report', and 'Search the Database'. A 'Login' button is also present in the top right corner. Below the navigation bar, there is a section titled 'As of June 1st, 2023 current strike validation progress is as follows:' with a bulleted list:

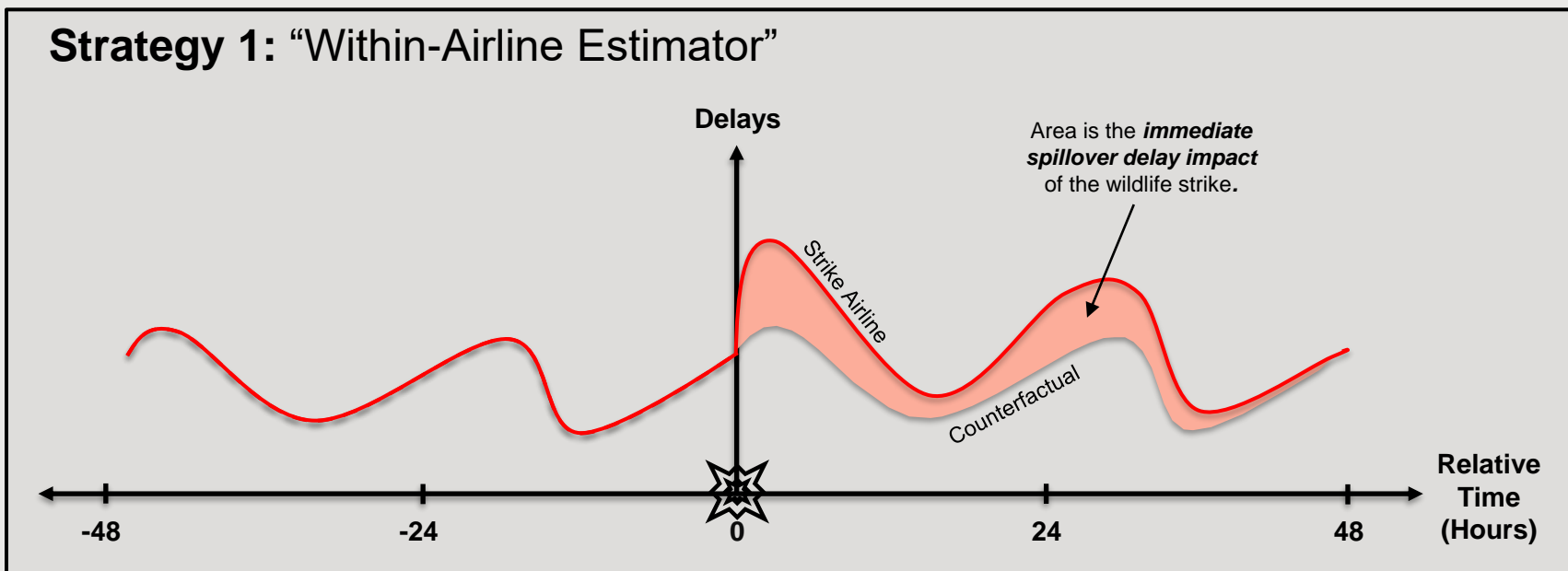
- 5200-7 processed through May 1st, 2023
- 5200-7E processed through May 7th, 2023
- Mandatory Occurrence Reports (MOR) processed through January 6th, 2023

 Below this, there is a note about submitting strikes via the new interface, with contact information for matthew.nelson@ees-ntt.com and yesley.major@fas.gov. The main heading is 'FAA Wildlife Strike Database', followed by a brief description: 'The FAA Wildlife Strike Database contains records of reported wildlife strikes since 1990. Strike reporting is voluntary. Therefore, this database only represents the information we have received from airlines, airports, pilots, Mandatory Occurrence Reports (MOR), incident/accident information, and other sources.' Below this are three prominent buttons: 'Search the Database', 'Report a Strike', and 'Update a Strike Report'. Further down, there is a paragraph about the increasing number of wildlife strikes and the FAA's research efforts, followed by a list of four research areas:

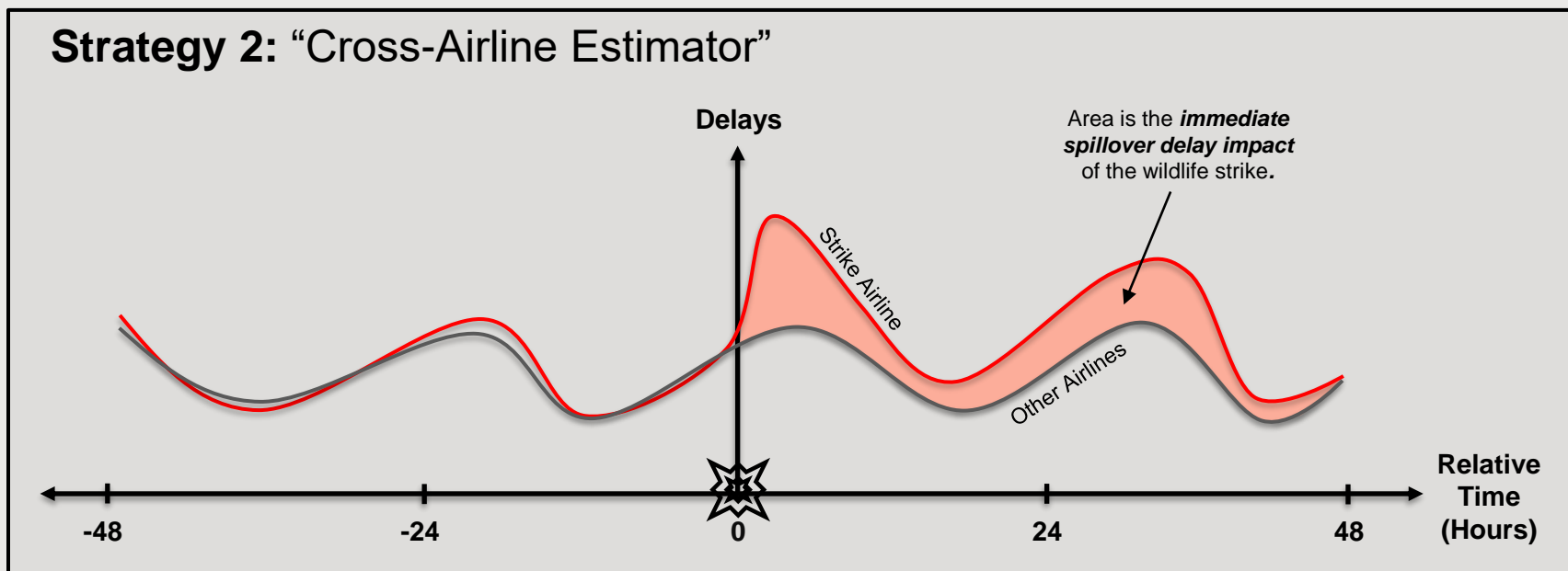
1. Habitat management
2. Wildlife dispersal, removal, and exclusion
3. Detection/prediction of wildlife movements and behavior so that aircraft can avoid high-risk activities, both temporally and spatially
4. Enhanced aircraft detection and avoidance by birds through novel aircraft lighting schemes.

 At the bottom, there is a link to the FAA Wildlife Hazard Mitigation Program site: http://www.faa.gov/airports/airport_safety/wildlife/.

How could we measure spillover effects?

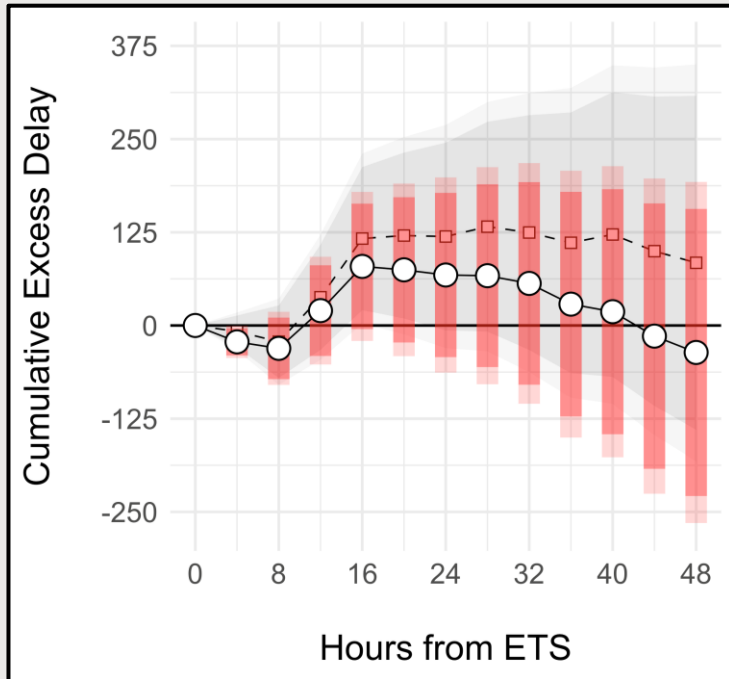


How could we measure spillover effects?

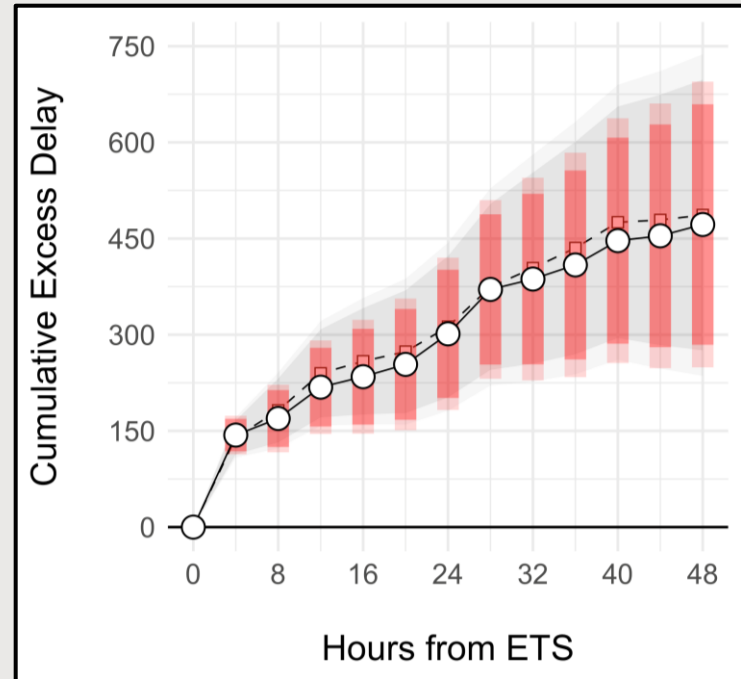


What have we found?

Non-Damaging Arrival Strikes



Damaging Arrival Strikes



What have we found?

Total Delays (Minutes) Surrounding the Average Damaging Arrival Strike in Sample

Period	48-Hours Pre-Strike	48-Hours Post-Strike	Difference	% Change
Other Airlines	395.13	397.42	2.3	0.58
Strike Airline	1,297.85	1,751.64	453.8	34.96

35% INCREASE in **DELAYS** for strike airline at destination airport in the two days following a damaging arrival strike.

This does not include flight cancellations (COMING SOON)

What do we know so far?

1. Non-damaging strikes do not produce network significant disruptions.
2. Damaging strikes do produce significant network disruptions.
3. Strike-induced network disruptions are contained within the strike airline.
4. The size of the network disruption depends on whether the strike occurred at a “hub” or not.

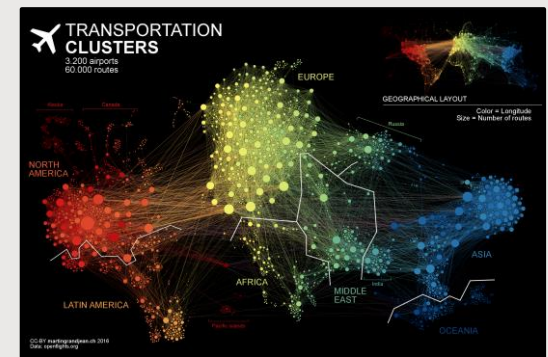
Damaging Arrival Strikes
35% increase in delays at destination airport alone.

Damaging Departure Strikes
28% increase in delays at destination airport alone.

Cost of Spillover Delays
Destination airport delay effects add an additional \$25 million in “spillover” costs to U.S. civil aviation each year .

What are the management implications?

1. The management of wildlife hazards can be justified beyond existential risks posed to humans and aircraft.
2. Management should continue to prioritize species that, if struck, have a high likelihood of damage (e.g., body mass and flocking behavior).
3. Through the lens of strike-induced network disruptions, wildlife hazard management produces a *positive externality* (i.e., management at one airport benefits flight efficiency throughout the network).





Questions?

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