- Measuring Effectiveness - Strike Data Evaluations and the Question of Standardization

North American Bird Strike Conference

Halifax, Nova Scotia, Canada

August 13-15, 2019

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BSC USA Chair
FAA National Wildlife Biologist

FAA Office of Airports

ICAO Annex 14 — Aerodromes

9.4 Wildlife strike hazard reduction

9.4.1 The wildlife strike hazard on, or in the vicinity of, an aerodrome **shall be assessed** through:

a) the establishment of a national procedure for recording and reporting wildlife strikes to aircraft;

* * *

National Procedure may be mandatory or voluntary

§ 139.337 Wildlife Hazard Management

(f) The plan must include at least the following:

(6) Procedures to review and evaluate the wildlife hazard management plan every 12 consecutive months or following an event described in paragraphs (b)(1), (b)(2), and (b)(3) of this section, including:

(i) The plan's effectiveness in dealing with known wildlife hazards on and in the airport's vicinity and

(ii) Aspects of the wildlife hazards described in the wildlife hazard assessment that should be reevaluated.

HOW DO YOU DETERMINE THE EFFECTIVENESS OF YOUR WILDLIFE PROGRAM?

- **REGULATORY COMPLIANCE**

  Regulatory compliance = probability of achieved goals and increased safety

- **MONITOR SAFETY DATA (broad, reactive)**

  Monitor hull losses, Fatalities

- **MONITOR TRENDS THROUGH DATA ANALYSIS / GAP ANALYSIS (specific, proactive, timely)**

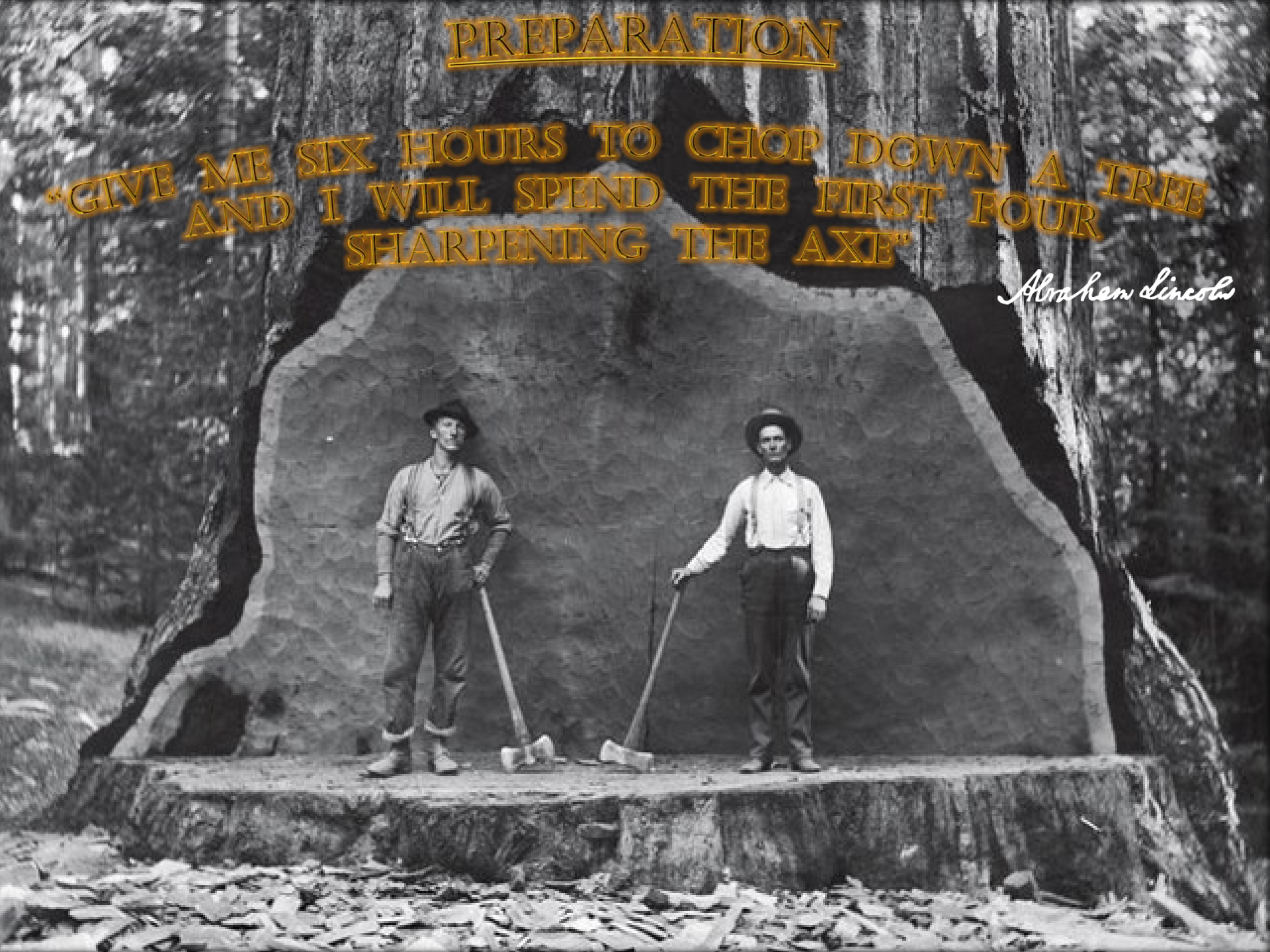
  Systematically evaluate strike data; Determine and Target data gaps and poor performance using metrics and KPI's

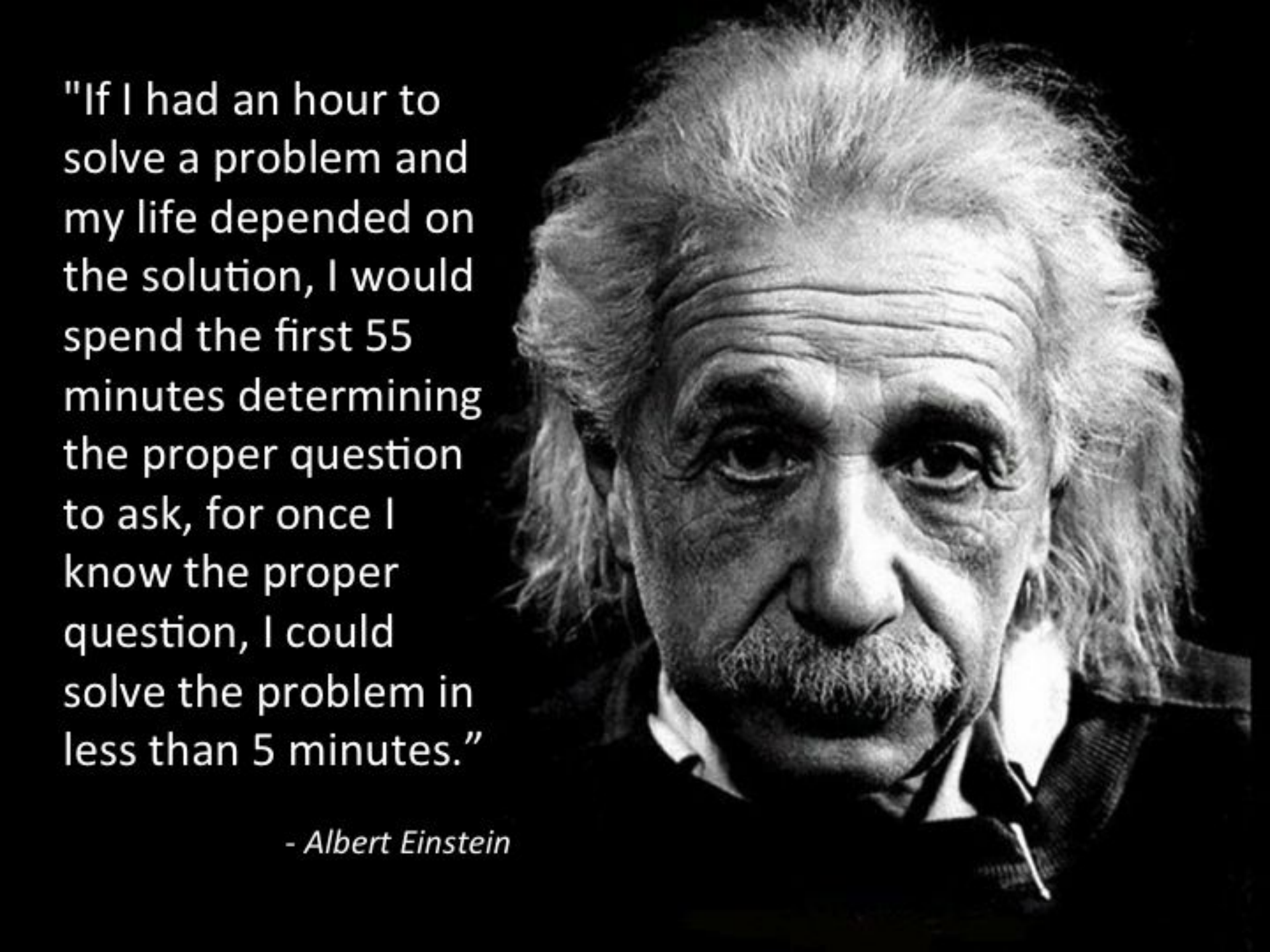
EVALUATION METHODS REQUIRE METRICS AND KEY PERFORMANCE INDICATORS

- Metrics are quantifiable measures used to gauge performance or progress (but can be qualitative)
- Metrics use data from a live source (i.e., it's still updating with new information)
- Select metrics that track procedures for increasing safety.
  - Strike Data ratios and trends, Number of Airports with Wildlife Plans, Number of Airlines and Airports reporting strikes, etc.
- All KPI's are metrics, but not all metrics are KPIs
- KPI's are KEY (vital signs focusing attention on what matters most)

FAA METRICS AND KPI's

- **Metric (KPI) 1.** Monitor ratio between damaging / non-damaging strikes
- **Metric (KPI) 2.** Monitor number damaging strikes per 100,000 operations.
- **Metric 3.** Monitor number Part 139 certificated airports with WHA's (100%)
- **Metric 4.** Monitor number of GA airport Assessments or Site Visits initiated (124 airports [91%] of 136 have conducted WHAs or WHSVs;
- **Metric 5.** Monitor the altitude of reported strikes including a comparison of damaging vs nondamaging strikes to evaluate off-airport hazards.

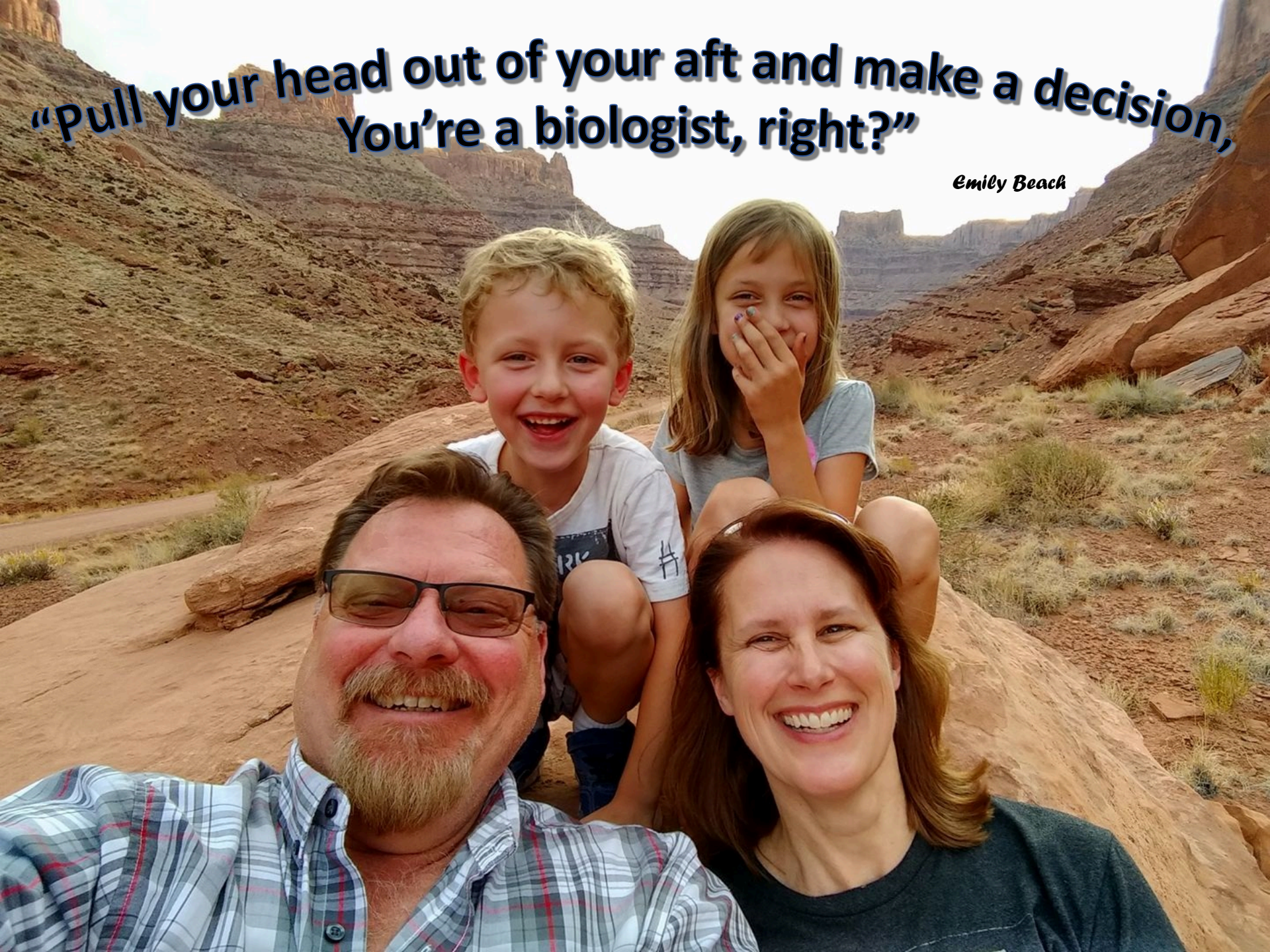

PREPARATION
"GIVE ME SIX HOURS TO CHOP DOWN A TREE
AND I WILL SPEND THE FIRST FOUR
SHARPENING THE AXE"
Abraham Lincoln


"If I had an hour to solve a problem and my life depended on the solution, I would spend the first 55 minutes determining the proper question to ask, for once I know the proper question, I could solve the problem in less than 5 minutes."
- Albert Einstein

MEASURING EFFECTIVENESS
Strike Data Analysis Options

- Strike totals
- Damaging strikes
- Strikes and damaging strikes / operations
- Ratio between damaging / non-damaging strikes
- Biomass struck per operations

So what method is best?


"Pull your head out of your aft and make a decision,
You're a biologist, right?"
Emily Beach

EXPECTATIONS OF STRIKE DATA

REGULATOR NEEDS ENOUGH QUALITY / QUANTITY DATA TO:

- determine high risk species
- track national trends
- provide scientific foundation for regulatory guidance

AIRPORTS NEED ENOUGH QUALITY / QUANTITY DATA TO:

- identify & mitigate hazardous species, strike dynamics and attractants and evaluate effectiveness of wildlife management program

INDUSTRY NEEDS ENOUGH QUALITY / QUANTITY DATA TO:

- evaluate effectiveness of aircraft components

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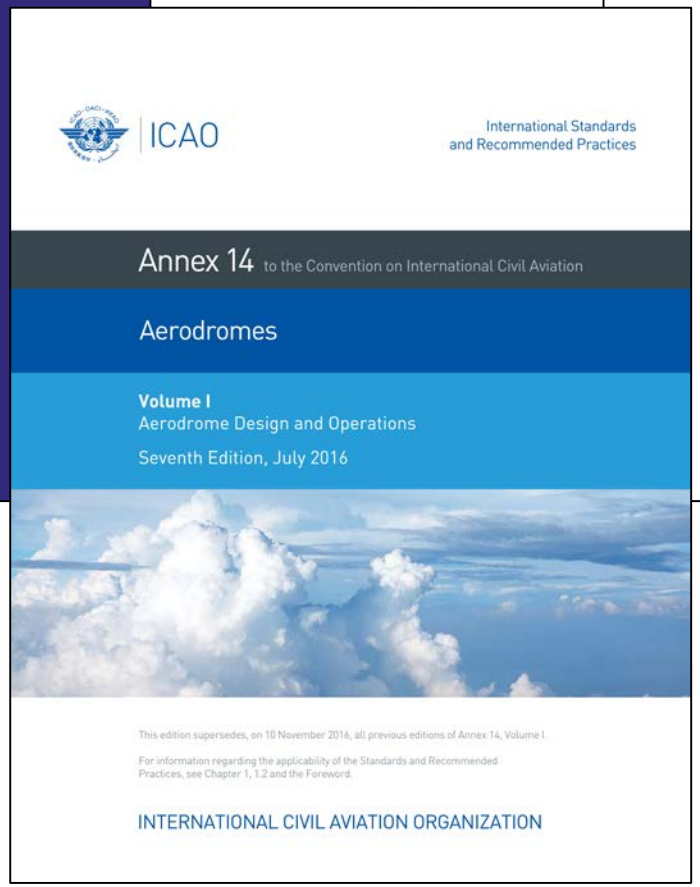

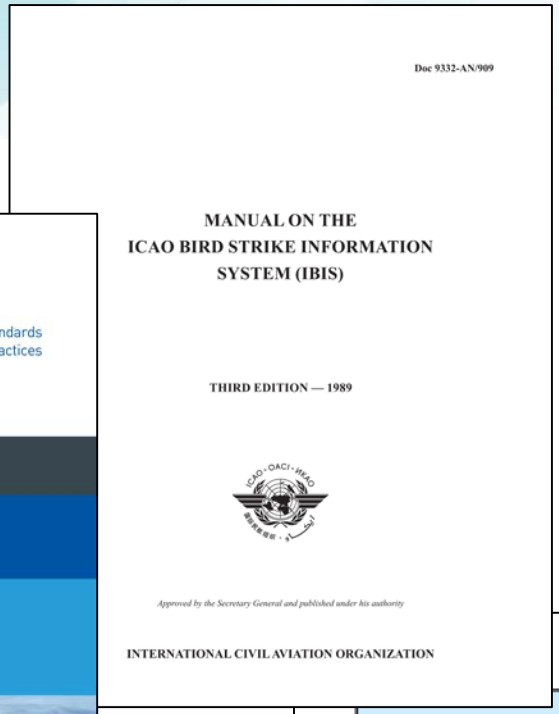

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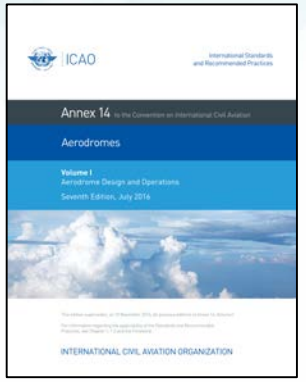


9.4 Wildlife strike hazard reduction

Note.—The presence of wildlife (birds and animals) on and in the aerodrome vicinity poses a serious threat to aircraft operational safety.

9.4.1 The wildlife strike hazard on, or in the vicinity of, an aerodrome shall be assessed through:

the establishment of a national procedure for recording and reporting wildlife strikes to aircraft;

the collection of information from aircraft operators, aerodrome personnel and other sources on the presence of wildlife on or around the aerodrome constituting a potential hazard to aircraft operations; and

an ongoing evaluation of the wildlife hazard by competent personnel.

Note.— See Annex 15, Chapter 8.

Wildlife strike reports shall be collected and forwarded to ICAO for inclusion in the ICAO Bird Strike Information System (IBIS) database.

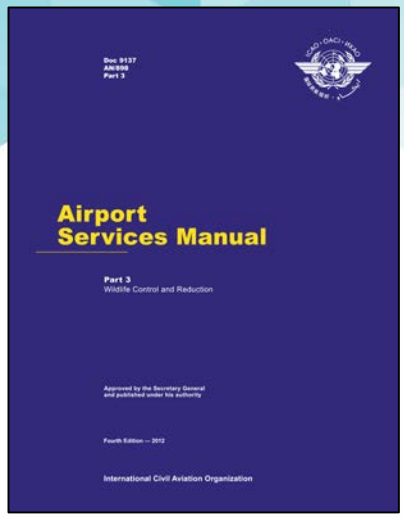
Note.— The IBIS is designed to collect and disseminate information on wildlife strikes to aircraft. Information on the system is included in the Manual on the ICAO Bird Strike Information System (IBIS) *(Doc 9332).*

Action shall be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.

Note.— Guidance on effective measures for establishing whether or not wildlife, on or near an aerodrome, constitute a potential hazard to aircraft operations, and on methods for discouraging their presence, is given in the Airport Services Manual *(Doc 9137), Part 3.*

The appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem. Where the elimination of existing sites is not possible, the appropriate authority shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.

Recommendation.— *States should give due consideration to aviation safety concerns related to land developments in the vicinity of the aerodrome that may attract wildlife.*



4.3. COLLECTING, REPORTING AND RECORDING DATA ON BIRD/WILDLIFE STRIKES AND OBSERVED BIRDS/WILDLIFE

4.3.3 **All bird/wildlife strikes must be reported to the airport.** It should be a requirement for all staff to report bird/wildlife strikes because it is only by full reporting that an accurate assessment of the real risk is possible. **Overall risk does not necessarily stem from the pure total of bird/wildlife strikes.** The risk is clearly greater if large flocking birds or large terrestrial mammals are involved than compared with small individual birds. Airport staff should record all details in a consistent manner and airline and other staff should also be encouraged to report all details.

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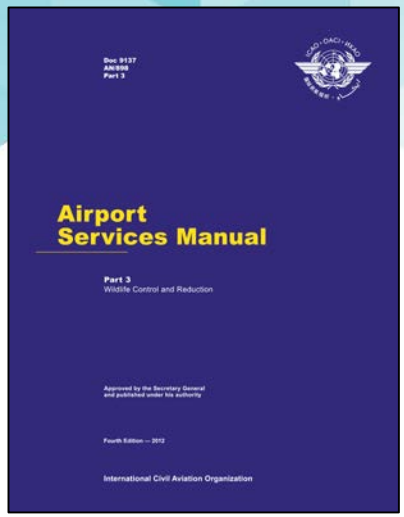
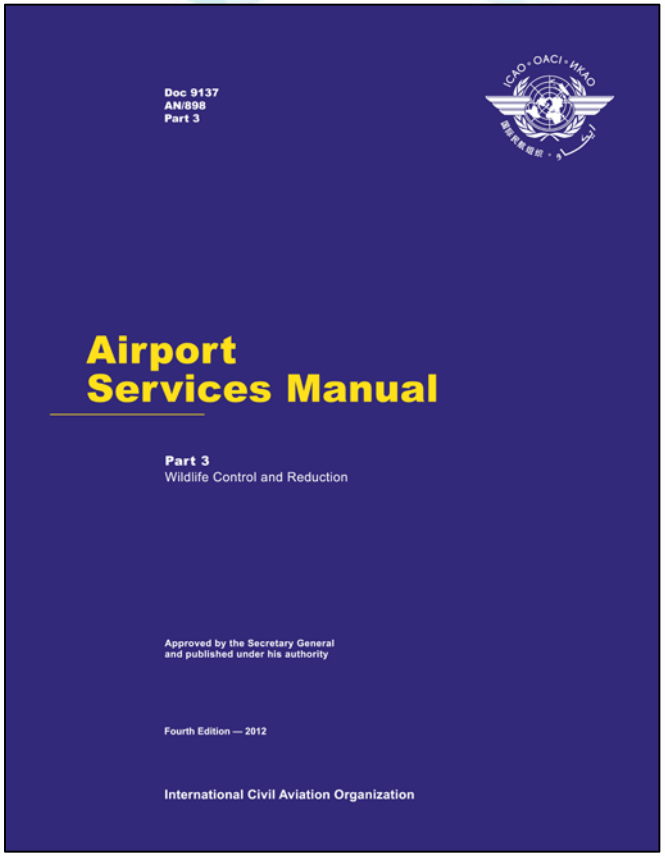


4.4 RISK ASSESSMENT

4.4.1 With a good set of bird/wildlife strike data the airport should conduct a risk assessment using strike data for each species and update these regularly. This will assist in prioritizing efforts and directing them to the highest risks. A risk assessment should take into account the numbers struck for each species and the severity of damage arising from those strikes. Action should clearly be targeted on those species which occur with the highest frequency and create the greatest damage.

4.4.2 The risk assessment methodology set out by the **International Birdstrike Committee** is recommended guidance, along with other documentation from States. See the links provided in the appendix to this document for reference.

Chapter 6
ASSESSMENT OF THE RISK OF BIRD/WILDLIFE STRIKES



Risk is the probability that the harmful event will occur, multiplied by the severity of the harm that could result. In this context it is the probability of a bird / wildlife strike by a particular group of birds / wildlife multiplied by the severity of damage to the aircraft that results.

Risk = (probability of an event) × (severity of harm) and so for bird/wildlife strikes:

Risk = (probability of a strike) × (severity of damage caused).

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Doc 9332-AN/909

MANUAL ON THE ICAO BIRD STRIKE INFORMATION SYSTEM (IBIS)

THIRD EDITION — 1989

Approved by the Secretary General and published under his authority

INTERNATIONAL CIVIL AVIATION ORGANIZATION

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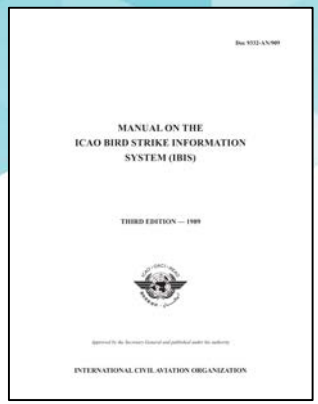

2.6.2 Whilst bird strike rates **may** indicate significant differences and be useful in determining action which **may** be required to reduce bird hazards to aircraft, these rates should be used with caution**. It may be misleading to compare bird strike rates between different airlines, aircraft types or aerodromes even within a State.** This **is** because of variations in aircraft operational factors, bird strike and aircraft movement reporting procedures, aerodrome environmental conditions and bird species.

2.6.3 **In addition, bird strike rates may not necessarily reflect the degree of bird hazard that may exist.** For instance, a relatively high bird strike rate at one aerodrome, if due to bird strikes involving small, non-flocking birds, may not reflect a greater hazard than that at an aerodrome which has a relatively **low** bird strike rate, but which is frequented by larger birds which also form flocks.

All strikes should be reported, whether or not they cause damage to the aircraft and whatever bird/wildlife species was involved.

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Standard 7

- Airports should establish a mechanism to ensure that they are informed of all bird/wildlife strikes reported on or near their property.
- **The total number of birdstrikes should never be used as a measure of risk or of the performance of the bird control measures at an airport.**
- **Airports should ensure that the identification of the species involved in birdstrikes is as complete as possible.**
- Airports should record all birdstrikes and include, as far as they are able, the data required for the standard ICAO reporting form.
- National Regulators should collate birdstrike data and submit this to ICAO annually.

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Wildlife Hazard Management at Airports

A Manual for Airport Personnel

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Second Edition, July 2005

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Reporting Wildlife Aircraft Strikes | **Date:** 5/31/2013 | **AC No:** 150/5200-32B
Initiated by: AAS-300 | **Change:**

1. Purpose.

This Advisory Circular (AC) explains the importance of reporting collisions between aircraft and wildlife, more commonly referred to as wildlife strikes. It also explains recent improvements in the Federal Aviation Administration's (FAA's) Bird/Other Wildlife Strike Reporting system, how to report a wildlife strike, what happens to the wildlife strike report data, how to access the FAA National Wildlife Strike Database (NWSD), and the FAA's Feather Identification program.

2. Applicability.

The FAA provides the standards and practices in this AC as guidance for all public-use airports, aviation industry personnel (e.g., Air Traffic Control, pilots and airline personnel, and engine manufacturers), and others who possess strike information. The FAA strongly recommends that the above aviation representatives and others possessing strike information participate in reporting.

3. Cancellation.

This AC cancels AC 150/5200-32A, Reporting Wildlife Aircraft Strikes, dated December 22, 2004.

4. Background.

The FAA has long recognized the threat to aviation safety posed by wildlife strikes. Each year in the United States, wildlife strikes to U.S. civil aircraft cause about $718 million in damage to aircraft and about 567,000 hours of civil aircraft down time. For the period 1990 to 2011, over 115,000 wildlife strikes were reported to the FAA. About 97 percent of all wildlife strikes reported to the FAA involved birds, about 2 percent involved terrestrial mammals, and less than 1 percent involved flying mammals (bats) and reptiles. Waterfowl (ducks and geese), gulls, and raptors (mainly hawks and vultures) are the bird species that cause the most damage to civil aircraft in the United States, while European starlings are responsible for the greatest loss of human life. Vultures and waterfowl cause the most losses to U.S. military aircraft.

Studies have shown that strike reporting has steadily increased over the past two decades; however, strike reporting is not consistent across all stakeholders (pilots, air carriers, airport operators, air traffic control personnel, etc.) in the National Airspace System. Although larger 14 CFR Part 139 airports and those with well-established wildlife programs have improved strike reporting, there is a wide disparity in overall reporting rates between Part 139 airports and general aviation (GA) airports in the National Plan of Integrated Airport Systems (NPIAS). Less than 6 percent of total strike reports come from NPIAS GA airports, whose reporting rates average less than 1/20th the rates at Part 139 airports. Most Part 139 airports (97 percent) have

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U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Wildlife Strikes to Civil Aircraft in the United States 1990–2018

U. S. DEPARTMENT OF AGRICULTURE
WILDLIFE SERVICES

2018: The "Year of the Bird"
Marking the Centennial of The Migratory Bird Treaty Act of 1918

Safer Skies for All Who Fly: Aircraft and Birds

Federal Aviation Administration
National Wildlife Strike Database
Serial Report Number 25

Report of the Associate Administrator of Airports
Office of Airport Safety and Standards
Airport Safety & Certification
Washington, DC

July 2019

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TABLES

Table 1. Number of reported wildlife strikes to civil aircraft in USA and to U.S.-registered civil aircraft in foreign countries, 1990–2018.

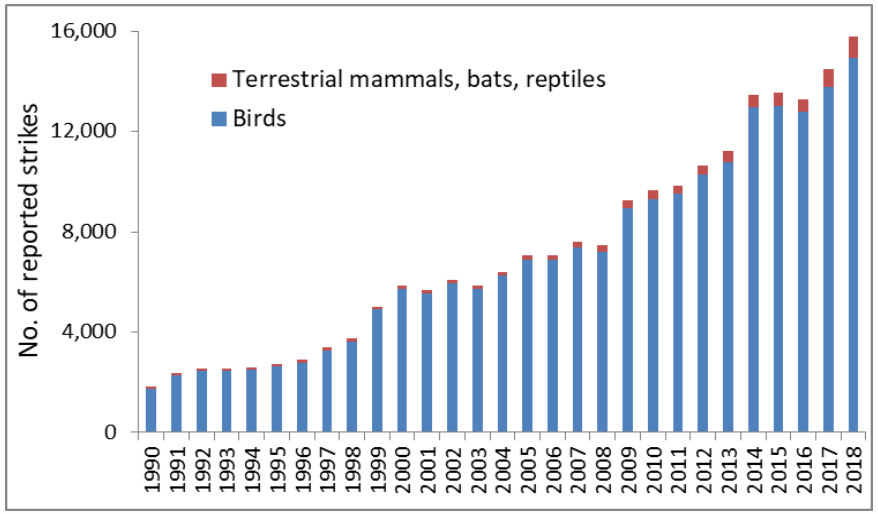
	USA[1]		Foreign		Total	
Year	Strikes	Damage strikes	Strikes	Damage strikes	Strikes	Damage strikes
1990	1,816	366	34	6	1,850	372
1991	2,352	395	37	5	2,389	400
1992	2,529	360	38	5	2,567	365
1993	2,541	395	34	4	2,575	399
1994	2,600	453	35	7	2,635	460
1995	2,717	486	52	11	2,769	497
1996	2,885	492	51	10	2,936	502
1997	3,386	569	69	9	3,455	578
1998	3,733	574	67	10	3,800	584
1999	5,017	685	95	18	5,112	703
2000	5,872	741	128	21	6,000	762
2001	5,696	630	124	15	5,820	645
2002	6,084	661	142	11	6,226	672
2003	5,864	612	137	20	6,001	632
2004	6,402	610	159	16	6,561	626
2005	7,046	585	181	20	7,227	605
2006	7,078	579	162	18	7,240	597
2007	7,603	553	142	16	7,745	569
2008	7,445	511	187	14	7,632	525
2009	9,257	585	251	20	9,508	605
2010	9,676	579	229	18	9,905	597
2011	9,857	519	262	23	10,119	542
2012	10,652	591	266	21	10,918	612
2013	11,221	596	196	13	11,417	609
2014	13,466	569	228	15	13,694	584
2015	13,564	607	244	12	13,808	619
2016	13,288	585	166	11	13,454	596
2017	14,503	649	161	9	14,664	658
2018	15,799	684	221	13	16,020	697
Total	**209,950**	**16,221**	**4,098**	**391**	**214,048**	**16,612**

[1] Includes strikes where airport is unknown because strike was en route or phase of flight was undetermined. See Table 2 for breakdown of strikes occurring in USA by type of wildlife.

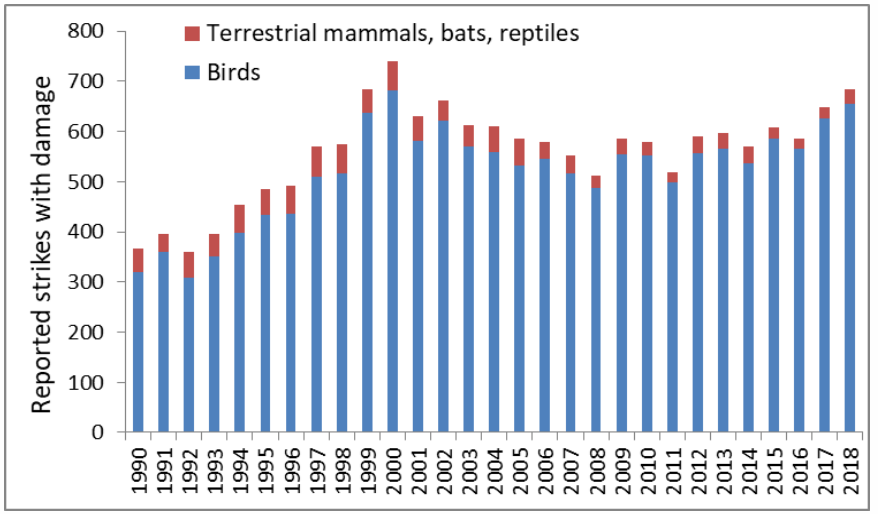
STRIKE REPORT CHALLENGE – USE THE DATA

- **Strike reporting continues to increase at all airports.**

- **Damaging strike within the airport environment (1,500 feet AGL) continue to decrease indicating safer airports.**



Strikes Reported to Civil Aircraft, USA: 1990 - 2018



Damaging Strikes to Civil Aircraft, USA: 1990 - 2018

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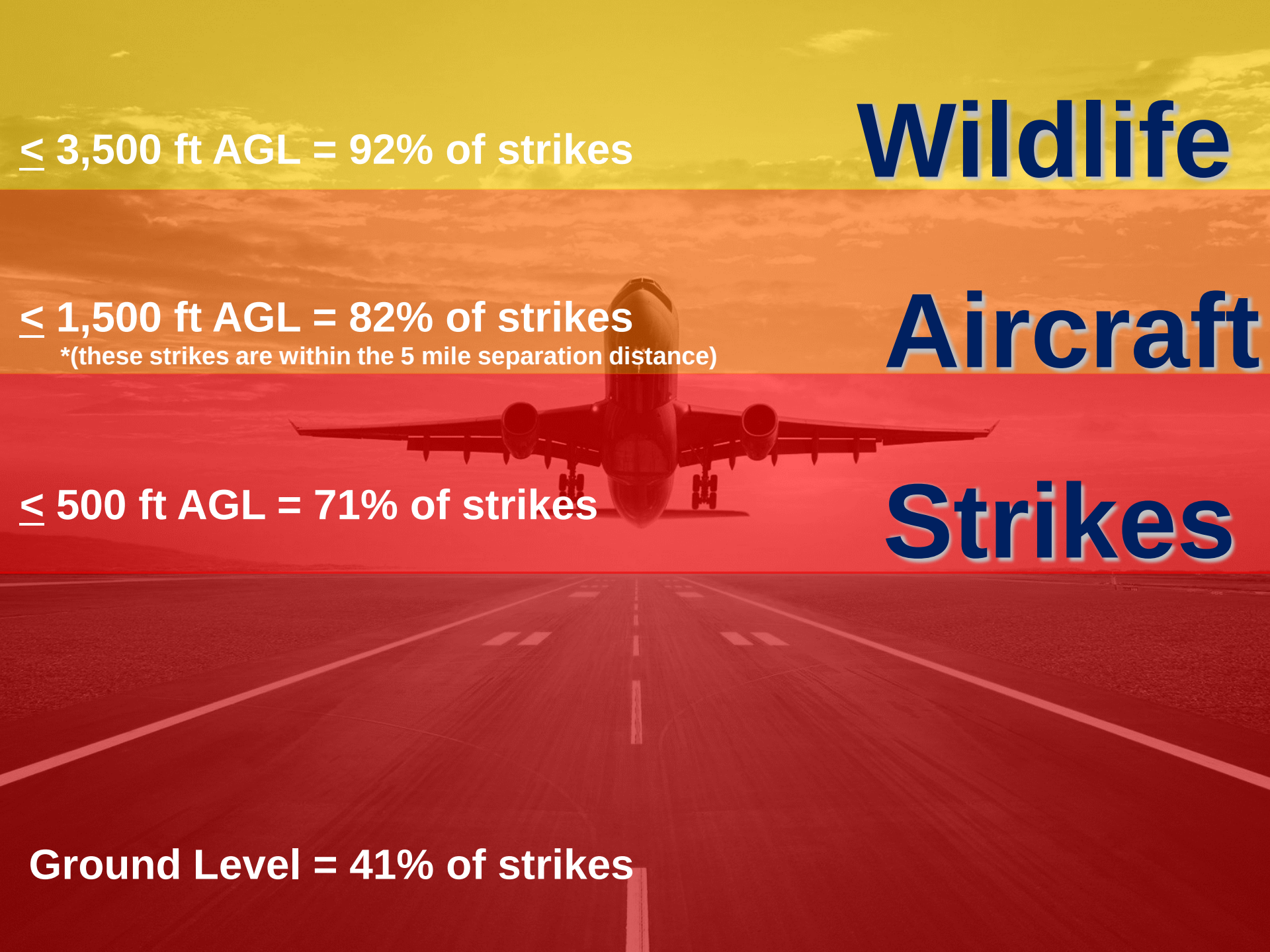
Wildlife Aircraft Strikes

≤ 3,500 ft AGL = 92% of strikes

≤ 1,500 ft AGL = 82% of strikes

*(these strikes are within the 5 mile separation distance)

≤ 500 ft AGL = 71% of strikes



Ground Level = 41% of strikes

Deriving Mass Struck

For the period to be assessed:

- Calculate the mass of all known species struck
- Determine the average mass of the (bird & bat) species involved in each strike (i.e. remove reptiles and mammals from finding average mass)
- Use average mass to fill unknown species gaps
- Multiply all masses by number of wildlife involved in each strike
- Total the mass (kg) for all strikes in that period
- Normalise for aircraft movements
  (kg/10,000 aircraft movements)

Airport A

Airport B

Difference in Movements

5 Strikes this year

50 strikes this year

Airport A	Airport B
	
5 Strikes	50 strikes
10,000 movements	100,000 movements
5 strikes/10,000 mv	5 strikes/10,000 mv
+1 additional strike	+1 additional strike
6 strikes/10,000 mv	5.1 strikes/10,000 mv
⬆ 20 %	⬆ 2 %

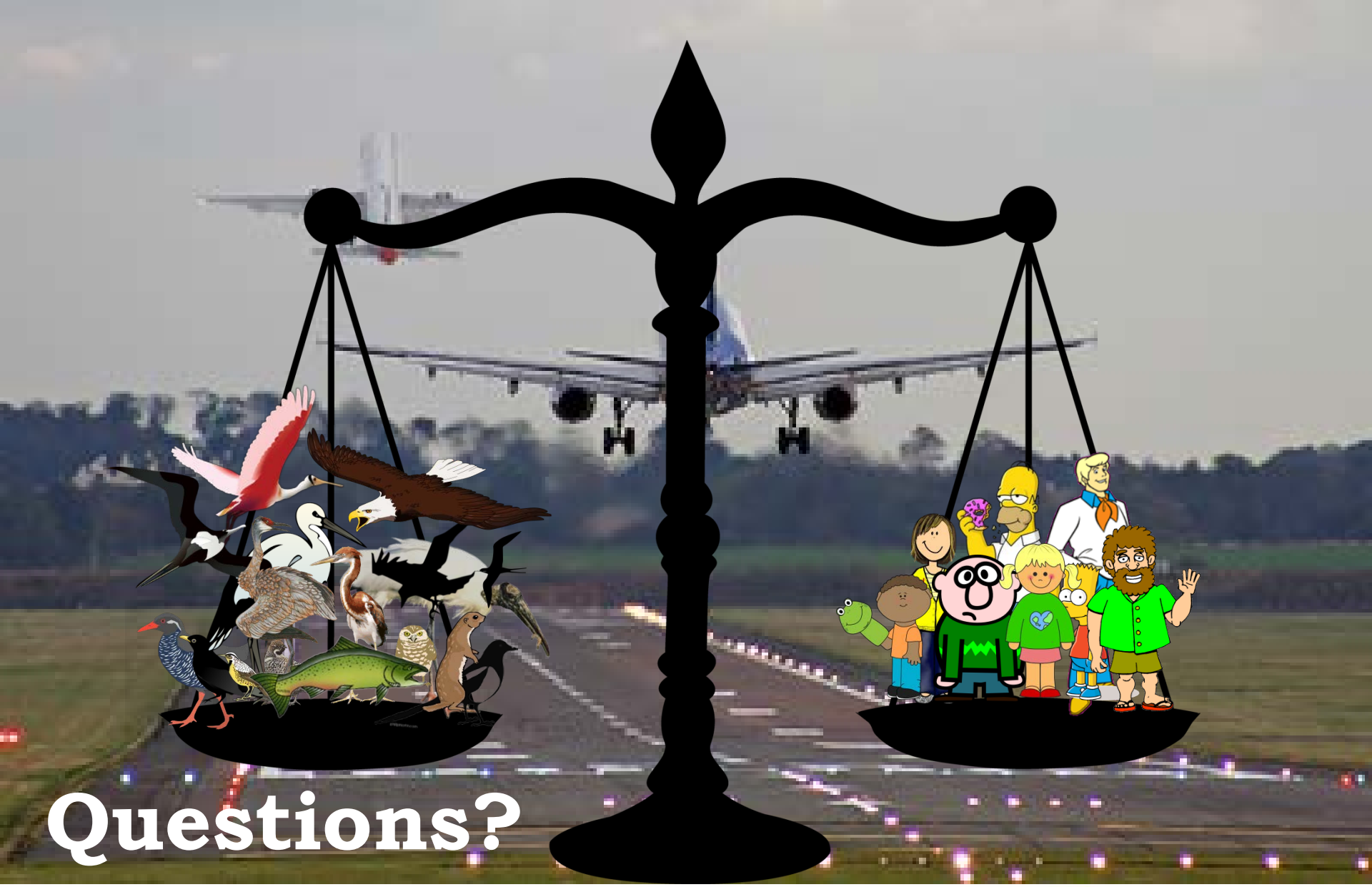
MEASURING EFFECTIVENESS
Strike Data Analysis Options

- Strike totals
- Damaging strikes
- Strikes and damaging strikes / operations
- Ratio between damaging / non-damaging strikes
- Biomass struck per operations

So what method is best?

MEASURING EFFECTIVENESS
Strike Data Analysis Guidance

- There is no current standard for analyzing strike data
- There may never be a single standard, but rather 2-3 that allow the best evaluation when combined and when used to determine risk
- Analysis options need to be detailed in regulatory guidance



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