# Using Integrated Surveillance Technology to Improve Wildlife Strike Reporting, Response and Mitigation

**Sara Handrigan**, Client Services Coordinator, Accipiter Radar
**Steve Osmek**, Airport Wildlife Biologist, Port of Seattle



Presented at 2024 Aviation Wildlife Management Conference, August 22nd

# We Know the Importance of Quality Aircraft-Wildlife Strike Reporting Data

U.S. Department of Transportation
**Federal Aviation Administration**

## Advisory Circular

**Subject:** Protocol for the Conduct and Review of Wildlife Hazard Site Visits, Wildlife Hazard Assessments, and Wildlife Hazard Management Plans

**Date:** 8/20/2018
**Initiated By:** AAS-300

**AC No:** 150/5200-38
**Change:**

## The National Wildlife Strike Database: A Scientific Foundation to Enhance Aviation Safety

**Richard A. Dolbeer** and **Michael J. Begier**
US Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, Washington, D.C.
**John R. Weller**
Office of Airport Safety and Standards, Federal Aviation Administration, Washington, D.C.

**ABSTRACT**: The U.S. Federal Aviation Administration's (FAA) National Wildlife Strike Database (NWSD) documents reports of civil aircraft collisions with wildlife in USA. The NWSD has been managed by the Wildlife Services Program of the U.S. Department of Agriculture through an interagency agreement since its inception. Although the NWSD includes about 170,000 reports of civil aircraft collisions with wildlife (97% birds) from 1990-2015 (14,000 in 2015), the overriding focus has been the quality control of data entered for over 90 variables ranging from species and numbers of wildlife struck, location and time of day, phase and height of flight, aircraft type, components struck and damaged, effect of strike on flight, and associated costs. This attention to detail allows the NWSD to be used in multiple ways to document the nature of the problem temporally and spatially for individual airports and nationwide. The NWSD is used by individual airports and FAA Airport Certification Inspectors to help objectively evaluate and improve Wildlife Hazard Management Plans by examining adverse-effect strike rates (number/100,000 aircraft movements) and the species causing those damaging strikes. The NWSD provides supportive evidence and guidance to state and federal agencies for issuing permits for wetland mitigation and removal of wildlife at airports. Nationally, the NWSD provides a science-based foundation for FAA regulations and Advisory Circulars related to wildlife management at airports and airworthiness standards for engines and aircraft components. In addition, the NWSD provides unique opportunities for basic research on topics such as bird migration (height and location of strikes) and bird behavior in relation to aircraft lighting. For example, recent research has shown that birds are more likely to strike the left side of aircraft where red navigation lights are located. The NWSD is a living document, continuously refined with new and revised strike events to enable improvements to aviation safety in an environmentally responsible, science-based manner.

**KEY WORDS:** aircraft, airport, aviation safety, bird strike, database, FAA, radar, Safety Management System, wildlife strike

**Proc. 28th Vertebr. Pest Conf.** (D .M. Woods, Ed.)
**Published at Univ. of Calif., Davis. 2018.** Pp. 152-157.

**11:30-12:00 TS1-P2 - Due Diligence in Analyzing Wildlife Strike Data to Pinpoint Gaps in Mitigation Efforts: a 35 Year Perspective**
Richard Dolbeer, Ph.D., *Science Advisor, Airports Wildlife Hazards Program*, USDA APHIS Wildlife Services

**2:00-2:30 TS2-P6 - Human Fatalities and Destroyed Aircraft Due to Wildlife Strikes, 1912 to Present**
Jeff Follett, *Chief Executive Officer*, Avisure

**3:00-4:00 TS3-P7 –Birdstrike Identification: A Fundamental Piece of Due, Smithsonian Institution Feather Identification Lab**

**09:00-09:30 CS1A-P8 - CS1A-P8 – Identifying Information Gaps in a Voluntary Strike Reporting System – Analysis of CLT Strike Data, 2021-2023**
David J. Castaneda, *Airport Wildlife Program Supervisor*, Charlotte Douglas International Airport

**11:00-11:30 CS2A-P11 - Putting it All Together: Using Incursion, Transect, Control, Opportunistic, FLIR, and Birdstrike Data to Quantify Birdstrike Risk, Develop a Management Strategy, and Monitor the Effect(s)**
Laurence M. Schafer, *Airport Coordinator and Staff Wildlife Biologist*, USDA APHIS Wildlife Services

**10:30-11:00 TS5-P18 - The Legacy of the Hudson and its Impact on Wildlife Strike Reporting**
Matthew Harman, *Ph.D., Candidate*, Resource Designs Inc. Natural Resource Research and Planning

## Information Captured Related to a Bird Strike

**Wildlife**

- Number of individuals
- Species
  - Species status (at risk)
- Recent observations
- Movements

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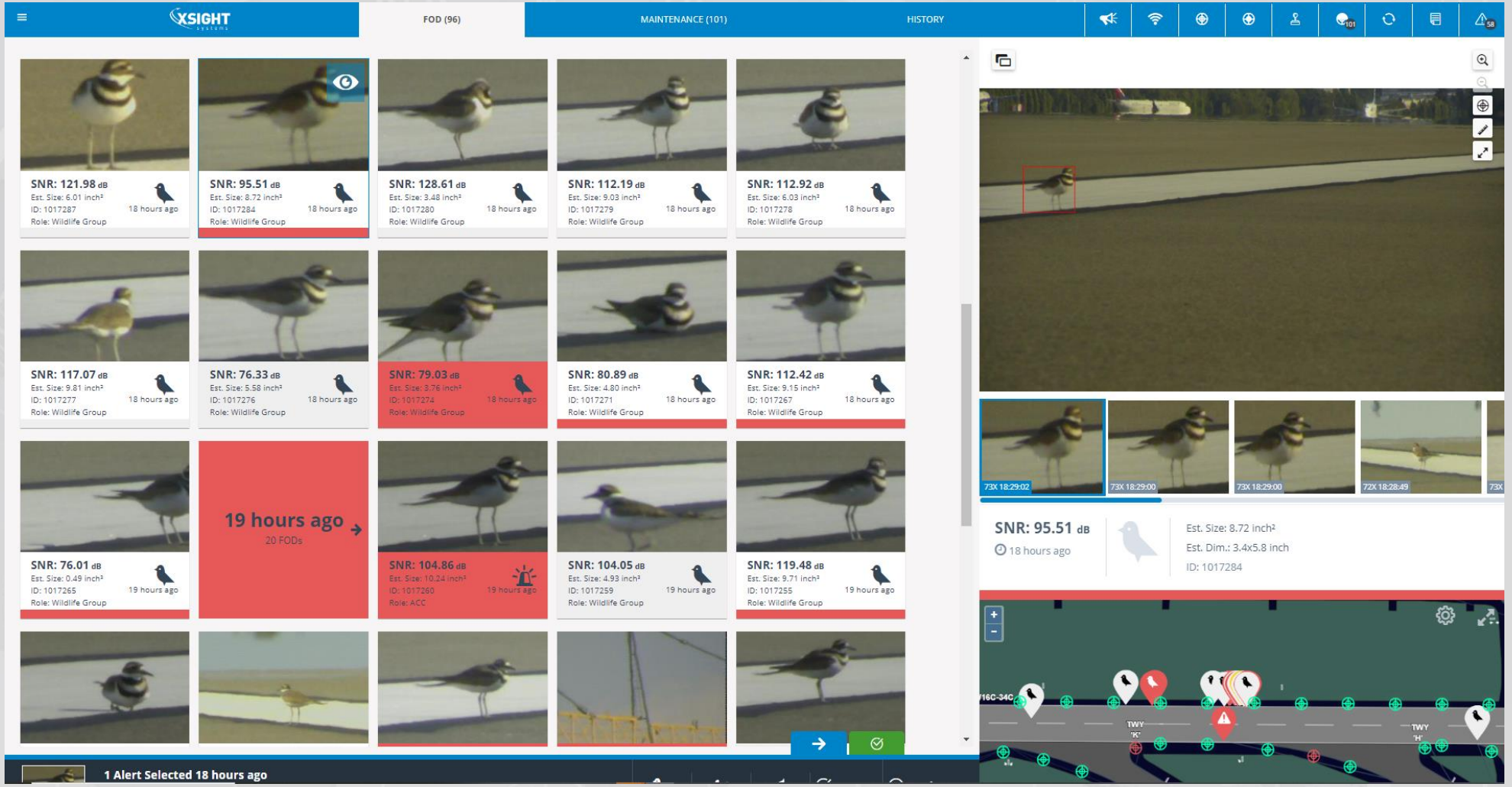

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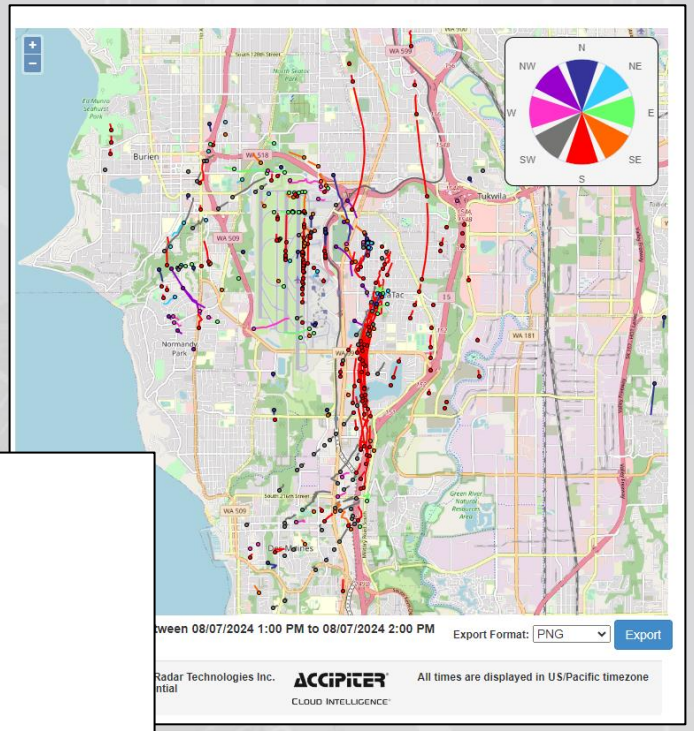
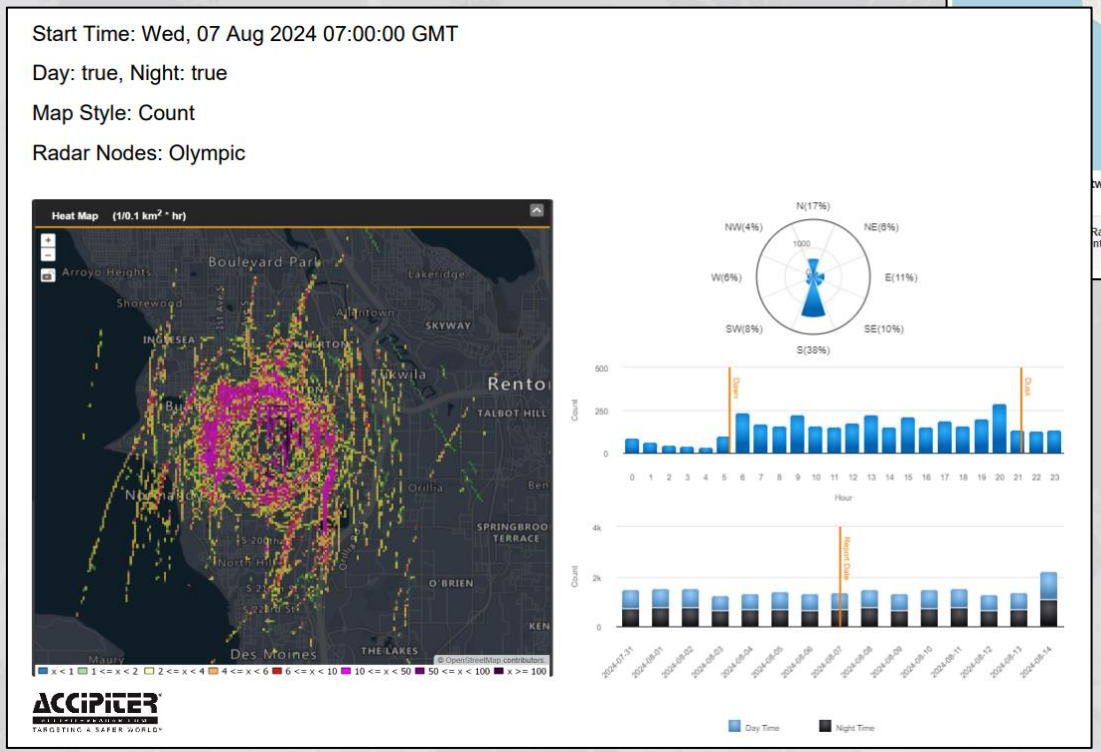


# Information Captured Related to a Bird Strike

ACCIPITER CLOUD SURVEILLANCE™

## Aircraft

- Tail Number
  - Airline
  - Make/Model
- Altitude
- Speed
- Phase of Flight
  - Location
  - Runway/Taxiway
- Pilot

| | |
|---|---|
| ICAO | A831B2 |
| Locator ID | N88NT |
| Position | 47.42775 -122.30867 |
| Flight | QXE2029 |
| Flight Radar | Open Website |
| Heading | 185 ° |
| Speed | 178.4 mph |
| Altitude | 1325 ft |
| Last Update | Aug 15 10:34:01 |
| Group | ADS-B |
| Node | SEA ADS-B |
| Sensor | ADS-B |
| Designation | Unknown |

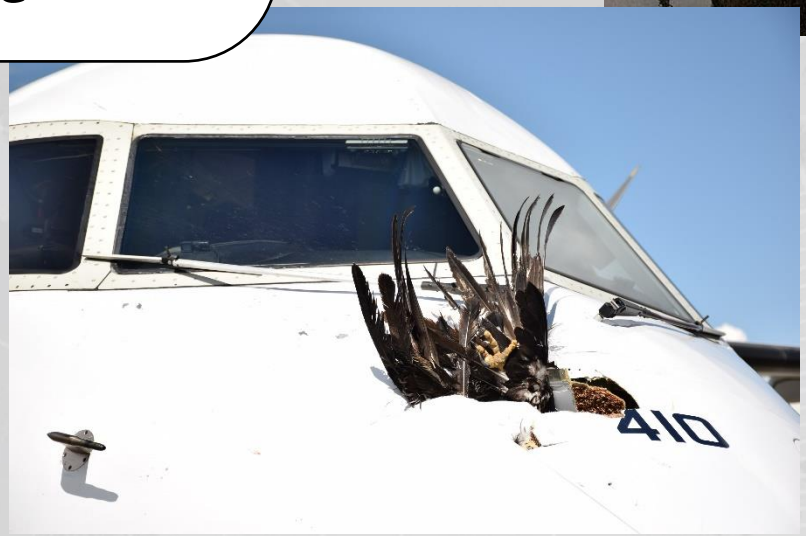
Download KML

Watch

## Information Captured Related to a Bird Strike

**Damage**

- AC Part
- Severity
- Cost Estimate
- Downtime



## Information Captured Related to a Bird Strike

### The Strike Itself

- Date/Time
- Photos/Video
- Location

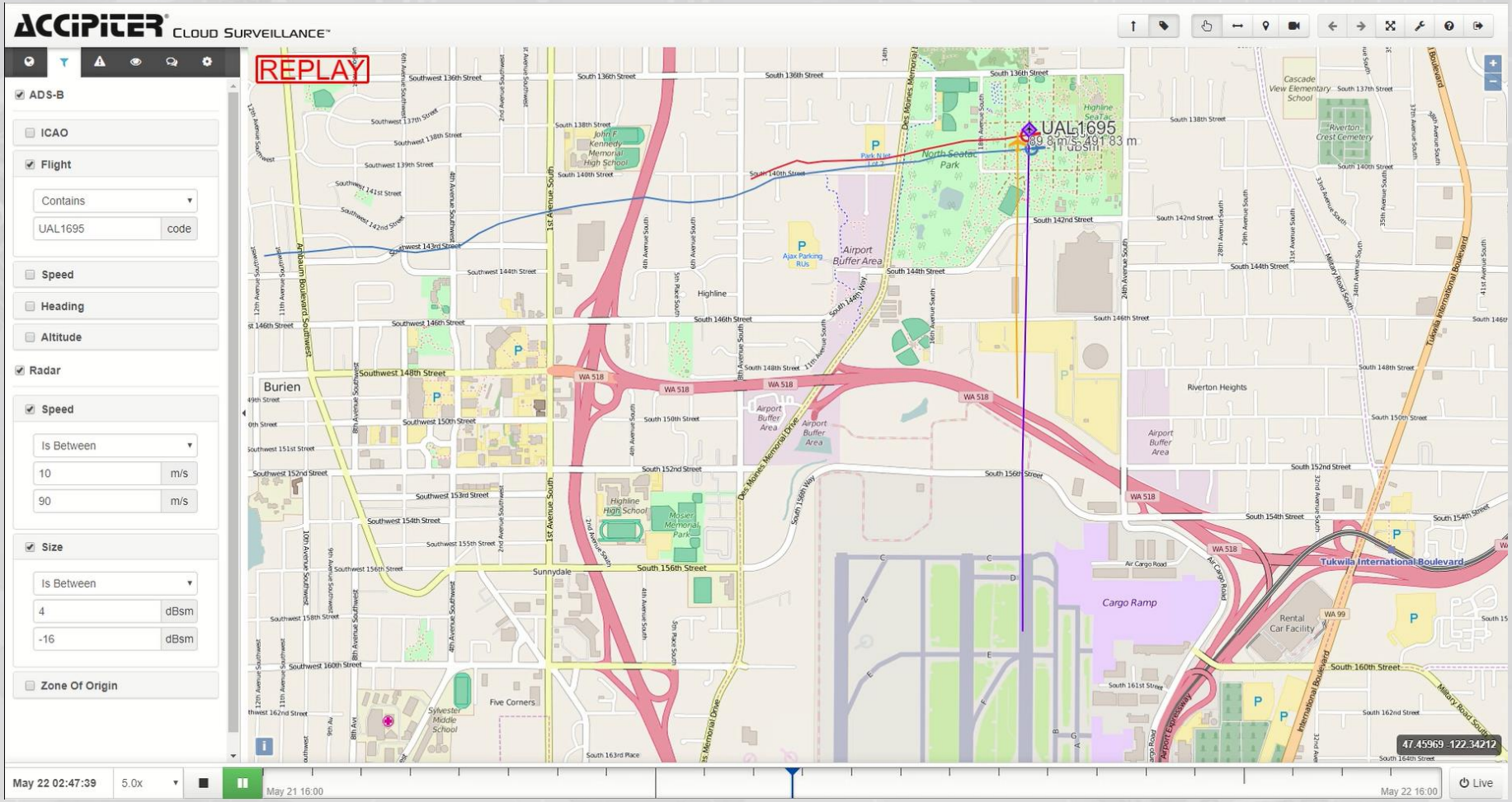





Photo credit: Matt Davis/Mcaulay Library

## Information Captured Related to a Bird Strike

### Environmental Conditions

- Weather

**Monthly Total Precipitation for SEATTLE TACOMA AIRPORT, WA**

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023 | 3.09 | 2.36 | 2.56 | 3.86 | 0.93 | 1.22 | 0.09 | 0.27 | 3.44 | 2.89 | 5.78 | 8.48 |
| Mean | 3.09 | 2.36 | 2.56 | 3.86 | 0.93 | 1.22 | 0.09 | 0.27 | 3.44 | 2.89 | 5.78 | 8.48 |

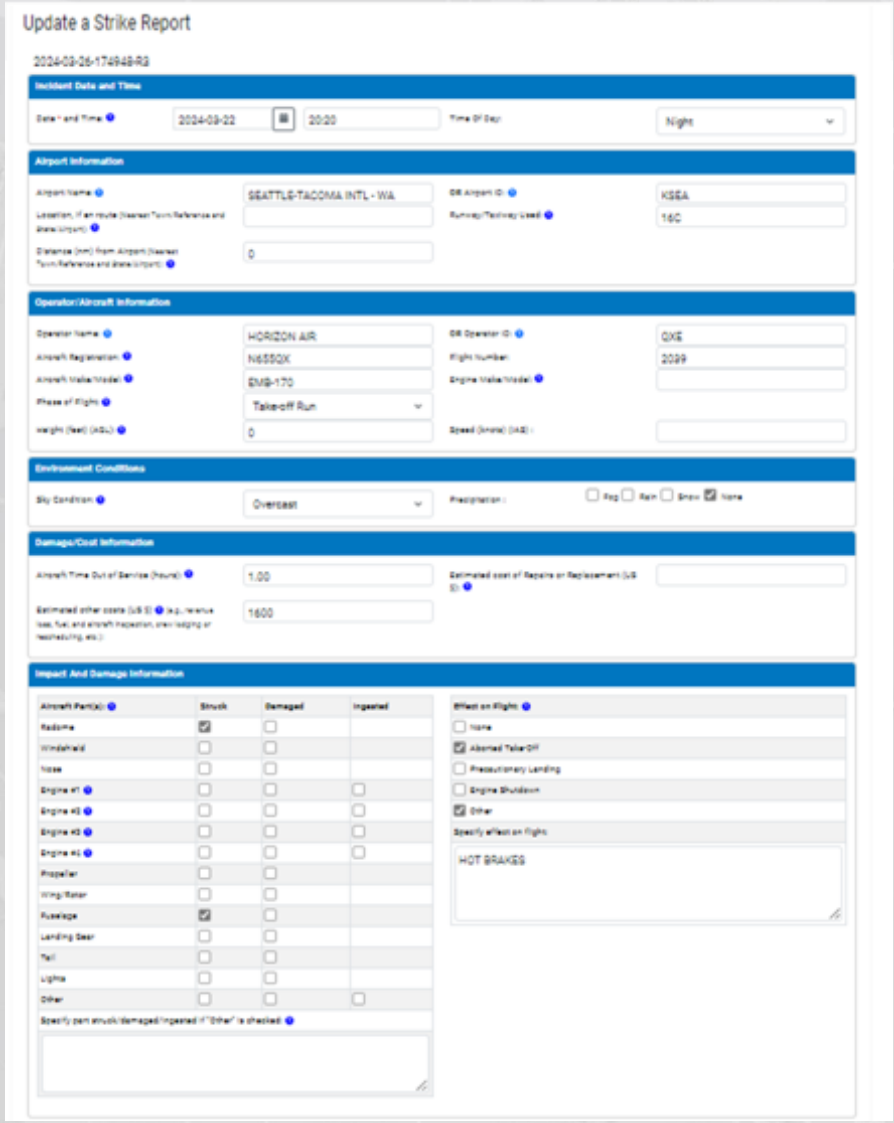
| Operator - Oper... | Flight Number | Advers... | Estimate Cos... | Wildlife Spe... | Surface Wet? ↓ |
|---|---|---|---|---|---|
| SKYWEST AIRLINES | 3752 | No | $0.00 | GULL | YES |
| UNKNOWN | | No | $0.00 | DUCK | YES |
| HORIZON AIR | 2053 | No | $0.00 | LARK | YES |
| | | No | $0.00 | OWL | YES |
| ALASKA AIRLINES | 106 | No | $0.00 | EAGLE | YES |
| | | No | $0.00 | OWL | YES |
| HORIZON AIR | 2039 | Yes | $1,875.00 | DUCK | YES |

# Sources of Data for Strike Reporting

- Pilot/FAA Tower Reports – Time of the report, content of the report, associated aircraft/airline/pilot
- Forms – Standard AOS reports
  - National strike reporting database
- Snarge – Sent to feather ID lab for identification
- Weather Stations – Precipitation, wind, temperature, other
- Maintenance Records – extension/cost of damage, downtime
- Airline partners
- News sources – Publicity
- Ebird – local reports of bird movements in the area
- Past strike records
- Other

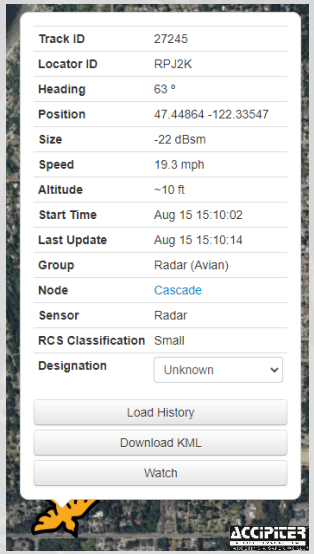
**Technology**

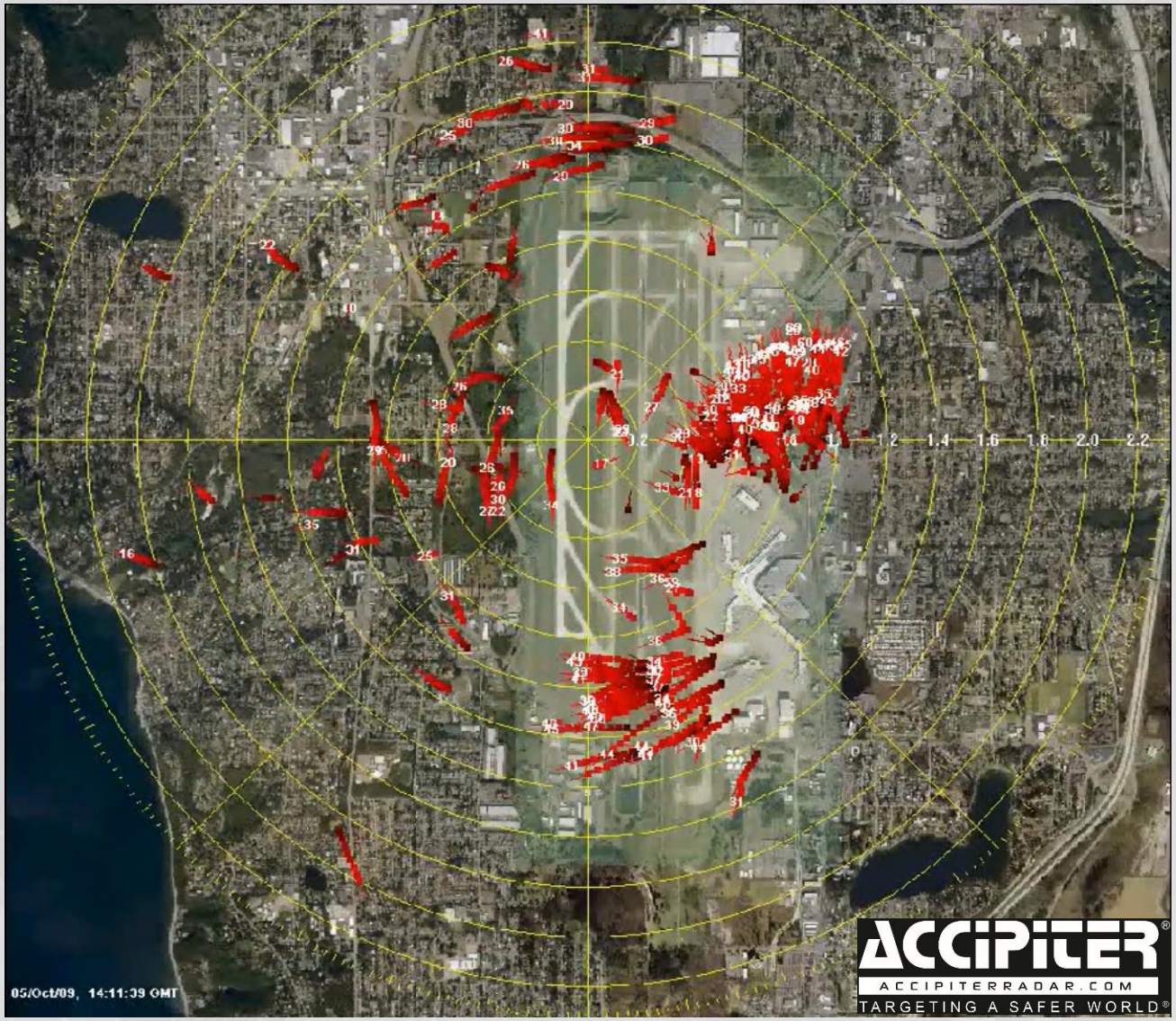
- Avian Radar – bird, aircraft, and weather positions pre and post incident
  - Event Dispatches
- ADS-B – aircraft positions (lat, long, alt, time)
- FOD Detection – location and images of wildlife ahead of the incident and carcases post-incident
- Noise Abatement (Flight Tracking) Software
- GPS Tagged Animals – Red-tailed Hawks
- Security cameras – visualizations of the strike



# Avian Radar System

- Detects moving targets on and off airport
- 3 radar units in operation
- Operates 24/7/365
- Alerts to persistent bird presence
- Capable of tracking the aircraft itself
- Data is retained forever to allow for historical analysis
- Detects birds at night when human visibility is limited

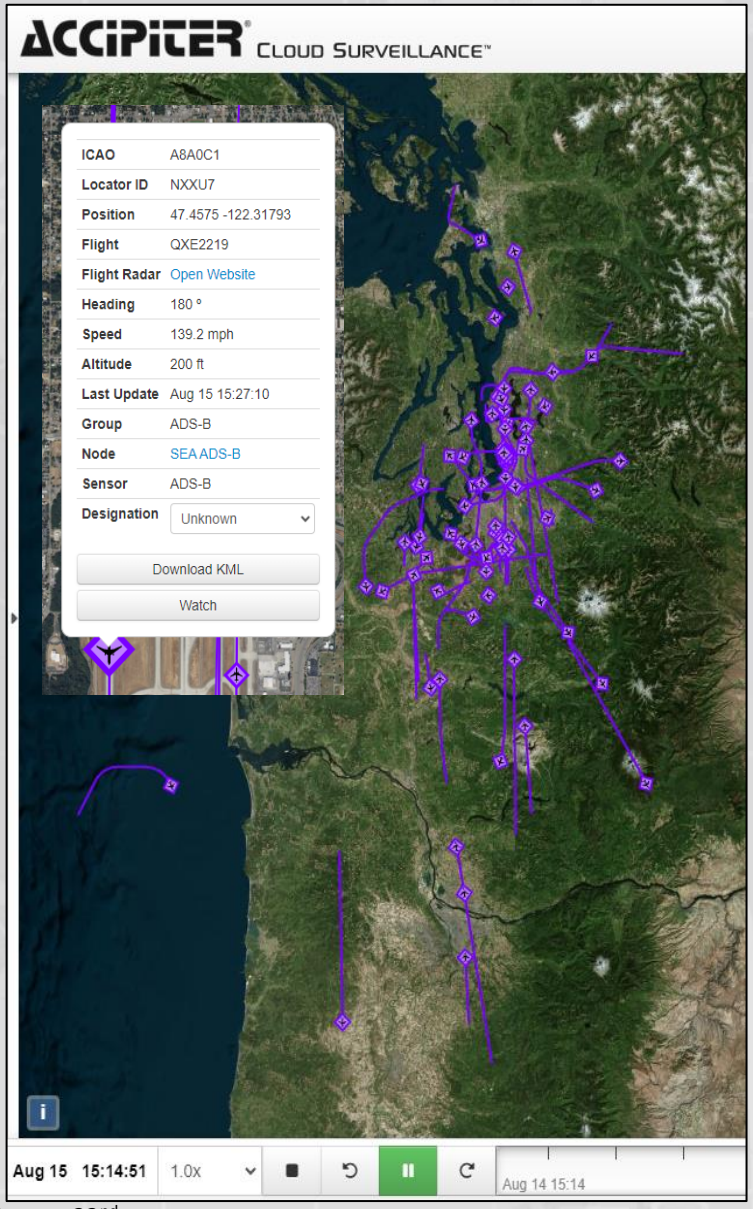


## ADS-B

Provides position and identification information for aircraft

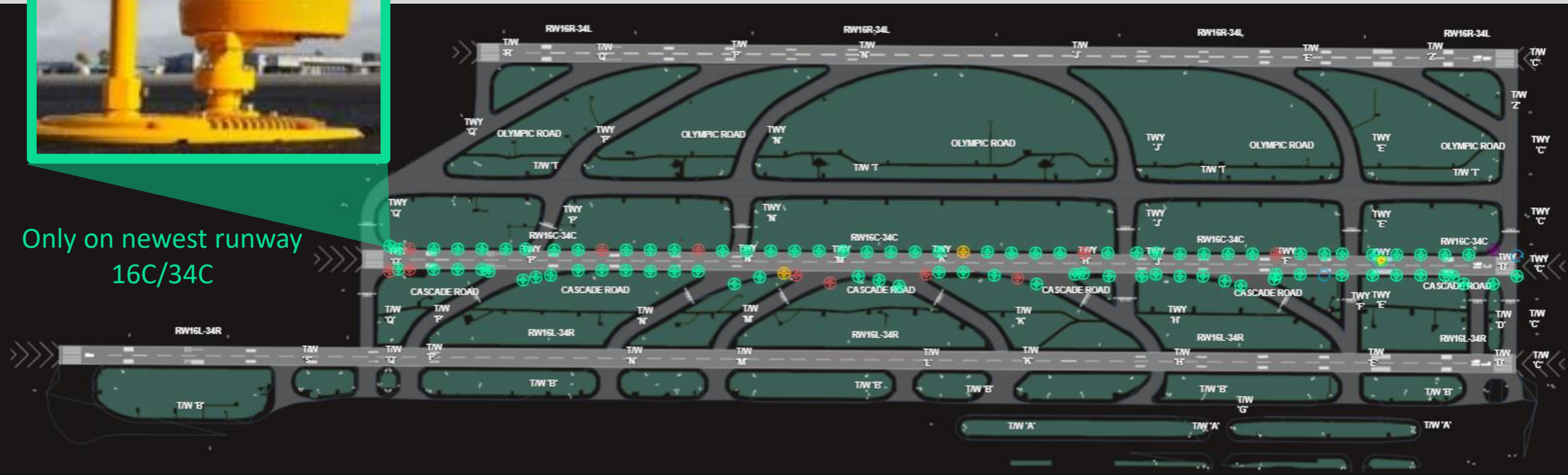
Data is stored forever for historical analysis



# Foreign Object Debris (FOD) Detection System

- 101 edge-light FOD sensors
- Operates 24/7/365 & radar 360 degrees
- Optical/infrared cameras take photos/video runway side only
- Biologists get unfiltered data...everything

Only on newest runway 16C/34C



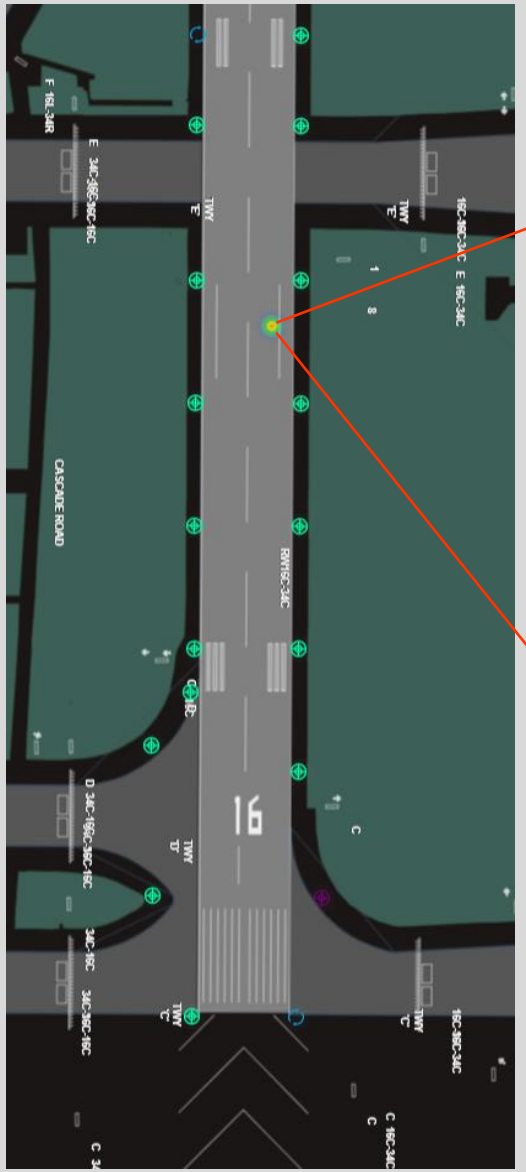
# FOD Detection System

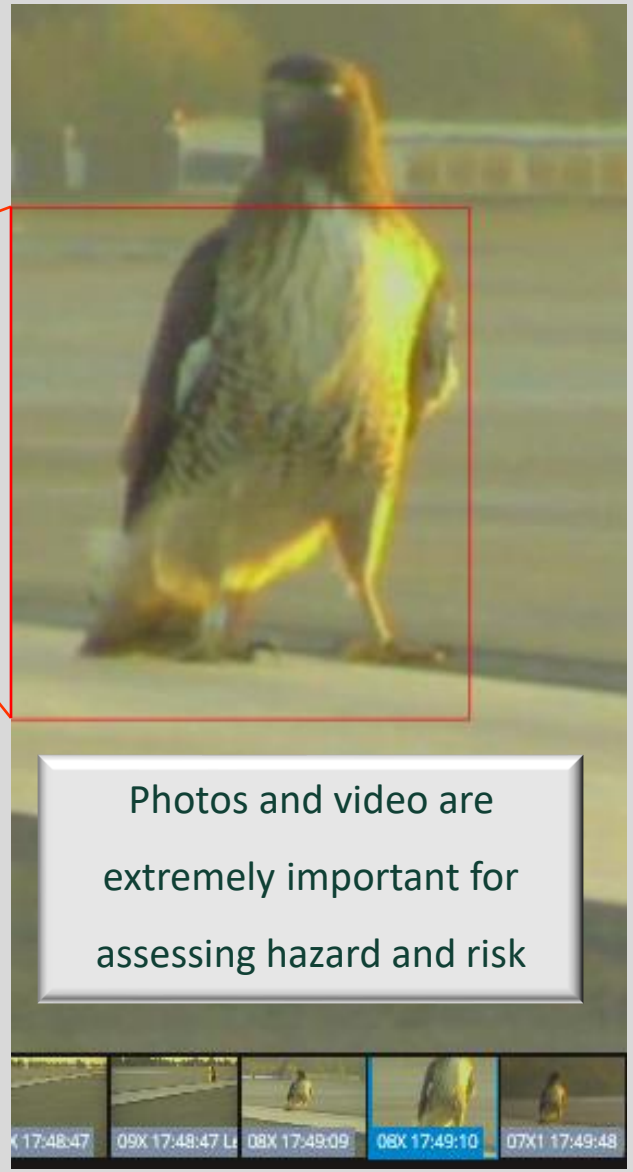
- Date, time, location, size and images/videos stored indefinitely

**ID:** 222894

**Date:** 10/24/17 | 5:48:45 pm
**Est. Size:** 108.63 inch²
**Est. Dim.:** 11.3x29.6 inch
**Radar:** 132.73 dB
**Range:** 105.82 feet
**Latitude:** 47.4592
**Longitude:** -122.3107

- New strikes detected quickly
  - Communicated to flight crew fast



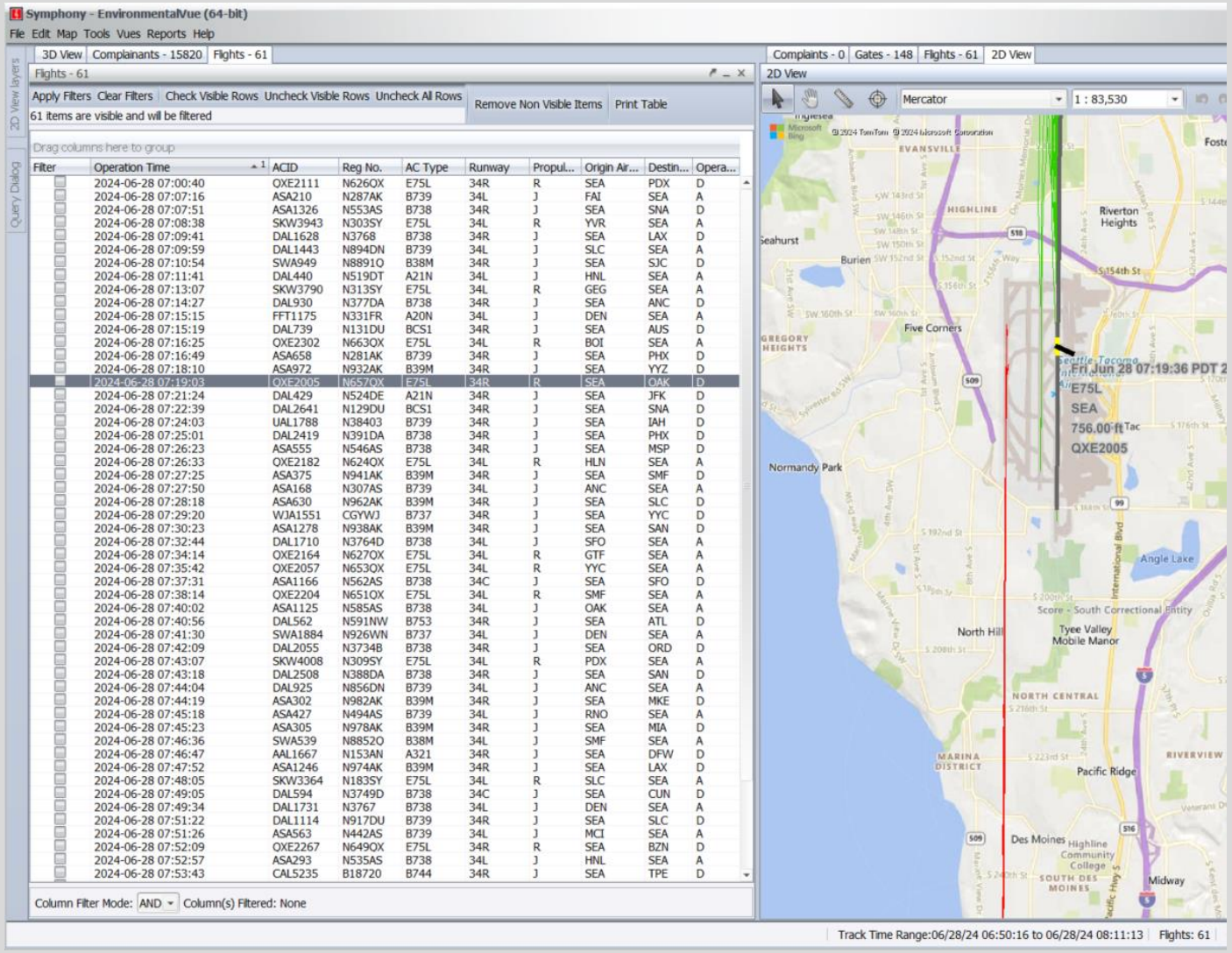
# FOD Detection System

Strike time, location and photo obtained real-time

- Other benefits
  - Improved strike rate information (strikes commonly scavenged)
  - More wildlife hazard alerts and harassment
  - Locations of prey densities identified

# Noise Abatement (Flight Tracking) Software

- Noise Abatement Software offers fast accurate departure and arrival times
- "Flight Aware" OK too
  - Often delayed info
  - Excludes data on airport
- Helps narrow down what aircraft struck wildlife
- Direct integration with air traffic control communications



# Existing Airport Integrated Camera Systems

## Extremely beneficial for

- Species ID
- Number struck
- Flock size and behavior

## Integrated camera software

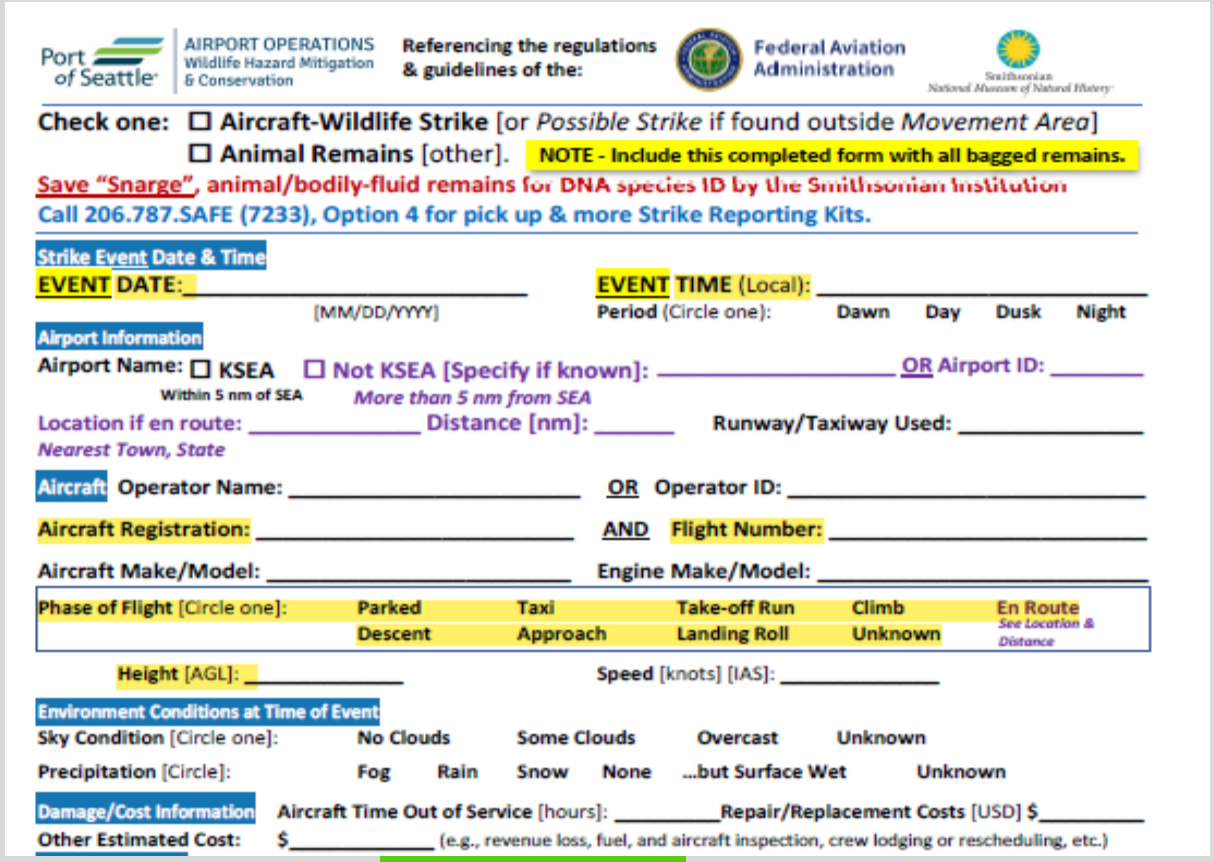
- Quickly access 100's of cameras
  - Fixed Cameras
  - PTZ Cameras

## However

- OTS Cameras - poor optics
- Objects must be close
- Infrared needed when dark

## Bird Strike Reporting Process

- Strike reporting kits provided to airlines
- Snarge recovered by Airport Operations
  - Sent to Smithsonian if unable to ID
- Technologies used for forensic examination
- Mandatory Occurrence Reports received later



Port of Seattle | AIRPORT OPERATIONS Wildlife Hazard Mitigation & Conservation

Referencing the regulations & guidelines of the: Federal Aviation Administration | Smithsonian National Museum of Natural History

**Check one:** ☐ **Aircraft-Wildlife Strike** [or *Possible Strike* if found outside *Movement Area*]
☐ **Animal Remains** [other]. **NOTE - Include this completed form with all bagged remains.**

Save "Snarge", animal/bodily-fluid remains for DNA species ID by the Smithsonian Institution
Call 206.787.SAFE (7233), Option 4 for pick up & more Strike Reporting Kits.

**Strike Event Date & Time**
**EVENT DATE:** _____ [MM/DD/YYYY] **EVENT TIME** (Local): _____
**Period** (Circle one): Dawn Day Dusk Night

**Airport Information**
**Airport Name:** ☐ KSEA (Within 5 nm of SEA) ☐ Not KSEA [Specify if known]: _____ OR Airport ID: _____ (*More than 5 nm from SEA*)
Location if en route: _____ Distance [nm]: _____ Runway/Taxiway Used: _____
*Nearest Town, State*

**Aircraft** Operator Name: _____ OR Operator ID: _____
Aircraft Registration: _____ AND Flight Number: _____
Aircraft Make/Model: _____ Engine Make/Model: _____

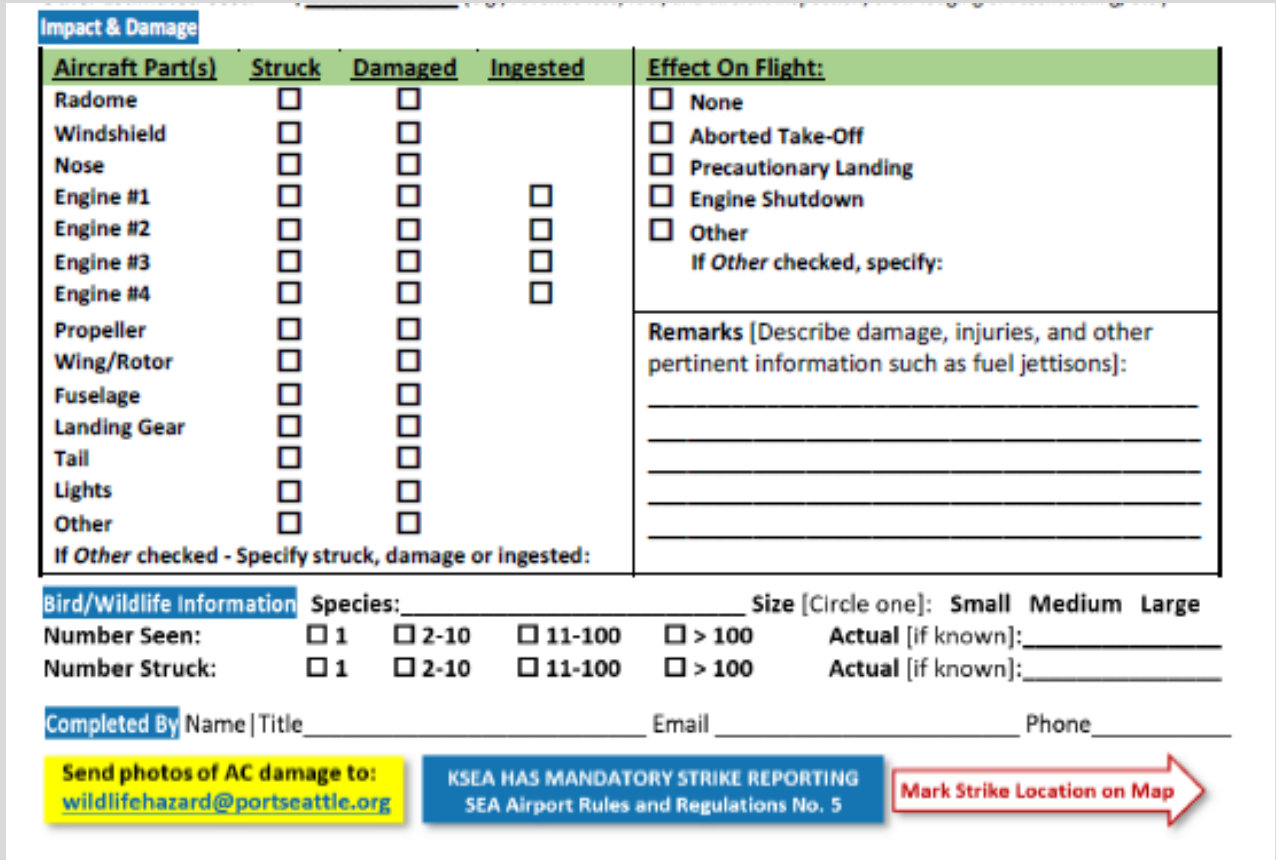
| Phase of Flight [Circle one]: | Parked | Taxi | Take-off Run | Climb | En Route (See Location & Distance) |
|---|---|---|---|---|---|
| | Descent | Approach | Landing Roll | Unknown | |

Height [AGL]: _____ Speed [knots] [IAS]: _____

**Environment Conditions at Time of Event**
Sky Condition [Circle one]: No Clouds Some Clouds Overcast Unknown
Precipitation [Circle]: Fog Rain Snow None ...but Surface Wet Unknown

**Damage/Cost Information** Aircraft Time Out of Service [hours]: _____ Repair/Replacement Costs [USD] $_____
Other Estimated Cost: $_____ (e.g., revenue loss, fuel, and aircraft inspection, crew lodging or rescheduling, etc.)

Top half of form



**Impact & Damage**

| Aircraft Part(s) | Struck | Damaged | Ingested |
|---|---|---|---|
| Radome | ☐ | ☐ | |
| Windshield | ☐ | ☐ | |
| Nose | ☐ | ☐ | |
| Engine #1 | ☐ | ☐ | ☐ |
| Engine #2 | ☐ | ☐ | ☐ |
| Engine #3 | ☐ | ☐ | ☐ |
| Engine #4 | ☐ | ☐ | ☐ |
| Propeller | ☐ | ☐ | |
| Wing/Rotor | ☐ | ☐ | |
| Fuselage | ☐ | ☐ | |
| Landing Gear | ☐ | ☐ | |
| Tail | ☐ | ☐ | |
| Lights | ☐ | ☐ | |
| Other | ☐ | ☐ | |

If *Other* checked - Specify struck, damage or ingested:

**Effect On Flight:**
☐ None
☐ Aborted Take-Off
☐ Precautionary Landing
☐ Engine Shutdown
☐ Other
If *Other* checked, specify:

**Remarks** [Describe damage, injuries, and other pertinent information such as fuel jettisons]:
_____
_____
_____
_____
_____

**Bird/Wildlife Information** Species: _____ Size [Circle one]: Small Medium Large

| | | | | | |
|---|---|---|---|---|---|
| Number Seen: | ☐ 1 | ☐ 2-10 | ☐ 11-100 | ☐ > 100 | Actual [if known]: _____ |
| Number Struck: | ☐ 1 | ☐ 2-10 | ☐ 11-100 | ☐ > 100 | Actual [if known]: _____ |

**Completed By** Name | Title _____ Email _____ Phone _____

Send photos of AC damage to: wildlifehazard@portseattle.org
KSEA HAS MANDATORY STRIKE REPORTING
SEA Airport Rules and Regulations No. 5
Mark Strike Location on Map

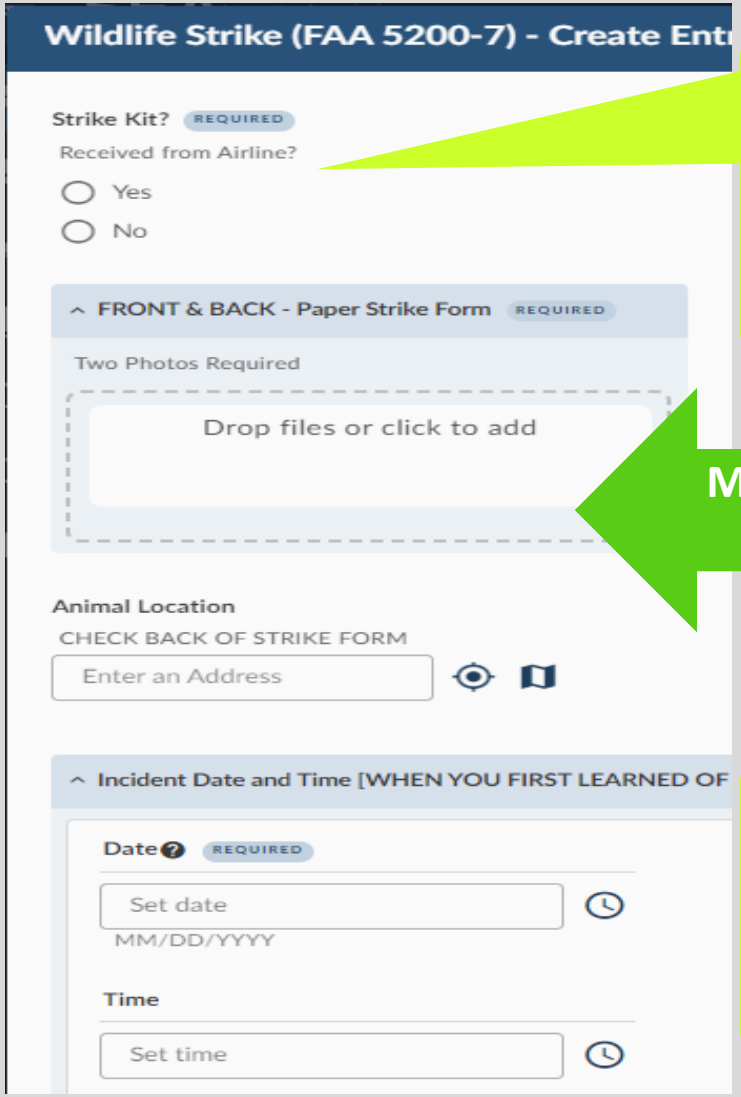
Bottom half of form

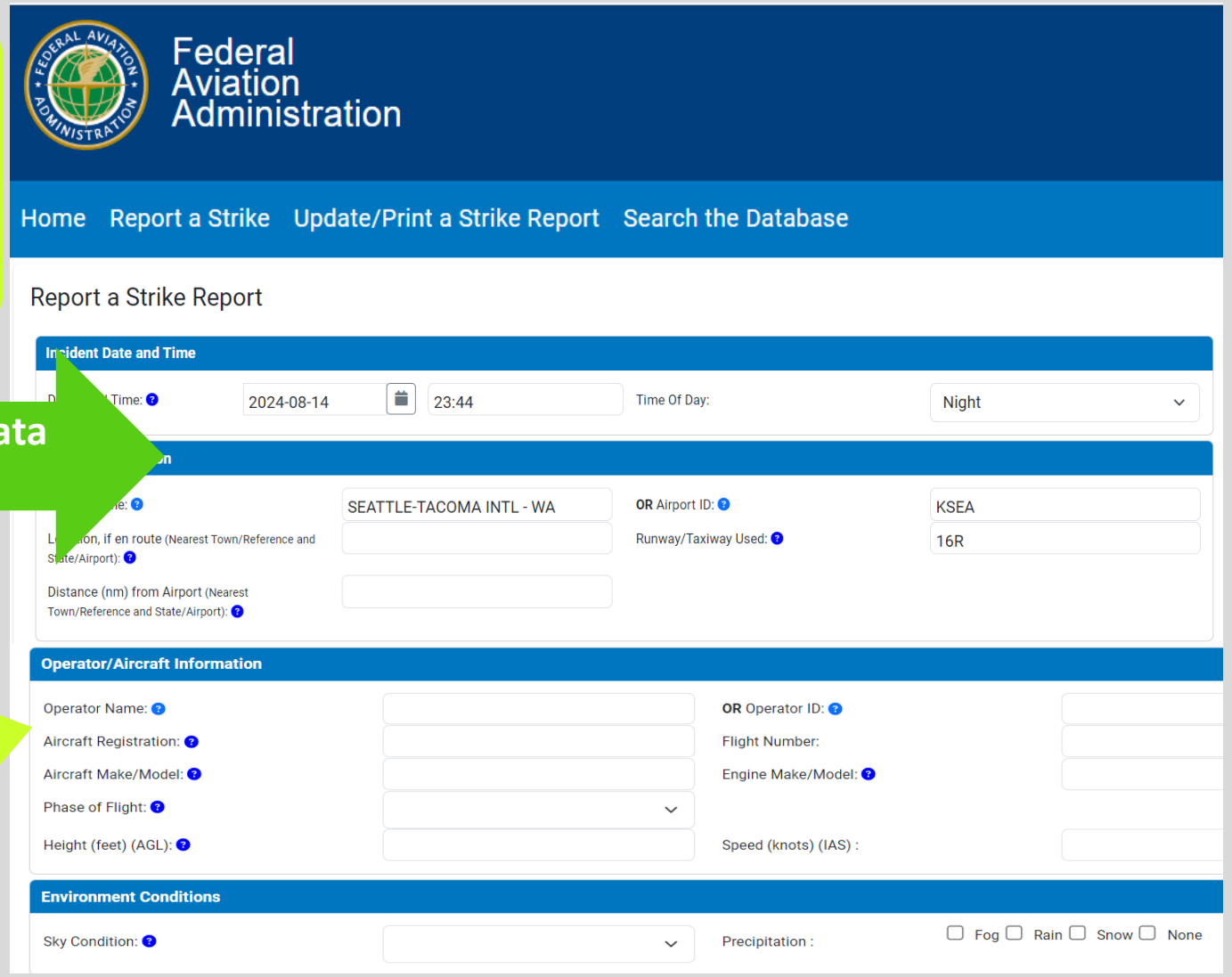
# Using Integrated Surveillance Technology to Improve Wildlife Strike Reporting, Response and Mitigation

SEA & Contractors (Accipiter) Provides Data

**Multi-Direction Data Transfer**

When FAA strike report is updated so is Veoci



2023-Nov-13 20:07 2023-11-16-113808

Strike Kit?

Received from Airline?

No

FRONT & BACK - Paper Strike Form

Two Photos Required

<No Value>

Animal Location

CHECK BACK OF STRIKE FORM

47.4592, -122.3112


**The Online strike database software enables others to upload important photos, video, and save Wildlife Hazard Review Meeting Reports all in one location**

Close

Edit

Hide Toolbox

COMMENTS INFO RELATIONSHIPS ACTIONS

**Direct collaboration with others outside the Port of Seattle consolidates records quickly**

Steve Osmek 2023-Nov-22 11:04

@Sara Handrigan Strike time is 20:07. That's when FOD system first detected the mallard on the runway. This is the exact lat long

SH

Sara Handrigan 2023-Nov-28 13:11

@Steve Osmek , avian radar analysis is complete and has been uploaded. Note that there WAS precipitation the night before this strike occurred.

Steve Osmek 10:24

@Mike Middleton Lets use this record to test the merging process that Phyliss does. Alaska Airlines has their own strike report from Anchorage where they detected mallards being struck at ZZZZ.

Add a comment to thread

## Monthly Wildlife Hazard Working Group Review Meetings

### Members

- Airlines
- Wildlife, Airport Operation's Safety Management System team
- Aviation Maintenance
- Various contractors (avian radar vendor, raptor contractors, etc.)
- Other entities, as needed to mitigate issue

**Purpose - To review strikes resulting in:**

- FAA Triggering Events
- Adverse Effect" (AE = costs the airlines $)
- Negative Effect on Flight (NEOF)

**Outcome – Improved risk mitigation**

**These meetings result in improved reporting quality, relationships, standard operating procedures & WHMP updates**

| Source | TIME | TOD | AIRPORT | LATITUDE | LONGITUDE | RUNWAY | LOCATION | PHASE_OF_FLIGHT | HEIGHT | SPEED | STR_WING_ROT | SKY | PRECIP | #_STRUCK | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Report from Airline confirmed Flight, Tail# | | | ZZZZ | | | | FOUND Anchorage, AK | | | | TRUE | | | 1 | Bird struck the wing and flap between engine no.1 and the fuselage. The ground crew discovered the strike after the plane sat overnight. No details of where or when the strike occurred were given. FOUND PANC. NIGHT 737-990, Engine Manufacturer CFM INTL. Classification Standard Engine Model CFM56 SERIES Smithsonian Wildlife/Species Identification: Mallard (Anas platyrhynchos) |

Mitigate Risks

# Resulting Triggering Event Mitigation Improvements

## Number of Triggering Events by Species

| | MITIGATION ACTIONS & PLANNING | European Starling | Rock Pigeon | American Crow | American Robin | Western Meadow lark | Glaucous-winged Gull | Mallard | Northern Harrier | Bald Eagle | Short-eared Owl | Red-tailed Hawk | Great Horned Owl | Domestic Dog (Aborted Takeoff) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MORE REACTIVE | Increase live trapping and other control efforts | 1 | 1 | | | | | | | | | | | |
| | Increase harassment and lethal removal when appropriate | | | 1 | 1 | | 1 | 1 | | | | | | |
| | Emphasize species ID and harassment | | | | | 2 | | 1 | 1 | | 1 | | | |
| | Raptor Strike Avoidance Program | | | | | | | | | | | 2 | | |
| | Set another SGH trap for a total of five (5) | | | | | | | | | | | 1 | | |
| | July - Oct, at minimum: Increased SGT to 10 traps and increase active trapping to dawn/dusk | | | | | | | | | | | 2 | | |
| | Continued trapping efforts to focus on night trapping and different traps | | | | | | | | | | | | 1 | |
| REVIEW OF PROCEDURES | Round table discussion with FAA Tower & SOG/QRG | | | | | | | | | | | | | 1 |
| | ROLLUP | | | | | | | | | | | | | |
| PROACTIVE | *Proposed Airfield Wildlife Habitat Mitigation Project* 2026-30 | | | | | | | *4* | | | | | | |
| | *Redouble efforts to identify attractants and inform FAA and USFWS of challenges.* | | | | | | | | | *1* | | | | |
| | *Cut grass shorter. Cut grass to 6" it's a discrepancy at 12"* | | | | | *1* | | | | | | | | |

# Examples of Improved Bird Strike Investigation and Reporting

2017-07-27 Starling Bird Strike

## Initial Report

- Strike occurred on July 27th, 2017
- Multiple birds involved and species identified as European starlings
- Confirmed that at least 6 birds were struck
- Flight EJA788

2017-07-27 Starling Bird Strike

## Avian Radar Investigation

- Identified the location and precise time of the strike by looking at the intersection between avian radar tracks and ADS-B

2017-07-27 Starling Bird Strike

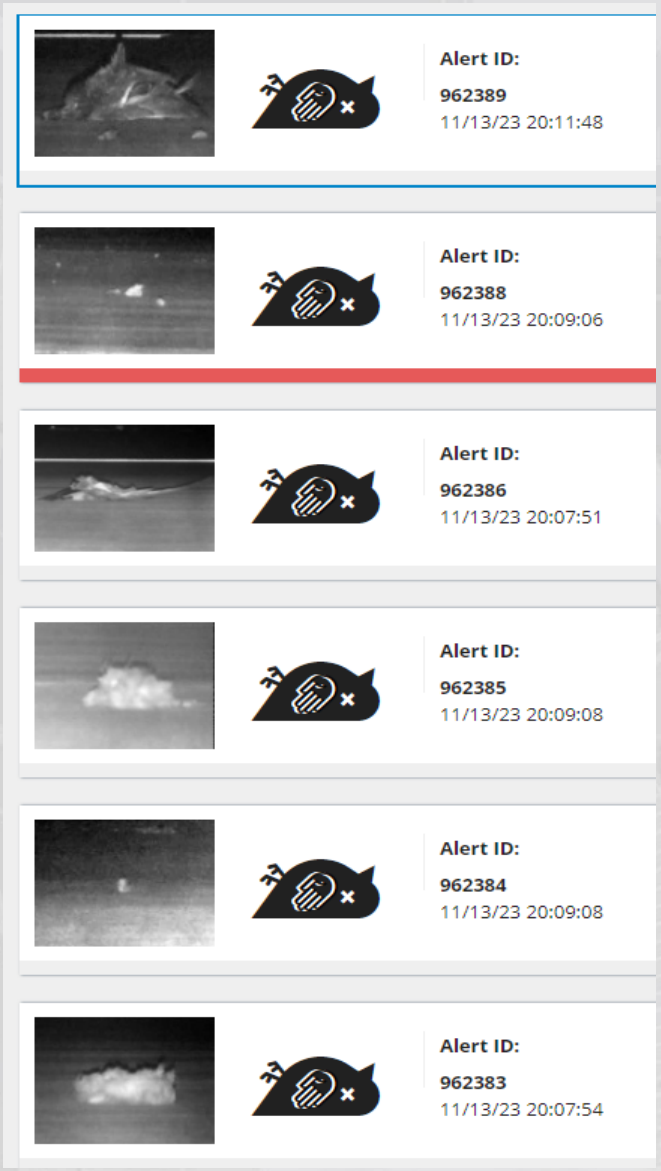
## Operational Response

- Called ATCT
- Walked the site
- 10 European starling carcasses discovered

**Carcasses retrieved so they would not attractant eagles**

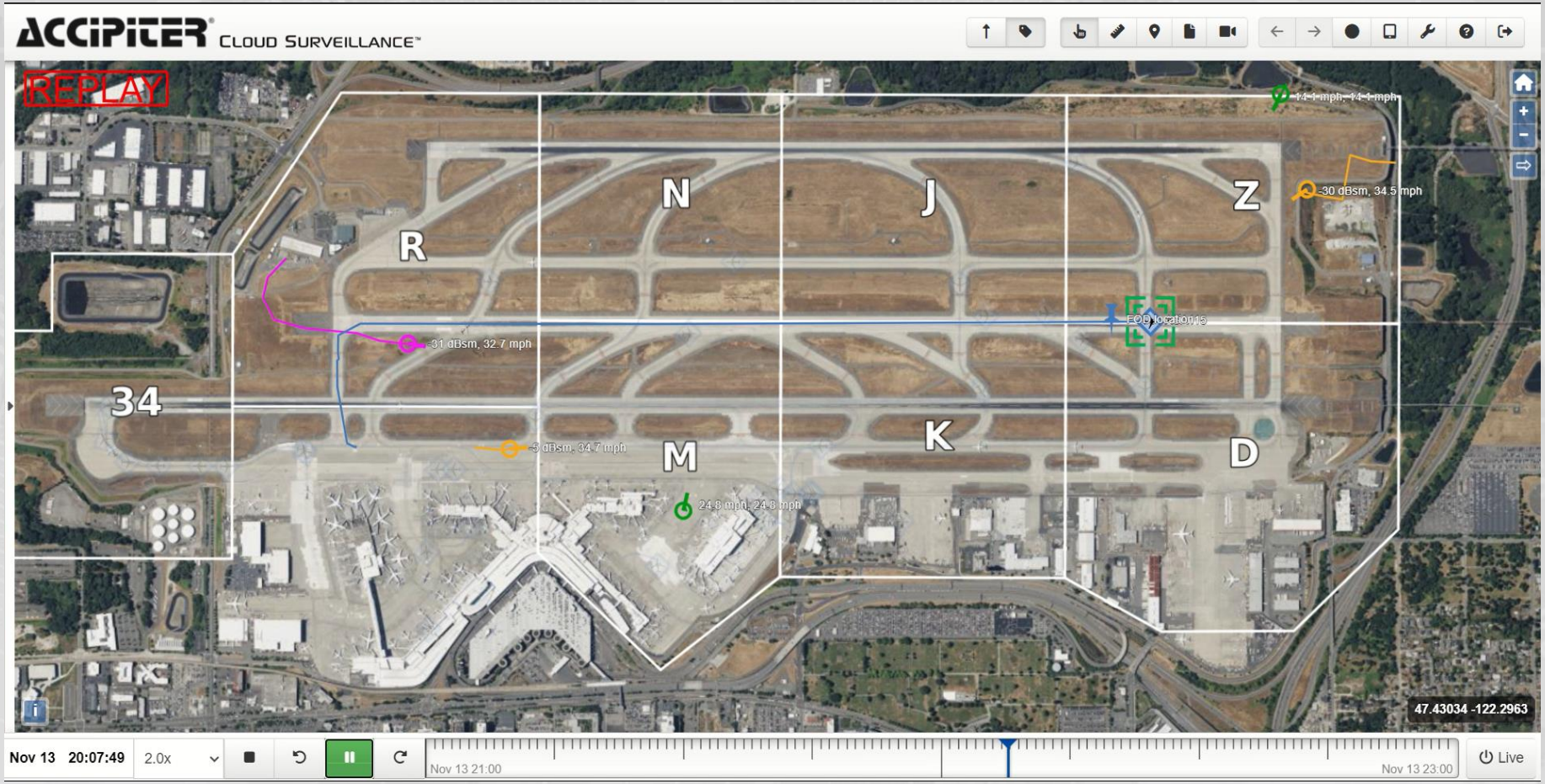
2023-11-13 Mallard Strike

- SEA staff were alerted to the presence of at least two carcasses on runway 34C using the FOD detection system
- Smithsonian confirmed ID as mallards

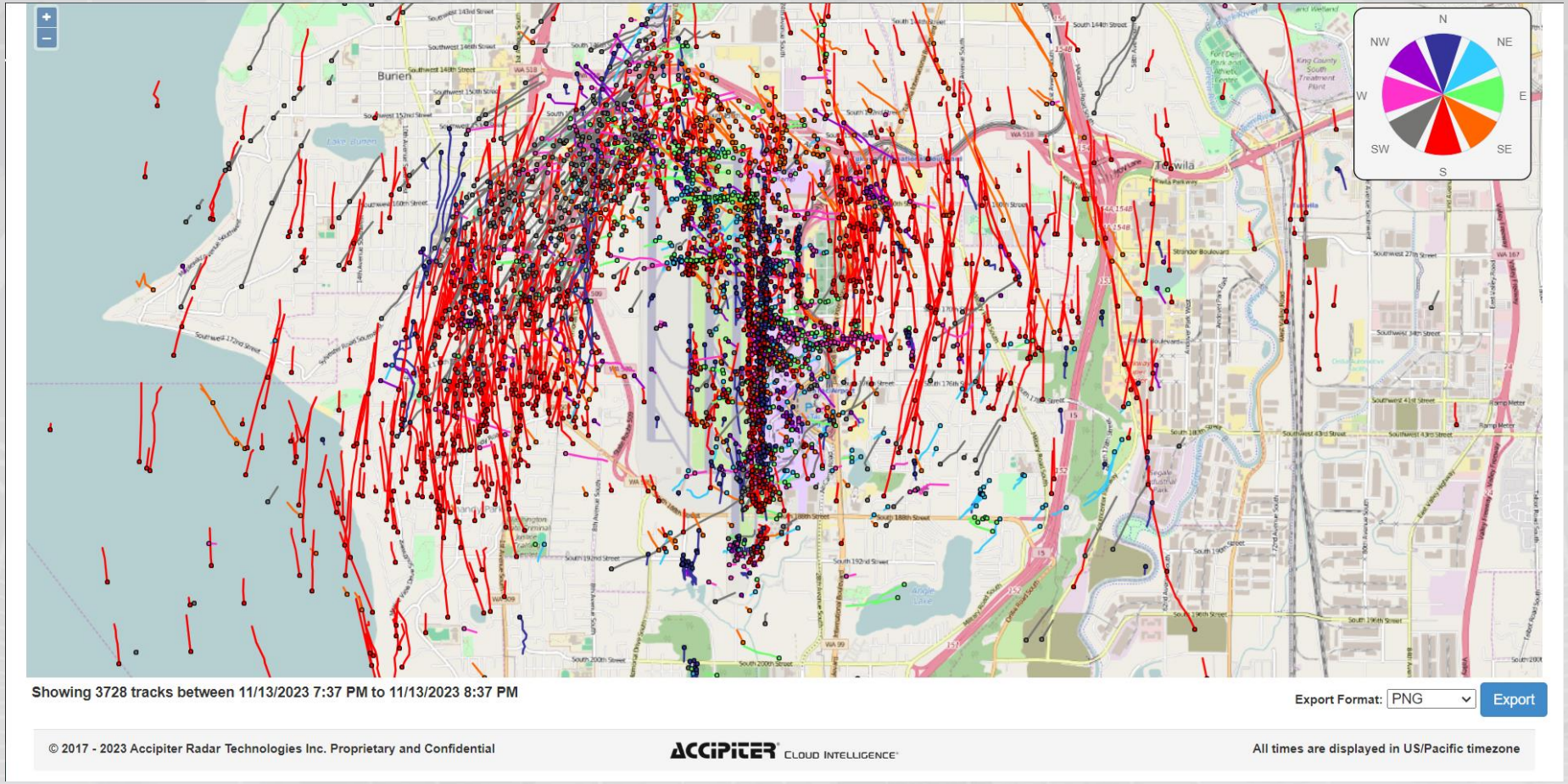
## 2023-11-13 Mallard Strike

ADS-B was used to identify a candidate aircraft (ASA115) that may have struck the birds during take-off while at 275 feet AGL travelling 195.6 mph.



## 2023-11-13 Mallard Strike

- Avian radar also showed that bird activity at SEA was heavy at the time of the strike

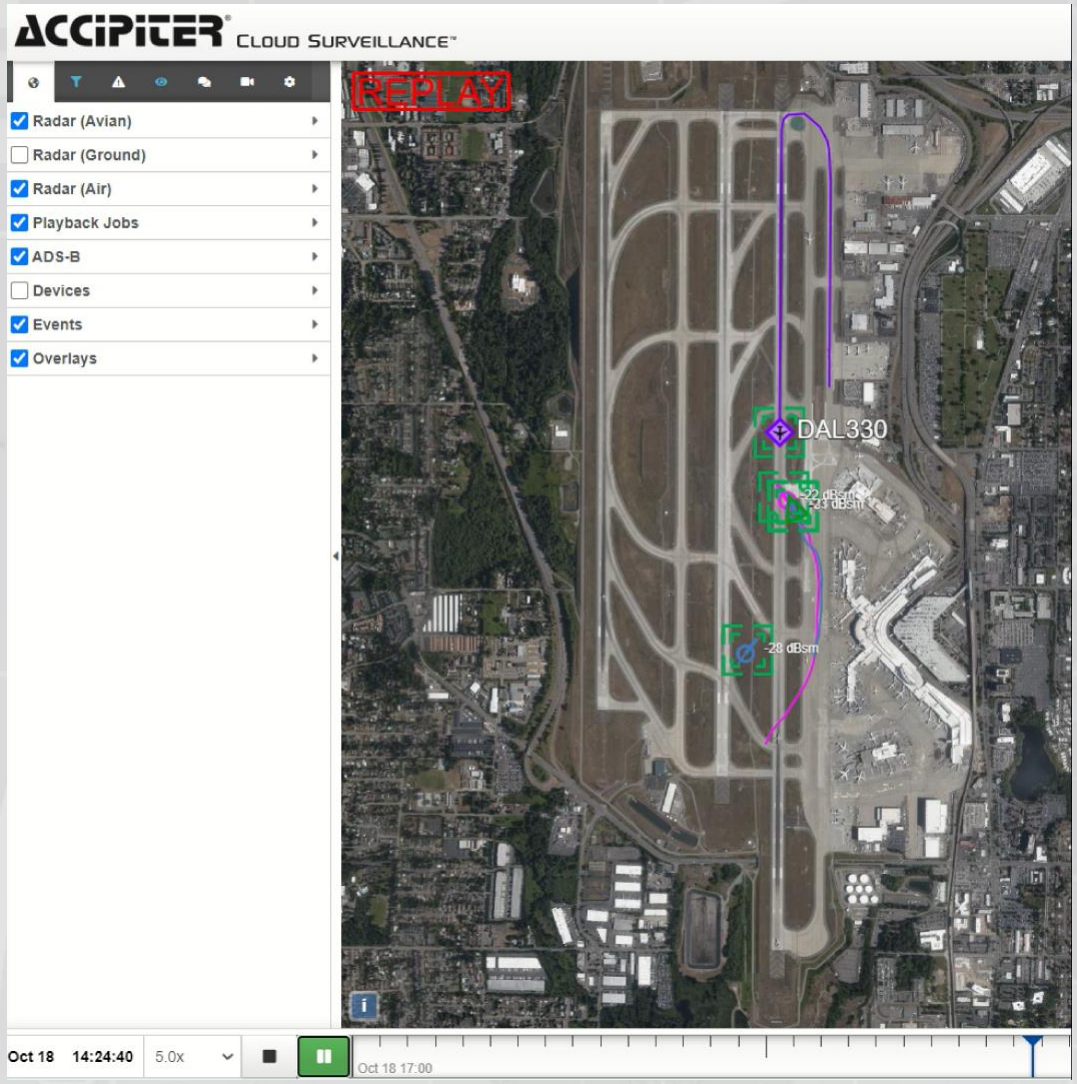


## 2023-11-13 Mallard Strike

- Reviewed at Wildlife Hazard Working Group Review Meeting
- Confirmed candidate aircraft with airline
- Updated corresponding  strike records in the NWSDB response
- Increased harassment and lethal removal of mallards

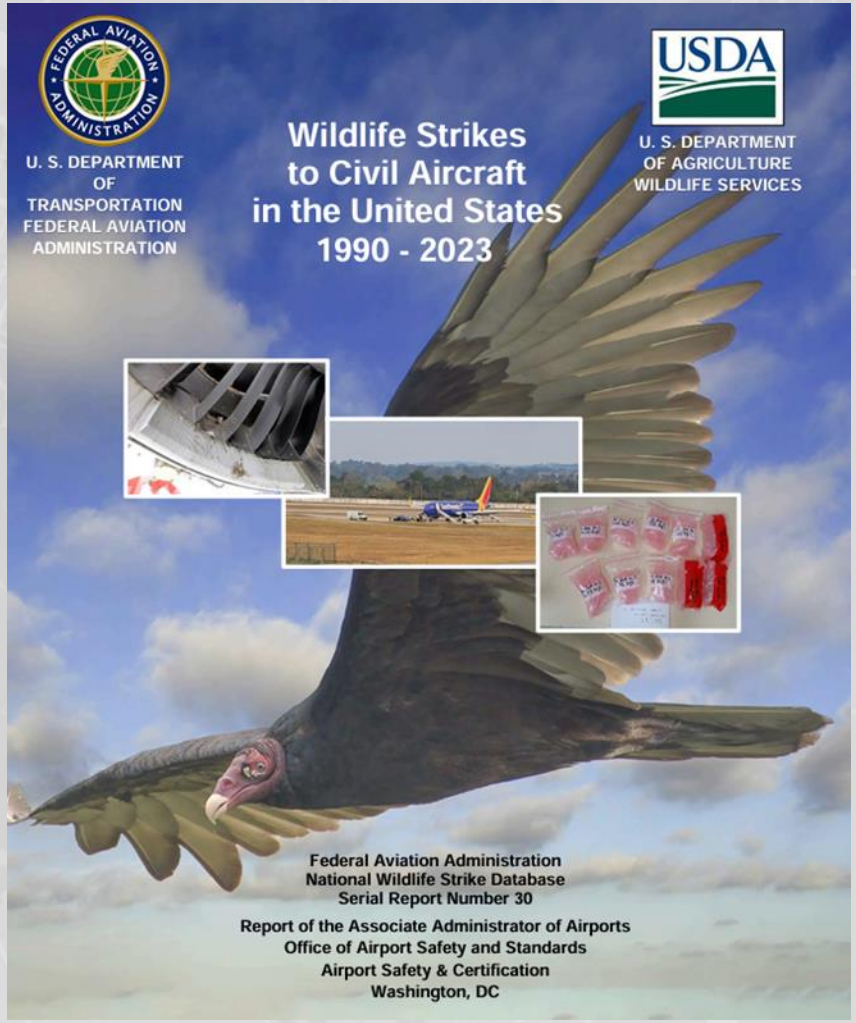
| Source | TIME | TOD | AIRPORT | LATITUDE | LONGITUDE | RUNWAY | LOCATION | PHASE_OF_FLIGHT | HEIGHT | SPEED | STR_WING_ROT | SKY | PRECIP | #_STRUCK | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Report from Airline confirmed Flight, Tail# | | | ZZZZ | | | | FOUND Anchorage, AK | | | | TRUE | | | 1 | Bird struck the wing and flap between engine no.1 and the fuselage. The ground crew discovered the strike after the plane sat overnight. No details of where or when the strike occurred were given. FOUND PANC. NIGHT 737-990, Engine Manufacturer CFM INTL. Classification Standard Engine Model CFM56 SERIES Smithsonian Wildlife/Species Identification: Mallard (Anas platyrhynchos) |
| Data source >> | FOD Detection System | | | | | | | Avian Radar | | | Reportiing Airline | Airport Operations/Wildlife | | | |
| Report From KSEA | 20:07 | Night | KSEA | 47.4490 | -122.3093 | 34C | KSEA | Take-off Run | 0 | 200 | FALSE | No Cloud | None | 2-10 | FOD detection system found 2 dead mallards fod # 962389 Smithsonian Wildlife/Species Identification: Mallard (Anas platyrhynchos) DATABASE NOTE: FLIGHTAWARE DID NOT HAVE THE N# FOR THIS AIRCRAFT BUT IDENTIFIED IT AS Boeing 737-900 (twin-jet) |

## 2020-10-18 Greater White Fronted Goose Strike




# Key Recommendations

- Gather all data in a central shared location
- Automate data sharing to improve efficiency and reduce human error
- Develop good relationships with key stakeholders to improve processes
- Cameras benefit wildlife strike investigations and assessing risk & hazard level
- Leverage technologies across the airport to improve wildlife detection, alerting and forensic examinations
  - Surface Area Management System
  - Perimeter Intrusion Detection System



# Questions?