

## **(8) CONOPS and OPSCON\*: One example of integrating avian radar into airport operations**

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For decades, radar technologies have been evaluated, validated, and utilized by researchers to determine how these systems can be employed to increase their awareness to the presence and the behaviors of flying birds. A critical locus of avian radar application is the airport where improved situational awareness, better hazard and threat analysis, and timely alerts to threats are elements of developing operational concepts (OpsCon). At airports radar data needs to be refined beyond what is typically useful in research, providing timely and meaningful information to airport personnel who have limited scientific training. At the Seattle Tacoma International Airport (SEA), avian radar evaluation and validation exercises began in 2007 utilizing FAA funding through the University of Illinois. In 2008, this technology helped the airport show that the SEA Netted/Lined Stormwater Pond BMP was effective at mitigating the facilities' attractiveness to hazardous waterfowl. Efforts to operationalize the avian radar at SEA began in 2008, just before the Miracle on the Hudson event which brought increased attention to the avian radar system at SEA. Unfortunately there exists a false perception that if pilots were made aware of birds that they could simply avoid hitting them. Under the OpsCon framework tailored to SEA's needs, radars have been deployed to support a Threat Viewer. The airfield is divided up into 10 regions where alerts are generated based on the detection of avian targets over short time intervals. Initially alerts were based on the number of bird tracks in an area. A revised alert now uses persistence over a set time period. . Today, when 2-12 "bird" tracks have persisted in region for more than 15% (>2.25 mins) of a running 15-minute period, the Airport Communication Center receives an auditory alert and notes the highlighted region from the ThreatViewer monitor. Following a dispatch from the ACC, the Airport Operations Specialist (AOS) drives to the area of concern searching for the threat, follows procedures to mitigate the threat, and later completes a form indicating what was observed and how/if the avian threat was abated following procedures identified in a separate group-specific Standard Operating Guideline (SOG). Analysis of AOS reporting indicate that the avian radar has been successful in increasing the awareness of bird threats to the AOSs and the response time to bird hazards has been decreased. Results also show that responder's ability to identify hazardous wildlife reported by the avian radar and to trust in new technology varies substantially by individual. Avian radar has increased our level of awareness to wildlife hazards on and near the airfield as well as the importance of reoccurring training programs that emphasize wildlife hazard management to airport operations personnel. Within NASA and the DOD, new technological system concepts are introduced within their respective organization using a Concept of Operations (ConOps) model, which is a single document that defines how new technologies will operate to achieve their various programmatic goals. In support of those overarching goals, group-specific Operational Concept (OpsCon) documents provide detail on the end-users objectives, under the direction of multiple Standard Operating Guideline (SOG) documents.

Osmek, S.D. and E.E. Herricks. 2015. CONOPS and OPSCON\*: One example of integrating avian radar into airport operations. Proceedings of the North American Birdstrike Conference 15. 35 pages.

# ConOps and OpsCon: One Example of Integrating Avian Radar in to Airport Operations

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With  
Support  
From



Concerned by the rising trend, Moran sent a letter to FAA Administrator Michael Huerta addressing the issue. Congressman Jim Moran (D-Va) told NBC Bay Area and with Congressman Joseph Crowley (D-NY),

## Avian Radar...

- ▣ ...has been used successfully for wildlife research and at many military installations for several decades.
- ▣
- ▣ After the *Miracle on the Hudson*, the media and now, again, members of the US Congress are asking:
  - ▣ Why aren't avian radars at every major commercial airport?
- ▣ **Answer** - Operationalizing this technology in a meaningful way is NOT necessarily easy
  1. Airports are different in many ways.

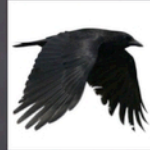
Training times can be coordinated relative to bird activity

## Quality of Data

- ▣ How precise does target location data need to be?
  - Is 2D coverage of the approach/departure path enough for SEA?
- ▣ How close to “Real-time” do alerts need to be?
  - Consider
    - ▣ 250 knots aircraft covers >> a statute mile in 15s
    - ▣ Roughly the amount of time it takes for an [uncooperative] flock of birds to first be detected and tracked, but not necessarily in a predictable manner.
- ▣ Radar limitations | data refinement needed

# Limitations & Workarounds

- ▣ Species not identified
  - Target reflectivity (RCS) does provide some indication of potential hazard
- ▣ 2010 FAA Radar AC
  - Standard Avian Target (SAT)
  - American crow
  - Ignoring Small flocks of small birds is the trade off at SEA
- ▣ Often too sensitive where it is scanning [x & s-band radars]
  - Rain clutter Insects, cottonwood seeds
  - Ground vehicle interference (2D)

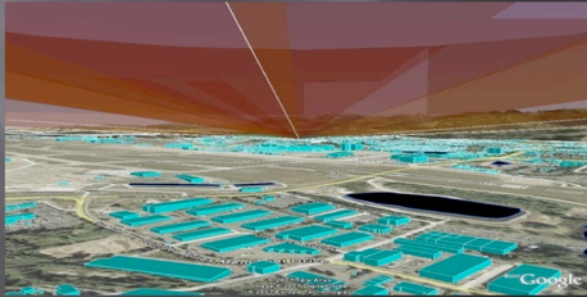


Rain  $\leq$  0.1/hr  
not an issue

Before I discuss how we used this tool for airport operations its important to discuss some radar limitations.

# Limitations

- ▣ Limited scanning coverage at SEA
  - ▣ At SEA, 2D coverage floor is ~50 to ~ 500 AGL
  - ▣ 10-15 degree effective beam angle



Before I discuss how we used this tool for airport operations its important to discuss some radar limitations.

## Overview

- ▣ Radar Installation at Sea-Tac Airport
- ▣ Past Benefits to the Port of Seattle
- ▣ Concept of Operations | Operational Concepts
- ▣ Operationalized Avian Radar at KSEA
- ▣ Associated effects on strike rate
- ▣ Next Steps

Overview...

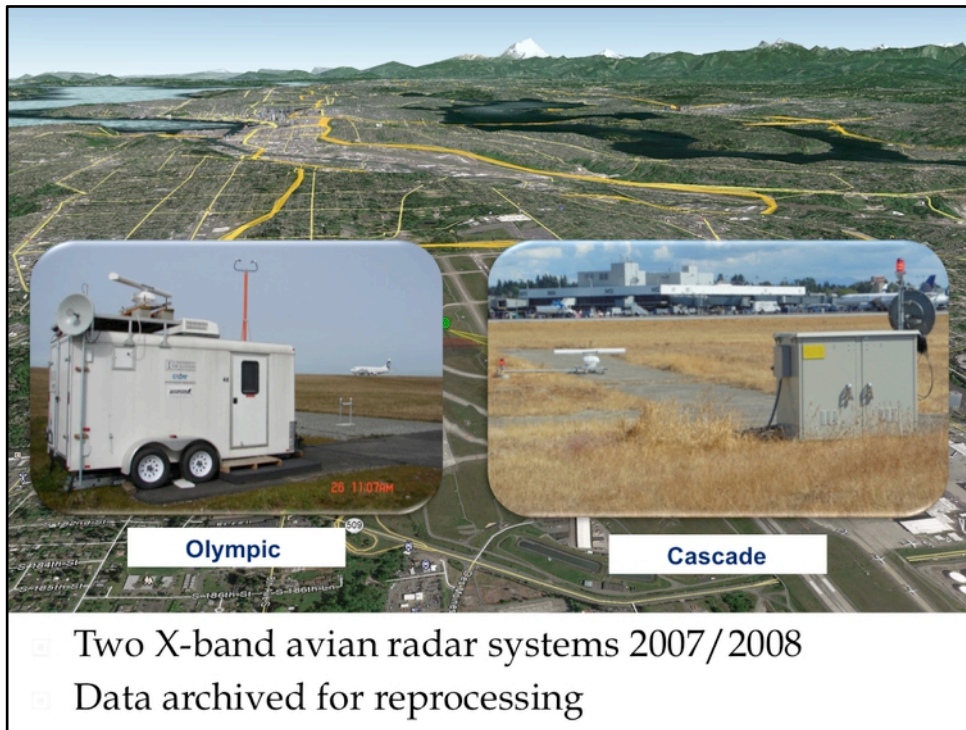
# Sea-Tac Airport Overview

< 2 miles from Puget Sound



## Summary

<b>Airport type</b>	Public
<b>Owner/Operator</b>	Port of Seattle
<b>Serves</b>	Seattle; Tacoma, Washington, US
<b>Location</b>	SeaTac, Washington, US
<b>Hub for</b>	<ul style="list-style-type: none"><li>Alaska Airlines</li><li>Delta Air Lines</li><li>Horizon Air</li></ul>
<b>Elevation AMSL</b>	433 ft / 132 m

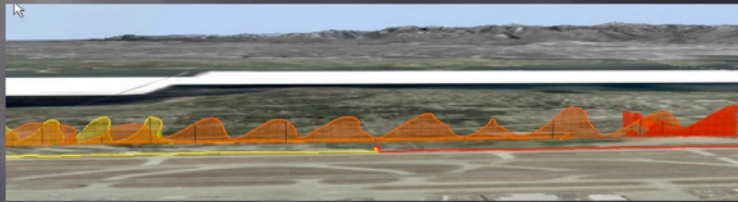




## SeaTac 2008-09

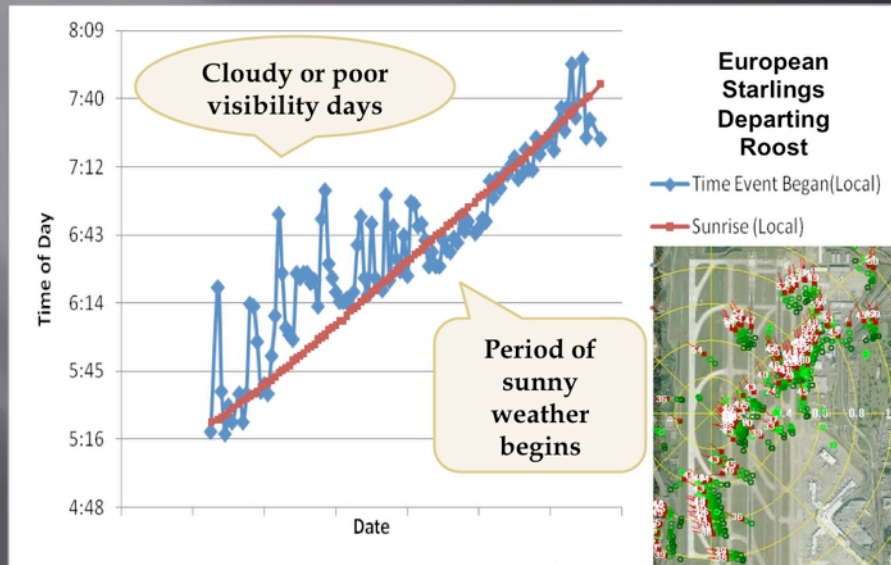


- ▣ Unmanned Aerial Vehicle/radar comparisons
  - RC Helicopter
  - Balloons
  - Trained Falcons
- ▣ Observer Comparisons
  - Biologists abilities vary



## Benefits to the Port of Seattle

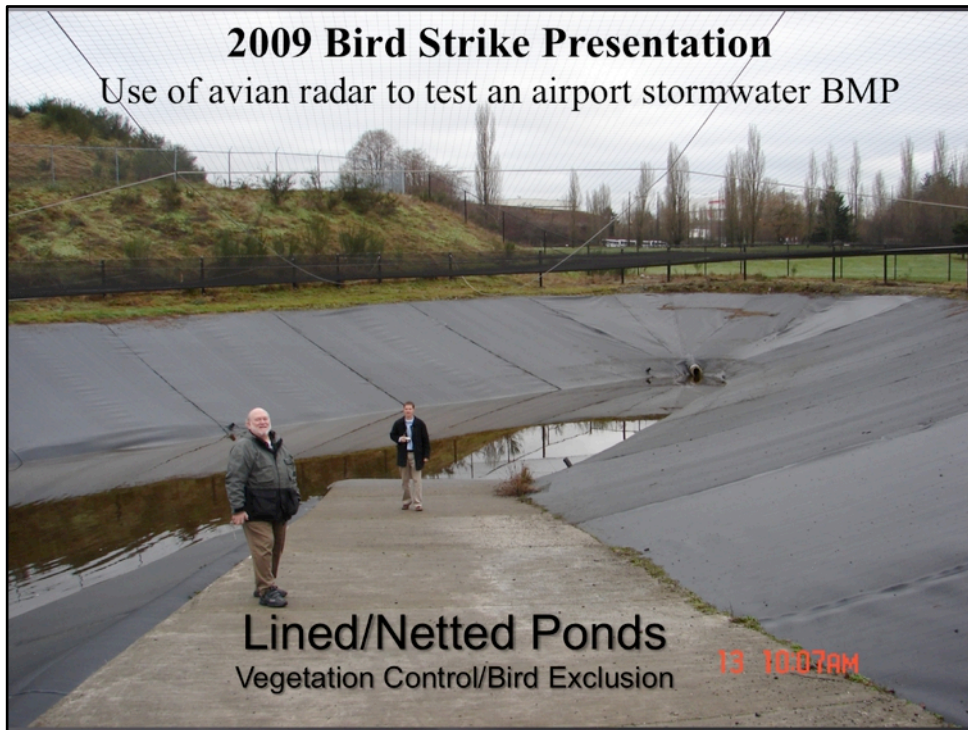
Post processing data



When the issue of real time is not important much information can be obtained

## 2009 Bird Strike Presentation

Use of avian radar to test an airport stormwater BMP



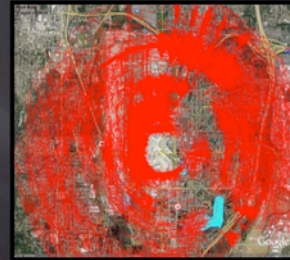
**Lined/Netted Ponds**  
Vegetation Control/Bird Exclusion

13 10:07AM

## Pond Study Methods

- ▣ Ponds were selected that were
  - An equal distance from the radar
  - In areas with little to no interfering clutter
  - Paired with habitat deemed acceptable to the FAA
- ▣ Fall 2008
  - 1,000 hrs. of data used when rain < 0.1"/hr

72 Hr burn  
for clutter  
determination



## 4 Pond Pairings with unattractive habitat

Control



Experimental



## 1 Pond Pairing with Open-Water Wetland (#5)

Control – Lora Lake



Experimental



## 4 POND PAIRINGS WITH UNATTRACTIVE HABITAT

### RESULTS

Pair#	LOCATION	AVG (s)	STDEV	ALARMS (n)	T VALUE	CONF.	RESULT
1	TYEE Pond	9.56	8.32	280	0.08	p<0.85	NULL
	TYEE-C	9.64	9.85	218			
2	IWS3 Pond	10.04	9.52	344	1.25	0.85	NULL
4	NEPL Pond	4.75	2.19	28	2.1	0.975	Control
	NEPL-C (AMA)	6.15	3.41	32			Higher
	SDE4-C	9.80	32.39	43	0.166	p<0.85	NULL

# POND PAIRING WITH AN OPEN-WATER WETLAND

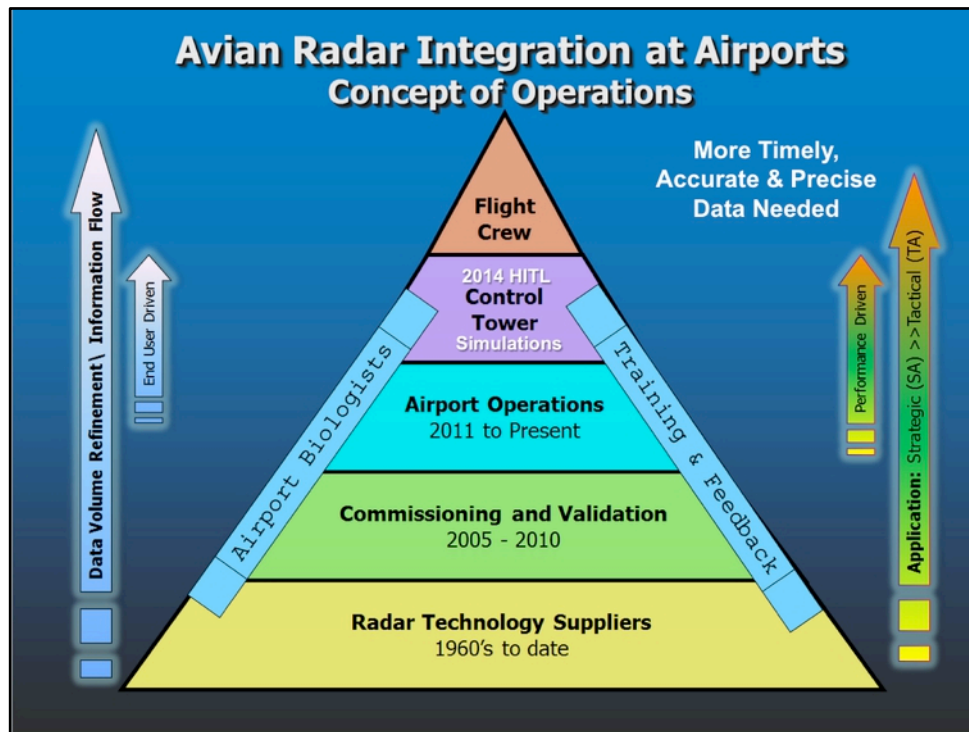
## RESULTS

Pair #	LOCATION	AVG (s)	STDEV	ALARMS (n)	T VALUE	CONF.	RESULT
5	SDN1 Pond	4.6	2.35	41	3.4	0.9995	Control
	SDN1-C (Lora Lk)	6.1	3.41	126			Higher



## Pond Study Conclusion

- ▣ **BMP Validation** – The netted/lined pond BMP appeared to be at least as effective as other unattractive areas.
  - Saved the Port of Seattle >> \$6 million
    - Did not install floating covers or balls
- ▣ **Radar Validation** – The radar confirmed what we knew: Lora Lake is a wildlife attractant.
  - Lora Lake will be filled in 2017



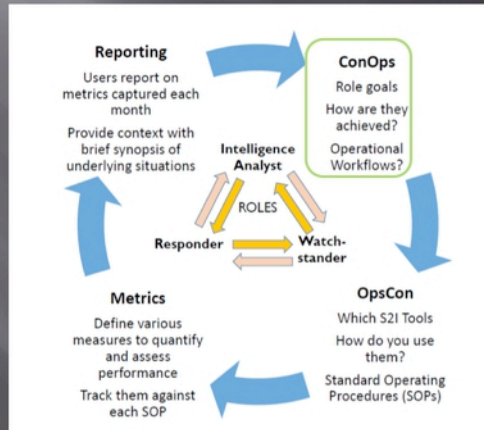
Data needs to be refined beyond what is typically useful in research, providing timely and meaningful information to airport personnel with wildlife and many other responsibilities.

**Anton Koros, FAA**

Advanced Operational Concepts Division ANG-C43

# ConOps | OpsCon

- ▣ Used by DOD and NASA with use of new technologies



Used with the permission of *Accipiter Radar Inc.*

A critical locus of avian radar application is the airport where improved situational awareness, better hazard and threat analysis, and timely alerts to threats are elements of developing operational concepts (OpsCon).

## ConOps

### □ GOAL

- To increase responsiveness of AvOps personnel to airfield wildlife hazards with avian radar using:

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## OpsCon

### 1. Watchstanders

12 Senior Operations Controllers (SOCs) in the Airport Communications Center (ACC)

Monitor door alarms, all airport cameras, trains, elevators, escalators and now avian radar alerts

### 2. Responders

8 Airport Operations Specialists (AOSs)

Responsible for all FAR 139 activities

### 3. Analysts (and trainers)

The same two Biologists

At airports radar data needs to be refined beyond what is typically useful in research, providing timely and meaningful information to airport personnel with wildlife and many other responsibilities.

# Metrics

< 60 Strikes/year

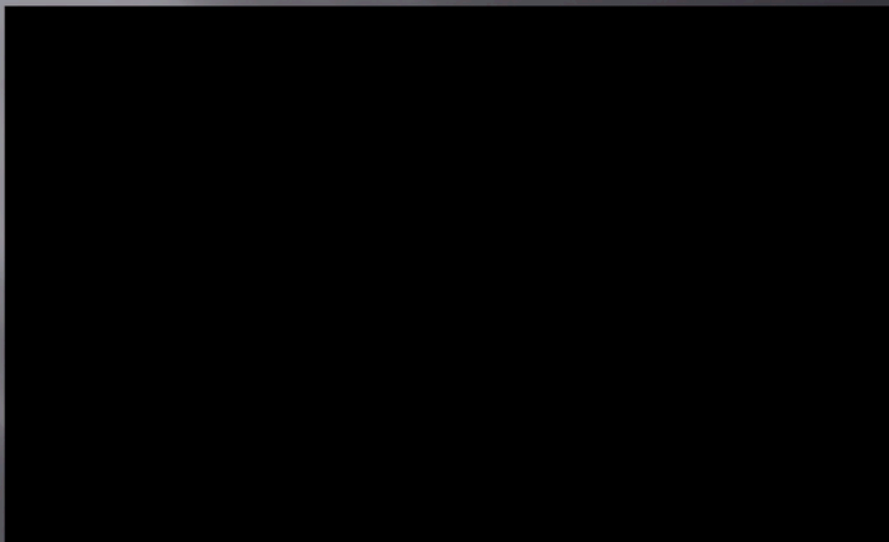
- Increased Awareness
  - One-on-one feedback
  - Response time
- Reduction in wildlife strikes

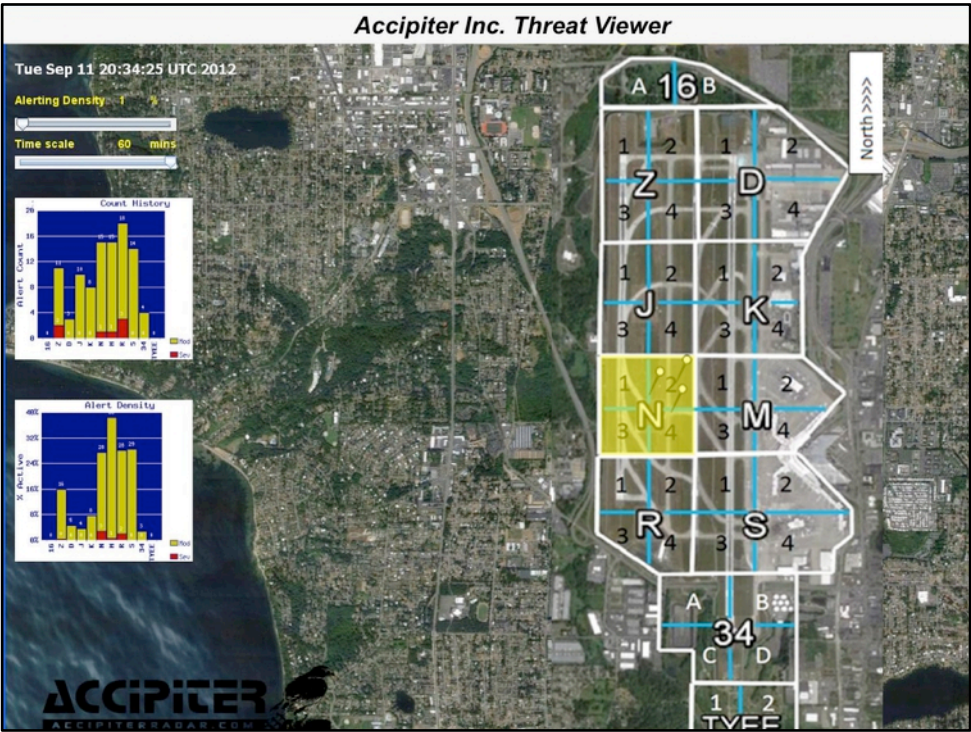
## Known species composition struck at SEA 2010-2014

SPECIES	PERCENT
SMALL PASSERINES	37%
RAPTORS	24%
WADING AND SHORE BIRDS	12%
STARLINGS AND BLACKBIRDS	8%
WATERFOWL	6%
GULLS	5%
PIGEONS AND DOVES	3%
AMERICAN CROW	2%

At airports radar data needs to be refined beyond what is typically useful in research, providing timely and meaningful information to airport personnel with wildlife and many other responsibilities.

## 2014 Avian Radar Update (YouTube)





# Group Specific SOGs

## ACC sends email to AOS



2015 SOC-AOS Avian Radar Dispatch Form for the FAA - Message (HTML)

Message | Insert | Options | Format Text | Review | Adobe PDF

Ctrl | Copy | Paste | Format Painter | Bold | Italic | Underline | Text Color | Background Color | Bulleted List | Numbered List | Indent Left | Indent Right | Decrease Indent | Increase Indent | Link | Unlink | Address Book | Attach File | Attach From Library | Signature | Follow Up | High Importance | Low Importance | Zoom

To: Viehoveer, Patrick - Contractor | Osmek, Steve

Cc: [Empty]

Subject: 2015 SOC-AOS Avian Radar Dispatch Form for the FAA

**DISPATCHING SOC - Immediately fill in the data for each field.**

DATE	DISPATCH TIME (local)	ALERTED REGION/QUAD	AOS RESPONDER'S NAME	SOC COMMENTS

Add the name of the responding AOS to this email and send.  
[Fountain.W@portseattle.org](mailto:Fountain.W@portseattle.org); [Hickson.A@portseattle.org](mailto:Hickson.A@portseattle.org); [Jenkins.J@portseattle.org](mailto:Jenkins.J@portseattle.org);  
[Larson.S@portseattle.org](mailto:Larson.S@portseattle.org); [Lewis.Jerome@portseattle.org](mailto:Lewis.Jerome@portseattle.org); [Oden.J@portseattle.org](mailto:Oden.J@portseattle.org); [Watson.D@portseattle.org](mailto:Watson.D@portseattle.org);  
or [Woods.J@portseattle.org](mailto:Woods.J@portseattle.org)

SOC - Thank you.

**RESPONDING AOS - 1<sup>st</sup> Push the "Reply All" button and fill in your observation results in each field before sending.**

ARRIVAL TIME (local)	SPECIES	NUMBER	RESULTS	AOS COMMENTS Example: include aircraft, truck, etc. interference

Send this form to [Viehoveer.p@portseattle.org](mailto:Viehoveer.p@portseattle.org) and [Osmek.s@portseattle.org](mailto:Osmek.s@portseattle.org).

**RADAR GRADE:**  
A = HAZARDOUS BIRDS SEEN AND MITIGATED (vehicle, siren, pyros, live round, called the ATCT, etc.).  
B = HAZARDOUS BIRDS SEEN BUT COULD NOT MITIGATE  
C = NO HAZARDOUS BIRDS SEEN  
D = NO BIRDS SEEN  
E = COULD NOT RESPOND (describe why in the AOS Comment field)

See more about Patrick Viehoveer.

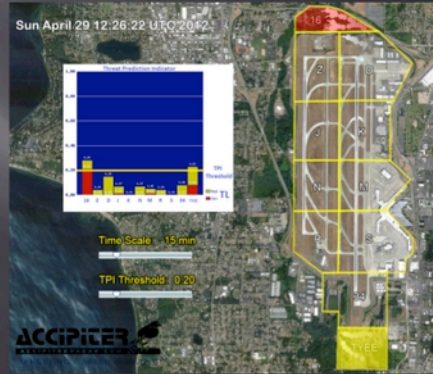
. Results also show that responder's ability to identify hazardous wildlife reported by the avian radar and to trust in new technology varies substantially by individual.

# Avian Radar – Operationalized First few months

## AVG SCORE (VALID RESPONSES ONLY)

# OF "A's"	1	
# OF "B's"	43	
# OF "C's"	1	
# OF "D's"	8	n=53
# OF "E's"	3	

A = HAZ WILDLIFE MITIGATED  
 B = HAZ WILDLIFE OBSERVED  
 C = ONLY NON-PRIORITY SPECIES OBSERVED  
 D = NO WILDLIFE OBSERVED  
 E = COULD NOT RESPOND BUT DATA SUBMITTED PROPERLY



# Erosion of Confidence

Port  
of Seattle

AIRPORT OPERATIONS  
Wildlife Hazard Mitigation  
& Conservation

August 10, 2015

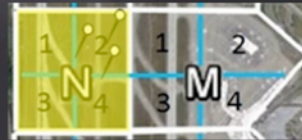
**AVIAN RADAR THREAT VIEWER  
IS OFF FOR RUNWAY CONSTRUCTION**

**3D radar would allow for filtering out vehicles by altitude**

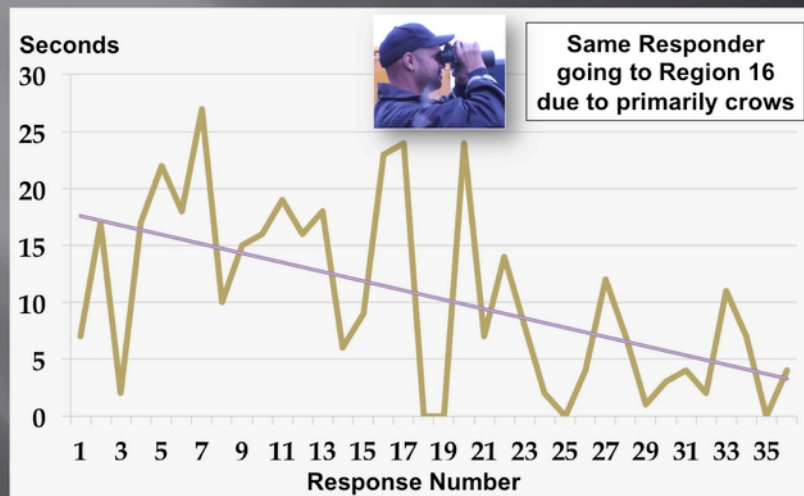
CALL STEVE OSMEK (206.419.8666) IF YOU HAVE QUESTIONS

## Extreme Differences Among Observers and Overtime

- ▣ Ability to detect birds
- ▣ Prioritizing
  - Ambulance Escort
  - Radar Response
- ▣ Adherence to protocol
  - Not
    - ▣ Going to the subregion
    - ▣ Scanning adjacent regions
    - ▣ Searching the ground
- ▣ Retraining is important!!!

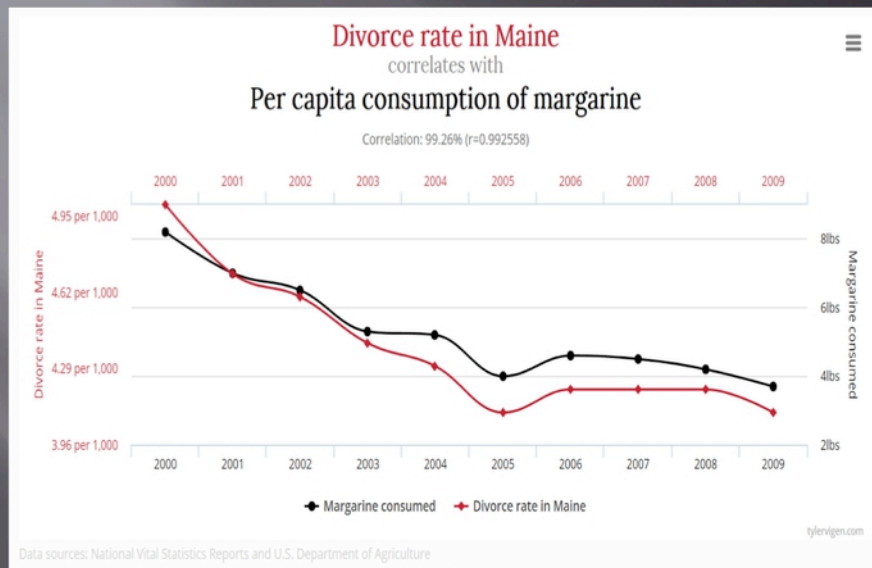


## Declining Response Time Trend



## Before we discuss strike rates

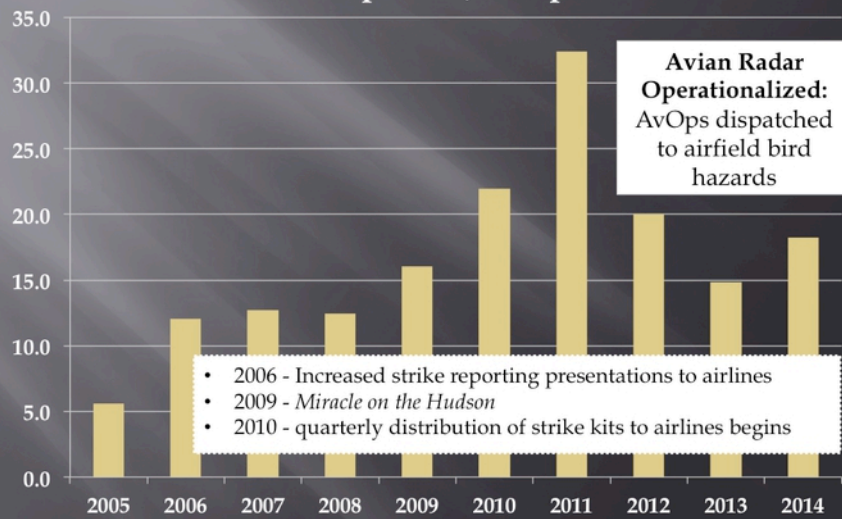
### Association or Correlation



Congressman Jim Moran (D-Va) and Congressman Joseph Crowley (D-NY)

## Correlation or Association?

KSEA Strikes per 100,000 operations



Congressman Jim Moran (D-Va) and Congressman Joseph Crowley (D-NY)

## Potential Next Steps for SEA

- ▣ 3D radar Capabilities
  - Enhanced filtering
  - Near miss data analysis
    - ▣ More numerous than strike data and can be used for heat mapping
  - Provide information on birds landing
- ▣ Analyze archived data



Aircraft scaring starlings on take off

## Lessons Learned

### ▣ Common Beliefs

1. An avian radar will replace a biologist or other employees
2. Avian radar detects all birds on and near the airfield
3. Avian radar reduces the need for wildlife removal
4. Avian radar is plug and play technology

### ▣ Port's Experience

1. More time was needed for training, respond to alerts and investigate information
2. Avian radar detects [moving] targets well where it can effectively scan...stationary birds are more difficult
3. Say what??  
Long-term, however, it can identify and reduce attractants.
4. Sea-Tac is a changing environments making 3D radar extremely important

**QUESTIONS?**

