

FOD Sensors & Avian Radar Operationalized

Subtitle:

Enhanced surveillance of the greater airfield

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It's Easier to Predict Where...than How



Regulators, Operators and Others are trying to understand what poses the greatest risk(s) on/near airports

KDPA - DUPAGE AIRPORT - WEST CHICAGO, ILLINOIS


NO DRONE FLY ZONE

DRONES AND AIRCRAFT DO NOT MIX



Drone?

KEEP DUPAGE AIRPORT AIRSPACE SAFE:
WWW.DUPAGEAIRPORT.COM/DRONES



FOD?




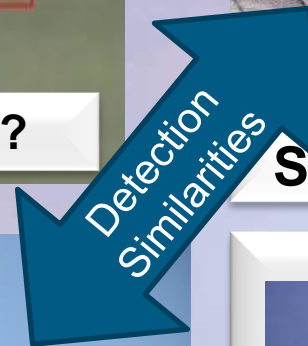
Security?



Ramp?



Wildlife?



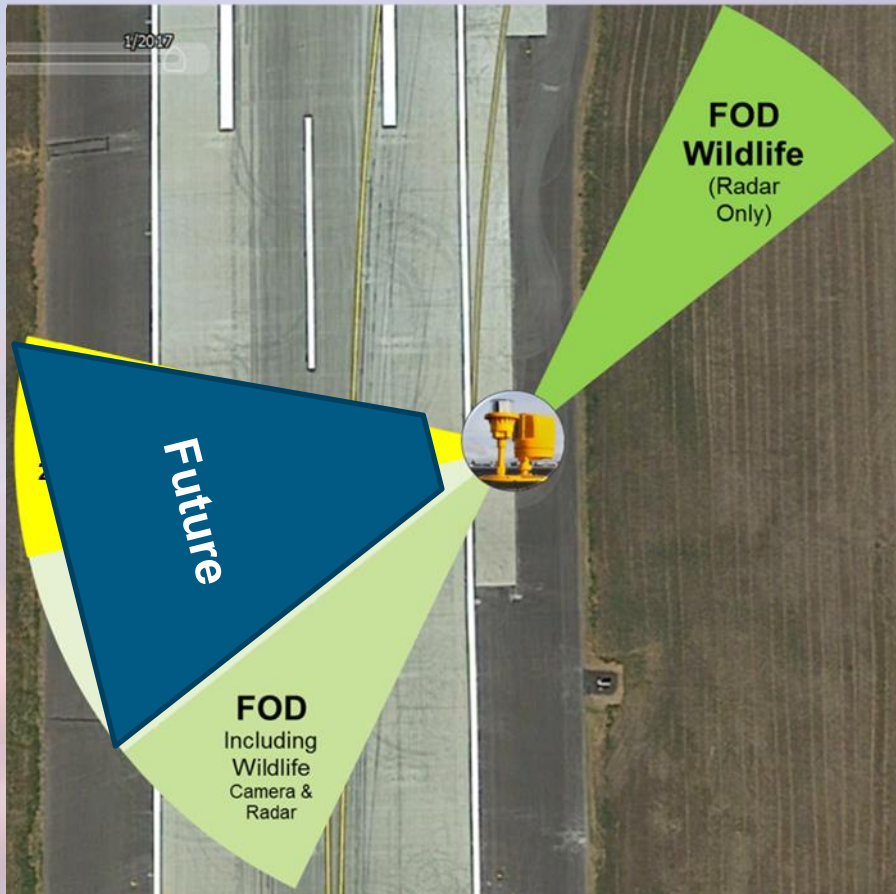
Runway

- Incursion?
- Excursions?

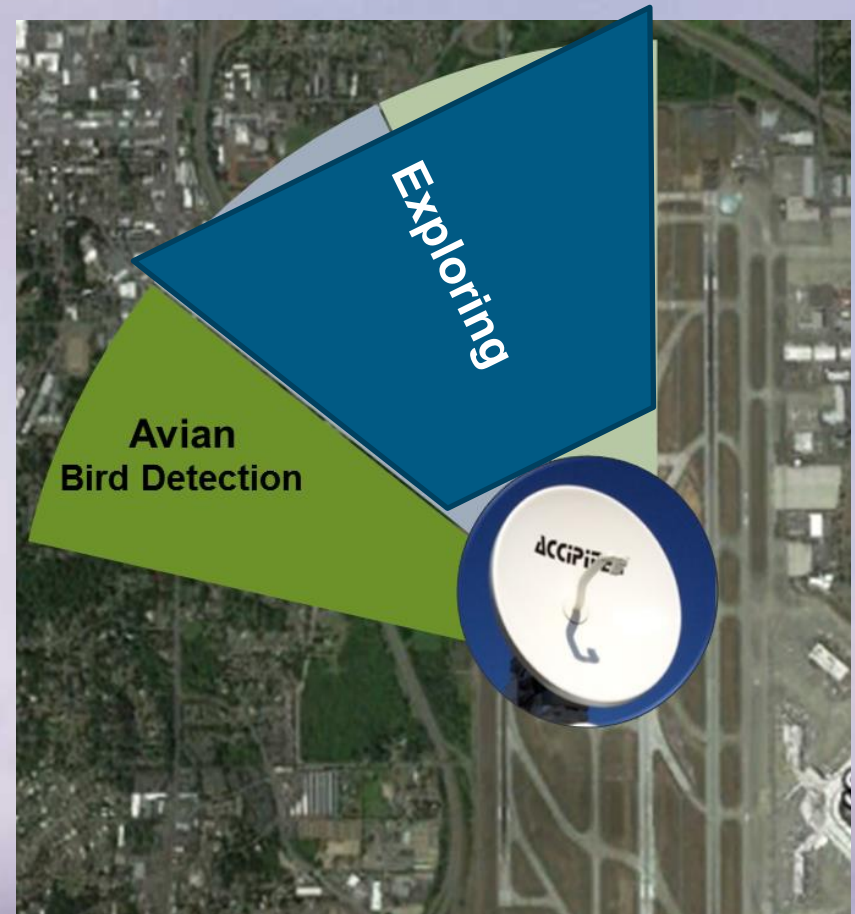
What if FOD, Bird, Drone and Other Detection Technologies were Integrated?

It would make it easier to write a business case...

FOD Radar/Camera for a 2D issue



Avian Radar for a 3D issue



Operationalizing a Sensor Must be Simple

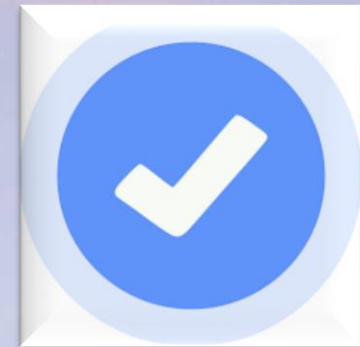
- **Filter** (better to over filter)

- Get rid of unwanted “noise”
 - Avian radar algorithms
 - FOD detection algorithms



- **Verify**

- The hazard
 - “Human-in-the-loop”



- **Respond**

1. Mitigate the Hazard
 - ❖ Pyros, shotgun, horn, etc.
2. Communicate the Hazard
 - ❖ When the hazard cannot be abated



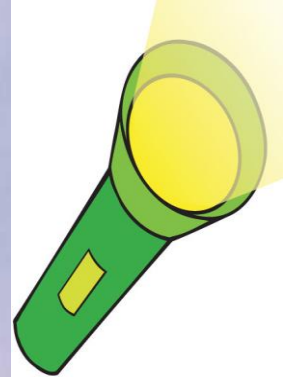
How should AirOps communicate hazards?

- **NOTAM**
 - Long term hazards
- **ATIS**
 - Shorter-term situations
- **SITREPS, BIRDREPS** or ...
 - At SEA we provide specifics over the FAA Tower Frequency when hazards cannot be abated.
 - Flight Crew is Made Aware too.
- **PIREPS**
 - Tends to be effective
 - Typically result in multiple visuals



Lessons Learned

- **Sensors can't detect all birds or hazards**
 - It's OK...people observe/record even less, especially at night.
- **Responders want to see the hazard they were sent to.**
 - **Birds, aka "FOD with a brain", are on the move**
 - **Responders get frustrated when they don't see the hazard.**
 - **Managers get frustrated when they don't have skilled observers**



Overview - SEA FOD Detection System

“FOD” Detection Sensors on Runway16C/34C

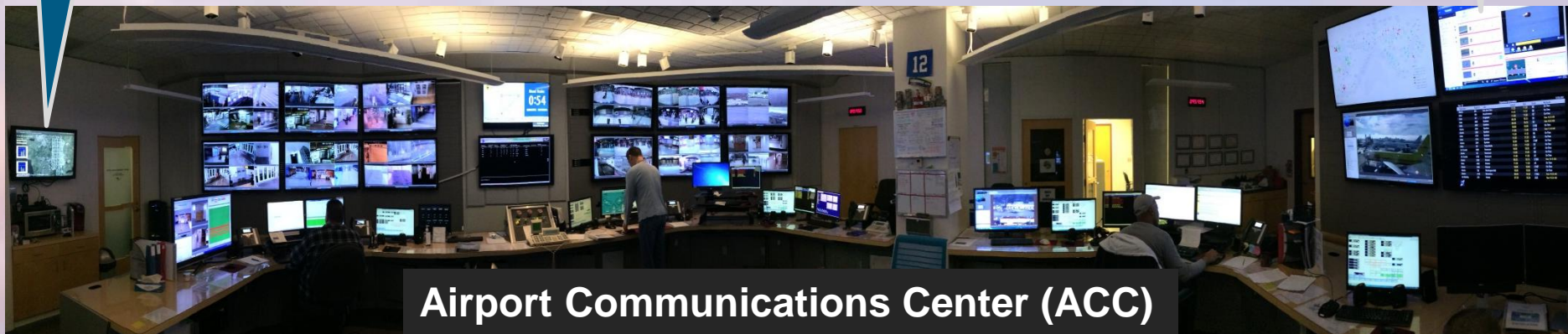
– 101 Edge light sensors by XSIGHT

- Radar 360°
- Camera scans runway only 180°
- Loud speakers, one per sensor, can harass birds
- Lasers for pinpointing FOD on the surface.
- **NO ONE IS STARRING AT FOD or RADAR MONITORS**



FODetect
Monitor

Avian
Radar
Threat Viewer
Monitor



Airport Communications Center (ACC)

FOD Detection System Monitor

Airport Communications Center (ACC)

Bird Detection
Bald Eagle

Off Runway Detections
Camera Only 2016/2017

XSIGHT systems FOD (154) MAINTENANCE (34)

Arrange By: Time

SNR (dB)	Est. Size (inch ²)	ID	Role	Detection Time
100.71	24.75	88412	XSIGHT	Detected a minute ago Updated
95.40	22.36	88411	XSIGHT	3 minutes ago
91.24	7.34	88410	XSIGHT	4 minutes ago
89.17	1.51	88405	XSIGHT	7 minutes ago
81.27	2.62	88402	XSIGHT	10 minutes ago
68.06	2.53	88400	XSIGHT	10 minutes ago
108.11	24.83	160512	Birds	Detected 4 minutes ago Updated
95.47	24.83	160511	Birds	5 minutes ago
112.31	24.83	160510	Birds	Detected 12 minutes ago Updated

Video Feed: SNR: 100.71 dB, Est. Size: 24.75 inch², ID: 88412, 3 minutes ago

Map: TWY 'E', RW16C-34C

ACC Dispatches AOS

Airport Operations Specialist (AOS)



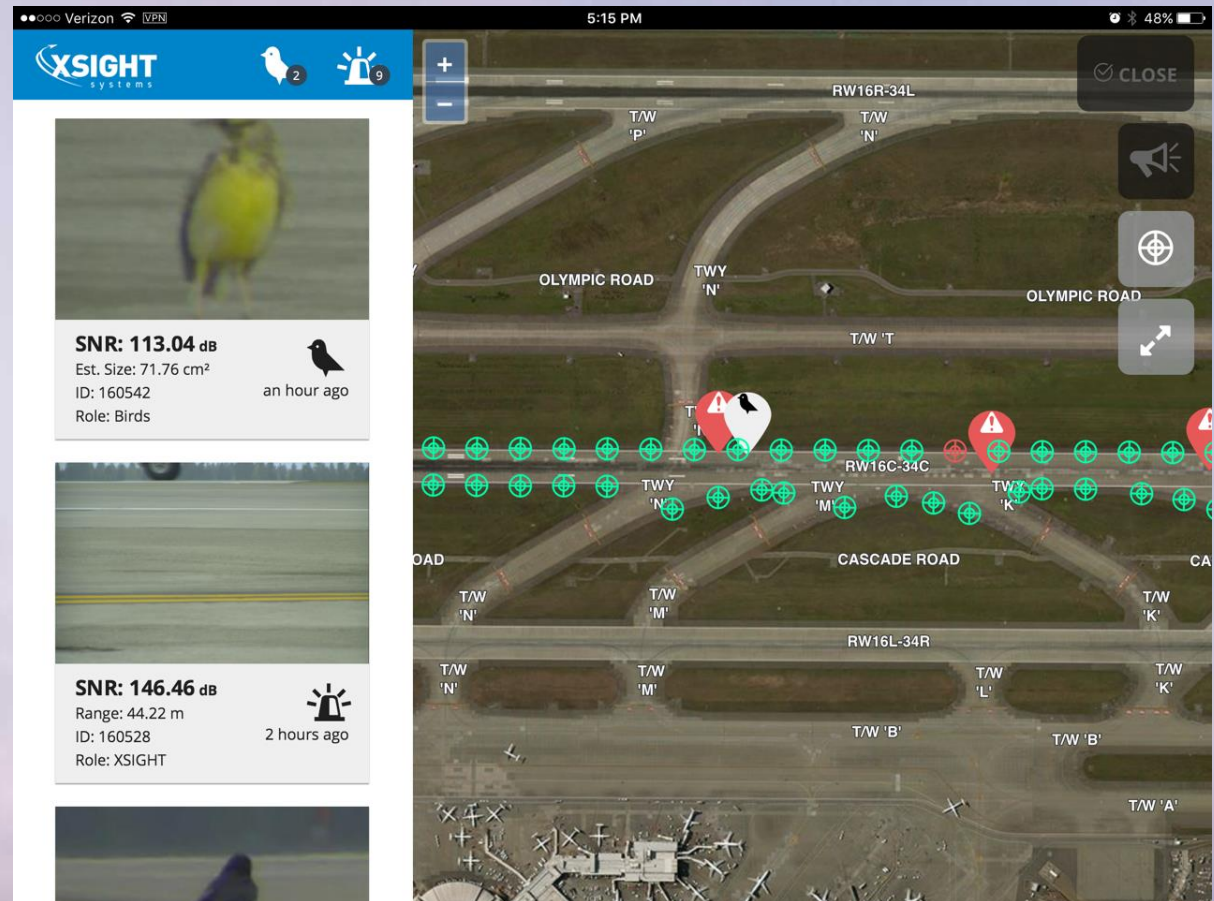
Example: AOS Response



FOD Detection System Operationalized

- AOS Uses iPad app to verify and respond to mitigate hazard.

Vehicle-based
RunwizeMobile
iPad View










iPads used for Remotely Harassing Birds



X 84524    CLOSE



 Deterrence Programs Helicopter      

Your Choice	 Helicopter	 Shotgun	 Sine Flanger	 Sine Mix
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Yellow camera icons indicate units which will emit preselected sounds

2016 ACC Hazards Received

Hazards detected after excluding the less hazardous objects

Type	Number	%
Moderate-Large Birds	1,206	99%
Metal, Tire chunk, Ice	13	1%
Total	1,219	100%



ACC Comments

“We see bird’s all the time”

- Realization



- **A new discussion is needed**
 - FOD Detection Systems are important for wildlife managers
 - Half of all strikes occur < 100 ft. AGL

Other Realizations...



- Prey items are a bigger issue than we first thought ($n > 7,200$)
- Bird strikes are removed by scavengers
- Birds resting patterns on runways

Birds Not Evenly Distributed

- Yellow = highest bird numbers.



- Ryan Hobbs, MS Thesis Project
 - The Evergreen College, Olympia WA

- Assigning a bird strike to an aircraft



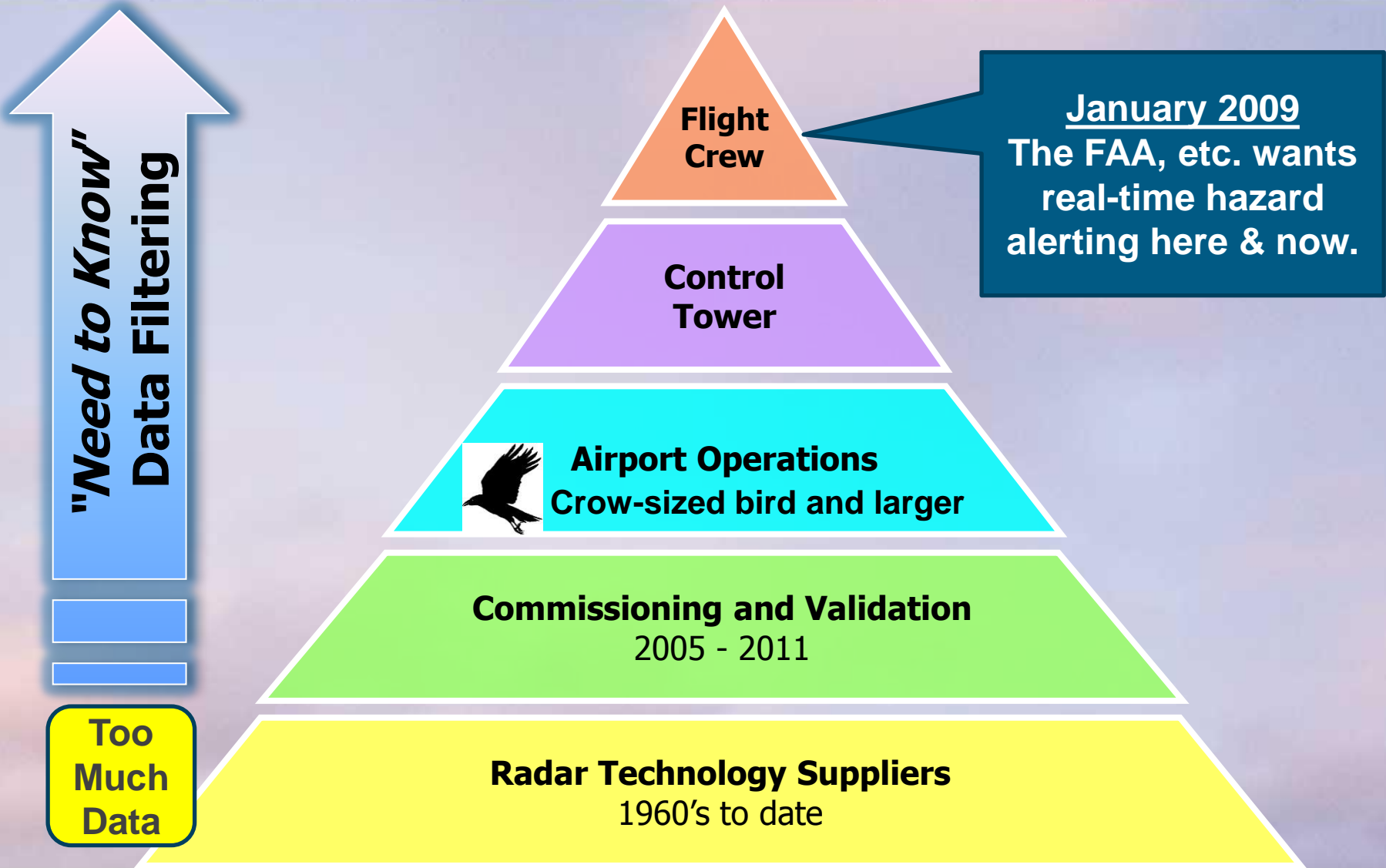
What about Avian Radar?

- “Miracle on the Hudson”



- Avian radar is being installed at a few airports
- Rarely are they operationalized.
- Why?

Birds are a 3D issue



Remember

It's OK if NOT ALL of the hazardous birds are detected. Why?



1 Agile Antenna

Multiple Radars are Typically Needed

(3 @ KSEA)



2 Fixed Beam

- Ops personnel still patrol for wildlife hazards
- Filtering produces actionable information!
 - Avoid the “**Wild Goose Chase**”
- *Example:*
 1. Where does hazardous bird activity persists?

“No one is staring at a screen” Bird Alerts are Audible

Utilizing a Predetermined Threshold of Minimum Bird Activity

- 15% of 15 minutes (2.25 minutes over a running 15 minutes)

Standard Operating Procedure (SOP)

- Threshold is triggered & Goose call alerts
- Region is highlighted
- Avian threat displayed
- OPS personnel are notified by radio
- These responders report their actions





2013 Sea-Tac Avian Radar SOP

Airport Operations Specialist (AOS)



Responder Reported Results

ARRIVAL TIME (local)	SPECIES	NUMBER	RESULTS	AOS COMMENTS Example: include aircraft, truck, etc. interference
1158	Starling	1000	Good	Birds on THR 16C LOC...GRADE A

Push send to deliver this form to Viehoever.p@portseattle.org and Osmek.s@portseattle.org.

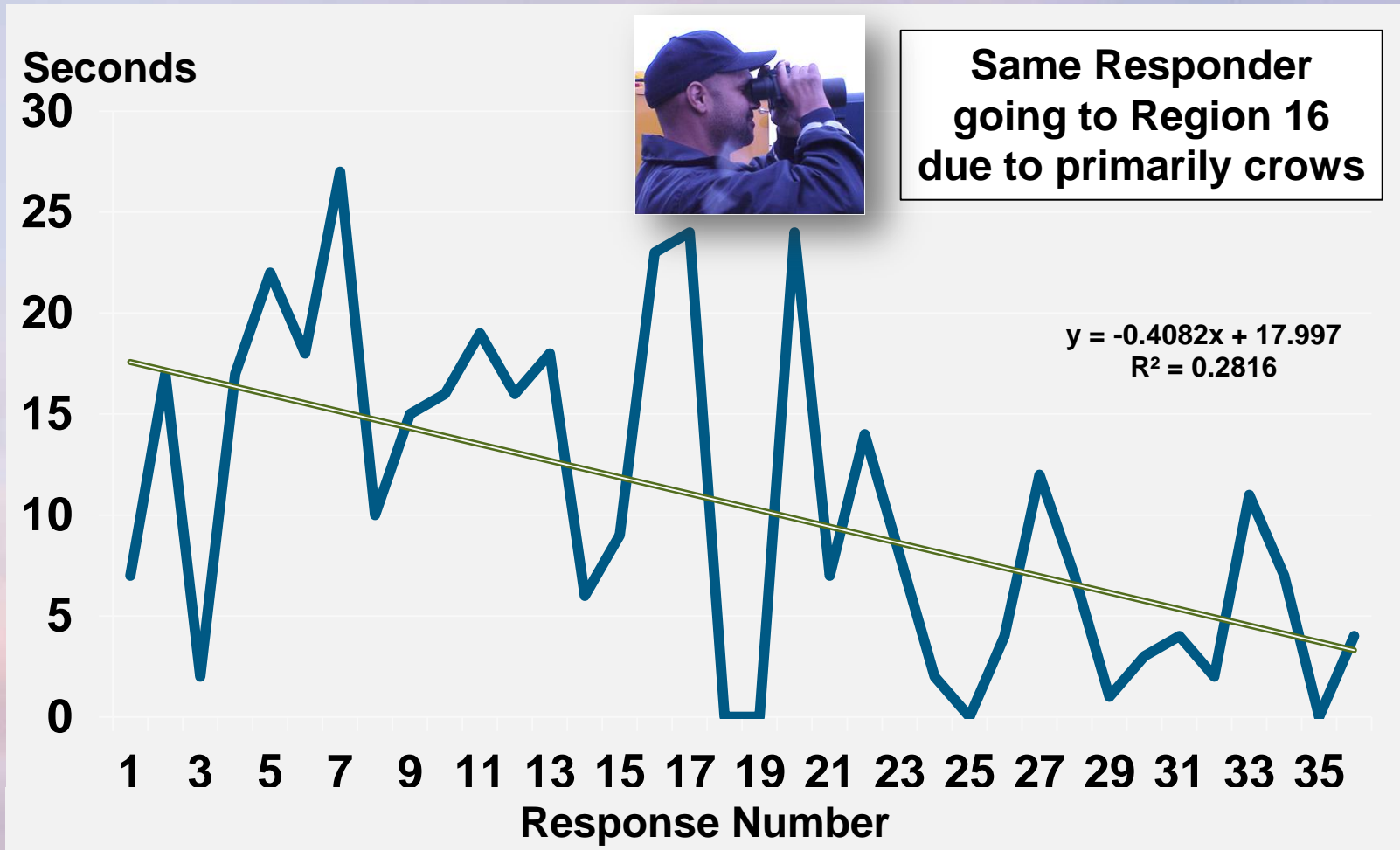
RADAR GRADE:

- 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)



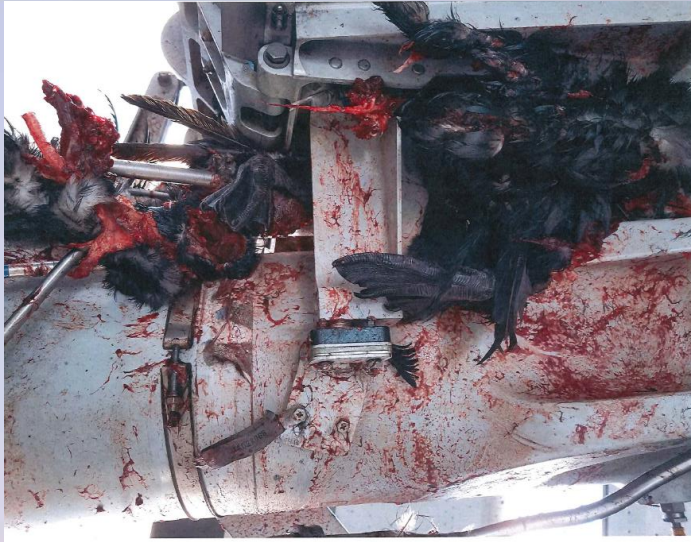
Awareness was increased

Response Time Declined

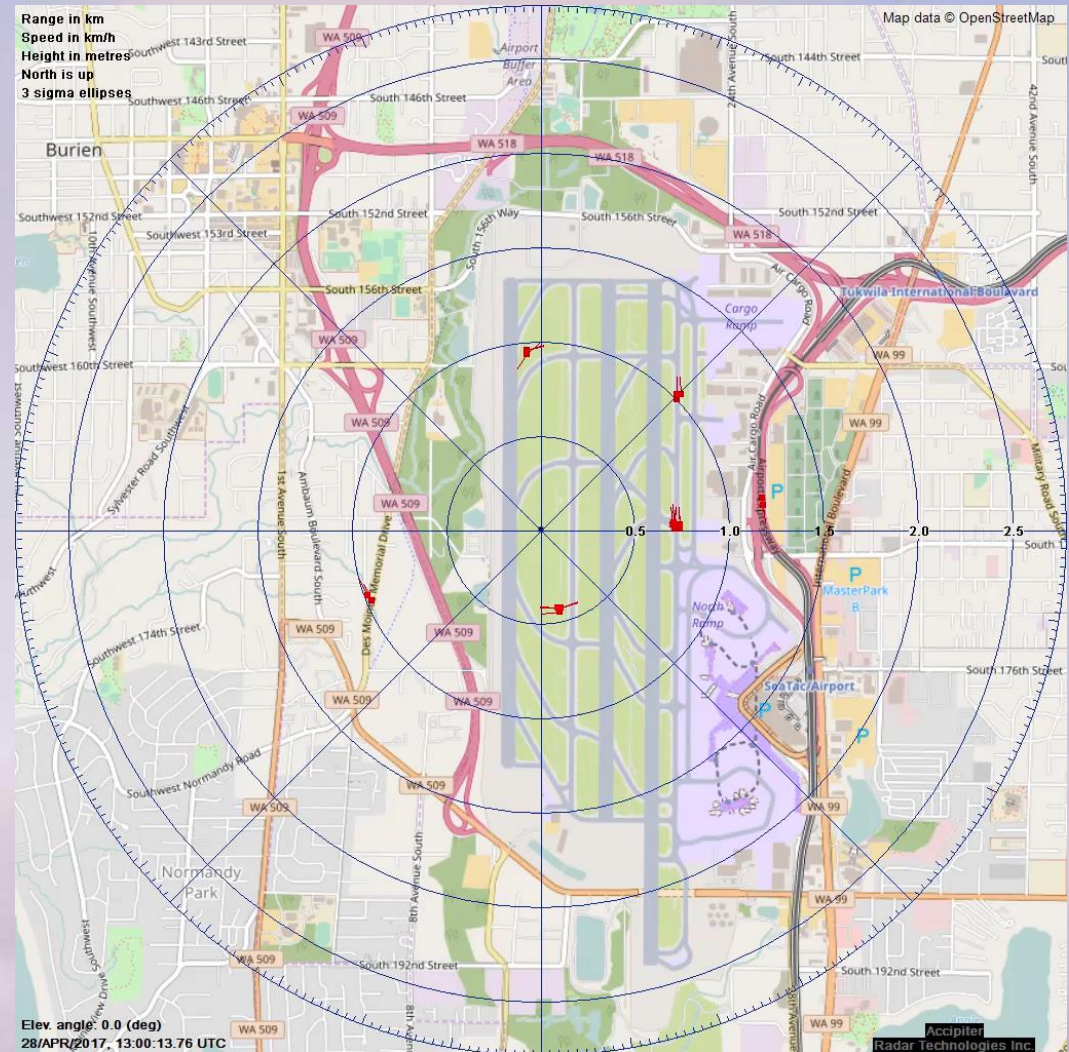


April 2017, Dawn, Sea-Tac Airport

At least 6 cormorants struck by B737



- Both engines damaged
- Landing gear damage
- 5 days downtime
- Dents
 - Both cowlings
 - Below windscreen



KSEA Reported Strikes Declining

