FOI #14118

July 9, 2013

Freedom Of Information Administrator
Port Authority OF New York and New Jersey
225 Park Avenue South - 18th Floor
New York, NY 10003

Re: FREEDOM OF INFORMATION REQUEST

Dear FOI Administrator,

I request, under the Port Authority Freedom OF Information Code (FOI), the Following information:
(1) current Wildlife Hazard Management Plan (WHMP) pertaining exclusively to all lethal and non-lethal mitigation of bird hazards (all species) within the property of John F. Kennedy International Airport.
(2) implementation, deployment, and current status of bird radar system (Accipiter Radar Technologies Inc.) at John F. Kennedy International Airport since 2009. Documents should indicate its current usage - bird radar data used

by pilots and air traffic controllers; effectiveness and latest assessment in detection of wild birds around JFK.

This information is for my personal interest, and I will pay all fees incurred for processing.

Documentation and records may be emailed to me in Adobe Acrobat (PDF) format at: [redacted] Or paper format (photo-copies) should be mailed to my home address: [redacted]

Thank you for your attention.

Sincerely,
Jeffrey Kramer
JEFFREY KRAMER

THE PORT AUTHORITY OF NY & NJ

FOI Administrator

June 10, 2014

Mr. Jeffrey Kramer

Re: Freedom of Information Reference No. 14118

Dear Mr. Kramer:

This is in response to your July 9, 2013 request, which has been processed under the Port Authority's Freedom of Information Code (the "Code") for copies of the current Wildlife Hazard Management Plan pertaining exclusively to all lethal and non-lethal mitigation of bird hazards (all species) within the property of John F. Kennedy International Airport; implementation, deployment, and current status of bird radar system (Accipiter Radar Technologies Inc.) at John F. Kennedy International Airport since 2009. The documents should indicate its current usage-bird radar data used by pilots and air traffic controllers; effectiveness and latest assessment in detection of wild birds around the aforementioned airport.

Material responsive to your request and available under the Code can be found on the Port Authority's website at http://www.panynj.gov/corporate-information/foi/14118-O.pdf. Paper copies of the available records are available upon request.

Certain material responsive to your request is exempt from disclosure pursuant to exemptions (4) and (5) of the Code.

Please refer to the above FOI reference number in any future correspondence relating to your request.

Very truly yours,

Daniel D. Duffy
FOI Administrator

225 Park Avenue South, 17th Floor
New York, NY 10003
T: 212 435 3642
F: 212 435 7555

Wildlife Hazard Control Measures – 14 CFR Part 139.337(f)(5)(iii)
Before conducting any wildlife control activities for the first time, staff must read and understand all conditions for control in the airport's wildlife permits. Staff must read all new or updated permits when they are issued to ensure that staff is familiar with the most current permit conditions.

Bird Control

- Harassment

Wildlife Management staff will use pyrotechnics, helikites, lasers, or other legal non-lethal methods to disperse wildlife hazards. If initial harassment methods are ineffective, assistance may be obtained from additional operations or wildlife contract staff or lethal control may be used. **New York State listed threatened and endangered species may be harassed using nonlethal control methods only. Federally listed threatened and endangered species may not be harassed without prior approval from USFWS.**

Staff authorized to use pyrotechnics will practice safety when handling. Pyros will be stored in the firearms safe when not in use and stored in the ammo box while on patrol. Protective eyewear and earplugs will be worn and pyros will be loaded and fired from outside the vehicle.

Gulls, starlings, brant, Canada geese, osprey, double-crested cormorants, mallards (*Anas platyrhynchos*), and black ducks (*Anas rubripes*) will be aggressively harassed using pyrotechnics or other hazing methods; lethal control may also be used by trained staff as necessary. At low tide, staff will coordinate with other staff or contractors as needed to deter gull clamming activity and prevent buildup of clam shells from taxiway and runway surfaces. Waterfowl and wading birds will be dispersed immediately from any wetland areas in the AOA. **Staff will maintain a zero tolerance policy for geese and mute swans and will not allow geese or mute swans to land or sit on airport property.** During late fall and winter, Landside Operations staff will coordinate with Wildlife Management or wildlife contract staff for additional assistance as needed to prevent geese, especially brant, from moving from one location to another. Immediate dispersal of geese is the first priority outside the AOA where lethal control will not be used. Within the AOA, lethal control of geese and mute swans will be the first priority and harassment will be used when lethal control is not feasible.

- Capture

Starlings, house sparrows, red-winged blackbirds, brown-headed cowbirds, or pigeons will be trapped and euthanized. When used, traps must be checked at least once per day and food and water must be available in the trap for captured birds. Birds will be euthanized and disposed of in accordance with the airport's depredation permits. Any non-target birds will be immediately released from the trap. Nets, boxes, or blankets may also be used to capture injured birds.

- Lethal Control

When non-lethal control efforts have failed to produce the desired results or when there is an immediate threat to aircraft safety, lethal control may be used. Lethal control consists of shooting, euthanasia by cervical dislocation or CO^2, or egg addling (oiling). Lethal control will be conducted within the AOA only, unless otherwise authorized by the Wildlife Biologist. Staff will wear eye and hearing protection when discharging firearms. Firearms will be kept locked in

the firearm safe when not in use and transported unloaded with the action open and the muzzle in a safe direction. All depredated birds should be disposed of in accordance with the airport's depredation permits.

Geese and mute swans will be killed whenever present in the AOA, unless shooting is not feasible (i.e. too far to shoot, adjacent to aircraft or in public view). When lethal control cannot be used, geese and swans must be aggressively harassed using nonlethal methods.

Gulls, mallards and black ducks will also be targeted for lethal control. Shooting gulls acts as a deterrent to gulls flying over the airport and may reinforce nonlethal control methods. Mallards and black ducks often become immune to nonlethal control methods and require lethal control to reinforce nonlethal methods.

Canada goose, oystercatcher (*Haematopus palliatus*), double-crested cormorant, barn swallow (*Hirundo rustica*), and killdeer (*Charadrius vociferous*) eggs will be oiled and/or destroyed in accordance with the airport's depredation permits to prevent the eggs from hatching. Once eggs have been destroyed, Wildlife Management staff must re-check nests regularly to make sure that no re-nesting has occurred. Other bird nests and eggs will also be destroyed as emergency take under the airport's permits. Pigeon and starling nests and eggs will be destroyed at any time and no permit is required for those activities. The Wildlife Biologist will coordinate with NYSDEC for nest and egg control of any threatened, endangered, or species of special concern.

Birds not specifically listed on the airport's federal depredation permit or covered under the airport's state airport air strike hazard permit may be taken if the bird presents an immediate hazard to aircraft. This must be reported to the Wildlife Biologist, who must file a written report of the emergency take to USFWS within 72 hours. **Threatened and endangered birds are excluded from this emergency take clause and may not be killed under any circumstances.**

Mammal Control

- Harassment

Mammals can be harassed using any available legal method; however, capture or lethal control are more effective for mammal control.

- Capture

Catchpoles, nets, and live traps will be used to capture mammals, particularly feral and domestic cats (*Felis domesticus*) and dogs (*Canis familiaris*). Traps are checked at least once per day and will not be left open in extreme heat or cold. Attempts will be made to contact the owners of any captured dog or cat, and severely injured wildlife may be taken to a veterinarian or wildlife rehabilitator for medical care. If an owner cannot be identified for cats or dogs, staff will take the animal to the local animal control shelter in Brooklyn and all paperwork should be given to the Wildlife Biologist.

Raccoons, opossums, and gray squirrels will be captured and euthanized and must not be relocated on or off airport property.

- Lethal Control

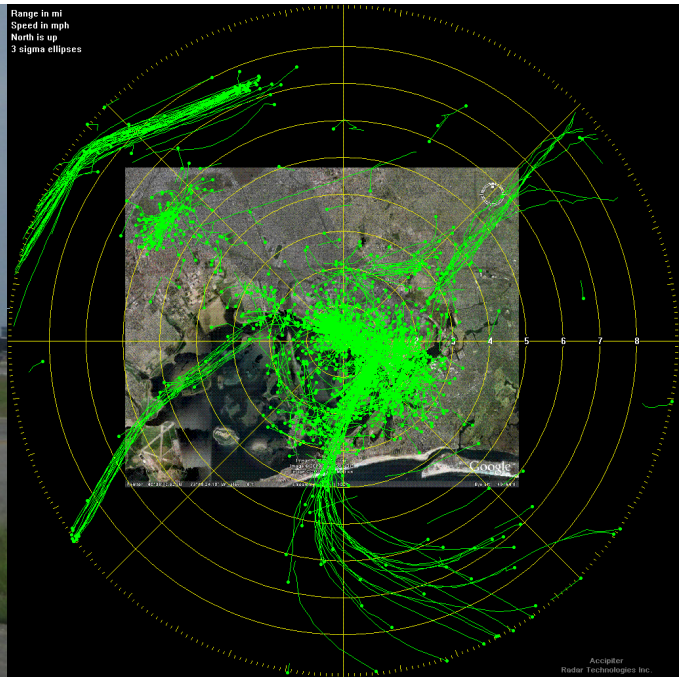
FEDERAL AVIATION ADMINISTRATION
APPROVED: Evelyn Mahoney
DATE: 9/24/13

Mammals such as black-tailed jackrabbits (*Lepus californicus*), muskrats (*Ondatra zibethicus*), cottontail rabbits (*Sylvilagus floridanus*), raccoons (*Procyon lotor*), opossums (*Didelphis virginiana*), and gray squirrels (*Sciurus carolinensis*) will be shot in accordance with the airport's state Airport Air Hazard Permit. Jackrabbits may be taken at any time. Shooting of dogs or cats is appropriate only when aircraft safety is threatened or when the animal is acting aggressively towards people or exhibits symptoms of rabies.

All mammal depredations will be recorded by date, species and number and disposed of in accordance with the airport's airport air strike hazard permit.

FEDERAL AVIATION ADMINISTRATION
APPROVED: Marilyn Mastny
DATE: 6/26/13

Radar Tuning at JFK
Aircraft Coverage & Multipath



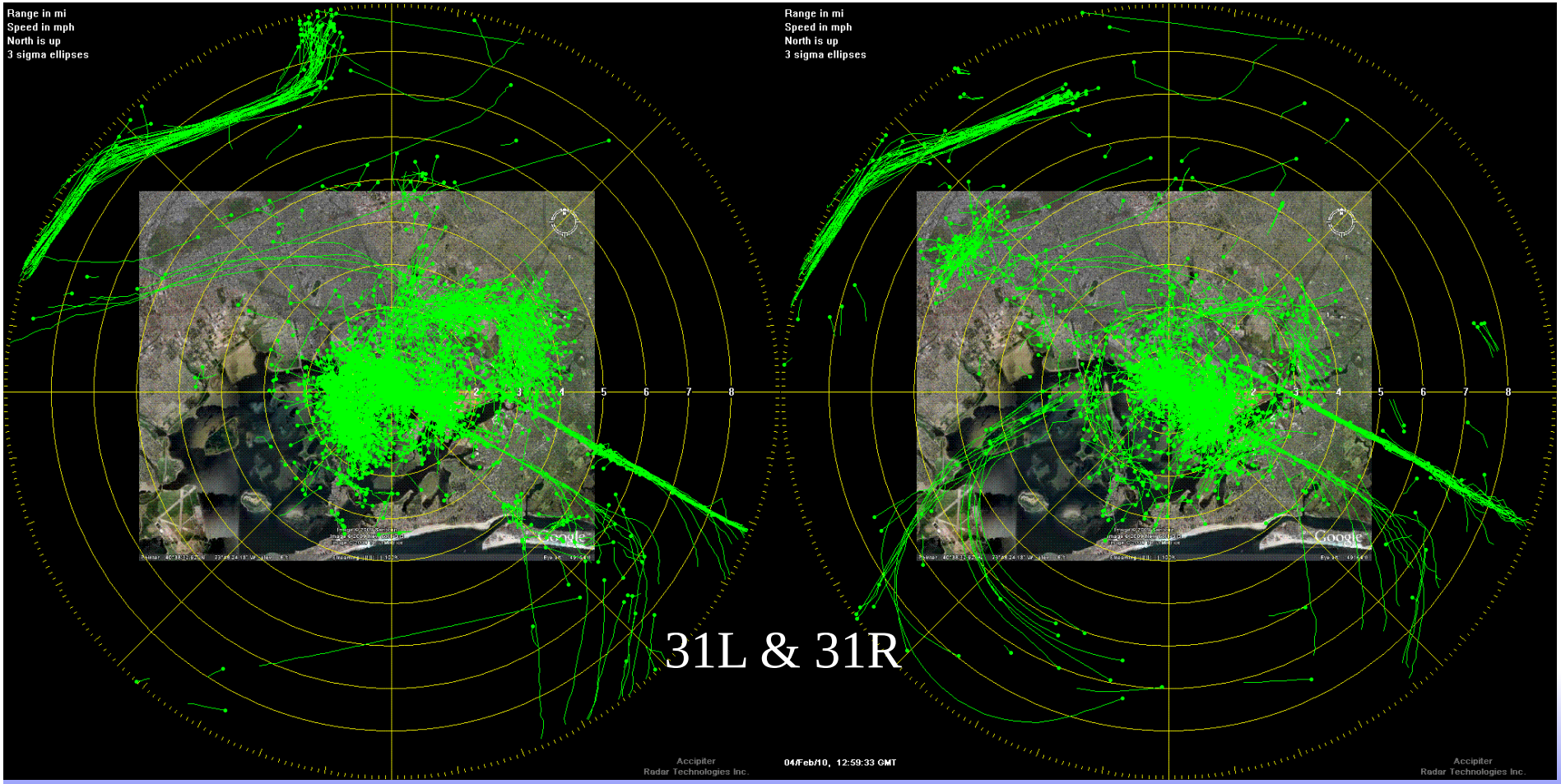
Introduction

- *Aircraft Tracking*
  - *At civil airports, a key requirement for avian radars is to provide coverage for aircraft approach, departure and pattern corridors – we measure this coverage by tracking aircraft with the avian radar*
- *Multipath Mitigation*
  - *When large structures such as taxiing or landing aircraft and the terminal complex are close to a radar, multipath is common as the radar signal bounces off of these objects as well as the targets of interest – multipath clutters the avian radar display if not dealt with*
  - *Radar engineers can mitigate the effects of multipath through a variety of means*
- *We are in the midst of dealing with the above*

1 hour aircraft patterns at 0800, 4 Feb 2010

Low-beam

High-beam

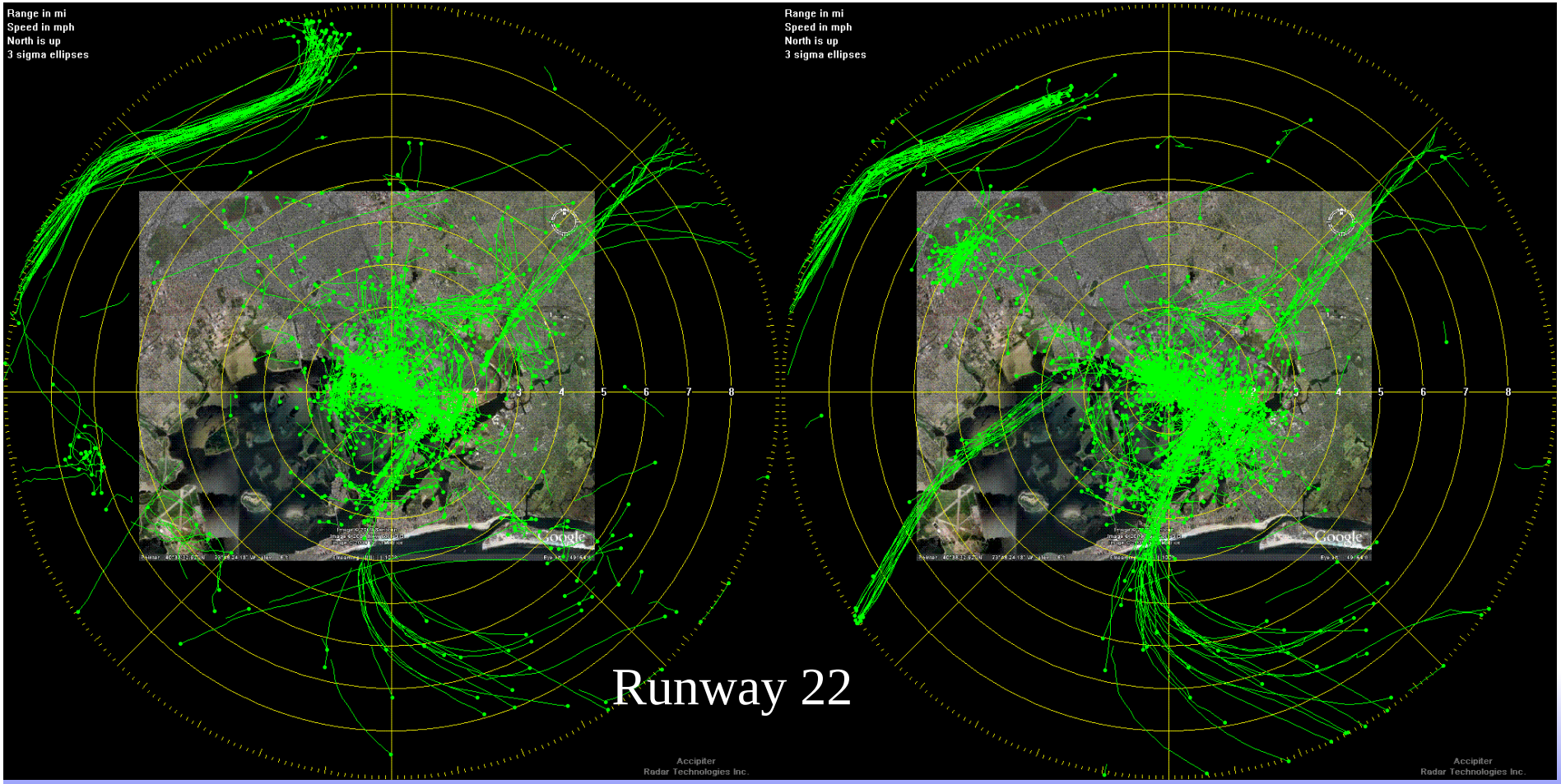


31L & 31R

1 hour aircraft patterns at 0900, 4 Feb 2010

Low-beam

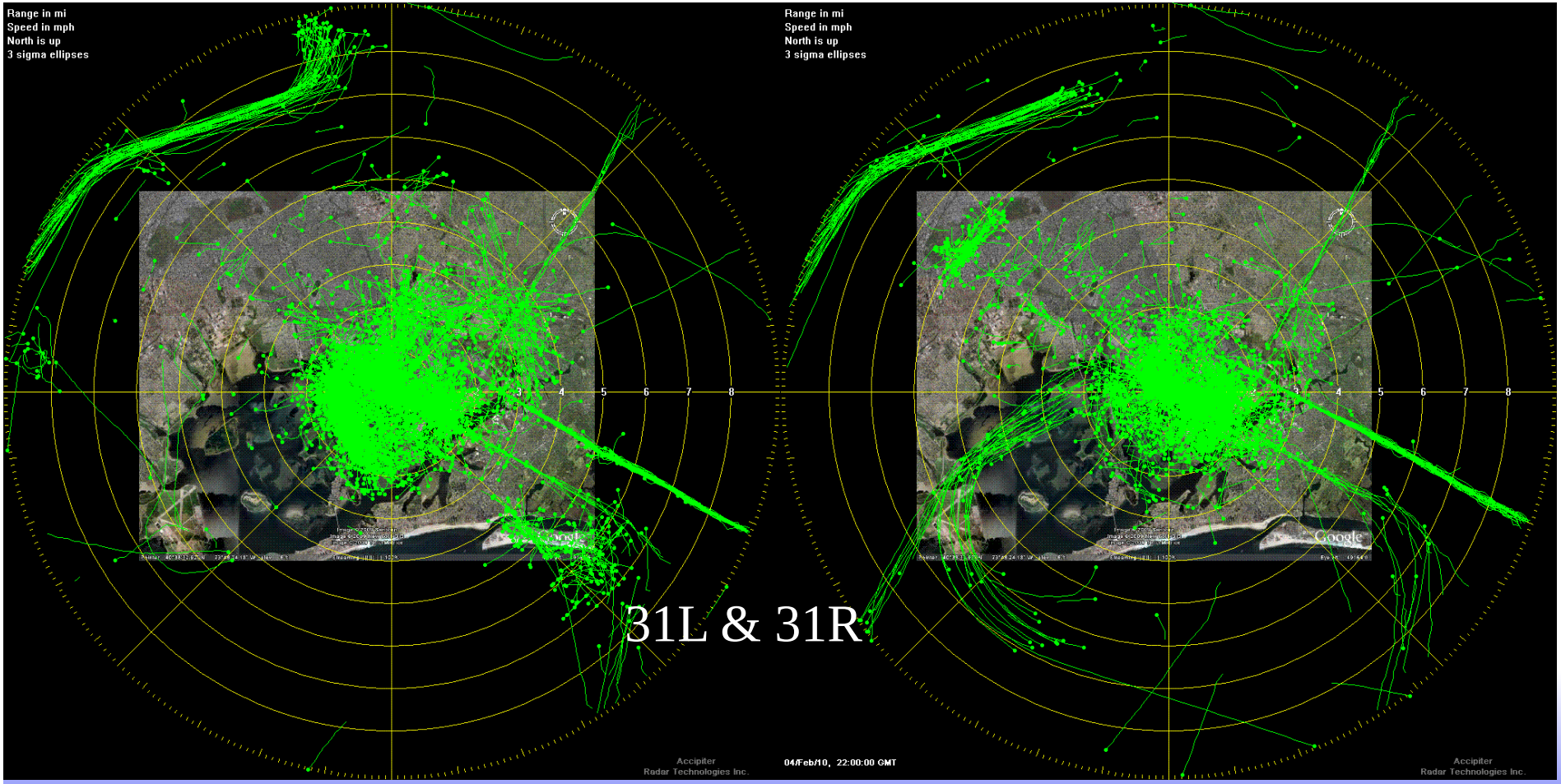
High-beam



1 hour aircraft patterns at 1700, 4 Feb 2010

Low-beam

High-beam

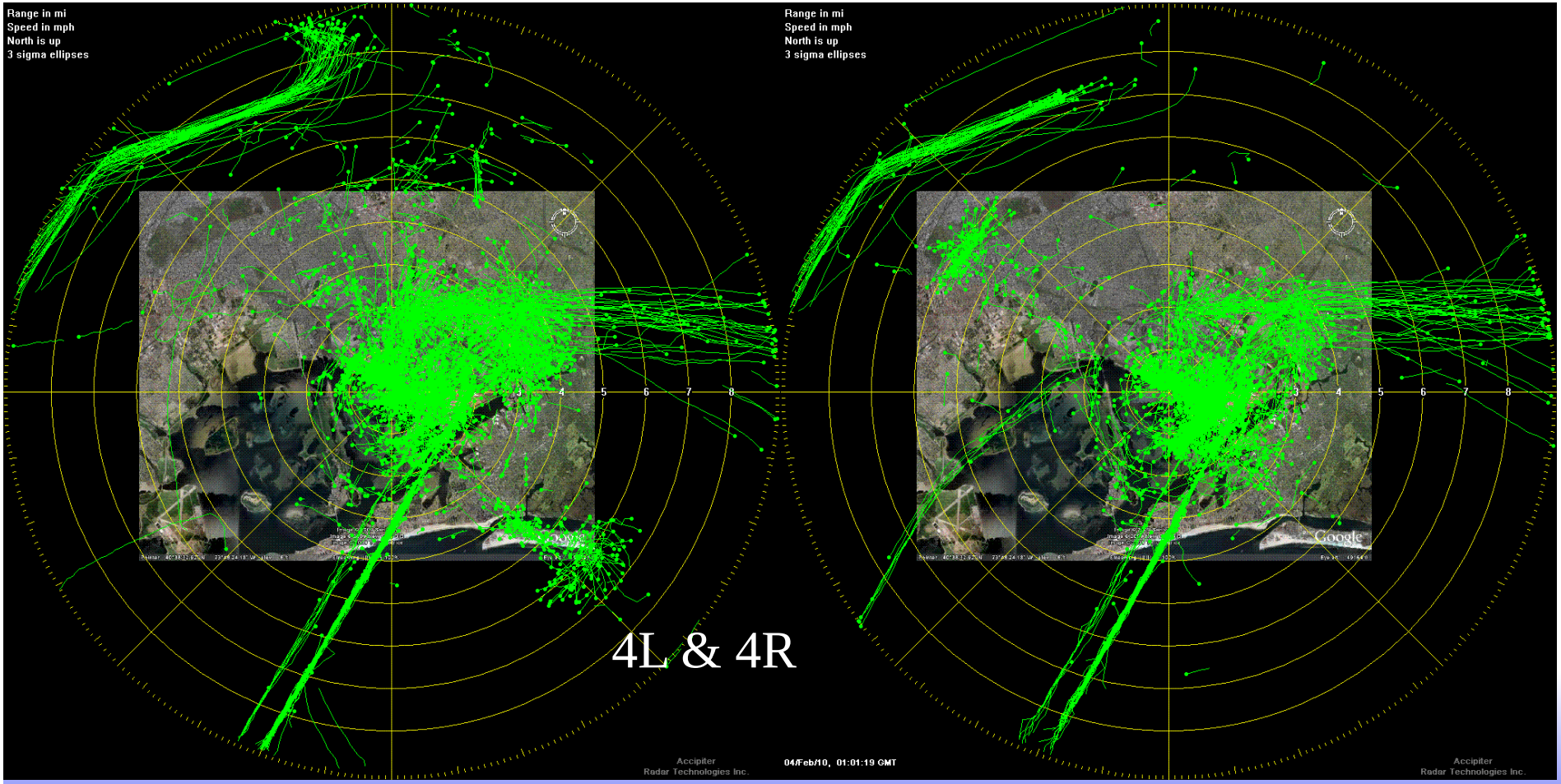


31L & 31R

1 hour aircraft patterns at 2000, 3 Feb 2010

Low-beam

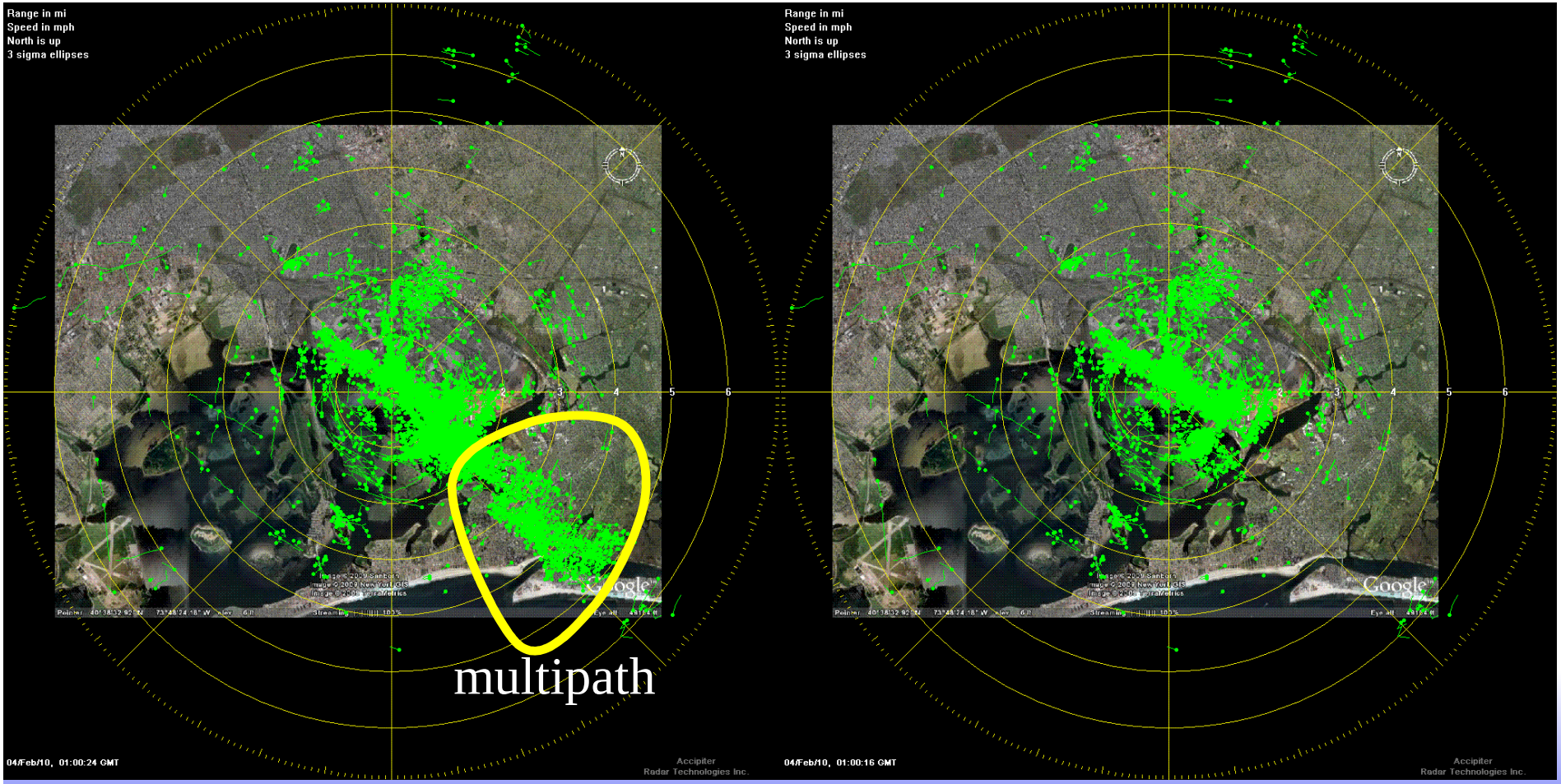
High-beam



1 hour bird patterns at 2000, 3 Feb 2010 for Low-beam radar

No masking

With masking



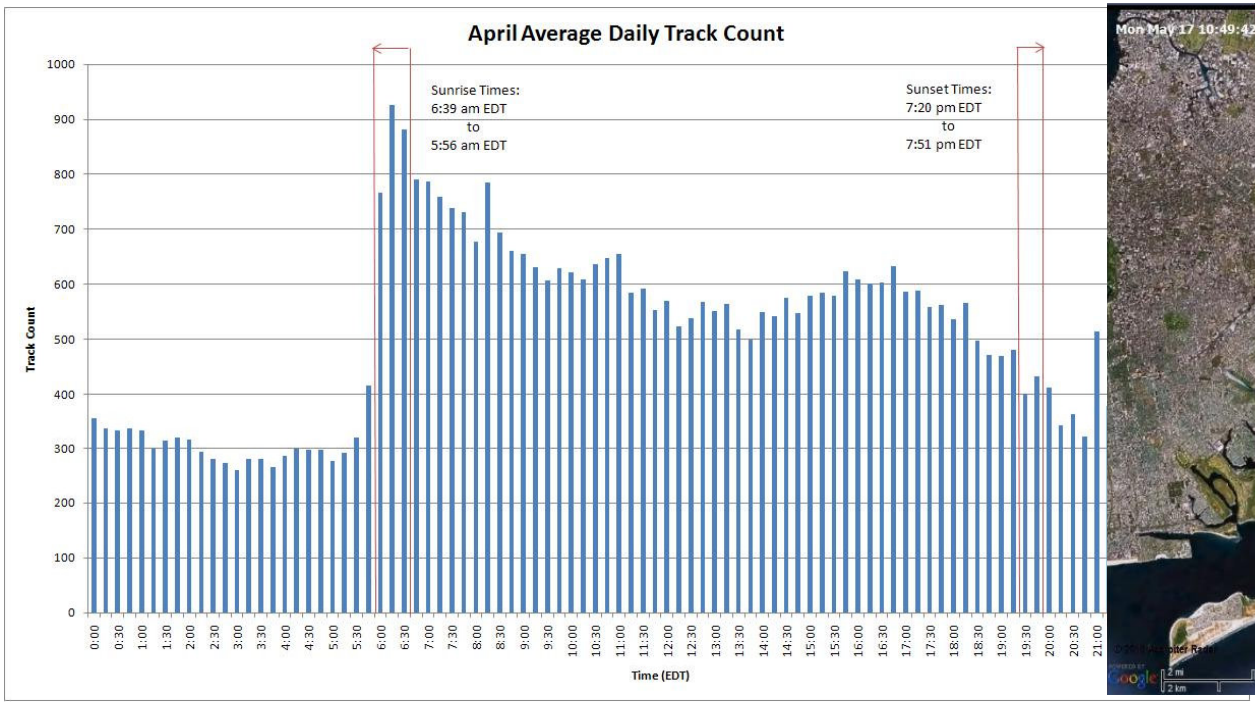
Multipath Mitigation

- Masking affected areas
  - The example presented here indicates how this will be done without losing excessive bird tracks
- Various other methods are available that we will use when we are next at JFK (some multipath comes from antenna-to-antenna)
  - Rotate trailer to shift the multipath
  - Raise antenna
  - Optimize antenna coverage geometry with feedback on priority coverage areas
- Once full network connectivity is in place, we will rapidly complete tuning with your feedback

Summary

- We have pretty good coverage of approaches and departures of 4, 22 and 31 using the AR-2 (the radar with the twin dishes)
- We are working on tuning. We will look at the AR-1 radar next.
- When we are finished, the tracks from all three radars will integrate to provide target information and situational awareness
- Stay tuned! Pardon the pun.

Maximizing situational awareness using airport avian radars



Tim J. Nohara, Ph.D, & Robert C. Beason, Ph.D
Accipiter Radar Corporation

ACCIPITER® Radar Technologies Inc.

Outline

- Introduction
- Lessons learnt from assessment programs
- Analytical needs for wildlife management
- Analytical needs for airfield management
- Analytical and visualization tools
- Quality assurance
- Conclusions

Introduction

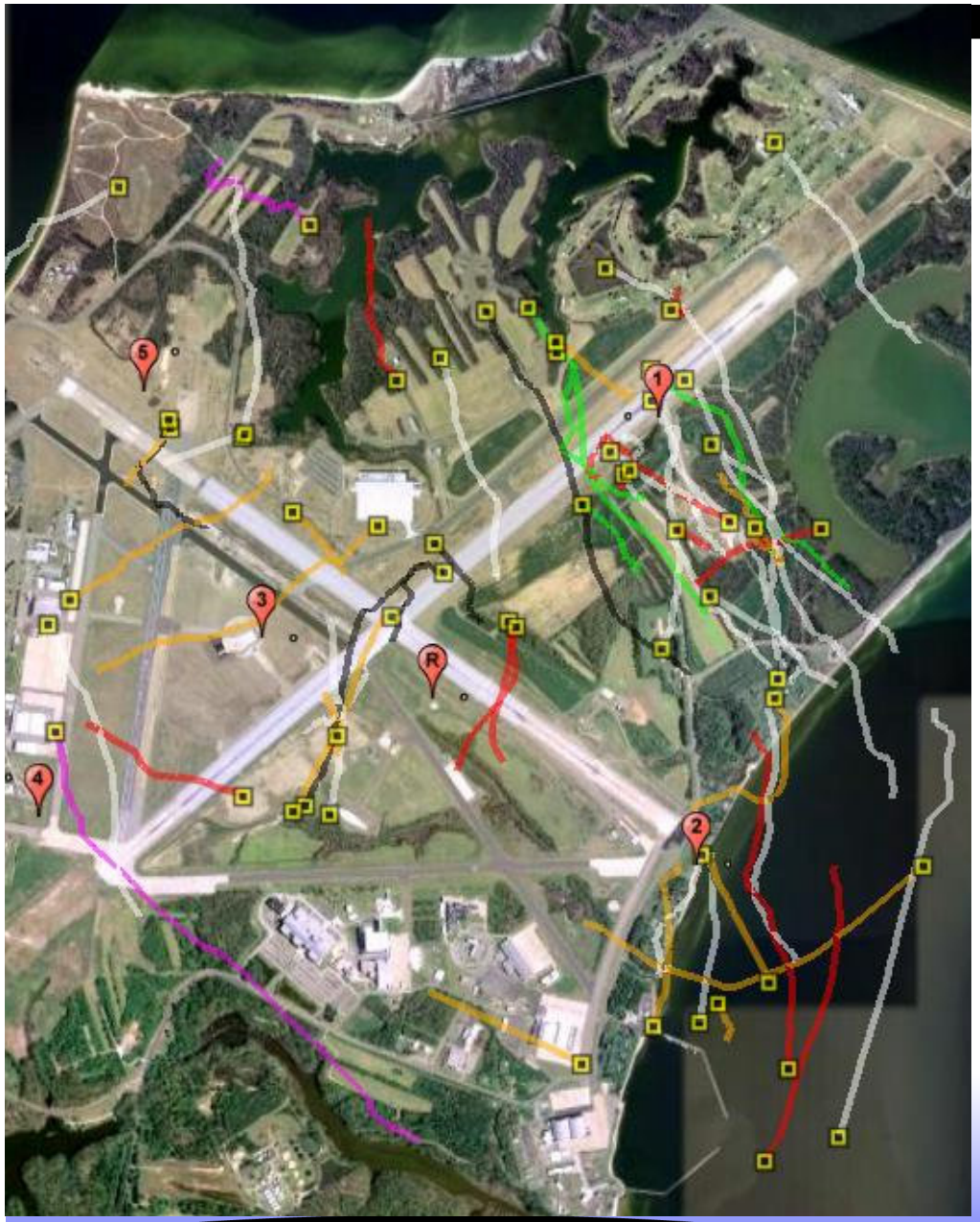
- Digital avian radar is a recent tool to help manage the threat of bird strikes.
- DoD's Environmental Security Technology Certification Program (ESTCP)
- FAA's CEAT at University of Illinois conducting a parallel digital avian radar assessment program

- DoD's Environmental Security Technology Certification Program (ESTCP) – Integration and Validation of Avian Radar (IVAR) is now complete
  - 3-year assessment, 400-page report
  - Field work carried out at seven sites
  - Participants included field site personnel, along with SPAWAR, CSC, USDA/WS, CUROL and FAA's (CEAT) U of I

- FAA's CEAT at University of Illinois conducted a parallel assessment program (Dr. Ed Herricks, P.I.)
  - To develop guidance to civil airports
  - Collaborated with radar manufacturers
  - Conducted numerous performance tests
  - Deployed radars at 4 sites for multi-year study through seasonal cycles
  - Long-term data management tested
  - Some reports out, others in preparation

Key lessons learnt from assessments

- DoD ESTCP IVAR – proved bird tracking capabilities & data integration/management
- FAA CEAT ARAP – measured performance & developed and demonstrated the concept of optimizing radar coverage to aircraft corridors
  - Sheer volume of radar target data generated highlights the need to standardized situational awareness tools for airports



Species (or class)	Visually Confirmed Tracks	Single Bird Max Range Observed (km)	Multiple Bird Max Range Observed (km)
American kestrel	2	1.4	0.9
Bald eagle	6	3.3	1.2
Barn swallow	3	2.1	1.4
Blackbird	2		2.2
Bonaparte's gull	7	0.9	0.8
Canada goose	5	2	1.9
Common grackle	9	2.1	1.8
Common loon	21	2	2.1
Crow	23	2.3	1.3
Double-crested cormorant	27	2.1	2.3
Great black-backed gull	2	1.4	1.4
Great blue heron	1		1.9
Greater yellowlegs	1		0.6
Gull	71	2.7	3.2
Hawk	1	0.7	
Herring gull	3	1.4	1.7
Mourning dove	1		2
Northern Harrier	1	1.2	
Osprey	38	2.7	1.7
Sandpiper	1		1.9
Purple martin	1	1.7	
Ring-billed gull	20	2.1	2.4
Red-shouldered hawk	1	2.4	
Songbird	2	0.6	1.4
Tern	3	1.5	
Tree swallow	1		1.8
Turkey vulture	29	3.1	3.2
Wilson's snipe	2	0.7	0.9
Unidentified	8	2.4	0.7

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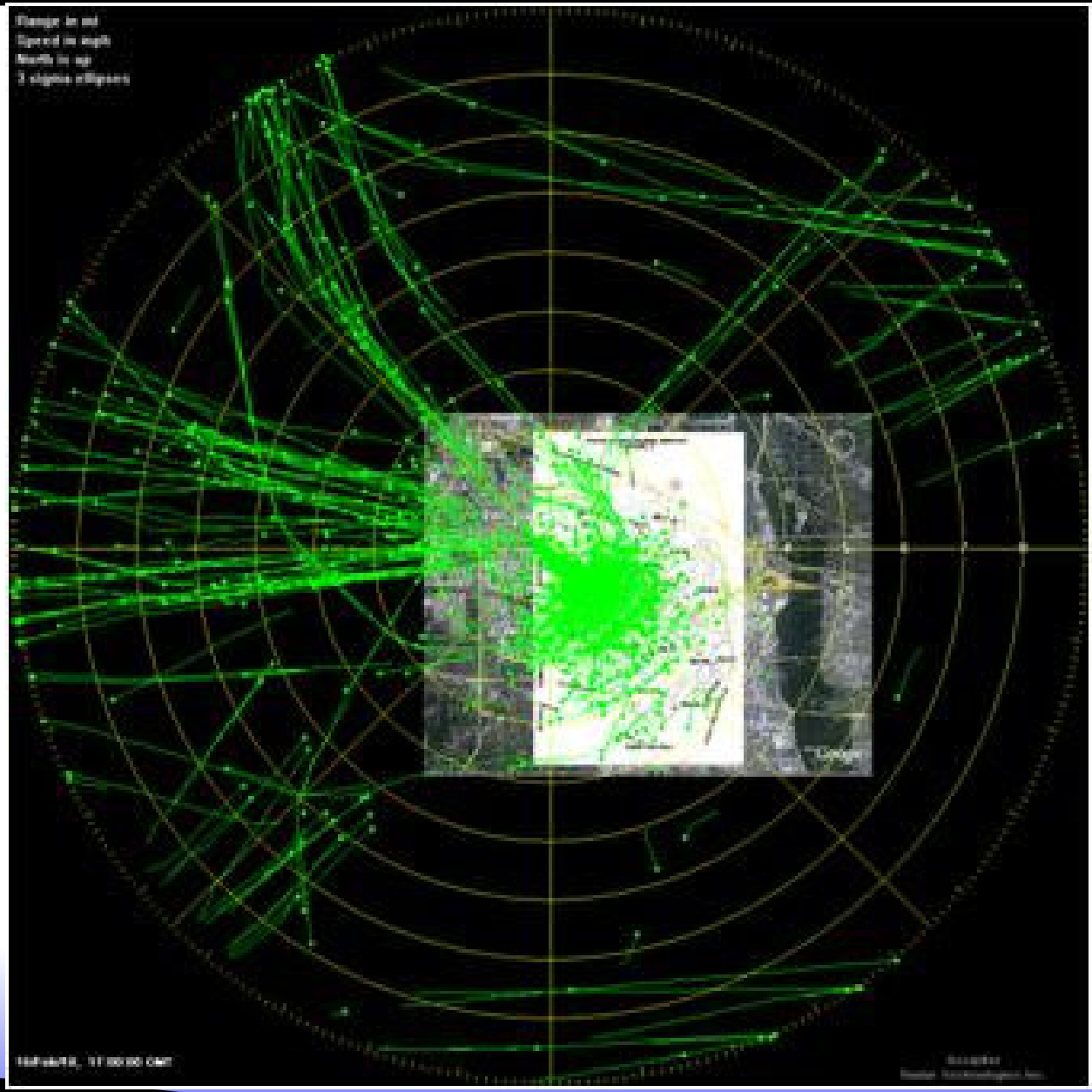
Chicago O'Hare

1 hour track history shows avian radar aircraft coverage based on runway usage during that hour.

Departures on 32L & 32R, 4L & 4R, and 28.

Approaches on 4L & 4R



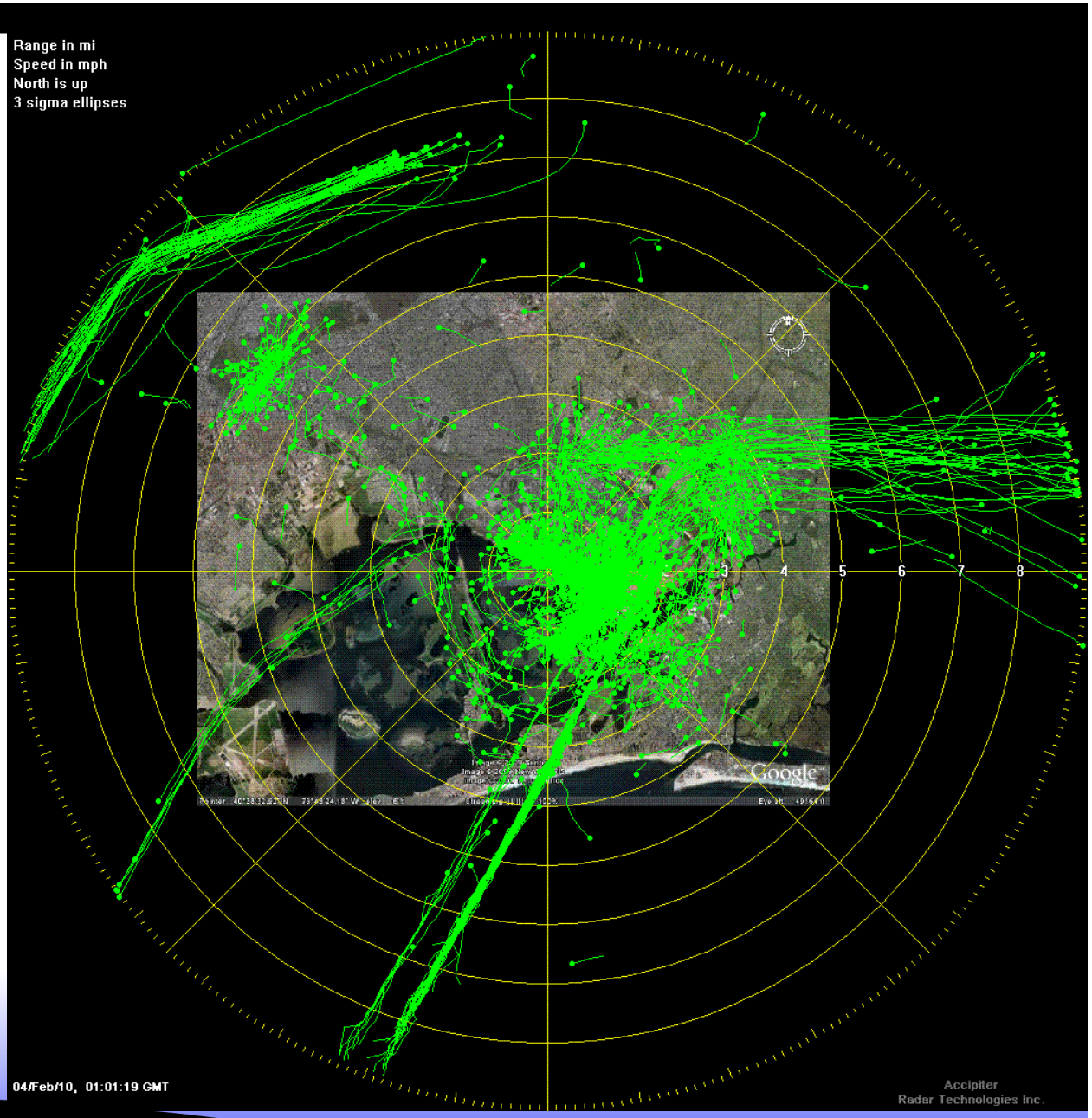
ACCIPITER® Radar Technologies Inc.

New York JFK

1 hour track history shows avian radar aircraft coverage based on runway usage during that hour.

Departures on 4L & 4R

Approaches on 4L & 4R



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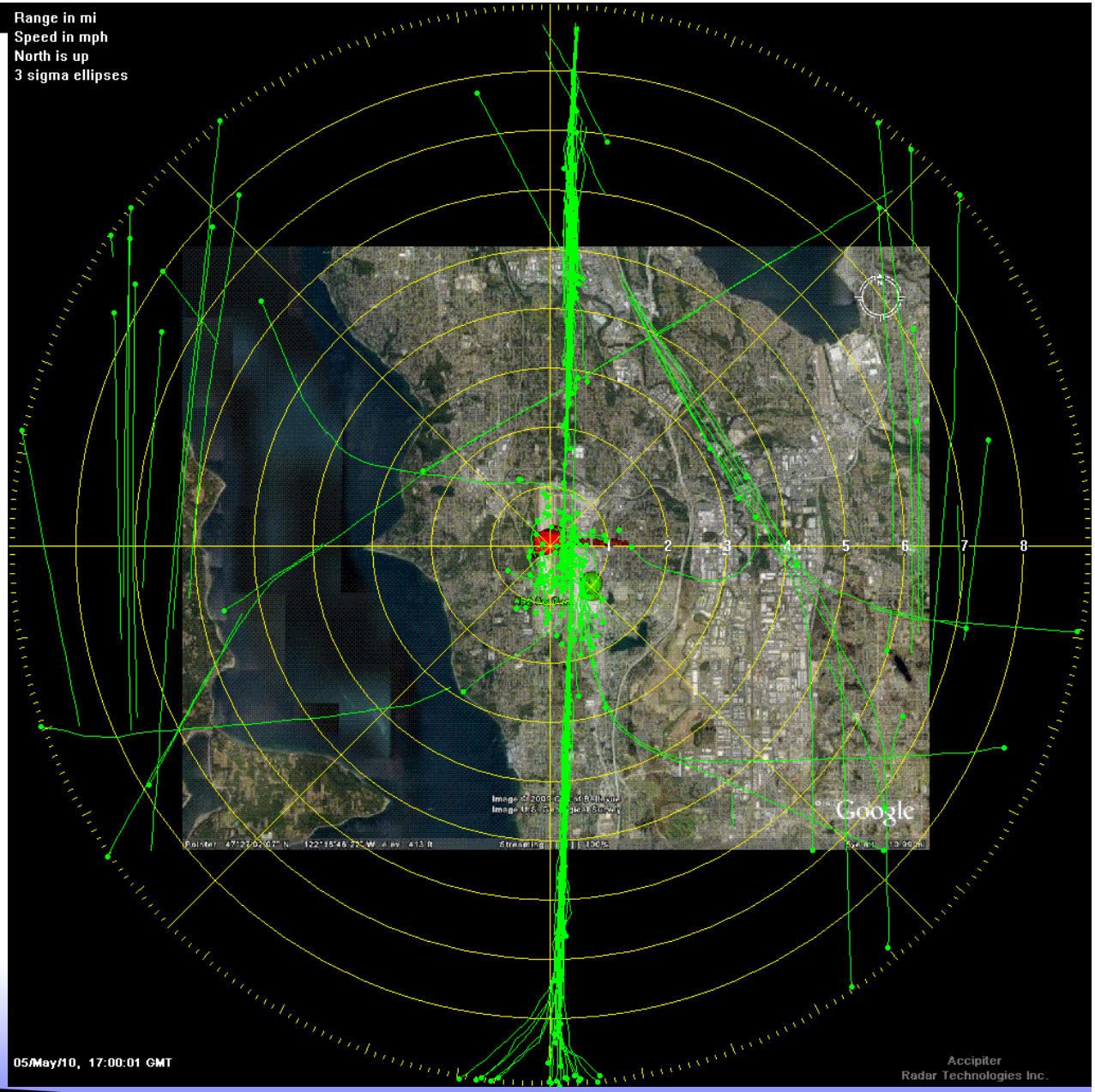
Seattle-Tacoma

1 hour track history shows avian radar aircraft coverage based on runway usage during that hour.

Departures on 16L

Approaches on 16C



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Analytical Needs

- 3-D target location information
- Target identification
- Visualization for different users

Wildlife management analytical needs

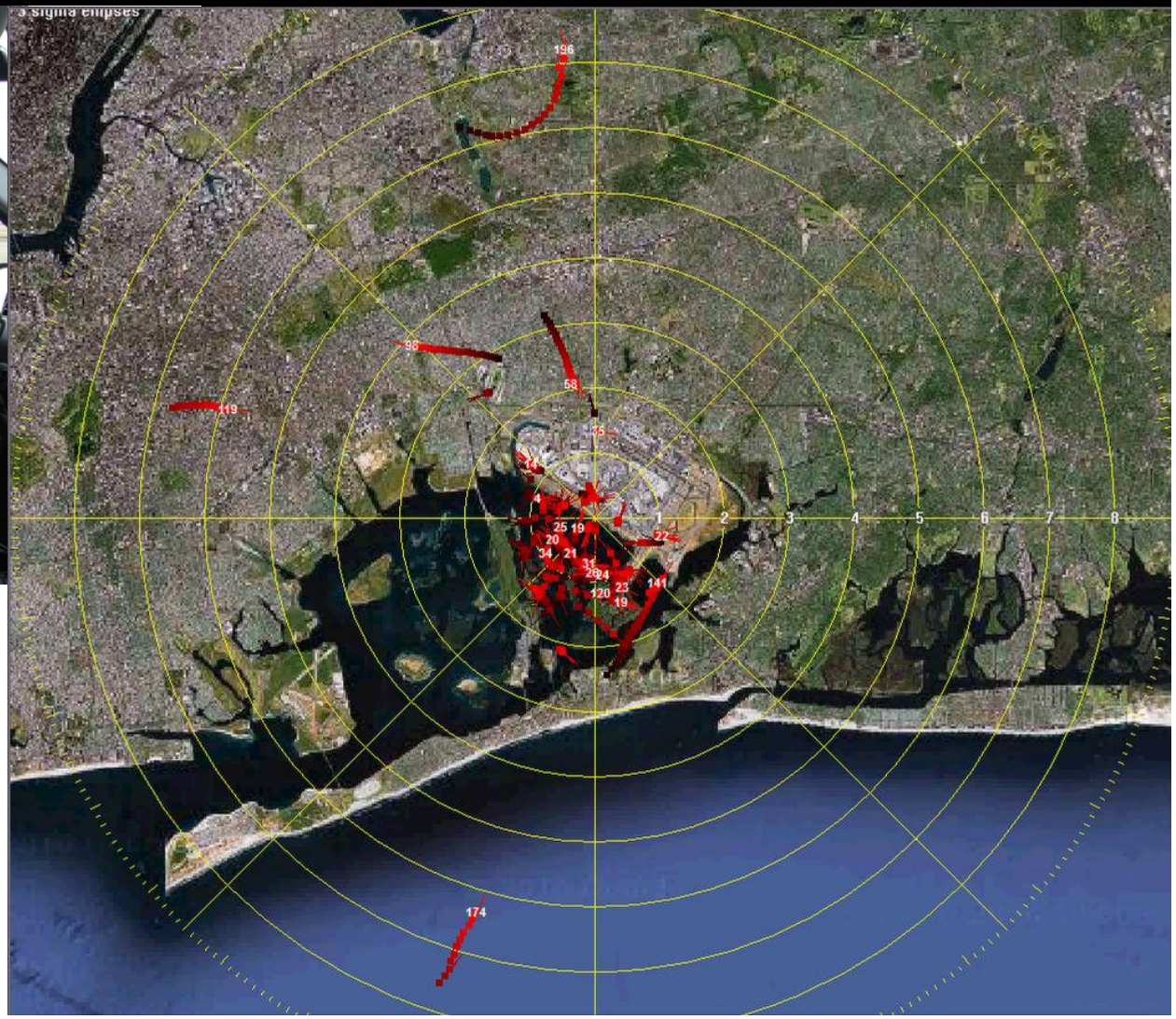
- Tactical
  - Know where the birds are all the time
  - Flexibility to respond to changing conditions
  - In-the-field viewing
- Strategic
  - Establish long-term behavior patterns
  - Quantify changes in patterns caused by habitat changes, population changes, deterrents, and wildlife management

Airfield management analytical needs

- Tactical
  - Alerted to rapidly developing threats
  - Know the altitude of bird concentrations
- Strategic
  - Know peak times of bird movements
  - Quantify the effects of airfield management and deterrents in use.

Analytical & visualization tools

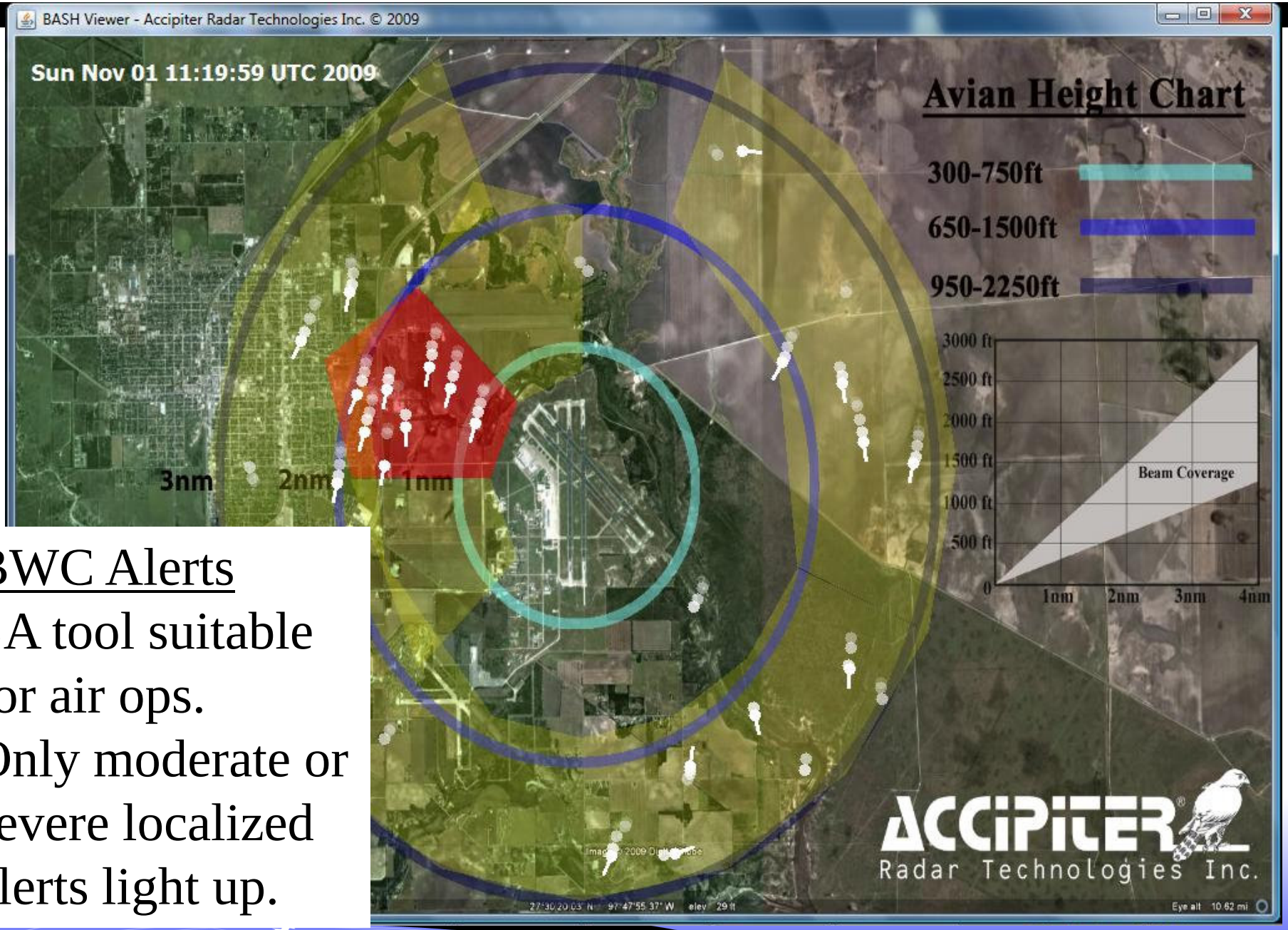
- Tactical tools providing real-time awareness of bird activities
- Strategic tools (using recorded historical data) provide awareness on changing trends
- A published bird strike with an A320 and a flock of geese that occurred at JFK on 17 May 2010 around 06:20 am and was captured by avian radar will be used as an example



Remote Track Displays

Gives real-time SA to wildlife life control personnel without giving up mobility.

ACCIPITER® Radar Technologies Inc.



BWC Alerts

SA tool suitable for air ops.

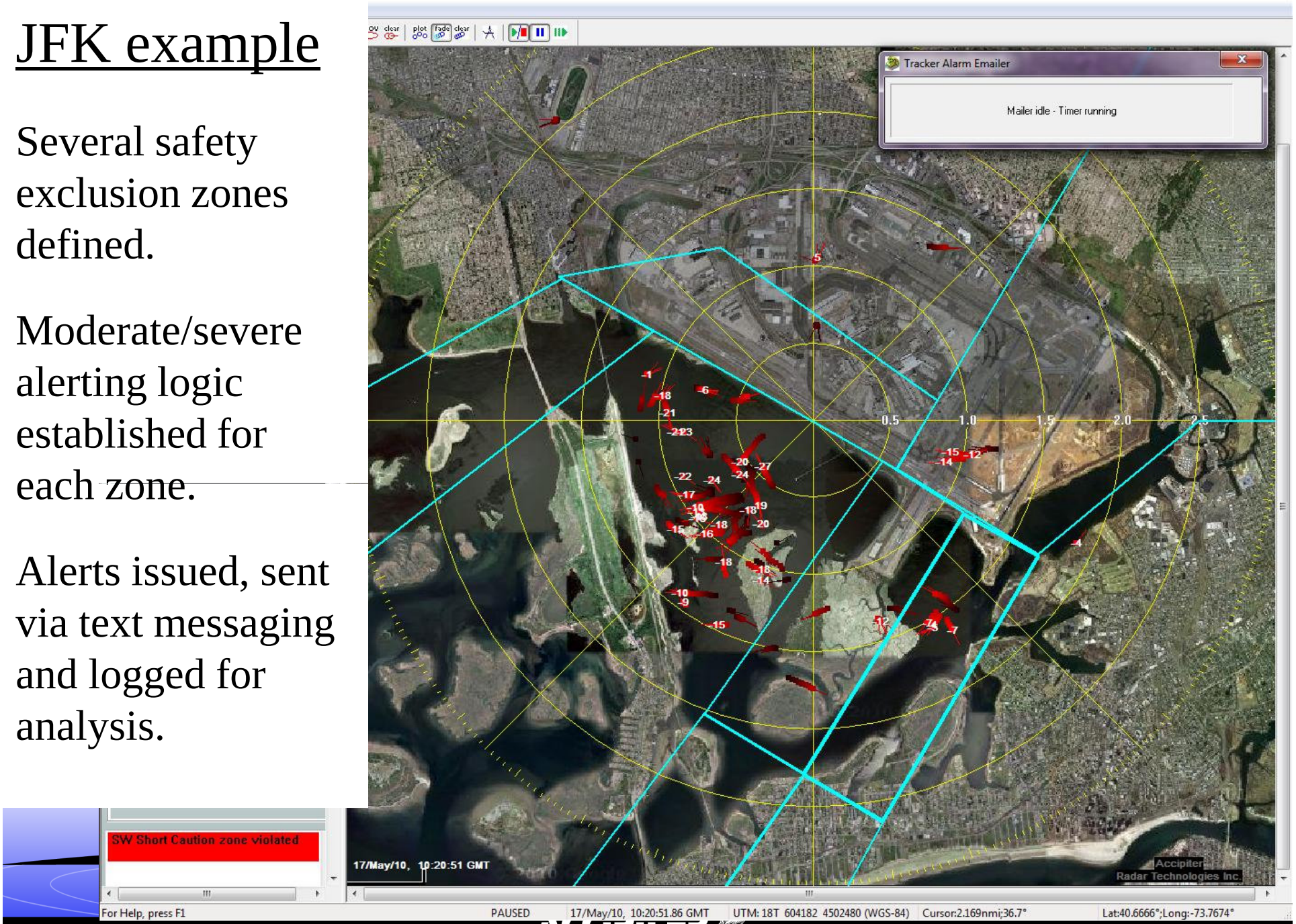
Only moderate or severe localized alerts light up.

JFK example

Several safety exclusion zones defined.

Moderate/severe alerting logic established for each zone.

Alerts issued, sent via text messaging and logged for analysis.



Programming BWC alerts

- Number of birds/flocks in a zone
- Time spent in the zone
- Size of birds (radar cross section (RCS))
- Speed and heading
- Height of birds
- Track characteristics (e.g. duration)

Selected targets

A320 that struck geese

Aircraft north of JFK

Small bird no.1

Small bird no. 2

Flock of geese involved in bird strike

ACCIPITER Radar Technologies Inc.

Estimated Radar Cross Section (RCS)

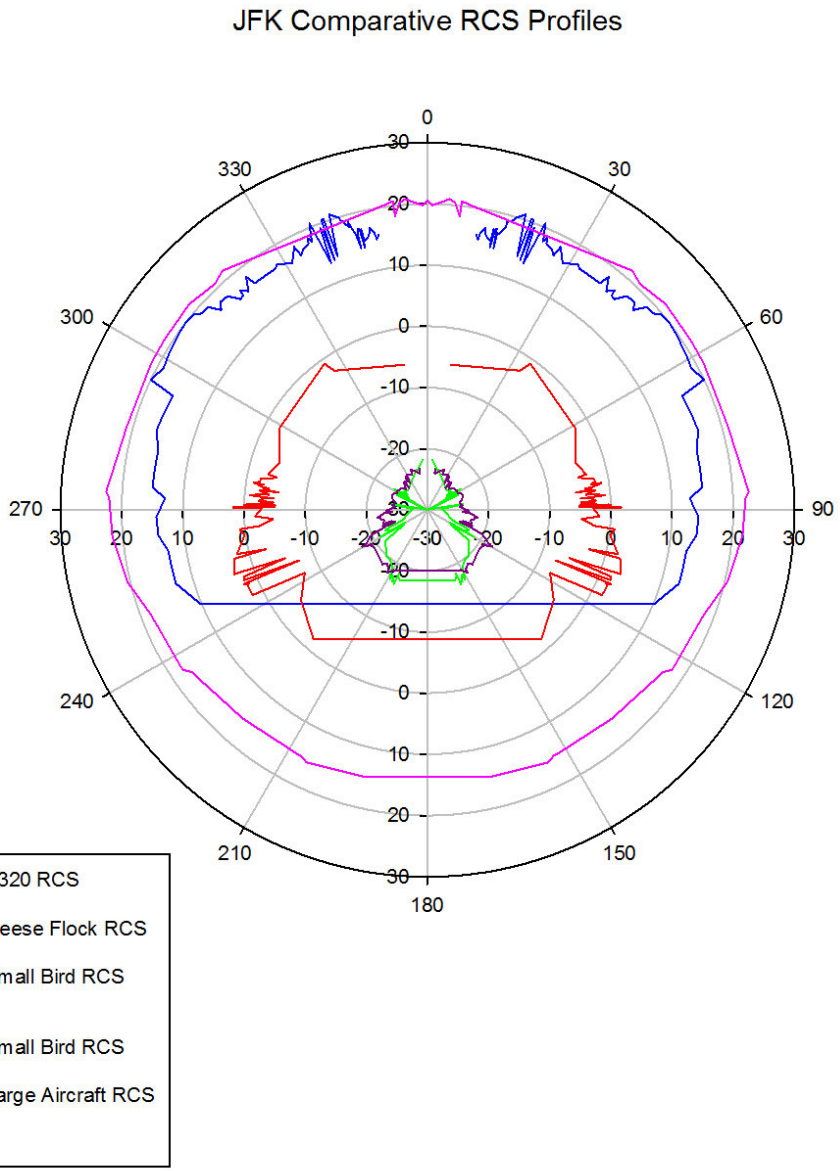
Aircraft 15 to 20 dBm^2

Geese 0 to -10 dBm^2

Smaller birds -20 to -30 dBm^2

RCS is radar's measure of size

We can use RCS to filter targets into different groups



BWC Alerts Display

Moderate alert on approach end of 4R

Severe alert indicated with birds crossing 4R & 4L

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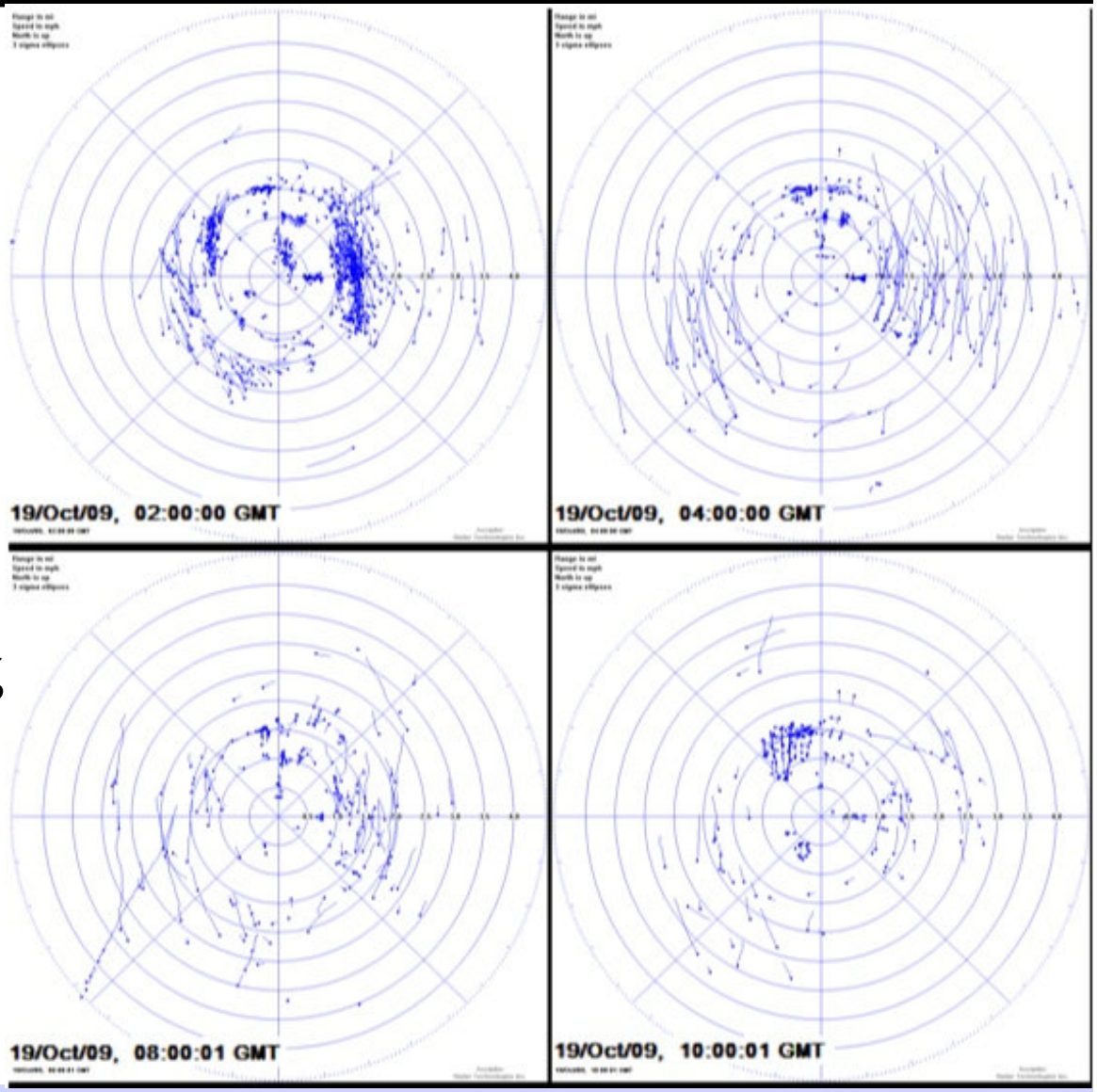
Track Histories

- Generated automatically
- Published to a web site
- Each frame shows accumulation of bird trajectories over that interval

- Allows quick understanding of temporal and spatial bird movements
- Can review previous day, week, month, year by point & click



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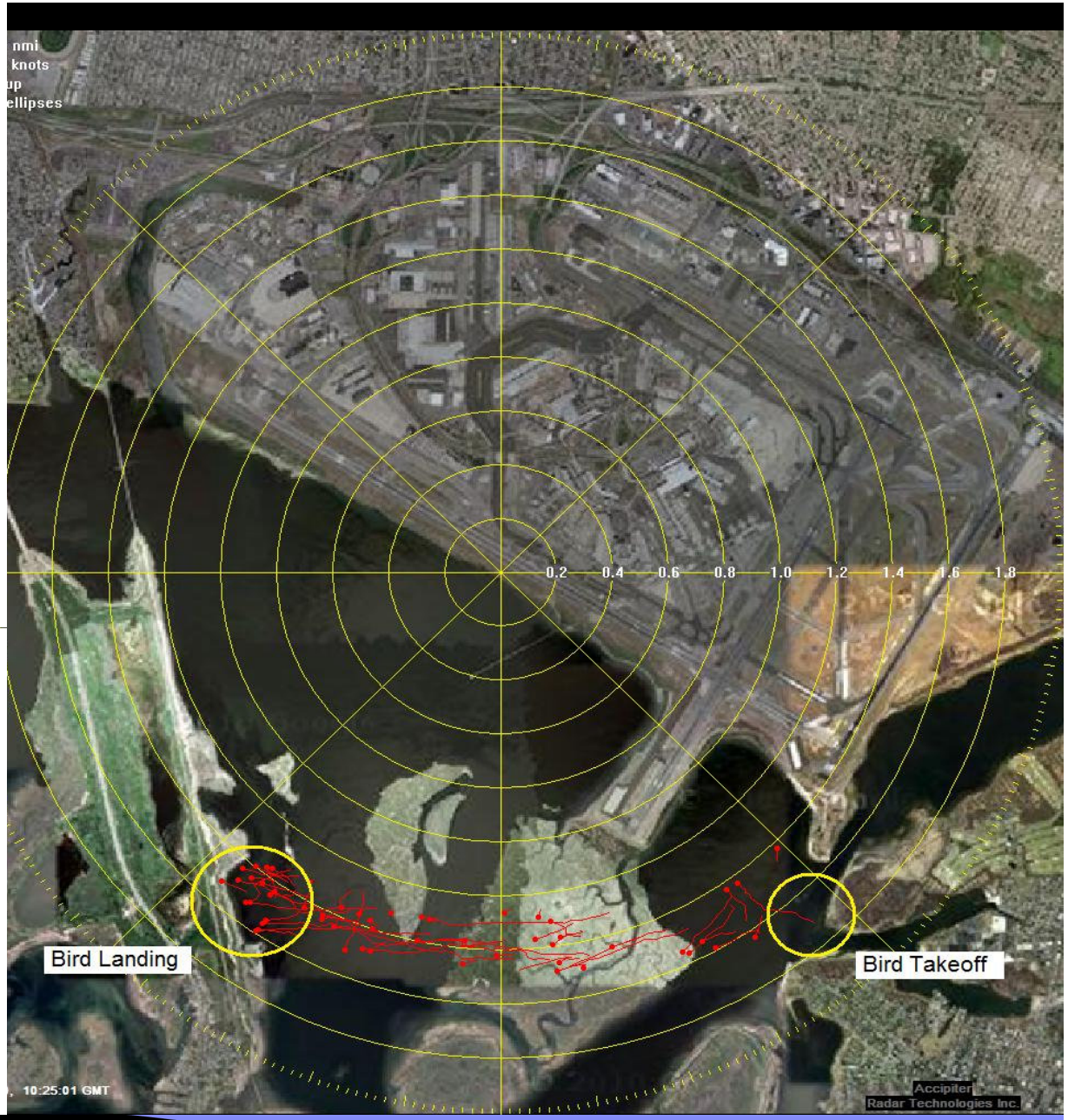
Tracks Database

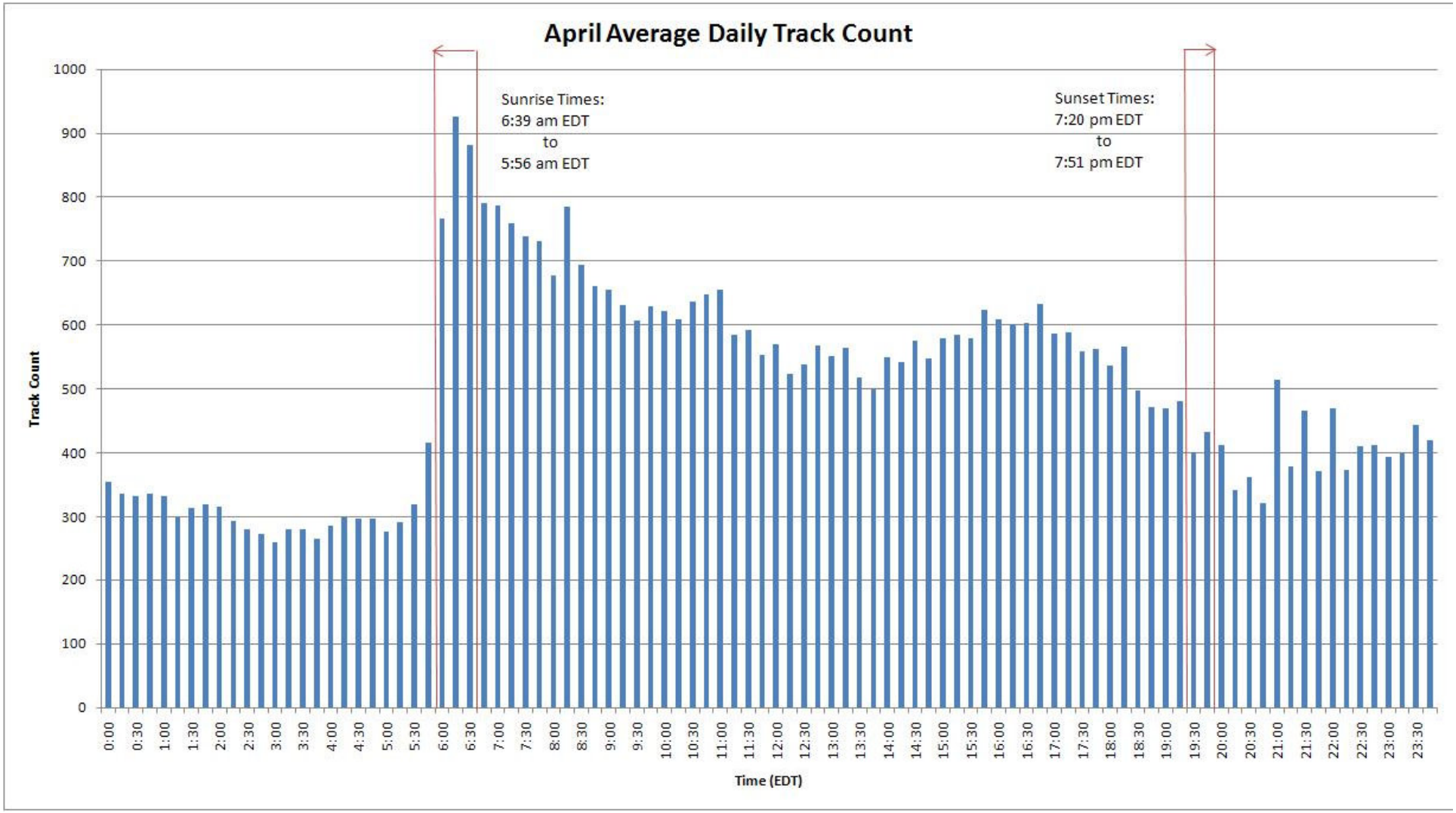
Identify a situation or pattern of interest.

Replay the tracks to identify their source and destination.

With speed, RCS, behaviour, and local knowledge, you may be able to identify group.

Extract the tracks of interest to document the situation

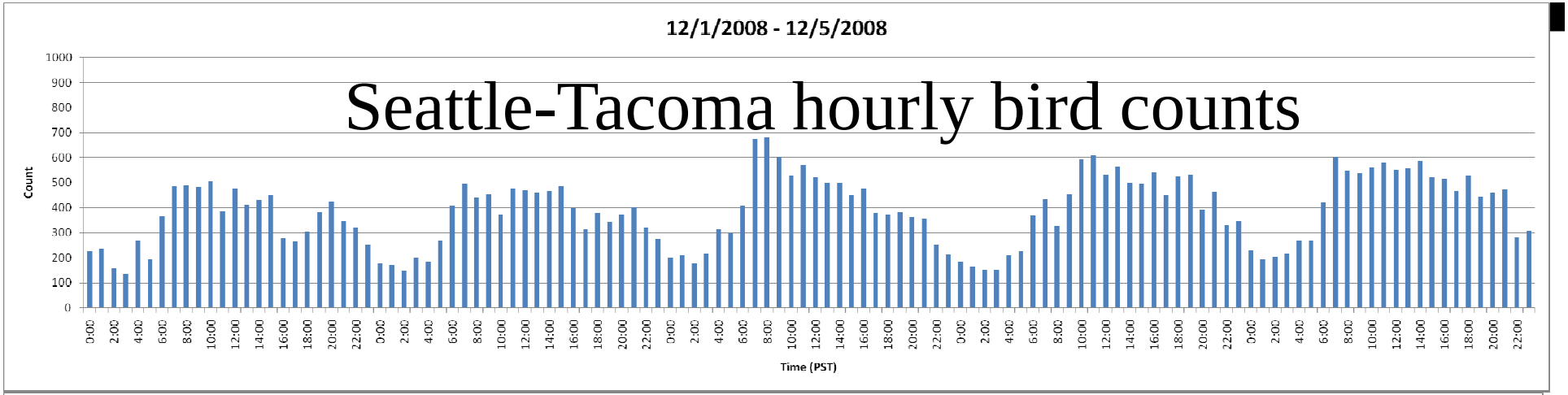


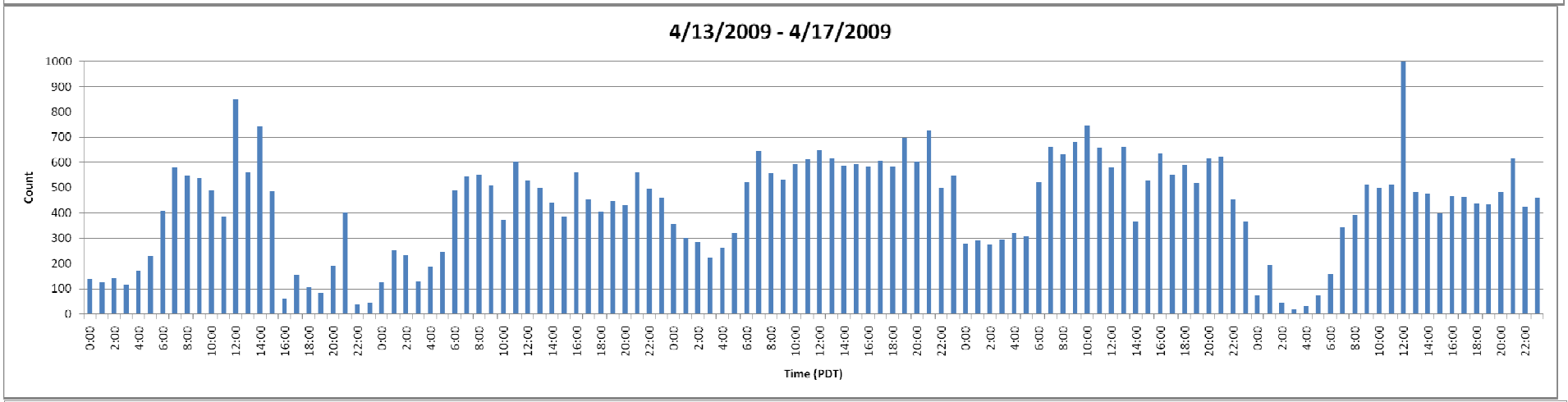


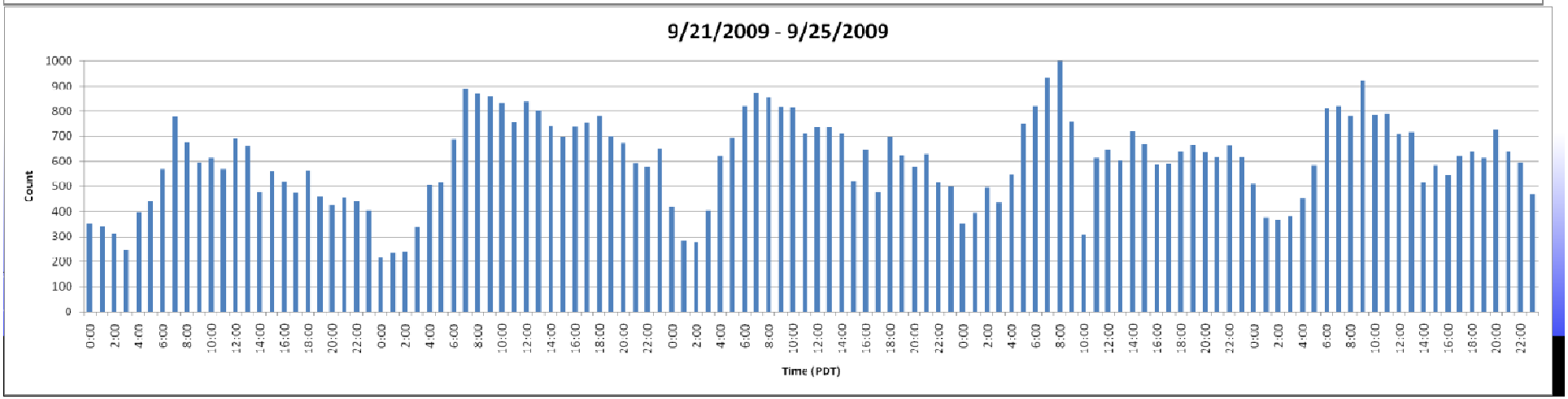
JFK bird counts averaged over entire month (for single radar)

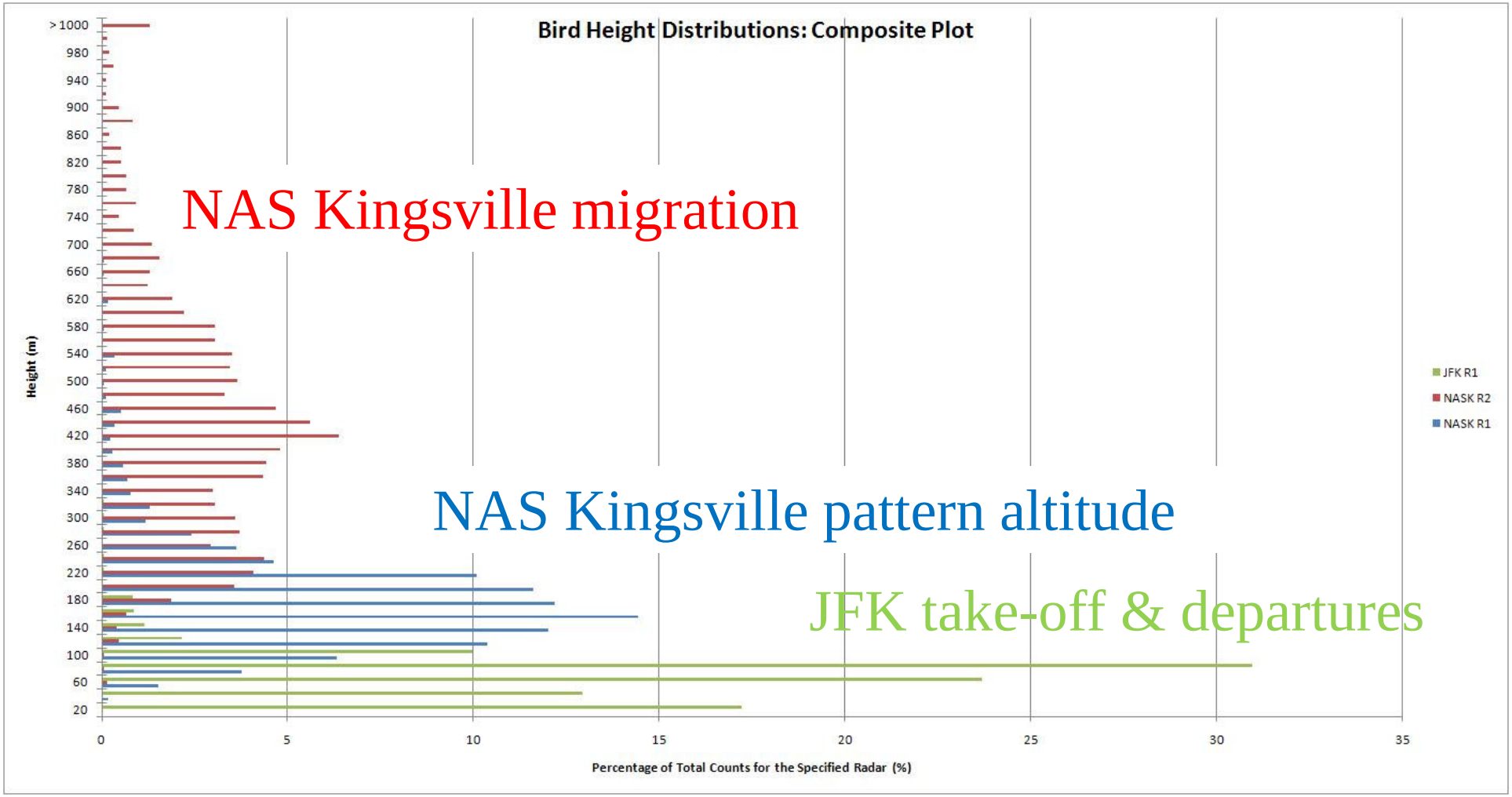
ACCIPITER® Radar Technologies Inc.

Seattle-Tacoma hourly bird counts



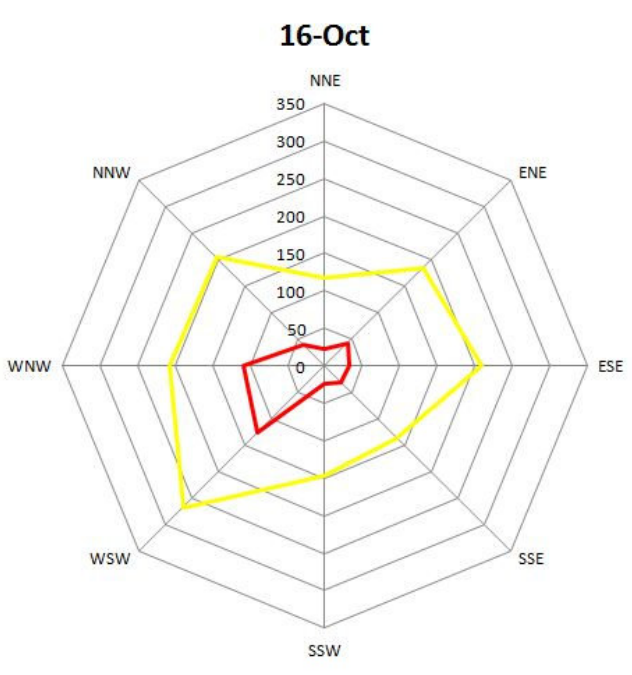


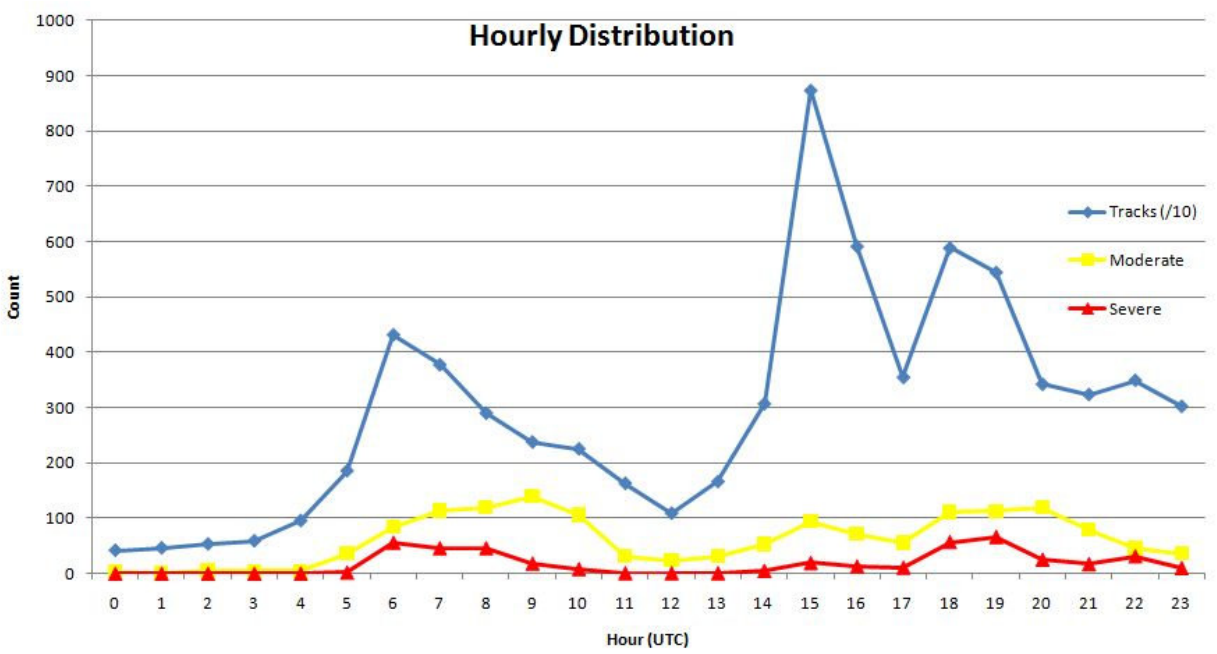




Altitude discrimination with dish antennas.

ACCIPITER® Radar Technologies Inc.





Spatial/Temporal Distributions of BASH Watch Condition (BWC) Alerts

Tool for understanding when and where BWC is low, moderate or severe

An advisory system based on BWC alerts is dynamic

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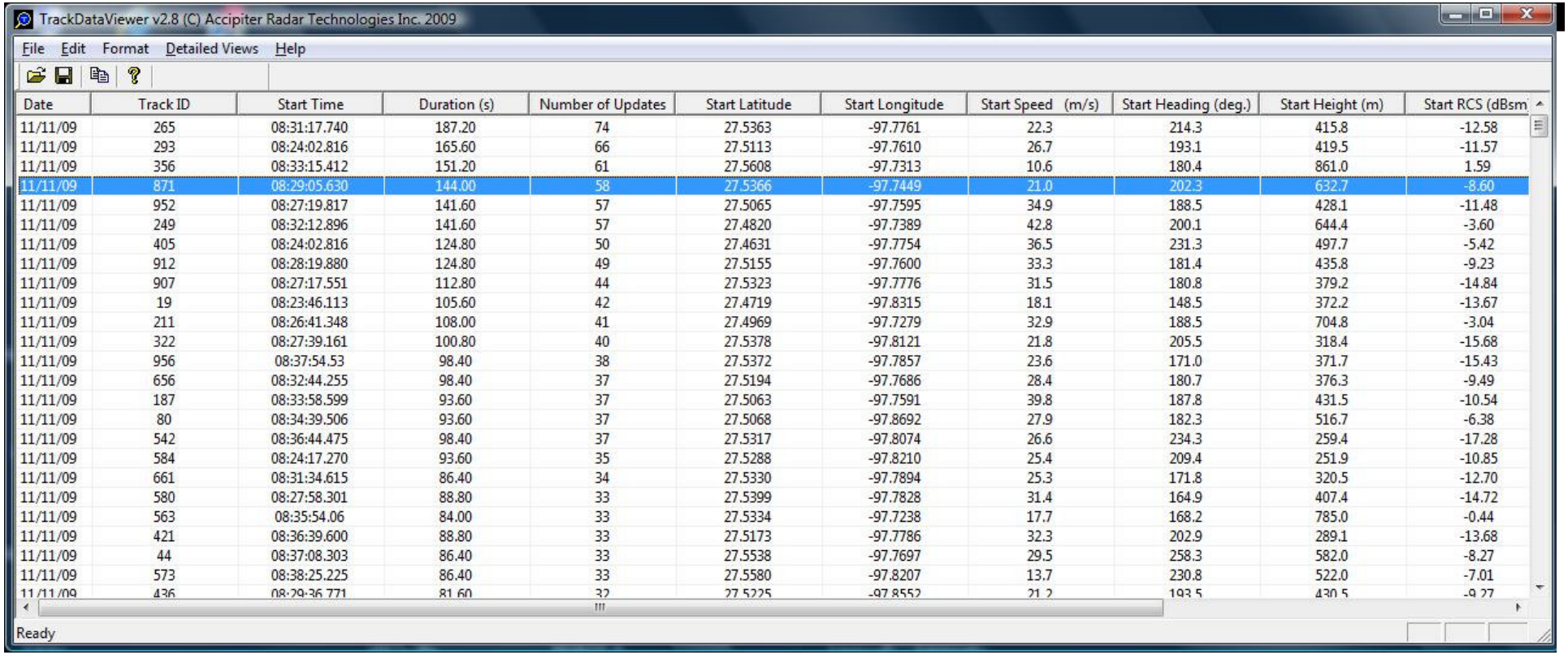
Quality assurance

- Ensure quality of track data that are the basis for most derived information tools
- Ensure consistency of track counts (abundance) and BWC alerts (related to risk)



Date	Track ID	Start Time	Duration (s)	Number of Updates	Start Latitude	Start Longitude	Start Speed (m/s)	Start Heading (deg.)	Start Height (m)	Start RCS (dBsm
11/11/09	265	08:31:17.740	187.20	74	27.5363	-97.7761	22.3	214.3	415.8	-12.58
11/11/09	293	08:24:02.816	165.60	66	27.5113	-97.7610	26.7	193.1	419.5	-11.57
11/11/09	356	08:33:15.412	151.20	61	27.5608	-97.7313	10.6	180.4	861.0	1.59
11/11/09	871	08:29:05.630	144.00	58	27.5366	-97.7449	21.0	202.3	632.7	-8.60
11/11/09	952	08:27:19.817	141.60	57	27.5065	-97.7595	34.9	188.5	428.1	-11.48
11/11/09	249	08:32:12.896	141.60	57	27.4820	-97.7389	42.8	200.1	644.4	-3.60
11/11/09	405	08:24:02.816	124.80	50	27.4631	-97.7754	36.5	231.3	497.7	-5.42
11/11/09	912	08:28:19.880	124.80	49	27.5155	-97.7600	33.3	181.4	435.8	-9.23
11/11/09	907	08:27:17.551	112.80	44	27.5323	-97.7776	31.5	180.8	379.2	-14.84
11/11/09	19	08:23:46.113	105.60	42	27.4719	-97.8315	18.1	148.5	372.2	-13.67
11/11/09	211	08:26:41.348	108.00	41	27.4969	-97.7279	32.9	188.5	704.8	-3.04
11/11/09	322	08:27:39.161	100.80	40	27.5378	-97.8121	21.8	205.5	318.4	-15.68
11/11/09	956	08:37:54.53	98.40	38	27.5372	-97.7857	23.6	171.0	371.7	-15.43
11/11/09	656	08:32:44.255	98.40	37	27.5194	-97.7686	28.4	180.7	376.3	-9.49
11/11/09	187	08:33:58.599	93.60	37	27.5063	-97.7591	39.8	187.8	431.5	-10.54
11/11/09	80	08:34:39.506	93.60	37	27.5068	-97.8692	27.9	182.3	516.7	-6.38
11/11/09	542	08:36:44.475	98.40	37	27.5317	-97.8074	26.6	234.3	259.4	-17.28
11/11/09	584	08:24:17.270	93.60	35	27.5288	-97.8210	25.4	209.4	251.9	-10.85
11/11/09	661	08:31:34.615	86.40	34	27.5330	-97.7894	25.3	171.8	320.5	-12.70
11/11/09	580	08:27:58.301	88.80	33	27.5399	-97.7828	31.4	164.9	407.4	-14.72
11/11/09	563	08:35:54.06	84.00	33	27.5334	-97.7238	17.7	168.2	785.0	-0.44
11/11/09	421	08:36:39.600	88.80	33	27.5173	-97.7786	32.3	202.9	289.1	-13.68
11/11/09	44	08:37:08.303	86.40	33	27.5538	-97.7697	29.5	258.3	582.0	-8.27
11/11/09	573	08:38:25.225	86.40	33	27.5580	-97.8207	13.7	230.8	522.0	-7.01
11/11/09	436	08:29:36.771	81.60	32	27.5225	-97.8552	21.2	193.5	430.5	-9.27

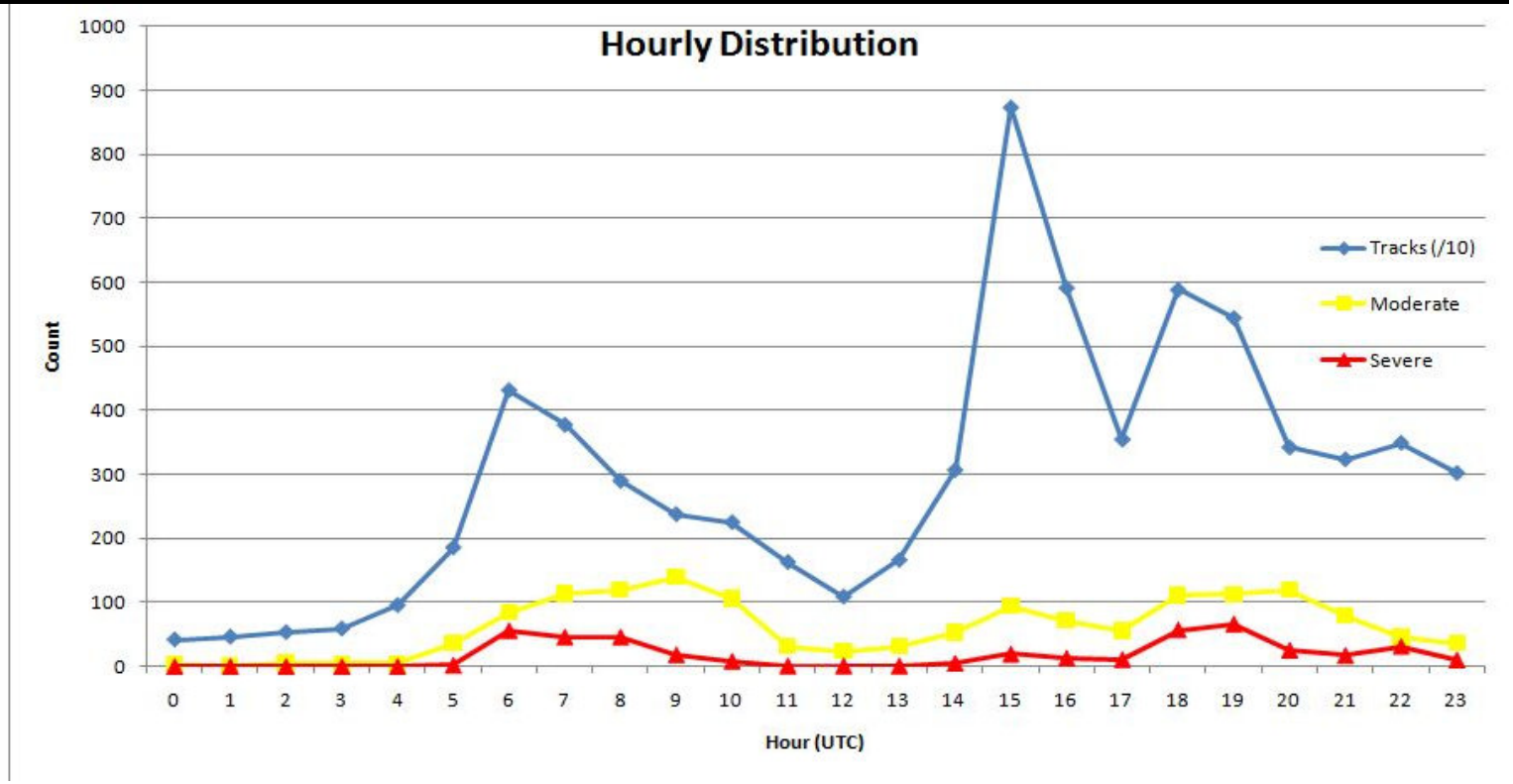
Maintaining track quality

Ground-truth and calibrate during commissioning

Use built-in-metrics to monitor periodically

Test consistency against baseline trends

Re-calibrate at least annually (use aircraft)



<u>Keeping abundance & BWC alerts calibrated</u>

Check for year-over-year consistency

Check for correlation against point and track counts

Check for correlation against track counts & BWC alerts

Adjust software filtering to maintain consistency

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Summary

- Digital, airport-based, avian radars have been tested extensively
- Independent reports now available or will be soon
- Overwhelming wealth of bird target data generated
- Tools are needed to exploit data but not increase the work load of users
- Tactical and strategic tools and methods have been proposed to maximize situational awareness
- Methods have been proposed to maintain quality assurance

Conclusions

- Tactical tools show wildlife biologists and airfield managers developing situations in real time
- Strategic tools provide for long term monitoring of changes in hazards & risks
- The time has never been better for all airport stakeholders to offer their knowledge and suggestions for further improvements and standardization

Acknowledgements

- We wish to acknowledge the collaboration and logistical support provided by all participants in the DoD ESTCP IVAR and FAA CEAT avian radar assessment efforts.

Q & A – Thank you

Dish @ 2°

Distance From Trailer (m)	Top of Beam (m)	Bottom of Beam (m)
500	44.963	10
1000	79.927	10
1500	114.89	10
2000	149.854	10
2500	184.817	10
3000	219.78	10
3500	254.744	10
4000	289.707	10
4500	324.671	10
5000	359.634	10

Dish @ 6°

Distance From Trailer (m)	Top of Beam (m)	Bottom of Beam (m)
500	80.27	44.963
1000	150.541	79.927
1500	220.811	114.89
2000	291.082	149.854
2500	361.352	184.817
3000	431.623	219.78
3500	501.893	254.744
4000	572.163	289.707
4500	642.434	324.671
5000	712.704	359.634

Avian Radar – Experience at John F. Kennedy Intl. Airport

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CENTER OF EXCELLENCE FOR AIRPORT TECHNOLOGY

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Introduction

- FAA avian radar performance assessment program at several US airports
- The Center of Excellence for Airport Technology (CEAT) cooperated with JFK to define objectives for radar analysis & analyze radar data
- Avian radar was deployed to JFK and was operational in January 2010
- After an initial period of tuning and calibration, the radars have been operating continuously since March 2010
- 2 radar systems deployed
  - AR1 (single sensor)
    - Located between runways 22L and 22R by Rockaway Blvd.
  - AR2 (dual sensors)
    - On Jamaica Bay at the midpoint of 13L/31R
    - Parabolic dish antennas - beam

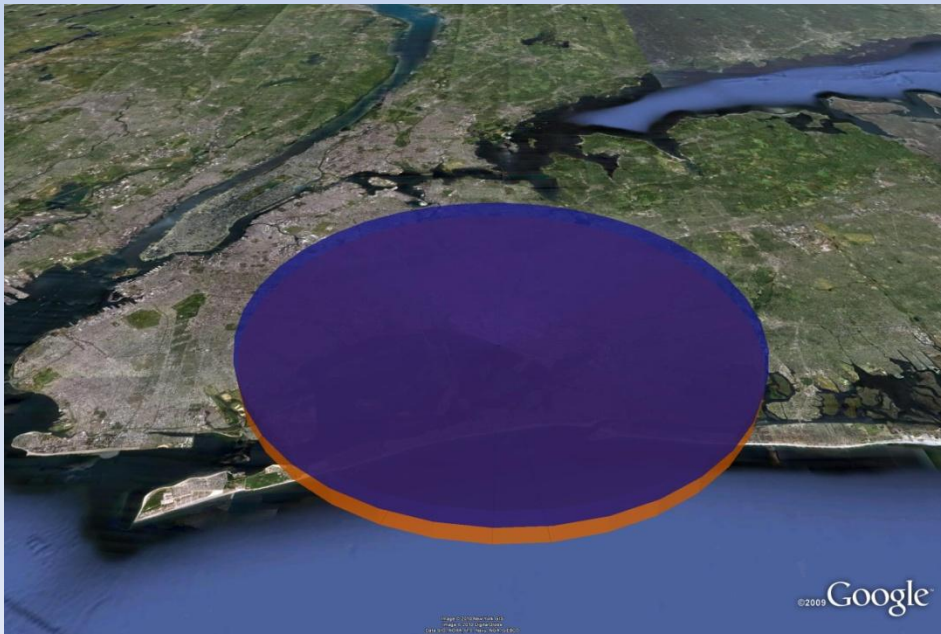

32177

Objectives

- **General Activity**
  - observe both low and high elevation targets with the AR2
  - Concentrations of detections shows where groups of birds are staging and what areas can be attractants to large numbers of birds
- **Night Movement**
  - Radar is a particularly useful tool for this task
- **Migration**
  - migration periods and patterns of bird dynamics related to migration
  - Radar is a particularly useful tool for this task
- **Local Bird Movements**
  - Radar can provide information on local bird movements
  - Information on long and short distance commuters.

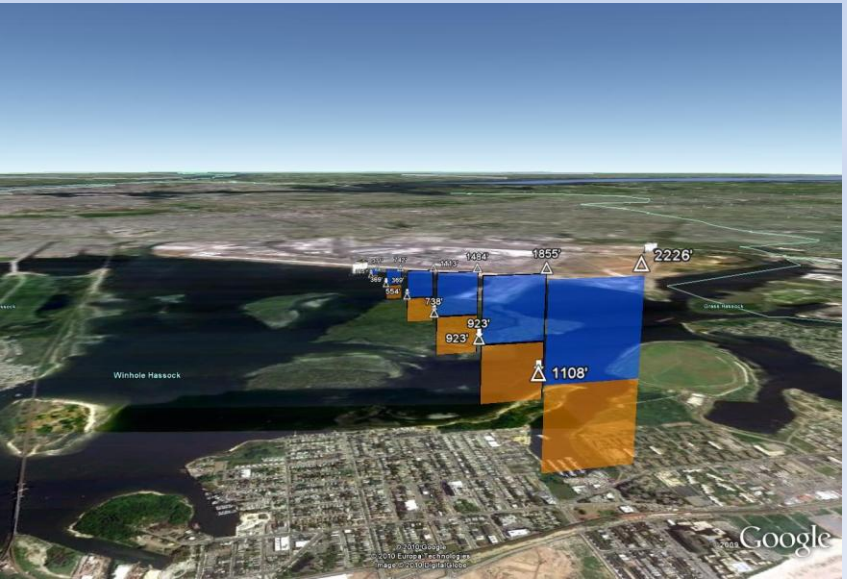
Understanding Radar Physics

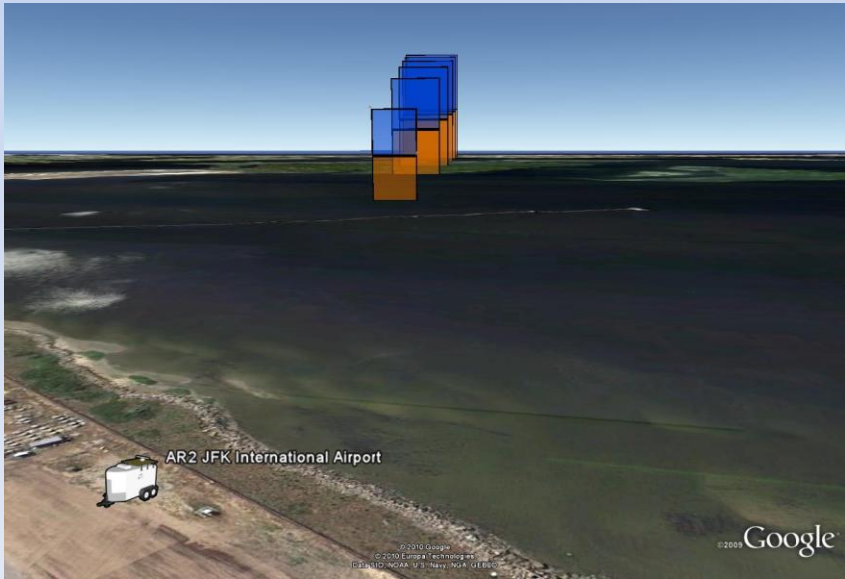
- The radar with a parabolic dish antenna produces a cone of energy which is directed in a beam.
- AR2 at JFK has 2 dishes set at different uptilt angles
- Hence 2 cones of energy emitted from the sensor
- Then antennas rotate 360 degrees for a complete zone of coverage.



Radar Physics

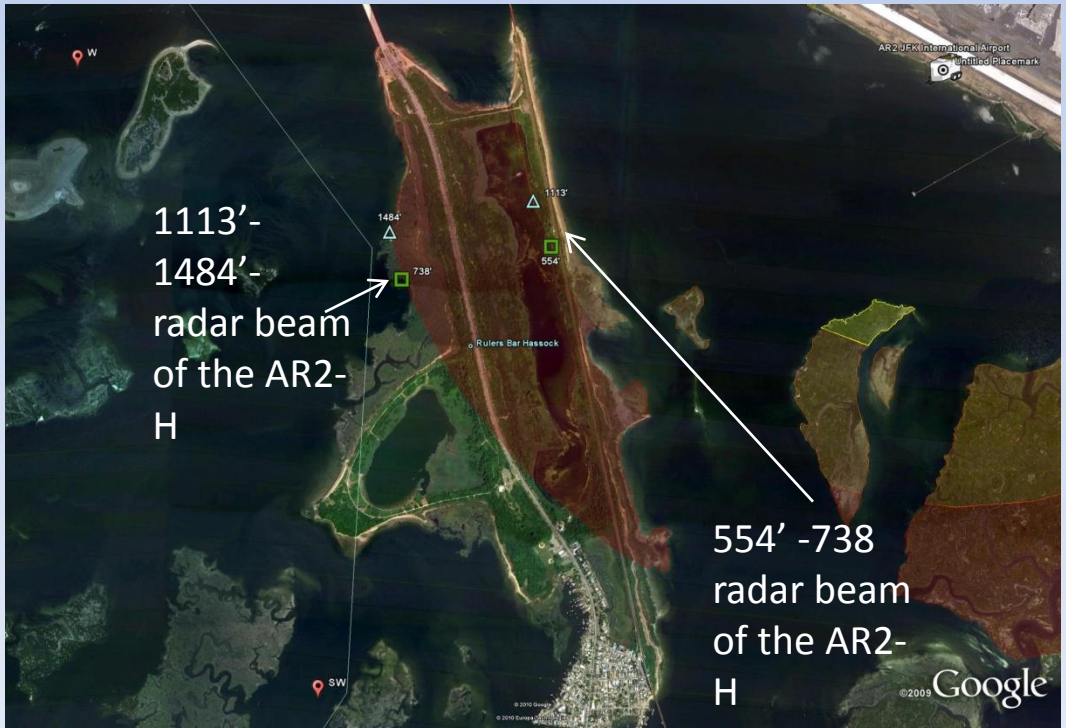
- The AR2-L (low) is a 4 degree beam tilted to center at 2 degrees above horizontal. Hence this sensor covers from horizontal to 4 degrees.
- The AR2-H (high) is a 4 degree beam tilted to center at 6 degrees above horizontal . Hence the AR2H covers from 4 to 8 degrees
- This a zone of coverage with altitude specific information.





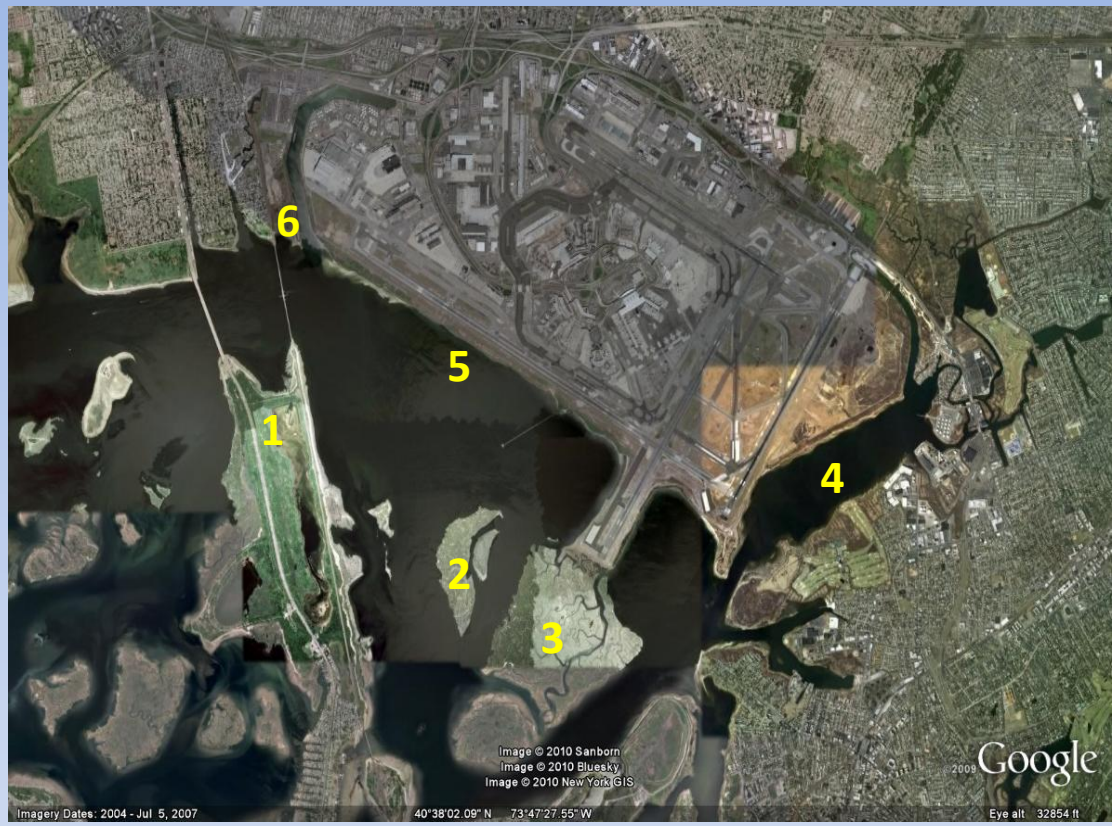
Understanding Radar Physics

- The volume of airspace coverage increases with range from the radar.
- For example, the eastern shore of Broad Channel is closer to the radar and at this range the beam detects birds at lower altitudes than on the SW side of the island.



Example Radar Coverage Elevations AR2-L

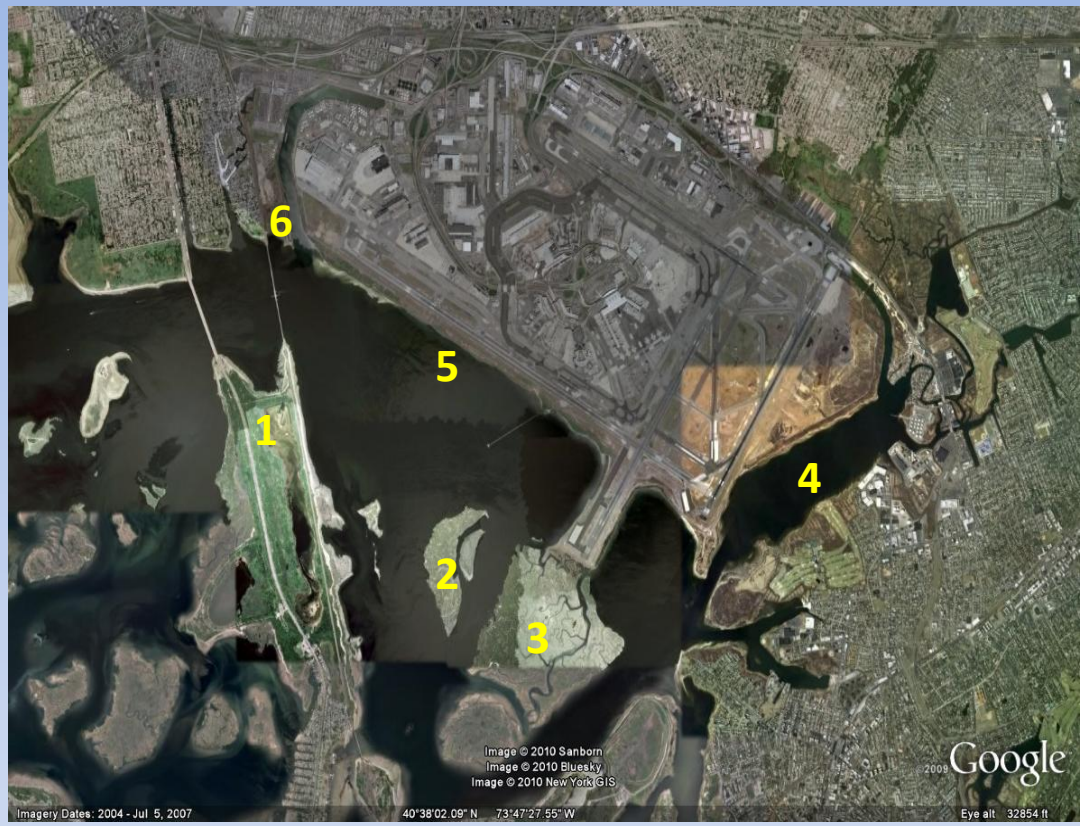
- 1 - Subway Island
  - 1.5 miles away from radar
  - Bottom of beam: 13ft.
  - Top of beam: 0.11 miles (580 ft)
- 2 – East High Meadow
  - 1.1 miles away from radar
  - Bottom of beam: 13ft.
  - Top of beam: .08 miles (410 ft)
- 3 – Joco Marsh
  - 1.52 miles away from radar
  - Bottom of beam: 13 ft
  - Top of beam: 0.11 miles (560 ft)
- 4 - Thurston Basin/Head of Bay
  - 2.50 miles away from radar
  - Bottom of beam: 13 ft
  - Top of beam: 0.17 miles (920 ft)
- 5 - Southern Coast of Airport
  - 0.62 miles (3,262.56 ft) away from radar
  - Bottom of beam: 13ft
  - Top of beam: .04 miles (230 ft)
- 6 - Bergen Basin
  - 2.06 miles away from radar
  - Bottom of beam: 13 ft
  - Top of beam: 0.14 miles (760ft)



- East Pond 1.75 miles away from radar
  - Bottom of beam: 13ft
  - Top of beam: .12 miles (640 ft)

Example Radar Coverage Elevations AR2-H

- 1 - Subway Island
  - 1.5 miles away from radar
  - Bottom of beam: 0.11 miles (580 ft)
  - Top of beam: 0.22 miles (1200 ft)
- 2 – East High Meadow
  - 1.1 miles away from radar
  - Bottom of beam: 0.08 miles (410 ft)
  - Top of beam: .016 miles (830 ft)
- 3 – Joco Marsh
  - 1.52 miles away from radar
  - Bottom of beam: 0.11 miles (560 ft)
  - Top of beam: 0.21 miles (1,100 ft)
- 4 - Thurston Basin/Head of Bay
  - 2.50 miles away from radar
  - Bottom of beam: 0.17 miles (920 ft)
  - Top of beam: 0.35 miles (1,900 ft)
- 5 - Southern Coast of Airport
  - 0.62 miles (3,262.56 ft) away from radar
  - Bottom of beam: 0.04 miles (230ft)
  - Top of beam: 0.09 miles (460 ft)
- 6 - Bergen Basin
  - 2.06 miles away from radar
  - Bottom of beam: 0.14 miles (760 ft)
  - Top of beam: 0.29 miles (1,500 ft)



- East Pond 1.75 miles away from radar
  - Bottom of beam: 0.12 miles (640 ft)
  - Top of beam: 0.25 miles (1300 ft)

Definition of Terms

Track

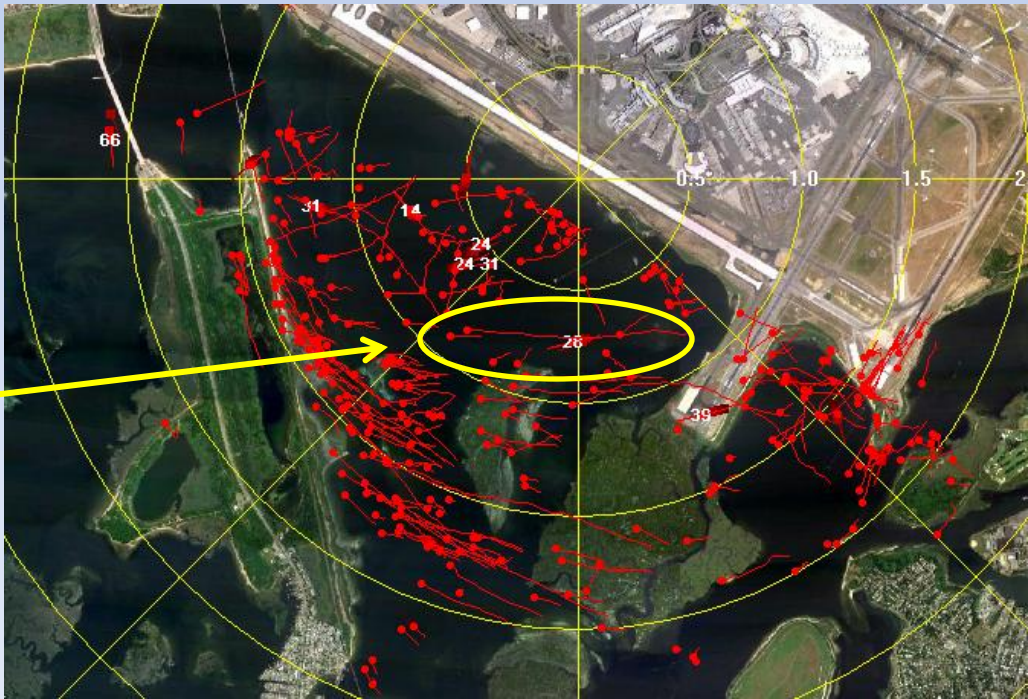
– Radar display of target movement

–A target may be a single bird, or a group of birds that are detected as a single target due to radar resolution.

–Each track is assigned an identifying number

–Each track has associated information like speed

Each red line represents a single track



Initial Track Observation (ITO) –

- ITO is a group of tracks that were first observed together at a particular location and moving in the same direction.
- Objective = identify coordinated movement typical of flocks.
- ITOs are typically short duration.
- Limited zone of coverage by the radar beam⟶ assessing target flight characteristics (altitude and direction)
  - Radar beam area based on range from the radar and radar antenna type.

AR2-H ITO tracked from Subway Island headed northeast towards runway May 3rd 2010 at 10:56 (local time).

Video of an ITO

Movement

- Large number of tracks and/or ITOs that exhibit similar behavior (heading, starting or ending point, etc).
- Long tracks with similar headings that are observed for several minutes.
- Best identified in track history plots.

Movement from NW to the SE pictured

Video of a Movement

Activity –

- General characterization of all movements over a defined time period (hours to years).
- Measured by counting tracks in defined time periods (dawn, daytime, evening, night, weeks, months, or seasons).

Introduction to CEAT Analysis

- Radar data can be utilized to identify movement and timing
- Large groups of tracks are highly visible and easy to record.
- By **analyzing ITOs and movements we can quantify patterns of bird dynamics** particularly in relation to sunset/sunrise and recorded tide values.
- Timing of bird movements may be predicted, if enough data is available.
- However, to understand JFK wildlife hazards we need to have a sense of typical bird movements and the species that produce tracks that reveal movement on the radar.

Validation

- Observation of birds from known areas at known times.
- CEAT will use observational information from several sources:
    1. Regular wildlife monitoring (point counts)
    2. Observations at the radar by CEAT personnel using techniques developed by CEAT at other radar installations.

Red = observation points with higher levels of bird movement based on interviews with USDA

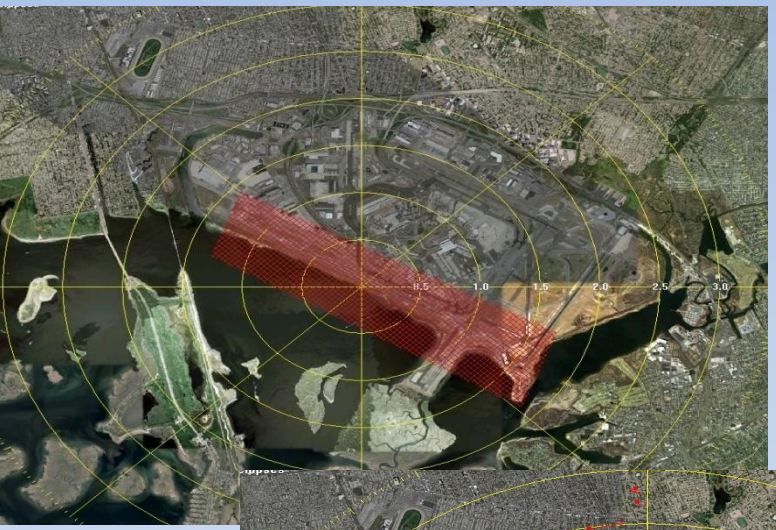
Yellow = observation points with lower levels of bird movement based on interviews with USDA

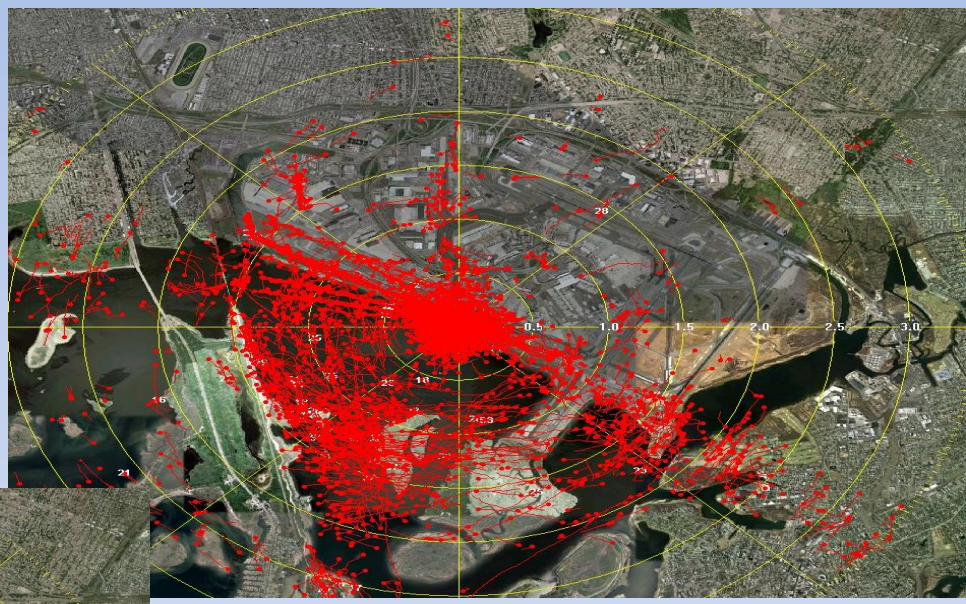
Methods Used to Analyze Radar Data

- Track History –
  - Since radar data is produced continuously need to separate data into manageable chunks
  - TH = the accumulation of tracks recorded by the radar for a given time period.
  - Automated process producing 30 minute time periods at JFK
- Replaying data at faster than real time
- Not all Tracks are birds
- Other sources of tracks
  - Multipath reflection = interference from aircraft produces that produce multiple false tracks.
  - Surface Vehicles - Radar detection algorithms based on speed may also include surface vehicles in tracks.
- MASKING
  - Therefore we mask some areas on the AR2-L to eliminate influence of non-bird target detection in our analysis.

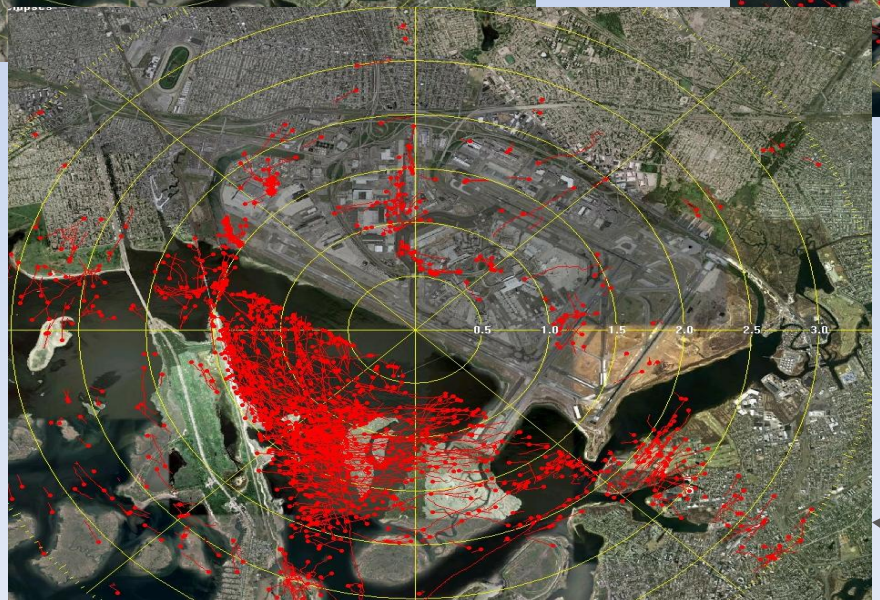
METHODS – MASKING on the AR2-L

Because the beam of the AR2-L covers low elevations over the airport, a mask was created to assist in our analysis. (Note: it was not necessary to mask the AR2-H)





May 20 2010; 04:30:00a.m.-5:00:01a.m.(Local Time),
without the use of a mask



May 20 2010; 04:30:00a.m.-5:00:01a.m.(Local Time),
With the use of a mask

Periods of Study

- Analysis has been completed for **May and September 2010**.
  - Migration
  - Local movement patterns
  - Radar settings and operations were consistent during both periods.
- In May, sunrise occurred around, or after, 5:25 am local time and the sunset after 7:50 pm local time.
- Bird movements began around 6:00 am (local) and increased throughout the day with movement tapering off by 8:00 pm (local).

- ***Days with precipitation were not included in the analysis.***

AR2-L

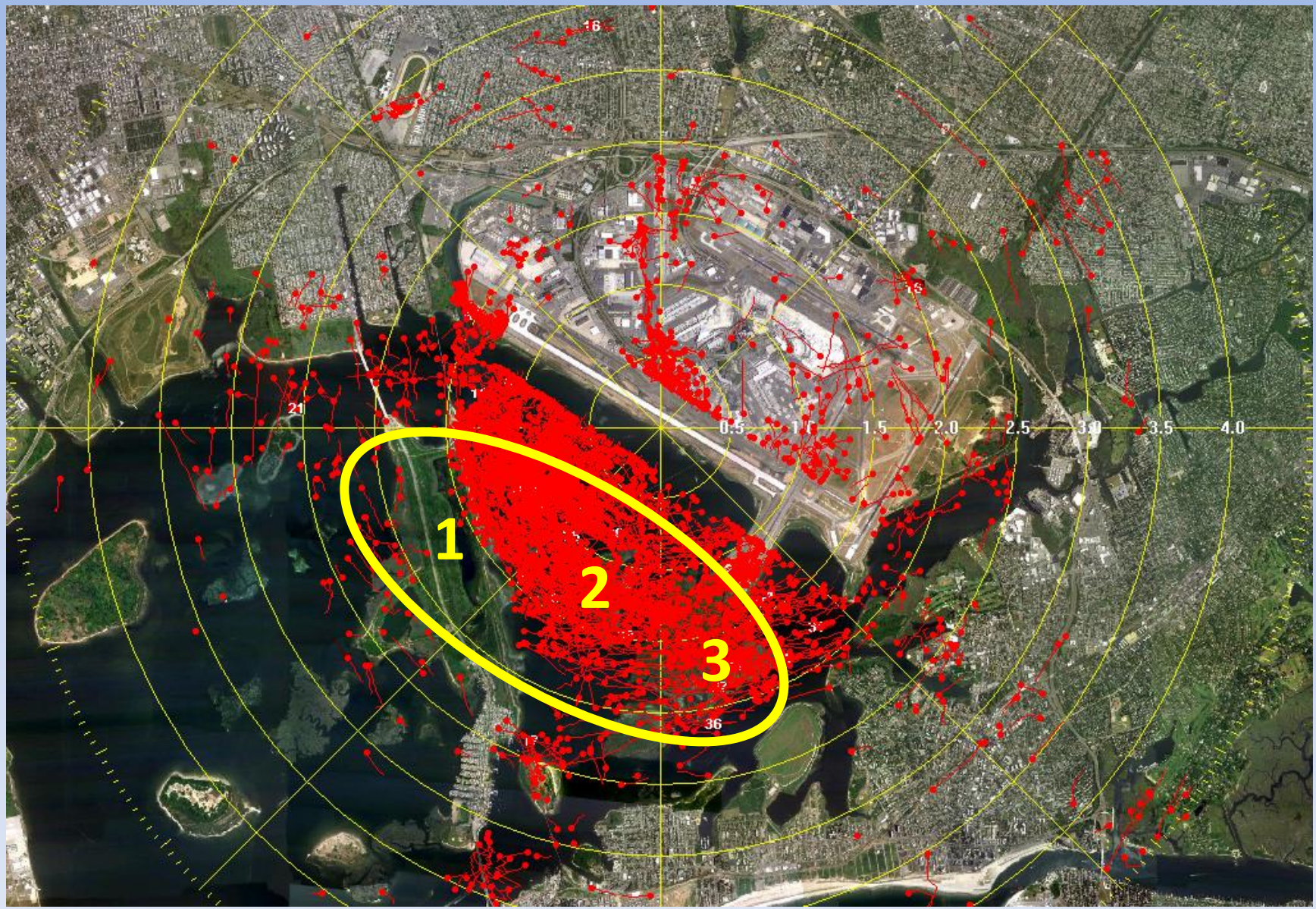
AR2-L track history with a mask for **May 20 2010**
05:00:00am-5:30:01am(Local Time)

The highlighted circle shows an area of dense tracks – high bird activity.

Note that tracks are present over the airfield but not in the masked area

AR2-L

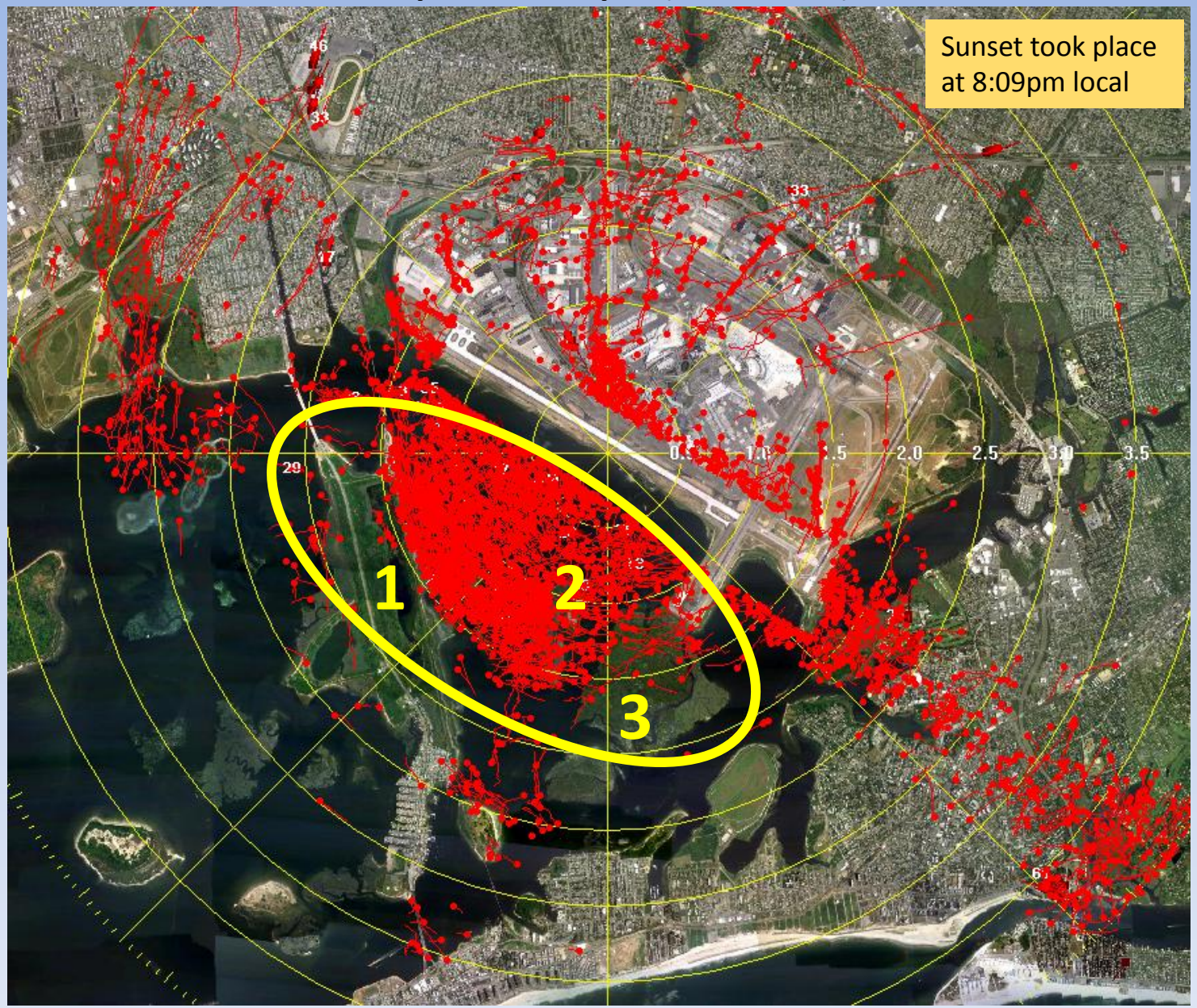
AR2-L track history with a mask for **May 20 2010**
1:00:01pm-1:30:00pm(Local Time)



Note increased density of tracks at midday.

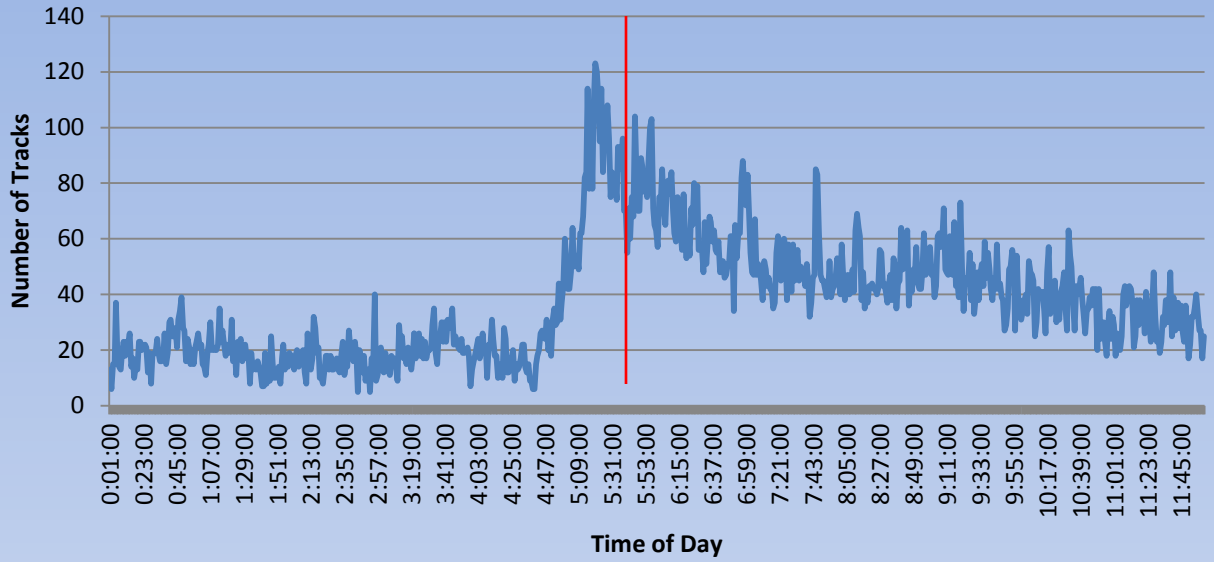
AR2-L

AR2-L track history with a mask for **May 20 2010**
8:00:01pm-8:30:01pm (Local Time)

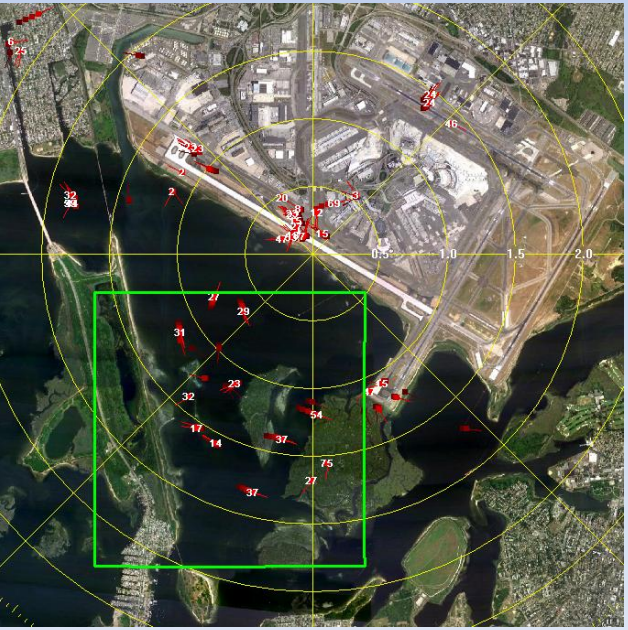


Note again the increasing density of tracks near dusk

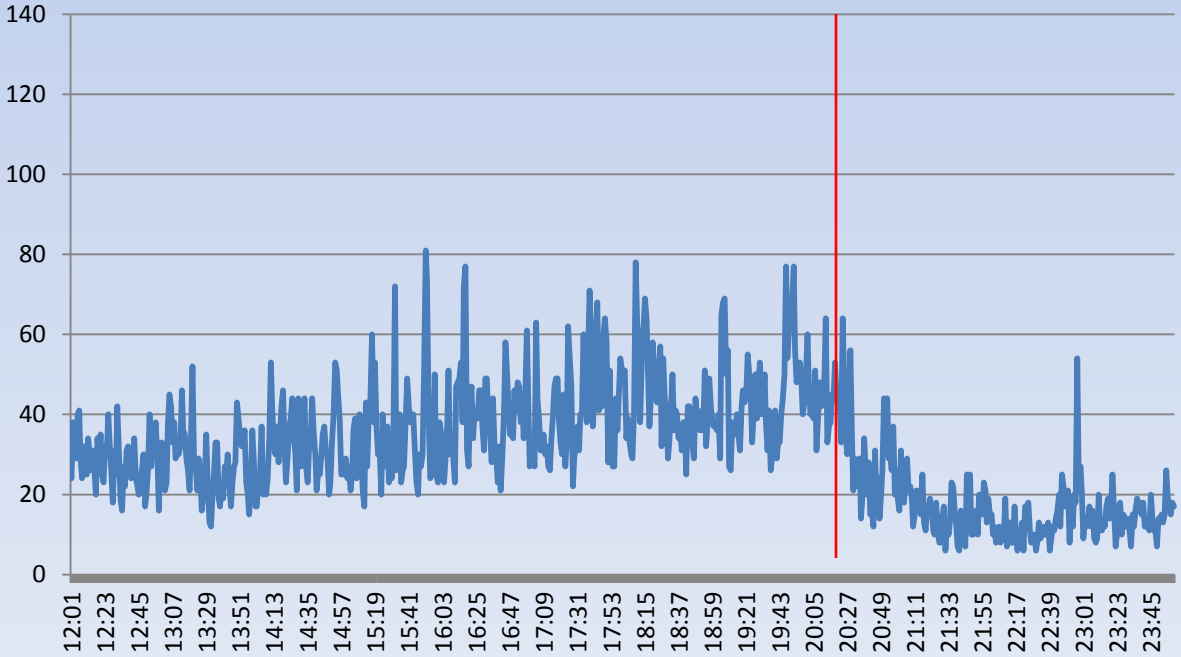
Tracks/Minute for May 20, 2010



Red = sunrise and sunset



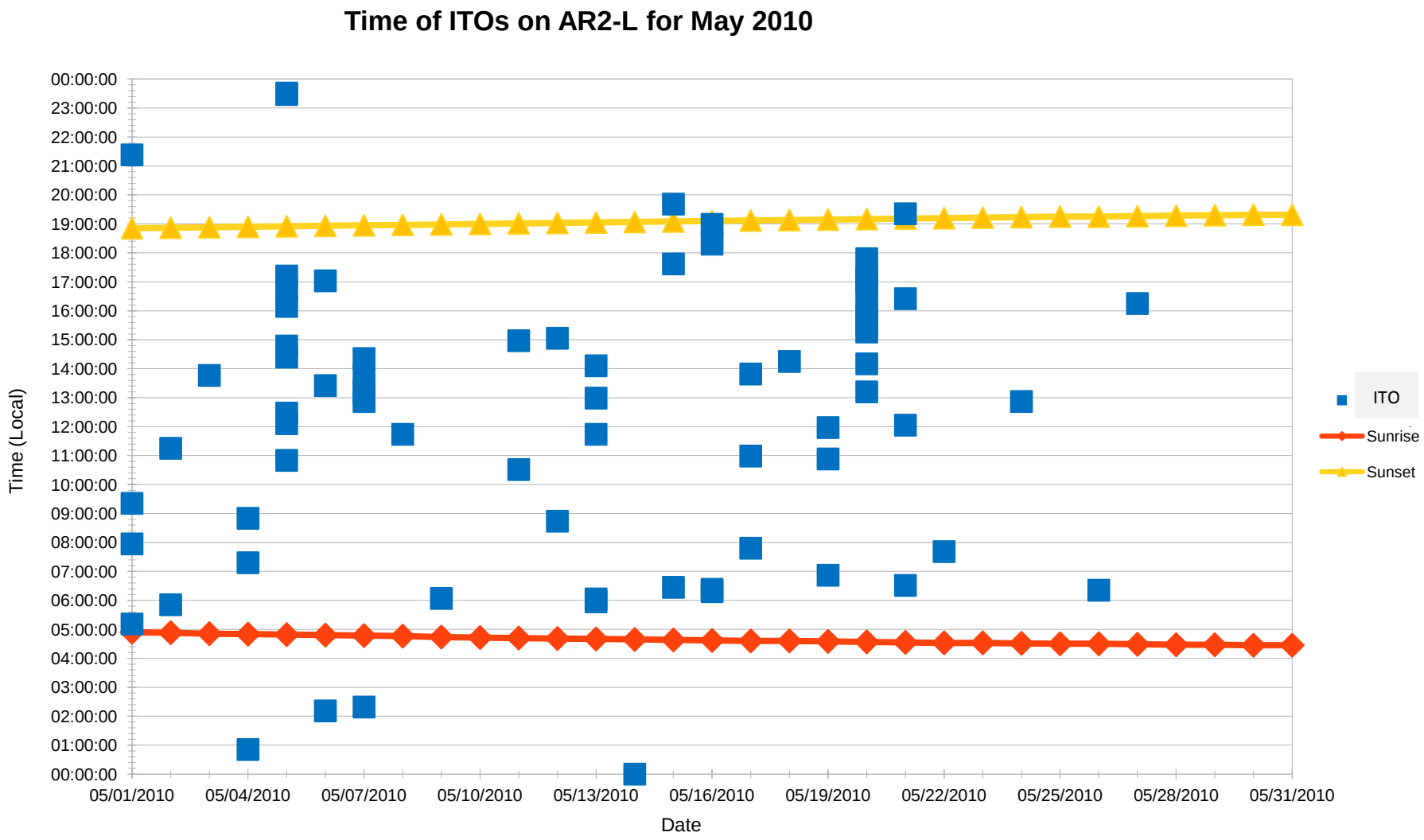
Tracks/Minutes for May 20, 2010



Radar Analysis Variables

- Evaluated 24 hour periods
- Related ITOs to variables below to obtain a general characterization of patterns and/or movement of birds in flocks
- Variables:
  - Timing
    - Sunrise and Sunset (upcoming graphs)
    - Tides
      - No correlation of the ITOs to high or low tide
  - Location of the Beginning of ITOs –
    - Information on movement pattern
    - General altitude obtained from beam uptilt and distance from radar
  - Direction of Movement

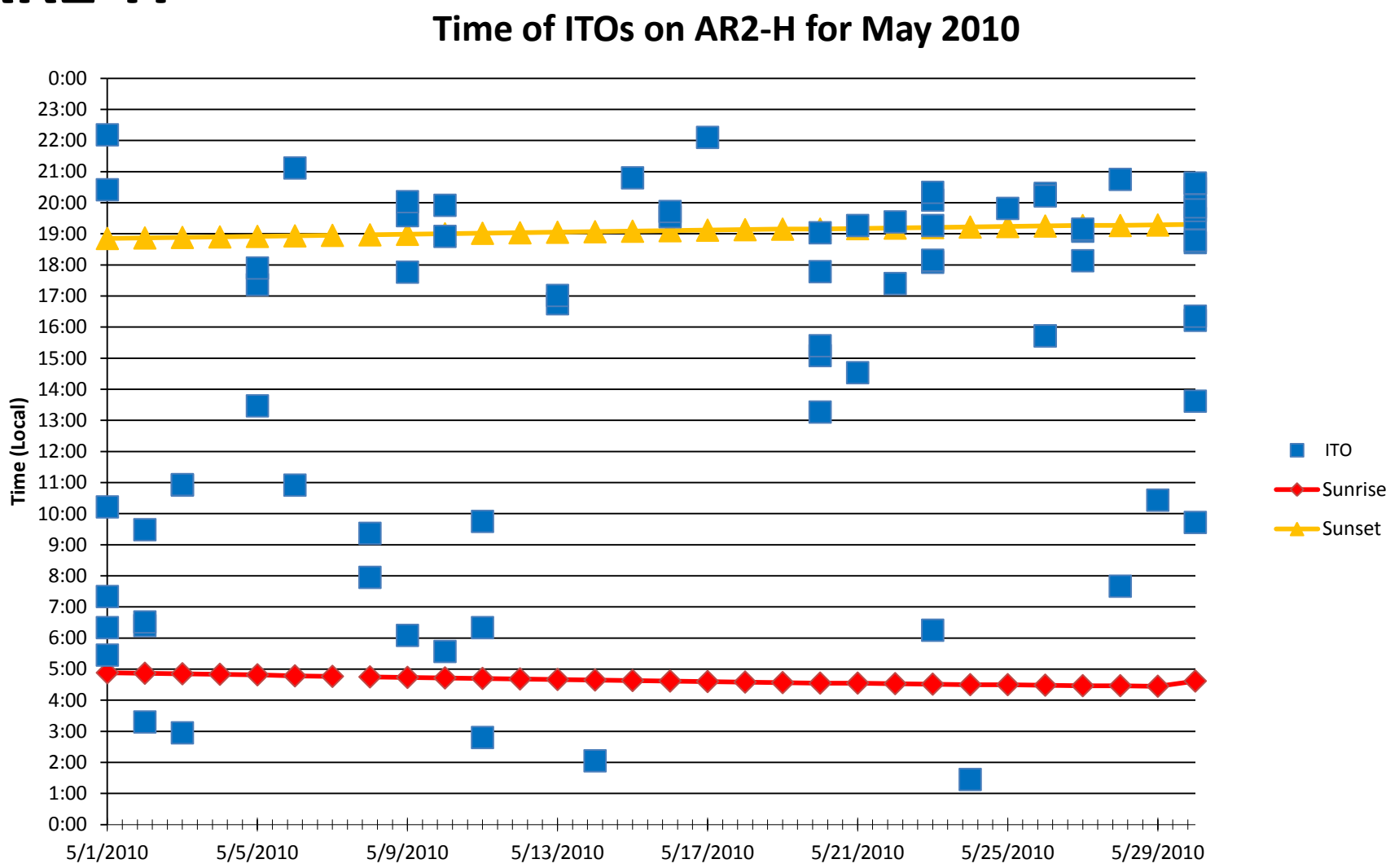
AR2-L



ITO results indicate both the variability that can be expected from day to day, and the general timing of ITO type movements during the day.

Note: it is possible to have many single tracks and no ITOs

AR2-H



This summary of ITO's indicates the difference in ITO activity with elevation and suggests somewhat higher levels of higher movement after sunset.

Temporal Analysis Conclusions for May 2010

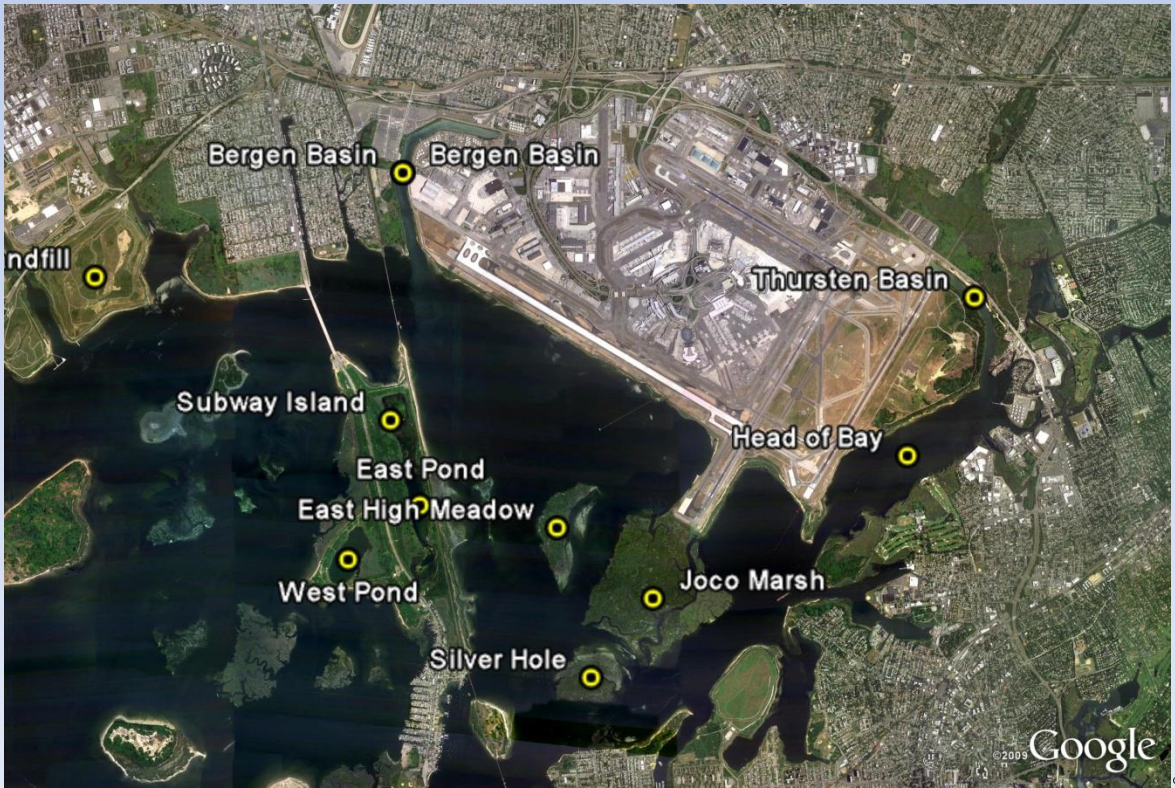
- Both
  - Bird activity (as evidenced by the number of ITOs in the bay) started around 6 am (local) and increased throughout the day.
  - Most ITOs in daylight
- AR2-L
  - After the 1:00pm(local time) the overall activity increased significantly
    - Determining ITOs was difficult after 1pm
- AR2-H
  - The number of tracks increased through out day and began slowing down at 8 pm (local).
  - More ITOs not in daylight than on the AR2-L

Location Analysis of ITOs for May 2010

- Characterization of location where targets begin to be tracked
- By focusing on ITO, CEAT was able to quantitate a certain type of typical movement
- Information included
  - Where the ITO was first tracks
  - Direction of ITO movement
- Most of activity, movements and ITOs observed in Jamaica Bay
- Targets are at different altitudes depending on the distance from the radar and uptilt of the radar

Location Analysis of AR2-L in May 2010

- There are 3 main locations of ITOs (5% of ITOS not in one of these locations):
  - JOCO Marsh (38%)
  - East High Meadow (30%)
  - Subway Island (27%)



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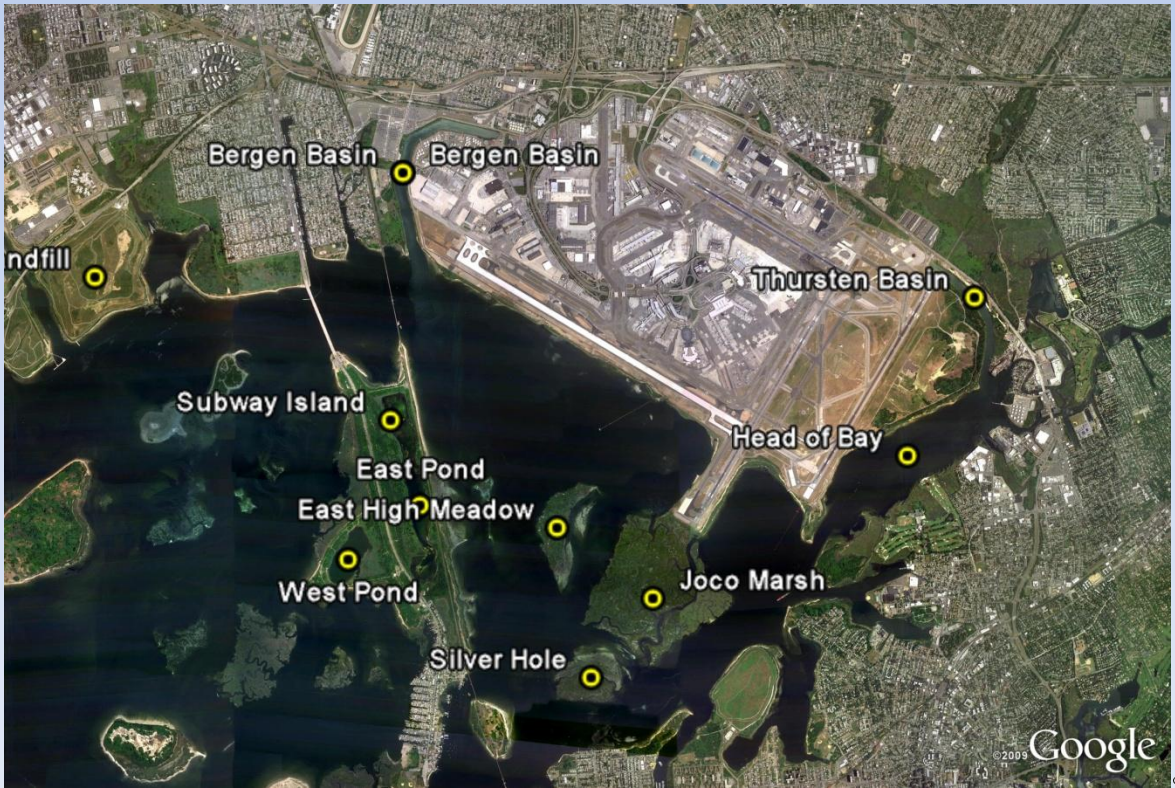
Location Analysis of AR2-H in May 2010

- The first ½ of May, ITOs early in the day were more frequent than later in the month
- Highest numbers of ITOs began to be tracked at the following locations
  - Subway Island - 27% - moved north or northeast towards shore, or east towards Thurston Basin
  - Bergen Basin -18% - moved towards the center of Jamaica Bay, Joco Marsh, or Subway Island
  - Southern Coast of the Airport. – 16% - same as Bergen Basin



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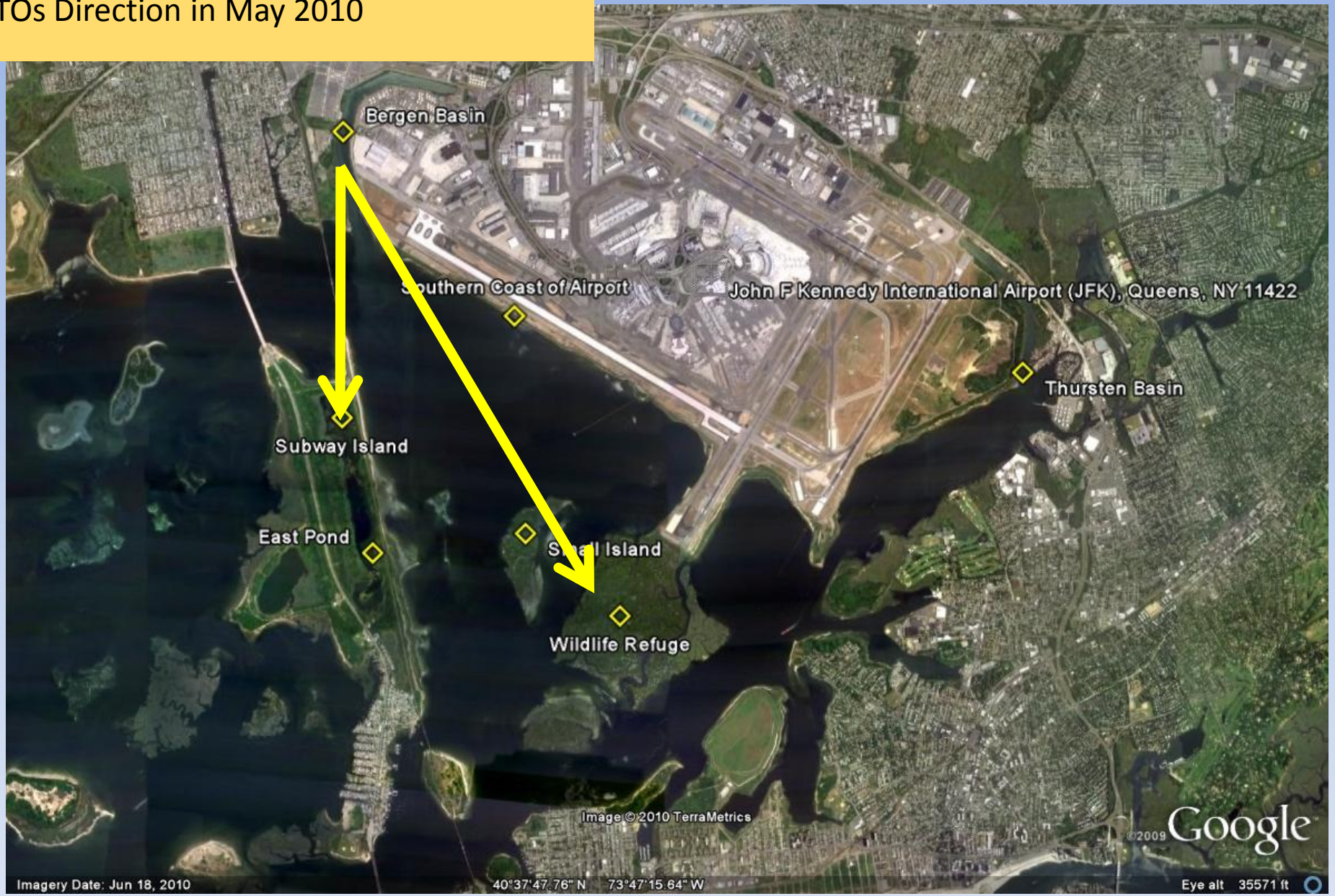
Direction of Movement for May 2010

- Beginning of tracks important but it leads to the next question: Where are they going to?
- Do the tracks regularly cross flight paths?
- This analysis may possibly provide insight to staging areas.
- Following slides show common movements of ITOs

ITOs Direction in May 2010

Majority of ITOs related to Subway Island on the AR2-H moved north or northeast towards the shore, runway, or east towards East head of Bay

ITOs Direction in May 2010

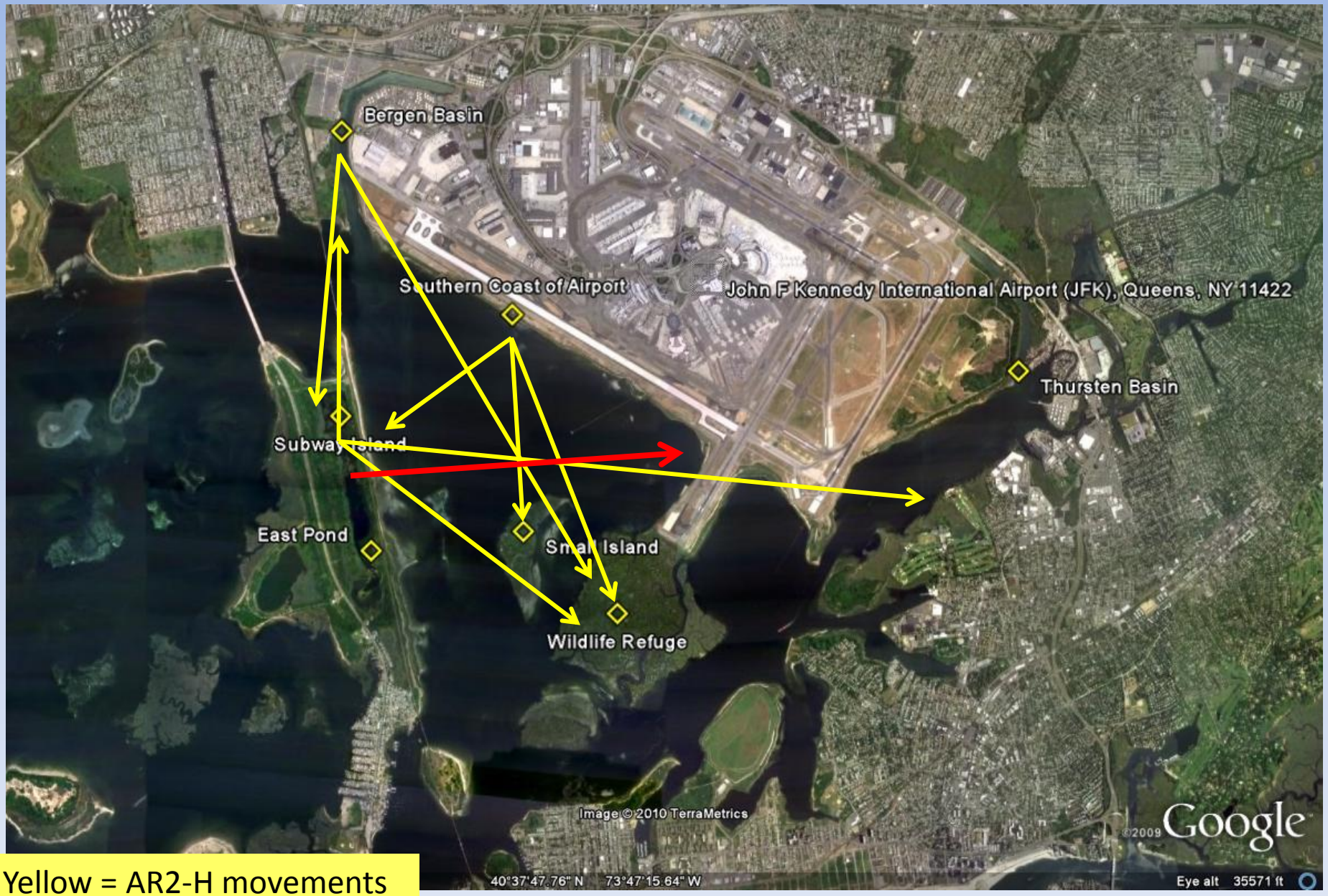


The ITOs related to Bergen Basin moved south or southeast towards Subway Island or Joco Marsh.

ITOs Direction in May 2010

The ITOs related to the South Coast of Airport moved towards East High Meadow, Joco Marsh and Subway Island.

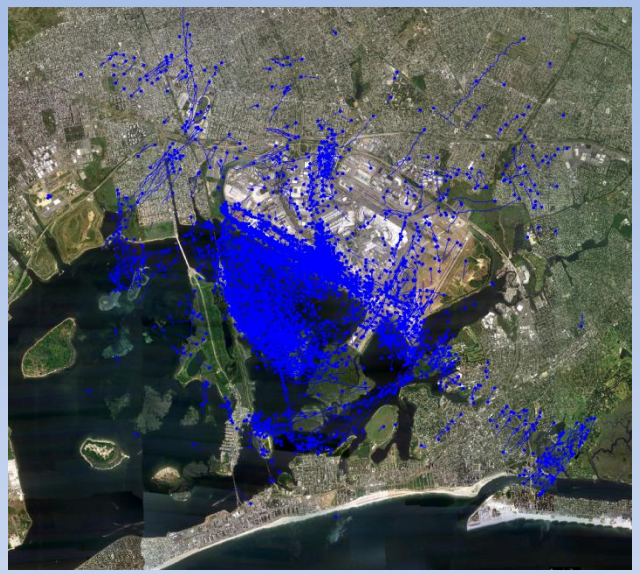
Common Movements on AR2 in May



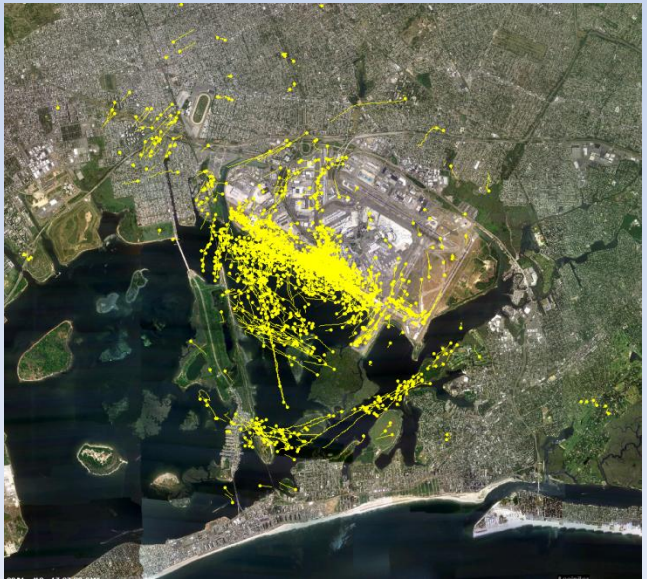
Yellow = AR2-H movements
Red = AR2-L movements

Comparison of Radars – Elevation Issues

- Overall bird activity was greater in AR2-L's data
- Number of ITOs was Similar for May 2010:
  - AR2-L - **67** ITOs
  - AR2-H's - **73** ITOs
  - The masking used in the AR2-L analysis
- Timing of activities was similar



Track history plots made using Track Viewer for AR2-L on May 20th, 2010 from 1:00 pm to 1:30 pm local time.



Track history plots made using Track Viewer for AR2-H on May 20th, 2010 from 1:00 pm to 1:30 pm local time.

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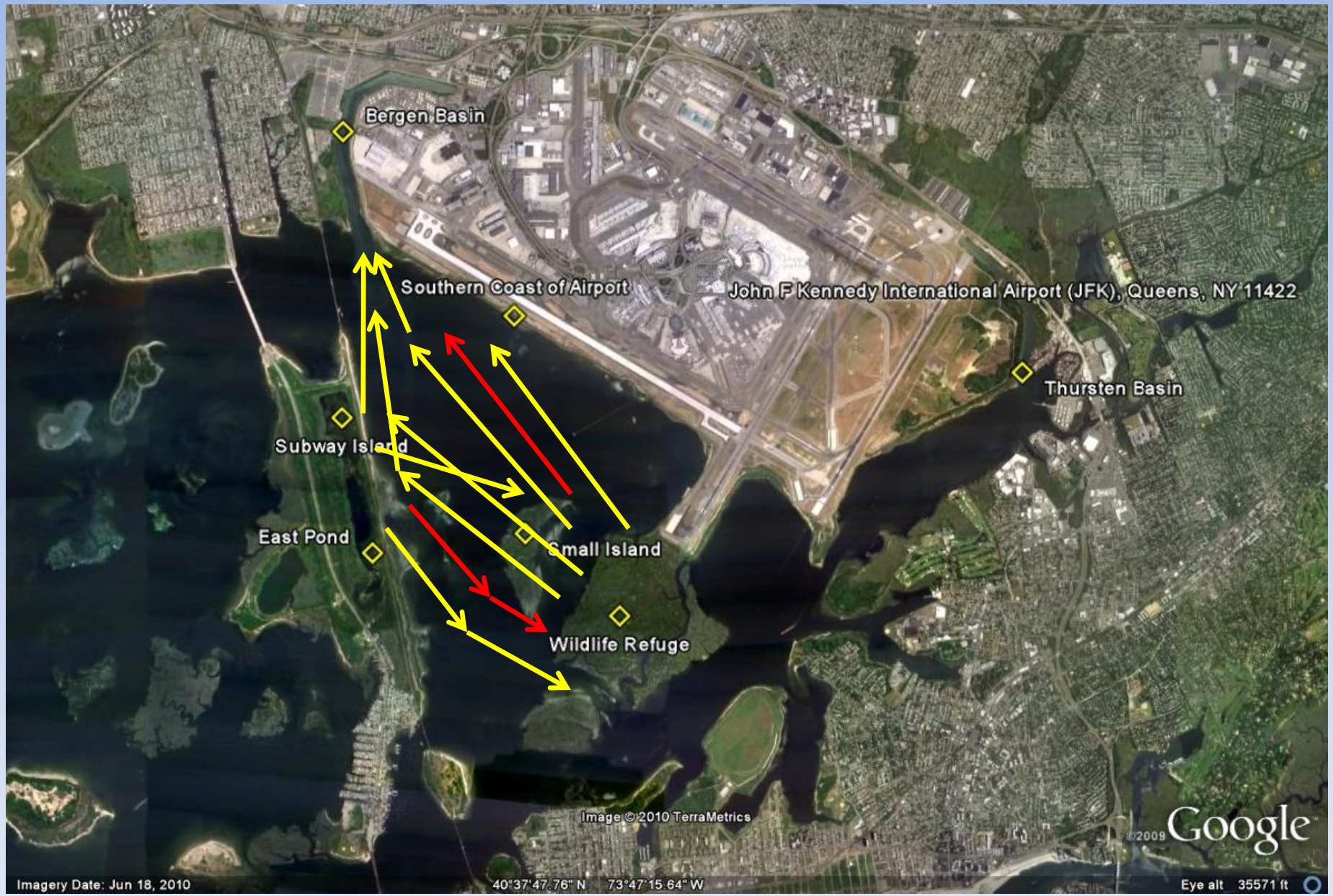
Analysis of Radar Data
September 2010

General Activity September 2010 (AR2)

- Less intensive analysis to follow up on the May studies
- More focused on movements
  - Large number of tracks or ITOs that exhibit similar behavior (heading, starting or ending point, etc).
  - Generally include long tracks
  - Observed for several minutes
- Movements and ITOs associated with Subway Island (similar to May 2010)
- Morning and evening movements
  - Large
  - Eastbound and westbound through Jamaica Bay
- Daytime activity is
  - Similar to morning and evening activity
  - Less intense than morning and evening
- The following slides show movements and the general direction of tracks.

Summary of Movements for September 2010 - Morning

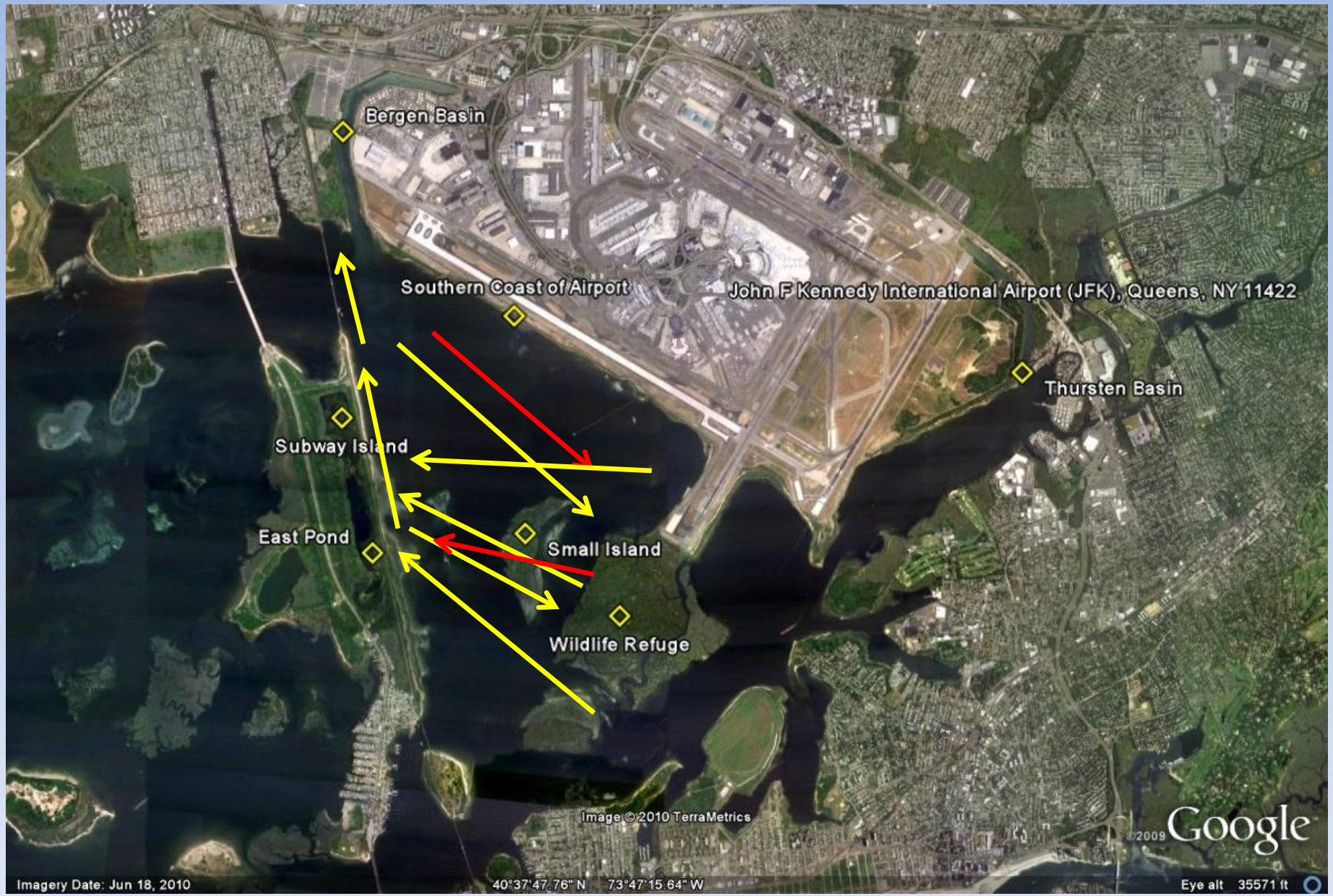


Yellow – AR2-L Red – AR2-H

Morning Activity

- Two components of movements (in AR2-L):
  - Westbound movement
    - Starting at Joco Marsh towards Subway Island and Bergen Basin.
  - Eastbound movement
    - Starting at Subway Island heading towards airfield and Joco Marsh.
  - Both
    - Simultaneously
    - Not necessarily start and end at the same time
- Movement Timing
  - Begin within a half hour of sunrise with
  - Most activity in the fifteen minutes around sunrise
- AR2H similar to AR2L but with fewer targets
- Reminder AR2-L elevation
  - Targets are at lower elevations,
  - Typically within a few hundred feet of the surface (e.g. at 1.5 miles the top of the beam is at about 600 ft).
- AR2-H have altitudes at eastern shore Subway Island of between 550ft-740ft.

Summary of Movements for September 2010 - Evening

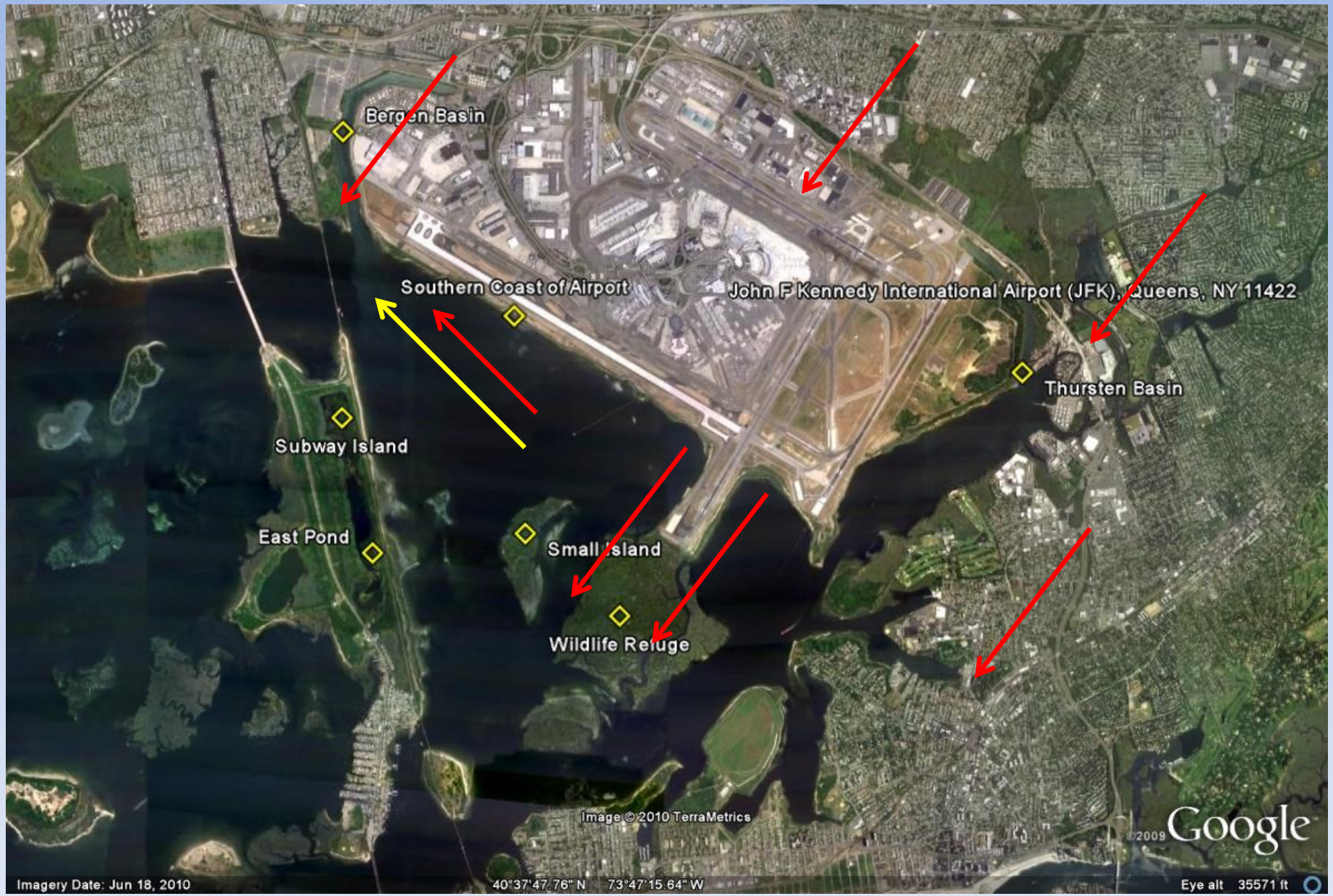


Yellow – AR2-L Red – AR2-H

Evening Activity

- Evening = about an hour before and continues through sunset
- Activity takes place over a longer period of time than sunrise
- Eastbound and westbound movement is similar to morning movement.
  - Eastbound movement is towards Joco Marsh.
  - Westbound movement is towards Subway Island.
- Activity detected in the AR2-H, but with fewer targets.

Summary of Movements for September 2010 - Night



Yellow – AR2-L Red – AR2-H

Night Activity

- Majority of activity is detected in Jamaica Bay.
- Majority of targets appear to head towards the northwest in the AR2-L.
- The activity on both AR2 radars detect a large number of targets at close range (within 1.5 miles).
- The AR2-H results are similar to the AR2-L - differences:
  - An area of strong southwestern movement beginning at the kilo extension and passing over Joco Marsh.
  - Long tracks that start from the north-northeast heading south-southwest.
- Long tracks indicative of migration, or long distance commuters on the AR2H.
  - Many of these tracks are at greater ranges.
  - Long tracks at high elevations are mostly likely birds that maintain consistent elevation and fly into the beam and then out of the beam. This pattern of tracks ending and beginning again is evident in both data playback and track histories.
  - The AR2-H beam coverage is at high elevation (greater than 700 feet).
  - Based on the physics of the radar beam, particularly for the AR2-H we do not know if the birds land when they exit the beam

Summary of Initial Radar Analysis

- New methodologies in historical radar analysis
- Locational Analysis
  - The avian radar reveals high levels of bird activity in Jamaica Bay.
  - Radar suggests Subway Island may play a significant role in overall activity at JFK.
- Timing –
  - Peak of activity in the 15 minutes surrounding sunrise.
  - Higher levels of acitivty in the afternoon and near sunset.
  - Least amount of activity at night
- Upcoming Studies
  - Comparison of amount of tracks in Jamaica Bay v. the airfield
  - Analysis of ITOs and movements for other months
  - Validation studies
  - And More !!!

U.S. Department
of Transportation

**Federal Aviation
Administration**

1 Aviation Plaza
Jamaica, NY 11434

January 04, 2010

FAA
Attn: Ryan King
AJP-6311, Bldg 296
Wm. J. Hughes Tech Center
Atlantic City, NJ 08405

RE: *(See attached Table 1 for referenced case(s))*
FINAL DETERMINATION

Table 1 - Letter Referenced Case(s)

ASN	Prior ASN	Location	Latitude (NAD83)	Longitude (NAD83)	AGL (Feet)	AMSL (Feet)
2009-AEA-959-NRA		NEW YORK, NY	40-38-15.54N	73-47-45.50W	15	23

We do not object to the construction described in this proposal provided:

You comply with the requirements set forth in FAA Advisory Circular 150/5370-2E, "Operational Safety on Airports During Construction."

Use only two discrte frequencies, i.e. 5.260 GHz and 5.805 GHz.

This determination does not constitute FAA approval or disapproval of the physical development involved in the proposal. It is a determination with respect to the safe and efficient use of navigable airspace by aircraft and with respect to the safety of persons and property on the ground.

In making this determination, the FAA has considered matters such as the effects the proposal would have on existing or planned traffic patterns of neighboring airports, the effects it would have on the existing airspace structure and projected programs of the FAA, the effects it would have on the safety of persons and property on the ground, and the effects that existing or proposed manmade objects (on file with the FAA), and known natural objects within the affected area would have on the airport proposal.

If you have any questions concerning this determination contact Guillermo Felix, (718)553-3345, guillermo.felix@faa.gov.

Guillermo Felix
DivUser

U.S. Department
of Transportation

**Federal Aviation
Administration**

,

January 11, 2010

FAA
Attn: Ryan King
AJP-6311, Bldg 296
Wm. J. Hughes Tech Center
Atlantic City, NJ 08405

RE: *(See attached Table 1 for referenced case(s))*
FINAL DETERMINATION

Table 1 - Letter Referenced Case(s)

ASN	Prior ASN	Location	Latitude (NAD83)	Longitude (NAD83)	AGL (Feet)	AMSL (Feet)
2009-AEA-960-NRA		NEW YORK, NY	40-38-55.14N	73-45-17.45W	15	23

We do not object with conditions to the construction described in this proposal provided:

You comply with the requirements set forth in FAA Advisory Circular 150/5370-2E, "Operational Safety on Airports During Construction."

Since the proposed frequency band 5250-5850MHz is sharing with aviation band (5600-5650MHz), the proponent must provide the discrete frequency or sub-band frequency for this proposal. No objection to the propose 9.4GHz

This determination does not constitute FAA approval or disapproval of the physical development involved in the proposal. It is a determination with respect to the safe and efficient use of navigable airspace by aircraft and with respect to the safety of persons and property on the ground.

In making this determination, the FAA has considered matters such as the effects the proposal would have on existing or planned traffic patterns of neighboring airports, the effects it would have on the existing airspace structure and projected programs of the FAA, the effects it would have on the safety of persons and property on the ground, and the effects that existing or proposed manmade objects (on file with the FAA), and known natural objects within the affected area would have on the airport proposal.

If you have any questions concerning this determination contact Guillermo Felix, (718)553-3345, guillermo.felix@faa.gov.

Guillermo Felix
DivUser

Airport Technology R&D

FAA Study of Bird Radar Power Issues

Presented to: FAA

By: Ryan E. King

Date: October 13, 2009

Federal Aviation Administration

FAA Bird Detection Technology

Bird Radar Program Description

- **Began in 2001 (development focus)**
- **Present – commercially available systems**
- **Avian Radar Components**
  - Sensor (off-the-shelf marine radar antennas)
  - Digital converter
  - Digital processor (computer)
  - Displays
  - Data management system
- **Technical**
  - S-Band frequency (~10 cm wavelength)
  - X-Band frequency (~ 3 cm wavelength)

FAA Bird Detection Technology

Bird Radar Program Description

- **JFK specific systems**
  - Supplied by Accipiter Radar Technologies, Inc.
  - X-Band frequency
  - 2 radars will be deployed
    - "**AR-2**"
      - Two Sensor System (Parabolic Dish Antenna)
      - 360° horizontal coverage
      - 4° antennas
      - Provides some altitude information for acquired targets
    - "**AR-1**"
      - Single sensor system (slotted array antenna)
      - 360° horizontal coverage
      - No altitude information provided

Power Requirements

- **110V AC**
- **20 Amp (30 Amp would be better)**
- **Highest draw is from trailer's roof mount air conditioning unit during some summer days. The A/C is necessary to keep computer equipment cool.**

FAA Bird Detection Technology

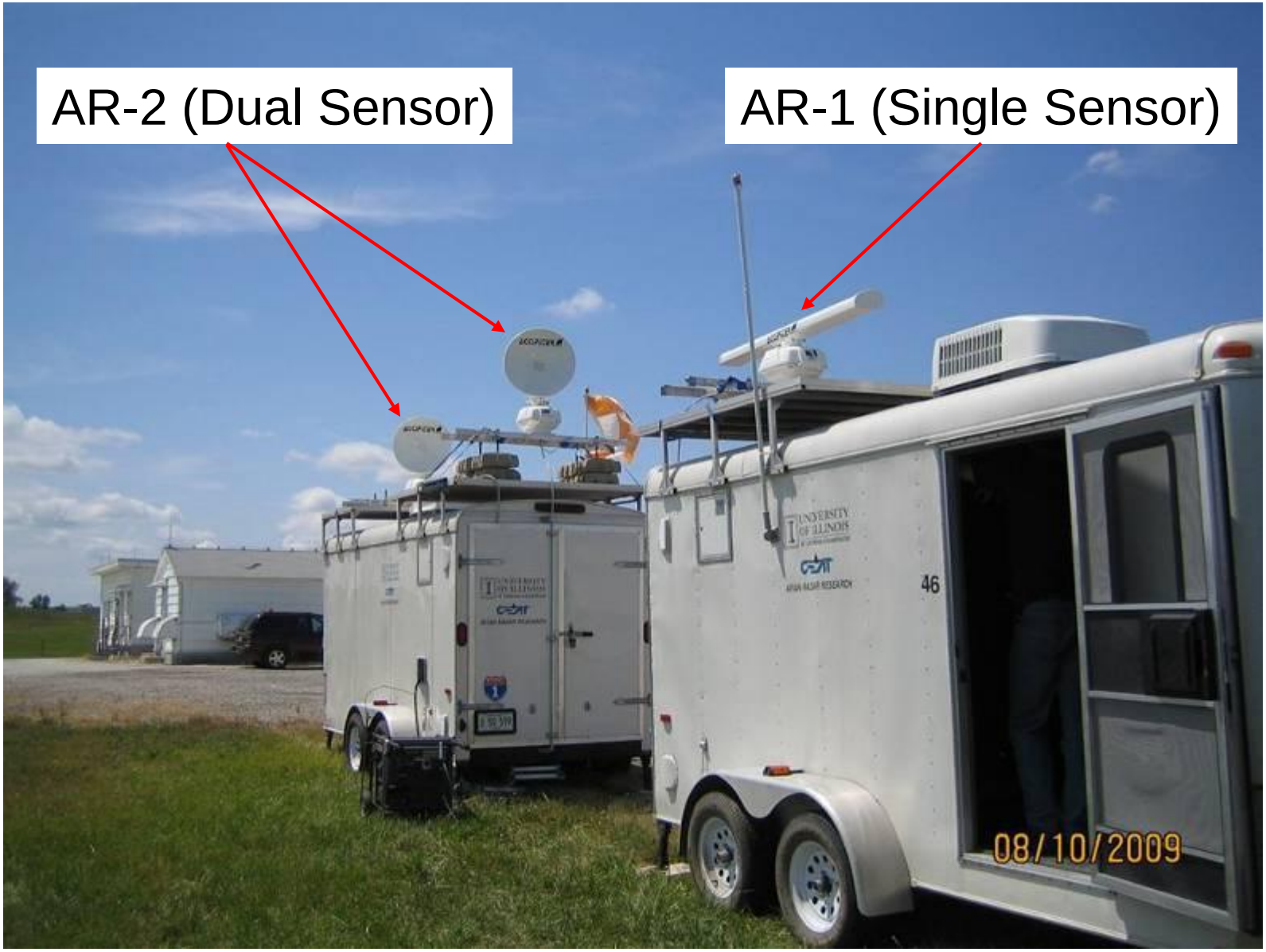
Introduction

- **Assessing Avian Radar Detection Systems for use at civil airports focusing on:**
  - Deployment Considerations (*Licensing, Transmission Interference, Location, Clutter, Form 7460 approvals, Physical and Communication Infrastructure*)
  - Data Acquisition, Processing and Management Capabilities
  - Validation of Target Detection and Tracking
  - Operational Reliability (*Maintenance Needs, Weather*)
  - Development of CONOPS/Use Case's
  - Integration of radar displays for aircraft movement control
- **Outcome – Guidance on deployment and use of radars at civil airports (e.g. Advisory Circular, Engineering Briefs, Cert Alerts etc.)**

Key Personnel

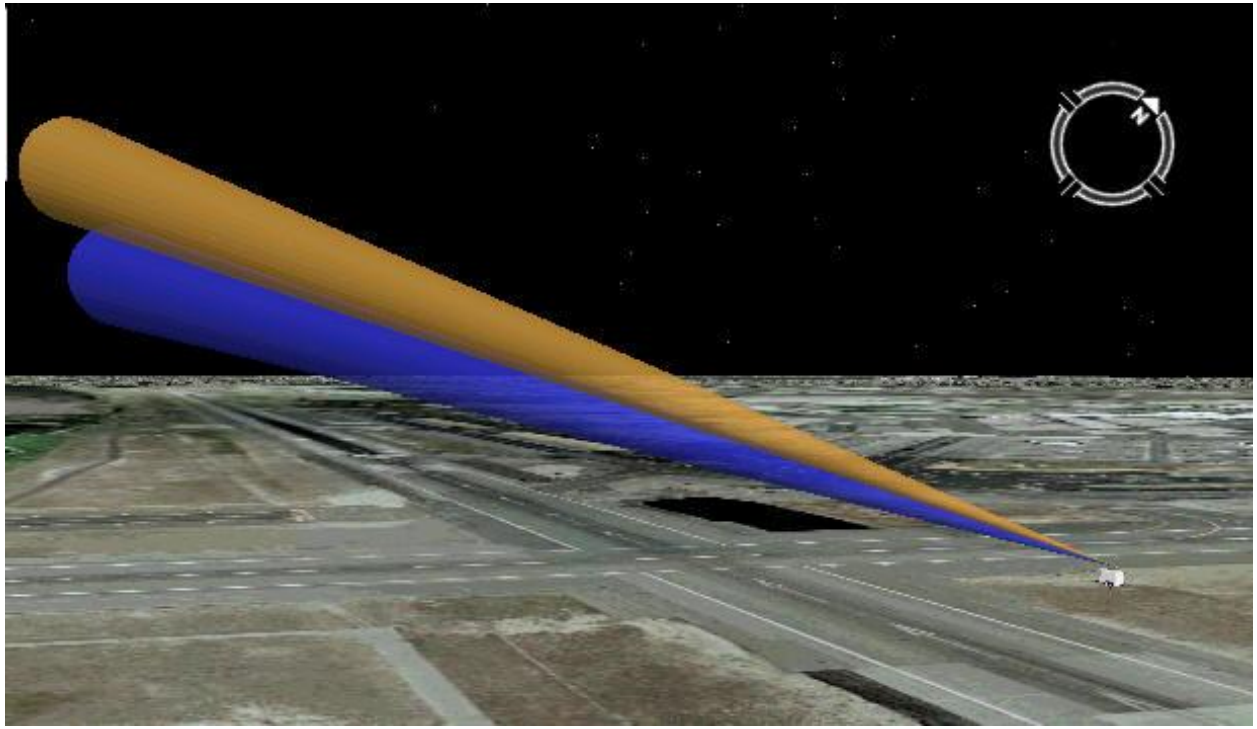
- **Ryan King – FAA Technical Center, Project Lead**
- **Dr. Edwin Herricks – Center of Excellence for Airport Technology (CEAT) at University of Illinois, Principal Investigator**
- **Laura Francouer – PANY&NJ, Manager Wildlife Operations**

Potential Sites at JFK


AR-2 (Dual Sensor)
AR-1 (Single Sensor)
46
08/10/2009

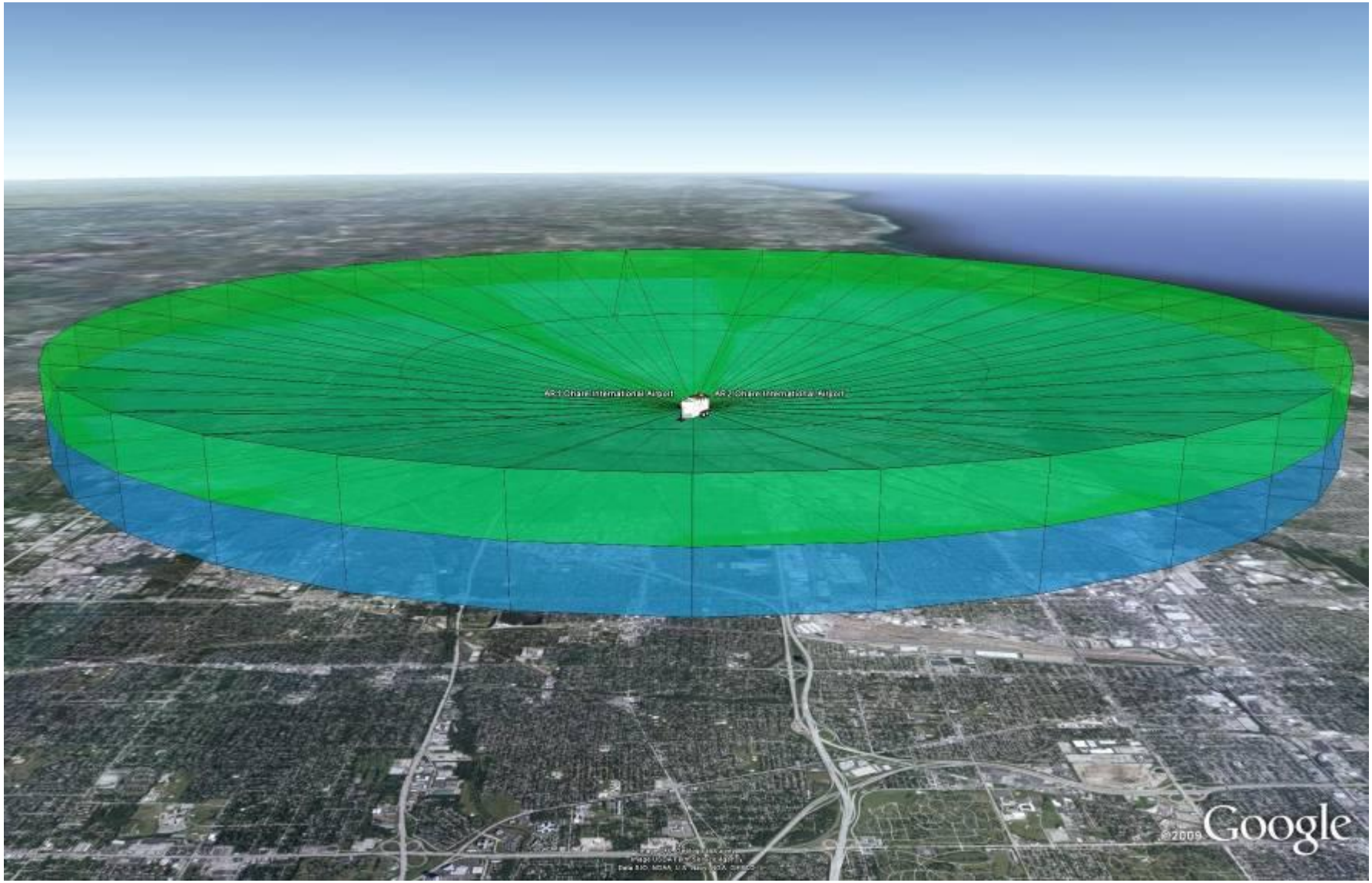
Parabolic Dish Antenna Coverage

Two Sensor



Computer representation of (AR-2) beams at SEA

Bird Radar at SEA


©2009 Google

Support Equipment

Inside Trailer

Monitor

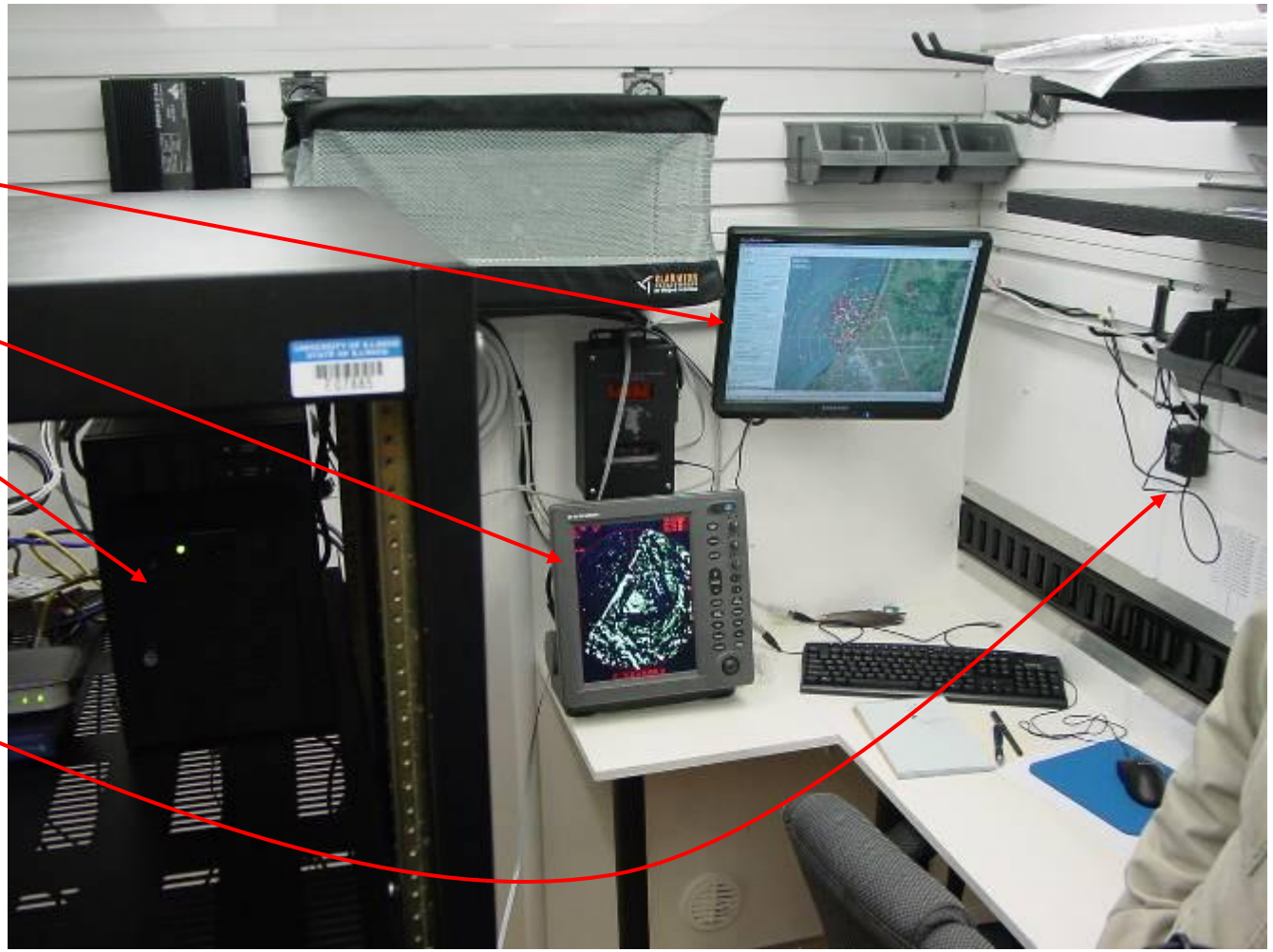
Display

Computer

Lights

A/C

Cell Phone



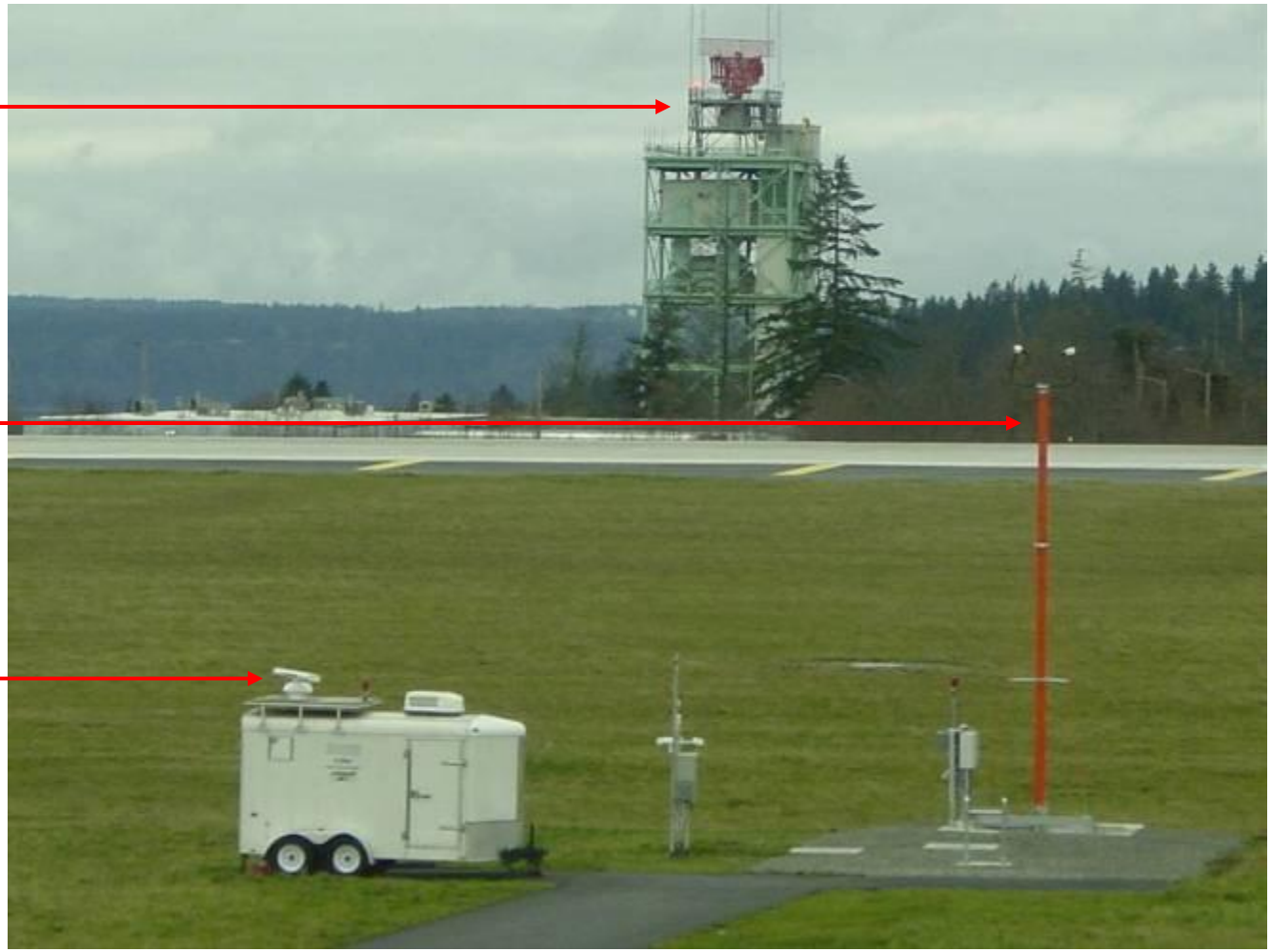
AR-1 Midfield at SEA

Power from FAA grid

ASR-9 Radar

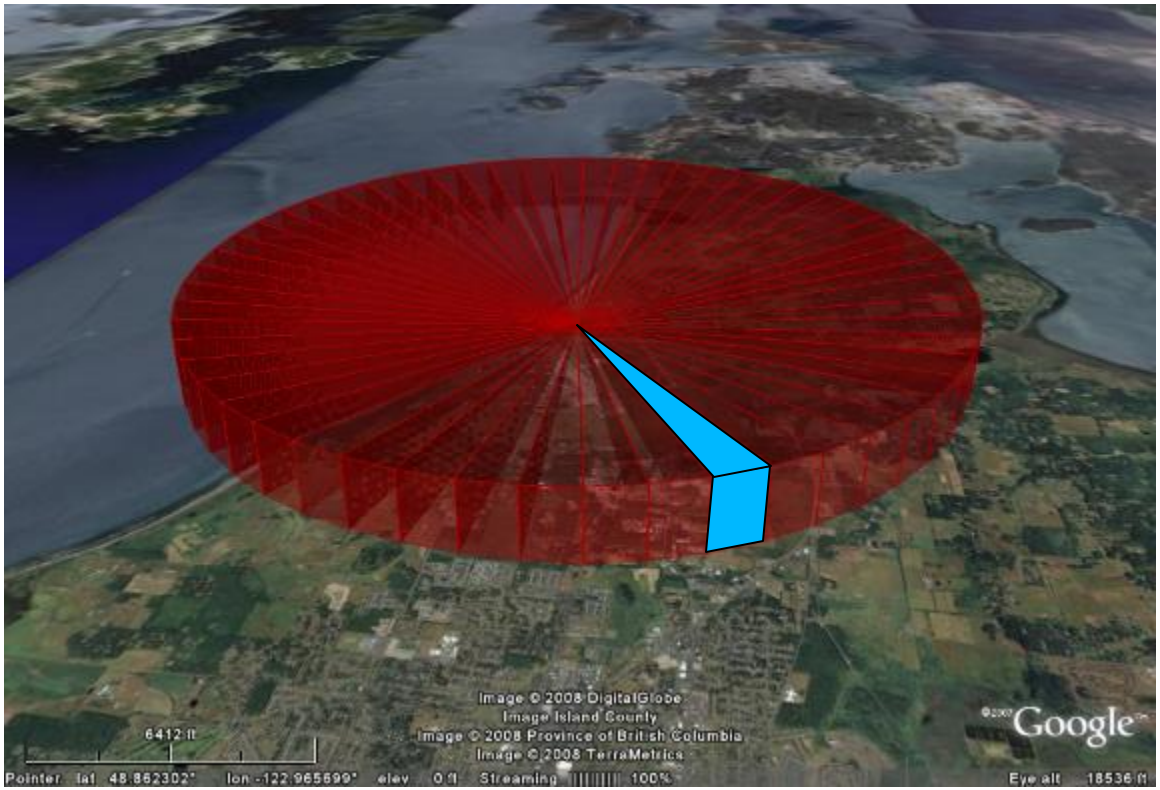
Runway Visual Range (RVR) sensor

Bird Radar AR-1



Array Antenna Coverage

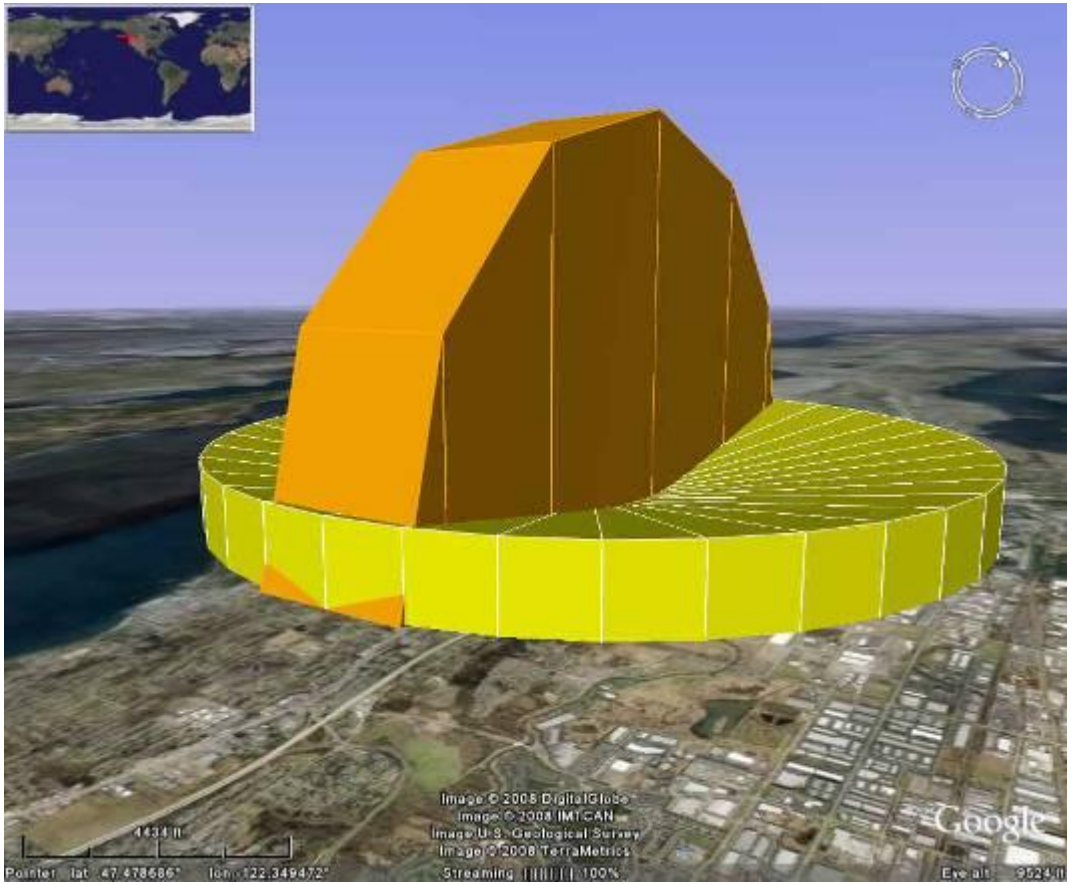
Horizontal Orientation



Provides ground-up coverage but altitudinal discrimination of targets is limited to the geometry of the beam

Array Antenna Coverage

Vertical and Horizontal Orientation



Avian Radar – Experience at John F. Kennedy Intl. Airport

THE PORT AUTHORITY OF NY & NJ

ILLINOIS

CENTER OF EXCELLENCE FOR AIRPORT TECHNOLOGY

FEDERAL AVIATION ADMINISTRATION

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BRONX
MANHATTAN
QUEENS
New Jersey
New York
NEWARK
JERSEY CITY
Ellis Island Immigration Museum
Statue of Liberty National Monument
Governors Island National Monument
La Guardia Airport
Newark International Airport
ELIZABETH
BROOKLYN
Frank Charles Memorial Park
John F. Kennedy International Airport
Canarsie Pier
Bergen Beach
Jamaica Bay Wildlife Refuge
STATEN ISLAND
Fort Wadsworth
Hoffman Island
Miller Field
Swinburne Island
Floyd Bennett Field
Plumb Beach
Breezy Point
Jacob Riis Park
Fort Tilden
STATEN ISLAND UNIT
JAMAICA BAY UNIT
Great Kills Park
Rockaway Point
PERTH AMBOY
ATLANTIC OCEAN
North Beach
Sandy Hook Lighthouse
Fort Hancock Historic District
SANDY HOOK UNIT
Holly Forest
Visitor Center
5 Kilometers
5 Miles

Introduction

- FAA avian radar performance assessment program at several US airports
- The Center of Excellence for Airport Technology (CEAT) cooperated with JFK to define objectives for radar analysis & analyze radar data
- Avian radar was deployed to JFK and was operational in January 2010 (AR-2)
- After an initial period of tuning and calibration, the radars have been operating continuously since March 2010 (AR-1 + AR-2)
- 2 radar systems deployed
  - AR1 (single sensor)
    - Located between runways 22L and 22R by Rockaway Blvd.
    - Array antenna
  - AR2 (dual sensors)
    - On Jamaica Bay at the midpoint of 13L/31R
    - Parabolic dish antennas - beam


UNIVERSITY
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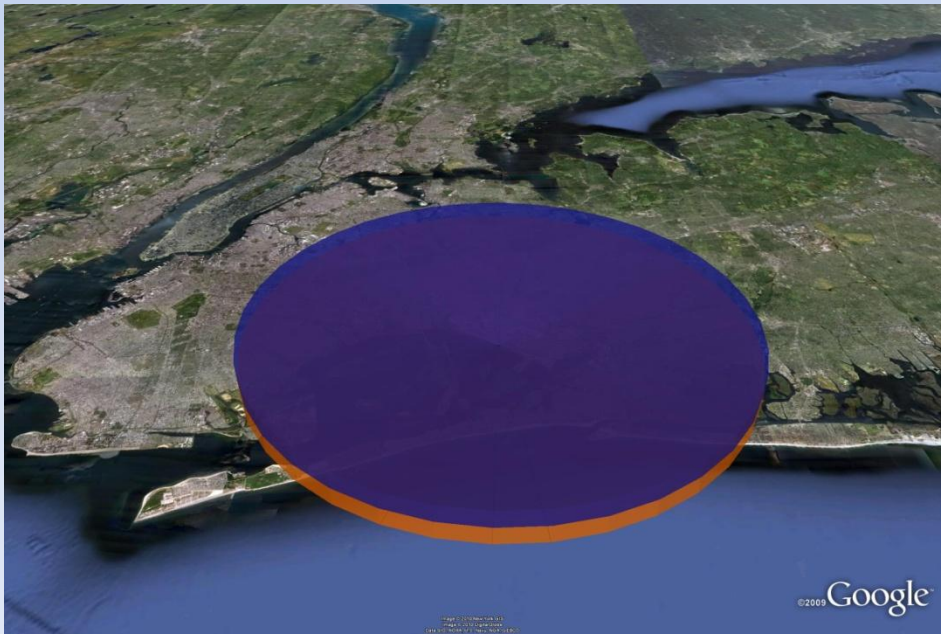
AT URBANA-CHAMPAIGN
AVIAN RADAR RESEARCH
ACCIPITER
32177

Objectives

- **General Activity**
  - Observe both low and high elevation targets with the AR2
  - Concentrations of detections shows where groups of birds are staging and what areas can be attractants to large numbers of birds
  - Timing related to sunrise/sunset & tides
- **Night Movement**
  - Frequency, timing, and direction
- **Migration**
  - migration periods and patterns of bird dynamics related to migration
- **Local Bird Movements**
  - Radar can provide information on local bird movements
  - Information on long and short distance commuters

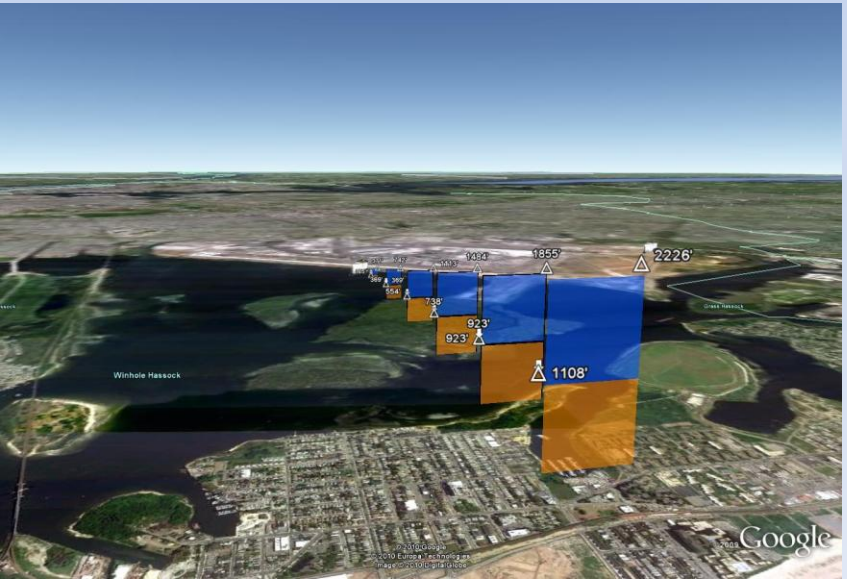
Understanding Radar Physics AR-2

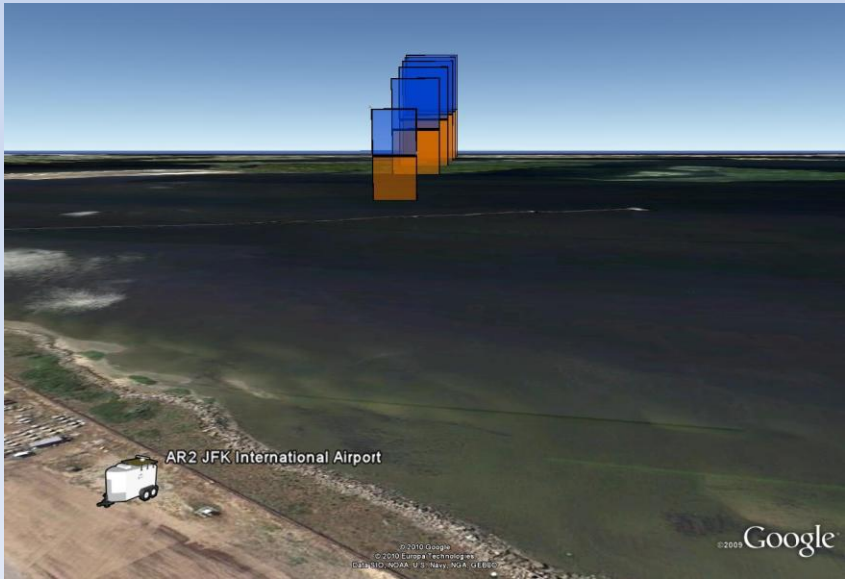
- Parabolic dish antenna produces a cone of energy directed in a beam
- AR-2 has 2 dishes set at different up-tilt angles
- 2 cones of energy emitted from the sensor
- Antennas rotate 360° for total coverage.



Radar Physics AR-2

- The AR2-L (low) is a 4° beam tilted to center at 2° above horizontal. Hence this sensor covers from horizontal to 4°
- The AR2-H (high) is a 4° beam tilted to center at 6° above horizontal . Hence the AR2H covers from 4° to 8°
- This a zone of coverage with altitude specific information.



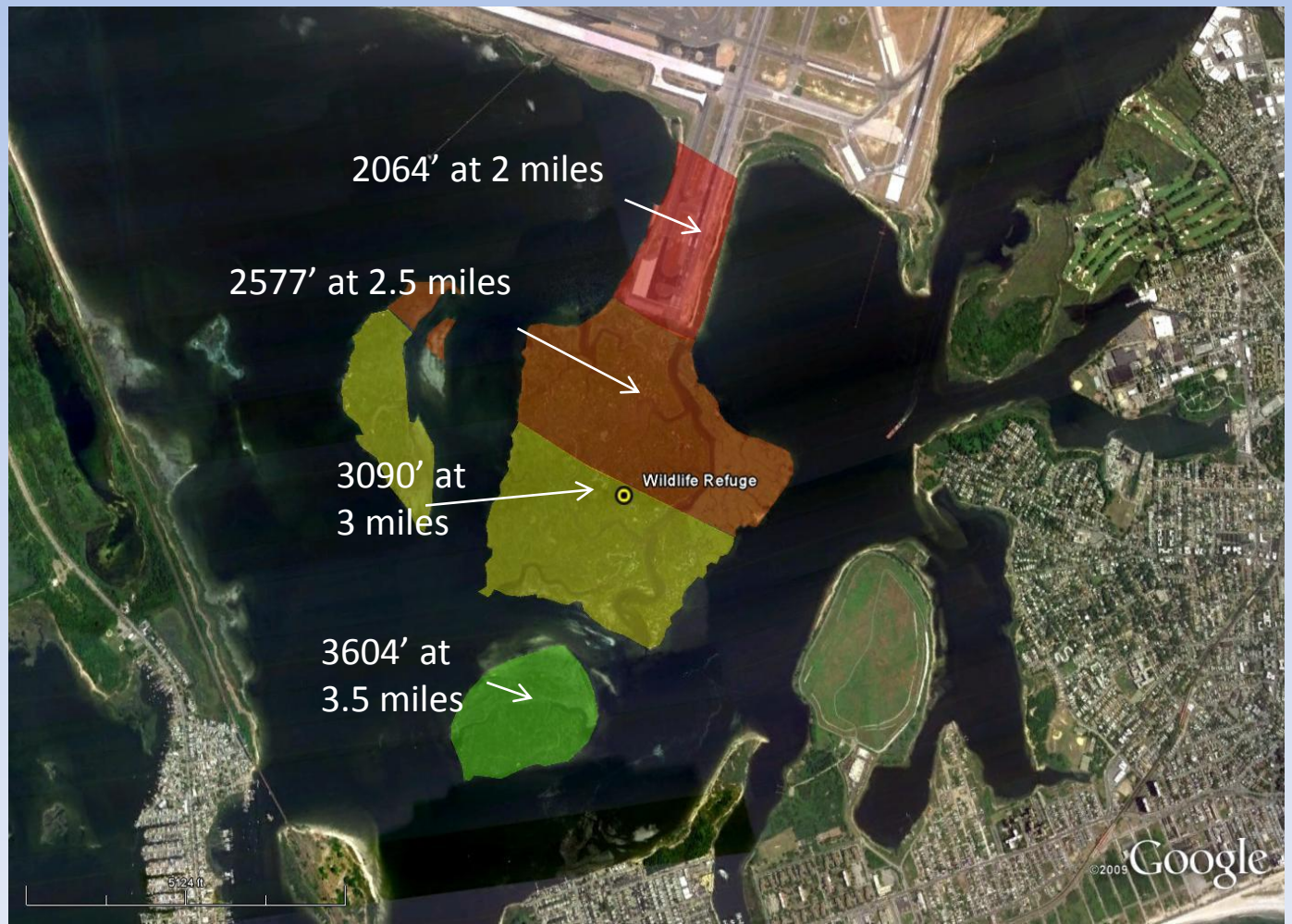


AR-1 Coverage Characteristics

- AR-1 antenna beam ht approx. 11º from horizontal
- Top of the beam reaches 1000 ft @ 1 mi, 3000 ft @ 3 mi
- Maximum range is 5 mi (with no coverage near the radar)

Understanding Radar Coverage AR-1

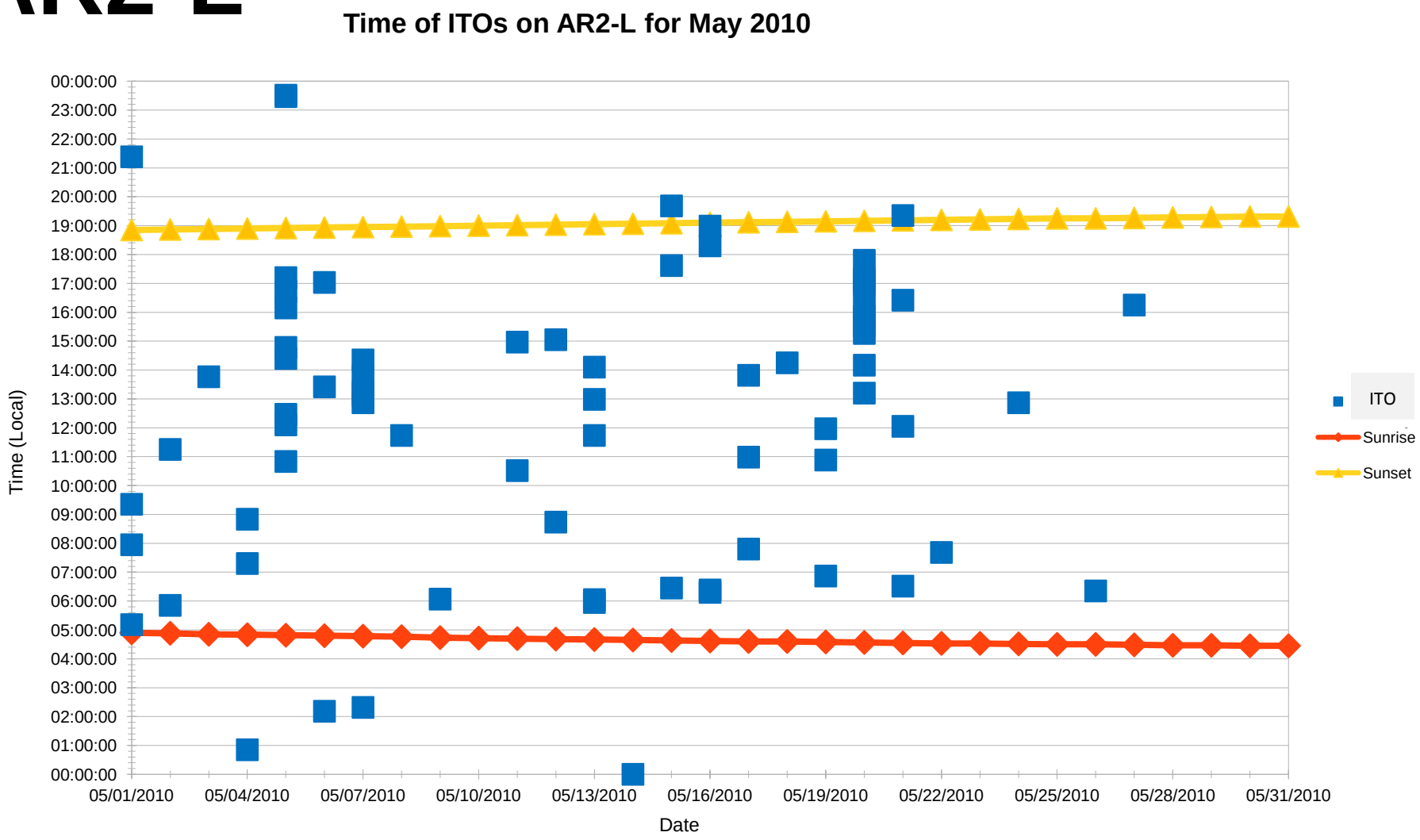
- Joco Marsh - top of the beam at the north is lower than at the south
- The energy producing a target echo is greater in the north than the south, influencing the size of targets reliably detected



Multipath

- Must understand to separate from bird tracks
- Common to all radars, multipath occurs when a large target is close to the radar
- Multipath occurs when radar pulse energy is reflected, strikes a 2nd object and both the primary and secondary echoes are received by the radar. The radar interprets the returns at 1st object's azimuth and the distance of the 2nd object.
- This usually appears as a "fan" of tracks moving in the same direction on the radar screen
- Aircraft are the main source of multipath at airports
- Large vehicles like semi-trucks also cause multipath.

AR2-L



Initial Track Observation (ITO) results indicate both the variability expected from day to day, and general timing of ITO type movements during the day.

Note: it is possible to have many single tracks and no ITOs

Summary of Initial AR-2 Analysis

- **Timing**
  - peak of activity in the 15 minutes surrounding sunrise.
  - higher levels of activity in the afternoon and near sunset.
  - least amount of activity at night
- **Location Analysis**
  - high levels of bird activity in Jamaica Bay
  - Subway Island may play significant role in activity at JFK
- **Upcoming Studies**
  - comparison of amount of tracks in Jamaica Bay v. JFK
  - analysis of ITOs and movements for other months
  - validation studies
  - and more !!!

Radar Validation – Bird Surveys

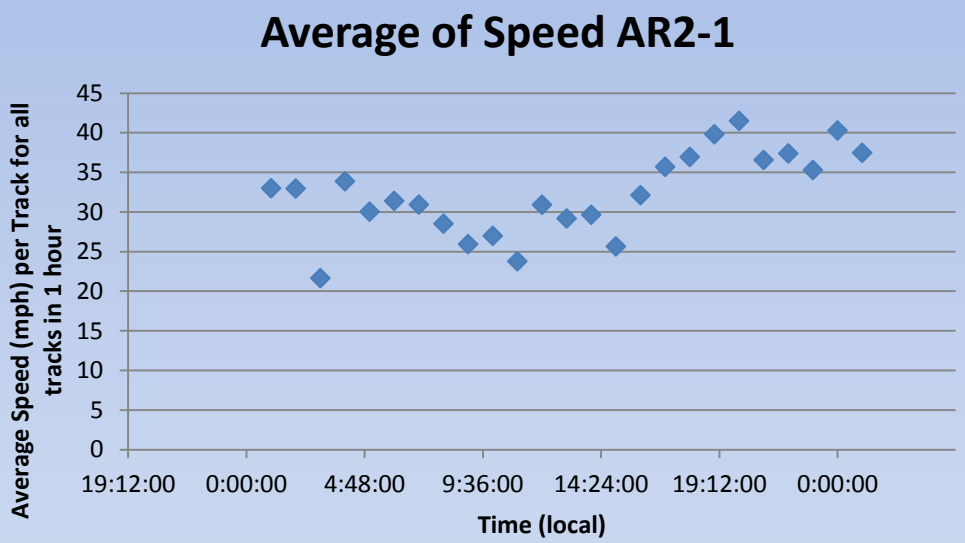
- 3 minutes in each location
- Data recorded:
  - Survey date & time
  - Time of individual birds
  - Bearing
  - Direction of movement

Bird Survey Validation Summary

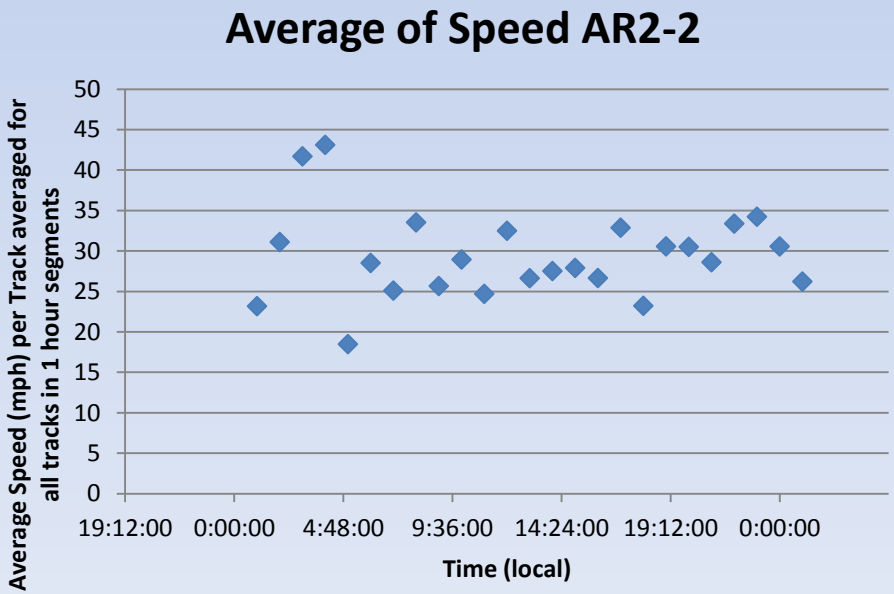
- **Benefits**
  - learn the airfield better
  - learn typical bird movements to a greater extent
  - By comparing field notes with radar records, gain sense of where we have radar coverage and where we do not
- **Drawbacks**
  - Very few targets moving and of appropriate height
  - Can’t see as far with binoculars
  - Lack of precision in bearing (at multiple observation points)

- Validation is ongoing for all avian radar installations
- Need to increase sample size.
- Must use other validation methods developed by CEAT.

AR-2 Average Speed (mph)

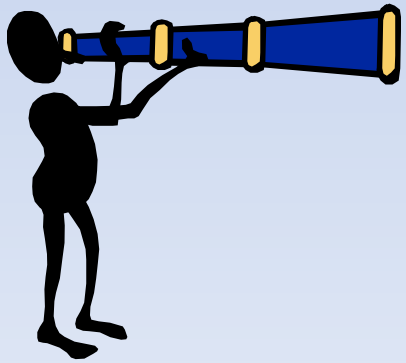


The speed for all updates in a track were averaged for an average track speed.
These avg. track speeds were then averaged for all the tracks in 1 hour segments for Nov. 22, 2010.



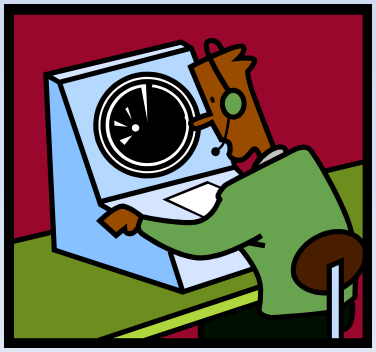
Radar Advantages

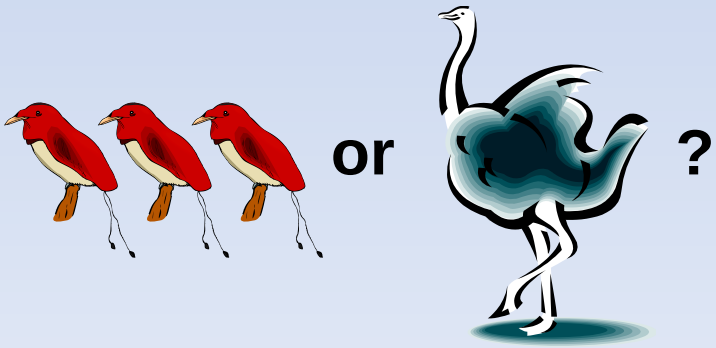
- Collect data remotely
- Collect data despite observation conditions
- Unbiased in observation locations
- Collects data faster than human observer
- Able to detect birds beyond human detection capabilities



Radar Limitations

- Not practical for real time warnings
- Very technical tool requires dedicated personnel
- Expensive
- Cannot discriminate between single birds and flocks or between species of birds
- Need several radar units to cover large areas
- May sacrifice distant detection for near detection





Airport Technology R&D

RPD-150

Wildlife Hazard Mitigation R&D

Presented to: JFK Ground Operations

By: Ryan E. King, Project Lead

Date: Tuesday March 19, 2009

Federal Aviation Administration

Wildlife Hazard Mitigation R&D

GOAL: Reduce the likelihood of bird collisions with aircraft both on the airport and in the terminal airspace vicinity that includes the approach and departure corridors.

Focus

Overall FAA Wildlife R&D Program

- Assessment, technical evaluation and development of **effective wildlife hazard mitigation**
  - Concepts
  - Systems
  - Sensors
  - Habitat management practices
  - Wildlife control tools and techniques to minimize bird activities around airports

Outcomes

- **Basis for the development of FAA standards, guidelines and performance specifications for the use and/or implementation of state-of-the-art concepts on the airport environment.**
- **Airport owners and operators will have improved capabilities to comply with FAA airport certification regulations.**

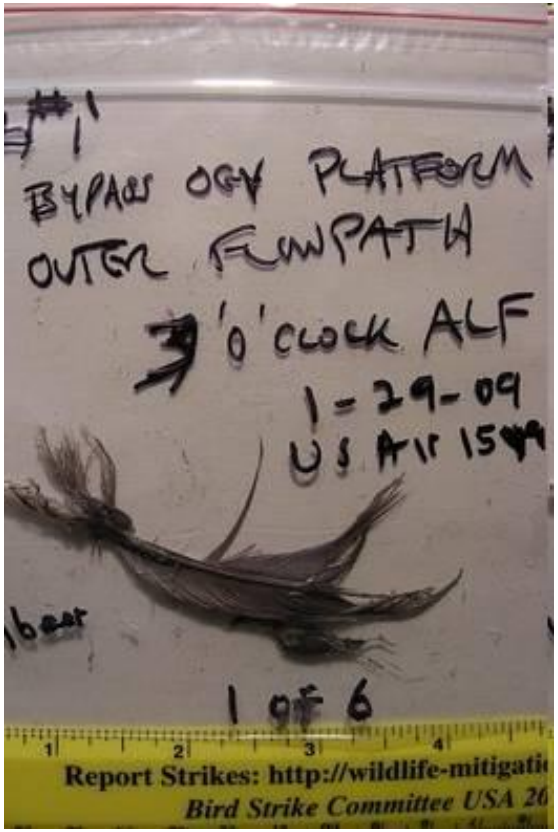
Program Structure

Universities, Federal Agencies, US Military

- **Smithsonian Institution Feather ID Lab**
- **Embry-Riddle Aeronautical University**
- **US Department of Agriculture Wildlife Services NWRC**
- **University of Illinois – CEAT**
- **US Military**

Smithsonian Feather ID Lab

- Feather remains identified from 707 separate civil strikes totaling 787 id's
- Increase of 198 (33%) id's from 2007
- More than 154 species id'd from strikes in 2008
- 140 of 787 of 2008 id's were id's to species level using DNA analysis alone.

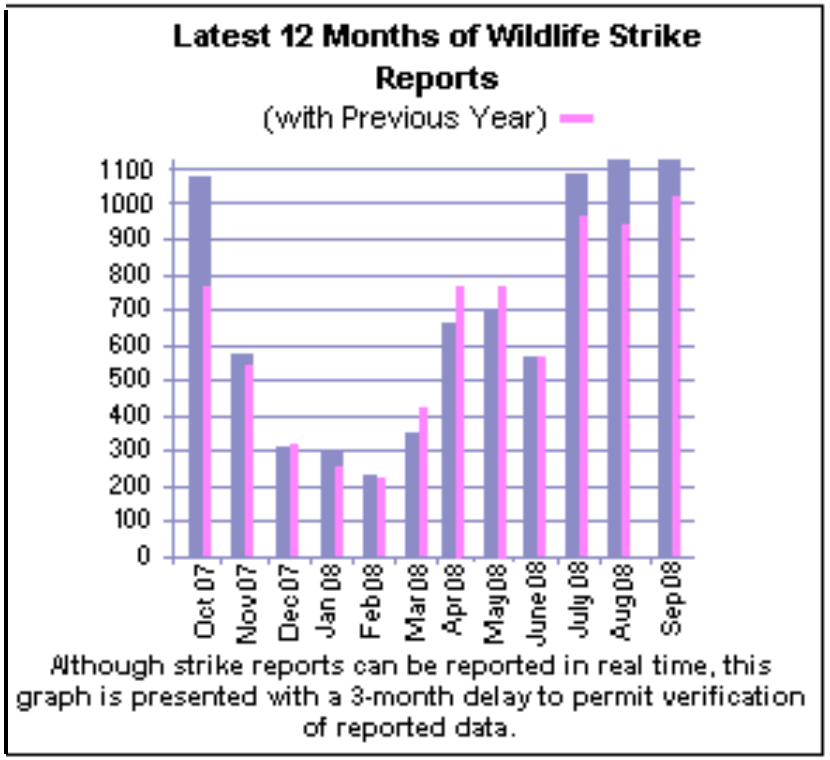


US Airways Flight 1549

FAA Online Strike Database

Current strike count:

110,833 (incl. Canada and USAF/BASH)



FAA Online Strike Database

Flight 1549 effect

- *1000 queries per month on average over the past two years.*
- *As of Dec. 22, 2008 total queries hit 60,000*
- *Normal usage trend would put us at 60,935 – 61,000 queries at Jan 20, 2009*
- *Actual totals up to Jan 20, 2009 = 62,200 queries*
- *Estimated spike of 1200 additional queries over three day period related to US Airways 1549 accident.*
- *Average daily query total = 33/day*
- *Three day period average = 340/day*

US Department of Agriculture

Animal and Plant Health Inspection Service/Wildlife Services

- **OPERATIONAL ACTIVITIES**
  - Strike data acquisition and editing/QA
  - Entry of reports into Database
  - Database analysis and annual report
- **RESEARCH ON WILDLIFE HAZARDS TO AVIATION**
  - Habitat use and foraging strategies of hazardous wildlife on and near airports
  - Methods and tools to reduce wildlife food, water, and cover attractants on and near
  - Research in basic wildlife biology and ecology to develop and enhance non-lethal wildlife control methods
  - Risk assessments associated with wildlife-aircraft collisions relative to management efforts at airports

US Department of Agriculture

Animal and Plant Health Inspection Service/Wildlife Services

- **ON-LINE NATIONAL WILDLIFE STRIKE DATABASE DEVELOPMENT AND MAINTENANCE**
  - System maintenance and application development for Wildlife Strike Database and reporting
  - Technical assistance from contractor to WS-NWRC
  - Attend meetings and conferences regarding Wildlife Strike Database
  - Develop a common format and structure for the North American Bird Strike Database
- **WILDLIFE STIKE REPORTING AND MITIGATION EDUCATIONAL OUTREACH**
  - Airport management and operating personnel
  - Commercial carriers
  - Business jet community
  - Private/General Aviation
  - Air Traffic Controllers

University of Illinois Urbana-Champaign

Center of Excellence for Airport Technology

- **Avian Radar Studies**
  - Deployment of Avian Radars
  - Management of Deployed Radars

- **GIS for Wildlife Hazard Management and Control**

Deployment of Avian Radars

- **Seattle – SEA TAC Airport**
  - Permanent Installation completed June 2007
- **Oak Harbor – Whidbey NAS**
  - eBirdRad installed
  - AR-1 installed February 2009
- **New York – JFK Airport**
  - AR-1 and AR-2 to be deployed Spring/Summer 2009
- **Dallas – Ft. Worth – DFW Airport**
  - DeTect MERLIN deployment (Planned – TBD)
- **Chicago – ORD**
  - AR-1 and AR-2 to be deployed by July 15, 2009

Subjects – ARTI Accipiter

Subjects – DeTect MERLIN

Performance Assessment

1. **Sensor location**

   Clutter mapping

2. **Radar Calibration (known targets)**

   Remote control helicopter & tethered balloons

3. **Data Acquisition and Management**

   Massive amounts of data/Technical challenges

4. **Data Visualization**

   Providing useful information to end users

   Track sequences

Assessment of:

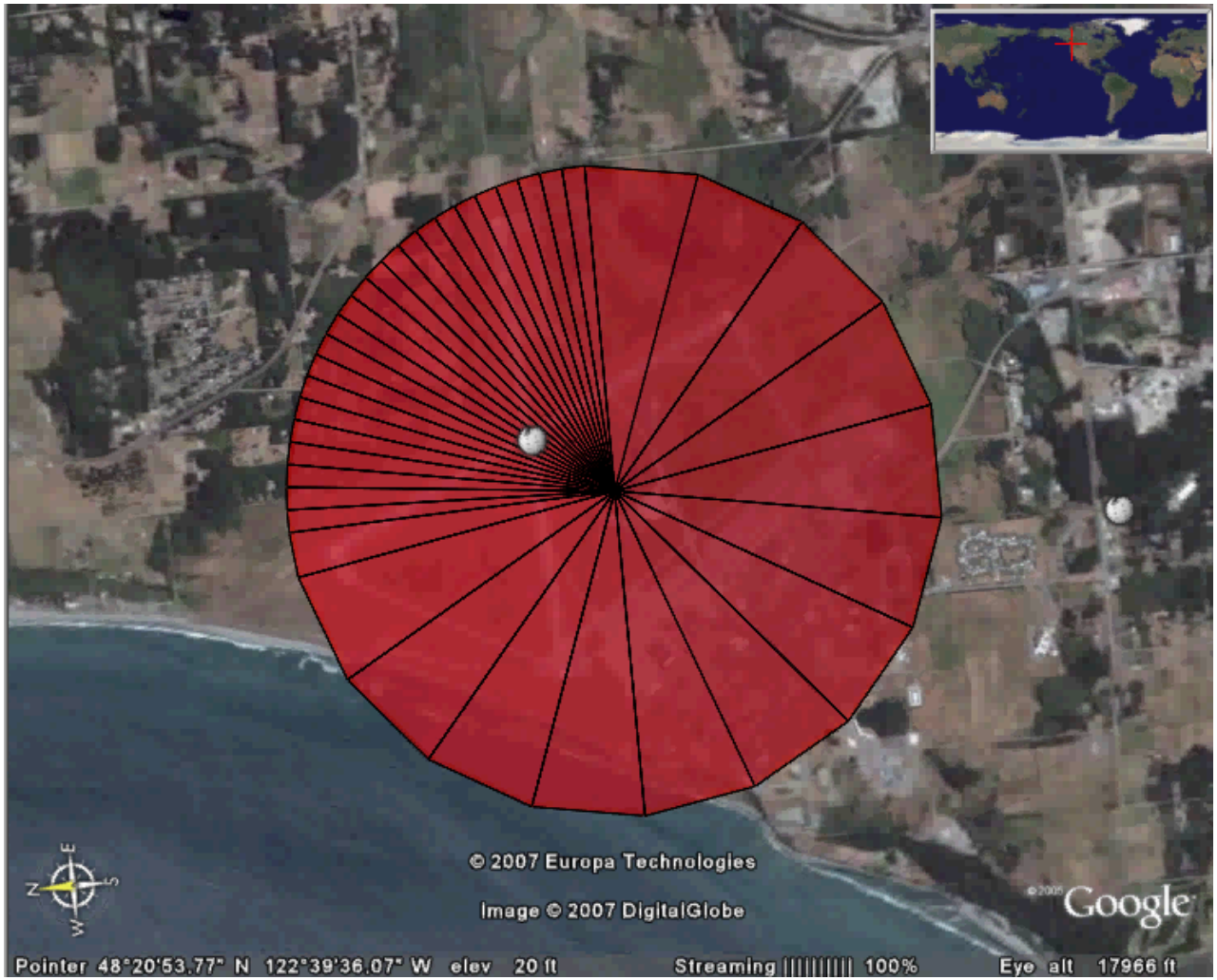
- The capability of the radar to provide validated measurements of latitude, longitude, range and altitude of targets as a function of time
- The Radar sensors analog signal characteristics affected by common adjustments available on the radar control console
- The Radar system digital signal characteristics affected by common adjustments available on the radar control console and in the radar data processor.
- Display capability in terms of geographic position accuracy, display latency, track fidelity, number of targets, and movement of targets.
- Calibrating the radar system with targets at known ranges and altitudes.
- Validating targets identified as birds by the radar system
- Assessing radar system bird detection and tracking reliability by monitoring and observing tracking continuity in the presence of clutter
- Ability of the radar system to identify (in real time) threats to aircraft safety related to wildlife, and the contribution of the radar system to wildlife management programs at the airport.
- Assessing radar system operation under different weather conditions
- Operational reliability and maintenance needs

Antenna Location

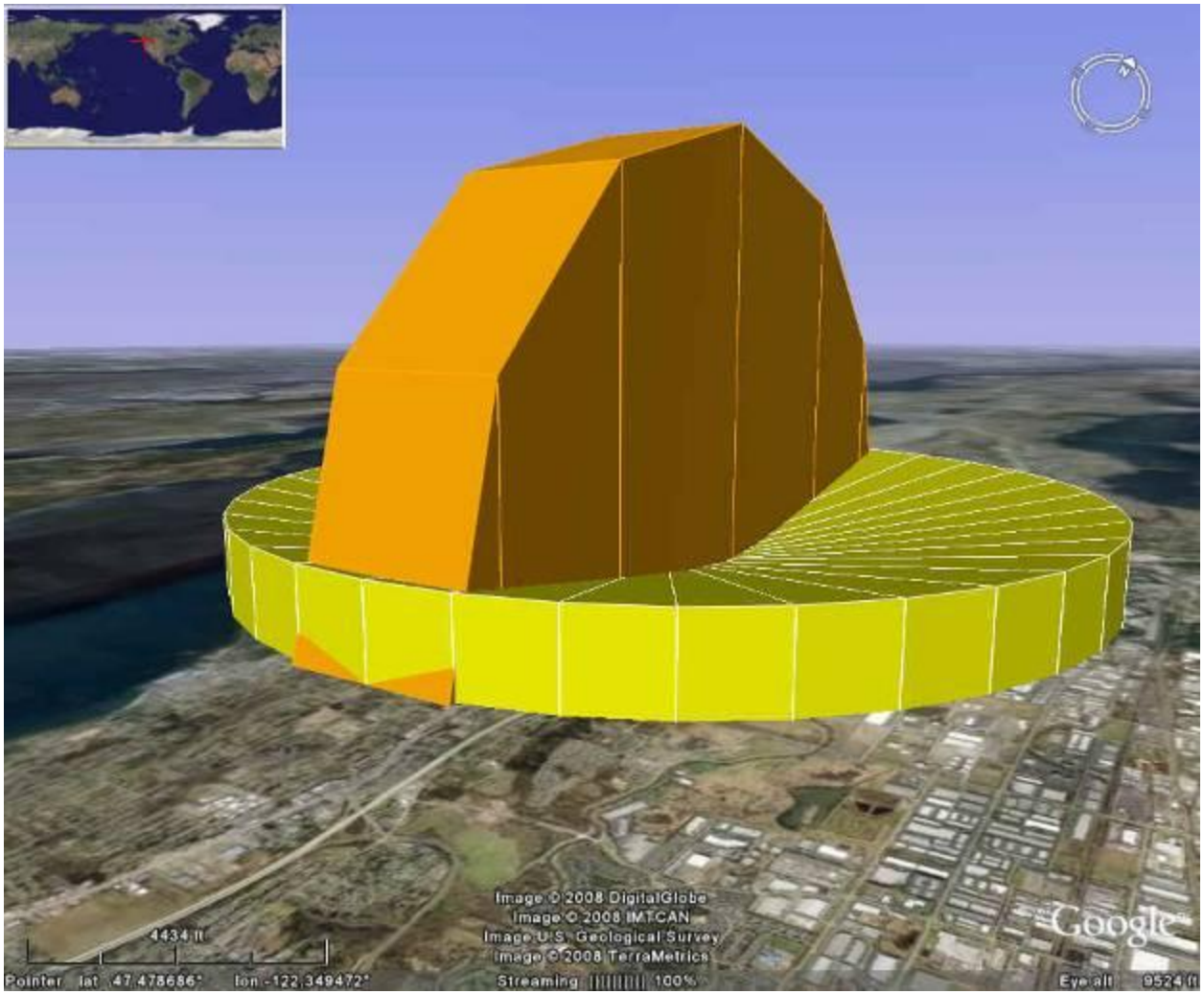
Assessment – Sensor Location

Trailer Setup at SEA

AR-2 Dish Coverage

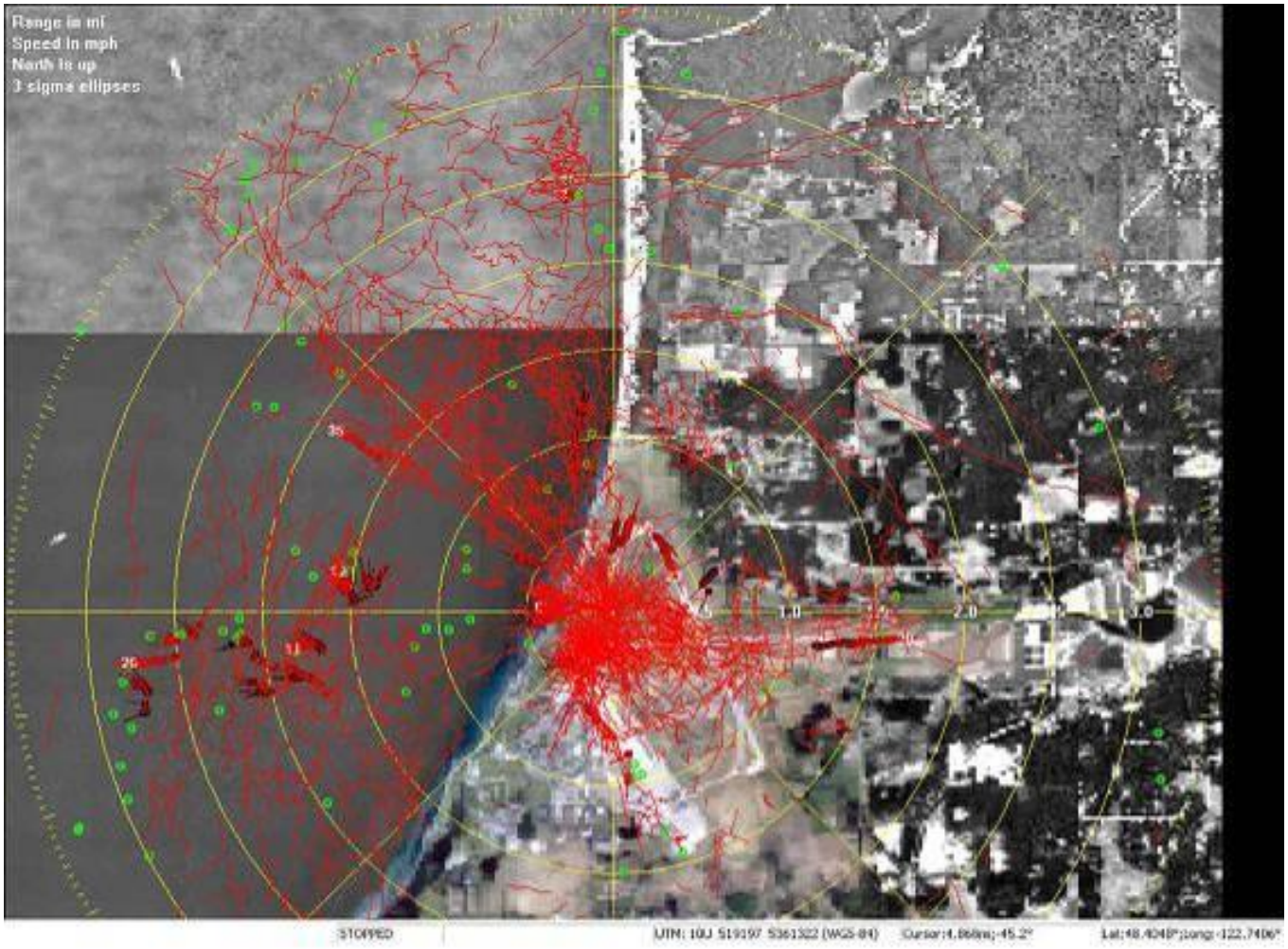


Array Antenna Coverage



1 hour track summary at NASWI

Assessment - Visualization



Questions

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Department of Civil & Environmental Engineering
Newmark Civil Engineering Laboratory, MC-350
205 North Mathews Avenue
Urbana, IL 61801-2352

To Whom It May Concern,

The University of Illinois Center of Excellence for Airport Technology (CEAT) is a designated Federal Aviation Administration Center of Excellence, operating under a cooperative agreement and funding from the FAA. CEAT is conducting a broad research program on the management of wildlife hazards at civilian airports. As part of this research, avian radars have been deployed at several airports in a performance assessment program. The deployment of avian radars at JFK airport is a part of that performance assessment program, and a continuation of research conducted at JFK by the FAA and CEAT since 2004. Two avian radars were installed according to PANYNJ guidelines, and meeting FAA requirements, in January 2010. These radars constantly monitor the airfield for bird activity and collect information on bird movement and dynamics. It is necessary to have connectivity to these radar units to provide for remote maintenance, and other operations. CEAT wishes to install a wireless bridge to connect the radars to an internet service provider (ISP) to allow for remote operation and management of the radars.

CEAT proposes to install a point to point wireless link that supports encryption, and operates in the public 5 Ghz band, which has been cleared for operation at JFK by the FAA. The wireless system will be directional, not wide area, so antennas will be installed at both the radar, and on a PANYNJ building. CEAT will arrange for an ISP to provide an outward link, requiring space for a small router unit in the PANYNJ building. CEAT has selected Buildings 269 and 254 for installation of an antenna, router, and ISP connection. The equipment will include external and in building components. The external components consist of a weather protected wireless radio and 2 ft diameter parabolic dish antenna. The small radio unit and antenna are mounted on a structure to provide line of sight to the radar. The external system is connected to internal support electronics, a router, by coaxial cables requiring building penetration, usually through existing conduit. The internal system consists of a small router, powered by 110 v lines power. This single power supply powers both internal and external units. In the typical installation the antenna and wireless radio mount on a building roof or wall (see figure). CEAT will confirm mounting with PANYNJ personnel.

CEAT will coordinate installation with PANYNJ personnel. A review of existing installation requirements indicate that CEAT personnel will be able to complete the installation, although CEAT will coordinate any building attachment and building penetration with PANYNJ personnel. The internal equipment can be located in existing utility closets in the proposed buildings. Internal equipment installation will be performed by the ISP.

Sincerely,

O / S / B

Elizabeth Woodworth
University of Illinois/CEAT
Manager of Technical Services

Figure 1. The wireless dish attached to the avian radar trailer


Figure 2. The wireless dish attached to the building at ORD.

JFK CLUTTER MAPPING POSITIONS

Point	Wypt	N	W	W2	Power	Description	Notes
1A	152	40.65879	73.82447	-73.8245	no	outfall 4A	no
1B	153	40.66052	73.81115	-73.8112	yes	outfall 1 & 2	better and more accessible than outfall 4A, fenced area owned by port nearby
1C	154	40.65098	73.81931	-73.8193		inside main airport, in depression which isn't taller than the trailer, good distance to next building, covers end of rnwy	
2	155	40.64908	73.82008	-73.8201			
2A	156	40.64693	73.81717	-73.8172	yes	by weather station, good view of 13R/13L, next to txwy P & D	
3	157	40.63793	73.79626	-73.7963	yes	1/2 circle of view, between txwy M & A	
4	158	40.6303	73.78178	-73.7818	no	fence near, good view of 2nd runway	
Z1	159	40.62857	73.77793	-73.7779	yes	lower fence, localizer antennae nearby which may create a dead zone	
5	160	40.62892	73.7775	-73.7775	no	end of txwy Z between 4R & 31L, very open and a good view of rnwy and bay	
5	161	40.62676	73.77399	-73.774	no	end of txwy Z between 4R & 31L, very open and a good view of rnwy and bay	
5B	163	40.62738	73.76752	-73.7675	yes	good view, localizer at end of rnwy, close to rnwy but Stan thinks its ok	
6	164	40.63464	73.76038	-73.7604	yes	antennae nearby	
7	165	40.64476	73.75272	-73.7527	yes	power not as close as other sites	
9	166	40.64729	73.75578	-73.7558	yes	long extension cord needed to get to power, will need to trench for extension cord	
S1	167	40.64441	73.75713	-73.7571	yes	next to a fire hydrant and on a slight berm	
S2	168	40.64198	73.75951	-73.7595	yes	near fire hydrant, gulls no longer a problem here due to insecticides now using	
8	169	40.63691	73.76799	-73.768	yes	many antennaes near here	

JFK CLUTTER MAPPING POSITIONS

Point	Wypt	N	W	W2	Power	Description	Notes
11	170	40.65927	73.79077	-73.7908	yes	in depression, near fence and lots of traffic, doesn't look as good as other sites	
Z2	171	40.65919	73.79427	-73.7943		approach end of 13L opposite of building 86	
P3	172	40.6619	73.79032	-73.7903	yes	lots of traffic in depression, not very open	
S4	173	40.65491	73.80903	-73.809	yes	near cell phone lot, power from light poles	
	174	40.65643	73.82306	-73.8231		no resolution	
12	175	40.65641	73.82304	-73.823	yes	outfall 6, low flying birds near basin here and geese, maybe put radar on groud here outside gate	
13	176	40.62682	73.77382	-73.7738	no	near wood piles and razor wire which is lower than the normal fence	