

# INTEGRATIVE MIGRATORY BIRD MANAGEMENT ON MILITARY BASES: THE ROLE OF RADAR ORNITHOLOGY

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## Report Documentation Page

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# INTRODUCTION

- There is considerable concern over the declines in populations of migratory birds that breed in North America and winter south of the United States border.
- A considerable amount of protected habitat for migratory birds can be found on military installations.

# INTRODUCTION

- The management of migratory birds on military installations must occur not only during the **breeding** and **wintering seasons** but also during **migration periods** in spring and fall.
- The emphasis of this paper is on the spring and fall migration periods when birds stop on military bases en route to their breeding and wintering grounds.

# INTRODUCTION

- In this paper we discuss how our work with three radar systems can compliment migratory bird management on the ground and also contribute to mission readiness by enhancing flight safety and the avoidance of bird strikes at military installations.

# INTRODUCTION

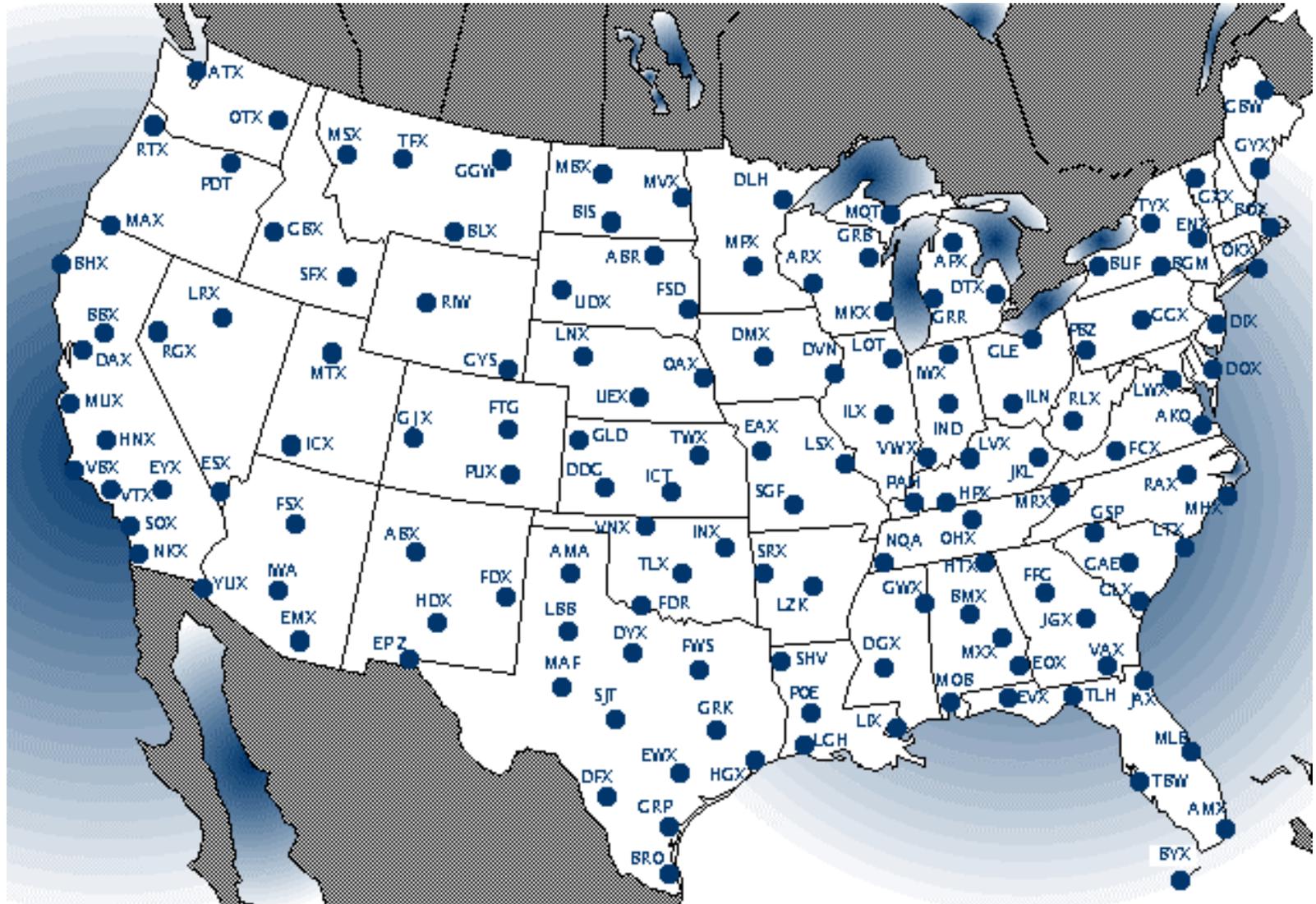
We use three different radar systems to monitor bird migration:

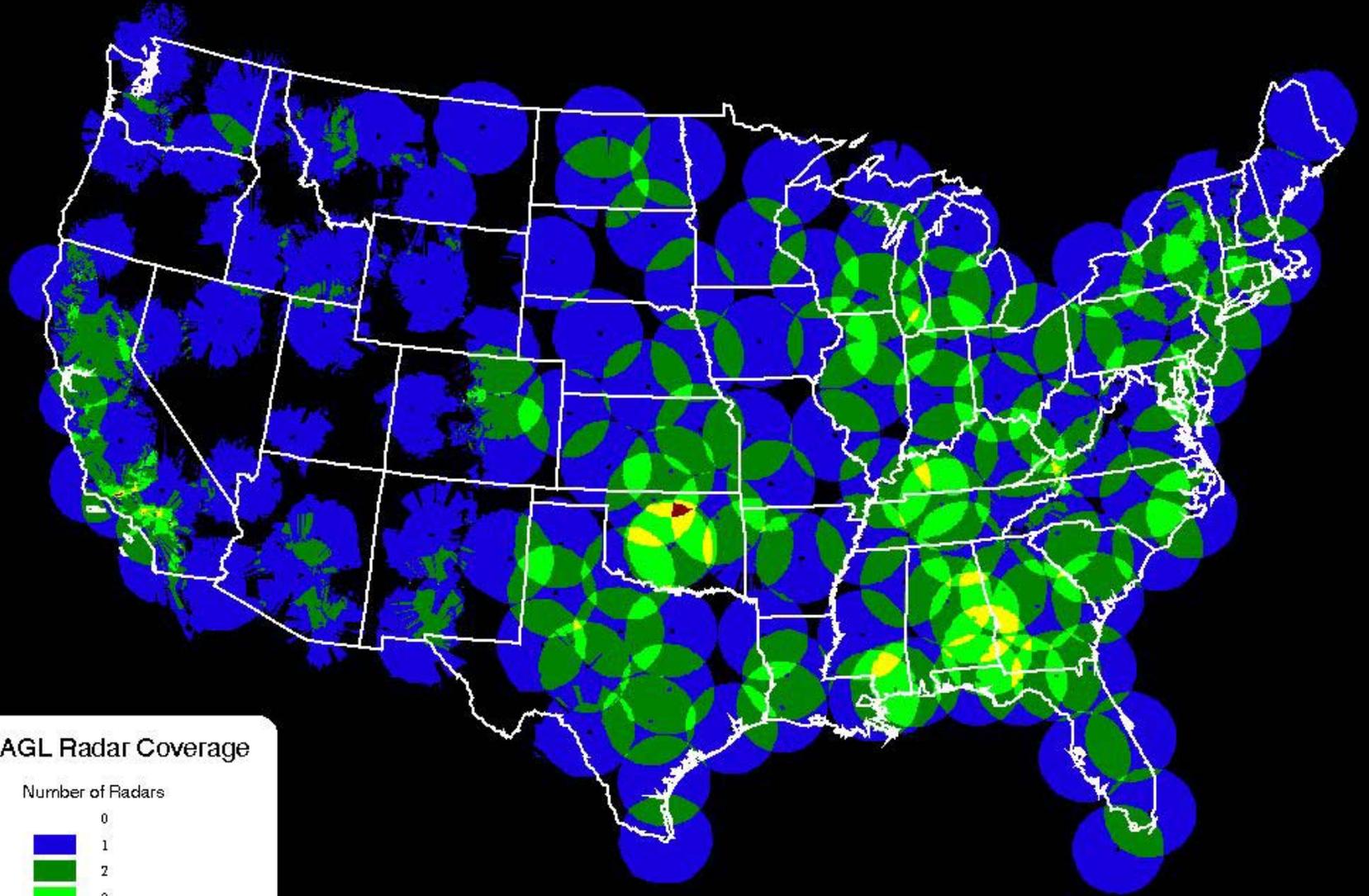
- WSR-88D (weather surveillance radar-1988, Doppler)
- A mobile high-resolution bird-detecting radar BIRDRAD
- Fixed-beam vertically pointing radar and thermal imager

# APPROACH

- Begin with an examination of migratory movements at a continent-wide scale,
- progress to a smaller scale of reference-- the 240km range coverage of individual weather radars,
- move to an even smaller scale—the 6 km range coverage of BIRD RAD, and
- end at the smallest scale with an examination of the flight behavior of individual birds.

# WSR-88D NATIONAL NETWORK

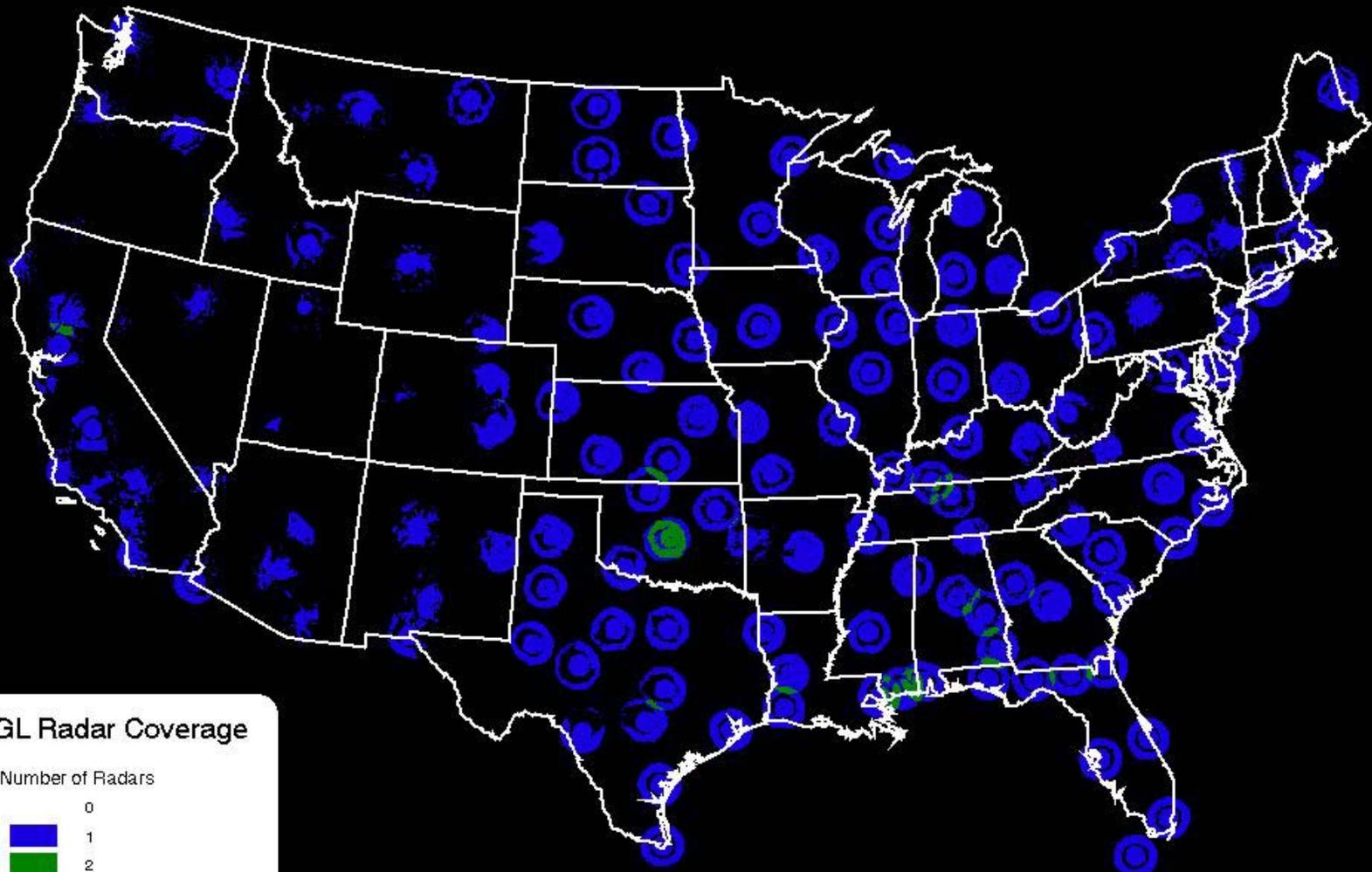




### 3 km AGL Radar Coverage

Number of Radars



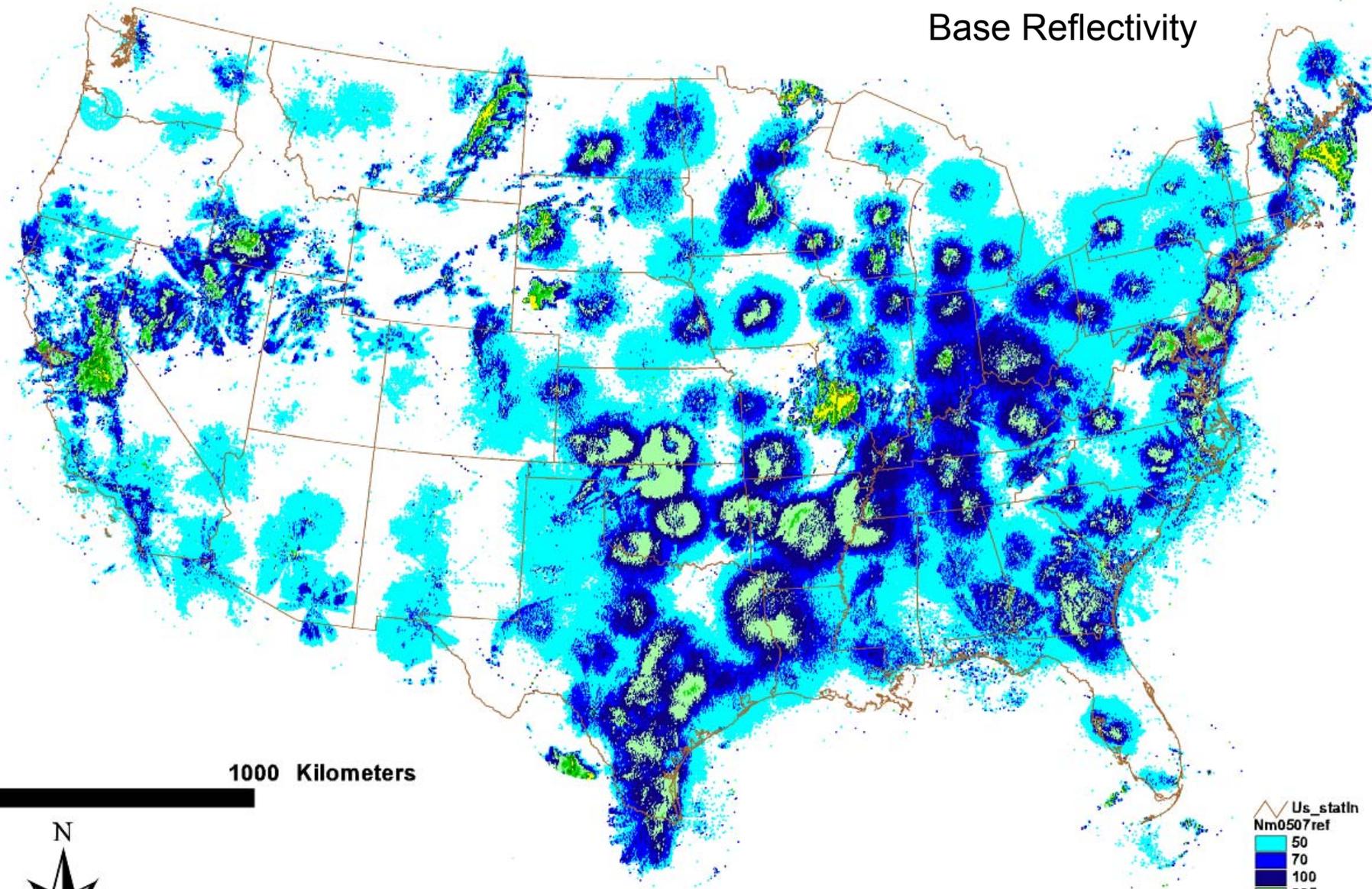


### 1 km AGL Radar Coverage

Number of Radars



# Base Reflectivity

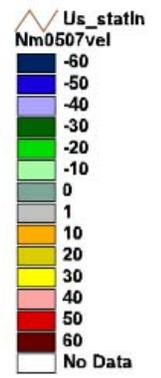
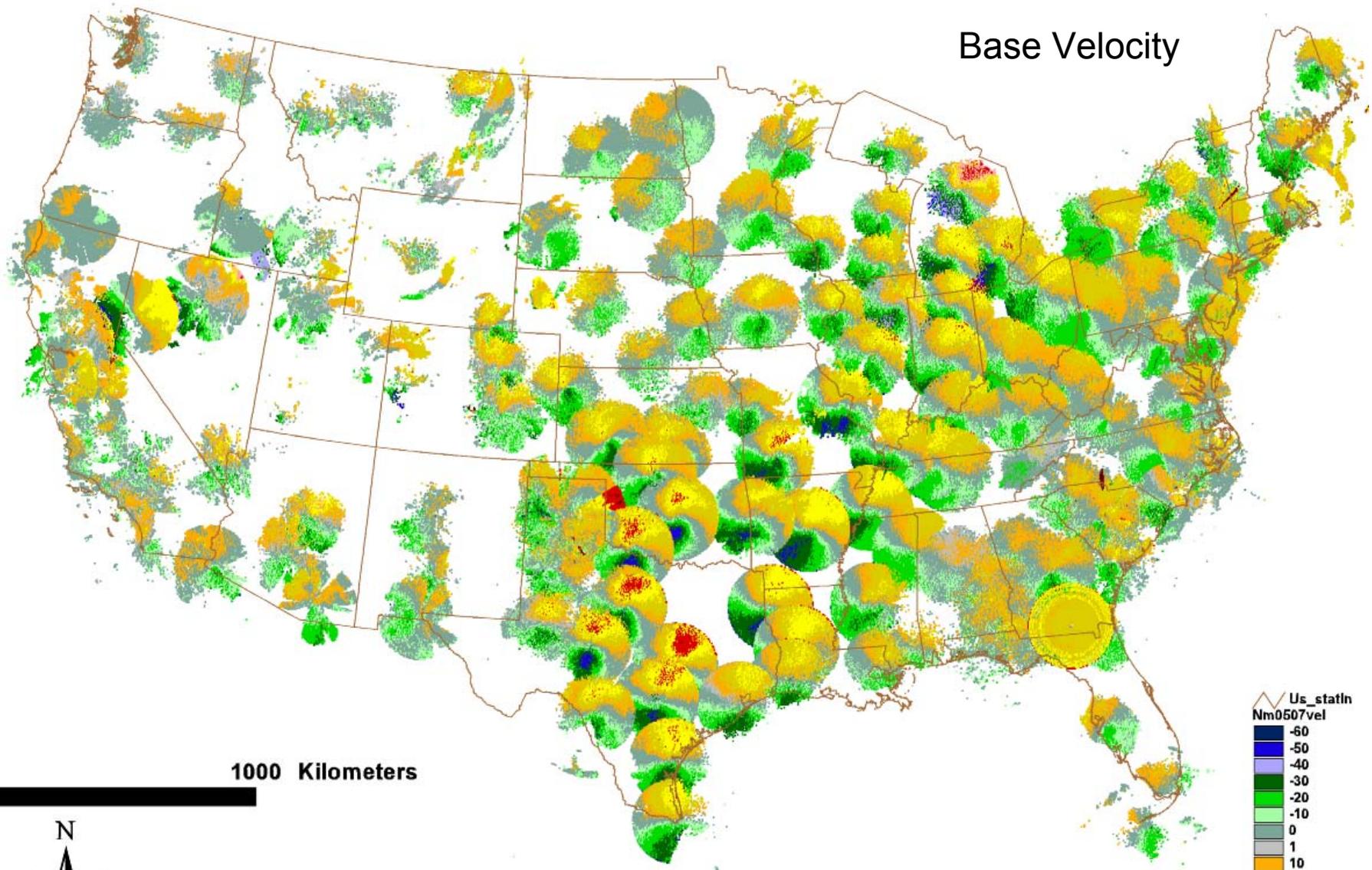


0 1000 Kilometers



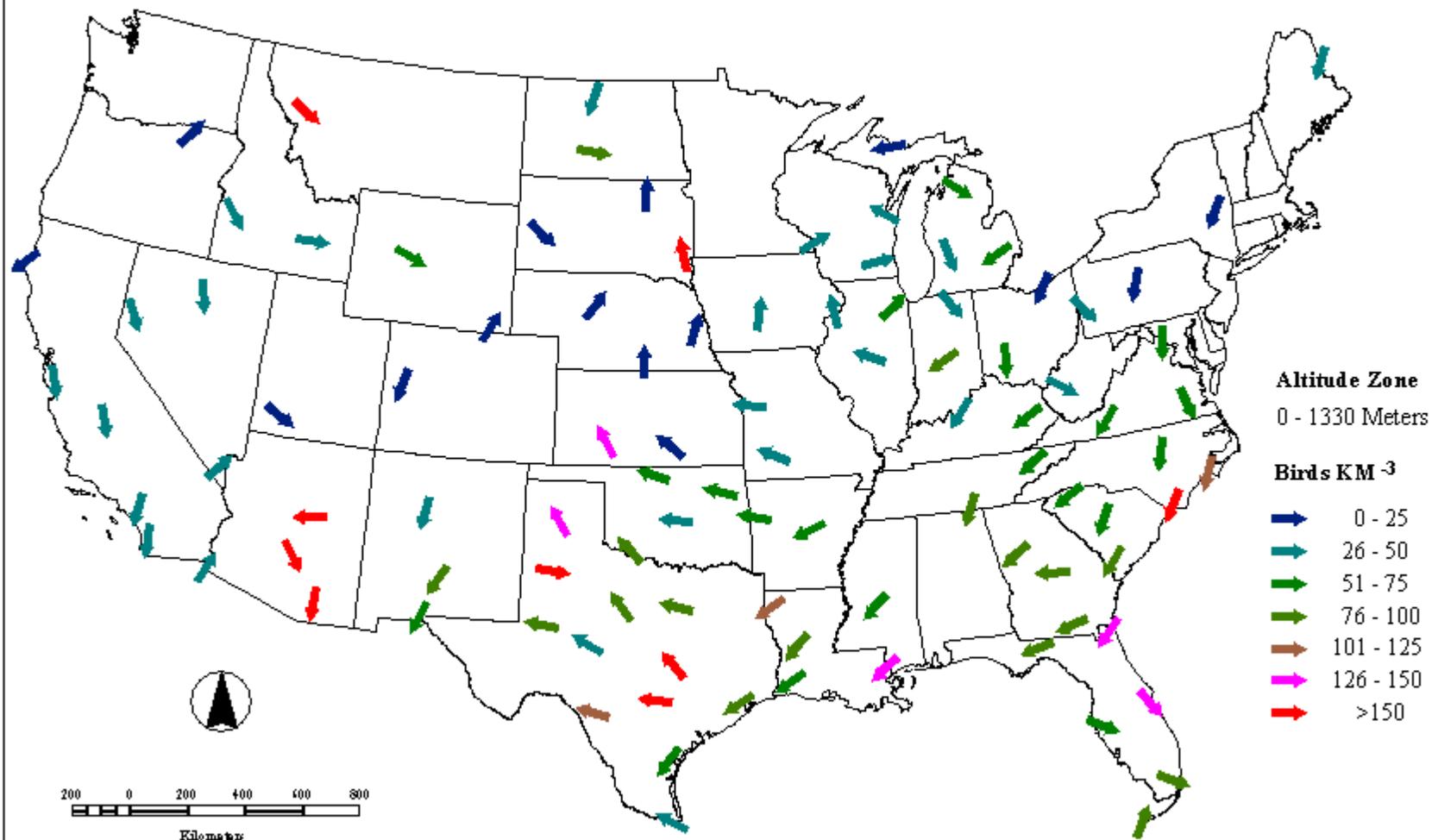
- Us\_statln
- Nm0507ref
- 50
- 70
- 100
- 225
- 600
- >1500
- precip
- No Data

# Base Velocity



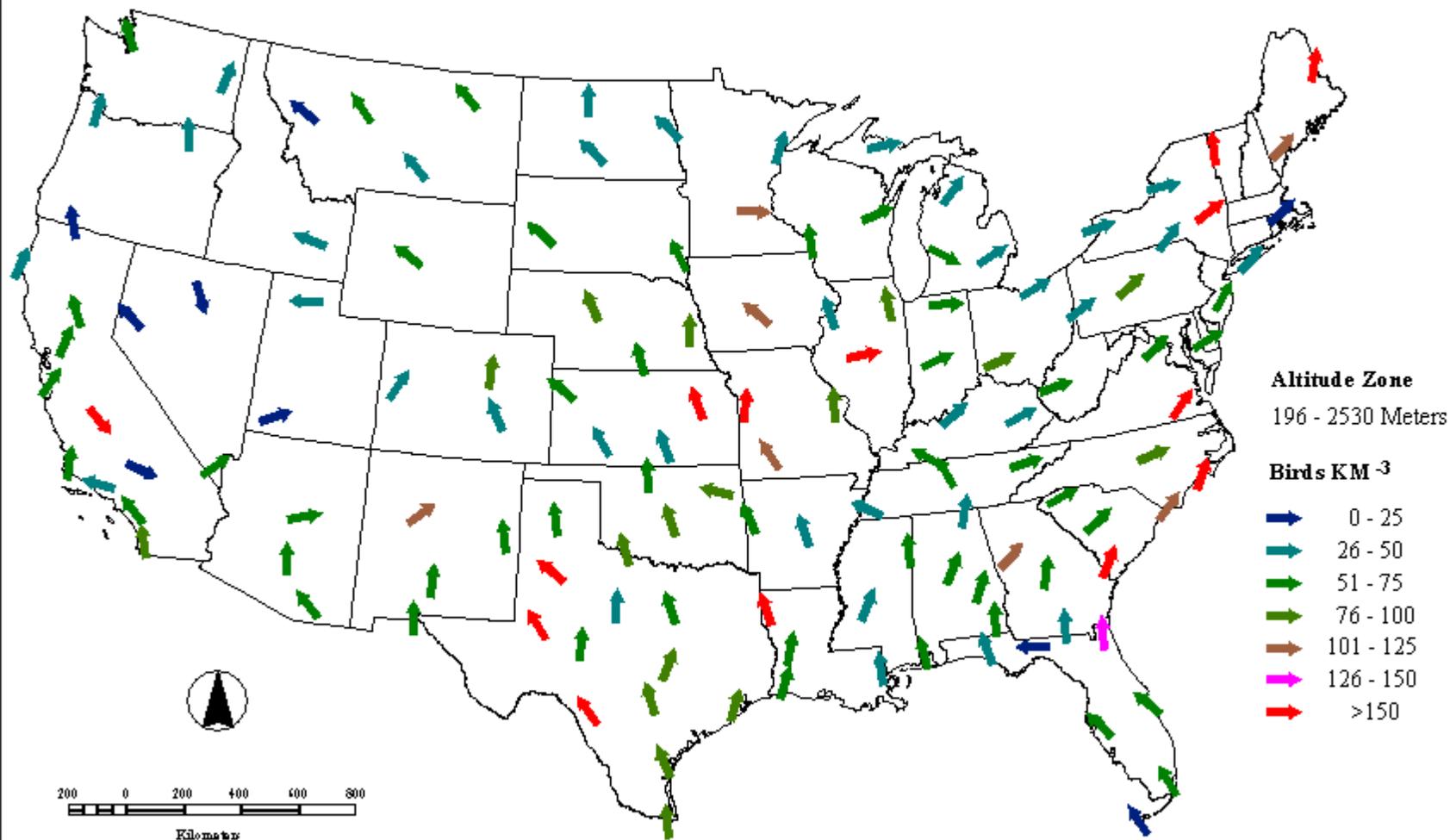
# Continent - Wide Bird Migration for the 0 - 1330 Meter Altitude Zone

8/ 7/ 2004



# Continent - Wide Bird Migration for the 196 - 2530 Meter Altitude Zone

5/ 10/ 2002 - 5/ 11/ 2002



# Continent - Wide Migration for the Highest Two Altitude Zones

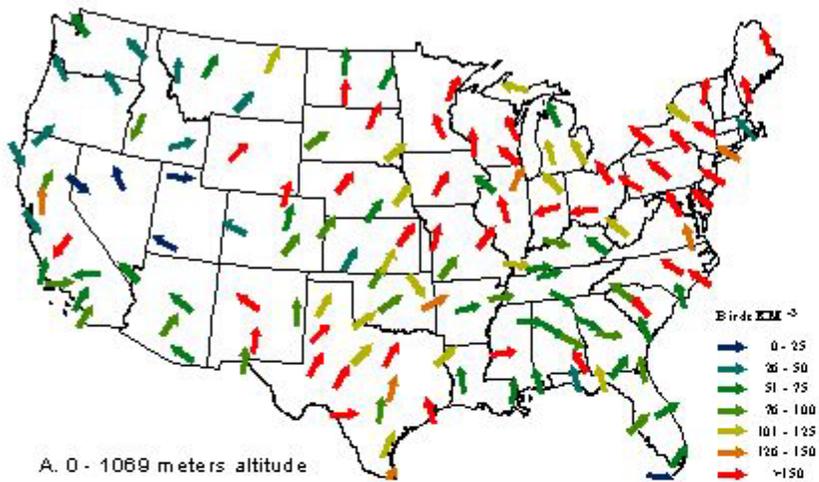
5/ 10/ 2002 - 5/ 11/ 2002



300 0 300 600 900 1200 Miles

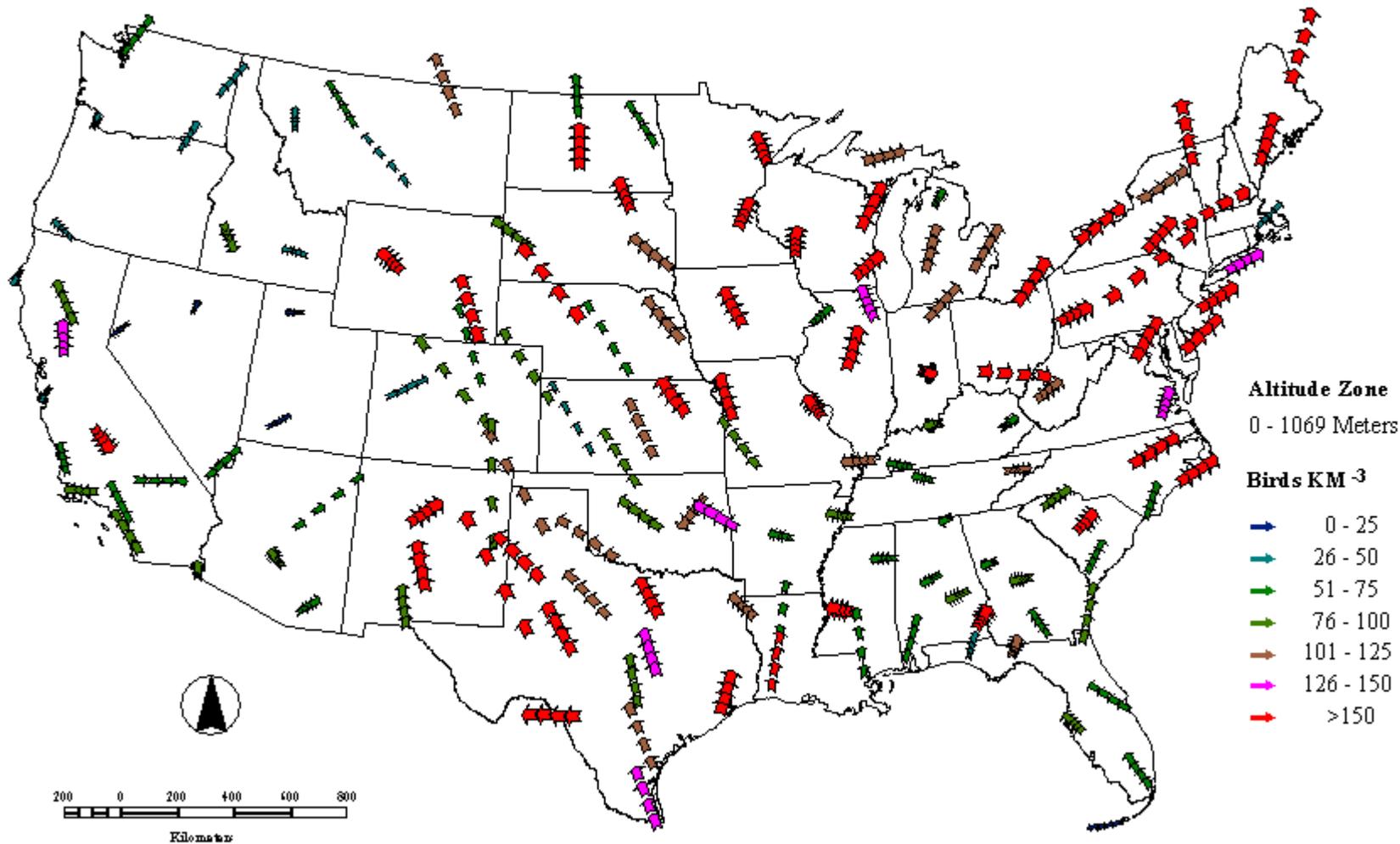
# Continent - Wide Migration for the Lowest Four Altitude Zones

5/ 10/ 2002 - 5/ 11/ 2002



# Continent - Wide Bird Migration for the 0 - 1069 Meter Altitude Zone

5/ 10/ 2002 - 5/ 11/ 2002

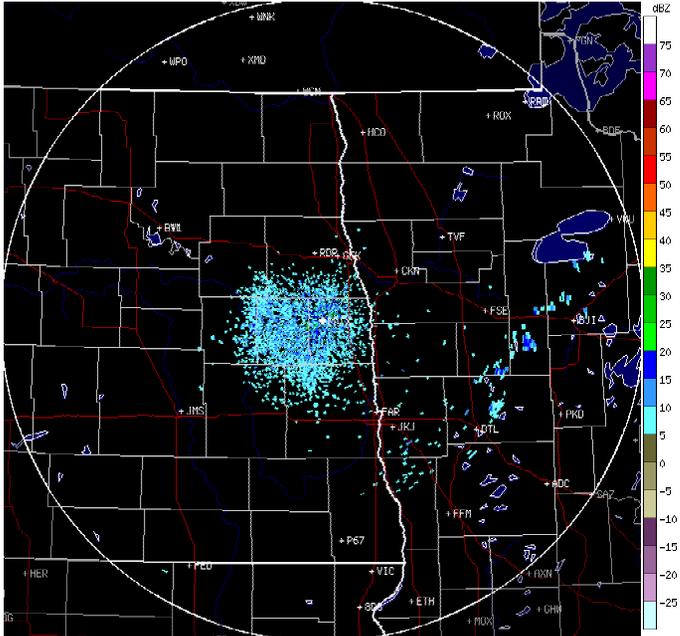


# Single WSR-88D Station

- Analysis of the relationship between weather variables (surface and aloft) and migration intensity and the development of migration forecast models based on forecast weather variables.
- These models will enable natural resource personnel to forecast the best time to census migratory birds on base.

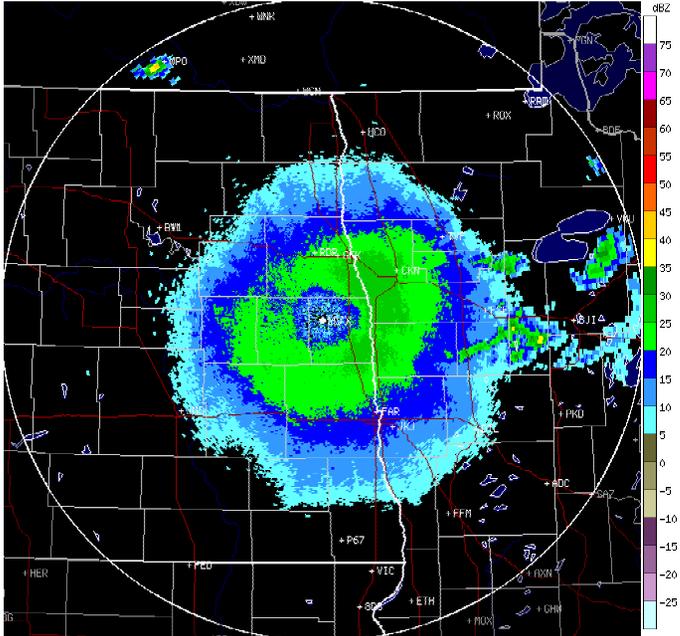
KMVX -- Grand Forks, ND/Mayville  
Base Reflectivity: 0.5 degrees, Precip Mode

03:58:41 UTC Tue 04 May 2004  
(c) UCAR: <http://www.rap.ucar.edu/weather/radar/>



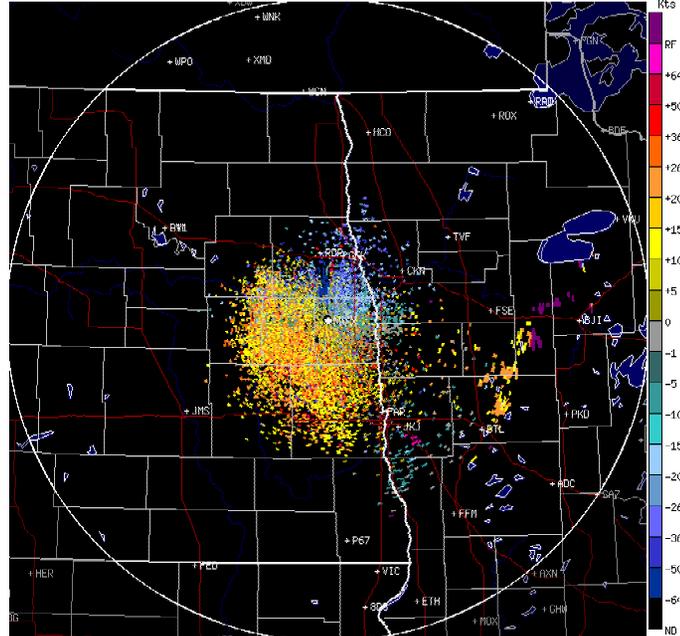
KMVX -- Grand Forks, ND/Mayville  
Base Reflectivity: 0.5 degrees, Precip Mode

04:10:02 UTC Sat 08 May 2004  
(c) UCAR: <http://www.rap.ucar.edu/weather/radar/>



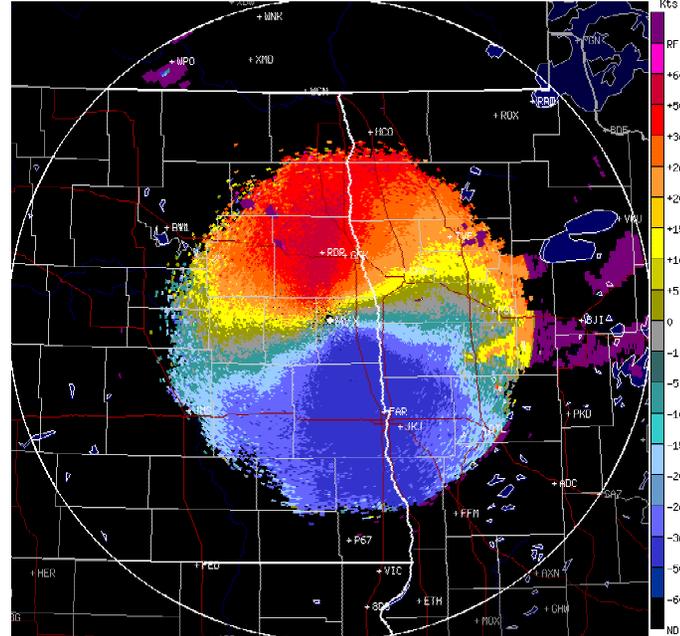
KMVX -- Grand Forks, ND/Mayville  
Base Velocity: 0.5 degrees, Precip Mode

03:58:41 UTC Tue 04 May 2004  
(c) UCAR: <http://www.rap.ucar.edu/weather/radar/>



KMVX -- Grand Forks, ND/Mayville  
Base Velocity: 0.5 degrees, Precip Mode

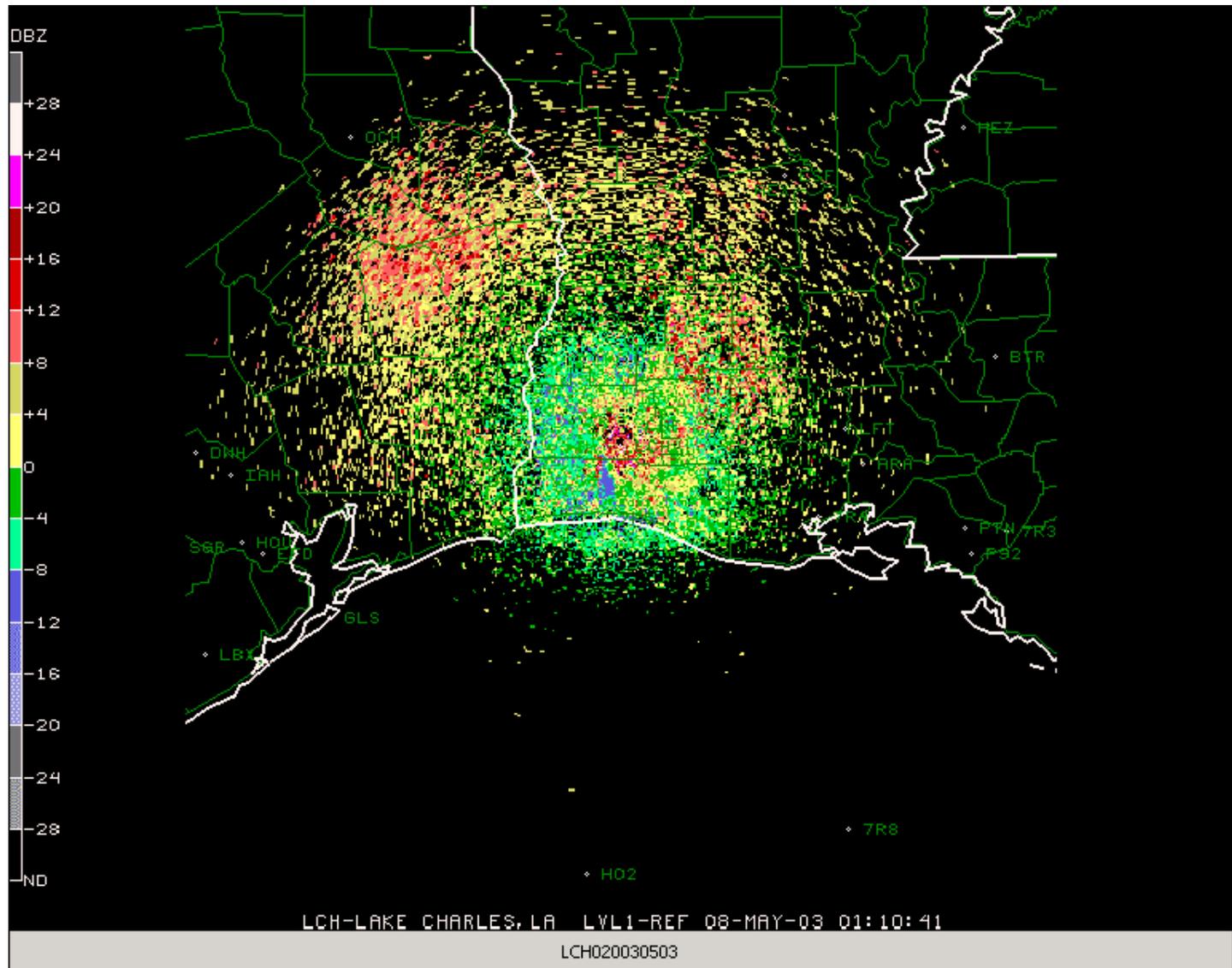
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(c) UCAR: <http://www.rap.ucar.edu/weather/radar/>



# Single WSR-88D Station

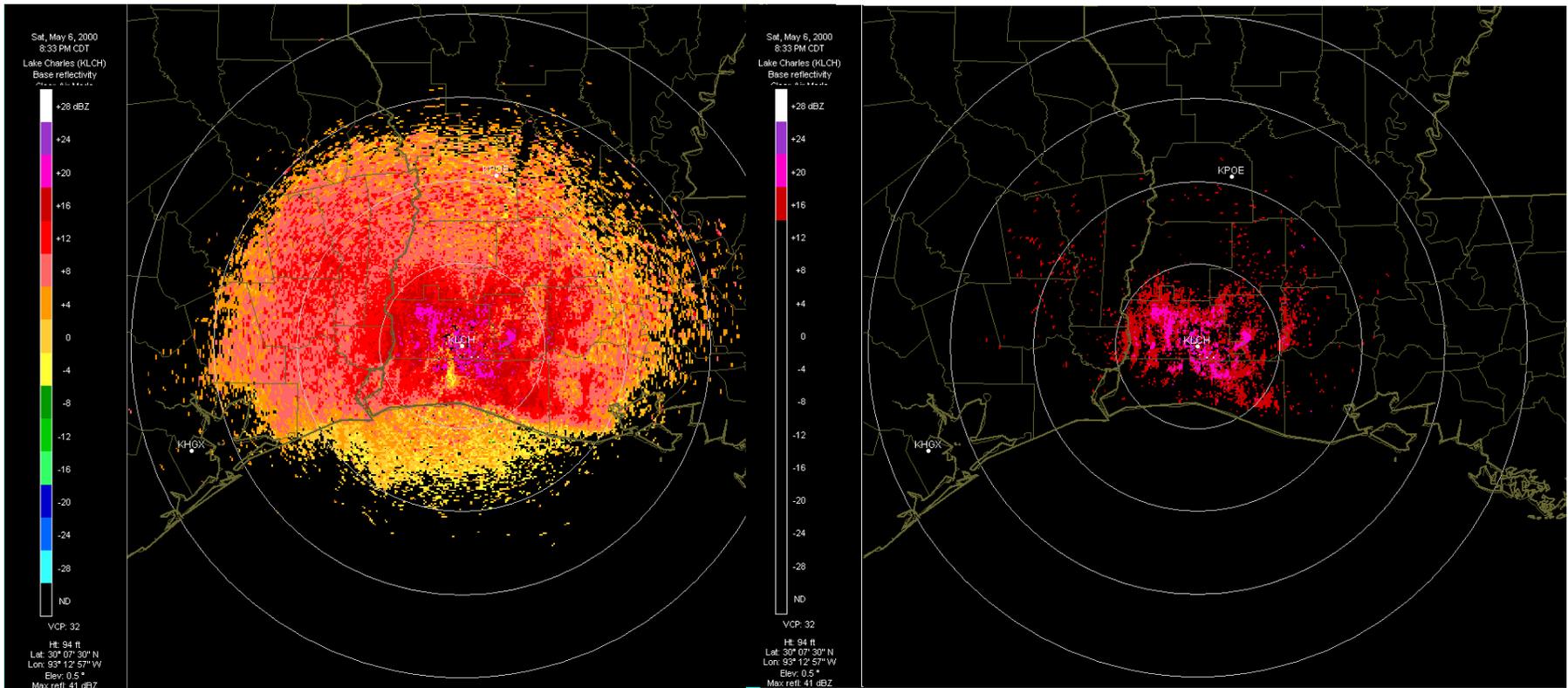
- Delimiting important migration stopover areas by detecting migrants as they depart stopover areas at the beginning of a flight segment.
- Identifying the type of habitat associated with the stopover areas based on classified satellite imagery

# Single WSR-88D Station (Lake Charles, LA) Showing a Migration Exodus Event

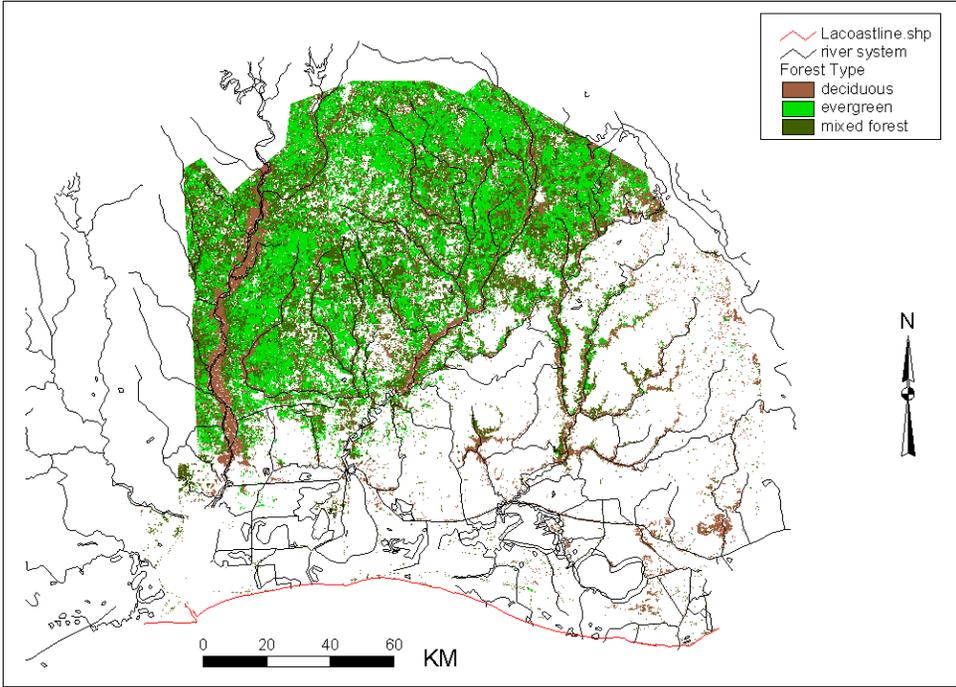


# Lake Charles, LA WSR-88D Station

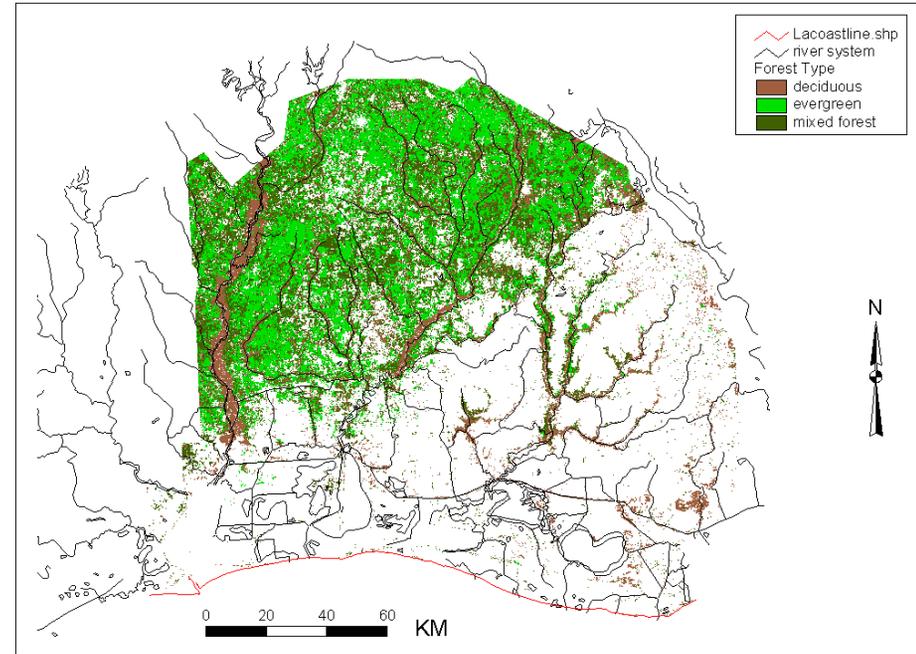
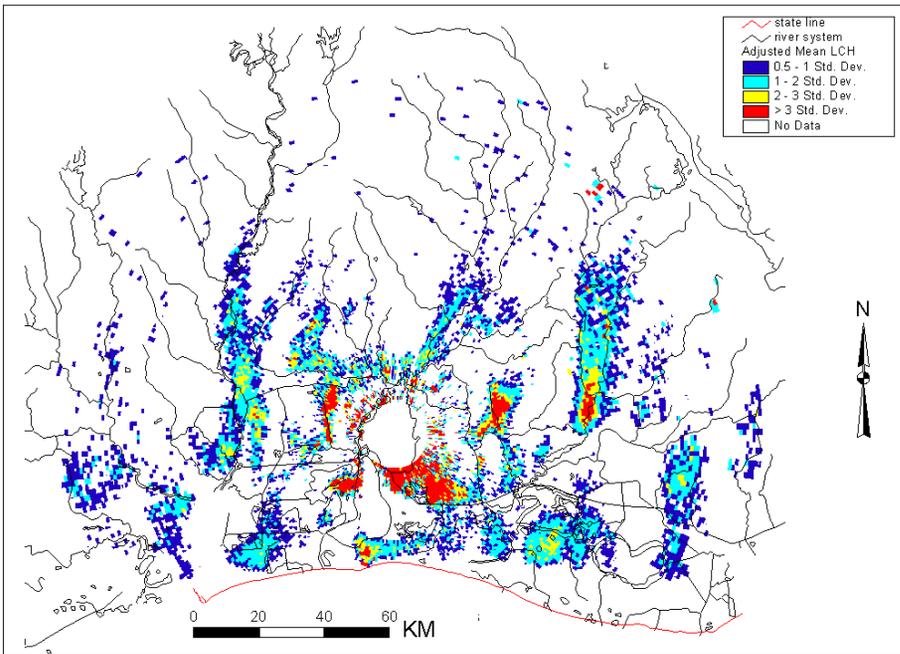
## Concentrations of departing migratory birds indicate locations of important migration stopover areas



# Satellite imagery and Vegetation Classification



# Bird Data from Radar Compared with Forest Type from Classified Satellite Imagery



# Mobile high-resolution bird-detecting radar BIRD RAD

- Furuno 50 kW marine radar
- 3 cm (X-band) wavelength
- parabolic antenna (1 meter)
- echo-trail feature
- GPS data



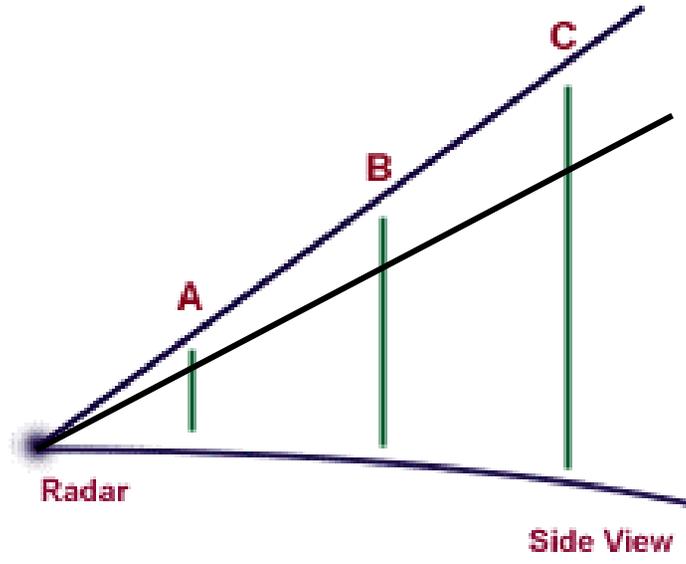
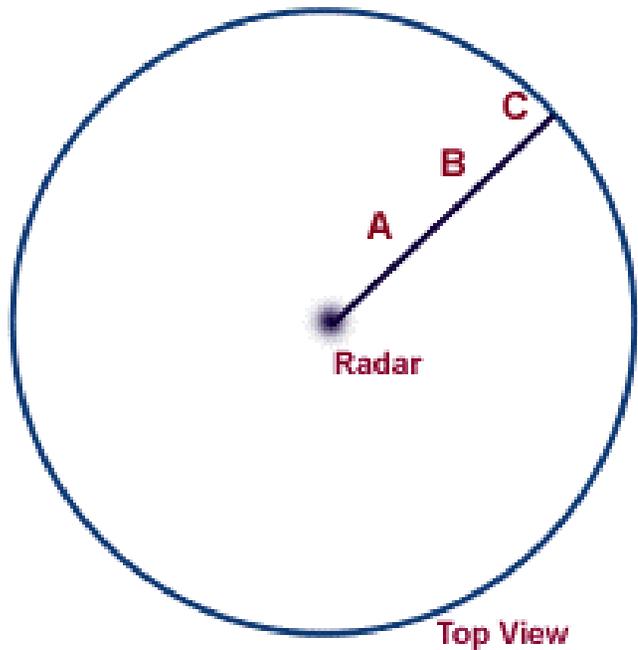
# Mobile high-resolution bird-detecting radar

## BIRD RAD



# Mobile high-resolution bird-detecting radar BIRD RAD



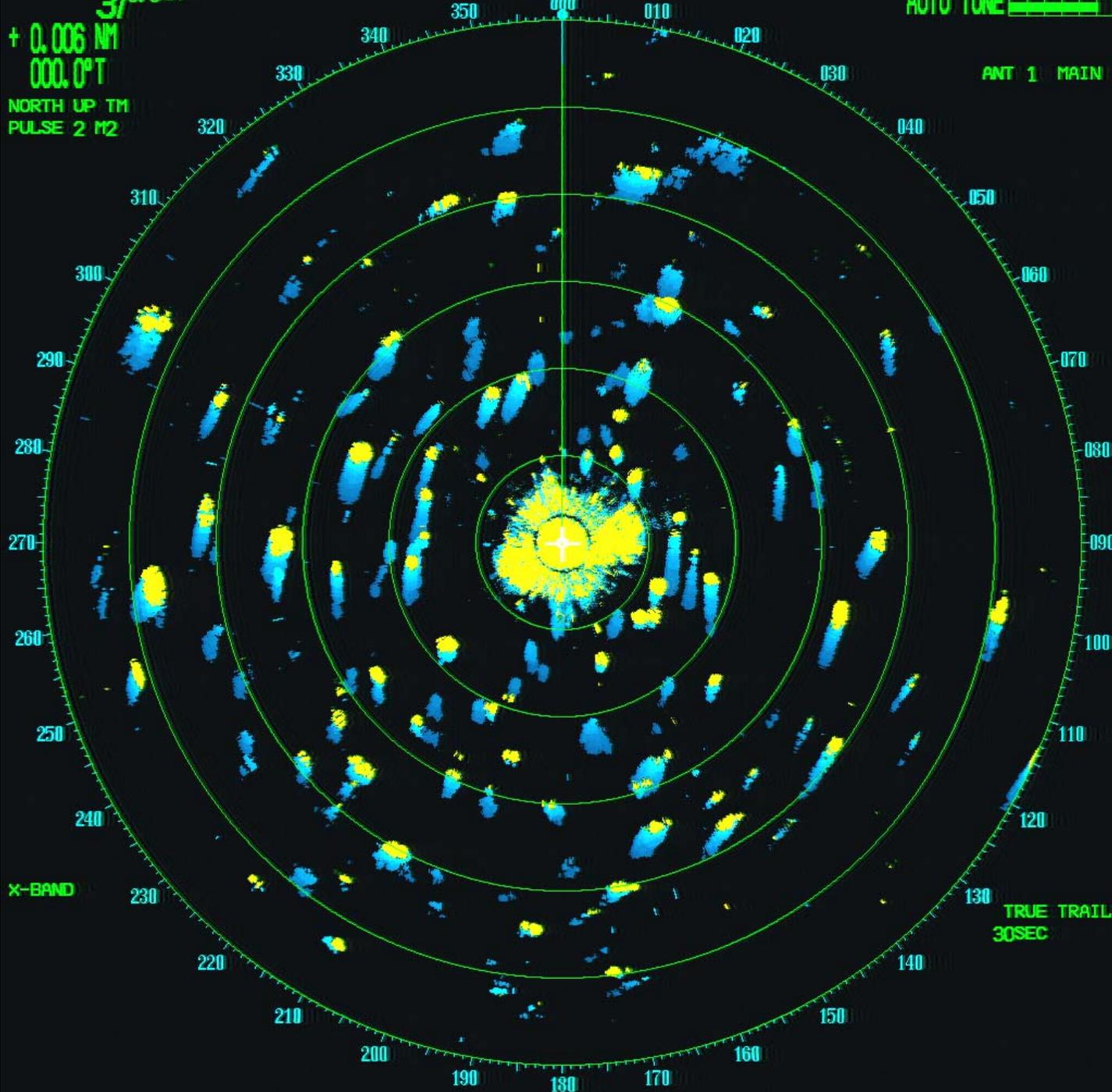


3/0.5NM  
+ 0.006 NM  
000.0°T  
NORTH UP TM  
PULSE 2 M2

AUTO TUNE 

HDG 0.0°T GYRO  
SPEED 0.0KT WT LOG

EPA  
TRUE VECTOR 30SEC WT



ANT 1 MAIN

TRUE TRAIL  
30SEC

OWN SHIP [GP]  
29° 40.156 N  
94° 04.477 W  
+CURSOR POSM  
29° 40.162 N  
94° 04.477 W

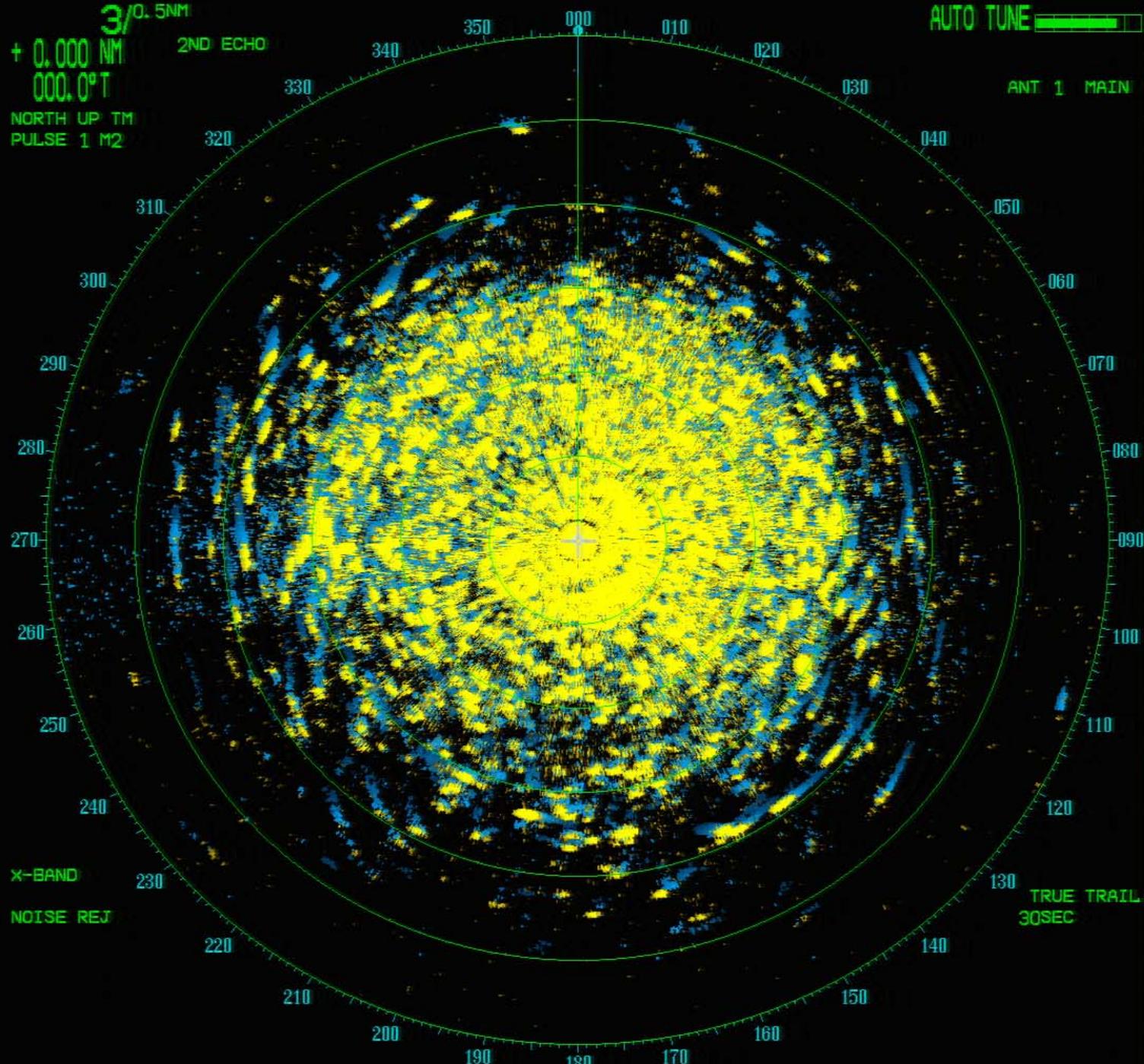
02-MAY-2003 00:10 UTC

3/0.5NM  
+ 0.000 NM  
000.0°T  
NORTH UP TM  
PULSE 1 M2

AUTO TUNE 

HDG 0.0°T GYRO  
SPEED 0.0KT WT MAN

EPA  
TRUE VECTOR 30SEC WT



ANT 1 MAIN

X-BAND  
NOISE REJ

TRUE TRAIL  
30SEC

OWN SHIP [GP]  
34° 39. 210 N  
82° 50. 247 W  
+CURSOR POSN  
34° 39. 210 N  
82° 50. 247 W

13-OCT-2003 00:49 UTC

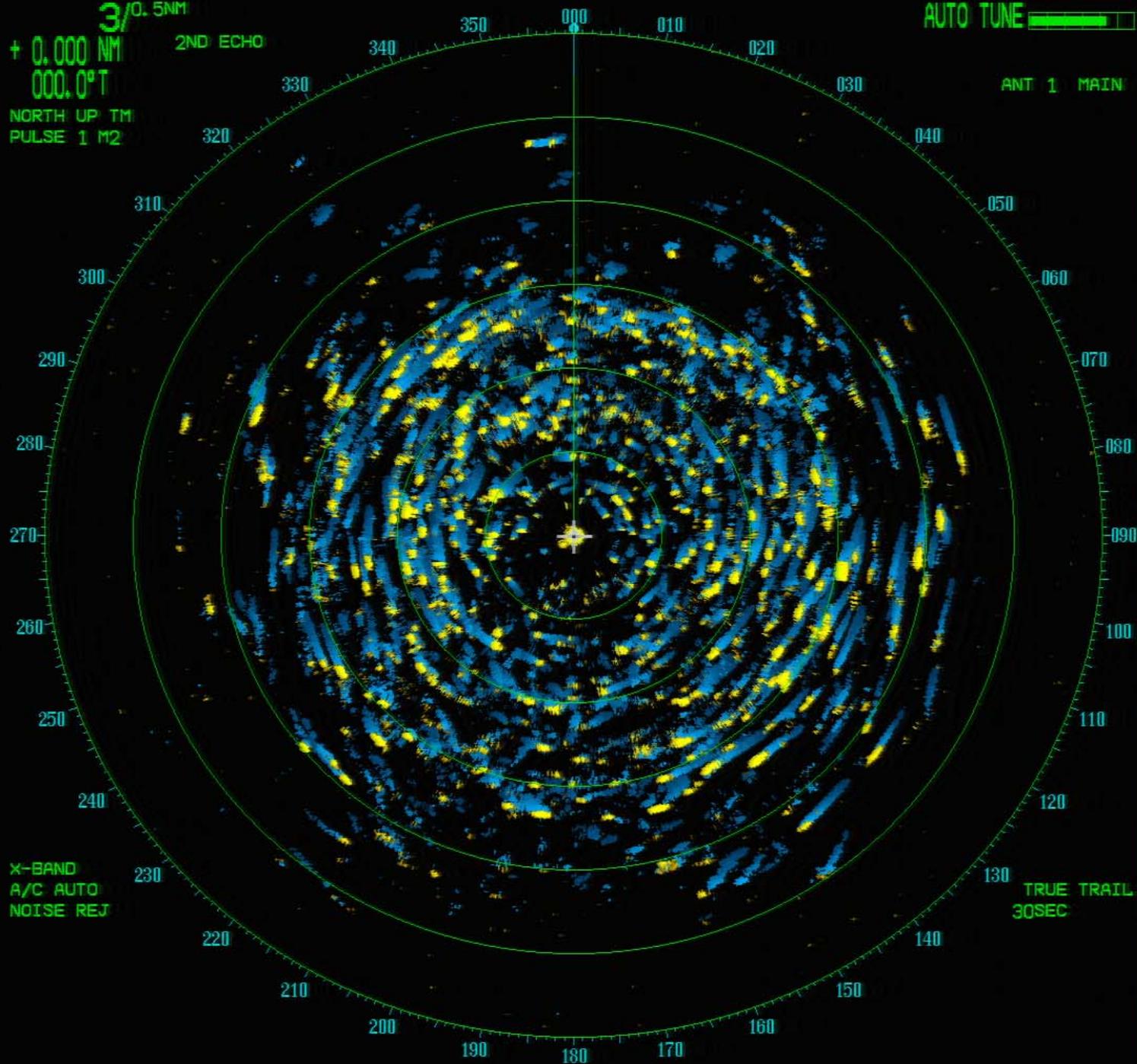
--- SIGNAL MISSING ---  
EPFS

3/0.5NM  
+ 0.000 NM  
000.0°T  
NORTH UP TM  
PULSE 1 M2

AUTO TUNE 

HDG 0.0°T GYRO  
SPEED 0.0KT WT MAN

EPA  
TRUE VECTOR 30SEC WT



ANT 1 MAIN

X-BAND  
A/C AUTO  
NOISE REJ

TRUE TRAIL  
30SEC

OWN SHIP [GP]  
34° 39. 210 N  
82° 50. 246 W  
+CURSOR POSN  
34° 39. 210 N  
82° 50. 246 W

13-OCT-2003 00:52 UTC

--- SIGNAL MISSING ---  
EPFS

# Thermal imaging and fixed vertical-beam radar

- altitude of movement
- direction of movement
- flock size







153 153 25

153 153 153

5-01-03 THU  
11:02:51 PM

I

I

LIVE



153 153 25

153 153 25

5-01-03 THU

11:02:34 PM

I

I

LIVE

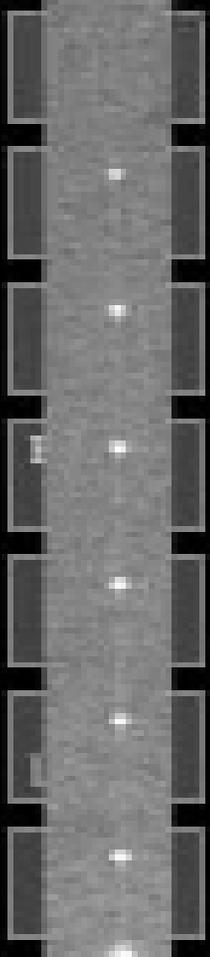


153 153 25

15 15 15

5-03-03 SAT

9:28:51 PM



Watch  
Live

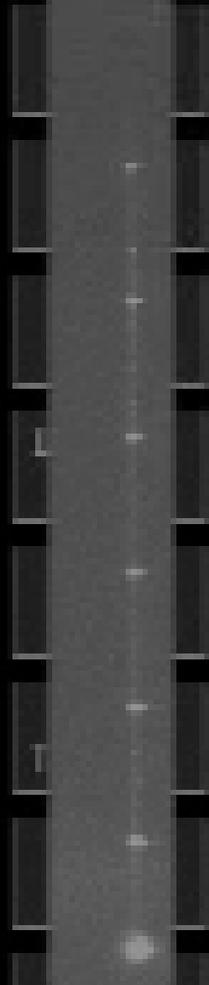


12:12:32

12:12:32

5-03-03 SAT

8:37:00 PM



L

T

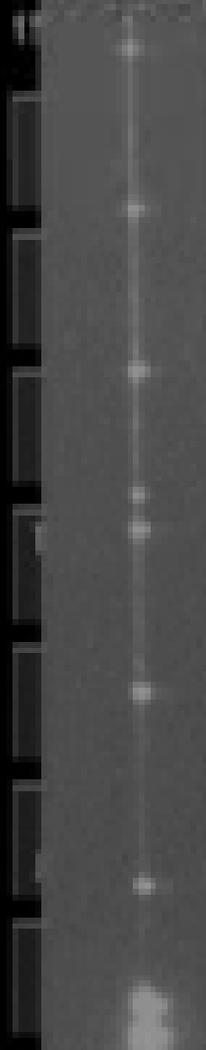
Live



10-13-88 FRI

1:18:21 AM

154111.3



UTDR  
Live



# Conclusions

- Radar ornithology is a valuable tool for the management of migratory birds on military installations:
  - Monitor migration at continent-wide scales
  - Delimit important migration stopover areas
  - Forecast migration intensity and facilitate on-the-ground bird identification and habitat association work
  - Enhance flight safety

# Acknowledgements

- Department of Defense Legacy Resource Management Program
- Department of the Navy, Naval Facilities Engineering Command HQ
- Houston Audubon Society
- Don van Blaricom, Alan Cunningham, Kang Shou Lu, and Stephen Jones for NIDS and GIS work





<http://www.clemson.edu/birdrad>