

# Use of Radar in the United Kingdom for Assessment of Offshore Wind Facilities and Pertinent Research

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A Workshop:  
Offshore and Nearshore Wind Facilities – Seaduck Impacts  
Second North American Seaduck Conference  
Annapolis, Maryland  
November 7-11, 2005

# What will we talk about:

- Off-shore wind energy - what, where, when
- United Kingdom – about their guidance for environmental assessment of wind energy projects with regard to birds
- Methods – mostly about radar

# The Service favors:

- Conservation of wildlife that are in the public trust - for the enjoyment of people now and in the future.
- Development of renewable energy, including from wind, that is friendly to birds, bats, other wildlife.
- Informed decisions based on adequate environmental assessment, including:
  - use of the affected air space by birds and bats over time,
  - impacts to wildlife - direct, indirect, and cumulative.



Information is key to informed decisions.



# Wind Turbine EVOLUTION



**Inland  
Wind Turbine**

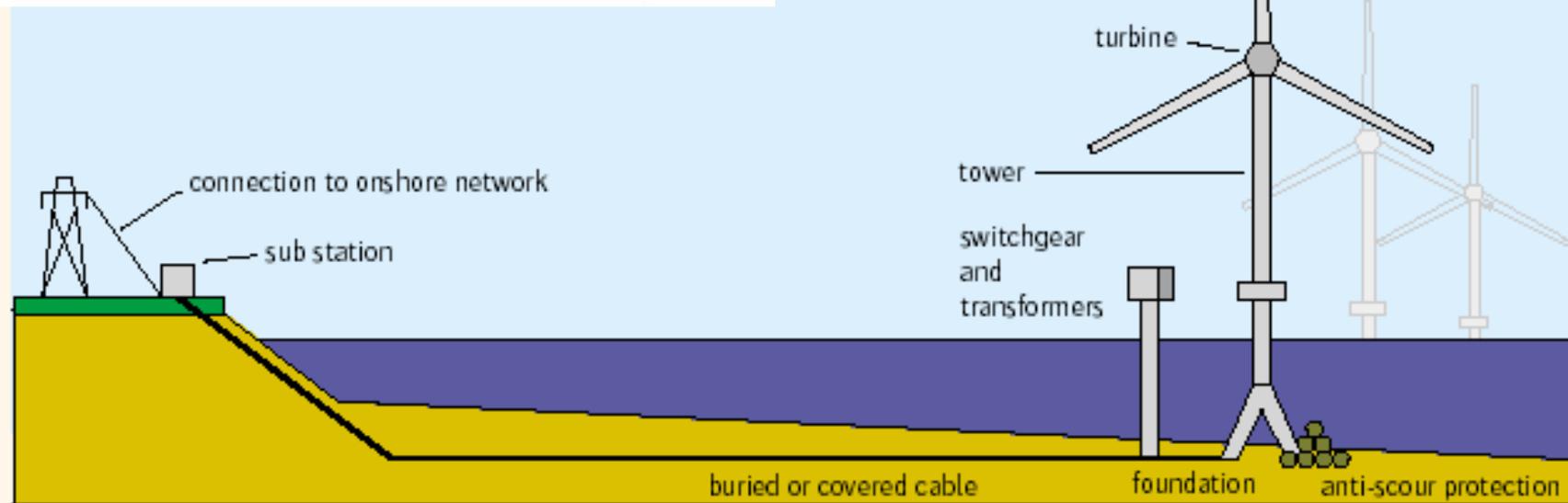
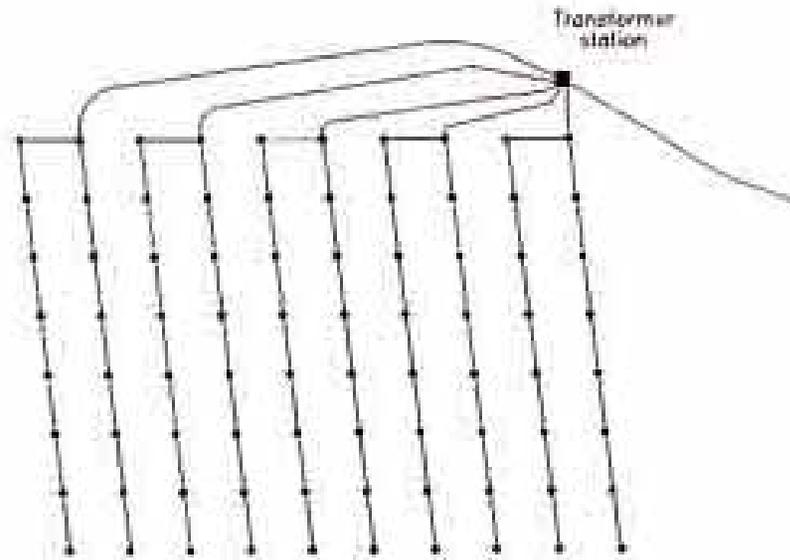


**Offshore  
Wind Turbine**



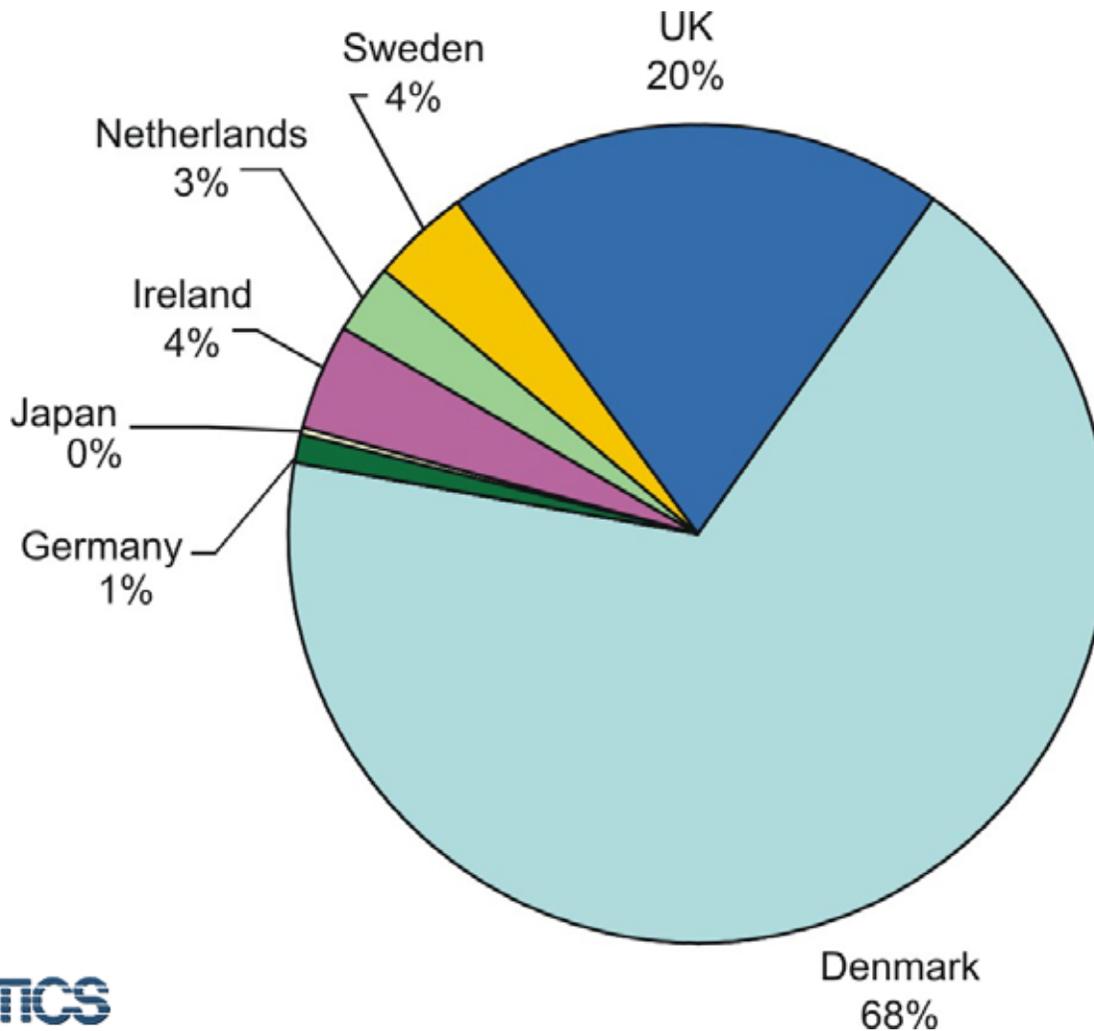
**Deep Water  
Wind Platform**

# Typical Offshore Wind Farm Layout

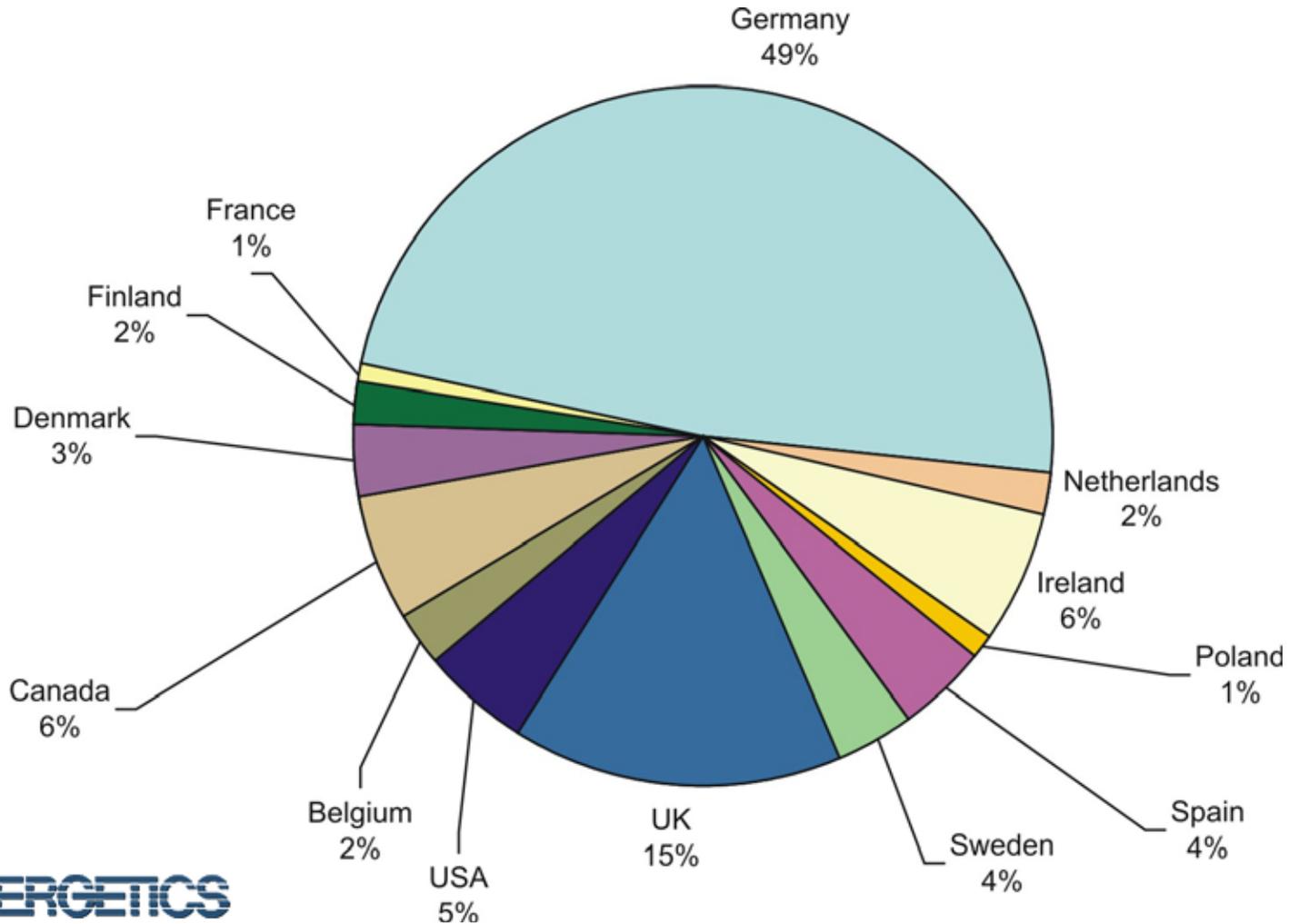


# Offshore Wind Projects

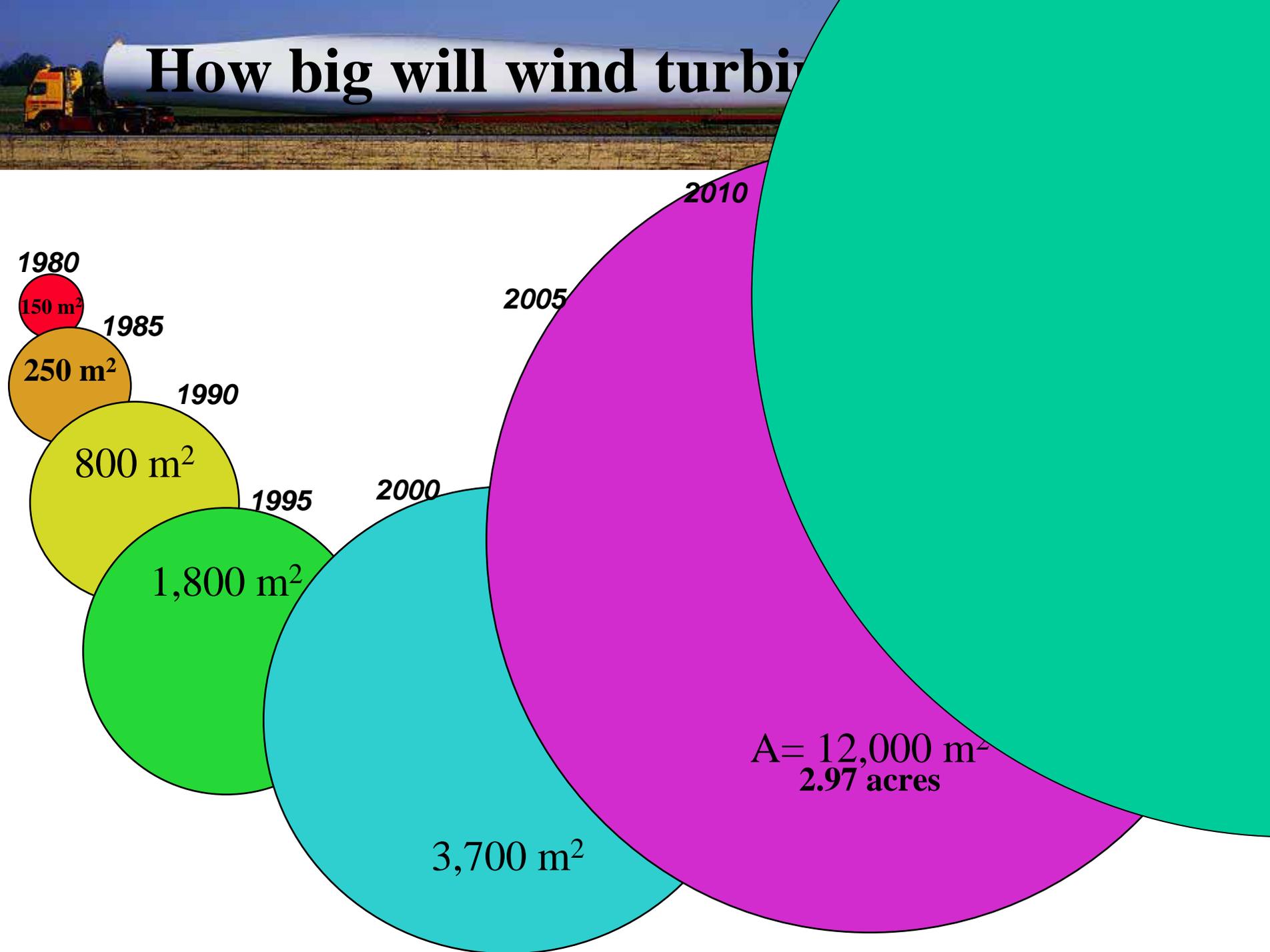
## Worldwide: 617 MW (2004)



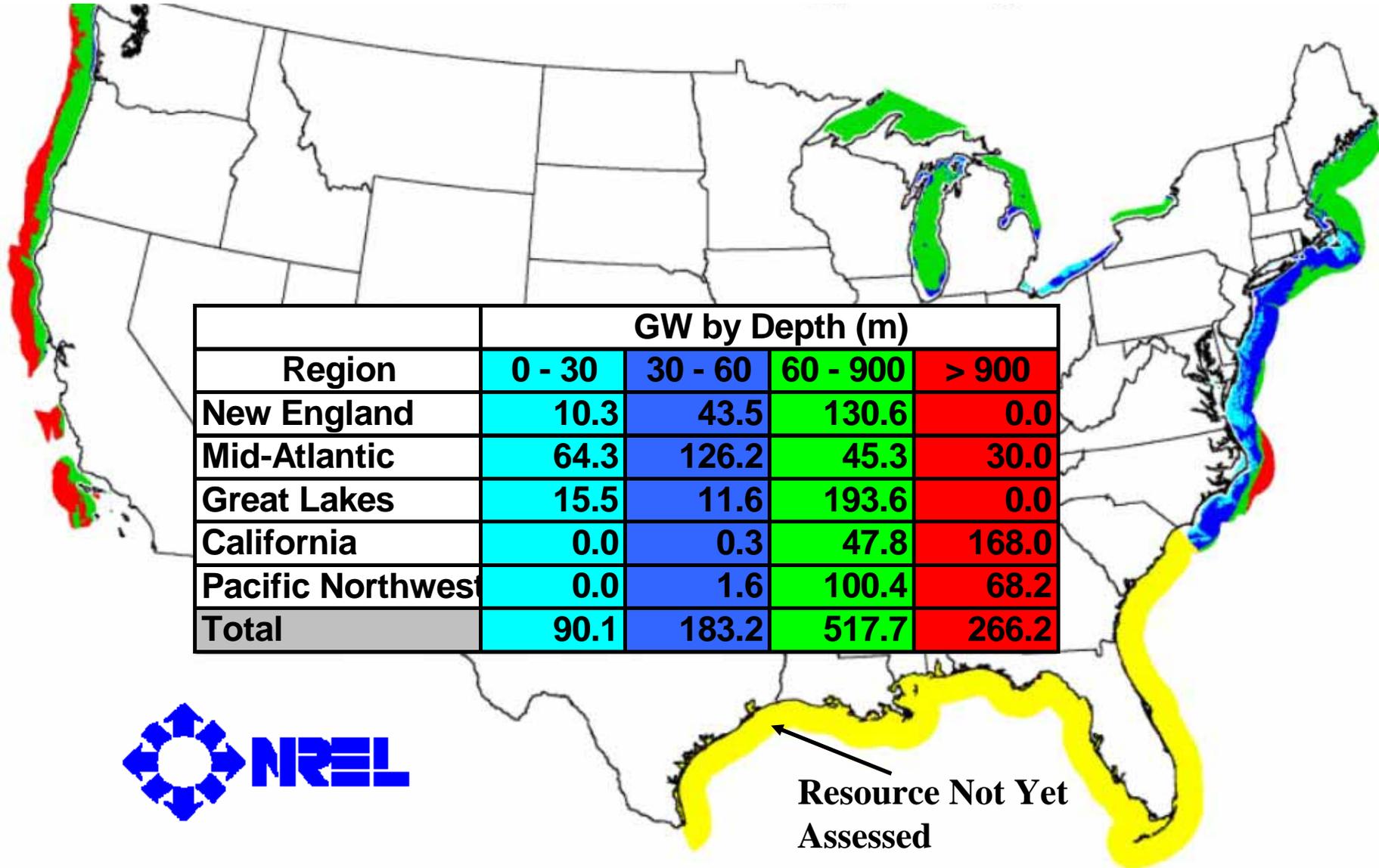
# Projected Offshore Wind Projects 11,455 MW (through 2010)



# How big will wind turbine



# U.S. Offshore Wind Energy Resource



In the United Kingdom, permitting is advised by the statutory body with jurisdiction for the region (England, Wales, Scotland, or Northern Ireland):

- Nature Conservancy Council for England (English Nature)
- Countryside Council for Wales
- Scottish Natural Heritage
- Northern Ireland Wildlife Service

In the United Kingdom, information needs for environmental impact assessment, including avian use of the project area prior to, during, and after construction, are informed by:

- statutory body with jurisdiction
- two guidance documents
- site-specific development requirements

# One of these documents is the DEFRA document:

- DEFRA - Department for Environment, Food and Rural Affairs
- Title - *Nature Conservation Guidance on Offshore Windfarm Development*

A guidance note on the implications of the EC Wild Birds and Habitats Directives for developers undertaking offshore windfarm developments (Version R1.9). March 2005. pp. 124.

- Prepared by - DEFRA in cooperation with the Scottish Executive, the National Assembly for Wales, Department of the Environment, the Countryside Council for Wales, English Nature, Scottish Natural Heritage and the Joint Nature Conservation Committee.
- Web link -

<http://www.defra.gov.uk/wildlife-countryside/ewd/windfarms/findfarmguidance.pdf>

## The other document is the COWRIE document:

- COWRIE – Collaborative Offshore Wind Research into the Environment
- Title – *Best Practice Guidance for the Use of Remote Techniques for Observing Bird Behavior in Relation to Offshore Windfarms*

A discussion document produced for the COWRIE consortium (first draft for comments). March 21, 2005. pp. 85.

- Prepared by – Mark Desholm, Tony Fox, and Patrick Beasley
- Web link -

[http://www.thecrownestate.co.uk/1355\\_remote\\_techniques\\_int\\_rpt\\_05\\_03\\_21.pdf](http://www.thecrownestate.co.uk/1355_remote_techniques_int_rpt_05_03_21.pdf)

## Site-specific development requirements include for example:

- Geographic location of the wind energy facility
- Size of the area and number of turbines
- Avian resources in the area
- Available baseline information on avian resources, i.e., , use in time and space including preconstruction flight patterns and trajectory
- Four impact types – habitat loss, displacement, barrier effects, collision mortality
- Significance of impacts – cumulatively with other projects and overall effect of all four impact types

## Significance — (from DEFRA guidance p 24)

- **Information** collected through surveys should provide the basis for determining if there is going to be a significant impact on birds.
- **Definition based on** the seven impact factors: magnitude, type, extent, duration, intensity, timing, and probability.
- **Definition not fixed** and can vary between projects.
- Each project to evaluate each impact factor.
- **No thresholds given** in terms of defining *significant*.
- **Consultation necessary** with appropriate organizations to determine the likely significance of impacts.

## Surveys — ( DEFRA guidance, Tables 2.2 and 2.3, pages 20 and 21)

- **Area** is the whole project area plus buffer of 1 to 2 km
- **Greater coverage** for aggregated distributions, smaller sample areas where birds are more evenly distributed.
- **Information** – bird numbers, distribution and density, behavior, movements and flight heights, records of any species not suitable for detection by aerial surveys.
- **Methods** – aerial, ship-based, **adapted marine radar** - multiple methods are often used because methods vary in the information that can be reliably obtained.

## Survey Duration -

- **3 years pre-construction** to give some indication of natural variation in bird numbers and distribution from year to year, unless no important concentrations of birds use the area that are subject to significant annual variation in numbers and distribution. (DEFRA guidance, Table 2.3, page 21).

## What works and what does not?

- Generally confined to describing bird movements in three-dimensional space.
- Surveillance radar cannot distinguish between individual birds and flocks of birds.
- Number of targets represents the minimum number of birds - not the total number of birds.
- Cannot detect collisions directly.
- If some birds in a flock collide with a turbine, the moving echo on the radar monitor will continue on the other side of the turbines as if nothing happened and no collision will be recorded.

Small high-resolution radars can be used to measure the altitude of flight as well as the direction and speed of travel within a few kilometers of the radar.



Small radars, often based on X-band marine radar





Label on a black component mounted on the wall.

Label on a grey component mounted on the wall.

Label on a grey component mounted on the wall.

Pulse Labs  
Label on a power supply unit mounted on the wall.

Label on a power outlet mounted on the wall.

SyncMaster 770 TFT  
Label on a cardboard box under the desk.

Label on a blue trash can under the desk.

Label on a tower PC case under the desk.

# Avian Radar



# Mobile Radar Unit

- Radar can count biological targets
  - Birds
  - Bats
  - Insects



# Visual Observations – Radar



# Avian Radar Barge

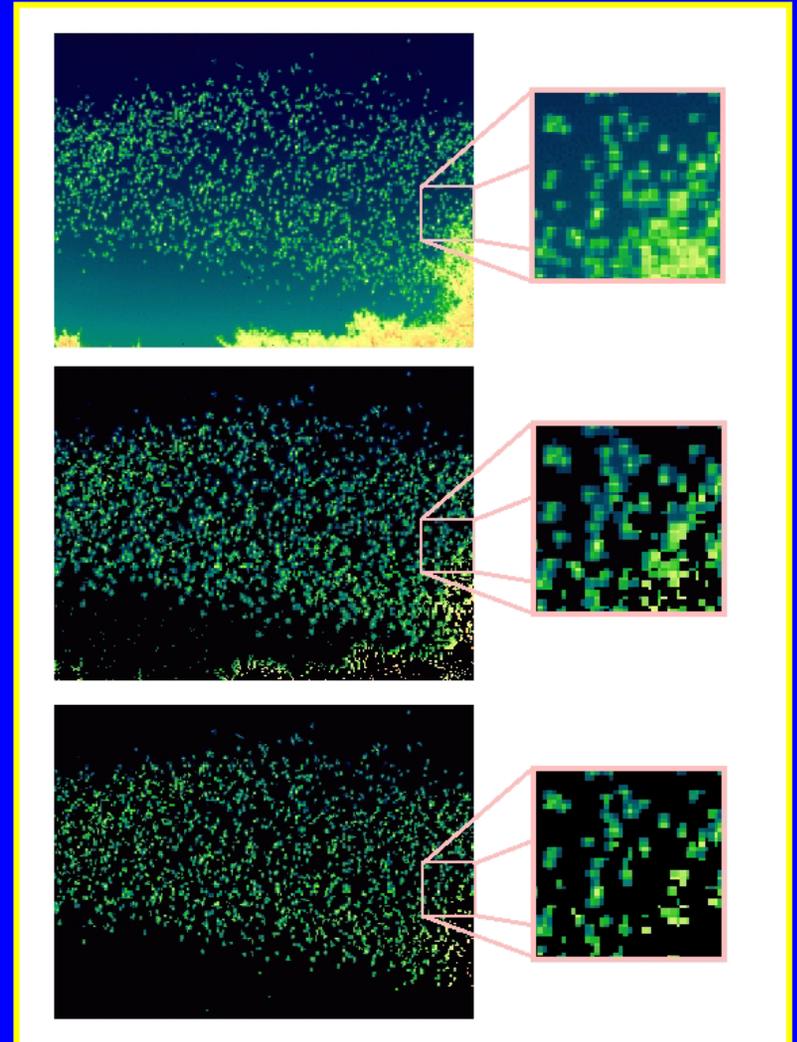


# Computer Vision Filtering of "Noise"

1. Unfiltered image  
(leaved tree branches in lower right)

2. Filtered image  
(non-moving images of leaves are removed)

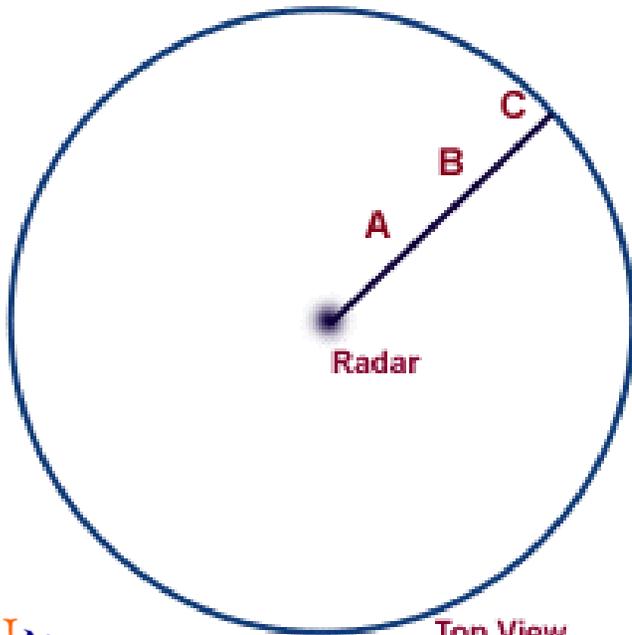
3. Filtered image with only directional-moving images retained)



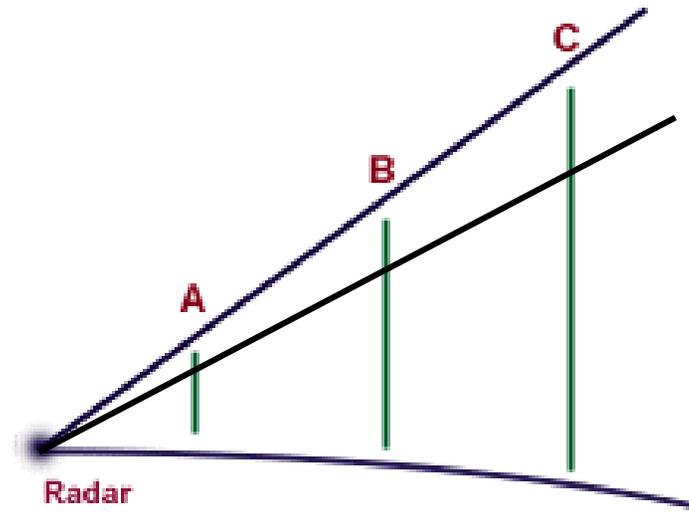
# Mobile Bird Detection Radar Purchased by the Crown Estate for Use in the United Kingdom

- The Central Science Laboratory (CSL), in the Department for Environment, Food and Rural Affairs, currently owns and operates one mobile Bird Detection Radar unit.
- That unit uses S-band (Horizontal) and X-band (vertical) adapted marine radar.
- CSL recently ordered a second mobile Bird Detection Radar unit from DeTect Inc. of Florida for use in the United Kingdom.
- These units ensure automated data collection continuously, 24 hours a day, are powered by a diesel generator, and can operate independently for periods of time on- or off-shore.





Top View



Side View

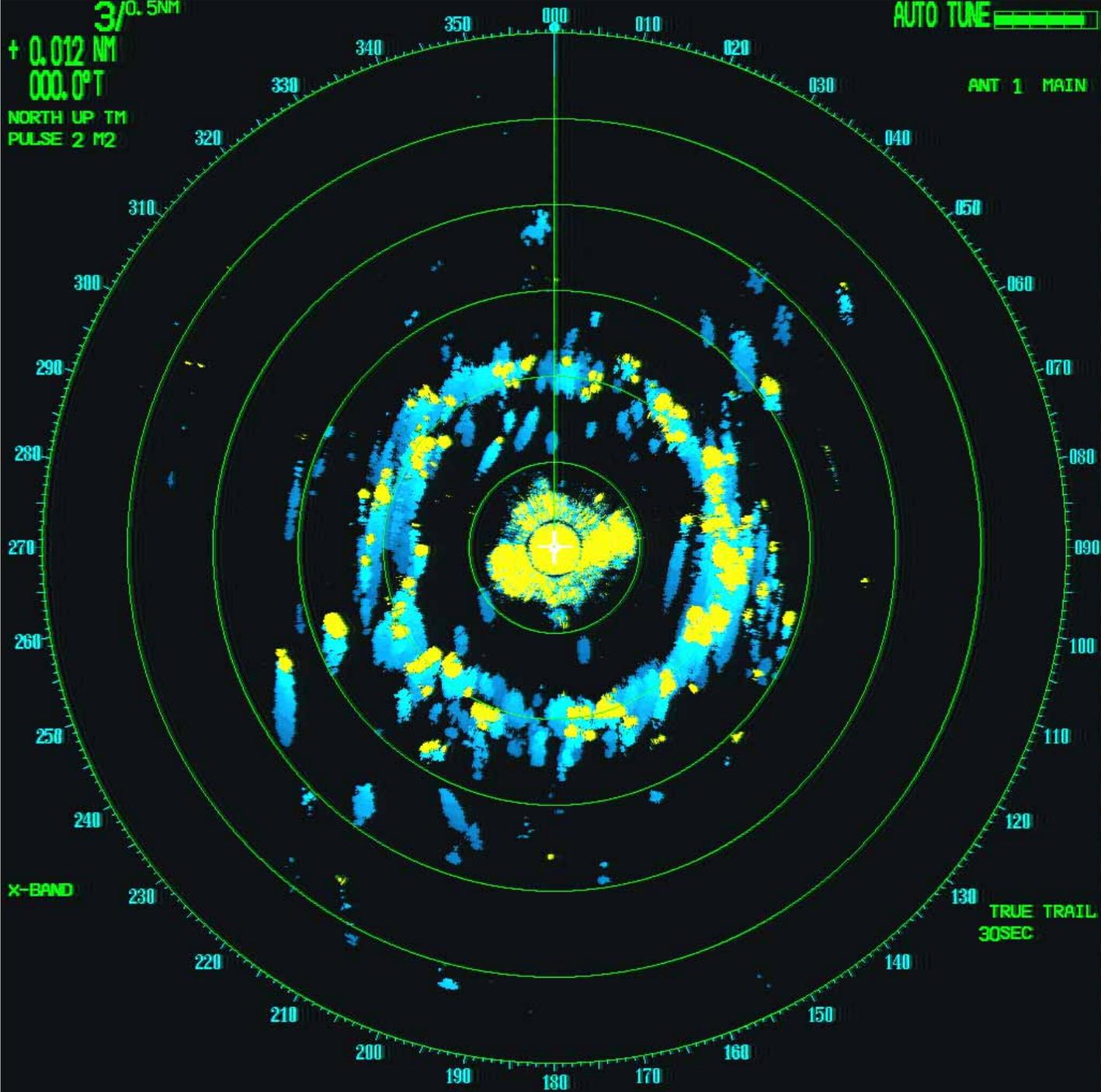


3/0.5NM  
+ 0.012 NM  
000.0°T  
NORTH UP TM  
PULSE 2 M2

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°40.155 N  
94°04.475 W  
+CURSOR POSN  
29°40.168 N  
94°04.475 W

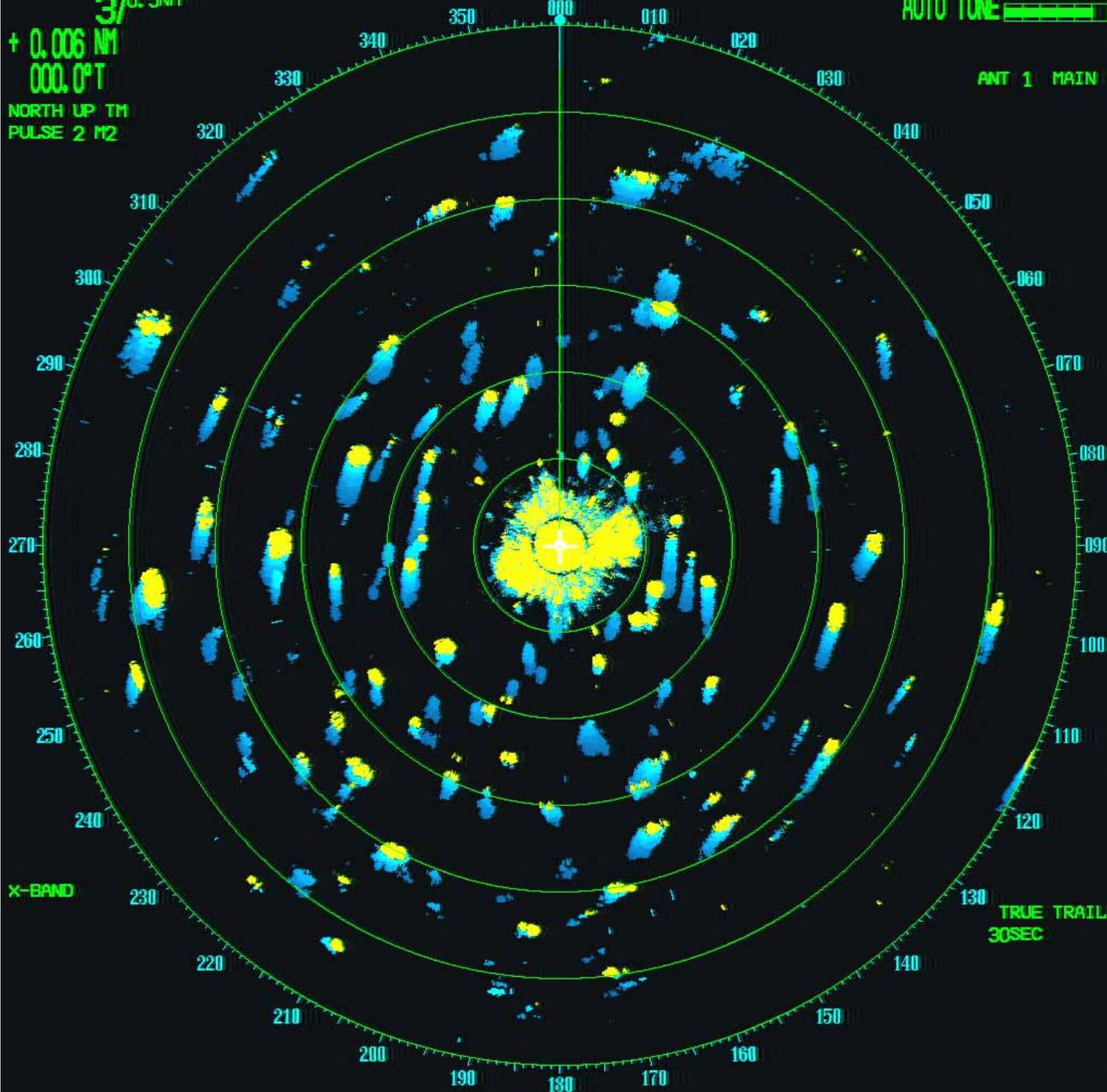
04-MAY-2003 20:28 UTC

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

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

# Conclusions

Radar is being used to provide valuable information on the flight dynamics of migrating birds and how they use atmospheric structure.

Radar can provide information on height, direction, number of targets, speed of birds in flight.

Mobile radar units adapted for detecting birds in flight use S-band (Horizontal) and X-band (vertical). Improved software allows detection during certain degrees of inclement weather and for considerable distance (km) depending on power, size and reflectivity of target, distance to target, weather, and other factors.

Mobile radar units are available with software packages that ensure automated data collection continuously, 24 hours a day, are powered by a diesel generator, and can operate independently for periods of time on- or off-shore.



**THANK YOU**

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