

# Wind Radar and FAA Issues

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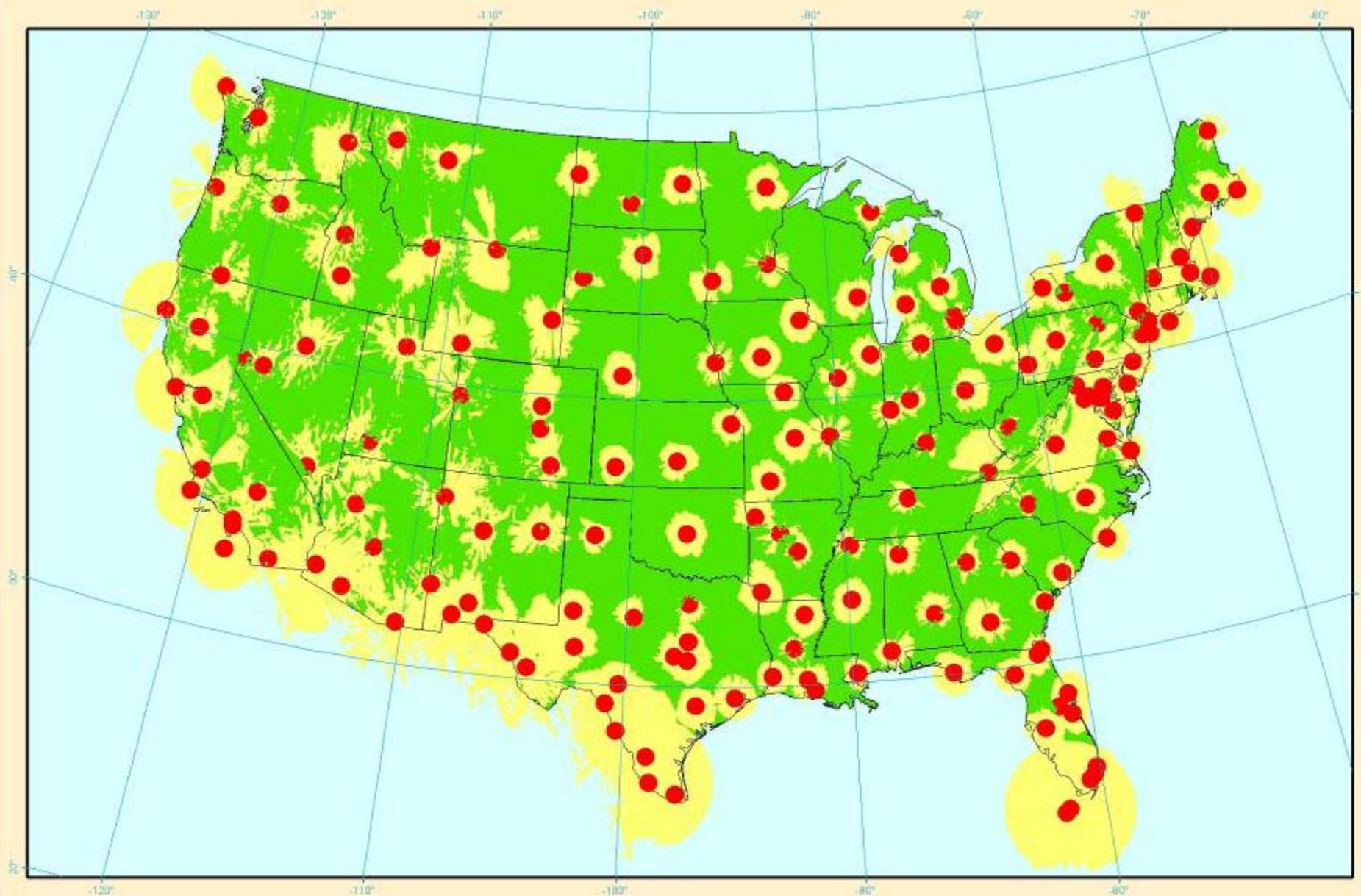
May 2008



# Wind Radar Concerns

- **Ongoing activities**
  - **>3000 MW under risk**
  - **All wind states impacted**
- **Significance**
  - **Impacts All**
  - **Start Early**
- **Mitigation under development**



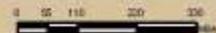


**Legend**

-  Potential Build Region
-  Build Region
-  Clipped\_20nmiBuffer

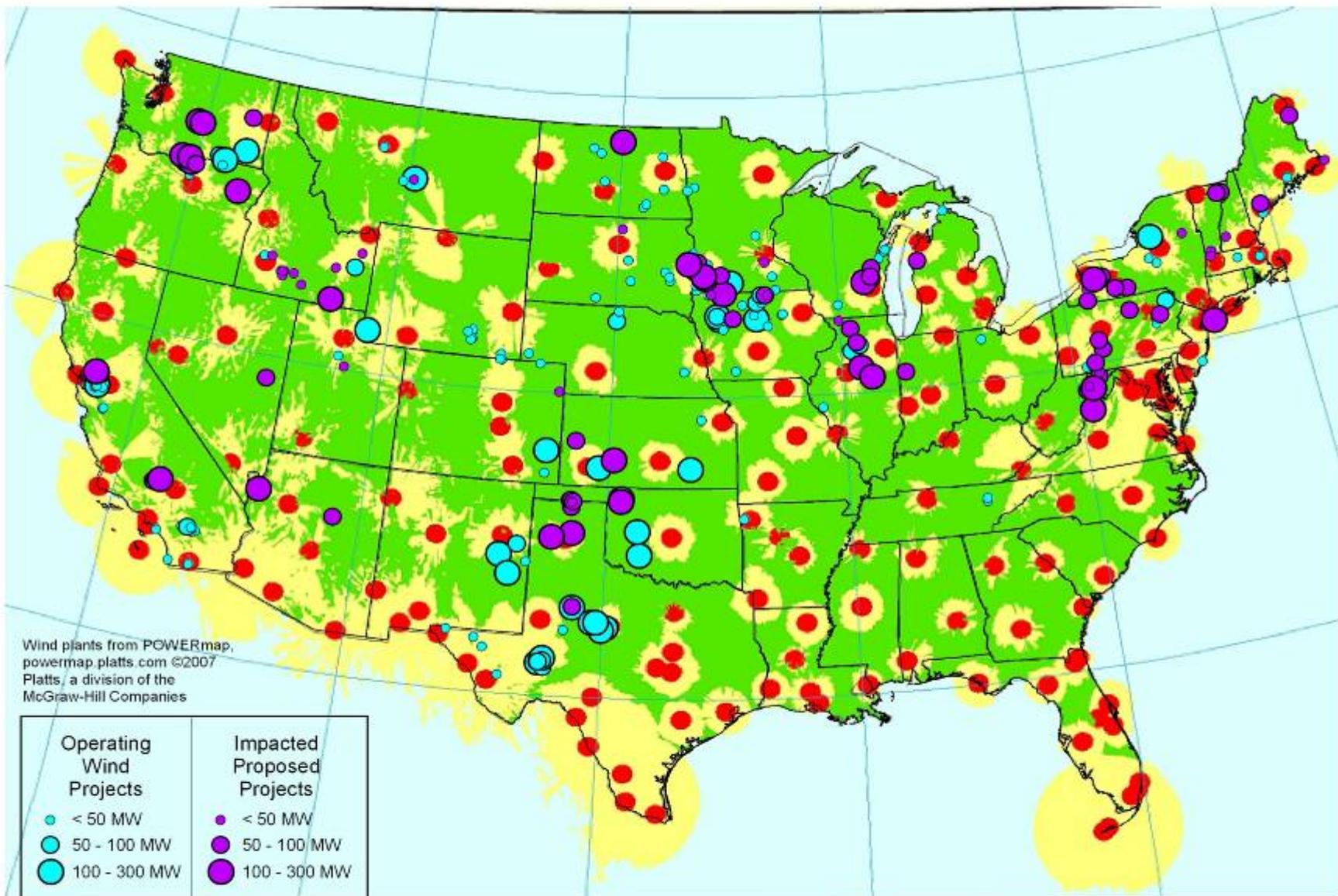
# United States Obstruction Build Map

Prepared by the 84th Radar  
Evaluation Squadron (ACC)  
Hill AFB, Utah  
06 February 2007



Source: ESRI Data & Maps CD  
Created in ArcGIS 9 using ArcMap

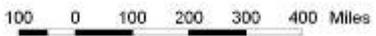




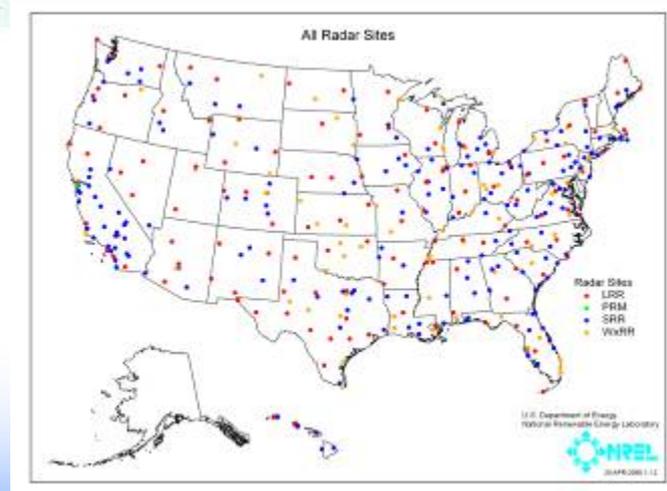
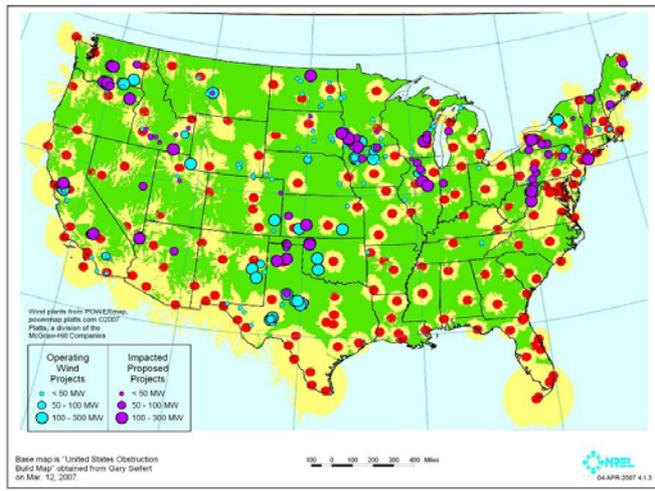
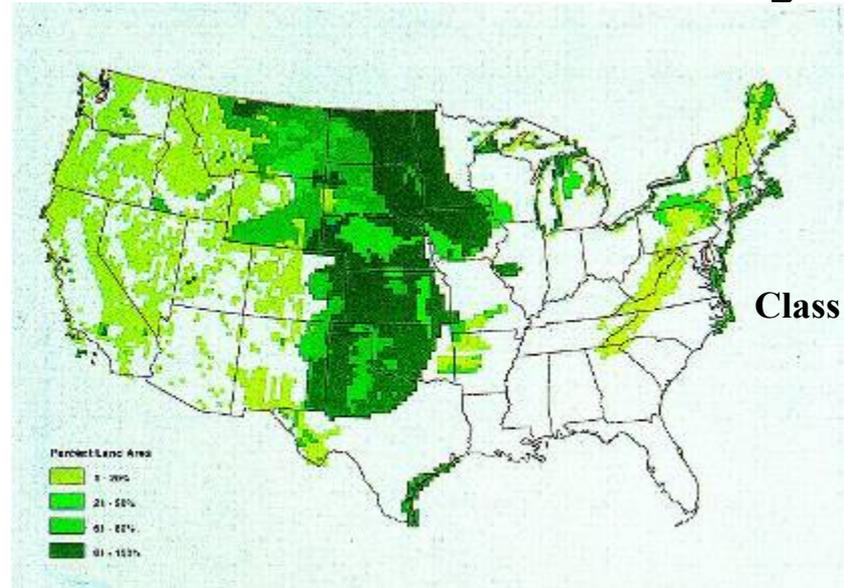
Wind plants from POWERmap,  
 powermap.platts.com ©2007  
 Platts, a division of the  
 McGraw-Hill Companies

Operating Wind Projects	Impacted Proposed Projects
<span style="color: red;">●</span> < 50 MW	<span style="color: purple;">●</span> < 50 MW
<span style="color: red;">●</span> 50 - 100 MW	<span style="color: purple;">●</span> 50 - 100 MW
<span style="color: red;">●</span> 100 - 300 MW	<span style="color: purple;">●</span> 100 - 300 MW

Base map is "United States Obstruction Build Map" obtained from Gary Seifert on Mar. 12, 2007.

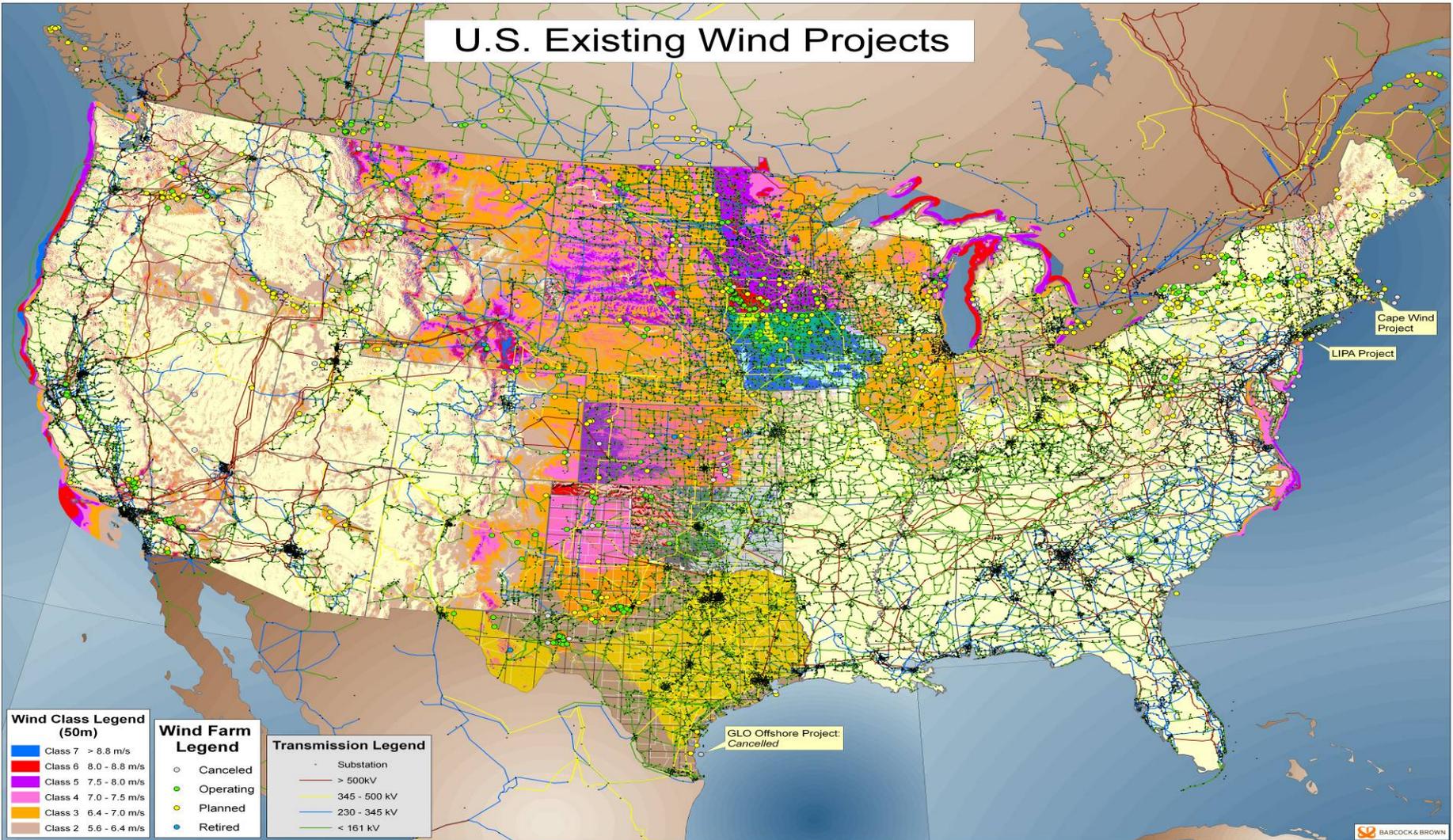


# X40 Growth In Future – See Any Overlap?



# US WIND

## U.S. Existing Wind Projects

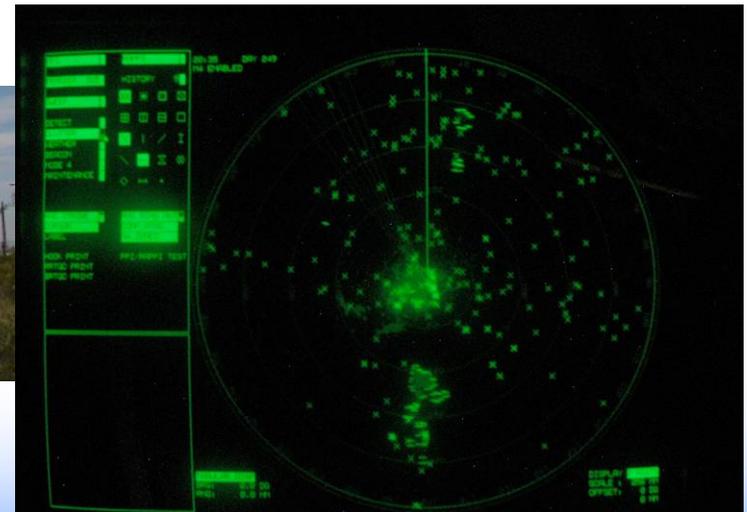


# Interference

- **If there is visibility, there is interference**
  - Remember, turbines are big reflectors
  - Interference is a relative term
- **Does interference impact the mission**
- **Experience shows a small percentage of wind farms do impact the ability to perform the mission**
- **Case by case assessment often needed**
- **FAA and Air Force supporting assessments**
- **Always negotiate, use tools only as screen to identify risk**

## Challenge:

- **FAA and DOD have different operational assessment criteria**
- **DOD has several internal agencies, all who have different criteria for operations and allowable impacts**
- **Software under control of radar manufacturers and wind issues are lower priority than FAA and DOD needs**
- **No single solution for process or mitigation technologies**
- **Impacts expected to increase as more turbines are installed**
- **Performance parameters and field data is limited, and privately held**



## **How problems are being addressed:**

- **Multi-pronged approach; multi-stakeholder involvement**
- **Collaborative research, case studies, radar evaluations, metrics refinements, tools, mitigation development and information sharing**
- **Commission independent wind radar baseline tests**
- **Foster technical solutions**
- **Reduce encroachment mentality**
- **Make results public and shared**
- **Foster mitigation discussions,**
  - **Toolkit meeting October 2007**
  - **Technical meeting December 2007**
  - **Jason report meeting January 2008**
  - **Next technical meeting being planned**



# Mitigation

- **FAA and/or manufacturers mitigation is often available**
- **Only DOD, DHS, & FAA experts can determine if mitigation is acceptable**
- **Examples include, but are not all inclusive**
  - **Impact studies**
  - **Farm optimization**
    - **Refine turbine locations**
    - **Checkerboard (one color with gaps)**
  - **Adjust look angle, use multiple beams selectively**
  - **Reduce RCA – Stealth the Blades**
  - **Transponder integration**
  - **Software optimization**
  - **Added Hardware**
    - **Post processors and advanced software**
    - **Adding transmitters and receivers**

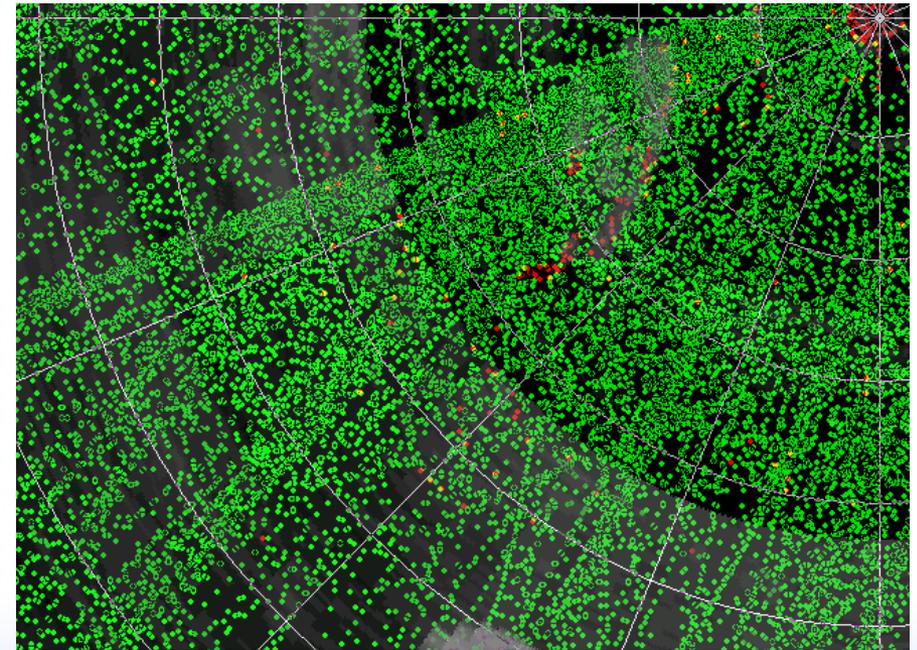
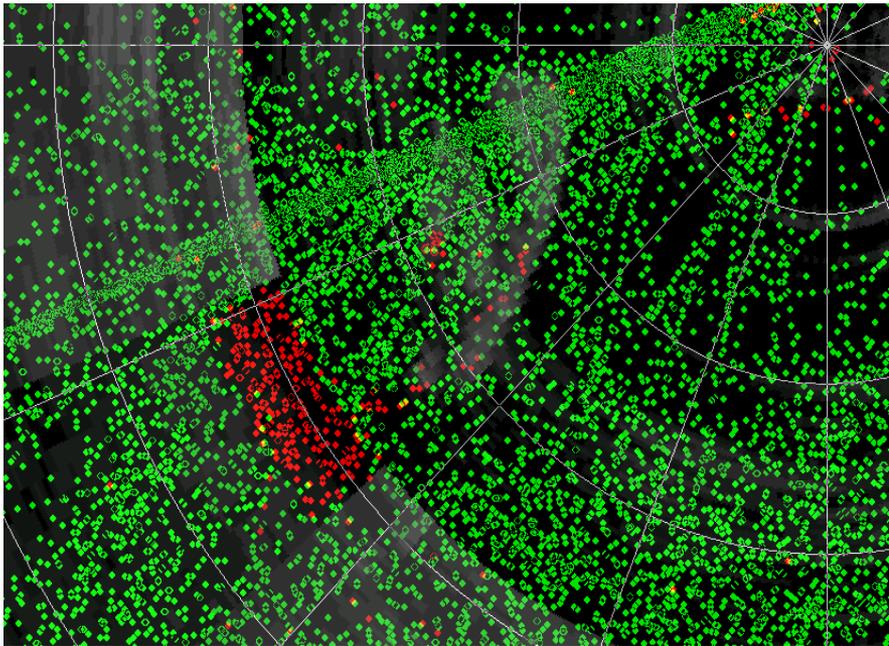


# Mitigation

- **Software improvements being investigated**
  - **Enhanced clutter mapping**
  - **Use of RAG Mapping**
  - **Concurrent processing**
    - **Separation of high and low beams**
    - **Tie to advanced clutter and geo based information**
  - **Improved CFAR processing**
  - **Improved filtering algorithms**
  - **Advanced tracking**
  - **Advanced adaptive Doppler filtering techniques**

# Examples of improvements

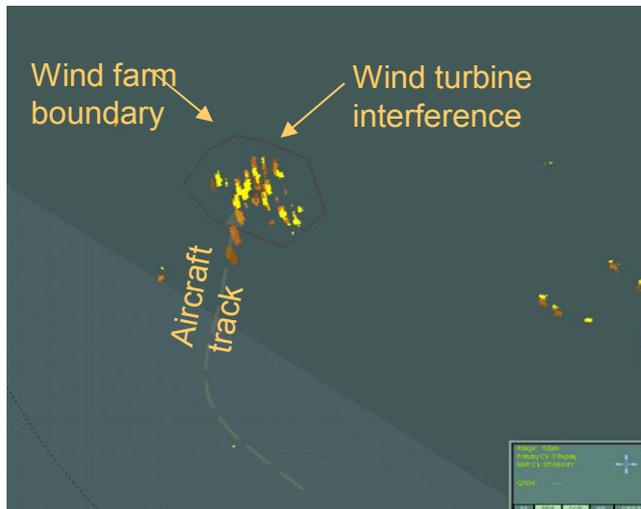
- Alaska site with change in low to high beam transition
  - Red is bad, green is good
  - Red is secondary only
  - Note improvement and reduction in loss of primary track over windfarm



# Improvements in Tracking Software

**Before**

**Primary lost, track lost**



Radar video as aircraft passes over wind farm

**After**

**Track was maintained**



Resulting plot output from ADT

# Impact on Developers During Siting

- **Due Diligence Questions Must be Addressed**
  - Radar
  - National Security Issues
  - Cost
- **Risk Management is Key**
- **Do Not Invest in Infrastructure Before Approved**
- **Location is Important**
- **Early Communication Critical**
  - FAA
  - AF/DHS
  - Risk of Disclosure a Challenge
- **Radar Line of Sight is First Filter**
- **Negotiate Final Turbine Locations**

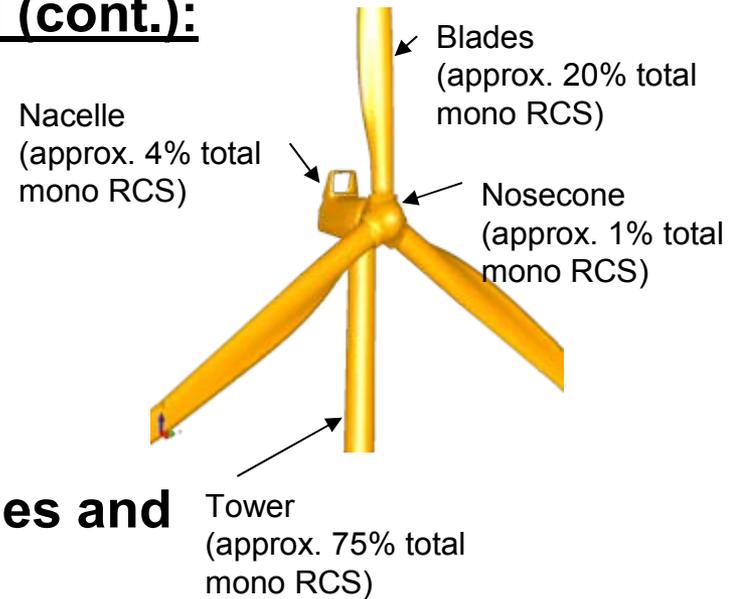
## Key issues currently being addressed:

- RFP for radar signatures at both LRR and ATC frequencies.
- ASR-4 Assessment in Texas, fall 08
- Technical Expert Peer Meeting (November 07)
  - Key findings; US Stealth capabilities, innovative filtering, phase array systems, gap fillers, test signal generators, layout optimization, improved processing, Tiger Team optimizing what we have, transponders on turbines with performance data, sensor fusion, integrate optical with radar, integrate two pulse discrimination, etc
- Developing Assessment Guidelines for review
- RFP for Advanced tracking demonstration on existing LRR systems
- Develop Assessment Process



## Key issues currently being addressed (cont.):

- **Develop Wind-Radar Checklist**
- **Operations Impact Guidelines**
- **Expand Mitigation Toolbox**
- **Provide Outreach**
  - Integrate screening tools
  - Educate developers on processes and risks
- **Plan FY-08 Case Studies and R&D Elements**
- **Coordinate with Manufacturers of Stealth Turbines**
- **Support Field Tests (Mitigation and Stealth Technologies)**
- **Develop assessment appeals process**



# Process

- **There is no single process – Yet!**
- **Developers are reluctant to offer advanced notice**
- **That is often too late**
- **FAA OEAAA acts as a focal point for US agencies**
- **AF has a proactive process**
- **Interagency team progressing well and policy help is anticipated**
- **Mitigation**
  - **Technology**
  - **Operations**
  - **Optimization**
  - **Siting**
  - **Other?**

# FAA LRR Tool

**Instructions:**

- Enter either a single point or a polygon and click submit to generate a long range radar analysis map.
- At least three points are required for a polygon, with an optional fourth point.
- The largest polygon allowed has a maximum perimeter of 100 miles.

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**Analysis Type:**

**Point**    **Latitude**                      **Longitude**

          Deg    Min    Sec            Dir            Deg    Min    Sec            Dir

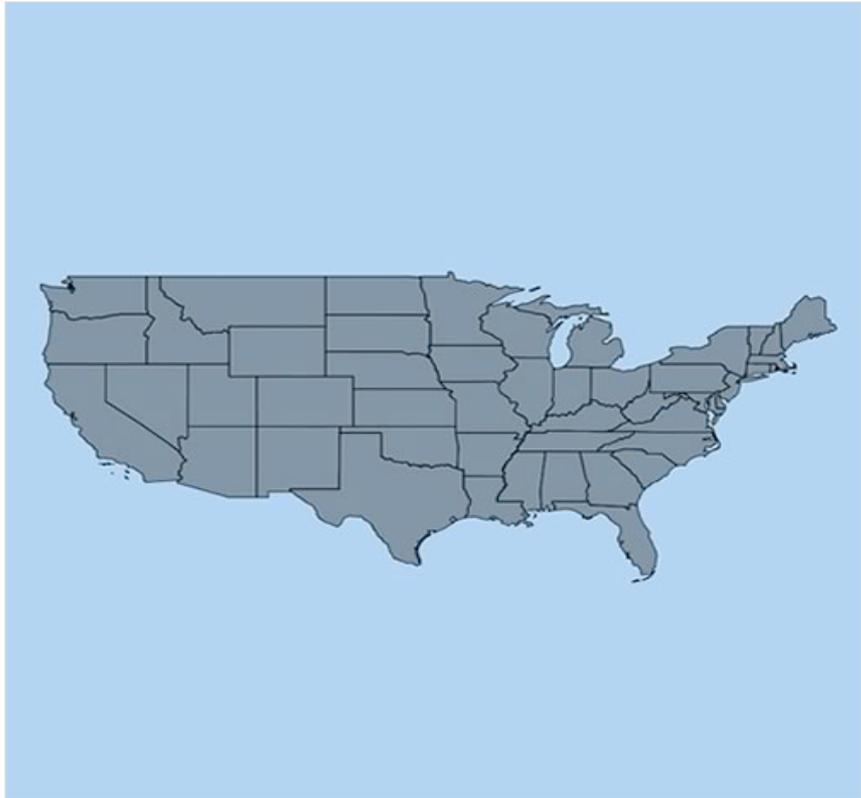
1                           

**Datum:**   

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**Map Legend:**

- **Green:** Development unlikely to impact long range radar operations. Standard aeronautical study required.
- **Yellow:** Potential for long range radar operational impact and mitigations options vary with development specifics. Standard aeronautical study required.
- **Red:** Long range radar operational impact highly likely, with diminished mitigation options. Extensive aeronautical study required.



<http://oeaaa.faa.gov/oeaaa>

<https://www.oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showLongRangeRadarToolForm>



# Quick ECIP Example

## NIST BLCC 5.2-04: ECIP Report

Consistent with Federal Life Cycle Cost Methodology and Procedures, 10 CFR, Part 436, Subpart A

The LCC calculations are based on the FEMP discount rates and energy price escalation rates updated on April 1, 2004.

Location: Alaska Discount Rate: 3%

Project Title: Tin City LRR Wind Power Analyst: INEEL

Base Date: January 1, 2007 Preparation Date: Wed Jan 12 11:40:25 MST 2005

BOD: January 1, 2007 Economic Life: 25 years 0 months

File Name: C:\Program Files\BLCC5\projects\tin\_city\ECIP\_2.xml

### 1. Investment

Construction Cost	\$850,000
SI/OH	\$100,000
Design Cost	\$50,000
Total Cost	\$1,000,000
Salvage Value of Existing Equipment	\$0
Public Utility Company	\$0
Total Investment	\$1,000,000

### 2. Energy and Water Savings (+) or Cost (-)

#### Base Date Savings, unit costs, & discounted savings

Item	Unit Cost	Usage Savings	Annual Savings	Discount Factor	Discounted Savings
Electricity	\$55.68352	3,735.8 MBtu	\$208,020	16.458	\$3,423,518
Energy Subtotal		3,735.8 MBtu	\$208,020		\$3,423,518
		(\$0.19/KWh 1,094,844 kWh)			
Water Subtotal		0.0 Mgal	\$0		\$0
Total			\$208,020		\$3,423,518

### 3. Non-Energy Savings (+) or Cost (-)

Item	Savings/Cost	Occurrence	Discount Factor	Discounted Savings/Cost
Annually Recurring	-\$15,000	Annual	17.672	-\$265,084
Non-Annually Recurring				
Turbine blade replacements	-\$80,000	10 years 0 months	0.744	-\$59,528
Non-Annually Recurring Subtotal	-\$80,000			-\$59,528
Total	-\$95,000			-\$324,609

4. First year savings \$189,820

5. Simple Payback Period (in years) 5.27 (total investment/first-year savings)

6. Total Discounted Operational Savings \$3,098,909

7. Savings to Investment Ratio (SIR) 3.10 (total discounted operational savings/total investment)

8. Adjusted Internal Rate of Return (AIRR) 7.77%  $(1+d)*SIR^{(1/n)}-1$ ; d=discount rate, n=years in study period



# Current Efforts

- **Mission and Radar system impacts - a valid concern**
- **DOD Wind Radar Guidance**
  - **Need more study if wind turbines are in line of sight**
  - **“Case By Case Assessment” recommended**
- **LRR R-Y-G screening tool draft available (FAA)**
- **Multi agency team working policy issues**
- **Technical teams investigating mitigation**
- **Screening tools under development**
- **Senior management becoming involved at DOE, DOI, DOD, CEQ**

# Summary

- **Raised awareness for action**
- **All parties concerned**
- **There is interference from wind turbines**
- **Case by Case assessment needed**
- **Approach all issues openly and fairly**
- **No and Yes are both acceptable answers**
- **Address mitigation**
- **Communicate well and often**
- **Strive for Win-Win Solutions**
- **Research and Process needed**



# Questions?



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