

Wind Turbine Radar Interference Mitigation

Program – Market Acceleration and Deployment
Benjamin Karlson
Sandia National Laboratories

August 2, 2021



FY21 Peer Review - Project Overview

Project Summary:

- This effort is aimed at solving deployment barriers for wind energy systems by developing mitigation methods which reduce or eliminate the adverse effect of wind turbines on radar systems. Sandia will continue to support and lead Wind Turbine Radar Interference Mitigation (WTRIM) activities including strategic planning, field-testing, as well as mitigation technology development, demonstration and deployment. The work plans for FY19 and FY20 are aligned with the Federal Interagency Wind Turbine Radar Interference Strategy published by the DOE.
- WTRIM Working Group agencies:
 - DOD, FAA, NOAA, BOEM, DHS
 - Other Partners: MIT LL, Regulus Group

Project Objective(s) 2019-2020:

- Facilitate the WTRIM Working Group
- Modeling & Simulation Tools Development
 - Maintain the NEXRAD Public Screening Tool
- Development & Deployment of Mitigation Technologies
 - Support the Travis Air Force Base Pilot Mitigation Project
 - Wind turbine blade radar cross section reduction

Overall Project Objectives (life of project):

- The overall objective of this project is to enable the timely and cost-effective deployment of wind energy systems across the US without adversely impacting national radar systems and federal agency missions.

Project Start Year: 2018

Expected Completion Year: FY20

Total expected duration: 2 years

FY19 - FY20 Budget: \$1,250,000

Key Project Personnel:

Benjamin Karlson

Bryan Miller (Subcontractor)

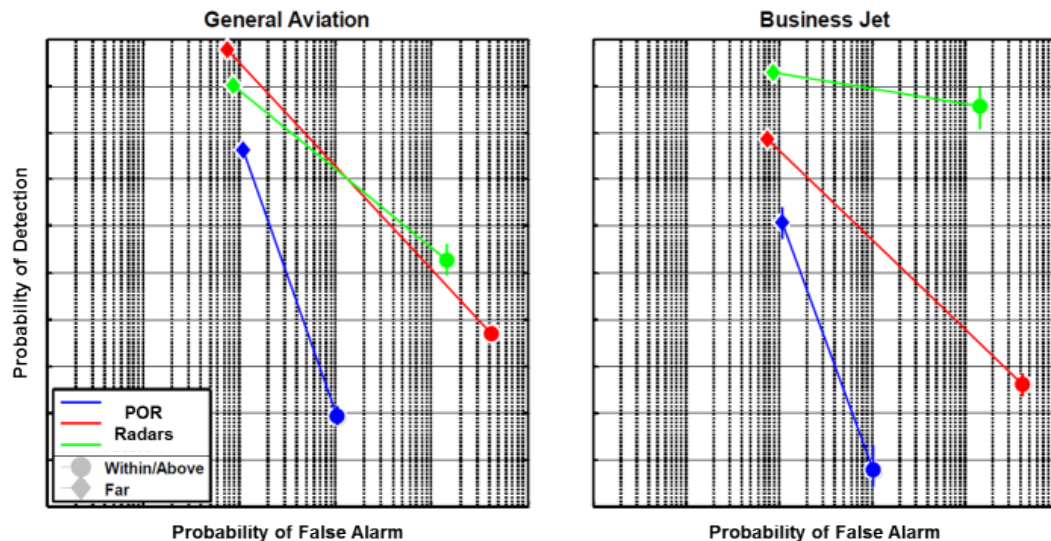
Key DOE Personnel:

Patrick Gilman



Project Impact

When located within the line-of-sight of a radar system, wind turbine blade rotation can cause interference.¹ With a renewed focus on clean energy development this problem is expected to get worse.



Sandia facilitates the multi-agency Wind Turbine Radar Interference Mitigation (WTRIM) Working Group dedicated to addressing these impacts to allow for continued wind energy deployment without adversely affecting the missions of these federal agencies.

The WTRIM Working Group exists to ensure that the agencies have a shared understanding of the problem as well as a shared ownership in the R&D to develop mitigations.

1. Sandia National Laboratory. Interagency Field Test & Evaluation Industry Report: Wind Turbine-Radar Interference Test Summary. September 2014.

Program Performance – Project Overview



Memorandum Of Understanding

Goals:

- Develop near- (5 years), mid- (10 years), and long-term (20 years) solution mitigations for wind turbine-radar interference
- Determine funding requirements to implement workable solutions

Sandia facilitates and supports the administrative operations of the WTRIM WG

Program Performance – Scope, Schedule, Execution

WTRIM Working Group Facilitation

- FY19:
 - Hosted and facilitated 34 WTRIM WG telecons
 - 3 In-person 2-day meetings
- FY20:
 - Hosted and facilitated 29 WTRIM WG telecons
 - 1 In-person meeting & 1 virtual meeting
 - Hosted a series of webinars on Offshore WTRIM
- Prepared and submitted Annual Progress Reports to WTRIM Senior

Modeling & Simulation Tools

- WTRIM Modeling & Simulation Tool Catalog
 - FY19 - Catalog provided to DOD's M&S Working Group for inclusion into their user group catalog
- NEXRAD Public Screening Tool
 - FY20 - Transfer of code to Sandia-owned servers
 - Public site in-progress
 - Encountered issues with code transfer and software licensing
 - Site release delayed
 - Anticipate site availability in FY21

Development & Deployment of Mitigation Technologies

- Travis Air Force Base Pilot Mitigation Project
 - FY19 - Supported test planning and execution in FY19
 - Contributed to the final report (FAA lead)
 - FY20 – Supported the FAA infill validation effort with the Civil Air Patrol assistance
- Wind Turbine Lightning Mitigation System Radar Cross Section Reduction
 - Report finalized and publicly released – Sept. 2020

Program Performance – Accomplishments & Progress

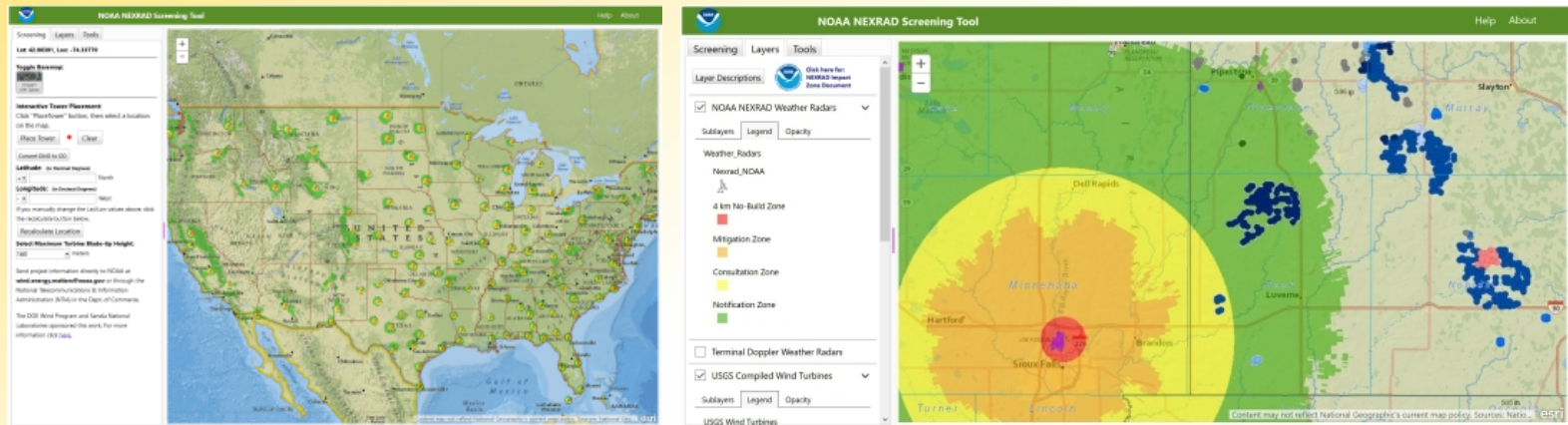
• Modeling & Simulation Tools

Task: NEXRAD Public Screening Tool

Objective: Provide publicly-accessible GIS-based tool for wind development prospecting

Impact: Enables developers to obtain a preliminary review of potential impacts to weather radars prior to official OE/AAA filing

Status: In progress – site is undergoing Review & Approval for public release on Sandia's open network



- Includes the latest version of the U.S. Wind Turbine Database
- Includes NOAA's Wind Farm Impact Zones for specified turbine heights
- Allows user to input lat/long of new wind turbine
- The use of this tool does not in any way replace the official FAA processes/procedures.

Program Performance – Accomplishments & Progress

Development & Deployment of Mitigation Technologies

Task: Travis Air Force Base Pilot Mitigation Project (FAA lead)

Objective: Collect performance, operations and maintenance, STARS integration, and system reliability data over an extended time period and create a pathway forward for future infills to be incorporated into the National Air Space surveillance system.

Sandia Role: Facilitate test planning and execution, coordinate with Civil Air Patrol, obtain wind turbine SCADA data during flight tests

Impact: FAA is establishing technical criteria for infill mitigation acceptance for ATC

Status: Test completed at end of FY19

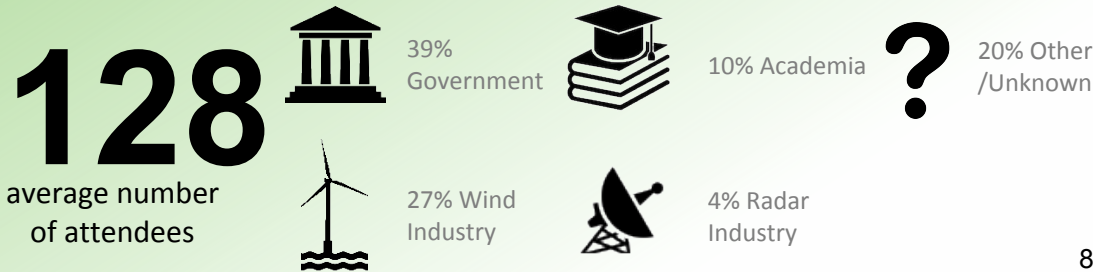


Examples of the types of sorties the CAP flew

Stakeholder Engagement & Information Sharing

FY20 Offshore WTRIM Webinar Series

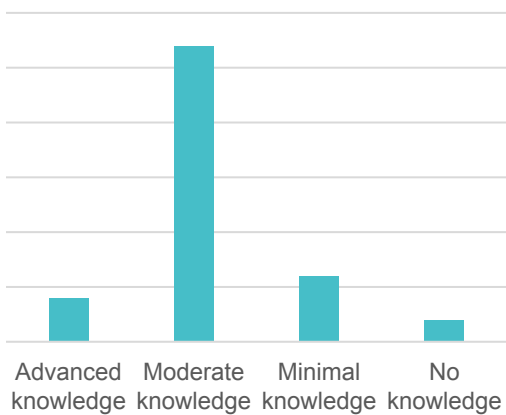
- Objective:** To facilitate an exchange of information between the offshore wind industry, radar experts, and federal agencies to discuss research needs for offshore wind development that may impact sensitive radar systems
- Impact:** 500+ individuals participated in one or more of the webinars
Increased R&D in offshore WTRIM areas (e.g. HF oceanographic radars, marine navigation)
- Status:** Held 6 publicly announced webinars on offshore WTRIM topics. Survey results below



8% of participants responded to survey

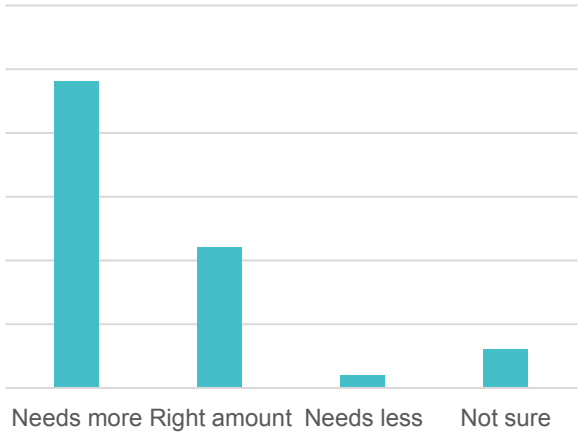
INCREASED RESPONDENTS' KNOWLEDGE

Please rate how much information was gained from this webinar series.



RESPONDENTS FEEL MORE R&D IS NEEDED

Do you feel the government agencies are putting enough R&D into the WTRIM issue?



Project Performance - Upcoming Activities

WTRIM Working Group Facilitation



- Shepherding a new Memorandum of Agreement for the WTRIM WG
- Updating the Federal WTRIM Strategy public-facing document
- Shepherding an Interagency Agreement between DOE and FAA to support mitigation strategies
- Developing a public-facing radar matrix document that will inform industry of key issues and on-going WTRIM R&D

Modeling & Simulation Tools



- Sandia will continue to improve upon the NEXRAD Public Screening Tool allowing for wind energy developers to prospect new wind areas and view potential impacts to NEXRAD weather radar systems

Development & Deployment of Mitigation Technologies



- Continue to support Pilot Mitigation Projects and field testing such as the CARSR-270 tech transfer to the ARS-11
- Investigating the feasibility of lightning protection cable RCS reduction for other single-band frequency radars of interest