



# DOE Offshore Wind Lidar Buoy Deployments

Technology, Research, Development, and Testing

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August 5, 2021



# FY21 Peer Review - Project Overview

### Project Summary:

- *Challenge:* U.S. offshore wind development is currently impeded by a lack of long-term wind observations at hub-heights; the industry is also challenged by high costs and the need to expand developable areas
- *Approach:* Deploy lidar buoys to collect data (including hub-height data) needed to improve siting, optimize designs, improve reliability and performance, increase safety, and reduce capital and operating costs
- *Key Project Partners:* Ocean Tech Services, DNV, Woods Hole Oceanographic Institution, AXYS Technologies, Inc., AXYS Services, Inc., Bureau of Ocean Energy Management (BOEM)

Project Start Year: 2014  
Expected Completion Year: 2026+  
Total expected duration: 12+ years

FY19 - FY20 Budget: \$5,939,314

Key Project Personnel: Alicia Gorton (PM), Will Shaw (co-PI), Raghu Krishnamurthy (co-PI), Rob Newsom, Mark Severy

Key DOE Personnel:  
Shannon Davis, Mike Derby

### Project Objective(s) 2019-2020:

- *Complete lidar buoy upgrades and lidar validation:* Upgrade lidar systems on buoys and perform lidar validation consistent with recommended practices published by the Carbon Trust
- *Support California buoy deployments:* Plan and coordinate two buoy deployments off the coast of California in partnership with BOEM
- *Initiate planning of instrumentation test buoy development:* Request information from offshore wind stakeholders on the uses and capabilities for an instrumentation test buoy
- *Plan and manage long-term buoy activities:* Continue detailed planning for out-year buoy missions that facilitates transitions to selected partners if deployment windows are available

### Overall Project Objectives (life of project):

- Enable efficient and effective deployment of lidar buoys and disseminate hub-height offshore wind data in support the U.S. offshore wind industry



# Project Impact



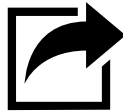
## Advance the State of the Technology

Upgrade lidar systems to ensure acceptable data availability and provide data needed to validate wind models



## Address Key Stakeholder Challenges

Validate lidar measurements to address key stakeholder concerns associated with measurement accuracy and uncertainty



## Impact and Relevance of Products and Outputs

Publicly accessible data used to validate wind models, improve the understanding of air-sea interactions, reduce uncertainty and risk, and support siting and design



## Catalyze Wind Energy Deployment

Provide buoy data freely to offshore wind stakeholders through the DOE Data Archive and Portal



## Support the Advancement of Sustainable, Equitable Wind Energy

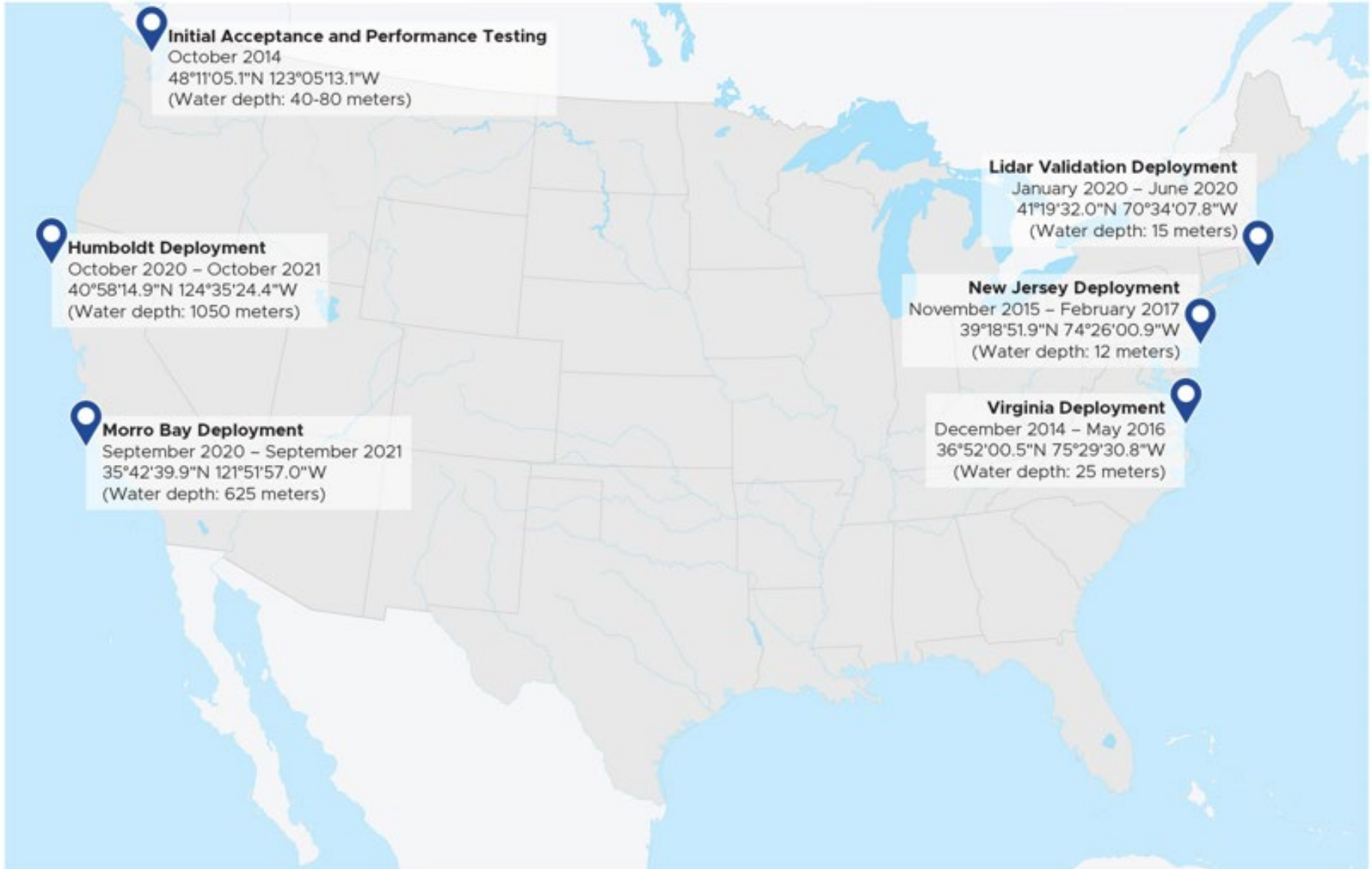
Partner with BOEM to deploy buoys off the coast of California to support West Coast offshore wind development



## Project Success and Impact

Facilitate offshore data collection using validated methods to advance the U.S. offshore wind industry with support from DOE and BOEM funding

# Project Impact



# Program Performance – Scope, Schedule, Execution



## Scope

- ✓ Complete lidar buoy upgrades and lidar validation
- ✓ Support California buoy deployments
- ✓ Initiate planning for instrumentation test buoy
- ✓ Plan and manage long-term buoy activities



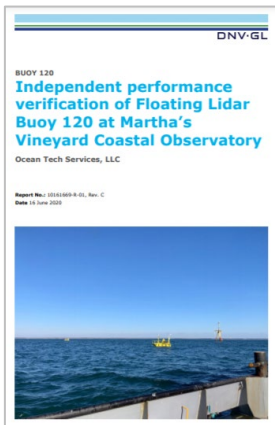
## Schedule

- ✓ Contracting delays
  - ✓ Technical delays
  - ✓ COVID-19 delays
- Safely and successfully upgraded, validated, and deployed buoys*



## Execution

- ✓ Independent lidar validation reports issued
- ✓ Managed and mitigated COVID-19 risks
- ✓ Commissioned buoys for deployment in California
- ✓ Deployed buoys Sept/Oct 2020



# Program Performance – Accomplishments & Progress



## Field Deployment

- ✓ Buoy upgrades and testing
- ✓ Lidar validation deployments
- ✓ BOEM-funded California buoy deployments



## Publications

- ✓ Independent lidar validation reports
- ✓ 2019 OCEANS Conference Proceedings
- ✓ Department of Energy Lidar Buoy Loan Program Description (updated report)
- ✓ Publications within PNNL Lidar Buoy Science project



## Presentations

- ✓ 2019 OCEANS Conference
- ✓ 2020 International Partnering Forum
- ✓ 2020 American Wind Energy Association Offshore WINDPOWER Conference
- ✓ Pacific Ocean Energy Trust Webinar
- ✓ International Ocean Science & Technology Industry Association Webinar



## Stakeholder Engagement

- ✓ Outreach content and material
- ✓ Presentations, posters, webinars
- ✓ Data dissemination via the Data Archive and Portal
- ✓ California deployment planning and permitting
- ✓ Instrumentation test buoy Request for Information (RFI)



## Data Dissemination

- ✓ Stakeholder engagement
- ✓ Data Archive and Portal

# Project Performance - Upcoming Activities



## Support BOEM-funded California Deployments

Manage and oversee buoy deployments off the coast of California in partnership with BOEM



## Plan and Manage Long-term Buoy Activities

Continue detailed planning for out-year buoy missions that facilitates transitions to selected partners if deployment windows are available



## Develop an Eddy Correlation Surface Flux Measurement System

Collaborate with University at Albany to develop and test an eddy correlation flux measurement package that can be integrated with a lidar buoy



## Initiate Instrumentation Test Buoy Procurement

Develop specifications, issue Request for Proposals, select awardee, and initiate procurement



## Initiate Planning on BOEM-funded Hawaii Deployment

Plan and coordinate buoy deployment in FY22 off the coast of Hawaii in partnership with BOEM



## Stakeholder Engagement and Information Sharing

Engage with relevant offshore wind energy stakeholders and ensure public access to buoy data

# Stakeholder Engagement & Information Sharing



## Outreach Material

- ✓ Brochures and fliers
- ✓ Buoy schematics
- ✓ Photo photos
- ✓ Web content



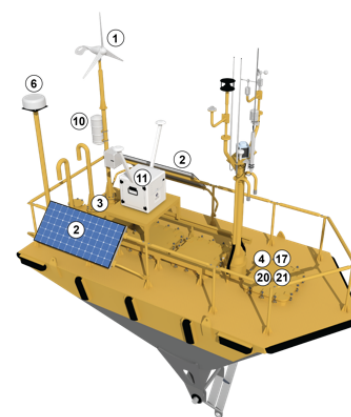
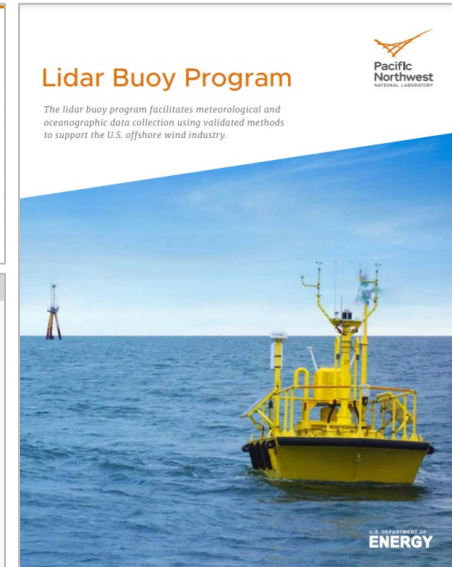
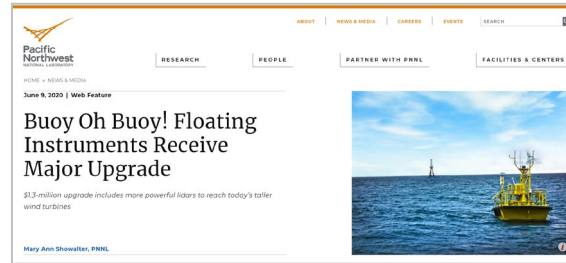
## Stakeholder Engagement

- ✓ Communicate status and progress of Lidar Buoy Program
- ✓ Discuss data analysis results
- ✓ Assess stakeholder needs



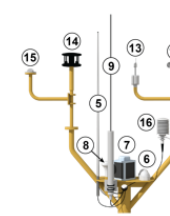
## Information Sharing

- ✓ Archive and disseminate data via Data Archive and Portal
- ✓ Facilitate informed decision-making



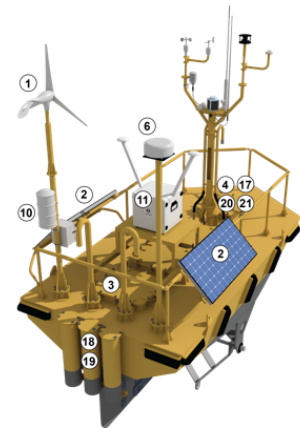
### Power, Data, Communication, & Navigation

1. Turbine
2. Solar panels
3. Diesel generator (compartment)
4. Data loggers (compartment)
5. Cellular antenna
6. Satellite antenna
7. Navigation light
8. AIS GPS antenna
9. AIS VHF antenna
10. Radar reflector



### Meteorological

11. Wind profile
12. Wind speed (cup anemometer)
13. Wind direction
14. Wind speed & direction (ultrasonic anemometer)
15. Solar radiation
16. Air temperature & relative humidity
17. Barometric pressure (compartment)



### Oceanographic

18. Water velocity profile (moonpool)
19. Salinity & water temperature (moonpool)
20. Wave spectrum (compartment)
21. Water temperature (compartment)