NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Innovation Showcase

Innovation &
Entrepreneurship

UAS Autonomous Inspection & Predictive Analytics for Wind Turbines

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Project Overview

- Technology focus on integrated sensing and predictive analytics
- “Sense-Understand-Decide-Act” in complex environments
- Market sectors critical infrastructure inspection (wind turbines), precision agriculture, Defense, and public safety
- SkyAI provides near-real time capability (act now prognostics) and system level analytics to optimize wind turbine availability to meet national renewable energy goals
- SkyAI reduces unplanned maintenance through improved predictive analytics and condition-based maintenance prescriptions

Problem & Opportunity

- The U.S. Department of Energy's (DoE) *Wind Vision Roadmap*:
  - Wind power to supply 35% of national electricity demand by 2050
  - Requires reduction in unplanned maintenance and improved condition monitoring systems
  - Improved production and reliability through collection of wind turbine performance and reliability data from wind plants
- UAS and predictive analytics emerging as key solution to address wind turbine availability and reliability goals
- UAS sales and inspection services to reach nearly $6B USD annually by 2024

Technology Solution

- Currently, most inspection solutions are manual (scaling turbine) or piloted UASs collecting visual data with manual post-processing of images
- SkyAI provides
  - Fully autonomous UAS flight operations
  - Multi-modal sensor data collection (LiDAR, camera, thermal, acoustic)
  - Artificial intelligence driven data analysis
  - Predictive analytics for condition-based maintenance and reliability improvements
- Licensing NASA technology to improve LiDAR resolution

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Market & Business Model

- UAS sales and inspection services to reach nearly $6B USD annually by 2024
- Customer base includes wind farm operators, inspection services, and turbine suppliers
- Collaboration with Sandia National Laboratories and New Mexico State University School of Engineering
- Revenue channels include:
  - A SAAS subscription model with 75% - 80% gross margin
  - System hardware and inspection services

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Current Development

- New Mexico Small Business Assistance (NMSBA) Program funded project
  - Sandia National Laboratories (SNL) provide their unique expertise that is not found in the private sector
  - SNL support includes non-destructive inspection techniques, sensor evaluation, and modeling & simulation tools
- Phase 1 tasks to be completed by 31 December 2018
  - LiDAR evaluation with NASA SuperResolution enhancement
  - Neural network engine deployed in Amazon Web Services cloud environment
  - UAS platform developed and autonomous inspection mission planning development underway

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Next Steps

- Phase 2 proposal submitted to NMSBA
  - Integrated sensor development (LiDAR, camera, thermal, acoustic)
  - Data sets for neural network engine training
  - UAS sensor integration and initial flight tests
- Strategic Needs
  - Incubation services (GeniusNY)
  - Engagement with wind farm operators to enable customer-centric design process
  - Capital partner for commercialization

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