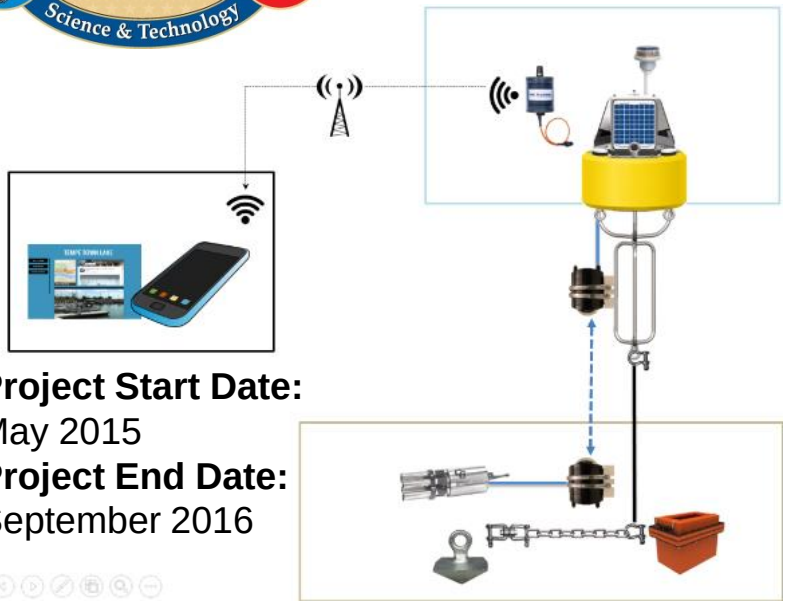
NEPTUNE



Project Start Date:
May 2015
Project End Date:
September 2016

Student(s) POC Info:

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Professor POC Info:

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Objectives:

1) Transmit C6 Sensor Platform data through OMMs and wireless modem to ASU server
2) Integrate sensor data transfer with solar powered buoy and sea battery for lake deployment
3) Deploy and maintain the system in Tempe Town Lake to monitor water conditions in real-time

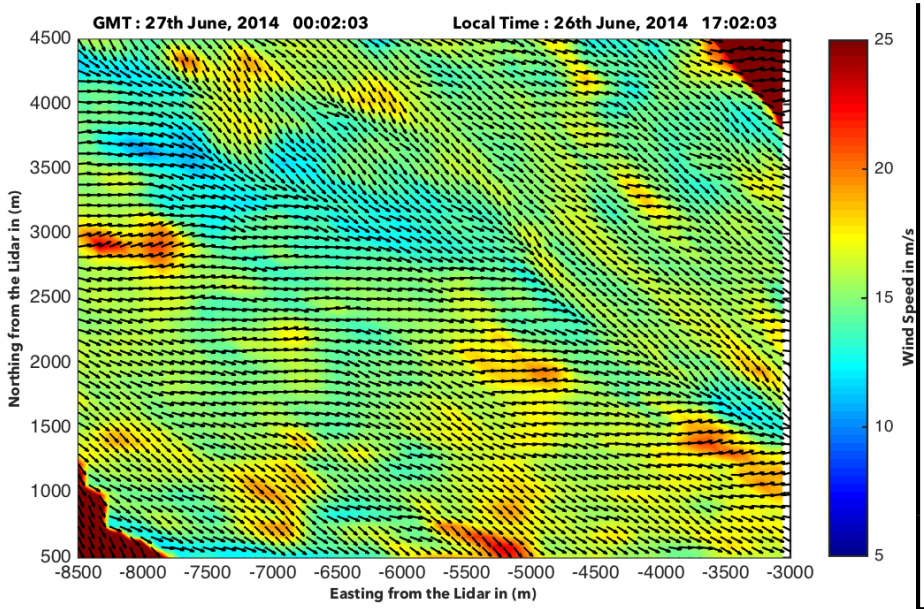
Current Status/ Accomplishments

- 90% of system components purchased and ready
- ASU server under construction
- Currently building the watertight link between C6 Sensors and Raven Modem

Product Schedule/ Milestones

- Initial data transfer from sensor to modem – May
- Power integration/data transfer refining – Summer
- Mock deployments - August
- One month deployment – September

Remote Sensing for Smart Renewable Power



Student(s) POC Info: Nihanth Cherukuru
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Professor POC Info: Ron Calhoun
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Mechanical Engineering, Arizona State University

Objectives

Application of a 3D scanning Doppler lidar for collective control and short-term power prediction for wind farms.

Project Start Date: Fall 2015

Project End Date: Fall 2017

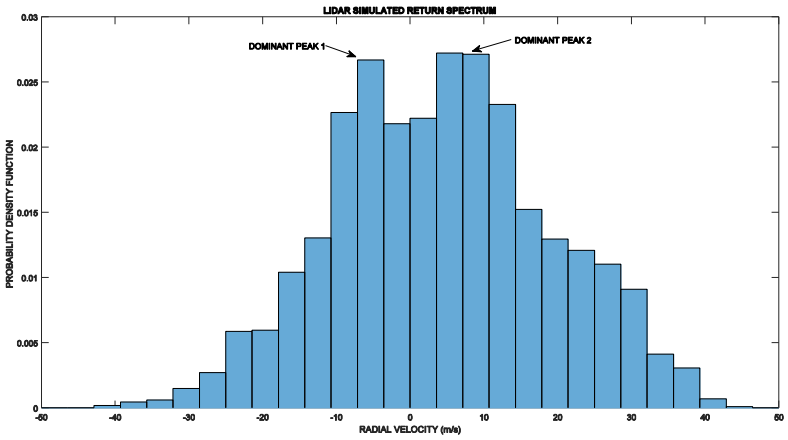
Product Schedule/ Milestones

- Retrieval Algorithms for mean wind and gust structure of approaching wind for adaptive wind farm optimization

Current Status/ Accomplishments

- A novel 2D vector wind retrieval for complex flows has been devised and tested on lidar scans from a wind farm in Tehachapi, CA.
- New retrieval preserves flow structures and is computationally efficient with real time application capability.

Sub-Range Gate Flow Structure



Simulate Return Spectrum With multiple Dominant Peaks

Student(s) POC Info: Sree Bhaskaran
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Professor POC Info: Ron Calhoun
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Project Start Date: Fall 2015
Project End Date: Fall 2017

Objectives

• To model the Doppler spread function within the lidar pulse volume with a more realistic distribution function, instead of the default Gaussian assumption.

• Extract precisely sub-range gate flow features like turbulence intensity and dissipation rate, by taking into account of the shape of the return spectrum.

• Sample a real 2-D and 3-D field using a lidar simulator to demonstrate the relevance of extracting more information as shown above. Doppler return spectrum with multiple dominant peaks.

Milestones

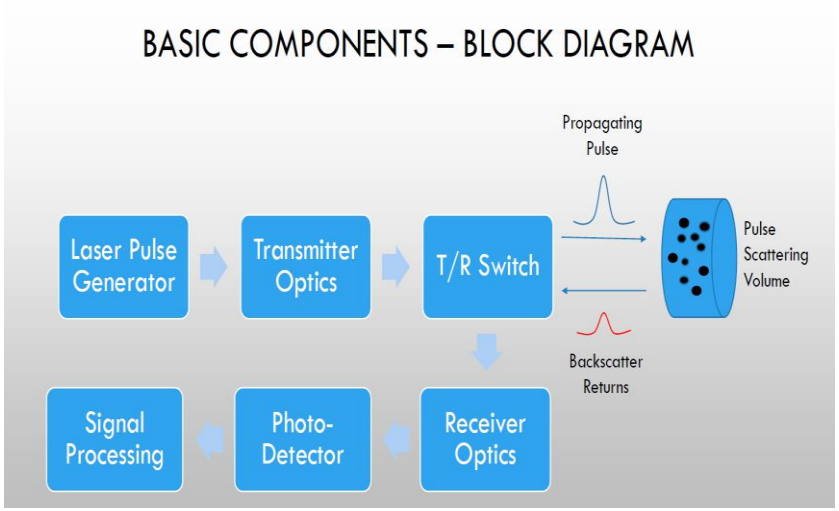
• Spectrum Estimation using Periodogram and Correlogram and Maximum Likelihood based Estimators have been tested successfully on raw simulated lidar data.

Current Status

• Simulating flow fields to sample realistic atmospheric turbulent flows and evaluate the performance of existing models.

• Testing lidar simulator on exiting analytical solutions describing vortex decay, and using Turbsim Software to simulate 3D wind field with Coherent Structures.

Laboratory Scale Direct Detection Lidar



Block Diagram – General Lidar System Components

Student(s) POC Info: Chad Stewart
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Professor POC Info: Ron Calhoun
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Project Start Date: Fall 2015
Project End Date: Fall 2017

Objectives

- To set up a simple laboratory scale optical device, demonstrating use of major components like laser pulse generator, optical amplifiers, photodetectors, oscilloscopes etc.
- To educate students on the standard signal processing algorithms incorporated for hard target range detection, processing sampled data using MATLAB or C/C++.

Product Schedule

- Obtained quotes from optical device vendors to procure all necessary equipment.

Current Status

- Exploring Raspberry-Pi based sensors for range detection using off the shelf laser, ultrasound or Infra-red sources.

Designing and Operating Self-Organizing Micro-grids for Civilian and Military Applications

RESEARCH

TRAINING

Start Date: Aug 2015 **End Date:** Aug 2017

Nathan Johnson, Assistant Professor
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Objectives:

1. Develop and test algorithms for self-organizing micro-grids that enable self-awareness, self-management, and self-diagnosis without higher-level controls
2. Establish interoperability requirements (hardware, controls, communication) for plug-and-play micro-grids that permit rapid expansion and adaption to changing needs in civilian and military applications
3. Create and test micro-grid hardware configurations for mobile deployment with on-board self-organizing controls
4. Train 30 Veterans in micro-grid sizing, design, component selection, integration, operation, and maintenance
5. Train 20 Veterans in electric grid operation using real-time SCADA system for transmission and distribution dispatch

Product Schedule/ Milestones

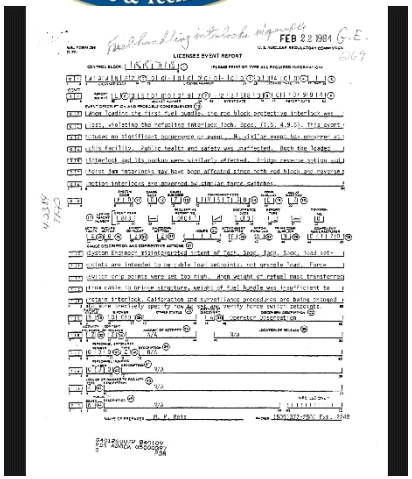
Year 1: Create simulation-based testing environment; Build 2 mobile micro-grids; Develop material for training programs; Deliver micro-grid boot camp and grid operator training

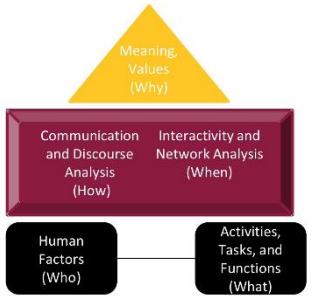
Year 2: Conduct experiments with algorithms in micro-grid test bed; Complete micro-grid design and control configurations for mobile deployment; Test integration of hardware, controls, and communication within ASU's micro-grid test bed

Current Status/ Accomplishments

- Control theory simulations setup for centralized, distributed, hierarchical, & self-organizing control
- 2 mobile micro-grids setup for experimentation
- 15 Veterans trained in micro-grid boot camp
- 10 Veterans trained in real-time grid operation

Energy Leadership Informatics





Project Start Date: January 2016
Project End Date: May 2017

Project Team

Jacqueline Hettel
Assistant Research Professor
Center for Energy and Society

Michael Simeone
Assistant Research Professor
Nexus Lab

Steffan Nelson
U.S. Navy Veteran
Mechanical Engineering Major

Jared Connor
U.S. Marine Corps Veteran
Criminal Justice Major

ELI Alumni
Tyler Gold
U.S. Air Force
Economics Major

Objectives

- ❑ **Develop a more efficient and more robust approach for organizational learning from lessons learned knowledge archives.**
- ❑ **Design models that organizational leadership desiring to make decisions around energy and safety can deploy in agile ways.**
- ❑ **Develop an innovative workflow that uses organizational knowledge assets to better understand organizational structures, and observe trends in communication.**
- ❑ **Design models for enhancing adoption of innovative leadership strategies for deploying solutions to energy safety culture opportunities in both the civilian and defense sectors.**

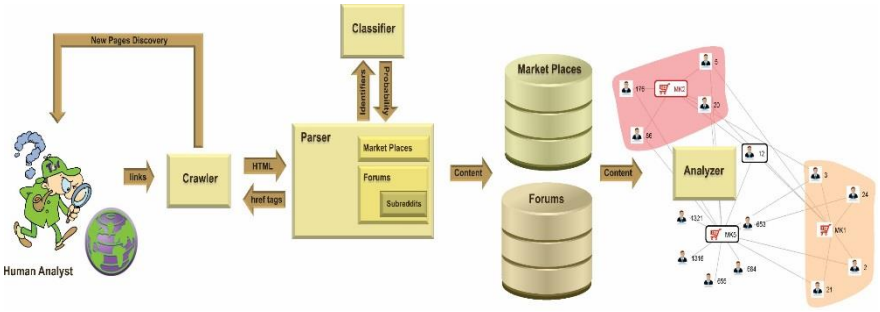
Product Schedule/ Milestones

Milestone	Due Date
Preliminary Results Report	June 30, 2016
Lessons Learned Data Architecture	July 30, 2016
Regional Trend Analysis	October 15, 2016
Site-level Trend Analysis	March 31, 2017
Final Report	May 15, 2017

Current Status/ Accomplishments

- ✓ **Nuclear LER Lessons-Learned Corpus Downloaded and currently under Quality Assurance review**
- ✓ **One team member graduated and employed with the Bureau of Labor and Statistics**
- ✓ **PI Hettel invited to give workshop in Kraków, Poland in July on methods used to create corpora from Lessons Learned databases from this project.**

CyCIT-WS: Cyber Critical Infrastructure Threat Warning Stream



Students POC Info:
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Professor POC Info:
Paulo Shakarian (shak@asu.edu)

Project Start Date: 8/7/2015
Project End Date: 8/31/2017

Objectives:

•Model power infrastructure software dependencies

•Mine malicious hacker darknet forums and marketplaces for threats to cyber vulnerabilities for critical infrastructure

•Develop software to provide warnings when new software exploits can impact power grid infrastructure

Product Schedule/ Milestones

- Create mathematical model of infrastructure dependencies and associated software
- Create darkweb crawling infrastructure
- Allow model to accept darkweb information to produce cyber threat warnings
- Hold intelligence analysis workshop

Current Status/ Accomplishments

- Created initial base infrastructure for darkweb crawling
- Started work toward modeling software dependencies in critical infrastructure
- Conducted pilot intelligence analysis training event with Phoenix PD and FBI
- Several accepted and recently submitted papers

Resilience Processes in Positive Case Studies

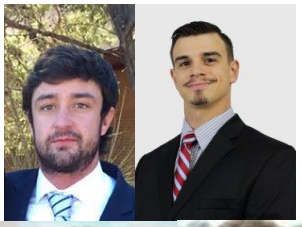
Project Start Date: April 15, 2016
Project End Date: September 15, 2016

Student(s) POC Info:

- **Dustin Simmons**
- **Lucien Hollins**

Professor POC Info:

- **Susan Spierre Clark**
- **Thomas P. Seager**



Objectives:

- **Collect stories from veterans about positive case studies**
- **Identify stories that inform both social and technical aspects of energy system resilience**
- **Create new knowledge for training military leaders and other personnel for design and management of resilient energy systems**

Product Schedule/ Milestones

- May - June: Collect stories from veterans and identify case studies
- June – August: read, interview, write
- August -- September: write and present results

Current Status/ Accomplishments

- Hired two student veterans
- Submitting IRB application
- Coordinating story collection with Tillman Center