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

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Remote Sensing for Smart Renewable Power

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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

**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

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

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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

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

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

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

Product Schedule/ Milestones

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary Results Report</td>
<td>June 30, 2016</td>
</tr>
<tr>
<td>Lessons Learned Data Architecture</td>
<td>July 30, 2016</td>
</tr>
<tr>
<td>Regional Trend Analysis</td>
<td>October 15, 2016</td>
</tr>
<tr>
<td>Site-level Trend Analysis</td>
<td>March 31, 2017</td>
</tr>
<tr>
<td>Final Report</td>
<td>May 15, 2017</td>
</tr>
</tbody>
</table>

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

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

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Resilience Processes in Positive Case Studies

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

Example:
Indian Bend Wash Greenbelt

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