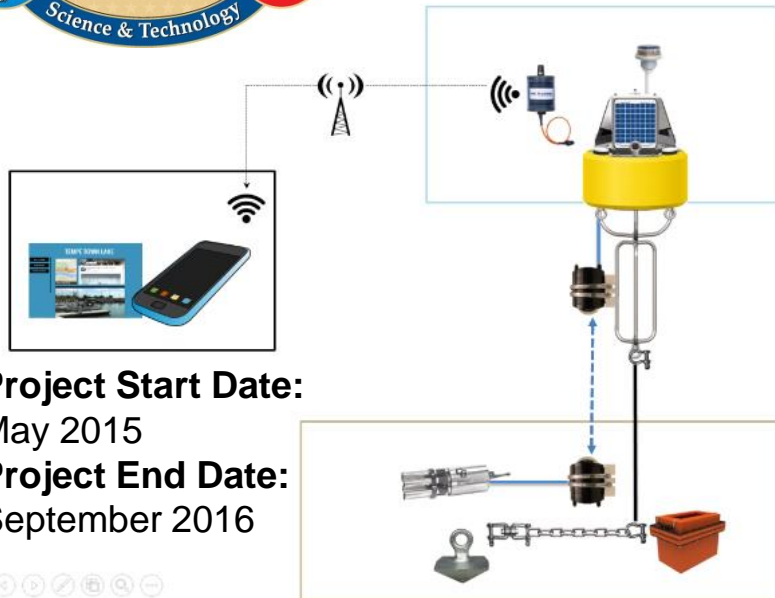




# NEPTUNE



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

## Student(s) POC Info:

Justin Arispe – [justin.arispe@gmail.com](mailto:justin.arispe@gmail.com)

Daniel Hensheid – [dhensche@asu.edu](mailto:dhensche@asu.edu)

Daniel La Rosa – [dalarosa@asu.edu](mailto:dalarosa@asu.edu)

Peter Tueller – [ptueller7@gmail.com](mailto:ptueller7@gmail.com)

## Professor POC Info:

Cody Youngbull – [acy@asu.edu](mailto:acy@asu.edu)

## 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

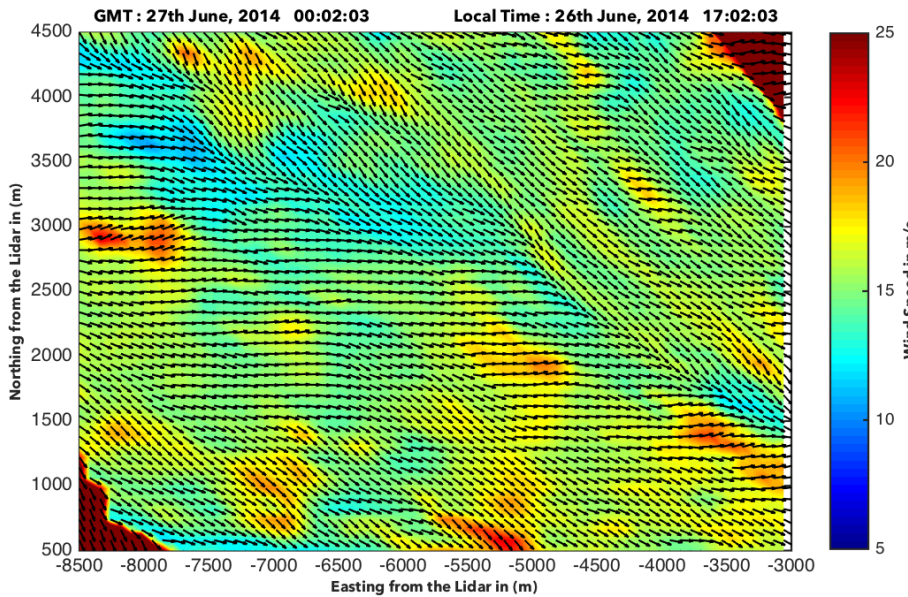
- 90% of system components purchased and ready
- ASU server under construction
- Currently building the watertight link between C6 Sensors and Raven Modem

## 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**  
[c.n.wagmi@gmail.com](mailto:c.n.wagmi@gmail.com)

**Professor POC Info: Ron Calhoun**  
[Ron.Calhoun@asu.edu](mailto:Ron.Calhoun@asu.edu)

**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**

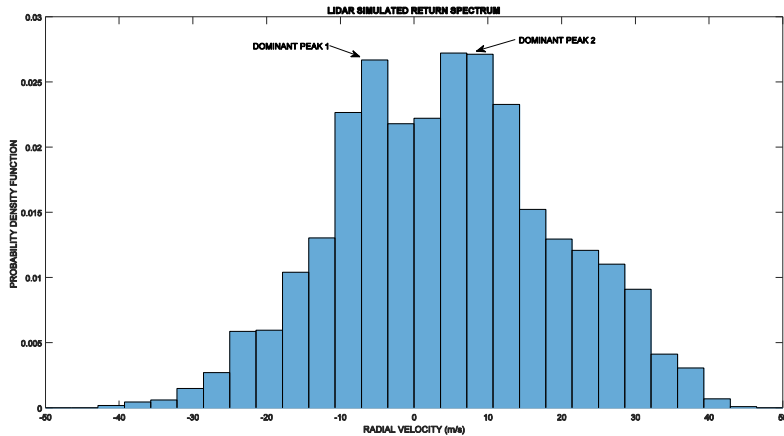
**Project End Date: Fall 2017**

## 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.



Simulate Return Spectrum With multiple Dominant Peaks

**Student(s) POC Info:** Sree Bhaskaran  
sbhaska4@asu.edu

**Professor POC Info:** Ron Calhoun  
Ron.Calhoun@asu.edu

**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

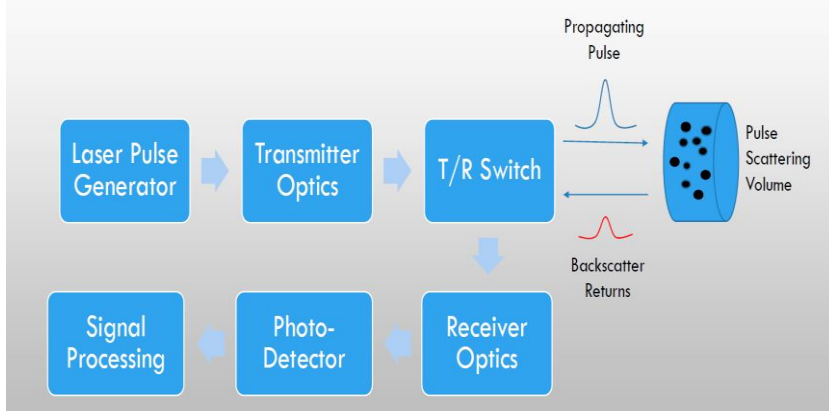
- Simulating flow fields to sample realistic atmospheric turbulent flows and evaluate the performance of existing models.
- Testing lidar simulator on exiting analytical solutions describing vortex decay, and using Turbsim Software to simulate 3D wind field with Coherent Structures.



# Laboratory Scale Direct Detection Lidar



## BASIC COMPONENTS – BLOCK DIAGRAM



Block Diagram – General Lidar System Components

**Student(s) POC Info: Chad Stewart**  
**castewa6@asu.edu**

**Professor POC Info: Ron Calhoun**  
**Ron.Calhoun@asu.edu**

**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  
nathanjohnson@asu.edu, 480-727-5271

**Samantha Janko**, Graduate Research Assistant  
sjanko@asu.edu

**Shaun Atkinson**, Research Specialist  
smatkins@asu.edu

**Yasser Yasaei**, Postdoctoral Scholar  
yyasaei@asu.edu

**Jennifer Flores**, Undergraduate Research Assistant  
jsanti13@asu.edu

**Alexander Mobley**, Undergraduate Research Assistant  
Alexander.Mobley@asu.edu

## 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

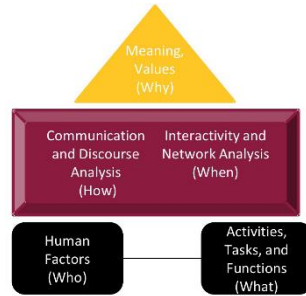
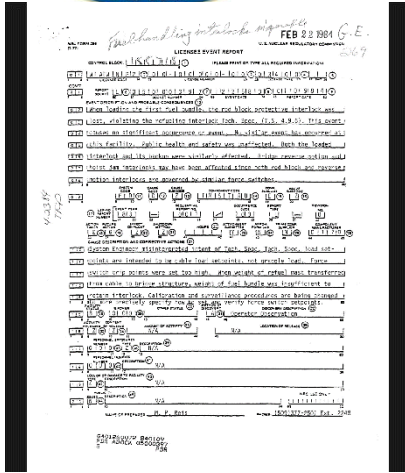
Year 2: Conduct experiments with algorithms in micro-grid test bed; Complete micro-grid design and control configurations for mobile deployment; Test integration of hardware, controls, and communication within ASU's micro-grid test bed

## 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

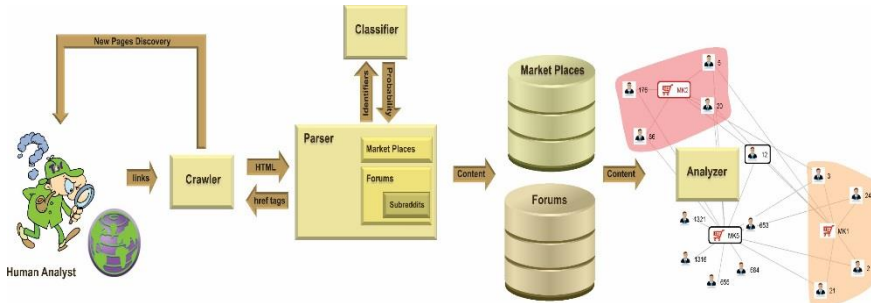
Milestone	Due Date
Preliminary Results Report	June 30, 2016
Lessons Learned Data Architecture	July 30, 2016
Regional Trend Analysis	October 15, 2016
Site-level Trend Analysis	March 31, 2017
Final Report	May 15, 2017

## 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:**  
Vivin Paliath ([vivin.paliath@asu.edu](mailto:vivin.paliath@asu.edu))  
Ahmad Diab ([ahmad.diab@asu.edu](mailto:ahmad.diab@asu.edu))

**Professor POC Info:**  
Paulo Shakarian ([shak@asu.edu](mailto: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

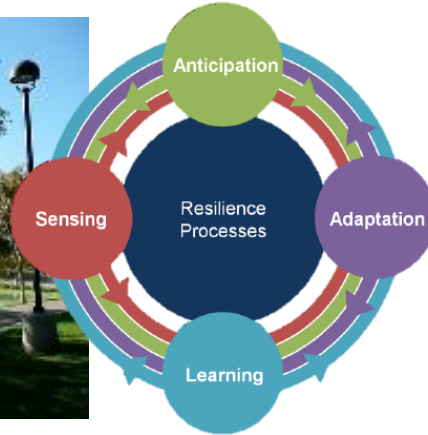
- Created initial base infrastructure for darkweb crawling
- Started work toward modeling software dependencies in critical infrastructure
- Conducted pilot intelligence analysis training event with Phoenix PD and FBI
- Several accepted and recently submitted papers



# Resilience Processes in Positive Case Studies



**Example:  
Indian Bend  
Wash Greenbelt**



**Project Start Date: April 15, 2016**

**Project End Date: September 15, 2016**

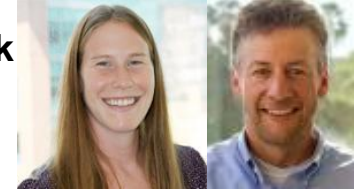
## Student(s) POC Info:

- **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**