

PNNL-SA-100831

*Smart Power Infrastructure Demonstration for
Energy Reliability and Security
(SPIDERS)*

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What Is SPIDERS?

- SPIDERS is a DoD Joint Capability Test Demonstration project (JCTD) that is co-sponsored by DOE and DHS.
- The SPIDERS JCTD addresses four critical requirements needed to demonstrate enhanced electric power surety for national security:
 - Protect defense critical infrastructure from power loss due to physical disruptions or cyber attack to the bulk electric grid.
 - Integrate renewables and other distributed generation to power defense critical infrastructure in times of emergency.
 - Sustain critical operations during prolonged utility power outages.
 - Manage DoD installation electrical power and consumption efficiently, to reduce petroleum demand, carbon “bootprint,” and cost.
- The SPIDERS JCTD will incorporate three separate microgrid installations, and uses a “crawl, walk, run” approach that lends itself to streamlining processes for DoD and civilian microgrid adoption.
 - Hickam Air Force Base in Hawaii: circuit-level microgrid, the crawl stage.
 - Fort Carson in Colorado: larger microgrid that will incorporate a large photovoltaic system and vehicle to grid storage, the walk stage
 - Camp Smith in Hawaii: the entire base will be incorporated into the microgrid; significant renewable energy and storage will be implemented, the run stage.

SPIDERS Participants

- DoD, DOE, DHS
- USPACOM, USNORTHCOM
- DOE - 5 National Laboratories
- Military Services
- Army Construction Engineering Research Lab (CERL)
- Naval Facilities Engineering Cmd.
- Local Utility Companies
- States of Hawaii & Colorado



US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory



SPIDERS 3 Phase Approach

STAIRWAY TO ENERGY SECURE INSTALLATIONS

Phase 1

PEARL-HICKAM CIRCUIT LVL DEMO

- Renewables
- Hydrogen Storage
- Hydrogen Fuel Cell
- Energy Management
- VSE SCADA Test at Idaho National Lab

Phase 2

FT CARSON MICRO-GRID

- Large Scale Renewables
- Vehicle-to-Grid
- Smart Micro-Grid
- Critical Assets
- CONUS Homeland Defense Demo
- COOP Exercise

Phase 3

CAMP SMITH ENERGY ISLAND

- Entire Installation Smart Micro-Grid
- Islanded Installation
- High Penetration of Renewables
- Demand-Side Management
- Redundant Backup Power
- Makana Pahili Hurricane Exercise

TRANSITION

- Template for DoD-wide implementation
- CONOPS
- TTPs
- Training Plans
- DoD Adds Specs to GSA Schedule
- Transition to Commercial Sector
- Transition Cyber-Security to Federal Sector and Utilities

RIGOROUS CYBER SECURITY ASSESSMENTS IN PHASE

Phase 1 Operational Demonstration (Complete)

- Phase 1 was composed of primarily legacy equipment. 1 generator and the solar panels were already in place.
- The OD was a 72 hour demonstration to ensure that the system performed as designed.
 - A reduction in fuel consumption of 30.4% was achieved. Associated reduction in emissions were achieved.
 - The successful integration of renewables with a peak of 12.5% was achieved.
 - The reliability of the system was increased since there were 2 generation sources that could be accessed.
 - Power quality was consistent with standards.



Phase 2 Operational Demonstration (Complete)

- Phase 2 was composed of primarily legacy equipment. The generators and the solar panels were already in place.
- The OD was a 72 hour demonstration to ensure that the system performed as designed.
 - A reduction in fuel consumption of 22.5% was achieved. Associated reduction in emissions were achieved.
 - The successful integration of renewables with a peak of 19.0% was achieved. This would have been higher but not all of the solar was available.
 - The reliability of the system was increased since there were 3 generation sources that could be accessed.
 - Power quality was consistent with standards.



Phase 3 Operational Demonstration (May 2015)

- The Phase 3 OD will be completed in 2015 and will encompass the entire fence line of Camp Smith HI.
- In addition to legacy equipment, 5 new tier 4i generators will be installed.
- The new generators are part of a plan to provide ancillary services under existing Hawaii Electric Company (HECO) Programs.
- Based on Phase 2 experiences, the focus of the OD will be on operations, operator reactions, and cyber security.



Concluding Comments

- The goal of the DOE participation in SPIDERS is to develop material that can be used by utilities to evaluate the performance of microgrids.

- This includes not only technical issues, but lessons learned from:
 - The design process
 - Contracting
 - Interactions with third party entities
 - Construction
 - Operations
 - Evaluations

- To the extent possible, all materials from the design process and the operational demonstrations is available to the public.

Questions or Comments?



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