



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

May 2012

COCOM Sponsors: USPACOM and USNORTHCOM
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Transition Manager: NAVFAC Engineering Service Center
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USPACOM Overview

- Largest of 10 Combatant Commands, 15 time zones
- 1 of 6 Geographic COCOMS (CENTCOM, SOUTHCOM, NORTHCOM, EUCOM, AFRICOM)
- 36 countries, 6 largest armed forces, 3 largest economies





USNORTHCOM Overview



- **USNORTHCOM anticipates and conducts Homeland Defense and Civil Support operations within the assigned area of focus (AOF) to defend, protect, and secure the United States and its interests.**
- **AOF is the United States, Alaska, Canada, Mexico, Bahamas, Puerto Rico, and the U.S. Virgin Islands and the surrounding water out to approximately 500 nautical miles.**





The Situation



Defense Science
Board



Feb 08 - “Critical national security and homeland defense missions are at an unacceptably high risk of extended outage from failure of the electric grid.”

May 09 - “Aurora threat revealed the possibility that sophisticated hackers could seriously damage the grid by destroying mechanisms downstream from the initial point of attack.”



Feb 10 - “DoD will conduct a coordinated energy assessment, prioritize critical assets, and promote investments in energy efficiency to ensure that critical installations are adequately prepared for prolonged outages caused by natural disasters, accidents, or attacks.”

References:

- The Defense Science Board Task Force on DoD Energy Security, “More Fight – Less Fuel,” February 2008.
- Powering America’s Defense, Energy and the Risks to National Security, by the Center for Naval Analyses Military Advisory Board, May 2009
- Quadrennial Defense Review Report, February 2010





SPIDERS Summary



The ability of today's warfighter to command, control, deploy, and sustain forces is adversely impacted by a fragile, aging, and fossil fuel dependent electricity grid, posing a significant threat to national security.

The SPIDERS JCTD will address four critical requirements:

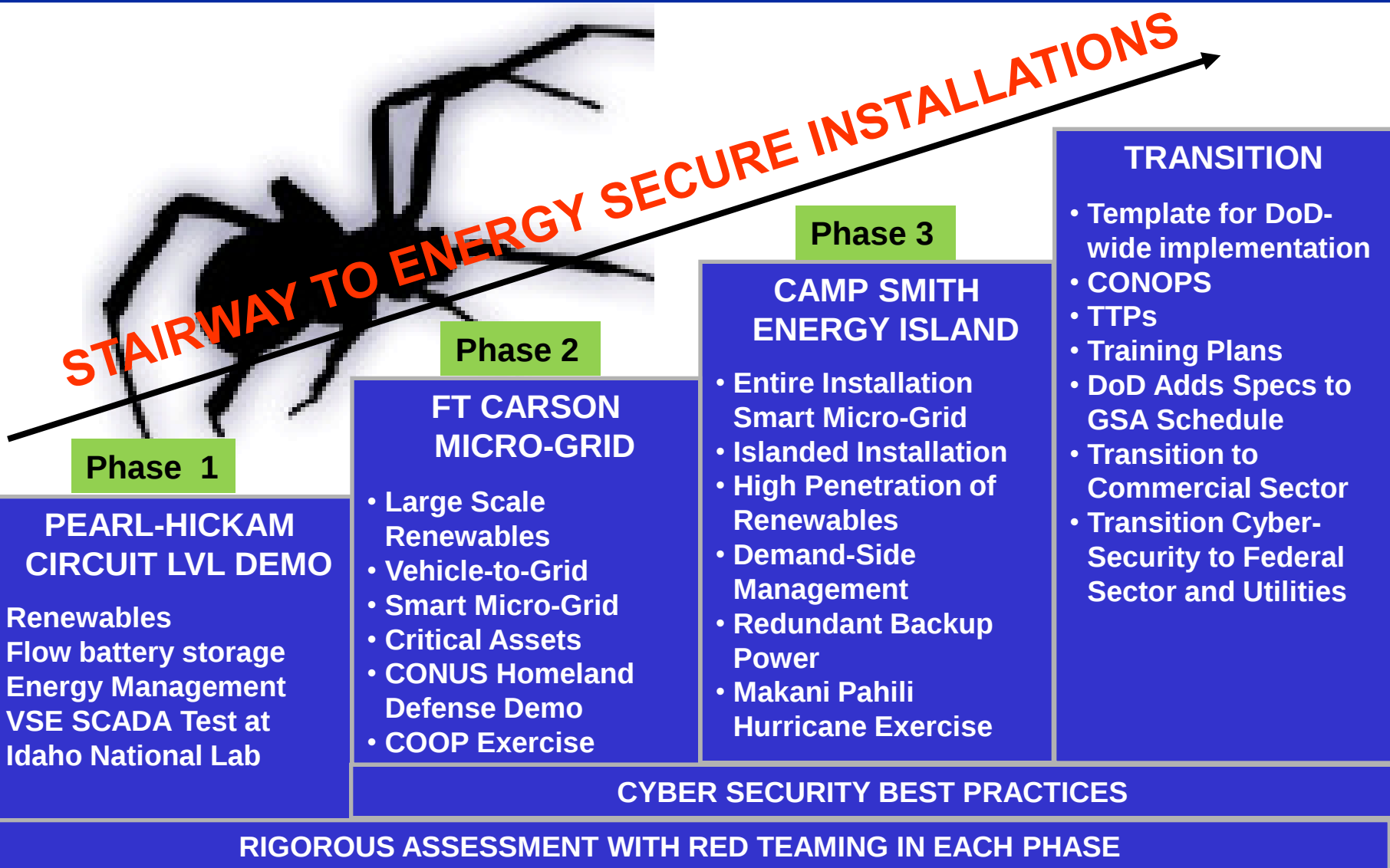
- Protect task critical assets from loss of power due to cyber attack
- Integrate renewable and other distributed generation electricity to power task critical assets in times of emergency
- Sustain critical operations during prolonged power outages
- Manage installation electrical power and consumption efficiently to reduce petroleum demand, carbon "footprint," and cost

The modern military needs to evolve its power infrastructure. New threats demand new defenses





SPIDERS Program Summary





SPIDERS Participants



- **USPACOM, USNORTHCOM
DOE, and DHS**
- **5 DOE Nat'l Labs**
- **USACE/ERDC-CERL**
- **Military Services**
- **Naval Facilities Engineering
Command**
- **Local Utility Companies**
- **States of Hawaii & Colorado**
- **Private Sector**



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



Hawaiian Electric Company



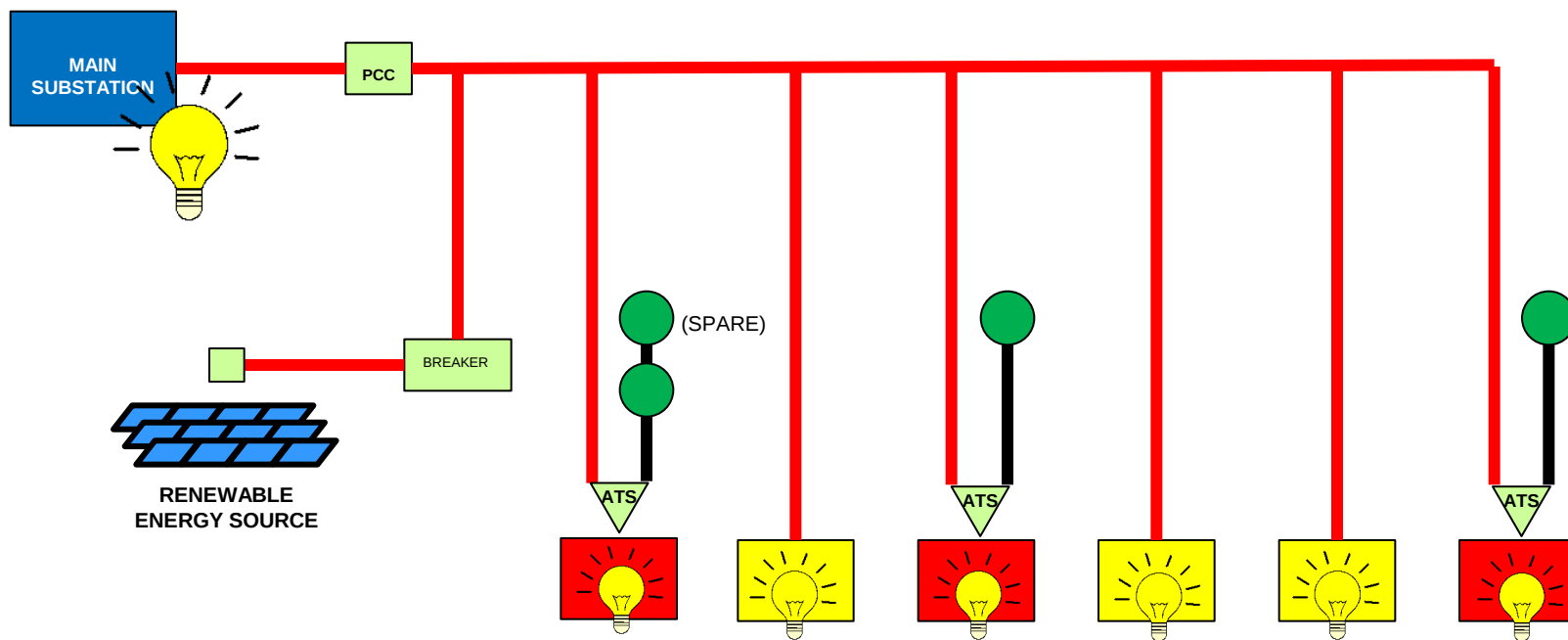
Colorado Springs Utilities
It's how we're all connected





Today – Normal Operations

Normal Commercial Power



■ Mission Critical

■ Not Mission Critical

● Backup Generator

△ ATS Automatic Transfer Switch

■ Breaker/Switch

■ PCC Point of Common Coupling (Main Breaker)

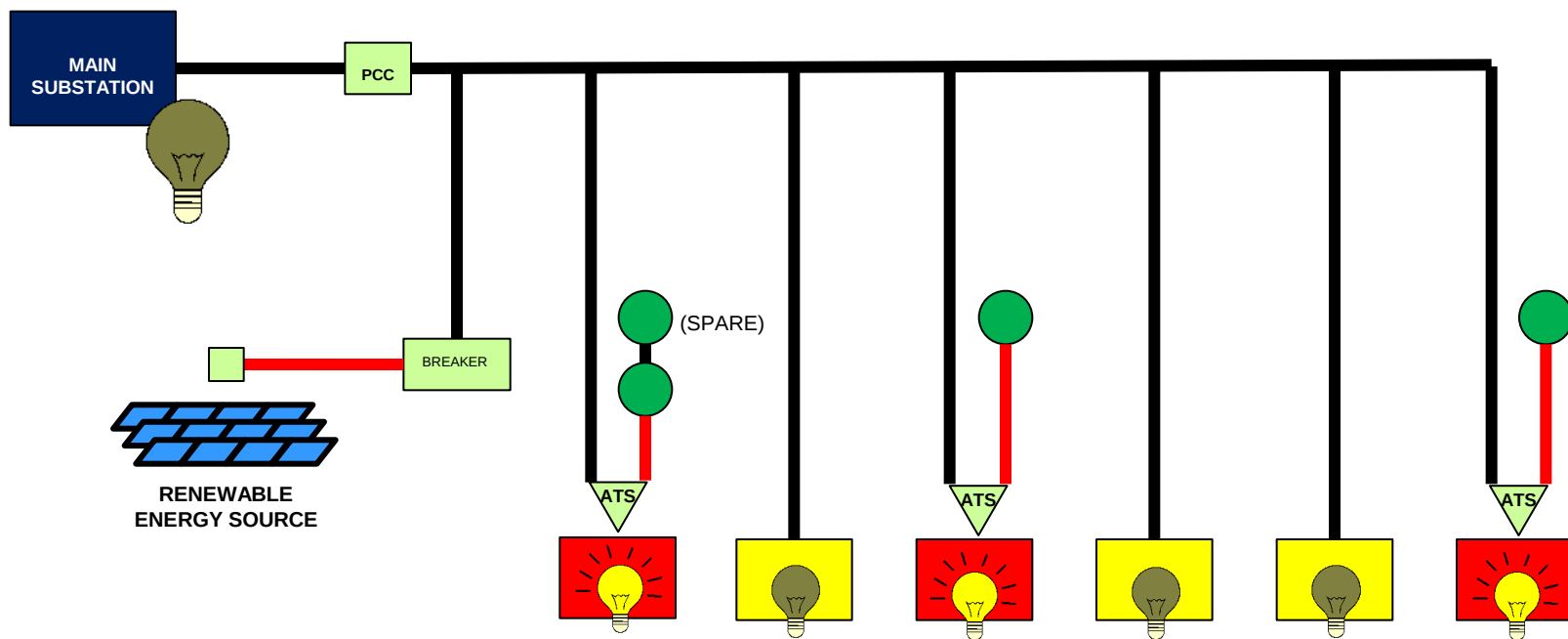




Today – Backup Operations

Loss of Commercial Power

Generators Start – Renewables Isolated



■ Mission Critical

■ Not Mission Critical

● Backup Generator

△ ATS Automatic Transfer Switch

□ Breaker/Switch

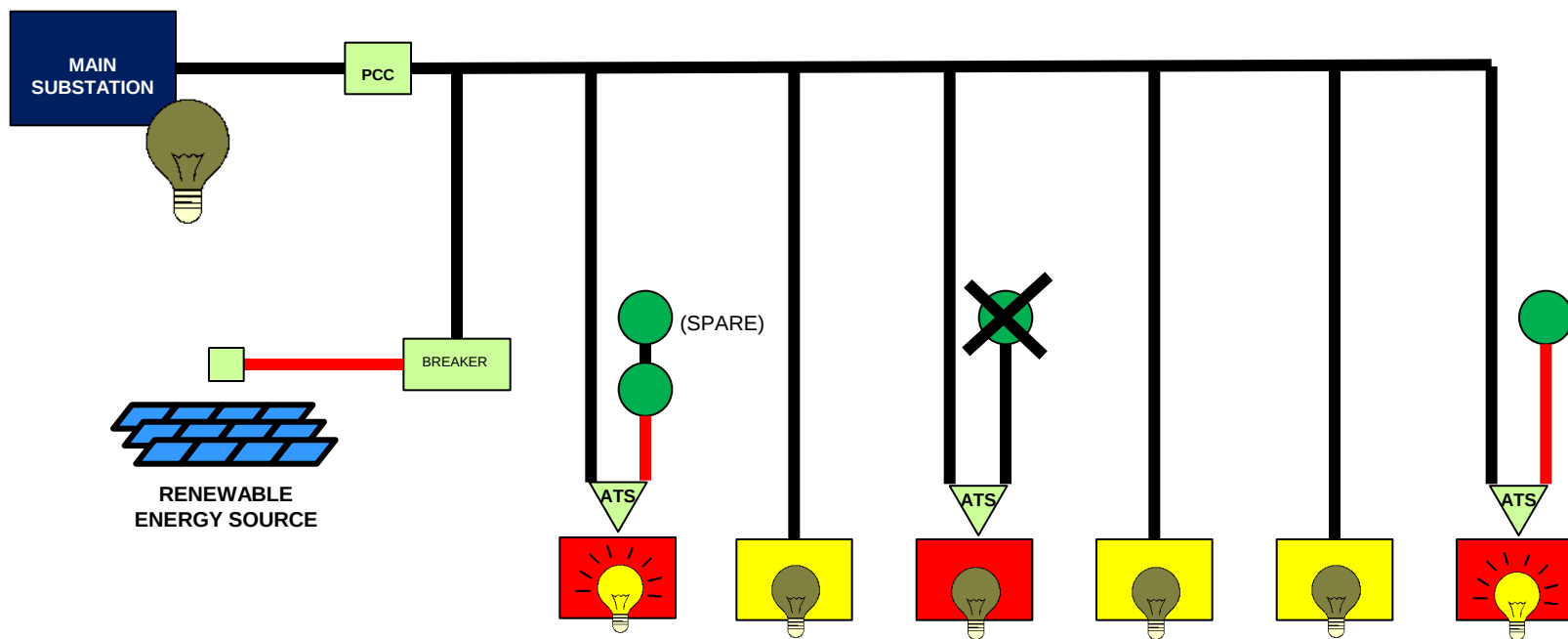
□ PCC Point of Common Coupling (Main Breaker)





Today – Backup Operations

Loss of Backup Generator(s)



■ Mission Critical
■ Not Mission Critical

● Backup Generator
▲ ATS

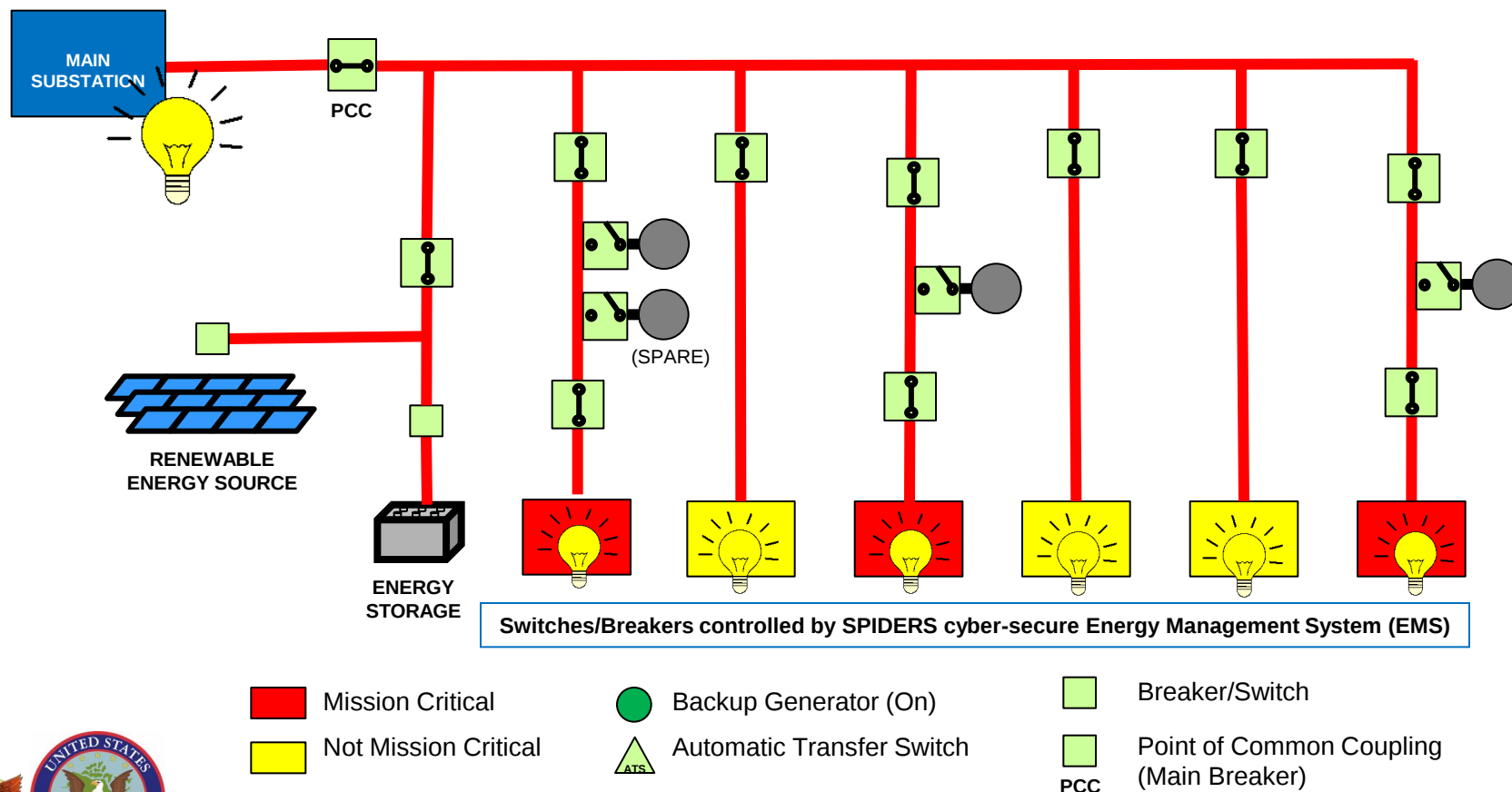
■ Breaker/Switch
■ PCC
Point of Common Coupling (Main Breaker)





SPIDERS Normal Operations

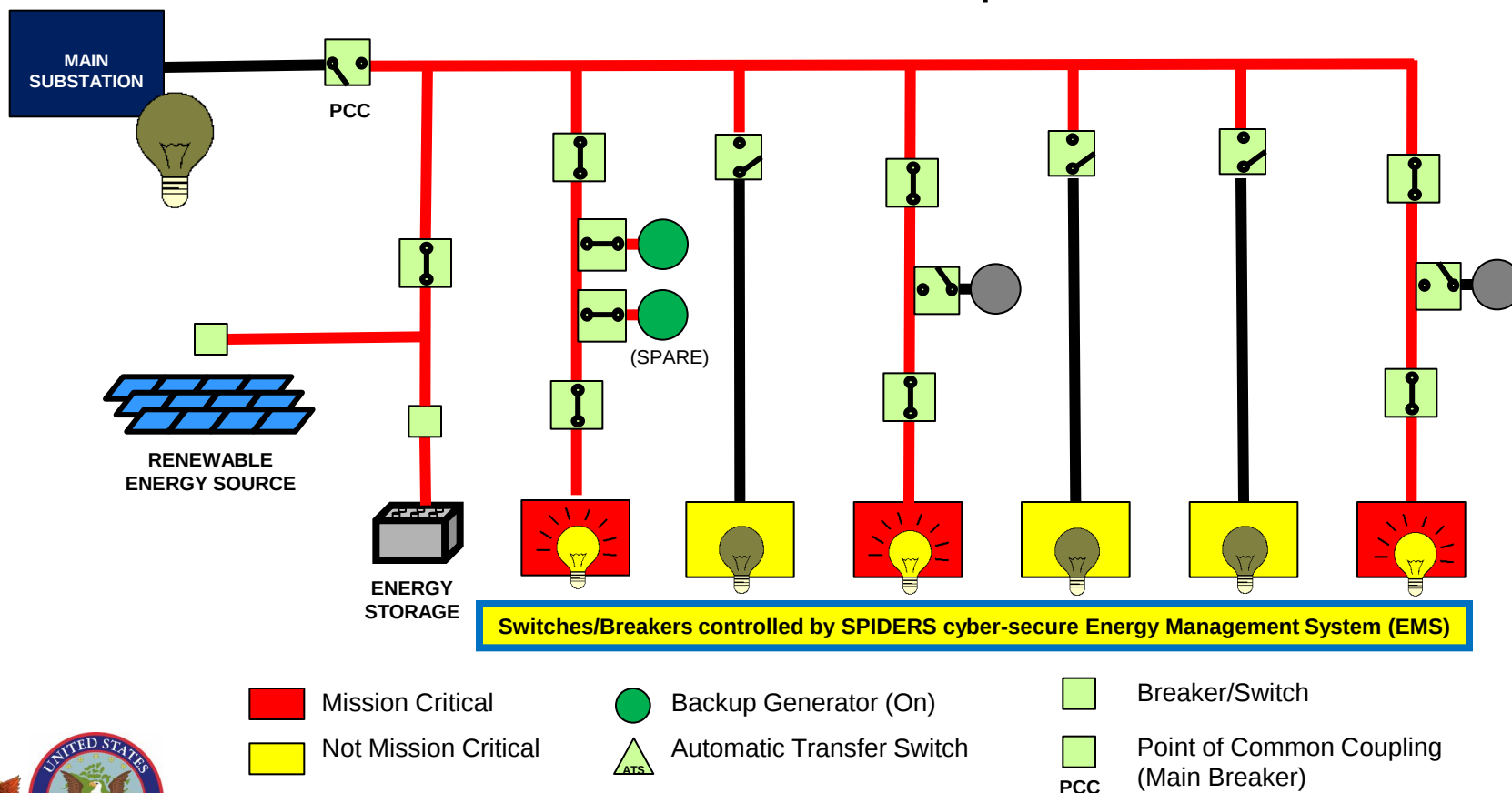
Normal Commercial Power





SPIDERS Backup Operations

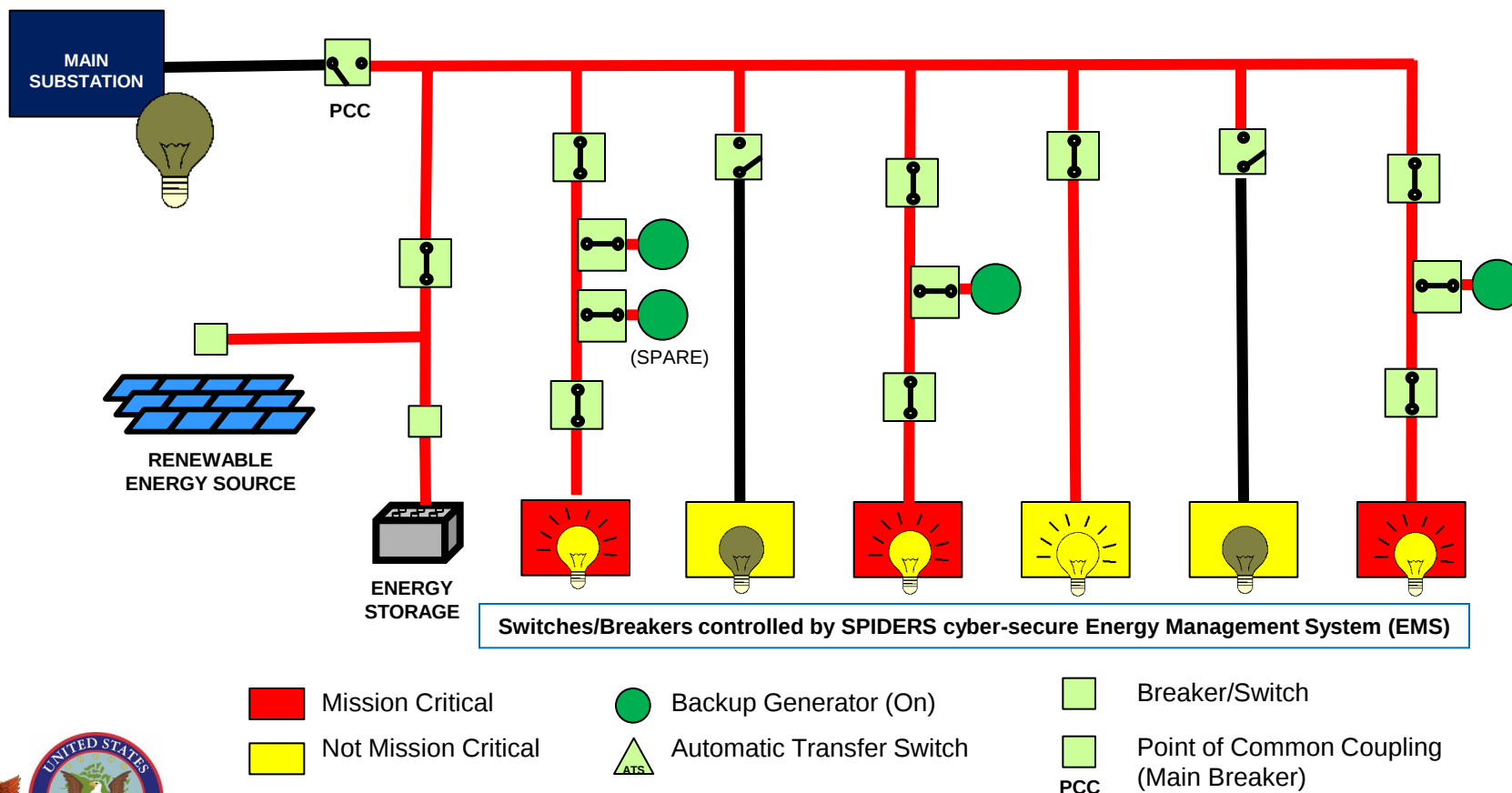
Backup Generator(s) shutdown for Maintenance or Power Optimization





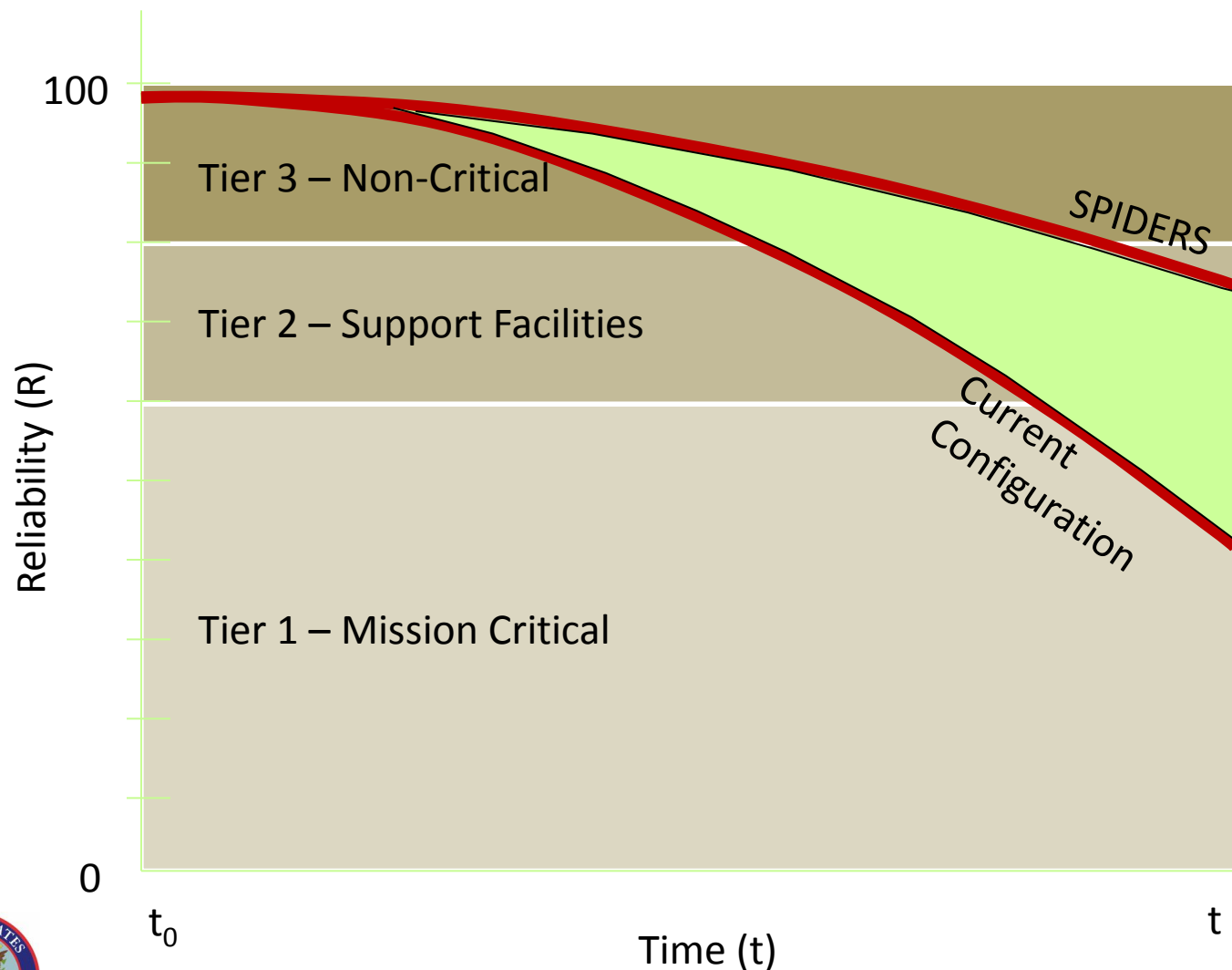
SPIDERS Backup Operations

Option to Power Non-Critical Facility





Notional Power Reliability





Results to Date



Official Start 17 June 2011 Cyber Security Strategy

Initial experiment – Idaho National Lab National SCADA Test Bed
PACOM-led with Sandia and Army red team attackers
Proved the concept with a simplified architecture

Industry days

JB Pearl Harbor-Hickam (JBPHH): - Mar 2011 (50 attendees)
- Sep 2011 (35 attendees)
Ft Carson: - Oct 2010 (40 attendees)
- Sep 2011 (65 attendees)

Phase 1 – Joint Base Pearl Harbor-Hickam, Hawaii

Preliminary design completed April 2011 (Sandia with Oak Ridge, Idaho, NREL)
System Integrator contract award – 23 November 2011
100% design review Apr 2012

Phase 2 – Fort Carson, Colorado

Request for Proposal submitted Jan 2012
Preliminary design Mar 2012 (Sandia with Oak Ridge, Idaho, NREL)
4 of 5 Smith electric vehicles delivered to Fort Carson

Phase 3 – Camp Smith, Hawaii

Conceptual design in progress (Sandia with Oak Ridge, Idaho, NREL)





Transition



Transition Management

Transition Manager: NAVFAC ESC (recently changed NAVFAC HQ)

Assistant Transition Manager: Pacific Northwest National Lab

DoD Transition

Uniform Facilities Criteria (UFC) for Smart Microgrid

Cyber design guides for Industrial Control Systems (ICS)

Residual systems

Operations and Maintenance

Operator Training

Sustainment

Commercial Transition

Cooperation with NIST for microgrid security standards

Working with industry associations and utilities (NERC, EEI, HECO, etc.)





SPIDERS Cyber Concept



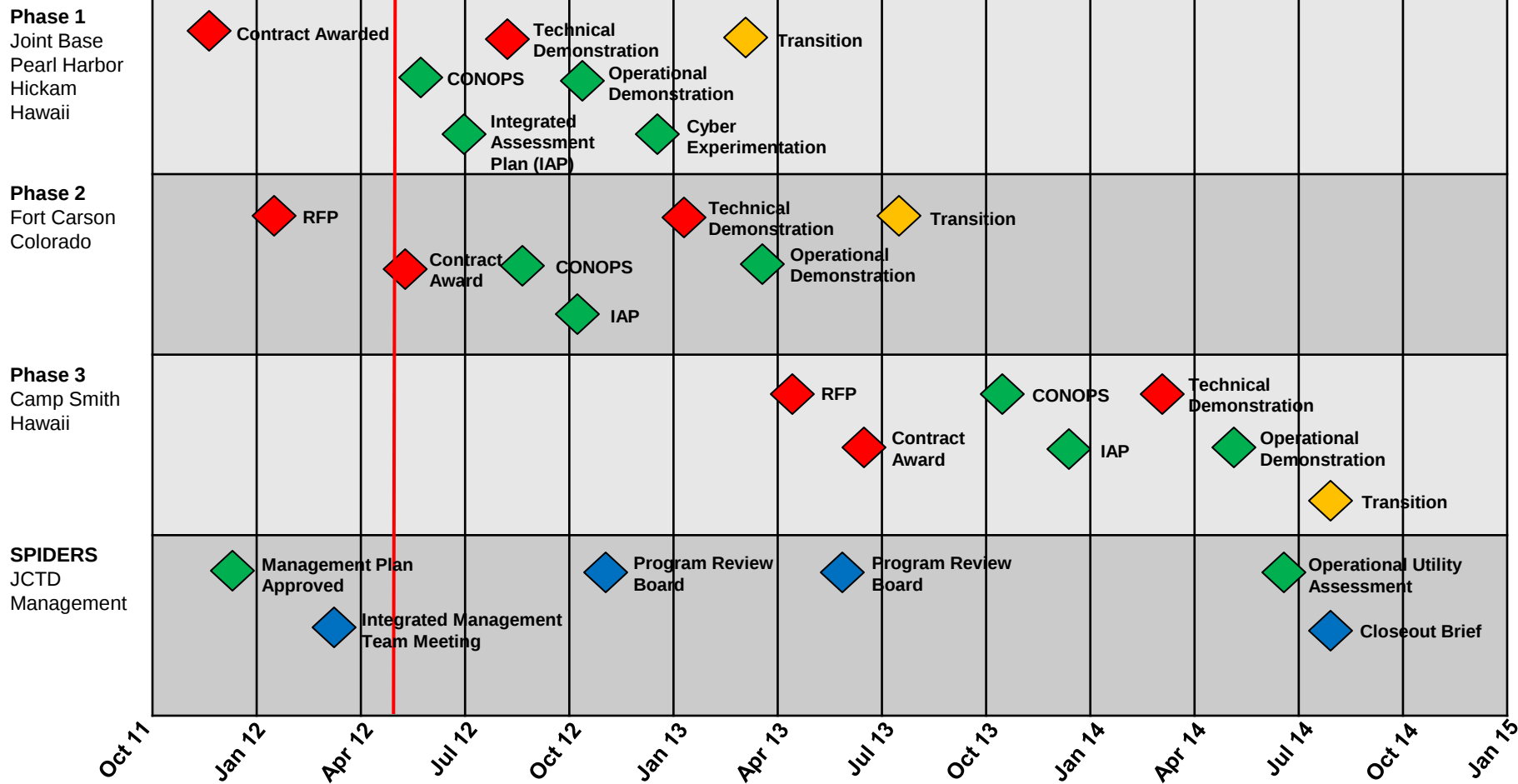
- 1. Initial experiment – INL National SCADA Test Bed**
 - **PACOM-led with Sandia and Army red team attackers**
- 2. Cyber requirements and initial designs by Sandia National Labs**
- 3. Integration contractor for each phase completes final designs**
- 4. DHS CSET assessment and vulnerability assessment in each phase**
- 5. PACOM cyber experiments provide lessons learned**
 - **Next experiment on Phase 1 live microgrid**
 - **Accompanied by SNL reference architecture experiments in lab**
- 6. Operational demonstration and independent assessment in each phase by Pacific Northwest National Labs, in conjunction with COOP exercise in Phase 2 and Makani Pahili state hurricane exercise in Phase 3**

Leverage military installations as infrastructure test bed

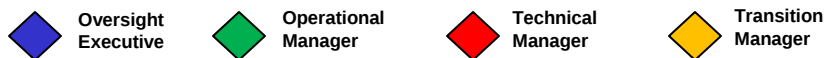




Schedule



Legend:





QUESTIONS?



SMART POWER INFRASTRUCTURE DEMONSTRATION FOR ENERGY RELIABILITY AND SECURITY