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

Sponsors: DoD, DOE, DHS

Operational Managers: PACOM and NORTHCOM

Technical Manager: USACE/ERDC-CERL

Asst Technical Manager: Sandia National Labs

Transition Manager: NAVFAC

Asst Transition Manager : Pacific Northwest National Lab

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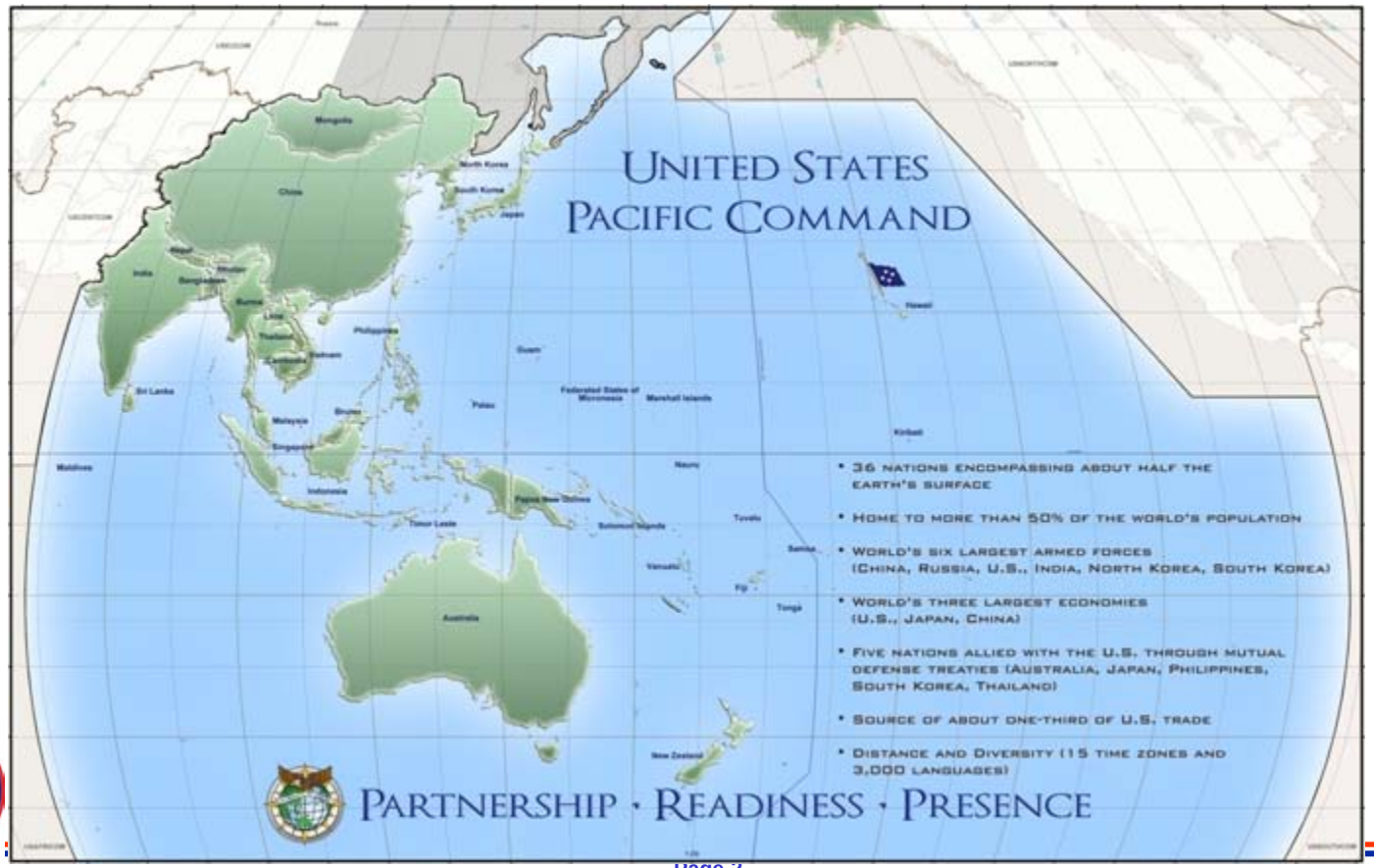
USPACOM Overview

- Largest of 10 Combatant Commands, 15 time zones
- 1 of 6 Regional 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."

CNA ANALYSIS & SOLUTIONS

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."

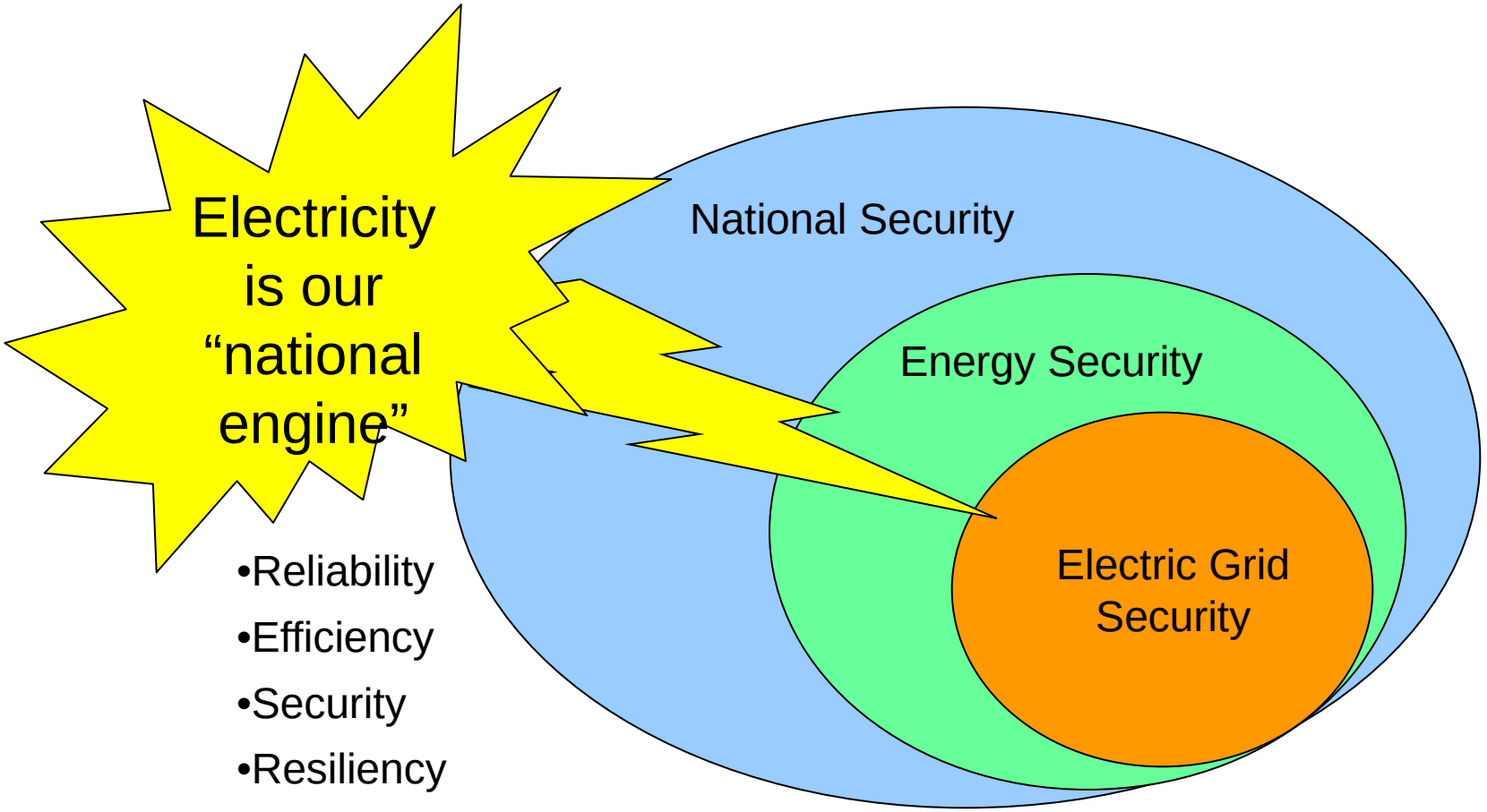
QDR

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*

The National Engine



Dependence on a Fragile Grid

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 deficiencies:

- Inability to protect task critical assets from loss of power due to cyber attack
- Inability to integrate renewable and other distributed generation electricity to power task critical assets in times of emergency
- Inability to sustain critical operations during prolonged power outages
- Inability to manage installation electrical power and consumption efficiently, to reduce petroleum demand, carbon "bootprint," and cost

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

What is the SPIDERS JCTD?

Reduce the "unacceptably high risk"* of extended electric grid outages by developing the capability to "island" installations while maintaining operational surety & security

- ***Demonstrate:***
  - *Cyber-security of electric grid applying virtual secure enclave to SCADA*
  - *Smart Grid Technologies & applications*
  - *Secure micro-grid for sustained mission assurance and emergency support*
  - *Integration of distributed & variable renewable generation and storage*
  - *Demand-side management*
  - *Redundant back-up power systems*
- ***Results in:***
  - Assessment of VSE capability to SCADA networks
  - First complete DoD installation with a secure, smart "islandable" micro-grid
  - Template for DoD-wide installation & industry energy security
- ***High Priority for Three Combatant Commands***

**From Defense Science Board Task Force on DoD Energy Security, Feb 2008*

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

Pacific Northwest NATIONAL LABORATORY

Sandia National Laboratories

NREL

Oak Ridge National Laboratory

INL

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

U.S. AIR FORCE

U.S.ARMY

NAVFAC
Naval Facilities Engineering Command

Hawaiian Electric Company

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

Expected SPIDERS Outcome

STAIRWAY TO ENERGY SECURE INSTALLATIONS

Phase 1

HICKAM AFB CIRCUIT LEVEL 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

CYBER-SECURITY STRATEGY

RIGOROUS ASSESSMENT WITH RED TEAMING IN EACH PHASE

Current Design Status

- Preliminary Design for Joint Base Pearl Harbor Hickam
- Waste Water Treatment Plant is critical load
  - Proxy for mission critical load (size and complexity)
  - Leverages existing hydrogen and RE infrastructure
  - Critical loads / uninterruptible
  - Critical loads / interruptible
- Conceptual Designs to be completed this year
  - Ft Carson, CO – larger micro grid and electric V2G
  - Camp Smith, HI – entire installation

Design process is a crawl, walk, run progression.

Cyber Experimentation

- Defense in depth of Industrial Control Systems
  - Virtual Secure Enclave
  - National SCADA test bed
- Utilize both DoD and DOE red teaming
- Final exam: Operational Utility Assessment

Leverage military installations as infrastructure test bed.

Transition Strategy

- Template for DoD-wide implementation
- Concept of Operations for installations
- Training Plans
- DoD Specifications added to GSA Schedule
- Transition to Commercial Sector
- Transition Cyber-Security to Federal Sector and Utilities

QUESTIONS?


SPIDERS
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