

DoD-EPRI Naval Base Ventura County Microgrid Project (Port Hueneme, CA)



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Presentation to:

CEC Microgrid Workshop

September 6, 2016



Problem Statement & Response

➤ Problem Statement

- At Military Bases, Reduce Energy Usage, Emissions, Intensity, Increase Renewable Onsite Energy Generation, and Improve Energy Security/Resiliency

➤ Response

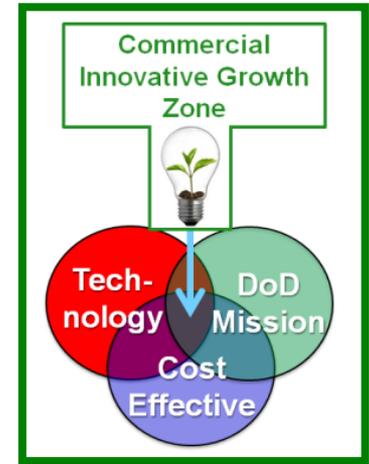
- Design, Construct, Install and Field Test At The Port Hueneme Naval Base An Innovative Transportable Microgrid (With Energy Storage and a Synchronous Condenser), Which Is Superior To Existing Practice & Technology. (Project Term: 9/30/16 to 9/30/19)



*480V, 3 Phase, 60Hz TMES Connection
at Navy Base Substation Site*

Technology Innovations

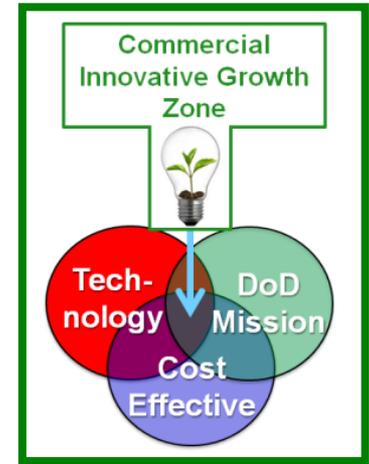
- No Loss of Power During Islanding and Resynchronization Events
- Battery System
 - Lower Costs To Supply Peaking Power
 - Lower Cycling Costs and Emissions (CO₂ and NO_x) From On-Site Fossil Generators (e.g., Diesel Gen-Sets)
- Synchronous Condenser Provides Rotational Mass, Power Factor / Voltage Support, and Mitigates Impact of Short Circuit Fault Conditions
 - Keeps High Ramp Loads and the Microgrid On-Line During Emergency Conditions for a Wide Variety of Electrical Conditions at Army, Navy, Marine, Navy and Coast Guard Sites



*One of Two Tesla Battery Modules
(Each Has 250kW - 4 Hour Rating)*

Technology Innovations

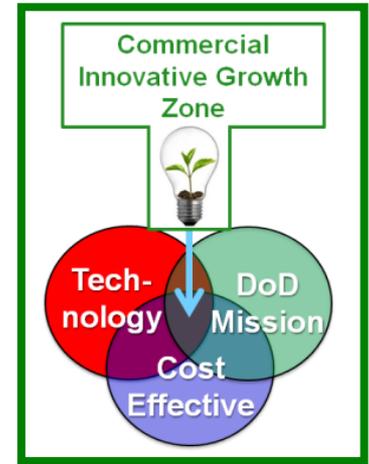
- Resilient Plug-and-Play, Modular Design Enables
 - Improved Scale-Up and Scale-Down Of Microgrid Capacity
 - Larger Set Of Potential Military Site Deployments
 - Easier Upgrade Retrofits of Hardware and Software
- Factory and Field Tests Will Include
 - Real Time Simulation and Interoperability Verification



*Schweitzer Engineering Laboratory
Real-Time Simulator*

Methodology and Functional Operational Characteristics

- Standards Based Approach
 - Uses IEEE Standards For Protection Relays, Ground Fault Conditions, and All Interconnection Hardware
- Robust Quality Controlled Manufacturing
 - Mature Equipment With Testing at Multiple Stages
- Consider Using Adaptive Protection Relays
- User-Specified Fully/Semi-Automatic Grid Reconnection After Islanding Event



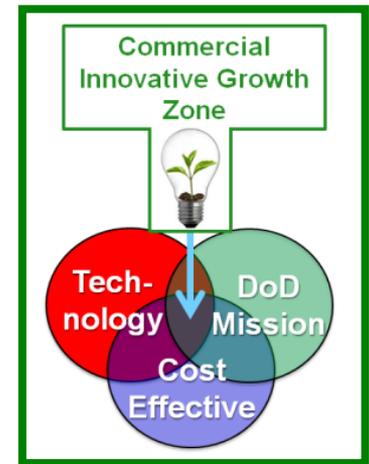
Methodology and Functional Operational Characteristics

➤ Hardware

- All Commercially Available with Guarantees, From Proven Vendors
- Tesla Battery-Inverter System with High Round Trip AC Efficiency:
 - At Site Installation Acceptance Test > 83%
 - Anytime During First 10 Years > 81.5%

➤ Economic Benefits (Preliminary Estimates)

- Benefit-Cost Ratio > 2
- Payback Period < 5 Years



Technology Maturity

➤ Mature Technology Components

- Schweitzer Engineering Laboratory (SEL) Control House (10 Year Warranty)
- Synchronous Condenser (3 Year Warranty)
- Tesla Battery-Inverter System (10 Year Warranty)
- SEL PowerMAX Controller & Protection Systems (10 Year Warranty)

➤ New Project Developments Required

- Hardware: None
- Software: Yes, Via Upgrade of Existing Microgrid Control Software

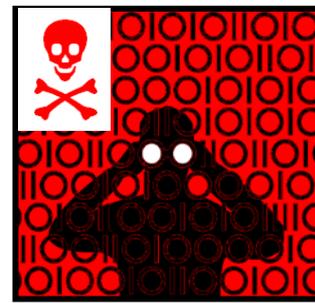


Schweitzer Engineering Laboratory PowerCORE Transportable Control House Showing SEL PowerMAX Microgrid Control System



One of 30+ Schweitzer Engineering Laboratory (SEL) Microgrid Control Systems Implemented since 2003

Technical / Project Risks



➤ Response to Cyber Security Risk

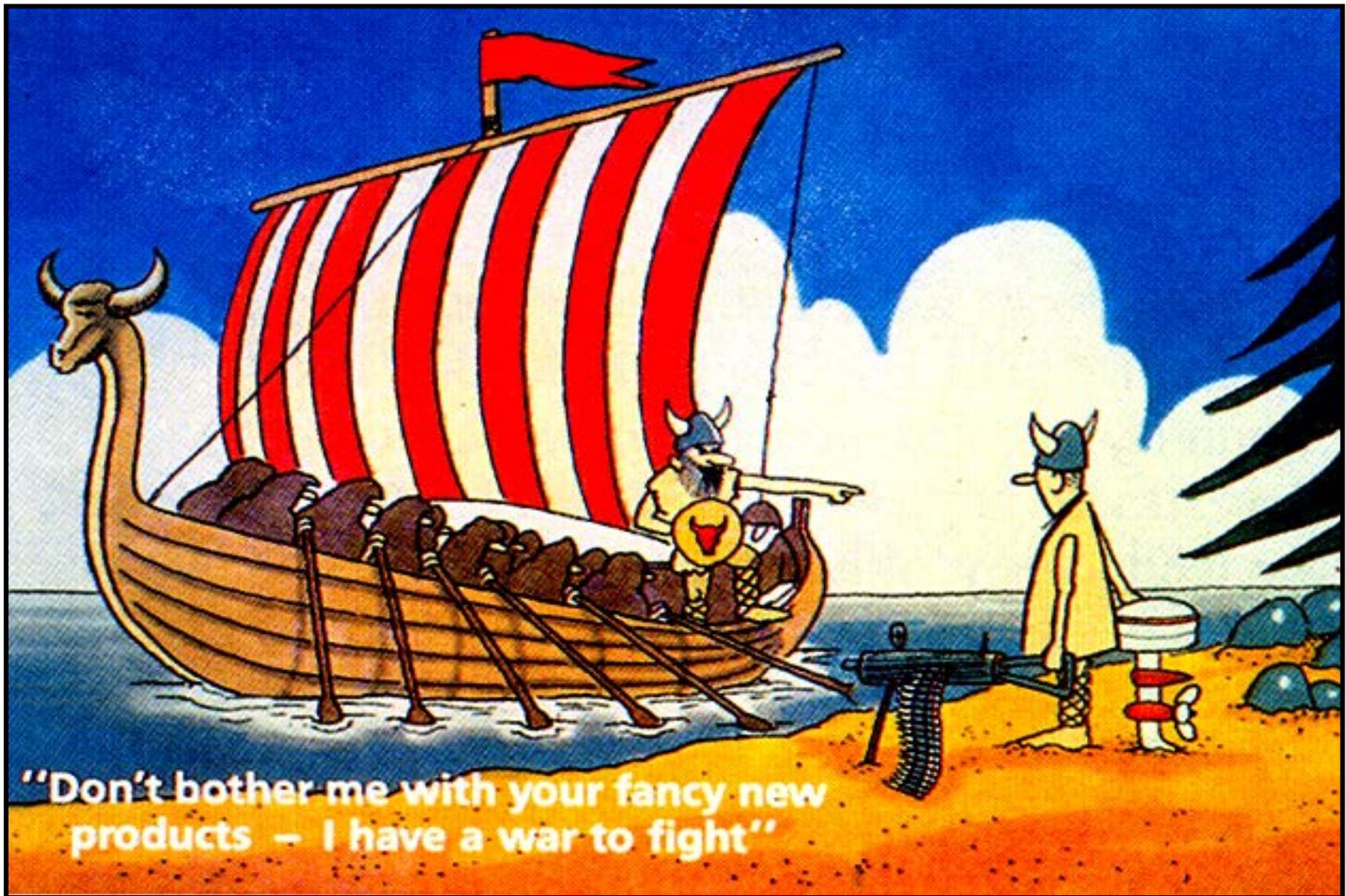
- Data Transfer Diode / Serial-Based Communication Protocol
- What-If Cyber Attack Scenario Testing
- Utilize Lessons-Learned from DoD Risk Management Framework (RMF) and DoD SPIDERS* Project and Testing Results

➤ Response to Battery Degradation Risk

- Tesla Battery Operation Is Within Tesla Specified Operating Conditions
- Obtained 10 Year Warranty On Battery-Inverter System from Tesla

➤ Response to Environmental / Construction Permit Time Delay Risks

- Start Environmental Permitting Process Early
- Allocated Manpower and Project Schedule With 50% Contingency



"We can't solve problems by using the same kind of thinking we used when we created them." - - - Albert Einstein