Welcome!

Joint Engineer Training
2015 JETC
Conference & Expo

hosted by the Society of American Military Engineers

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Contingency Power—New Technologies

Moderator: Col. William Haight, P.E., USA (Ret.), Louis Berger

Speakers:
- Col. Andrew Backus, P.E., PMP, USA, Executive Officer/Chief of Staff, Assistant Secretary of the Army (Installations, Energy & Environment)
- Col. Robert Nicholson, USA (Ret.), Director, Operations, KBR
- Raymond Mardini, P.E., Vice President of Operations, Louis Berger
- Construction Electrician Chief Cory Wright, USN, Mobile Utilities Support Equipment Technician, NAVFAC Engineering
- and Expeditionary Warfare Center
- Lt. Col. Paul Zackrison, P.E., USAF, Chief, Expeditionary Engineering Division, Air Force Civil Engineer Center
Contingency Energy – New Technologies

- Contingency power initiatives
- Service programs for power kit and organizations
- Commercial prime power options / considerations
- Contingency power resiliency
- Open discussion - future power challenges

Moderator: COL(Ret) Bill Haight, PE (Vice President | Louis Berger)
Army Base Camp Power
Joint Engineer Training Conference

COL Andrew Backus, PE, PMP
Office of the Assistant Secretary of the Army
(Installations, Energy and Environment)
Operational Energy:

The energy and associated systems, information, and processes required to train, move and sustain forces and systems for military operations. It provides advantages in the form of extended range and endurance, flexibility and resilience, enhanced mobility and freedom of action.
Army Power and Energy

Every Soldier An Energy Manager

Basing
- Installation
- Contingency

Soldier

Vehicles
- Tactical
  - Air
- Non Tactical
  - Land

OPERATIONAL ENERGY

Operational Energy: The energy and associated systems, information and processes required to train, move and sustain forces and systems for military operations.

NET ZERO STRATEGY

Assistant Secretary of the Army (Installations, Energy, & Environment)
Life Cycle of Contingency Bases

MTOE Solutions – Organic Tents, Gensets & Hi-Power

End State
An integrated system of solutions from which to project combat power, and protect and sustain forces that is resource efficient, environmentally responsible, and regionally appropriate throughout the life-cycle and across the spectrum of employment.

Initial Standard: Tents, Force Provider or BEAR

Temporary Standard: SEA Huts, CHU, RLB, Converted Building
MIL Eng/LOGCAP/AFCAP/GCSC Constructed

“Problem Space”

Semi-Permanent or Permanent Standard: Brick/Frame/Steel Buildings & Infrastructure
MIL Eng/LOGCAP/AFCAP/GCSC or USACE Constructed

Assistant Secretary of the Army (Installations, Energy, & Environment)
How the Army Fights

**MCO**
- Combined Arms Maneuver (CAM)
- Control Terrain
- Defeat enemy forces
- Eliminate military capability
- Offense and Defense
- Limited routes
- High OPTEMPO
- Organic equipment

**Stability**
- Wide-Area Security (WAS)
- Secure Land Area
- Civil Control
- Civil Security
- Dispersion
- Multiple routes & sites
- Complexity of Operations
- Organic and contractor equipment

**Full Spectrum Operations**
- **Simultaneous** Offensive, Defensive, Stability Operations.
- **Differing proportions** - rapidly varied based on situation, and tactical, operational, strategic environment.
- **Synchronized** lethal and non-lethal operations.
- **Decentralized** operations over operational distance.
- **Multiple** small platforms operating independently.
- **Sacrifices** economies of scale for wide area effects.
- Equipment sets the baseline – usage determines consumption.

“Future operations require forces that are able to accomplish more, while utilizing fewer resources.” - TRADOC Pam 525-4-1 – The Army Functional Concept for Sustainment, 13 Oct 2010
Mission Enhancements through OE

**Before**
- Multiple Generators running at sub-optimal levels
- Generator wetstacking
- High Generator Maintenance
- Resupplied by airdrop, Sling Load
- Significant equipment and manpower requirement for resupply

*3kW generator at COP Nerkh powers a single B-hut despite other generators operating far below capacity in close proximity.*

**After**
- Balanced generator with loads to remove excess generators
- Installed hybrid energy solutions to meet energy demands of mission critical systems
- Improved reliability of supply
- Provided OE Subject Matter Expertise to Leaders & Soldiers
- Reduced resupply requirements

**Tactical Energy Security Investments are Expanding CHOICE**
- Reduced fuel consumption
- Reduced # of generators online
- Enhanced mission effectiveness
  - More platoon time for primary mission
  - More helicopter flight time available
  - Expanded logistical flexibility
  - Improved readiness of sensitive equipment
- Short payback periods – saving money
Summary of Changes

Before:
- 13ea generators producing 1400kW
- Fuel loaded into a truck tank and moved to 8 sites daily

After:
- 1ea 250kw with about 120kW load
  (1ea 250kW inline as back-up)
- Added 1ea distribution box & 1100’ of cable found as excess on BAF
- Fuel pump shifted so its hose can reach 1000gal tank next to generators

IMPACTS
- Saving about 1600gal of JP8 per week
- Reduced refueling time by 30hrs/week
- Reduced maintenance team from 10 to 2 people & saved 20hrs per week on PMCS and maintenance
Overseas Contingency Basing

249th EN Bn Mission

**Tactical**
- Base camps size: Smaller
- Duration: Shorter

**Tactical Prime**
- Base camps size: Smaller
- Duration: Shorter

**Sustained**
- Base camps size: Larger
- Duration: Longer

1-200 KW range

201 KW – 4.5 MW range

4.5 MW and up

**Basic:** Bagram - January 2002

**Expanded:** Bagram – August 2002

**Enhanced:** Bagram – Present

*600 man Base Camp ≈ 1 MW of demand
1 PLT can produce 3.2 MW of power*
Power Generation Comparison

1 Megawatt Load - 600 personnel Base Camp (Average Annual Consumption)

<table>
<thead>
<tr>
<th>Fuel:</th>
<th>Two MEP-810B</th>
<th>AMMPs x 25</th>
<th>TQG x 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost:</td>
<td>513,248 Gallons</td>
<td>540,930 Gallons</td>
<td>582,540 Gallons</td>
</tr>
<tr>
<td>Cost:</td>
<td>$6,672,224 ($13/gal)</td>
<td>$7,032,090</td>
<td>$7,573,020</td>
</tr>
<tr>
<td>Maintenance:</td>
<td>Two units</td>
<td>25 units</td>
<td>25 units</td>
</tr>
<tr>
<td>Distribution:</td>
<td>Grid can cover entire base camp</td>
<td>Limited to approx. 150 ft. from generator</td>
<td>Limited to approx. 150 ft. from generator</td>
</tr>
<tr>
<td>Backup Capability:</td>
<td>3 generators online</td>
<td>0 generators</td>
<td>0 generators</td>
</tr>
</tbody>
</table>
Sustainability, Logistics and Basing S&T

STO-D Focus Areas

Fuel Demand Reduction 25%

- Supply Side-Power Generation
- Supply Side-Alternative Thermal / Electric Energy
- Supply Side Power Control, Distribution, Storage
- Demand Side-HVAC
- Demand Side-Habitation Systems
- Demand Side-Organizational Systems

Water Demand Reduction 75%

- Supply Side-Water Purification
- Supply Side-Water Generation
- Supply Side-Water Recycling & Repurposing
- Demand Side-Organizational Systems

Waste Reduction 50%

- Source Reduction
- Waste Reduction and stabilization
- Waste to Energy
- Waste Re-purposing
- Water Based Liquid Waste Management
- Waste Management Analysis
- Planning and Management Tools

TECD Technology Thrust Areas

Enabling Technologies (Examples)

- Microgrids
- Integrated Energy Efficient Shelters (Liners, HVAC, Lighting)
- Fixed and Flexible Photovoltaics
- Energy Efficient Organizational Systems (Kitchen, Laundry, etc)

- Water Recycling & Reuse
- Water Quality Monitoring
- Water Efficient Organizational Systems (Kitchen, Laundry, Hygiene)
- Water Generation (Air, etc)

- Waste Source Reduction
- Waste to Energy Conversion
- Blackwater Dewatering

Assistant Secretary of the Army (Installations, Energy, & Environment)

UNCLASSIFIED
Collaborative Advancement of Standards

ERDC Tactical Microgrid Standards Consortium Management

Tactical Microgrid Standards Working Group
Chair: ERDC-CERL
CERDEC, ARL, PM E252, NAVFAC, AFCEC, E20, PM FSS, NSWC

Service Review
249th, BEAR, MUSE, PM FSS, E20

Draft Standards

Joint Service Stakeholders Group
Army, Navy, Air Force, Marine Corps, OSD, PM MEP

Combined Review
DOE, NIST, and Industry

Final Draft Standards

Standard Approval, Publication and Adoption

Goals/Objectives

Review, Clarifications, Suggestions

Test and Validate Standards

Microgrid Interconnection and Islanding Technical Working Group

Microgrid Operational Communication and Controls Technical Working Group

Microgrid Safety and Grounding Technical Working Group
Assistant Secretary of the Army (Installations, Energy, & Environment)

Contingency Basing Evaluation & Training

**Potential Solutions**

**Base Camp Integration Lab (BCIL)**
- Focus on *expeditionary* equipment, operational energy, and resource efficient technologies for Force Provider PoR (600 PAX) and small/x-small Contingency Bases
- Integrate and evaluate base camp capabilities
- Validate performance and technical readiness
- Data collection and *head-to-head* technology comparison vs. current equipment
- Force Provider unit training
- Throughput: 30K Soldiers per year

**Coordinated Integrated Solution Transition**

**Contingency Basing Integration and Technology Evaluation Center (CBITEC)**
- Focus on Prime Power, protection, construction, environmental protection capability requirements and Soldier training for medium and larger Contingency Bases
- Contingency basing component integration and evaluation and data collection/comparison
- Contingency basing *doctrine and TTP development*
- Develop Theater Construction Standards
- Comprehensive schoolhouse training (Engineers, Military Police, CBRN, Transportation)
- Throughput: 90K Soldiers per year

**Army Warfighting Assessments**
- Refine the network and assess solutions to Army’s Warfighting Challenges
- Annual evaluations to assess materiel, doctrine and organizational design
- Operational Testing that includes CONOPS
- Integrated Army Expeditionary Base Camp

The Army is evaluating and integrating solutions to address Contingency Basing challenges and Capability Gaps.
Forward Base Mode Sites

- The 249th EN BN provides power to critical remote sites
  - Power to radars and mission critical facilities
  - Power to Logistical Support Areas and FPE base camps
Working with the Army

  **ACSIM:** [http://www.acsim.army.mil/](http://www.acsim.army.mil/)  
  **USACE:** [http://www.usace.army.mil/](http://www.usace.army.mil/)

- **Renewable Energy on Army Lands**

- **Science and Technology**
  - Army Acquisition Business Website: [https://acquisition.army.mil/asfi/](https://acquisition.army.mil/asfi/)
  - Base Camp Integration Laboratory: [https://pmfss.natick.army.mil/](https://pmfss.natick.army.mil/)

- **Facilities Energy Innovation**
  - Strategic Environmental Research and Development Program (SERDP) & Environmental Security Technology Certification Program (ESTCP): [http://www.serdp.org/](http://www.serdp.org/)

- **Vehicle Innovation**

- **Small Businesses**
Overview

- BEAR (Basic Expeditionary Airfield Resources) 101
- Expeditionary Power Generation Equipment
- Expeditionary Distribution Equipment
- Expeditionary Base Development
- Current Expeditionary Energy RDT&E Projects
BEAR supports limited and “bare base” operations defined as a location with a runway/taxiway, adequate parking space for aircraft, and a source of non-potable water.

$1.6B Assets to support 2,239 aircraft and 134,364 personnel at 10 austere & 54 semi-austere locations

- Billeting
- Messing
- Hygiene
- Power
- Water Purification and Distribution Systems
- Environmental
- Aircraft Shelters
- Flightline Equipment
- Industrial Equipment
Prime Base Engineer Emergency Force (BEEF)
- Bed down a flying unit mission at a forward base
- Protect and sustain the base (priority is airfield)
- Recover the base in event of attack/damage

RED HORSE
- Self-sufficient construction and heavy repair
- Theater Asset
Power Generation Equipment

- 30KW and 60KW Portable Generators, 120/208VAC
  - Provide immediate power upon arrival
  - Emergency power after installation on Central Power Plant
- 750KW MEP-12 and 800KW BPU (BEAR Power Unit)
  - 4160VAC, Prime Power Rated, Paralleled on multiple circuits
  - Set-up at a selected site for the central power plant
  - Power demand for 3300-person base can exceed 12MW
Distribution Equipment

- **PSC (Primary Switch Station)**
  - High voltage switching and distribution station
  - Receives input from up to 3 HV generators; 3 outputs
  - Sited within 250ft of BPU/MEP-12s

- **SDC (Secondary Distribution Center)**
  - Basically a 150KVA stepdown transformer; 4160 to 120/208
  - Receives power from PSC or another SDC
  - Low voltage side has sixteen 100-amp outputs

- **High voltage cable; 1/0-direct burial**
  - Comes on reel assembly to provide 9,000 linear ft.
  - Connections made via commercial-type load-break elbows
Base Electrical Development

Day 1-5
- CE technicians begin to erect key facilities and connect 30/60KW generators to power key facilities
- CE Electricians and Power techs begin central power plant development (cables, PSC, Fuel Bladders, grounding)
- Additional teams begin trenching/cable installation throughout the base and install SDCs

Day 6
- The first 4-6 BPUs/MEPs are brought on-line
- Some 30/60KW generators off-line; back-up power source

Day 7-21
- Technicians continue installing cable/SDC across the base until most all facilities are powered from central plant
Typical Distribution System

- SDC
- Generator
- PDC/PSCs

Integrity - Service - Excellence
BEAR System for Load and Installation Mgt (BSLIM)

- Capability to centrally manage the Base electrical grid
- Capability to integrate renewable sources into the grid
- Manual or automated load shedding during critical demand periods
- Power critical loads with renewable energy during outages
- Contract awarded to Eaton Corp 1 Sept 2014
BEAR Energy Efficient Shelter System

- Joint program with Army Natick; Funded by ASD OEPP - $17M, 3 yr program
  - Joint testing of 15 shelters (8 AF, 7 Army at Ali Al Salem AB, Kuwait)
  - Tropical testing at Andersen AFB, Guam summer 2014
  - Completed winter testing at Ellsworth AFB, SD April 2014
  - Test new shelter sys with improvements summer 2015 at Holloman AFB
- Achieving over 50% energy savings to cool 2 shelters with one ECU
- Develop requirements document for next generation BEAR energy efficient small shelter fall 2015/spring 2016; joint venture with Army/Marines
BEAR Waste-to-Energy

- Reduces the energy (fuel) required to dispose of municipal solid waste from a BEAR camp.
- Eliminate open burning and associated health hazards
- Capable of handling waste stream without sorting
- Scalable; 2.5 – 7.5 tons per day with additional primary chambers
- Waste Heat and Snygas recovery and feedback
Expeditionary Waste Water Processing System (EW2PS)

- Housed inside of a BICON
- Weigh less than 10,000 lbs.
- All connections compatible with current BEAR Water System
- Processed water to meet/exceed reuse standards
- Minimum throughput of 15,000 GPD
- Reduces energy needs for water processing by 25%
AFCEC Reach Back Center

- Mon – Fri, 0700–1600 CST
- 24/7 Reach Back Capability
- Voice mail/Standby Duty Officer
- 24-72 hour response time
- RFI’s stored in database
- 80% of requests completed by RBC Agents
- Eases subject matter expert’s workload

“Over 59,000 Request’s For information since 2005”

📞 Toll Free: 1-888-232-3721
📞 DSN: 312-523-6995
✉️ NIPR: AFCEC.RBC@us.af.mil
✉️ SIPR: AFCESA@aetc.af.smil.mil

Central point of contact for “ALL AFCEC”; assisting DoD Civil Engineers in the execution of their mission across the full operational spectrum.

Integrity - Service - Excellence
Commercial Prime Power Options and Considerations

Raymond Mardini, PE, Commander, CEC, USN (Ret)  
Vice President | Louis Berger Power
Benefits of Prime Power

- **Quality of Life & Mission Readiness Enhancement for Soldiers**
  - Significant noise and air pollution reduction at living quarters, and commonly used facilities since all power gen occurring in one central location
  - Greatly improved system reliability by eliminating outages due to maintenance, repairs and refueling

- **Cost Savings to USG**
  - Reduction in fuel consumption due to efficiency in power plant centralization, automation, and optimization
  - Power gen based on load demand vs. running on low load,
  - Potential for burning used engine oil in gensets, thus eliminating need for like volume of fuel and HAZMAT disposal. All of the above resulting in
  - Fewer fuel deliveries and convoys; also
  - Cutback in operation and maintenance cost – economies of scale,
  - The removed spot generation can be used elsewhere in theater at smaller FOBs
Benefits of Prime Power, cont.

- **Victory Base Complex Savings – $181M/Year**
  (2007 Gov’t prepared briefing)
  - MW spot generation removed - 101
  - Number of fuel tankers eliminated - 3,457
  - Number of fuel convoys eliminated - 174
  - Cost savings of Spot Gens O&M - $35M
  - Cost savings of Fuel Reduced - $47M

74MW, VBC EAST, IRAQ
Value in Leased Power Plants

- **Supplement Existing USG Organic Power Assets**
  - Tap into larger pool of power generating and distribution assets
  - Cummins for example has > 500 distributor locations worldwide

- **Contractor’s Expertise in Turnkey Power Solutions**

- **Rapid Delivery and Installation**
  - Modular and scalable power systems (expandable power plant)
  - Installation/commissioning complete in as few as 4 to 6 weeks depending on plant size, location

- **Equipment leased for as Long as Needed, then removed**
  - Redirect savings to other critical procurement
Why Leased Power Pants, cont.

- **Reliable Power Plant**
  - Integrated generating equipment & power controls/synchronization
  - Protection schemes at plant and distribution network
  - Fuel type: Diesel/JP8, natural gas

- **Cost Savings to USG**
  - Contractor responsible for full maintenance, repairs, and overhaul
  - USG walks away at end of contract obligation
  - No additional asset management or storage fees
  - Allows soldiers to concentrate on war-fighting missions
Planning & Recommendations

- **Planning**
  - Up-front planning for sizing power plant capacity and distribution network
  - Technology selection based on environment and fuel source availability
  - Initial Capital Expenditure for rapid mobilization & installation, testing and commissioning
  - USG on-base life support to Contractors

- **Recommendations**
  - Theatre-wide organization to champion power requirements
    - Maximize economic advantages
  - Better coordination across contracting agencies and contracting vehicles
  - Streamline funding appropriations (colors of money)
    - VBC-West power plant operationally ready one-year prior to completing LV distribution by another contractor (separate contract)
Naval Facilities Engineering and Expeditionary Warfare Center (NAVFAC EXWC)

Mobile Utilities Support Equipment (MUSE)

CEC(SCW/EXW) Cory Wright
21 May, 2015
History of Camp Lemonnier, Djibouti, Africa (CLDJ)

- November 2002 – USS MOUNT WHITNEY Arrived off the coast of Djibouti with CJTF-HOA Staff.
- May 2003 – CJTF-HOA moved into CLDJ under MARCENT control (~88 Acres)
- March 2006 – Power Assessment completed
  - 6.5MW power plant (Prime Power II) (380V distribution)
  - Approximately 130 tactical generators spread throughout
  - 1250kW carried by dedicated 20kV feeder from EDD
- July 2006 – USCENTCOM assumes command of CLDJ.
- January 2007 – Land lease agreement signed extending CLDJ to ~500 Acres
- August 2007 – CLDJ became fully self-sustaining (power production)
- September 2007 – 7.2MW MUSE Power Plant installed as interim solution
- 2010 – 11kV distribution system installed
- 2011 – Prime Power III brought online (6MW)
- 2014 – MILCON submitted for Central Energy Plant
- 2015 – Additional eight generators added at Prime Power III (12MW)
Forecasting Requirements

- **Plan at least 5 years out**
  - Plan for an Enduring Base if unknown duration
  - Plan for major maintenance, overhaul, replacement
  - Plan for MILCONs whether or not they are approved/funded

- **Look at all renewable energy options**

- **Consider local utility options**
  - Solid State transformers for 60Hz requirements

- **As the site becomes permanent invest in energy conservation projects** (climate control is biggest consumption)

- **Design your power plant to have N+2 or better** (location dependent)

- **Distribute at higher voltages to reduce line loss to the end user**

![Projected Load (MW) Graph]

- FY12
- FY13
- FY14
- FY15
- FY16
Mobile Utilities Support Equipment (MUSE)

- **Primary Mission**
  - Provide specialized utility equipment for temporary support of shore utility systems. (OPNAVINST 11300.5C)
    - Inventory includes 750kW-2,500kW diesel generators and 1,500kVA-5,000kVA mobile substations

- **Alternative Energy Initiatives**
  - Construction of Microgrid Test Facility
    - Secure, controlled environment to test emerging alternative energy resources
    - Large Scale Energy Storage (Batteries)
    - Photovoltaic (50kW Array)
  - Organic Rankine Cycle Unit
  - Biofuel Testing completed in August 2013

- **28 technicians (additional 22 Satellite billets and 4 IA)**
- **Single division within PWBL (E-8)**
- **Historical average of 58 MW deployed ISO shore installations, surface and subsurface fleets, strategic communications**
  - 103 MW of total generation capacity
  - 190 MVA of total transformation
• ISO Modules
• Scalable from 5kW to 10MW
• Systems designed for 2-10 hours at full load
• Integrate with grid connected commercial buildings
• Power Security (Island Mode)
• Can be charged with other renewable energy sources (i.e. Solar and wind)
Organic Rankine Cycle Unit

- Optimizes waste heat utilization
- Generates power (~40-70 kW)
- Reduces engine cooling load (~40-50 kW)
- Expected 8-12% Fuel Economy Improvement
- Packaged for deployment ease and flexibility
Solid State Transformer

• Compact, lightweight and mobile.
  • Enables rapid replacement of transformers that may be damaged as a result of floods, earthquakes, hurricanes, tornados, wildfires or other natural disasters. SSTs may be rapidly transported using helicopters and common fixed-wing aircraft.

• Provide bidirectional current flow
• Easy to parallel and can be used for any frequency and voltage application.
• Convert voltage and frequency.
• Work well for smaller applications (below 100kVA).
Turbine Generators

- 1.1MW Standby rating
- Uses almost all commercially available fuels
- Small foot print and light weight
  - 12’L x 5’W x 5’H
  - Weighs ~9k lbs.
- Powered by Lycoming T-53 Engine
- Can parallel up to 34MW
- Very low maintenance costs
- Not currently governed by EPA
Keys to Sustainable, Reliable Power

COL (Ret) Robert (Bobby) Nicholson
Director, Operations | KBR Government Services
Keys to Sustainable, Reliable Power

- **Strong Preventive Maintenance (PM) Program**
  - Daily generator checks
  - Internal audits and inspections (check the checker)
  - Maintain ASL parts at required level
  - Manufacture training programs

- **Excellent Quality Plan**
  - Identify systemic issues thru Work Instruction reviews
  - Conduct Kaizen events

- **Equipment**
  - Establish pure fleet as much as possible
  - Retire high hour and non-pure fleet generators when possible
  - Conduct Maintenance/Logistics Management Reviews
  - Implement Load Readings tracker
  - Generator Refurbishment Facility

Power Generation Team at Camp Bondsteel, Kosovo
Camp Bondsteel O&M Program

• Four (4) Load-share Generator pads utilized as primary power supply for Camp Bondsteel
  - Total of 18 x 1.1MW generators
  - 2,400 kW power generated within 24 hours
  - Age of Generators: 13 years

• Robust O&M Program, diagnosis and repairs performed regularly have preserved these generators well beyond their life expectancy

• Antifreeze and supplemental coolant additives monitored and corrected during engine service

• Annual blow-by testing
Camp Lemonnier O&M Program

- **Pure fleet** - Streamlining of parts and supply chain management

- **Scheduled maintenance for reliability**
  - Tailor O&M to environmental conditions; extend asset life.
  - Significant cost savings to the US Government preventing a catastrophic failure of a unit

- **Power plants allow constant monitoring of units**
  - Units physically checked hourly, electronic monitoring recording hourly operational readings
  - Prime power verses stand alone generators equals no unplanned power outages.
  - Central tank or tanks reduces refueling time, facilitates fuel supply system monitoring & allows for lower fuel temperature.
Camp Redleg O&M Program

- Deployed to UAE and began technical inspection in November 2014
  - Operational Readiness Rate (ORR) 28% upon arrival
  - O&M increased ORR rate to 96%
  - ORR plan includes changing coolant and pressure washing radiators more often due to ambient temperatures

- Power Optimization
  - Corrected load imbalance
  - Began moving and consolidating assets, generators and power distribution units (PDUs), to affected locations to lighten loads and assist with increased power demands. With the addition of generators this began the load balance process and continued as assets became available

- Rebuilds performed in Kuwait
  - conduct technical inspections of the re-fit gen-sets prior to placing them into service
  - alternators and fuel pumps were not exchanged at re-fit
  - flammable material installed at re-fit for noise dampening – fire hazard
CHALLENGES

• Counterfeit Materials are a global Problem
  – Request Certificates of Conformance for materials supplied from vendors
  – Require Statements of Conforming and Genuine Products for bids
  – Initiate product identification training

• Tampering
  – Patrons may alter equipment
  – Utilize substandard materials and temporary fixes
  – Potential for creating hazards
Open Discussion / Questions

- Future Contingency Power Challenges – different theaters, different users
- “Net Zero” and Renewable Energy Targets – implications for Contingency Power
- Integrating commercial providers into planning and training

Closing Comments