



Less is More: DoD's Strategy for Facility Energy Security and Environmental Sustainability

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Deputy Under Secretary of Defense
(Installations & Environment)*

*E²S² Symposium
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“In the 21st Century, the reality is that there are environmental threats which constitute threats to our national security... climate change has a dramatic impact on national security: [from] rising sea levels, to severe droughts, to the melting of the polar caps, to more frequent and devastating natural disasters all raise demand for humanitarian assistance and disaster relief. ”

**Secretary Leon E. Panetta
Environmental Defense Fund Reception
May 2, 2012**



I. Energy



II. Environment



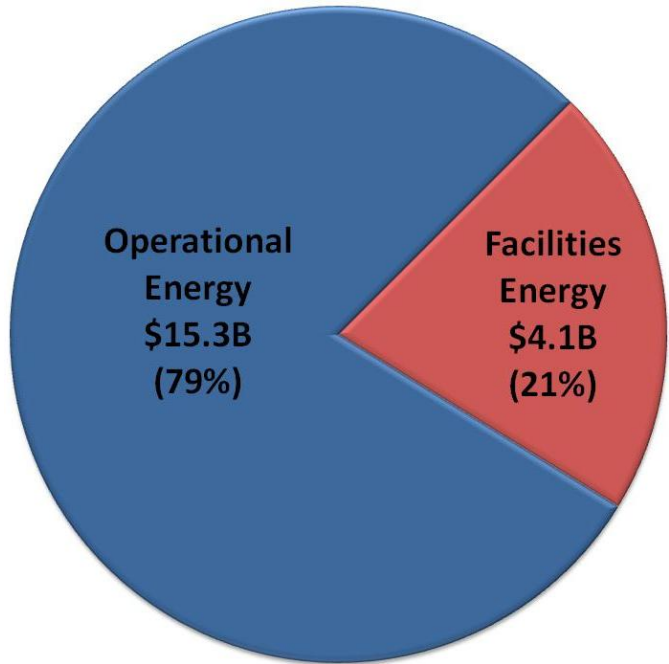
III. Other Priorities



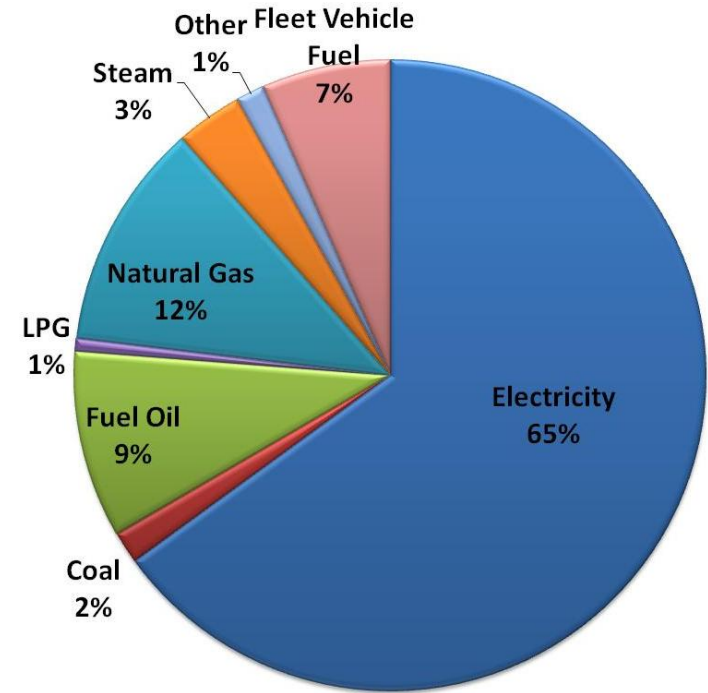


DoD Energy Costs, FY2011

Acquisition, Technology and Logistics



DoD Energy Costs
FY11: \$19.4B
FY10: \$15.2B



Installations

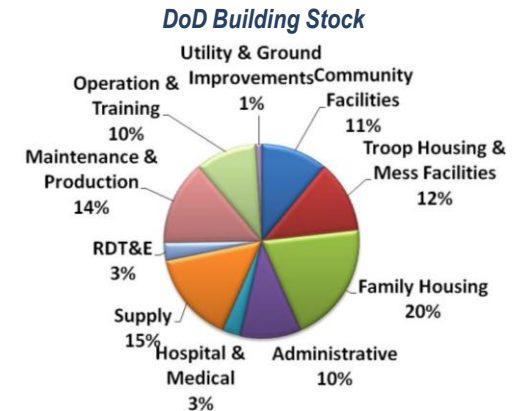


Why Facility Energy Matters

Acquisition, Technology and Logistics

- **Significant Cost**
 - FY11: \$4.1 billion (21% of total DoD energy costs)
 - Cost likely to increase as troops return
- **Environmental Impact**
 - Contributes a disproportionate share (~ 40%) of GHGs
- **Mission Assurance**
 - Permanent installations increasingly provide direct support to the war fighter
 - DoD's reliance on a fragile commercial electricity grid places continuity of critical missions at serious and growing risk ¹

DoD's Built Infrastructure



- **509,926 Facilities** (buildings and structures)
 - 298,897 buildings
 - 2.3 billion square feet
- **Comparisons**
 - GSA: 9,018 government buildings
 - 420 million square feet
 - Walmart US: 4,498 buildings
 - 710 million square feet
- **160,000 Fleet Vehicles**

¹ Defense Science Board, "More Fight – Less Fuel," February 2008



Facility Energy Core Strategy

Acquisition, Technology and Logistics

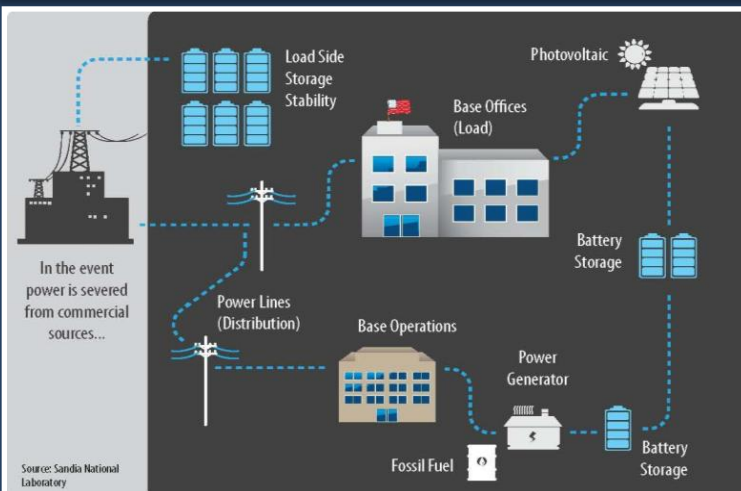
Reduce Demand



Expand Supply



Enhance Security



Leverage Advanced Technology



Installation Energy Test Bed: Roadmap

Acquisition, Technology and Logistics



Smart Secure Installation Energy Management

- Micro-grids
- Energy Storage
- Ancillary Service Markets



Efficient Integrated Buildings

- Design, Retrofit, Operate
- Enterprise Optimized Investment
- Advanced Components
- Intelligent Building Management



On-Site Generation

- Cost Effective Renewables
- Waste to Energy
- Building Integrated Opportunities



Facility Energy Core Strategy: Reduce Demand

Acquisition, Technology and Logistics

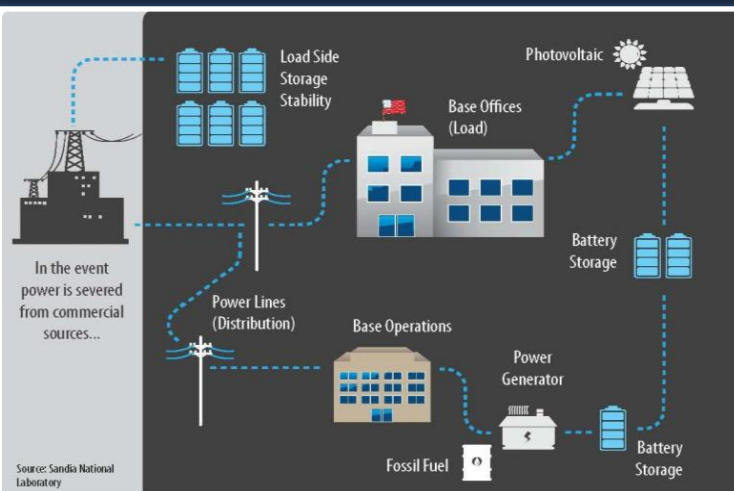
Reduce Demand



Expand Supply



Enhance Security



Leverage Advanced Technology



Installation Energy Test Bed: Roadmap

Acquisition, Technology and Logistics



Smart Secure Installation Energy Management

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Efficient Integrated Buildings

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On-Site Generation

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Facility Energy Strategy: Reduce Demand

Acquisition, Technology and Logistics

- **Retrofits**
 - \$1.1B in FY13 budget
 - Commitment to execute \$1.2B in performance-based contracts in FY12-13
- **New Construction**
 - LEED Silver (or equivalent), ASHRAE +30%, etc.
- **Information Management**
 - Updated metering policy (Spring '12)
 - Enterprise Energy Information Management System (Spring '12)



NSWC Corona
(Energy Retrofits)



Offutt AFB (LEED Gold)



U.S. Air Force Academy (Future LEED Platinum)



Facility Energy Strategy: Reduce Demand

Acquisition, Technology and Logistics

Additional Activities to Promote High Performance Buildings:

- **Developing Unified Facilities Criteria (UFC) for High Performance Buildings**
 - Set minimum standards for all new construction and major renovations
 - Ensure compliance with federal mandates
 - Draw elements from ASHRAE 189.1
 - Require life-cycle cost analysis of building design
 - Due out in late 2012
- **Studying Cost Effectiveness of Green Building Standards and Rating Systems**
 - DoD has partnered with the National Research Council to study the cost effectiveness of ASHRAE 189.1, LEED, Green Globes and other standards
 - Will recommend strategies to ensure cost-effectiveness is considered in all future capital investment decisions
- **Co-chairing (with GSA and DoE) a process to evaluate and compare 3rd party green building certification systems**



Facility Energy Core Strategy: Expand On-Site Generation

Acquisition, Technology and Logistics

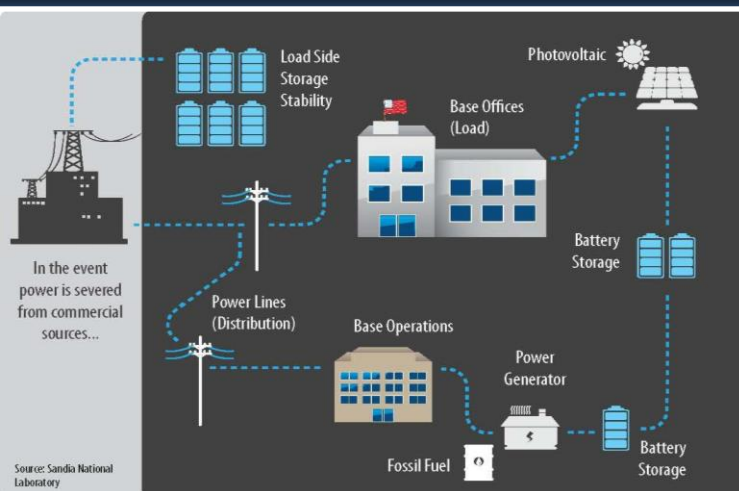
Reduce Demand



Expand On-Site Generation



Enhance Security



Leverage Advanced Technology



Installation Energy Test Bed: Roadmap

Acquisition, Technology and Logistics



Smart Secure Installation Energy Management

- Micro-grids
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On-Site Generation

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Facility Energy Strategy: Expand On-Site Generation

Acquisition, Technology and Logistics

“Defense Department Increases Commitment to Renewable Energy to 3 Gigawatts”

-Washington, DC, April 10, 2012



“U.S. Air Force To Develop 1 Gigawatt of Renewable Energy By 2016”

**-Bloomberg News
April 11, 2012**

“The Department of Defense...will make one of the largest commitments to clean energy in history -- with the Navy purchasing enough capacity to power a quarter of a million homes a year. ”

**-President Obama,
State of the Union
January 24, 2012**

“Army seeks \$7.1 B in private investments for renewable energy”

**-Announced by Secretary of the Army John McHugh
GovEnergy Conference, August 10, 2011**



Facility Energy Strategy: Expand On-Site Generation

ICF Solar Study

Acquisition, Technology and Logistics

Army: 1

Fort Irwin

Navy: 2

NAWS China Lake

NAF El Centro

Air Force: 3

Edwards AFB

Nellis AFB (including NTTR)

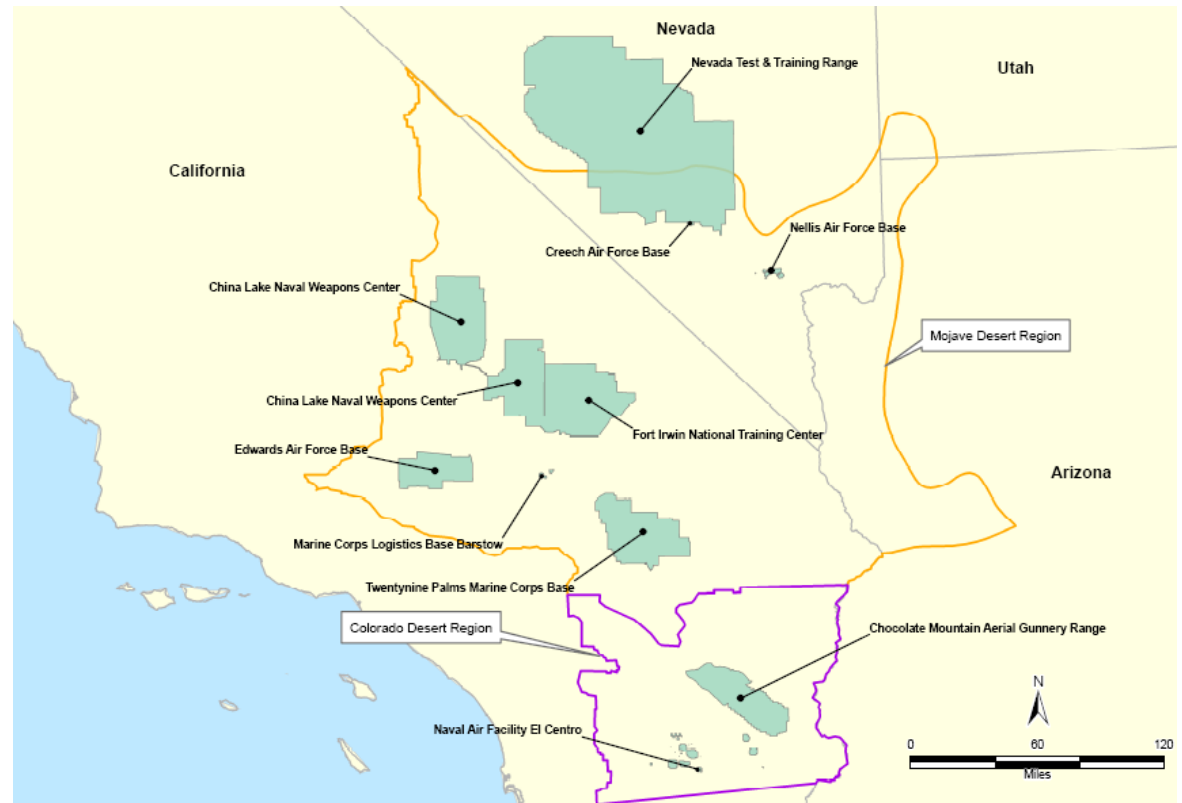
Creech AFB

Marine Corps: 3

MCAGCC Twentynine Palms

MCLB Barstow

Chocolate Mountain Aerial Gunnery Range



Study restricted to land inside installation boundaries including Withdrawn Lands.



Facility Energy Strategy: Expand On-Site Generation

ICF Solar Study

Acquisition, Technology and Logistics

Key Findings:

- **96% of the surface area of the CA installations is technically infeasible due to conflicts (mission, slope, flood hazard, biological & cultural resources)**
- **7,000 megawatts (MW) of solar energy development is nevertheless technically feasible and financially viable**
- **Private developers can tap the solar potential with no capital investment requirement from DoD**
- **Federal government could potentially receive approximately \$100 million/year in rental payments/reduced cost power**
- **Technical, policy and programmatic barriers exist (transmission, withdrawn land management)**



Facility Energy Strategy: Expand On-Site Generation

Navy

Acquisition, Technology and Logistics

NAWS China Lake Geothermal



Joint Expeditionary Base Little Creek



Ford Island Runway PV Project





Facility Energy Strategy: Expand On-Site Generation

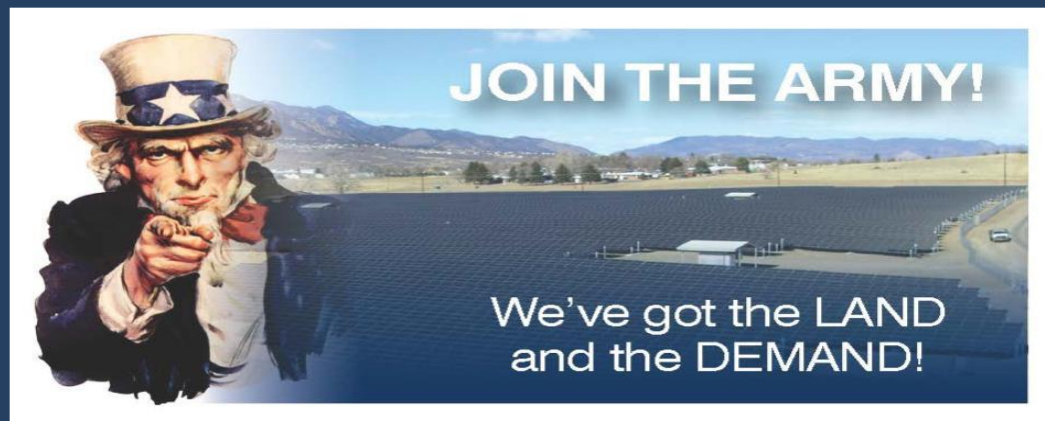
Army

Acquisition, Technology and Logistics

Tooele Army Depot



Fort Carson





Facility Energy Strategy: Expand On-Site Generation

Air Force

Acquisition, Technology and Logistics

FE Warren Air Force Base



Massachusetts Military Reservation



Nellis Air Force Base





Facility Energy Strategy: Expand On-Site Generation

Solar PV on Privatized Housing

Acquisition, Technology and Logistics





Facility Energy Strategy: Expand On-Site Generation

Acquisition, Technology and Logistics



“We’re being out-foxed by the desert tortoise. The expression should be ‘out-tortoised’.”

- CA Governor Jerry Brown



Facility Energy Core Strategy: Improve Energy Security

Acquisition, Technology and Logistics

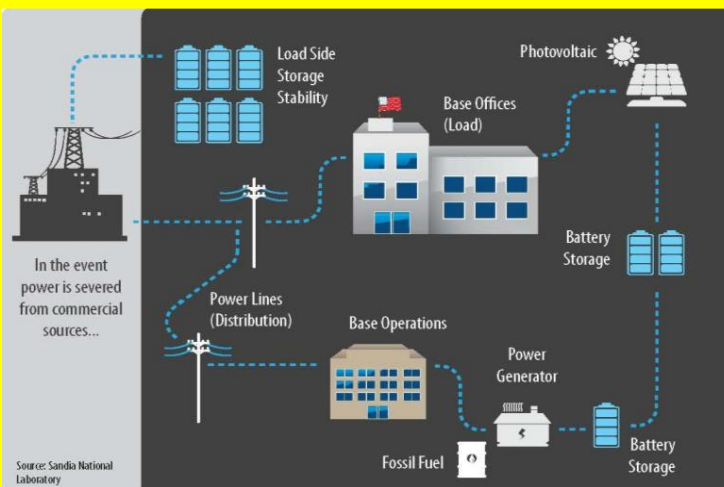
Reduce Demand



Expand On-Site Generation



Improve Energy Security



Leverage Advanced Technology



Installation Energy Test Bed: Roadmap

Acquisition, Technology and Logistics



Smart Secure Installation Energy Management

- Micro-grids
- Energy Storage
- Ancillary Service Markets



Efficient Integrated Buildings

- Design, Retrofit, Operate
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On-Site Generation

- Cost Effective Renewables
- Waste to Energy
- Building Integrated Opportunities



Facility Energy Strategy: Improve Energy Security

DoD and Microgrids

Acquisition, Technology and Logistics

Advanced microgrids are a triple play for DoD:

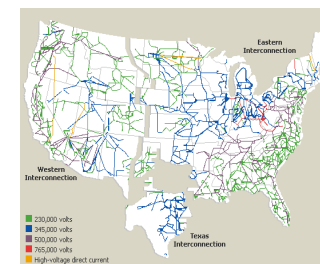
- Reduce energy costs by allowing for load balancing and demand response
- Facilitate the incorporation of renewable and other on-site energy
- Allow an installation to maintain mission-critical loads if the grid goes down

Microgrid (conceptual)



US Electric Grid

Interconnected grid



High voltage transformers





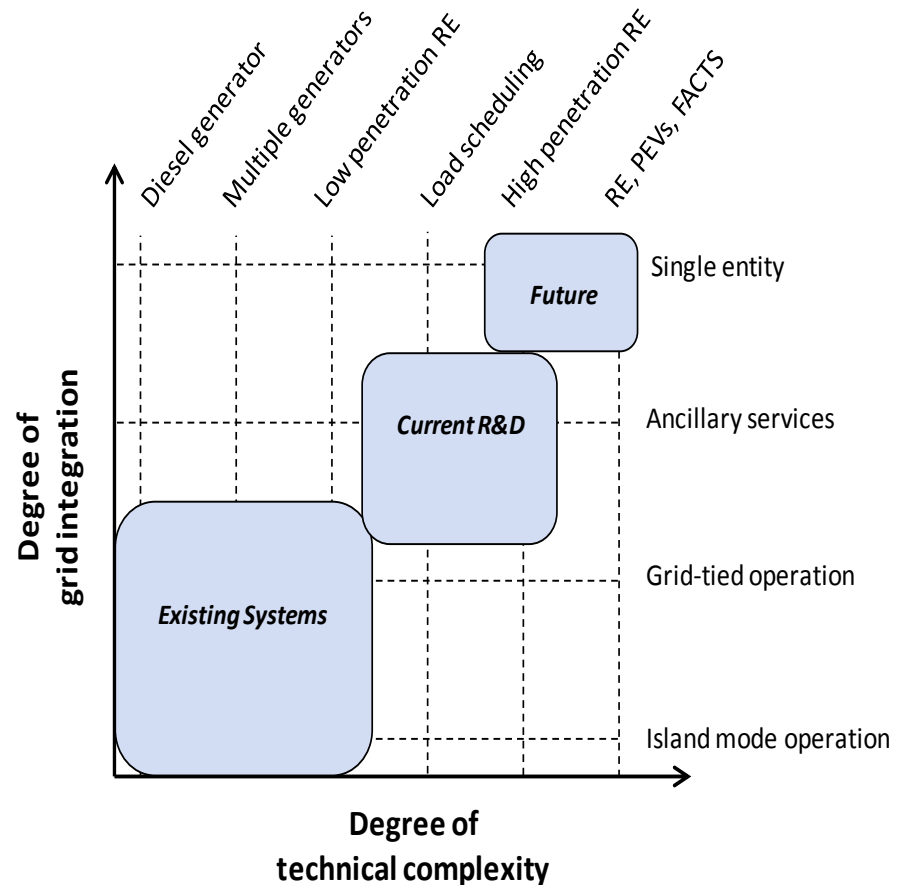
Facility Energy Strategy: Improve Energy Security

DoD and Microgrids

Acquisition, Technology and Logistics

Microgrid Path

- Key challenges
 - Networking multiple generators
 - Introduction of renewable generation
 - Higher penetrations potentially provide greater benefit
 - Faster system response
 - Seamless integration
 - Cybersecurity





Facility Energy Strategy: Improve Energy Security

DoD and Microgrids

Acquisition, Technology and Logistics

Analytical Studies Underway:

- **MIT/Lincoln Lab**
 - Classify different M/G architectures
 - Compare relative cost-effectiveness
- **ICF International**
 - Case studies of 3 installations
 - Opportunities to use M/G and other energy security technologies (e.g., on-site generation, electric V2G) to reduce costs and generate revenue
- **Business Executives for National Security (BENS)**
 - Alternative business models
 - Appropriate scale and scope
 - Impediments to deployment



Facility Energy Core Strategy: Leverage Advanced Technology

Acquisition, Technology and Logistics

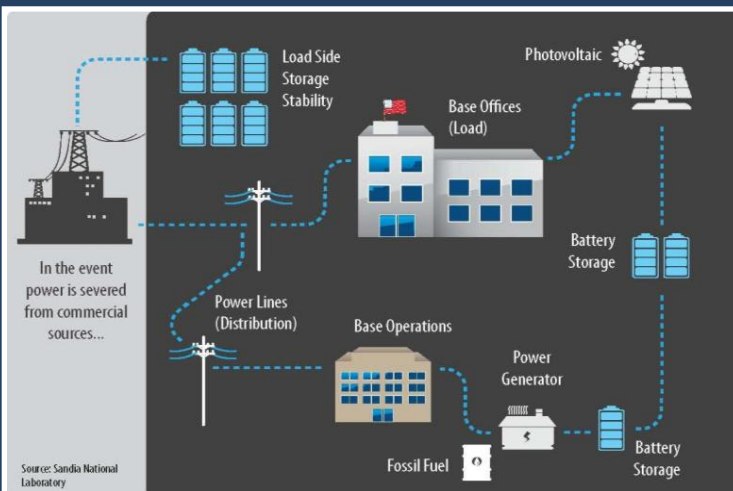
Reduce Demand



Expand On-Site Generation



Improve Energy Security



Leverage Advanced Technology



Installation Energy Test Bed: Roadmap

Acquisition, Technology and Logistics



Smart Secure Installation

- Energy Management
- Micro-grids
- Energy Storage
- Ancillary Service Markets



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On-Site Generation

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Installations: Test Bed for Pre-Commercial Energy Technology

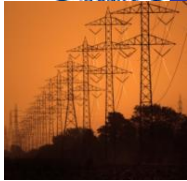
Acquisition, Technology and Logistics

- **Emerging technologies hold the promise of dramatic improvements in building energy performance but face major impediments to commercialization and deployment**
 - Building industry is highly fragmented
 - First user bears significant costs
 - A&E firms face liabilities but do not share in savings
 - Lack of operational testing deters potential adopters
- **DoD is uniquely positioned to help overcome these barriers**
 - It is in DoD's self interest given the size of our inventory (Wal-Mart has its own energy test bed but it is limited to big-box stores)
 - DoD's built infrastructure is unique for its size and variety— it captures the diversity of building types and climates in U.S.
 - Military has 150 years of experience as a sophisticated first user of new technology and an early, market-creating customer (jet engines, aircraft, integrated circuits, GPS, internet)



ESTCP Installation Energy Test Bed Roadmap

Acquisition, Technology and Logistics



Smart Secure Installation Energy Management

- Micro-grids
- Energy Storage
- Ancillary Service Markets



Efficient Integrated Buildings

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On-Site Generation

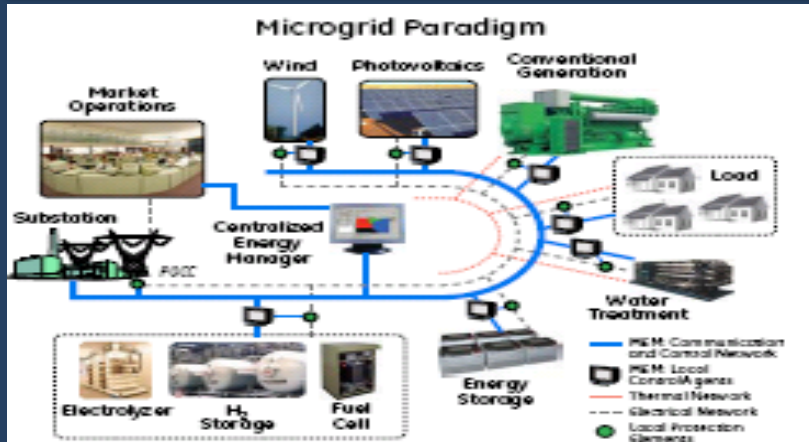
- Cost Effective Renewables
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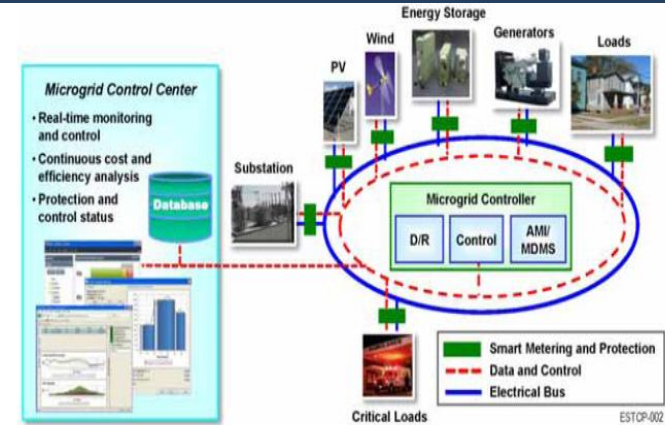
Installation Energy Test Bed: Smart Secure Installation Energy Management

Acquisition, Technology and Logistics

Smart Microgrid at 29 Palms



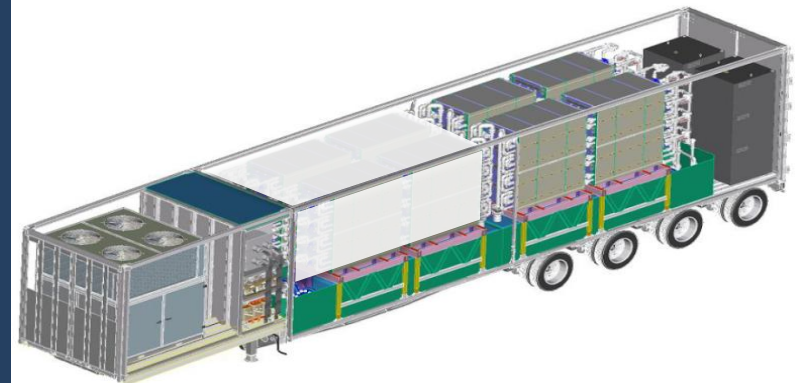
Lockheed Martin Microgrid at Ft. Bliss



Sodium-Metal-Halide Battery Energy Storage System at 29 Palms



Zinc Bromide Flow Battery at MCAS Miramar





Installation Energy Test Bed: Smart Secure Installation Energy Management

Acquisition, Technology and Logistics

- **Microgrids, Energy Storage & Ancillary Service Markets**
 - **Four ongoing demonstration projects**
 - **Lead Organizations: GE (2), UTRC and Lockheed Martin**
 - Two to be completed this year
 - 29 Palms, Ft. Bliss, Joint Base McGuire-Dix-Lakehurst
 - **FY 2012 : 6 new demonstration projects**
 - **Lead Organizations: Eaton, GE, Satcon, Raytheon, LBNL, Honeywell**
 - 29 Palms, Ft. Bliss, Ft. Detrick, Ft. Irwin, MCAS Miramar, LA AFB, Ft. Sill
 - **Four different energy storage approaches**
 - **Two ancillary services demonstrations**



Installation Energy Test Bed: Efficient Integrated Buildings

Acquisition, Technology and Logistics

Electrochromic Windows



Interior Lighting



Nano Technology HVAC (Membrane Dehumidification)



Solar AC





Installation Energy Test Bed: Efficient Integrated Buildings

Acquisition, Technology and Logistics

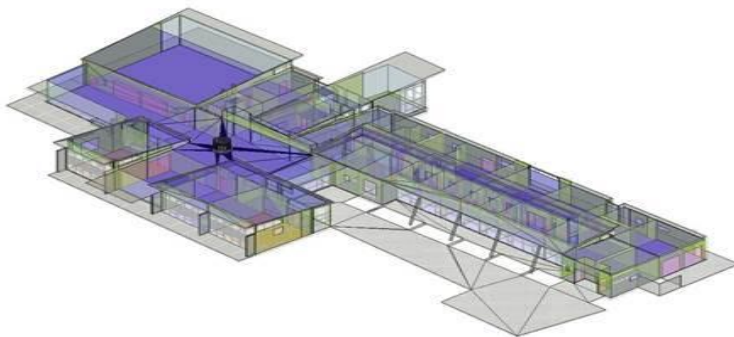
Rapid Building Energy Assessment



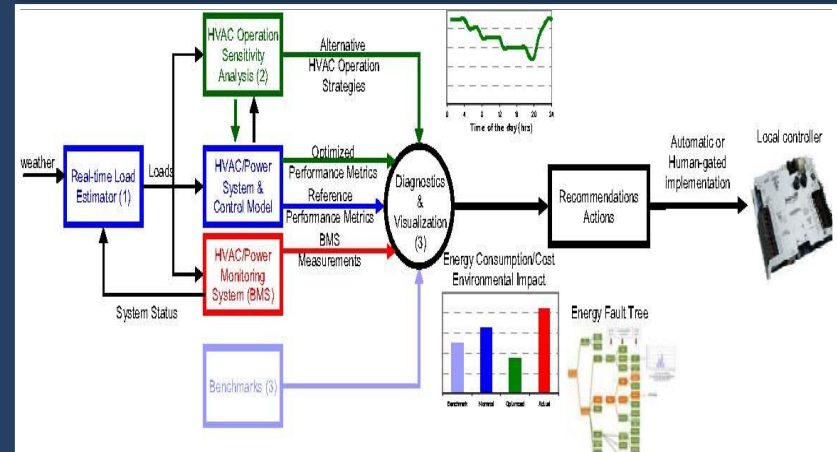
Drive-By Thermal Imaging



Building Energy Modeling



Continuous Building Commissioning





Installation Energy Test Bed: Efficient Integrated Buildings

Acquisition, Technology and Logistics

- **Design, Retrofit & Operate: Enterprise Optimized Investment, Advanced Components & Intelligent Building Management**
 - **22 active projects**
 - UTRC, Philips Research, 3M, PNNL, NREL, NFESC, ERDC-CERL, and many small companies and universities
 - Located on Army, Navy, Air Force and Marine Corps installations across CONUS
 - **FY 2012 : 17 new demonstration projects**
 - UTRC, 3M, Autodesk, Siemens, Honeywell, LBNL, NREL, ERDC-CERL, Army/AF Exchange, Naval District Washington, NFESC and multiple small companies



Installation Energy Test Bed: On-Site Generation

Acquisition, Technology and Logistics

BIPV Roofs



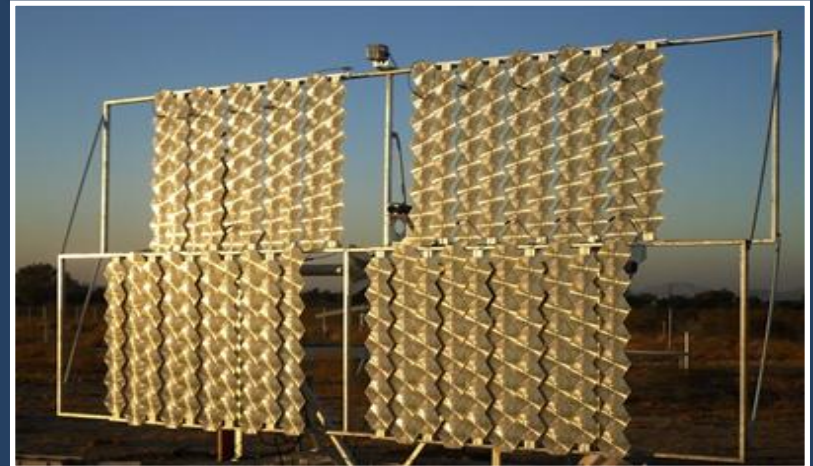
Grid Parity Solar Power



Low-BTU Landfill Gas Microturbine



Morgan Solar Sun Simba





Installation Energy Test Bed: On-Site Generation

Acquisition, Technology and Logistics

Solar Air Heated Roofs



Solar Thermal and Electric Energy



Biomass Gasifier



Waste to Energy Gasifier





Installation Energy Test Bed: On-Site Generation

Acquisition, Technology and Logistics

- **Cost Effective Renewable, Waste-to-Energy & Building Integrated Technologies**
 - **15 ongoing demonstration projects**
 - Infinia, Nanosolar, FlexEnergy, American Solar, Skyline Solar, Electricore, Infoscitex
 - Located on Army, Navy, Air Force and Marine Corps installations across CONUS
 - **FY2012: 4 new demonstration projects**
 - Cogenra, Ener-G-Rotors, Morgan Solar, Southern Research Institute



I. Energy



II. Environment



III. Other Priorities





The Climate Change Threat

Acquisition, Technology and Logistics

Sea level rise and built infrastructure



Permafrost melt in Alaska



Training lands



Stressed ecosystems and threatened and endangered species





How Have We Responded to Date?

Acquisition, Technology and Logistics

Regional Impact Studies

- Impacts of sea level rise and storm surge on military installations
- Impacts to installations in the Southeast and Southwest
- Impacts on DoD assets in Alaska

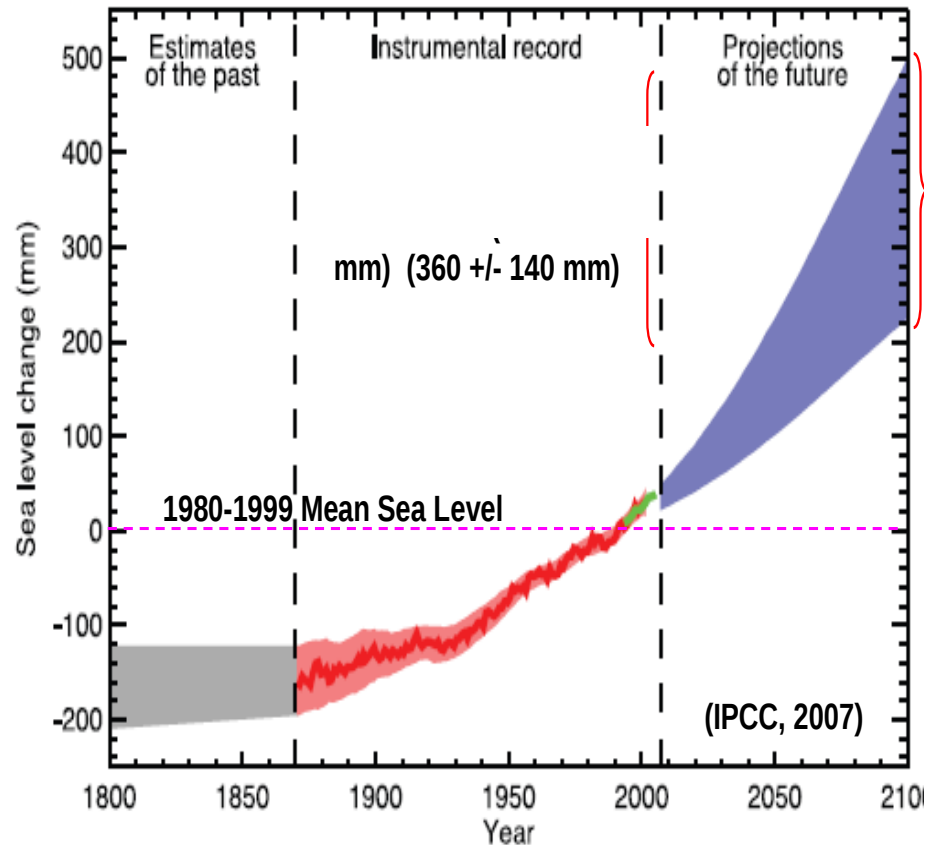
Mitigation and Adaptation

- DoD forestry and carbon management
- Coastal zone plant species response
- Installation Energy Test Bed



Sea Level Rise Impact

Acquisition, Technology and Logistics

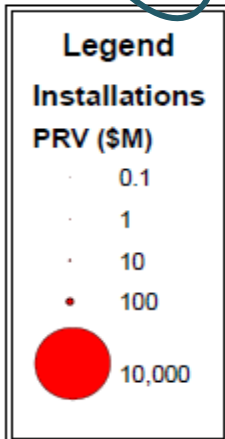
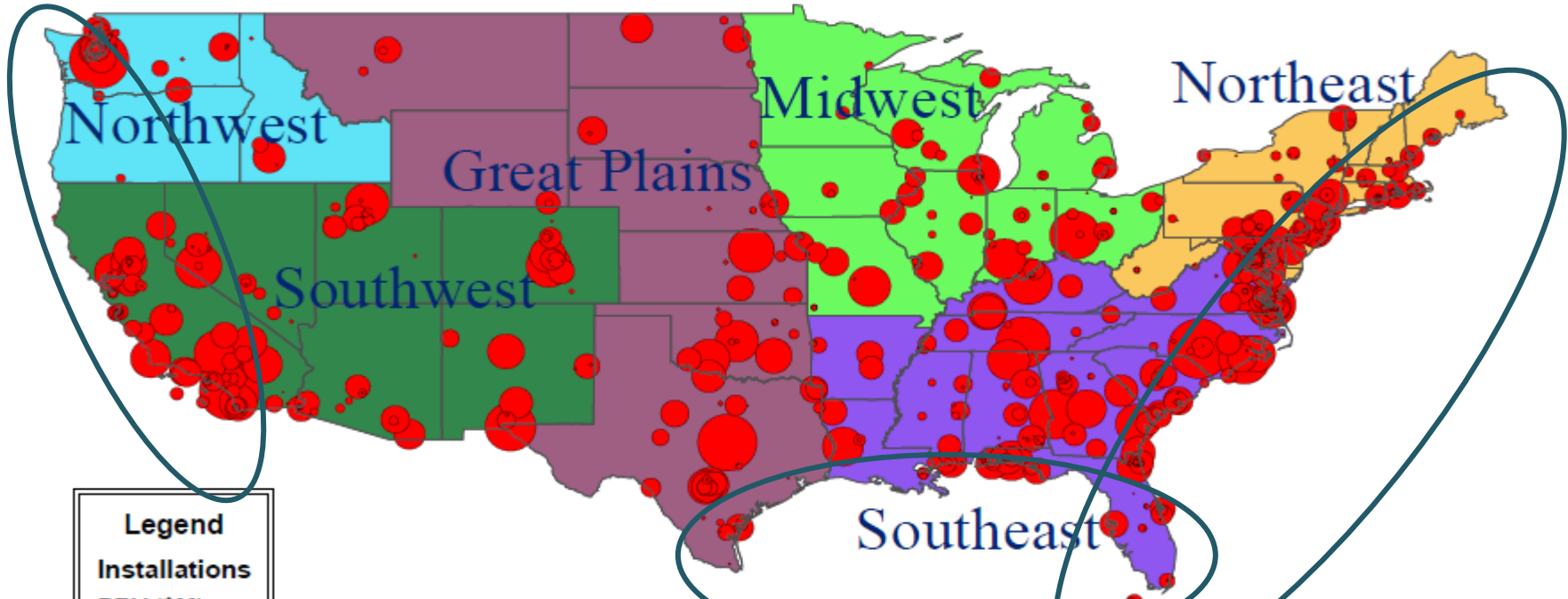


- **Significant Threat to Coastal Military Installations**
 - New methodologies required to fully assess threat
 - Adaptation approaches required
 - Scenarios 2100
 - 0.5m, 1.0m, 1.5m, 2.0m
 - Reflects current scientific assessment range



Military installations by region and Property Replacement Value (PRV) (\$M)

Acquisition, Technology and Logistics



Region

Coasts
Great Plains
Midwest
Northeast
Northwest
Southeast
Southwest

Climate change problems

Sea-level rise	Storm surge	Storm runoff
Drought	Water competition	Population + climate
Heat waves	Lower water levels	Floods & droughts
Extreme heat	Severe flooding	Sea-level rise
Sea-level rise	Water problems	
Heat related stress	Water problems	Sea-level rise/storm surge
Water problems	Flooding	Sea-level rise/storm surge

Sources:

Base Structure Report 2010 (PRV)
Military Installations, Ranges, and Training Areas (version 1.0, 2010)
Regional climate impacts from USGCRP



Climate Change R&D: Decision Frameworks

Acquisition, Technology and Logistics

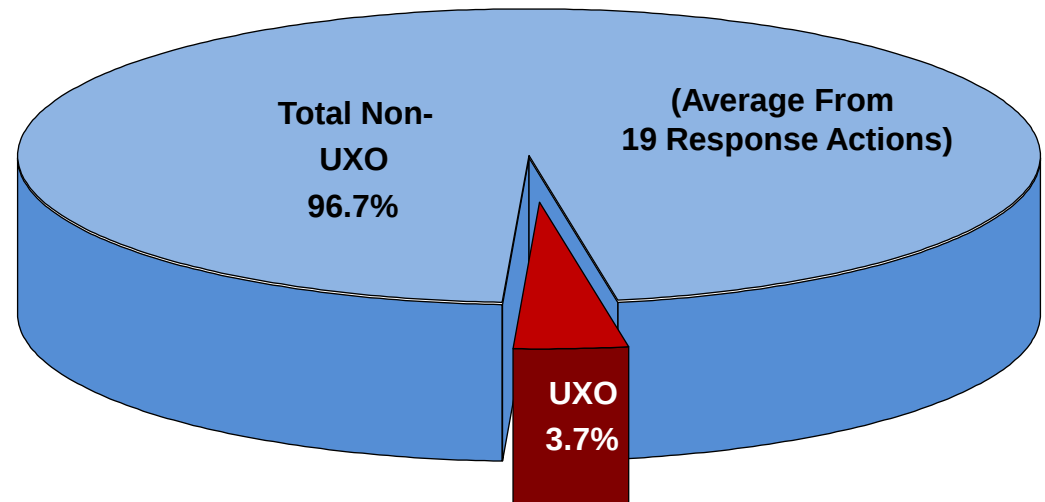
- **Climate Change Decision Tools for DoD Installations**
 - Identify the type and value of climate-related information needed by DoD natural and built infrastructure planners and managers to assess future climate change risks and vulnerabilities
 - Identify, enhance and develop tools and methodologies that enable the generation of such information at the required spatial and temporal scales
 - Use pilots to assess approaches to climate change risk assessment and decision-support strategies that are resilient in the light of the uncertainties



UXO Cleanup Dilemma

Acquisition, Technology and Logistics

- **Less than 4% of excavations are UXO**
 - Usually <1%
 - Ex. Camp Butner
 - 7 items out of > 100,000 digs
- **Most items are harmless scrap**
- **Excavation of suspected UXO drives cost and time**





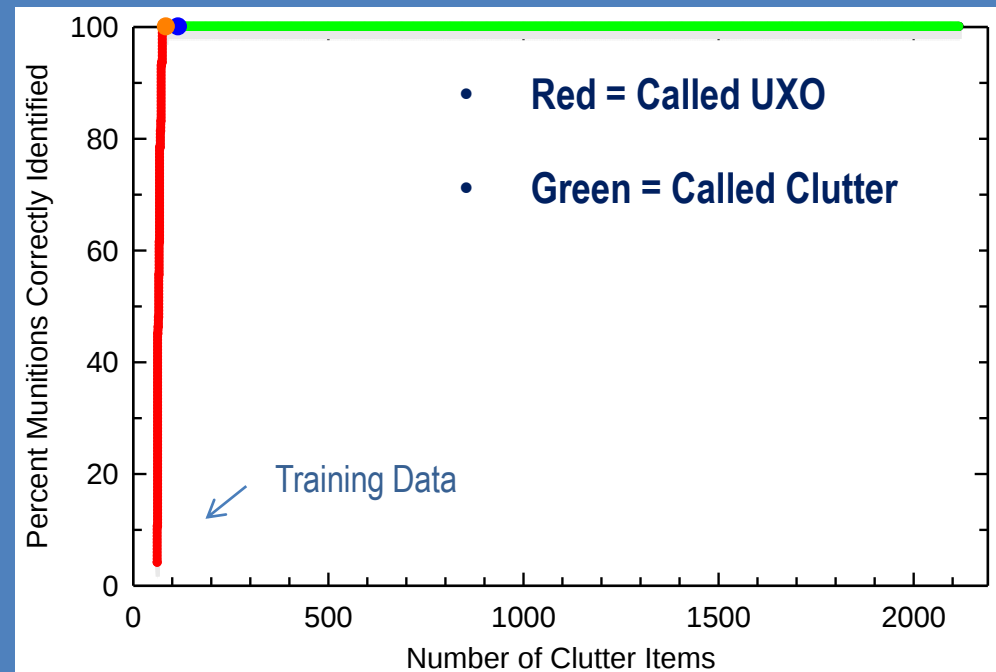
New Technology Enables Discrimination

Acquisition, Technology and Logistics

- SERDP/ ESTCP have been investing in this area for 10 years
- Result is technology that can distinguish UXO from clutter with high degree of reliability

Advanced Sensor at former Camp Butner, NC

- Near-Perfect Results are Achievable on a Real UXO Site
 - 100% of munitions correctly called UXO
 - Over 2000 correctly called clutter out of about 2100 total
 - Eliminate ~95% of clutter with no missed UXO





Commercially Available Sensor

Acquisition, Technology and Logistics



GEOMETRICS

Innovation • Experience • Results

Now Available For Rent or Sale!

- ❑ Proven in ESTCP-funded testing at Aberdeen Proving Ground and San Luis Obispo
- ❑ Advanced UXO detection and discrimination
- ❑ May be towed or front-mounted
- ❑ Complete 3-axis polarizability measurement, allowing for estimation of target depth, size, and shape
- ❑ Rugged, light-weight antenna cart suitable for man-portable or vehicular-towed operation
- ❑ 3 orthogonal high power transmitter loops permit precision static characterization from a single point
- ❑ 7 tri-axial dB/dt receiver cubes sample the vector secondary TEM field
- ❑ Wide dynamic range, high bandwidth A/D converters
- ❑ User-friendly acquisition software
- ❑ Optional dual-mode (TEM/Mag) acquisition capability
- ❑ Optional platform attitude sensor measures platform magnetic heading, pitch, and roll.
- ❑ Windows-based acquisition software permits:
 - Acquisition parameter selection
 - On-site data QC
 - Real-time data display and operator feed-back during acquisition
- ❑ Custom Geosoft Executables (GX) support importing data into Oasis montaj™ and automate many data processing procedures unique to MetalMapper.

Metal Mapper Multi-Component TEM UXO Detector

The MetalMapper is a 3rd generation UXO detection and discrimination system. It is the first commercially available system incorporating recent advances in Electromagnetic methods for advanced ordnance detection and discrimination.



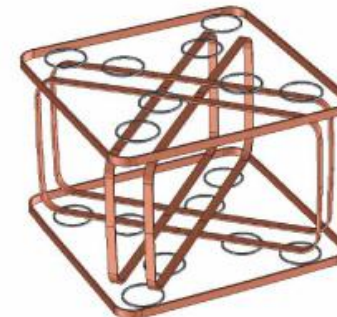
Vehicle-towed deployed at SLO (June '09)

This instrument brings advanced SERDP and ESTCP supported technology from the laboratory into the field. This instrument is capable of fully interrogating a

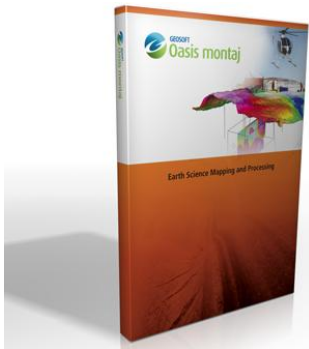
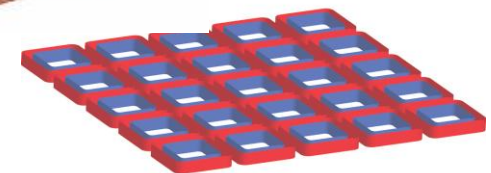


UX-Analyze

Acquisition, Technology and Logistics

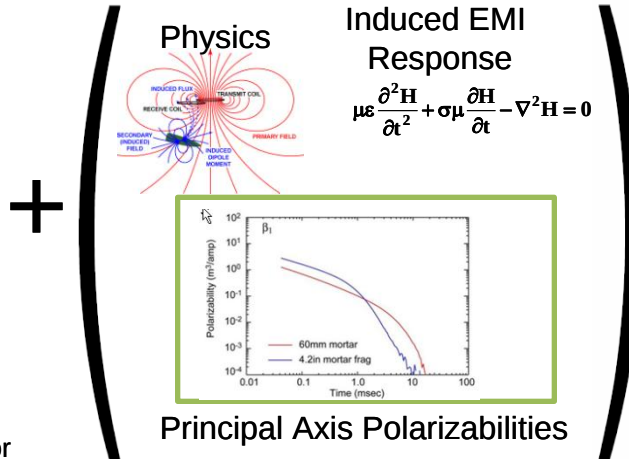


Advanced
UXO sensors



Commercial mapping,
processing, &
visualization software for
earth sciences

Computing
Environment



Analysis
Algorithms



UX-Analyze Training / Workshop

Acquisition, Technology and Logistics

Over 140 people representing more than 28 firms...

IDA	ARM	Matrix Design	AMEC
USACE	Fugro	EODT	Weston Solutions
GeoVision	ITSI	CH2M Hill	UXB
3DGeophysics	Zapata Inc.	URS Corp	Malcolm Pirnie
Sky Research	UXA Environ.	Parsons	Nova Research
TetraTech	SAIC	NAEVA	Zonge
PDQ	ECC	Shaw	InDepth
ERT Corp	GEL	HydroGeologic	TLI



Live Site UXO Discrimination Demonstrations

Acquisition, Technology and Logistics

- Goal: Validate Discrimination Technologies
 - Establish performance capability as function of site conditions
 - Establish operational procedures and costs
 - Documentation and Quality Control
 - Train government and contractor community
 - Gain regulatory acceptance
- Multiple Live Sites Required
 - Munitions type
 - Site conditions
- Engagement
 - Regulators
 - Site Managers
 - Industry





ESTCP Live Site Demonstrations

Acquisition, Technology and Logistics

- **Completed demonstrations**

- former Camp Sibert, AL
- former Camp Butner, NC
- former Camp Beale, CA
- Ft. Sill, OK
- former Camp San Luis Obispo, CA
- Mare Island Naval Shipyard, CA
- former Pole Mountain TMA, WY

- **Demonstrations in progress**

- former Spencer Range, TN
- Massachusetts Military Reservation

- **Many more planned**

- former Camp Ellis, IL
- former Camp Elliot, CA
- former Camp George West, CO



Live Site Demonstrations

Acquisition, Technology and Logistics

ESTCP Classification Pilot Program Live Site Demonstrations





Production Contractor Participation in ***Live Site Demonstrations***

Acquisition, Technology and Logistics

Zapata	NAEVA	Parsons	CH2M HILL
Shaw	URS	Sky Production	Weston Solutions
ARCADIS/Malcolm Pirnie		USACE QA Geophysicists	



SERDP and Guam's Brown Tree Snake

Acquisition, Technology and Logistics





SERDP and Guam's Brown Tree Snake

Acquisition, Technology and Logistics



“In a effort to rid Guam of the brown tree snake, which have overrun the island, officials have begun air-dropping mice laced with poison and fitted with parachutes. Because sometimes the best solution is the simplest one.”



Acquisition, Technology and Logistics

DoD and EPA Sign Memorandum of Understanding to Increase Sustainability of Military Bases

02/08/2012

WASHINGTON – The Deputy Under Secretary of Defense for Installations and Environment, Dorothy Robyn, and the Environmental Protection Agency (EPA) Assistant Administrator, Paul Anastas, signed an agreement that formalizes the partnership between the Department of Defense (DoD) and EPA to develop and implement technologies that will help create sustainable American military bases all over the world.

Under this Memorandum of Understanding (MOU), DoD and the EPA's Office of Research and Development will collaborate in the development of innovative technologies to help DoD create sustainable and resilient military bases across the country and overseas. The cutting-edge research of EPA and DoD scientists and engineers will be used to develop and demonstrate tools and technologies that will aid DoD in achieving its vision of sustainability.

The mission of DoD is to provide the military forces needed to deter war and protect the security of our country. To successfully execute this mission, our Military Departments must have the energy, land, air, and water resources necessary to train and operate, today and in the future, in a world where there is increasing competition for resources. Sustainability provides the framework necessary to ensure the longevity of these resources, by attending to energy, environmental, safety, and occupational health considerations.

This MOU underscores the Administration's commitment to fostering collaboration among Federal agencies. In addition to enabling the sharing of resources, this agreement provides an opportunity for DoD, in collaboration with EPA, to use its military bases as test beds for innovative technologies that can then be shared more broadly in communities across the country.

[Memorandum of Understanding](#)



I. Energy



II. Environment



III. Other Priorities



BRAC (brak), *n.*

Base Realignment and Closure, a congressionally authorized process used by the Department of Defense to reorganize its base structure to more efficiently and effectively support its armed forces, increase operational readiness and facilitate new ways of doing business.



“DoD seeks more BRAC rounds, sparking opposition”

-Federal Times, January 27, 2012



**“BRAC Offers Unmatched Cost Savings,
Pentagon Official Says”**

**-American Forces
Press Service
March 21, 2012**

**“Cuts needed with or without
BRAC, Pentagon Says”**

-March 8, 2012

**“HASC Chairman on BRAC:
‘Kill it’”**

-February 2, 2012

**Lawmakers: Don’t even think about
BRAC**

**-NavyTimes
May 9. 2012**

**NDAA Passes House, No
BRAC in 2013**

**-WKTV News
May 18. 2012**



Inside the New UFC

Acquisition, Technology and Logistics

UFC 2-100-01
15 May 2012

UNIFIED FACILITIES CRITERIA (UFC)

INSTALLATION MASTER PLANNING



APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

- Theory
- Content
- Application



Problem: 7 Attributes of Sprawl

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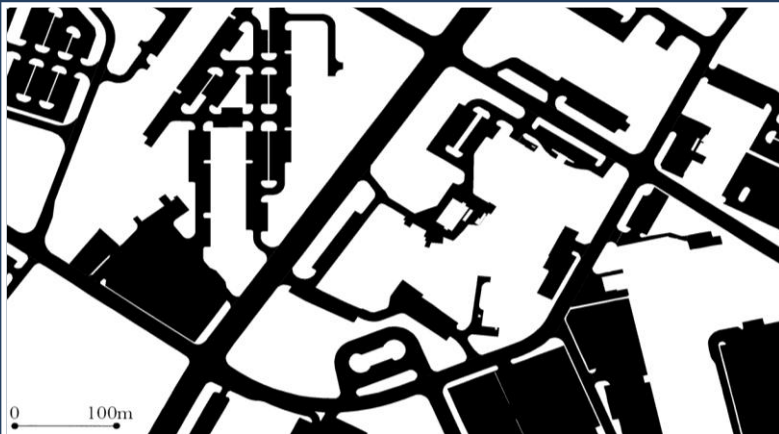
Auto-Focused



Widely-Spaced



Abundantly Paved



Increasingly Franchised





Ten Strategies

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- Establishes overarching vision for installations based upon ten key planning strategies:



- Creates consistent master planning approach and product formats:





Sustainable Planning

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Compact Infill Development



Horizontal and Vertical Mixed-Use



Transit Oriented Development



Narrow Wings





Stakeholder Engagement

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Before...



After!





“As one of the largest landowners and energy consumers in the world, our drive is to be more efficient and environmentally sustainable. We have to be able to... transform the nation’s approach to the challenges we are facing in the environment and energy security.”

“Let me assure you that DoD is helping to lead this nation when it comes to preserving our environment and building a more sustainable and secure energy future. ”

**Secretary Leon E. Panetta
Environmental Defense Fund Reception
May 2, 2012**