SERDP and ESTCP Energy Initiatives

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Environmental Policy

• Environmental Mission: Provide, operate and sustain in a cost-effective and environmentally sound manner the installation assets and services necessary to support our military forces

• DoD Environmental Programs:
  – maintain, restore and improve DoD’s natural and built infrastructure
  – preserve the environment
  – protect our communities
Environmental Management

• **History**
  – denial ➔ compliance ➔ prevention ➔ sustainability

• **Environmental sustainability**
  – weapon systems: manufacture, maintenance and use
  – facilities and ranges to support the mission

• **Environment and Energy are linked**
  – Environmental performance impacts energy use
  – Energy decisions have environmental impacts
    • Air quality
    • Global warming
  – Sustainability forces a linkage
Sustainability

• What does it mean?
“…to ensure the needs of the present without compromising the ability of the future generations to meet their own needs.”
– Brundtland Commission – 1987

• Triple Bottom Line
– People (Human Capitol)
– Readiness (Military Capitol)
– Planet (Natural Capitol)
DoD’s Environmental Technology Programs

- Demonstration / Validation
- Basic and Applied Research
Environmental Technology Development Process

Requirements → Basic/Applied Research → Advanced Development → Demonstration/Validation → Implementation → Commercialization

REGULATORY COOPERATION
INDUSTRY PARTNERSHIPS
SERDP

- Established by FY 1991 Defense Authorization Act
- DoD, DOE and U.S. EPA partnership

Purposes

- Address DoD and DOE environmental concerns through R&D
- Share data collection and analysis capabilities
- Identify and share DoD research technology
- Identify private sector technologies useful to DoD
ESTCP Goals

• Demonstrate innovative cost-effective environmental technologies
  – Capitalize on past investments
  – Transition technology out of the lab

• Promote implementation
  – Direct technology insertion
  – Gain regulatory and end user acceptance

*Priority: needs of the DoD user community*
Environmental Drivers

Sustainability of Ranges and Range Operations

Maritime Sustainability
Threatened and Endangered Species

Toxic Air Emissions and Dust

Unexploded Ordnance and Munitions Constituents

Urban Growth  Noise  NOX and PM & Encroachment
Environmental Drivers

Reduction of Current and Future Liability

Current Liabilities

- Chlorinated Solvents
- Munitions Constituents
- UXO
- Emerging Contaminants

Future Liabilities

- Control Life Cycle Costs
  - Elimination of Hazardous Materials
  - Achieve Compliance Through Pollution Prevention

Contamination from Past Practices
Environmental Quality

Weapons Systems & Platforms

Munitions Management

Environmental Restoration

Sustainable Infrastructure
SERDP/ESTCP Initiatives

• Biodiesel

• Gas Turbine Engines

• Green Building Design

• Future Energy Initiatives
Biodiesel

• Nontoxic, biodegradable fuel made from organic fats and oils
• Designated an Alternative Fuel under EPACT
  – Specification set by ASTM 6751
• Environmental benefits
  – Renewable resource
  – Cleaner air emissions
  – Reduced greenhouse gas emission
  – Cost savings
    • Most cost effective method to meet alternative fuel vehicle requirement
Non-Tactical Vehicles

- Tested in 10 DoD vehicles/generator
- Assessed for typical DoD loads
- Assessed in cooperation with
  - CARB and NREL
- Compared: multiple biodiesel blends and types, CARB ULSD and JP-8
- Assessed regulated and unregulated air emissions and fuel efficiency

- Air emissions statistical equivalent to CARB ULSD
  - Cleaner than JP-8 or diesel fuel no 2
- No differences between YGA, YGB or soy based
- No maintenance of mileage issues
  - widely used across DoD
Tactical Vehicles

- Tri-service assessment for non-deployed tactical vehicles
  - Non-deployable and deployable tactical vehicles and equipment
  - Laboratory testing, controlled field testing and fleet demonstrations
- Dem/Val biodiesel and fuel management technologies and procedures can meet military requirements
  - quality control procedures
  - tank management procedures
  - tank filtration technologies
  - fuel storage
  - stability, cold flow and water affinity
  - fuel additives
Gas Turbine Engines (GTE)

- GTE are primary use of fuel in DoD
  - Environmental issues are significant
    - NOx, particulate matter (PM) etc.

- Multifaceted RDT&E program
  - Assessment
    - Measurement techniques
    - Source inventory
  - New combustor technology
    - Trapped Vortex Combustor
  - Fundamental combustion science
    - Support engine design
    - Assess fuel impacts
Trapped Vortex Combustor

IDEA CONCEIVED
AFRL/PR/AFOSR
1993-1995

CONCEPT EVALUATED
AFRL/PR/AFOSR/SERDP
1996

ESTABLISHED DESIGN
AFRL/PR/NAVSEA/SERDP AFRL/PR/AFOSR/SERDP
1997 1998-2003

SECTOR TESTS
AFRL/PR/AFOSR/SERDP
1998-2003

ANNULAR TESTS
NAVAIR/AFRL/ESTCP
2004-2008

Lean Burn
Rich Burn
Lean Burn
Rich Burn

Primary = 3.30
φ
Total = 0.26

Primary = 0.26
φ
Total = 0.24

25.4mm
1.75 mm Dia. FUEL JET
2.286 mm Dia. AIR JET

Annular Air = 2000 slpm

40% Reduction in Aircraft NOx
58% Reduction in Lean-Blow-Out
42% Increase in Altitude Re-light
40% Increase in Turndown Ratio
Fundamental Combustion Science

- Develop prediction tools for real fuels
  - Predict PM formation
  - Understand engine design issues
  - Assess fuel impacts

- Multi-institute effort
  - Experimental
  - Theoretical
  - Engine Simulations
    - <$6M over 4 years
Green Buildings

• Demonstrate “whole system” design processes
  – Using COTS building materials and components
  – >25% decrease in operational cost
    • and environmental risk reduction
  – Jointly funded with milcon and Army Southeast IMA
    • Ft. Bragg

• Validate first costs, life-cycle costs, resource use, and waste generation
  – Electrical and water use and cost
  – Solid waste sent off-site, lbs and cost
  – Wastewater sent off-site
  – Storm water flow to sewers
  – Air quality – VOCs and O2/CO2 balance
  – Cost of O&M: custodial, grounds, repairs
  – Construction costs
  – Occupant comfort and productivity
SERDP/ESTCP Energy R&D

• Support the goal of sustainability
  – Address both the demand and supply side
    • leverage DOE’s and private sector investments

• Address multi-Service requirements
  – Stimulate and integrate

• Focus
  – DoD unique needs
  – DoD unique opportunities
New Energy Initiatives

SERDP

• Scalable Power Grids: Facilitate The Use of Renewable Energy Technologies
  • Provide DOD installations and contingency operations with the capability to network distributed energy resources (including renewables) in a “plug-and-play” scalable configuration

• Electricity from Waste Heat for Deployed Forces
  • Extract the maximum amount of energy from every heat source that is normally present in deployed forces locations: mobile kitchens, diesel engines/generators etc

ESTCP

• Innovative energy efficiency and renewable technologies for sustainable installations
ESTCP Methodology

• Partner With Stakeholders and Test at DoD Facilities
  – Developer, regulators, end-user
  – Direct transition

• Validate Operational Cost and Performance
  – Independent test and evaluation
  – Satisfy regulatory and user communities

• Identify DoD Market Opportunities
  – Technology transfer across DoD
Installation Energy Dem/Val

• Use DoD facilities as test bed for innovative energy technologies
  – Validate performance, cost, and environmental impacts
  – Transfer lessons learned, design and procurement information across all Services and installations
    • Partner with Services’ engineering support centers
  – Directly reach out to private sector for innovations

• Test and evaluate for all DoD facilities
  – In cooperation with Energy Conservation Investment Program (ECIP)
Sponsored by SERDP and ESTCP

Partners in Environmental Technology

Technical Symposium and Workshop

December 4 - 6, 2007

Marriott Wardman Park Hotel
Washington, D.C.
Home Pages

http://www.serdp.org

http://www.esttcp.org