Integrating Sustainability Into Weapon System Acquisition Within The Department Of Defense (DoD)

Remmie Arnold, CCEA, Technomics

Walt Cooper, Technomics

Special thanks to our sponsor Paul Yaroschak, ODUSD (I&E)

Date: Thursday June 12, 2014
Track: Life Cycle Costing
Room: Matchless

Agenda

1. Executive guidance
2. Describe Sustainability
3. Why Sustainability Matters
4. Draft version of "DoD Guidance – Integrating Sustainability into DoD Acquisitions"
5. Initial pilot efforts and analyses
6. Way forward

Executive Guidance on DoD Sustainability

- Executive Order 13514—Federal Leadership in Environmental, Energy and Economic Performance (05 Oct 2009) establishes an integrated strategy for sustainability in the federal government.

THE WHITE HOUSE

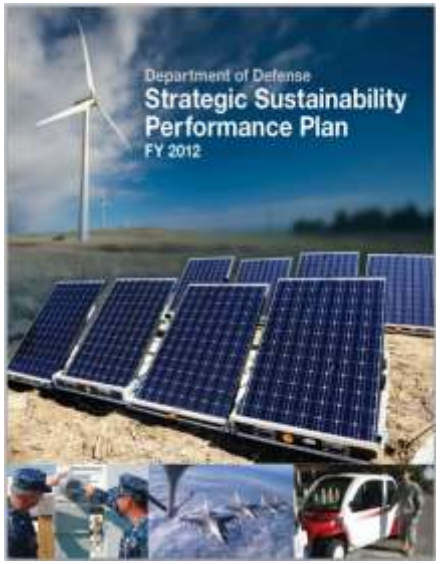
Office of the Press Secretary

For Immediate Release — October 5, 2009

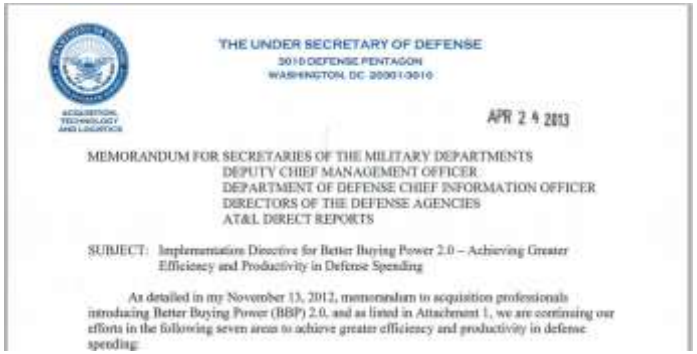
EXECUTIVE ORDER

FEDERAL LEADERSHIP IN ENVIRONMENTAL, ENERGY, AND ECONOMIC PERFORMANCE

By the authority vested in me as President by the Constitution and the laws of the United States of America, and to establish an integrated strategy towards sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for Federal agencies, it is hereby ordered as follows:



- The Strategic Sustainability Performance Plan (SSPP) includes goals for efficiency and reductions in energy, water, solid waste, and the use of hazardous chemicals and materials.



THE UNDER SECRETARY OF DEFENSE
3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

APR 2 4 2013

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
DEPUTY CHIEF MANAGEMENT OFFICER
DEPARTMENT OF DEFENSE CHIEF INFORMATION OFFICER
DIRECTORS OF THE DEFENSE AGENCIES
AT&L DIRECT REPORTS

SUBJECT: Implementation Directive for Better Buying Power 2.0 – Achieving Greater Efficiency and Productivity in Defense Spending

As detailed in my November 13, 2012, memorandum to acquisition professionals introducing Better Buying Power (BBP) 2.0, and as listed in Attachment 1, we are continuing our efforts in the following seven areas to achieve greater efficiency and productivity in defense spending:

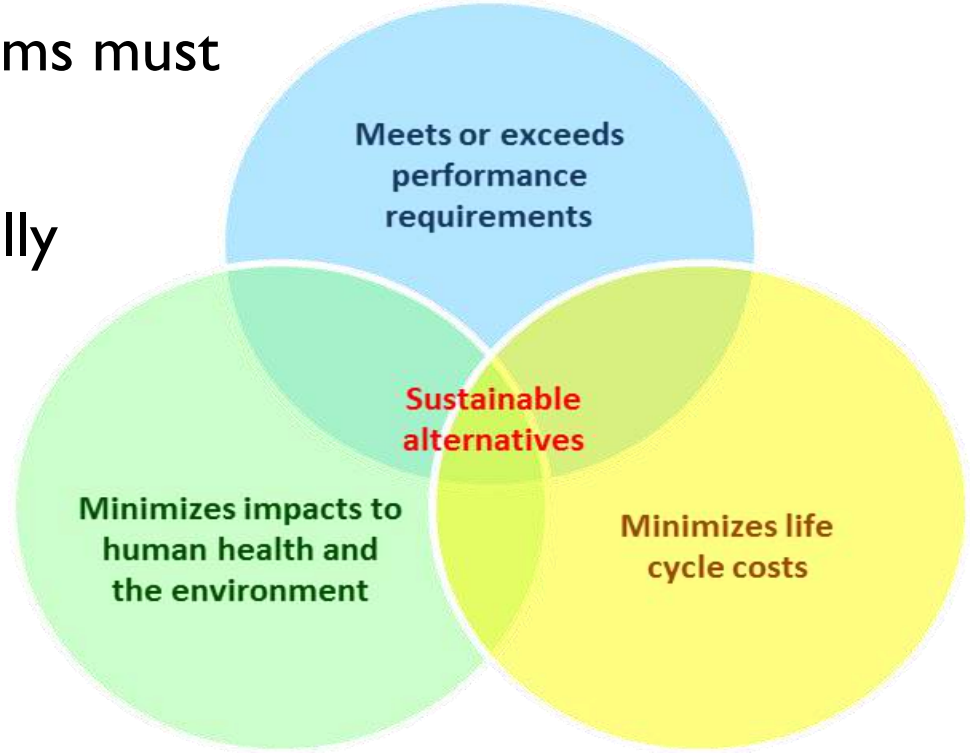
- Better Buying Power initiative establishes affordability goals

Sustainability Described

- Simply put, the capacity to endure
- Global context: A durable and self-sufficient balance between social, economic, and environmental factors
- DoD Acquisition context: Wise use of resources to minimize mission, human health, and environmental impacts and associated costs during the life cycle
- Differs from "sustainment" – DoD term for support needed to operate and maintain a system over its lifetime

The Importance of Sustainability

- The DoD acquires weapons systems that must be sustained for decades
- Resources are at a premium and in many cases dwindling
- To meet mission requirements well into the future while reducing life cycle costs, systems must be made more sustainable
- Acquisition personnel must fully understand life cycle impacts and the costs of systems to avoid inadvertently pushing costs "downstream"



Current Sustainability Related Guidance

- DoDI 5000.4: Cost Analysis Requirements Document (CARD): Provides the "what"
  - 1.2.1x.2 "Environmental Conditions"
  - 1.2.3 "Human Performance Engineering"
  - 1.2.4 "System Safety"
  - 10.4 "Environmental Impact Analysis"
- DoD O&S Cost Estimating Guide: Provides the "how"
  - Maintenance costs related to the environment
  - Disposal (including hazardous waste)
  - Worker safety

Current Sustainability Related Guidance

Army Cost Analysis Manual: Chapter 6

- Provides high level guidance for environmental cost considerations
- Maps environmental costs to Army CES elements
- Does not provide guidance on methodology for calculating costs

CHAPTER 6 – ENVIRONMENTAL QUALITY COSTING

Table 6- 1. Environmental Cost Elements

CES/ WBS	Element Name	Overhead[1]	Tradeoff Analyses[2]	NEPA[3]	Pollution Prevention[4]	Conservation[5]	Remediation and Restoration	Demil and Disposal
1.0	**RDT&E**							
1.01	Dev Eng	X	X		X			X
1.02	PEP	X	X		X			X
1.03	Dev Tool	X			X			X
1.04	Proto Mfg	X			X	X		X
1.05	SE/PM	X	X	X	X			
1.06	ST&E	X	X	X	X	X	X	X
1.07	Training	X	X	X	X	X	X	X
1.08	Data	X	X	X	X	X	X	X
1.09	Spprt Equip							X
1.10	Dev Fac	X	X	X	X	X	X	
1.11	Other RDT&E							
2.0	**Procurement**							
2.01	Nonrecr Prod	X	X	X	X	X	X	X
2.02	Recur Prod	X	X	X	X	X	X	X
2.03	Engr Chng	X		X	X	X	X	X
2.04	SE/PM	X	X	X	X			
2.05	ST&E	X	X	X	X	X	X	X
2.06	Training	X	X	X	X	X	X	X
2.07	Data				X			
2.08	Spprt Equip				X			
2.09	Op/Site Act	X			X	X		
2.10	Fielding	X	X	X	X	X	X	X
2.11	Tng Ammo/Msl				X			
2.12	WR Ammo/Msl				X			
2.13	Mods			X	X		X	X
2.14	Other							
3.0	**Mil Constrct**							
3.01	Dev Constrct	X	X	X	X	X	X	X
3.02	Prod Constrct	X	X	X	X	X	X	X
3.03	Op/Site Act	X	X	X	X	X	X	X
3.04	Other	X	X	X		X	X	X
4.0	**Mil Pay**							
4.01	Crew	X						
4.02	Maintenance	X						
4.03	Sys Spec Spprt	X						
4.04	SE/PM	X						
4.05	Repl Persnl	X						
4.06	Other							
5.0	**O&M**							
5.01	Fld Maint (Civ)	X					X	
5.02	Sys Sp Base Op				X	X	X	X
5.03	Spares				X			
5.04	Repr Parts				X			
5.05	POL				X			X
5.06	End Item S&M	X		X	X	X	X	X
5.07	Transportation	X			X		X	X
5.08	Software				X			
5.09	ST&E	X	X	X	X	X	X	X
5.10	SE/PM	X	X	X	X		X	X
5.11	Training	X			X			X
5.12	Other							
6.0	**AWCF**							
6.01	Wr Res	X			X	X	X	X

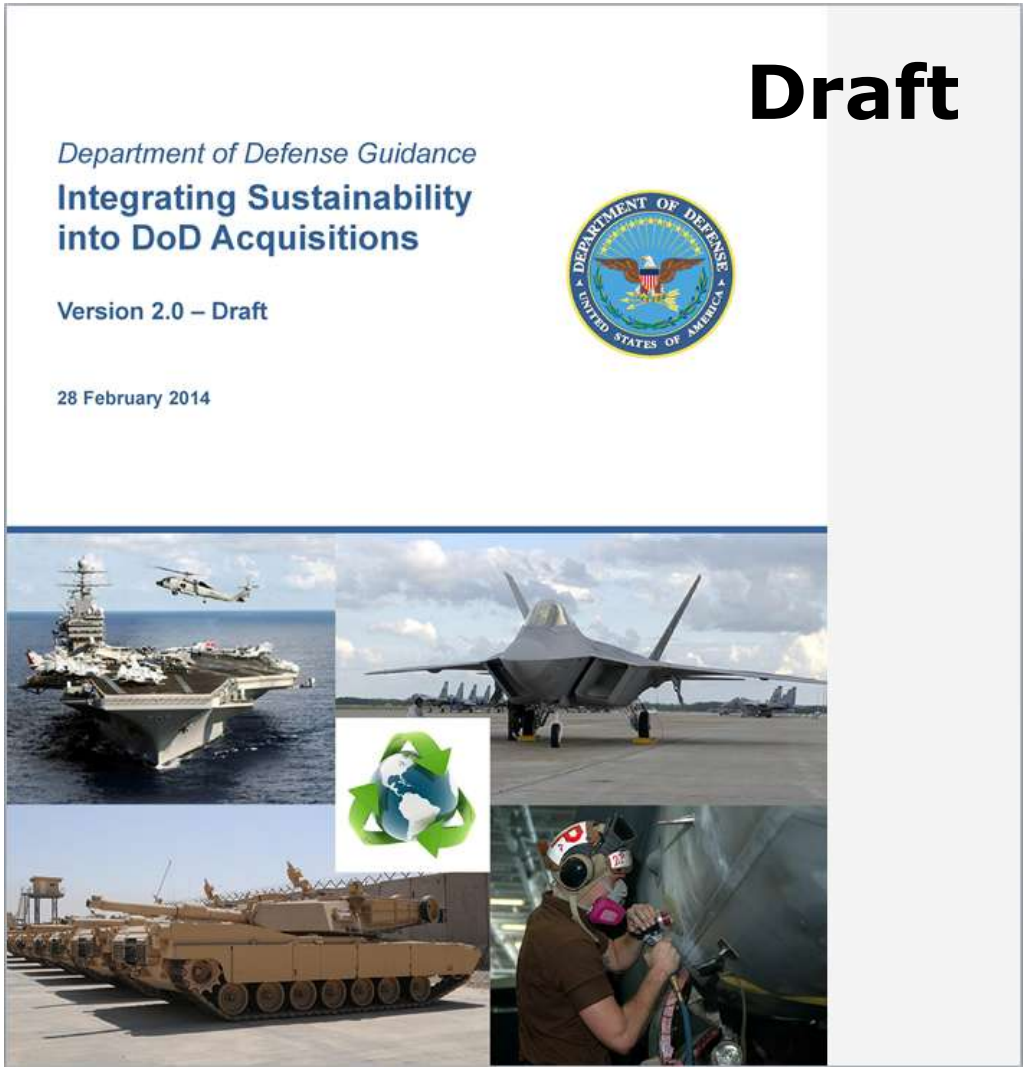
Portions of O&S Costs That Sustainability Investments Might Affect

Principle	O&S Cost Element Most Likely Affected	Portion of O&S costs from which cost reductions might take place (%)	Effect of a 5 to 10% reduction (%)
Utilize low-impact materials	Unclear	Not addressed	Not addressed
Optimize system-wide energy consumption	2.1– Operating Material	5 to 25	Not addressed
Improve system and component design • Durability • Standardization • Minimized over-design	3.0 – Maintenance (all second-level elements) 5. 1– Hardware Modifications or Modernization	20 to 70	1 to 7
Minimize life cycle waste	3.0 – Organizational-, intermediate-, and depot-level consumables and reparables	20-60	1 to 6
Minimize life cycle pollution	6.1 – Installation Support	1 to 5	< 1
Minimize risk	1.3 – Other Unit-Level Manpower	<5	<1

If investing based on improving designs and minimizing life cycle waste could reduce costs by 5 to 10% within associated O&S cost elements, then overall O&S costs could be reduced by as much as 2 to 13%.

4. Sustainability Analysis Guide

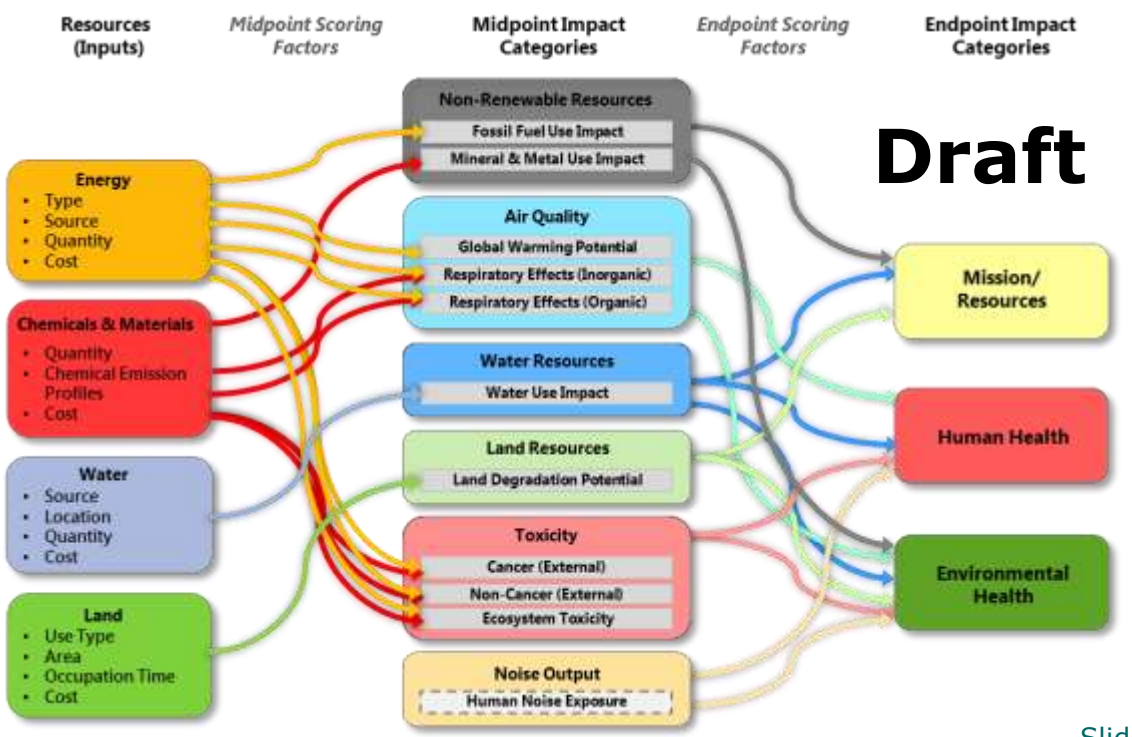
- Introduces Sustainability Analysis and provides guidance on how to use the results to better inform tradeoff, design, and supportability decisions
- Life Cycle Assessment (LCA) compares human health & environmental impacts
- Life Cycle Costing (LCC) captures costs associated the impacts & other direct costs throughout the life cycle



Guide – Streamlined LCA (SLCA)

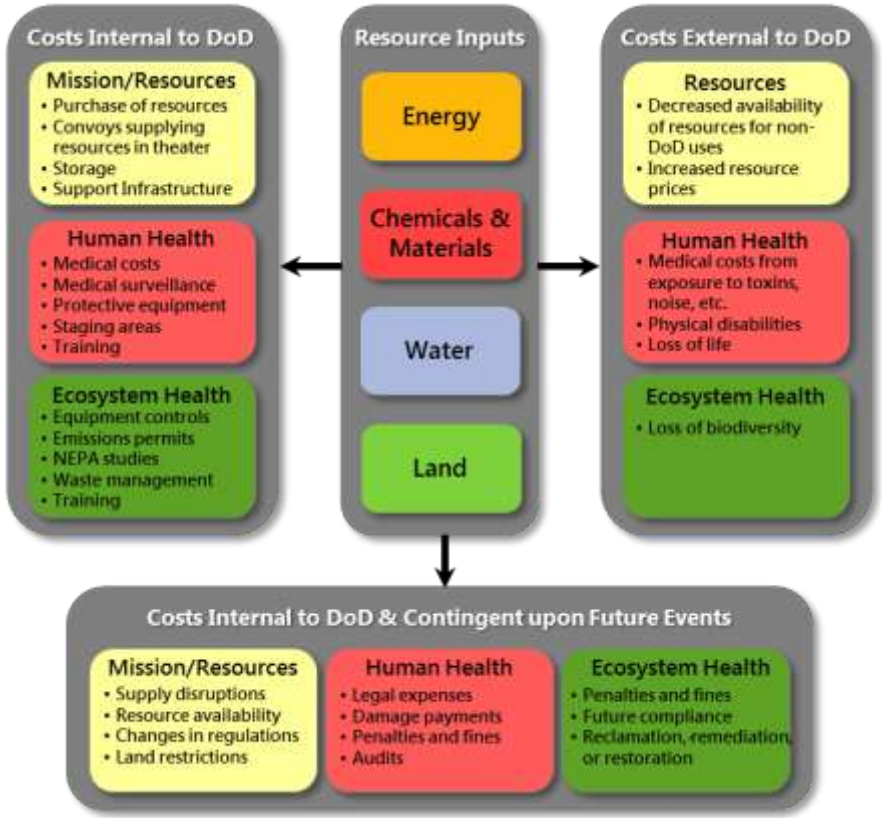
- **Mission (Resource Availability)**: Includes impacts to resource reserves that, if depleted or unavailable, could negatively affect the ability of defense personnel to complete the mission
- **Human Health**: Includes health impacts to defense personnel or surrounding communities that could increase internal or external costs
- **Environmental Health**: Includes impacts to natural cycles (e.g., the earth's hydrological cycle), ecosystems, or wildlife that could increase internal or external costs

SLCA Framework



Guide – LCC

- Provides high-level overview of guidance for developing life cycle costs, reviews established methods to estimate life cycle costs
- Provides additional guidance for calculating sustainability related costs not traditionally assigned to the system because they are:
  - Not visible in aggregated costs (Internal to DoD)
  - Contingent upon future activities or events that may or may not happen
  - Tied to the resulting impacts borne by society and the environment (External to DoD)



LCC Framework **Draft**

Steps in Sustainability Analysis

Draft

- Step 1: Define the Scope of the Analysis
  - Establish the functional unit and system boundary for the chosen alternatives
  - The functional unit defines the capability of each alternative in comparable units
- Step 2: Develop a Life Cycle Inventory: List all relevant system inputs (resources) and outputs (emissions) that fall within the boundary established in STEP 1
- Step 3: Estimate Life Cycle Impacts: Applying the Guides predefined scoring factors
- Step 4: Estimate Sustainability-related Costs: Use results from Steps 1 and 2 to identify potentially hidden costs both internal and external to the DoD
- Step 5: Synthesize Results and Iterate

5. First Pilot Efforts

- Purpose: Quantify differences in life cycle costs and human health/environmental impacts between chrome and non-chrome primer design alternatives for:
  - Acquisition of 573 aircraft (System 1)
  - Acquisition of 117 aircraft (System 2)
- Identify information availability: Where does life cycle cost data reside and at what level of detail?
- Test underlying methodologies for cost and impact estimates:
  - What barriers arise in trying to identify life cycle costs and impacts?
  - How can methods be used to scale cost and impact analysis across the entire acquisition process?

Conclusions about LCC

- Need to consider "cost clusters"
  - Determine the group of costs with highest impact and work backwards to cost drivers that can be mitigated/eliminated

- Need to improve granularity and scope of cost accounting
  - In most cases the standard DoD O&S cost structures too aggregated and miss hidden costs.
  - VAMOSC historical data difficult to work with.

Additional Analyses

For four systems…

- Develop activity profiles for 4 MDAPs:
  - 2 Aircraft
  - Ship
  - Tracked Vehicle
- Estimate activity profiles
- Compare sustainability costs to life cycle estimates

Activity Profiles

- Attributes
  - Energy
    - Energy consumed by the system when operating and when in overhaul/availability
    - Amounts obtained from VAMOSC and OSMIS systems
  - Water
    - Water used by crew members and consumed by sub-systems, e.g., onboard cooling sub-systems, propulsion sub-systems
    - Water consumed in washdowns during routine maintenance and overhauls
  - Chemicals & materials: oils, lubricants and paints
  - Land
    - Conservation, pollution prevention, and natural resources management
    - Maintenance of training ranges
- Fleet sizes and OPTEMPOs extended from FY 2012 inventories, except for System 3, for which we included a growth ramp
- Only the O&S phase of the life cycle – 30 years for all 4 MDAPs

Notional Activity Profile for System 3

- Energy
  - 2,600 steaming hours underway @ 1,045 gal/steaming hour underway
  - 1,000 steaming hours not underway @ 250 gal/steaming hour not underway
  - 60 ships in Year 1, ramping to 70 ships at Year 11
  - Standard price of F-76 ($3.61) from DLA-Energy
- Water
  - Used Army Quartermaster Planning Guide for per-person consumption rates
  - Water for washdowns extrapolated from Army Quartermaster Planning Guide
- Chemicals & materials
  - Oils and lubricants: 2% of energy costs
  - Paint
    - Surface area ~80,000 ft^2; based on length (506ft), width (beam = 66ft) and height (3x draft = 93ft)
    - Paint Cost per ft^2 = $0.24
    - Labor Cost per ft^2 = $3.35
    - Facilities Cost per ft^2 = $2.62
    - Topside Painting Frequency = 2 times per year
    - Hull Painting Frequency = 1 time every 7 years
- Land: N/A

$M	Year 1	Year 2	Year 3	...	Year 29	Year 30	Total
Energy	$ 642.7	$ 653.4	$ 664.1	...	$ 749.8	$ 749.8	$ 21,903.7
Water	$ 0.6	$ 0.6	$ 0.6	...	$ 0.7	$ 0.7	$ 19.6
Chemicals & Materials	$ 36.8	$ 37.4	$ 38.0	...	$ 42.9	$ 42.9	$ 1,252.9
Land Use							

Preliminary Findings

- Development of activity profiles
  - Dominated by energy attribute… Amounts consumed readily available, along with standard prices
  - Water, chemicals & materials, land – require research and assumptions
- Cost estimates of activity profiles
  - Energy and water are straightforward
    - Energy data can be found in sources such as VAMOSC and OSMIS
    - Guidance on water consumption can be found in the Quartermaster's "Water Planning Guide"
  - Chemicals & materials and land require research and assumptions
- Life cycle cost estimates related to sustainability
  - Access to estimates is an issue for contractors
  - That said, we were able to assemble O&S cost estimates for MDAPs of interest and estimate sustainability costs as a portion of total O&S costs

Chemicals/Materials and Land Use Impacts

Field level actual costs, with sustainability related impacts (such as corrosion repair and training facility upkeep), are not captured in a way that allows for easy use in estimating future costs.

- Results are reliant on SMEs (how we estimated frequency of painting System 3)
- Results are reliant on assumptions (how we estimated land use at Location 1)
- Can created useful views of costs – from "50k feet"
- Greater investment – time and money – will be needed to create a more precise estimate

Challenges

- Establishing an empirical data base
- Improving granularity in current cost collection systems without creating onerous reporting requirements
- Gaining top-level leadership support

6. Way Forward

- Continue pilot efforts to wring out methods for sustainability analysis – four more projects identified
- Develop standardized reporting procedures for collection of sustainability costs
- Increase empirical data to be used as a foundation for developing cost estimating relationships and cost factors