Integrating Sustainability into DoD Acquisition Programs

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Paul Yaroschak, P.E.
Deputy for Chemical & Material Risk Management
Office of the Deputy Under Secretary of Defense (Installations & Environment)
The Vision

DoD developers, program managers, and prime contractors **analyze alternatives** for meeting mission requirements and **make informed decisions** that result in:

- Sustainable Systems
- Lower Total Ownership Cost

How? Sustainability Analysis Using Life Cycle Assessment (LCA) Methods
Sustainability Analysis

LCA + LCCA = Sustainability Analysis

- NEPA
- EA/EIS
- Total Ownership Cost
- Trade Space Analysis
- Supportability Analysis
- Business Case Analysis
1) A diagram that compares alternatives by showing their relative life cycle human health and environmental impacts - a great decision tool for making sustainable decisions

2) Life cycle costs related to the impacts for each alternative...informs Total Ownership Cost estimates
   - Internal (to DoD)
   - External (to society)
   - Contingent (risks)
1) Process level LCA (the gold standard per ISO 14040/44)
   • Life cycle inventory…data intensive
   • Life cycle impact assessment (LCIA)

2) Hybrid Economic Input-Output LCA
   • Focuses on attributes with most impact
   • Monetizes the impacts for LCC estimates
   • Pilot test underway – DOD/Boeing/Sikorsky

3) Streamlined LCA (SLCA)
   • Modified process for DoD acquisitions
   • Employs Multi-Attribute Analysis
LCA Model for DoD

Inputs
- Energy
- Chemicals & Materials
- Water Use
- Land Use

System Boundary
- Research & Development
- Production & Deployment
- Operation & Support
- Disposal

Outputs
- Mission Impacts
- Human Health Impacts
- Environmental Impacts
- Life Cycle Costs

Impacts
Impacts

Resources (Inputs) | Scoring Factors | Impact Categories
---|---|---
ENERGY
- Energy Type
- Energy Source
- Energy Quantity

CHEMICALS & MATERIALS
- Hazards List
- C&M Source
- C&M Quantity

WATER
- Water Type
- Water Source
- Water Quantity

LAND
- Land Type
- Incremental Land Use Quantity
- Occupation Time

- Fossil Fuel Depletion Potential
- Energy Source Reliability
- C&M Availability
- C&M Recovery Potential
- Total Water Use
- Human Cancer Toxicity Potential
- Human Non-Cancer Toxicity Potential
- Respiratory Effects Potential
- Ionizing Radiation Potential
- Human Noise
- Freshwater Ecotoxicity Potential
- Marine Ecotoxicity Potential
- Terrestrial Ecotoxicity Potential
- Ecosystem Noise
- Global Warming Potential
- Ozone Depletion Potential
- Smog Potential
- Water Recovery Efficiency
- Water Loss Efficiency
- Water Scarcity
- Fit-for-Use
- Water Degradation Potential
- Land Degradation Potential
Spider-Web Decision Diagram
Traditional Environmental Costing

Conventional Costs  Hidden Costs  Contingent  Relationship & Branding  Societal

Easier to Measure  More Difficult to Measure
Sustainability Costing using EIO-LCA

Conventional Costs

Hidden Costs

Contingent

Relationship & Branding

Societal

Internal Costs

Contingent Costs

External Costs
Sustainability Costing using EIO-LCA

Conventional Costs

Hidden Costs

Contingent Costs

Societal Costs

Internal Costs

Contingent Costs

External Costs
Total Cost of Ownership

- **Alternative A**
- **Alternative B**
- **Alternative C**
- **Alternative D**
- **Alternative E**

**Cost ($M)**

- **Contingent**
- **External**
- **Internal**
• Calculate impacts & life cycle costs of two design alternatives for two current acquisitions:
  • Boeing P-8
  • Sikorsky H60R

• Design alternatives: a fully chromated coating system and a non-chromated system manufactured and sustained over 30 years
  • Chosen due to amount of data available
LEARN

• Where does life cycle cost data reside in DoD and at what level of detail?

• What barriers arise in trying to identify sustainability/ESOH life cycle costs?

DEVELOP

• A consistent method for characterizing impacts and their associated costs.
  • Use available data & Enviance Integrated Hybrid Total Cost Assessment (IHTCA) tool
Progress - Strategic

• Benchmarking study on LCA methods & tools

• LCA framework truth-tested with Boeing, Lockheed-Martin, General Dynamics, Raytheon & Sikorsky…all positive

• Coordination with key OSD offices & Services
  - Systems Engineering, Logistics & Material Readiness, Operational Energy, Manufacturing & Industrial Base Policy, Defense Standardization Office, Services’ ESOH Acquisition IPT, OSD-CAPE

• Briefing to DoD Senior Systems Engineering Forum with positive results
• Sustainability section drafted for the Defense Acquisition Guidance, Chapter 4

• Detailed Guidance for Streamlined LCA (SCLA) developed along with automated tool

• Sustainability to be an element in Supportability Analysis and Business Case Analysis – SLCA provides “how to”
Benefits of Sustainability Analysis

• Provides a practical yet rigorous and consistent analyses

• Forces thinking about life cycle activities of system:
  – Human health & environmental impacts
  – Life cycle costs of impacts

• Bottom line: More informed decisions with more thought to life cycle implications
Questions & Discussion

Paul Yaroschak
Deputy for Chemical & Material Risk Management
Office of the Deputy Under Secretary of Defense
(Installations & Management)
Current Situation

- Some good practices & results exist
- But...Sustainability insufficiently considered across DoD
  - Examples: energy, water use, noise, toxic chemical use
- Need better **Total Ownership Cost** estimates
  - Not all sustainability & ESOH life cycle costs are estimated and analyzed
  - Some costs are in different “stovepipes” (e.g., installation O&M)
  - Large operating & support (O&S) costs often passed to operators
  - ~70% of Total Ownership Cost in O&S category
What’s Needed?

• Practical “doable” method for LCA
  – Not resource or data intensive
  – Modified process for DoD acquisition process

• Must be flexible enough for a variety of systems, equipment, & platforms – big or small

• Must be flexible enough to be used from Analysis of Alternatives (AoA) through design phases

• Integrates with Systems Engineering process

• Must help identify sustainability/ESOH related life cycle costs for Total Ownership Cost estimates
The LCA Steps

STEP 1: Defining the Functional Unit (Section 6.1)

STEP 2: Defining the Scope (Section 6.2)

STEP 3: Defining the System Boundaries (Section 6.3)

STEP 4: Building an Input Inventory (Section 6.4)

STEP 5: Assessing Human Health and Environmental Impacts (Section 6.5)

STEP 6: Comparing Alternatives (Section 6.6)

Goal: Select the most sustainable system that meets performance requirements
At Milestone B, identify & mitigate ESOH risks & document in PESHE\(^1\)

\(^1\) Programmatic Environmental Safety & Health Evaluation
Incorporate sustainability “up-front” starting in Analysis of Alternatives (AoA) & continuing through design
Example Life Cycle Costs

Chemical & Materials Attribute

- Personal protective equipment
- HAZMAT training
- Workplace IH monitoring & medical monitoring
- Hazardous waste management and disposal
- Air handling/waste treatment systems
- Emissions/discharge permits
- Contingent liabilities for health/environmental damages
Life Cycle Costs

Integrating Sustainability and Affordability in DoD Acquisition Process