Sustainability Analysis in the Adaptive Acquisition Framework

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Noblis support to
Office of the Assistant Secretary of Defense for
Energy, Installations, and Environment (OASD(EI&E))
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Outline

- **Acknowledgements and Introduction**
- **Background and Policy**
- **Resources and Methodology**
- **Application in RDT&E**

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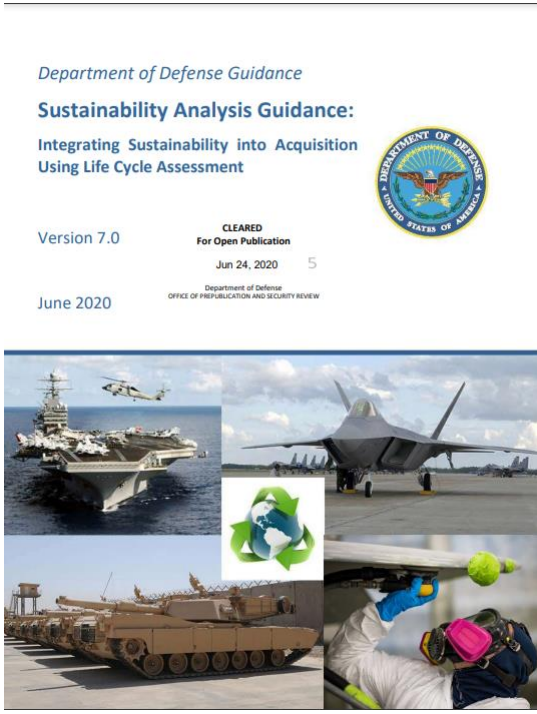
Sustainability Analysis Introduction

- **Sustainability Analysis facilitates incorporation of sustainability considerations in Defense Acquisitions**

- **Sustainability Analysis quantifies life cycle costs, emissions, and environmental impacts of design decisions.**
  - Can be used to identify the most sustainable alternative among those that meet performance requirements.
  - Quantifies emissions (e.g., GHGs) and usage of energy, water, waste, chemicals
  - Users include weapon system managers, product support managers, RDT&E Programs

- **Sustainability Analysis resources include:**
  - Sustainability Analysis Guide (SAG)
  - Supply Chain Emissions Factors (i.e., DoD Scoring Factors)
  - Example analyses available for public use
  - Short Course materials (e.g., Short Course at SERDP-ESTCP Symposium)

- **The SAG provides a description of how to meet sustainability requirements within Adaptive Acquisition Framework.**



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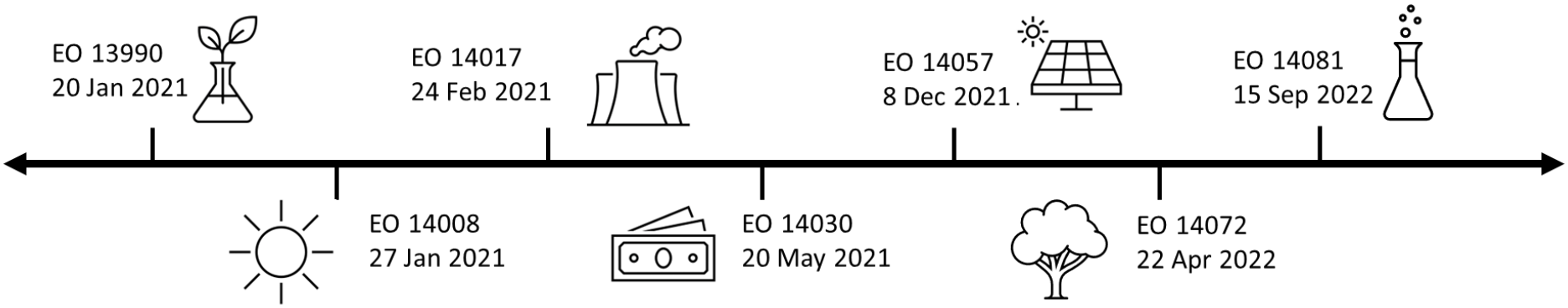
Sustainability Requirements Span Executive Orders (EO)



EO 13990

- Incorporate Social Cost of Greenhouse Gases (SC-GHG) in areas of decision-making, budgeting, and procurement.
- Limit exposure to dangerous chemicals and pesticides;, including to low-income and communities of color.

EO 14008

- Orders climate considerations to be an essential element of United States national security policy.
- Climate crisis requires significant short-term GHG reductions and net-zero emissions by mid-century or before.

EO 14030

- Requires suppliers to (1) disclose greenhouse gas emissions and (2) disclose climate-related financial risk and (3) set science-based reduction targets.
- Orders agencies to consider the SC-GHG in procurement decisions and, where appropriate and feasible, give preference to bids and proposals from suppliers with a lower SC-GHG.

EO 14017

- Agencies required to assess climate risks to the availability, production, or transportation of critical/essential goods.

EO 14057

- Federal Government to lead by example in order to achieve a carbon pollution-free electricity sector by 2035 and net-zero emissions economy-wide by no later than 2050.
- Secure a transition to clean, zero-emission technologies and transform procurement and operations

EO 14072

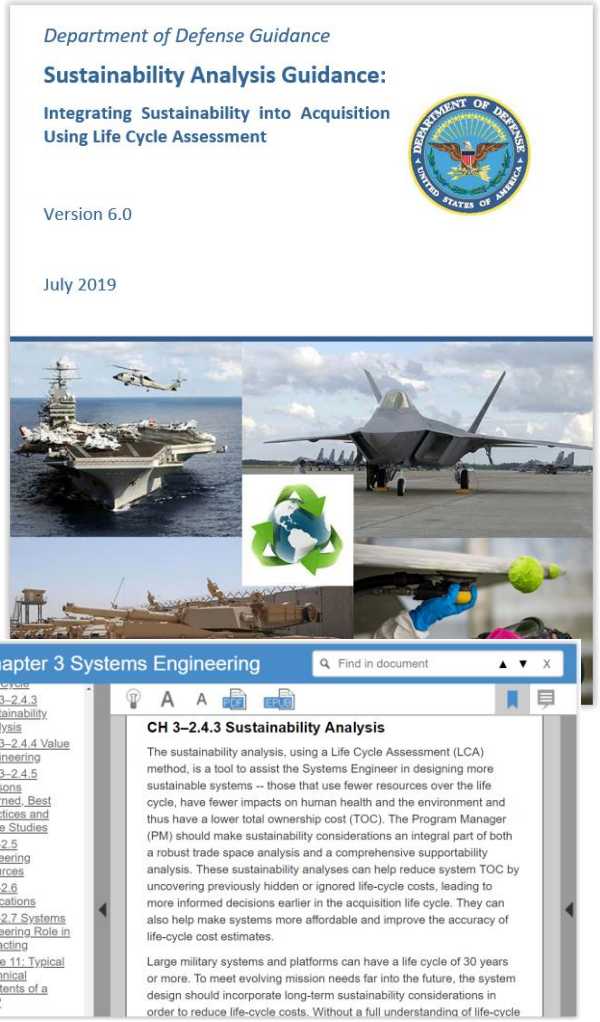
- Develop policies to institutionalize climate-smart management and conservation strategies of forests on Federal lands

EO 14081

- Harness Biotechnology and Biomanufacturing R&D sustainably and increased biobased procurement

The Adaptive Acquisition Framework includes Sustainability Considerations

- **Environment, safety, and occupational health (ESOH) must be considered during the acquisition process and for the duration of a system's life cycle.**
  - "DoDI 5000.02 requires … appropriate measures be taken to reduce O&S costs by influencing system design early in development…. since the opportunities to reduce O&S costs decline significantly as the system design evolves." (Operating and Support Cost-Estimating Guide; CAPE 2014)
- **Sustainability Analysis Guide (SAG) provides a full description of how to incorporate sustainability consideration in support of acquisition requirements.**
- **SAG includes traditional "internal" life cycle costs in addition to often-overlooked "external" costs.**
  - Includes the Social Cost of Greenhouse Gases (SC-GHG)
- **The SAG is in the process of being updated in accordance with new policy**



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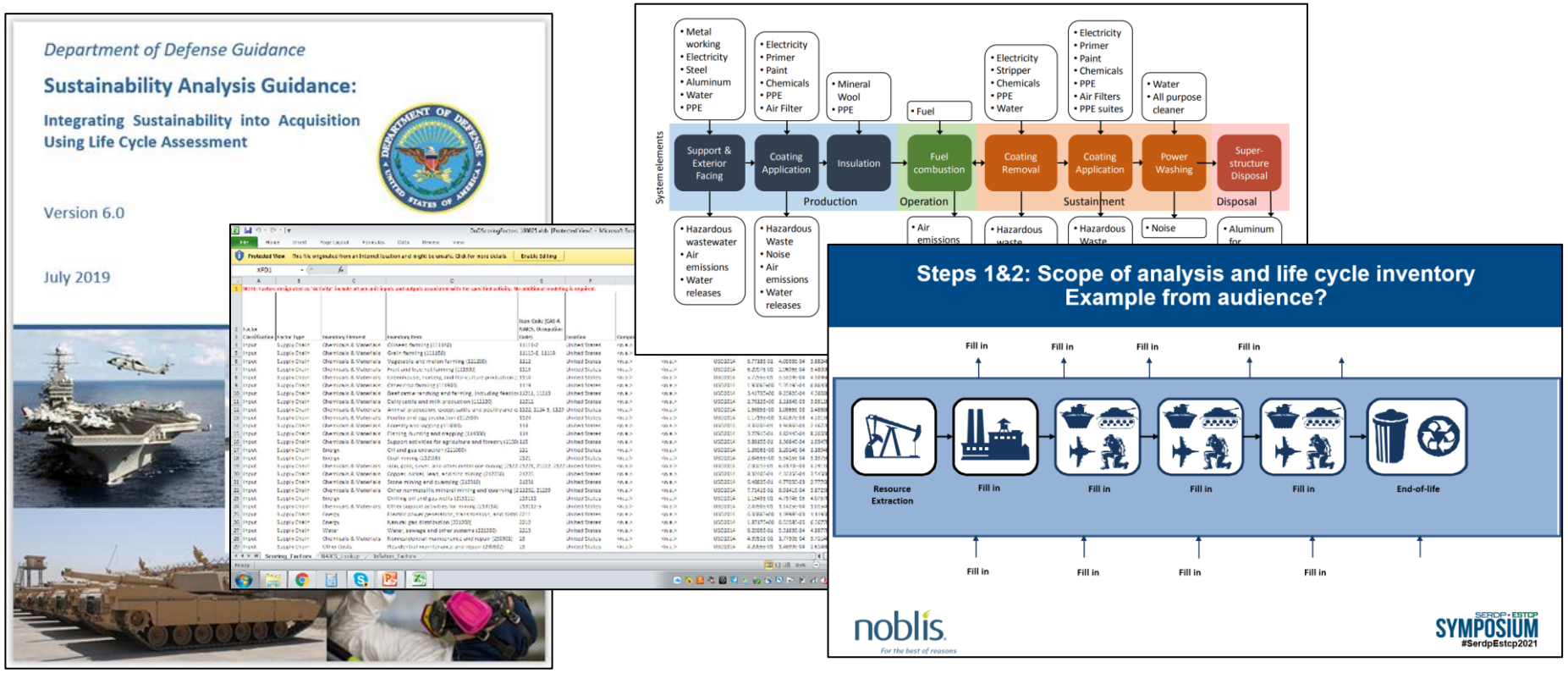
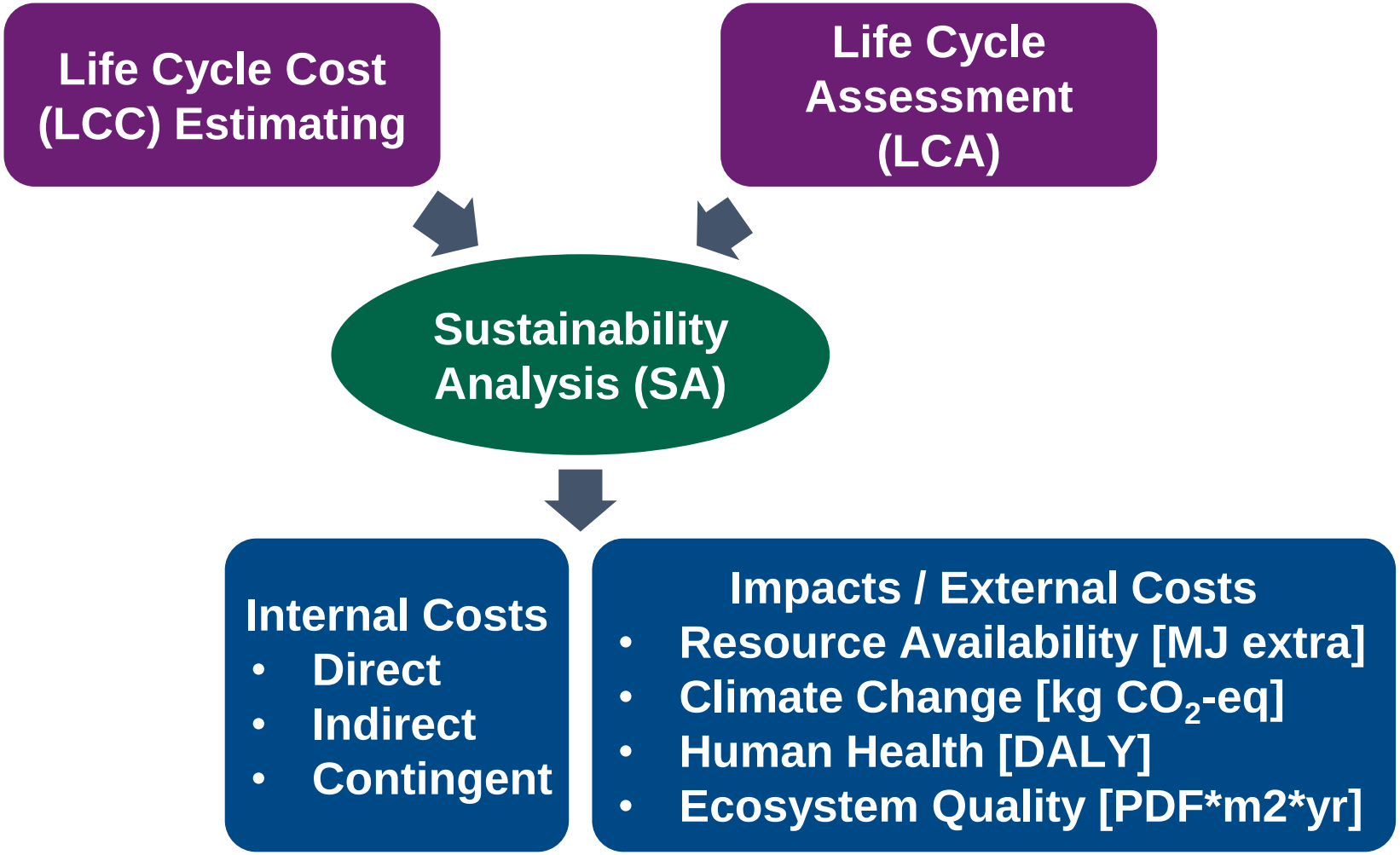
Sustainability Analysis Resources

- **Sustainability Analysis Guide**
- **Supply Chain Emissions Factors**
  - (i.e., DoD Scoring Factors)
- **Example analyses**
- **Short Course materials**



Link to guide and resources: https://denix.osd.mil/esohacq/home/

Sustainability Analysis Guide Methodology



Example Inputs and Outputs

Inputs, Outputs, and Impacts

Inputs & Outputs

Required:
- Energy
- Chemicals and Materials
- Water
- Land
- Releases & Waste
- Procured Goods
- Procured Services

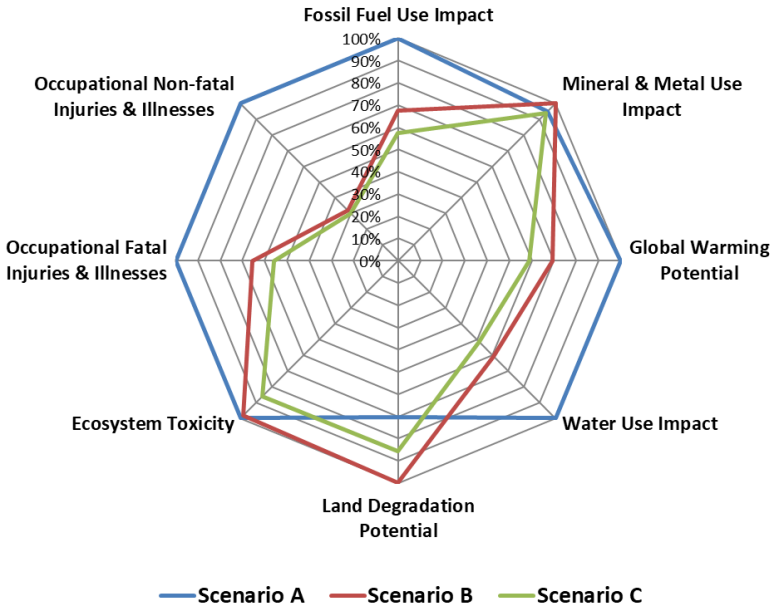
Midpoint Impacts

Required:
- Climate change
- Ecosystem toxicity
- Water use
- Fossil energy use
- Land use
- Mineral use

Endpoint Impacts

Required:
- Climate change
- Human health
- Ecosystem quality
- Resource availability

Example Results from LED Lighting for Littoral Combat Ships



Sustainability Analysis quantifies emissions (to air and water) and usage of energy, water, waste, chemicals. Emissions and energy are translated to impacts (e.g., global warming potential, ecosystem quality).

DoD Supply Chain Emissions Factors

- **Support estimates of supply chain emissions**
  - Support tool that accompanies SAG
  - Scoring factors translate product spend data to emissions and environmental impacts
  - Estimates include Scope 3 GHG emissions
- **Support estimates of supply chain (Scope 3) GHG emissions**
- **Uses defense specific model**
  - Defense Input Output (DIO) model
  - Aligns with EPA USEEIO model, incorporating the latest available information from BEA, TRI, US GHG Inventory, NEI, etc.
  - Model is currently in the process of being updated.
- **Estimates Social Cost of Greenhouse Gases (SC-GHG)**
  - Scoring factors calculate CO2-eq and SC-GHG.
  - Factors need to be updated to align with new SC-GHG values.
- **Estimates other environmental impacts (e.g., Ecosystem Quality)**
- **Available at https://www.denix.osd.mil/esohacq/index.html**

Supply Chain Emissions Factors Example

Estimate emissions and SC-GHG by spend data and NAICS code

Inventory Element	Inventory Item	Item Code (CAS #, NAICS, Occupation Code)	Location	Climate change *kg CO2-eq*	SC-GHG USD2014
Chemicals & Materials	Turned product and screw, nut, and bolt manufacturing (:	33272	United States	4.9590E-01	8.0454E-02
Chemicals & Materials	Coating, engraving, heat treating and allied activities (33	3328	United States	7.6120E-01	1.0618E-01
Chemicals & Materials	Valve and fittings other than plumbing (33291A)	332911-2, 332919	United States	3.8079E-01	7.0321E-02
Chemicals & Materials	Plumbing fixture fitting and trim manufacturing (332913)	332913	United States	3.4646E-01	8.0682E-02
Chemicals & Materials	Ball and roller bearing manufacturing (332991)	332991	United States	4.2769E-01	5.7778E-02

Estimate emissions and for defense specific activities by mass-based unit

Inventory Element	Inventory Item	Item Code (CAS #, NAICS, Occupation Code)	Location	Inventory Item Unit	Climate change *kg CO2-eq*	SC-GHG USD2014
Energy	Electricity use, average generation mix	<n.a.>	South Carolina, U.S.	MJ	1.2987E-01	2.0315E-02
Energy	Electricity use, average generation mix	<n.a.>	South Dakota, U.S.	MJ	1.1739E-01	2.1484E-02
Energy	Electricity use, average generation mix	<n.a.>	Tennessee, U.S.	MJ	1.6533E-01	2.2161E-02
Energy	Electricity use, average generation mix	<n.a.>	Texas, U.S.	MJ	1.8444E-01	2.4500E-02
Energy	Diesel combustion in light utility vehicle	<n.a.>	Global / Unspecified	L	3.2083E+00	4.8942E-01
Energy	Diesel combustion in locomotive	<n.a.>	Global / Unspecified	L	3.2702E+00	5.3791E-01

The Emissions Factors are available to estimate emissions or impact of design decisions during acquisitions

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Example Requirement: Strategic Environmental Research and Development Program (SERDP) Statements of Need (SON)

Example: Development of Advanced Coating System (WPSON-20-C1)

- Objective: **New, innovative advanced protective coatings and systems**
  - Improved protective properties
  - Require few resources
  - Easier to use
  - Environmentally sustainability
- **The "new" system must be able to meet performance requirements** …
  - Operational protective properties
  - Less complex application techniques
  - Ability to selectively strip or apply coatings
- … and, it **must be more sustainable** …
  - Reduced life cycle costs and impacts associated with human health and the environment
  - Energy efficient
  - Improved chemistry
- … **when compared with current and legacy systems**.

Example requirement: Hydrofluorocarbon (HFC) alternative SON

- HFCs are high global warming potential (GWP)
  - AIM Act requires a phase down of usage based on global warming potential (GWP) values
  - Identified as critical to the United States reaching its Paris Agreement GHG goals
  - Integrated in weapon systems subsystems

- SERDP and ESTCP released a SON for low GWP-HFC alternatives
  - “The objective of this SON is to identify, develop and test lower-GWP alternatives to refrigerants in use by the Department of Defense”
  - Pre-proposals are due the first week of January.

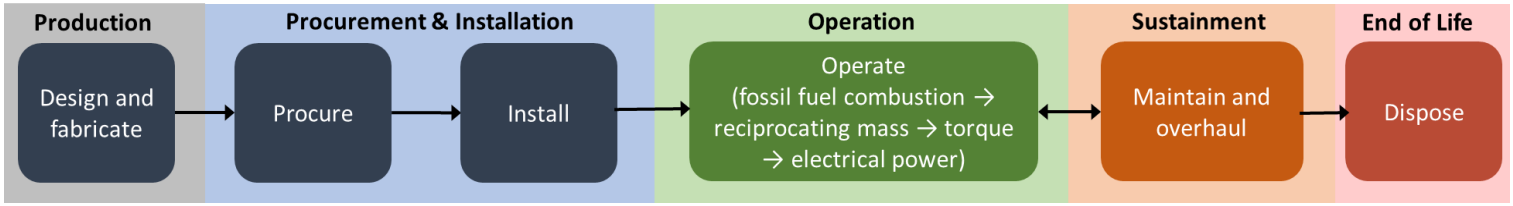
Sustainability Analysis can be used to quantify life cycle GHG emissions reductions and costs.

Example Applications across DoD

- Chromium plating alternatives for weapons systems components in the Navy
- LED Lighting on a littoral combat ship
- Additive vs. traditional manufacturing for aviation fuel nozzles
- Back-up and renewable power scenarios at Fort Hood, TX
- **Alternative engine designs for T-AGS(X) Naval Oceanographic Vessel**
- Sustainable alternative to C-4 Demolition Brick
- PFAS-free alternative firefighting foam replacement

Example Alternative engine designs for T-AGS(X) Naval Oceanographic Vessel

- Pilot Project Scope
  - Compare seven diesel engine combinations (ECs) (including baseline) with two air emissions compliance tiers, in accordance with OPNAVINST 5090.1.
    - Baseline: Shipboard EC with EPA Tier 3 (T3) emissions control



  - Assess return on investment (ROI) and cost savings, and minimized trade-off penalties imposed on fuel consumption, range, payload, availability, useful life, and LCC.

- Partnership

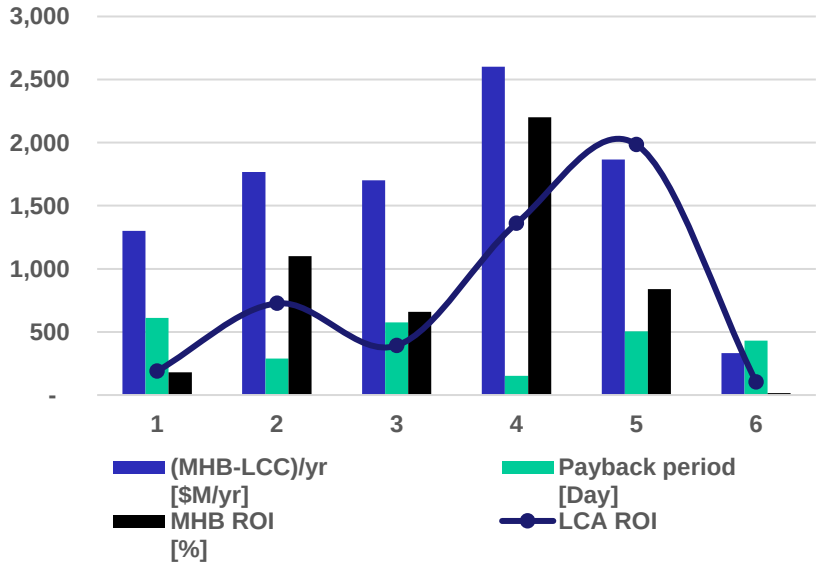
NAVSEA NAVAL SEA SYSTEMS COMMAND

NAVSEA WARFARE CENTERS Philadelphia

Example Alternative engine designs for T-AGS(X) Naval Oceanographic Vessel

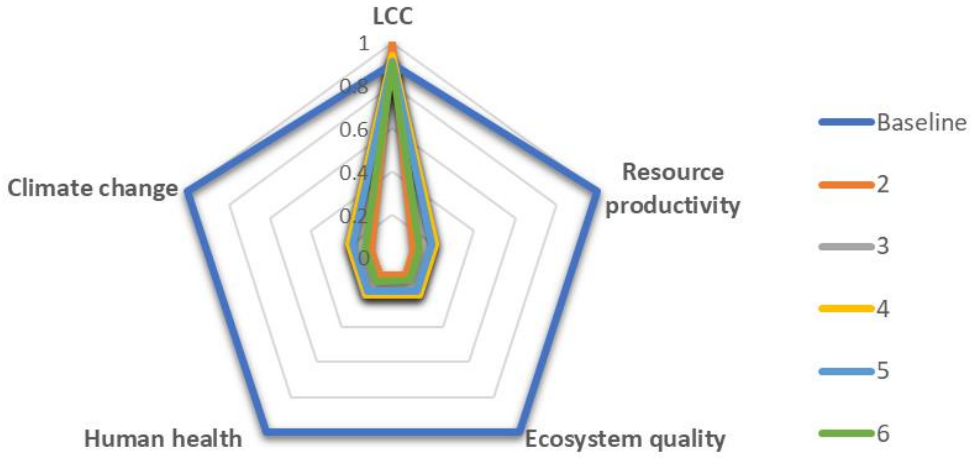
Monetized Health Benefit (MHB) and LCC Results

- Costs included installation design, procurement, installation, operation, and maintenance and overhaul.
- Annual savings (MHB - LCC) are 330 - 2,600 $K/yr.
- Payback period is 5 - 20 months.
- MHB ROI is 10 - 2,200%.



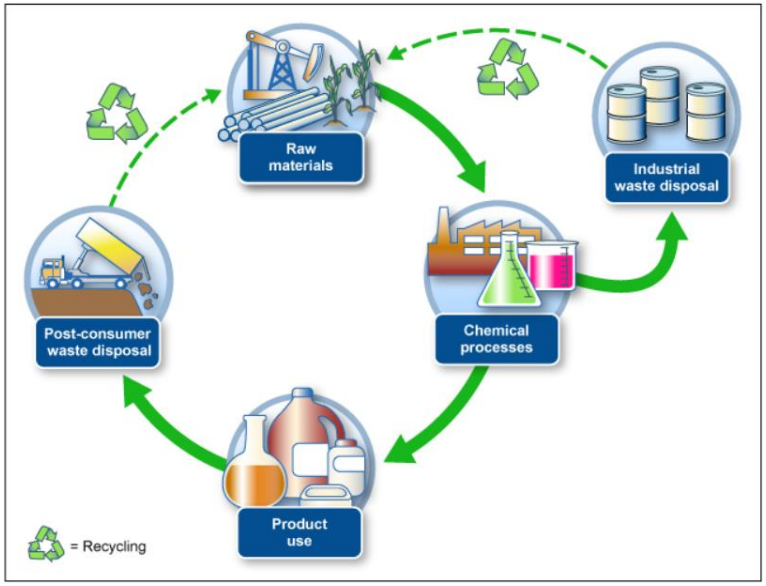
Endpoint Impacts and LCC Results

- Normalized all systems (baseline and alternatives) to the worst-performing system.
- Decreased internal costs and potential environmental liability for the Navy when the following alternatives are selected (EC 4 , 2, 5, 3, 1, and 6, in descending ROI order).



Next Steps

- DoD SAG will be updated to align with new policy and requirements
- Supply chain emissions factors will be updated with increased resolution for defense sector
- Development of DoD-relevant pilot studies
- Short course at 2022 SERDP-ESTCP symposium
- Development of toolkit for RDT&E application



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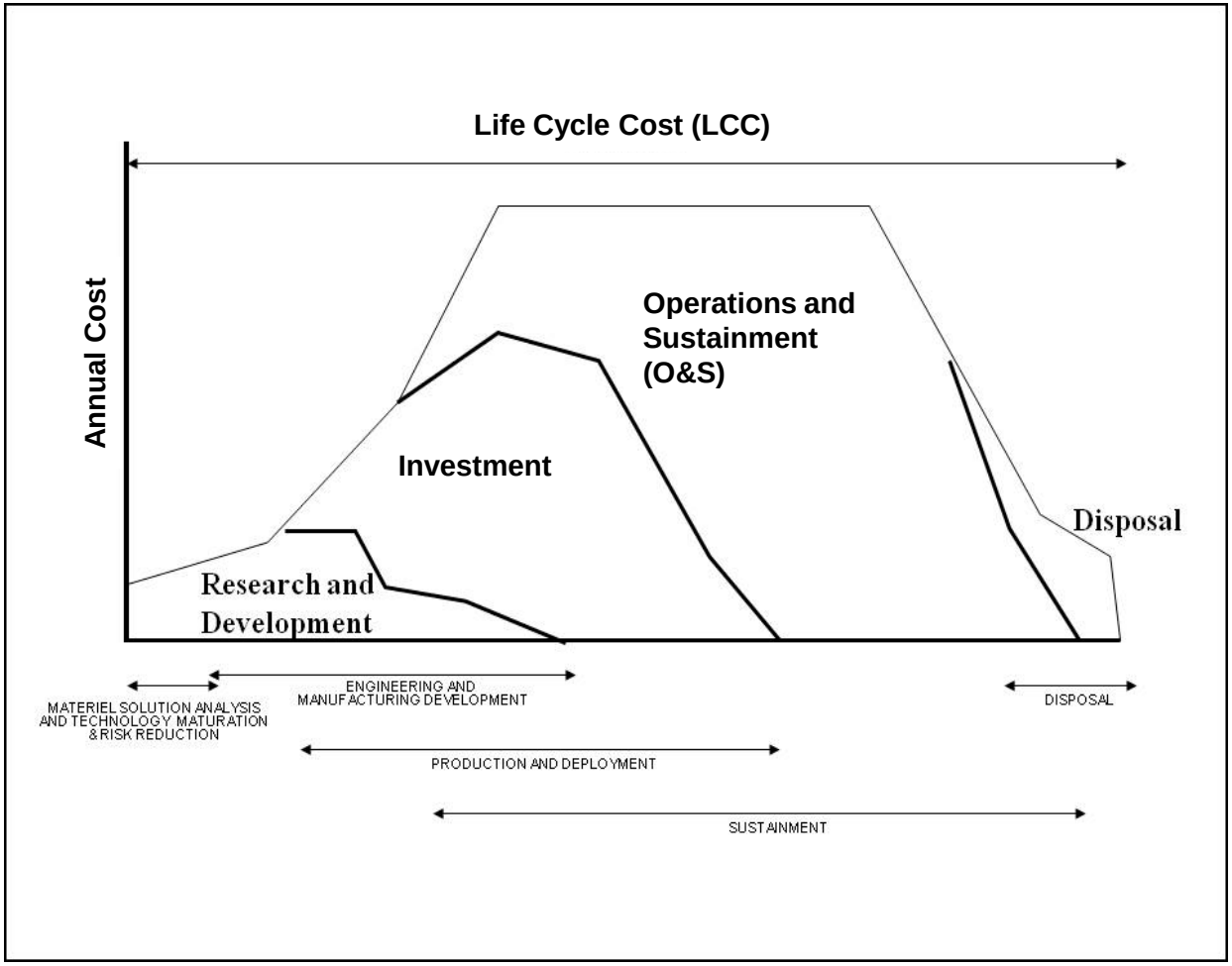
Questions?

Mission Drivers

- **Mission Performance**
  - Improved performance – recent technology enhancements
  - Improved logistics – shorter tail, less material into the field
- **Price versus Cost over Life Cycle – Better Value**
  - Use and dispose of less, longer life cycle, increase affordability
- **Material Availability**
  - Made from domestically sourced materials offering increased supply chain security
  - Reduced dependency on fossil fuels
  - Reduced impact on non-renewable resources
- **Reduced Health and Environmental Impacts**
  - Reduced exposure to hazardous materials – lower liability
  - Lower impact on personnel, operations and training lands

Systems Engineering and Defense Acquisitions



- ~80-90% of LCC committed during R&D
- 60-80% of LCC incurred during O&S

Systems engineering approaches, including sustainability analysis, are needed from cradle to grave

GHG emissions captured as part of sustainability analysis