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Problem Statement Template
TEAM: PURPLE Number: #1

Problem Statement Title: Transitioning the Existing Fleet

Problem Statement: A plan does not currently exist to incrementally decarbonize the existing propulsion system technologies.

Effective Outcome: Develop an RDT&E roadmap and transition plan of existing or developing technologies compatible with existing propulsion systems that could be used to achieve incremental decarbonization through retrofits/repowering.

Unique Conditions: There needs to be a mandate to act as a driver to implement viable technologies into use in the existing fleet.

Standards/Desirements: All technologies evaluated need to fit within the envelope of the existing vessels. All of the decarbonization technologies also have an on-vessel and in-port infrastructure and safety system tail that needs to be developed in parallel.

Technology Research Areas of Interest:

- Alternative fuel technologies
- Emissions controls
- Combustion enhancement
- Optimized operations
- Hoteling/non-propulsion load improvements

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Problem Statement Template
TEAM: PURPLE Number: #2

Problem Statement Title: Modular and Scalable Next-Generation Technologies

Problem Statement: In the face of an uncertain clean energy transition where technology winners have not been identified, there is a need to adopt different propulsion based on external factors for a given asset class.

Effective Outcome: Ability to interchange multiple different propulsion systems into a given asset class to avoid risk of investments becoming obsolete.

Unique Conditions: There is a lack of control of the energy environment that CBP and DHS operates in, and the technology development lifecycle is faster than the acquisition lifecycle.

Standards/Desirements: The same vessel performance (range, speed, endurance, etc.,) can be achieved regardless of the propulsion system being used (batteries, fuel cells, alternative fueled engine, etc.).

Technology Research Areas of Interest:

- Modular power generation systems (e.g., electric generating combustion engines, fuel cells, SMR, other)
- Energy storage systems (batteries, flywheels, capacitors, etc.)
- Drivetrain systems (electric drive propellers)
- Modular vessel architecture (bolt-on energy)

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Problem Statement Template
TEAM: PURPLE Number: #3

Problem Statement Title: Develop Optimal Technologies for the Mission

Problem Statement: How do you influence innovation in the commercial sector and other government agencies to benefit national security agencies to achieve the optimal technology solution?

Effective Outcome: Whole-of-government leveraging and unity of effort to accelerate the pace of technology development.

Unique Conditions: Innovation could happen in areas where we're not expecting it. There could be a paradigm change in another area and these applications need to be open to adopting it.

Standards/Desirements:

Technology Research Areas of Interest: Please list what you have seen, looked at, or tested and what were the outcomes. Please also note any general areas of research that should be conducted as a starting point.

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Problem Statement Template
TEAM: GREEN Number: #1

Problem Statement Title: Unreliable commercial market drivers

Problem Statement: Avoid propulsion, infrastructure, and power system industry members driven solely on government requirements

Effective Outcome: An industry creating synergy with government and commercial demands

Unique Conditions: Government push but not sustainment, Buy American Act considerations, U.S. workforce re-trained, new authorities and regulations would have to be codified in law, influence of fossil fuel companies, use of tax credits

Standards/Desirements: diverse set of companies who operate in the various AE industries (solar, nuclear, thermal, hydrogen, ammonia, biomass, methanol, electric), geographically dispersed based on fuel source, and can operating vertically within the entire supply chain. technology fit for duty (replacement propulsion meet or exceed current performance requirements including cruising, on-station, hazardous conditions,

Technology Research Areas of Interest: Please list what you have seen, looked at, or tested and what were the outcomes. Please also note any general areas of research that should be conducted as a starting point.

Systems approach to integrating AE, political environment conducive to adopting new laws (I.e. clean air and water act), Depts of Commerce/Transportation in industry categorization

Problem Statement Template
TEAM: GREEN Number: #2

Problem Statement Title: Modularity and Scaleability

Problem Statement: Preparing maritime industry to incorporate multiple interoperable solutions

Effective Outcome: Ability to achieve 2050 solution with multiple technologies.

Unique Conditions:
New spatial designs and allocations, retrofit limitations, maritime industry will require a generation shift in a short amount of time, drastic increases in power relative to tonnage (vessel size and displacement), energy storage technology limitation (battery or other tank, energy density and life)

Standards/Desirements: No degradation of mission based on changing propulsion drivers, charging time standards

Technology Research Areas of Interest:
Optimum module size (physical and power), successful sea trials, management of modules, software and hardware integration, coordinate with other technology modules such as fuel cell batteries or liquid

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Problem Statement Template
TEAM: GREEN Number: #3

Problem Statement Title: global and national infrastructure

Problem Statement: none of the AE infrastructure is near to petroleum infrastructure

Effective Outcome: Alternative energy network that can support the maritime industry

Unique Conditions: Microgrid at port option (decarbonize on your own), port authority and pipeline owner operators are SLTT and Private sector,

Standards/Desirements: What standards or minimum qualifications must the technology meet to be implemented successfully. You can use threshold and objective numbers, if available.
Ports have infrastructure for diverse refueling options (bio, hydrogen, etc), gradual phasing of AE, example: renewable diesel mix with other fuel types,

Technology Research Areas of Interest: Please list what you have seen, looked at, or tested and what were the outcomes. Please also note any general areas of research that should be conducted as a starting point.

Grid and interaction with micro grids, selling/trading energy unit, pipeline with different materials - different zoning laws - state government oversight, windmill recharging station, mobile battery service at sea, kinetic buoy rechange, grid decarbonization, helicopter dropped module energy storage rechargers,

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Problem Statement Template
TEAM: ORANGE Number: #1

Problem Statement Title: Lifecycle system support

Problem Statement: The cost of the system lifecycle is not cost-competitive inhibiting industry development and adoptions. The TRL of alternative energy systems and infrastructure is underdevelopment.

Lifecycle support is the entire cost of the system from the initial acquisition, fuel, maintenance, safety, training, and disposal. The entire cost of the system lifecycle must be considered for government development and industry adoption. The sustainable alternative energy engine needs to be left on the maritime vessel and resist corrosion and other wear comparable to current solutions. The lifecycle maintenance costs should be equivalent to current options. This includes development and costs related to safety and training. Supply chain management. Sustainability. Resilience against manmade and natural threats.

Effective Outcome: AE Systems must be compatible and interoperable to new tech, affordable, sustainable, and resilient.

Unique Conditions: Zero infrastructure, low TRL for alternative solutions, and operating environment.
Disposal, recycle, and repurpose.

Standards/Desirements: Infrastructure covers 80% of the DHS maritime mission locations.
The lifecycle cost of AE systems would be cost-competitive with conventional solutions.

Technology Research Areas of Interest: Infrastructure, compulsion systems, scalability of alternative energy fuels, integration of power and propulsion systems,

Problem Statement Template
TEAM: ORANGE Number: #2

Problem Statement Title: Form, fit, and function

Problem Statement: Current propulsion systems do not meet net zero lifecycle emissions.

Effective Outcome: A fuel agnostic sustainable AE propulsion system that meets or exceeds current DHS component needs for mission requirements.

Unique Conditions: Scalability (different size vessels), infrastructure for refueling, modularity and interchangeability, power requirements for propulsion and onboard systems, durability and ruggedization, redundancy, reliability. Footprint of the system (propulsion system and battery), sustainability, scalability, emergency power supply options, possibility of retrofitting, operating range, leveraging other government solutions, propulsion design

Standards/Desirements: No loss in current mission capabilities (mission need statement and operations requirements document (ORD)) while meeting zero emissions.

Technology Research Areas of Interest: Evaluate AE systems against current mission capabilities

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Problem Statement Template
TEAM: ORANGE Number: #3

Problem Statement Title: Transition of sustainable alternative energy to industry.

Problem Statement: AE systems does not meet current maritime industry requirements nor does the infrastructure exist for refueling. In a risk-averse environment, industry does not have the incentives to invest in technology.

Effective Outcome: Industry adopts sustainable alternative energy solutions. Increase infrastructure and commercial availability.

Unique Conditions: Lack of incentives and government support, international standards, risk of uncertainty, lack of infrastructure (domestic and global), leverage of other government solutions, understanding international market trends, acceptance of high risk solutions, government regulations for adoption of technology (federal, state, local), political environments, commercialization vs. military needs, competition for materials and material shortages, environmental impact vs. cost, limited cruising range, multiple uses in non-maritime environment (i.e. ships in port)

Standards/Desirements:
Must meet industry needs for range of different jobs (shipping, fishing, etc.)
Must be cost-competitive
Must meet infrastructure needs
Industry consensus standards to promote competition and interoperability

Technology Research Areas of Interest:
Infrastructure
AE System design (increase TRL)
Cost-effective materials and fuel