

REDUCING FUEL CONSUMPTION: A MARITIME ENERGY PORTFOLIO MANAGEMENT APPROACH



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Report Documentation Page

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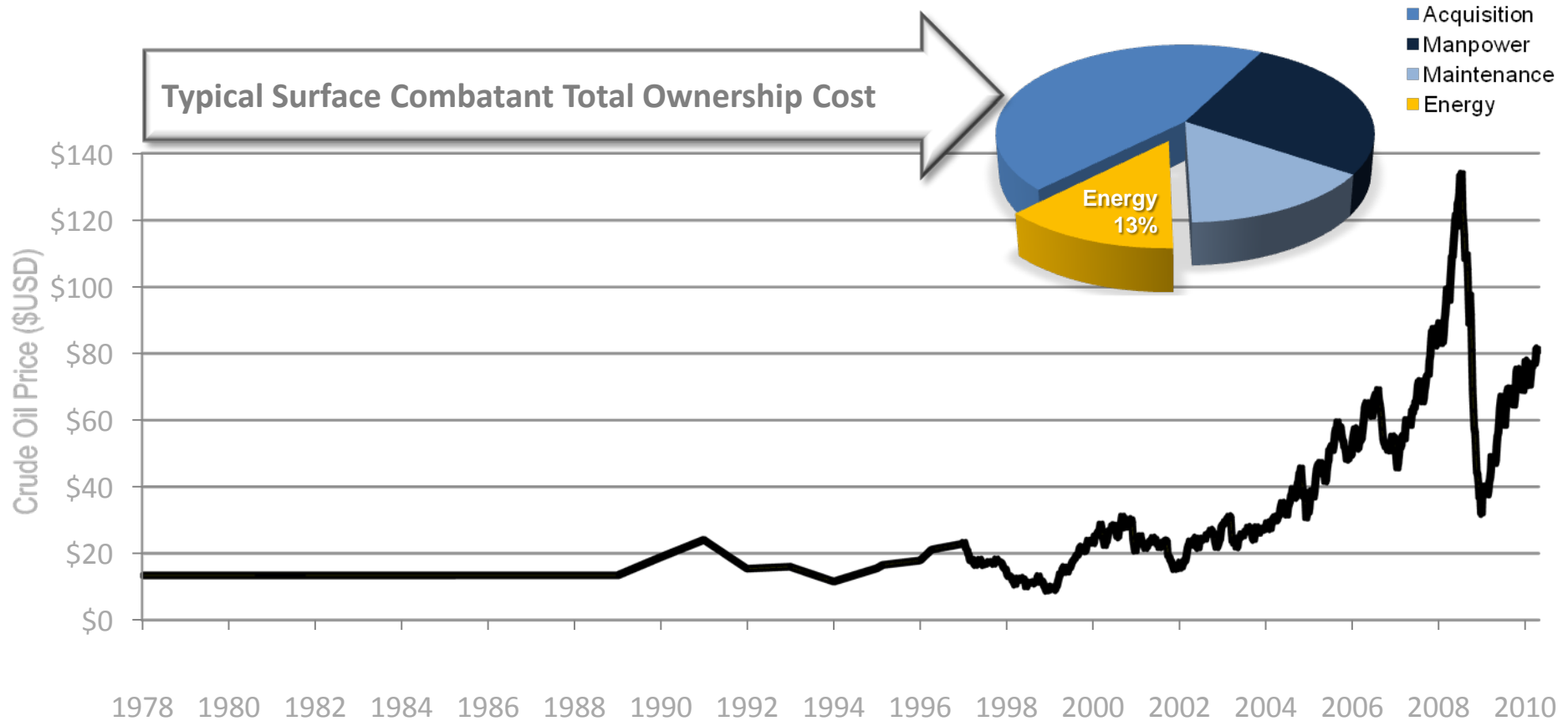
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Outline

- **ENERGY AS A NAVY IMPERATIVE**
- **ENERGY DECISION FRAMEWORK**
- **MARITIME ENERGY PORTFOLIO PROCESS**
- **IMPACT TO NAVSEA ENERGY PROGRAM**

Navy Energy Profile

Typical Surface Combatant Total Ownership Cost



Energy Demands and Costs Continue to Rise
Manpower and Maintenance Budgets are Challenged
We Have the Ability to Control Acquisition Costs

US Navy Tactical Energy Goals

INCREASE ALTERNATIVE ENERGY USE DON-WIDE

- By 2020, 50% of total DON energy consumption will come from alternative sources.

SAIL THE "GREAT GREEN FLEET"

- DON will demonstrate a Green Strike Group in local operations by 2012 and sail it by 2016.

ENERGY EFFICIENT ACQUISITION

- Evaluation of energy factors will be mandatory when awarding contracts for systems and buildings.

EFFICIENCY AND CONSERVATION AFLOAT

- By 2020, the Navy will increase efficiency and reduce overall fuel consumption afloat by 15%.

Energy Decision Framework



Energy Efficiency Enabling Technologies

FLEET/CRUISE/AMPHIB: 2012-2030

Rank	Technology	TRL
1	FLEET - BVP	7
2	AMPHIB - Combustion Trim Loop	8
3	AMPHIB - Prop Coatings	8
4	CRUISES - Gas Turbine Online Water Wash	8
5	AMPHIB - Stern Flaps	8
6	CRUISES - Hull Coatings	8
7	AMPHIB - Solid State Lighting	8
8	CRUISES - Solid State Lighting	8
9	CRUISES - HED	8
10	CRUISES - Heat Energy Recovery	4

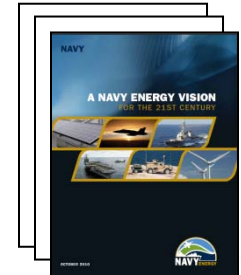
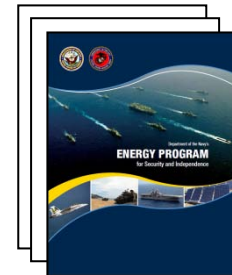
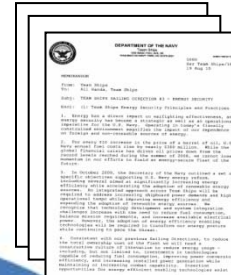
NOTIONAL: TRL Backlog Summary

NOTIONAL: Technology Summary

NOTIONAL: Value Case Summary - Benefit

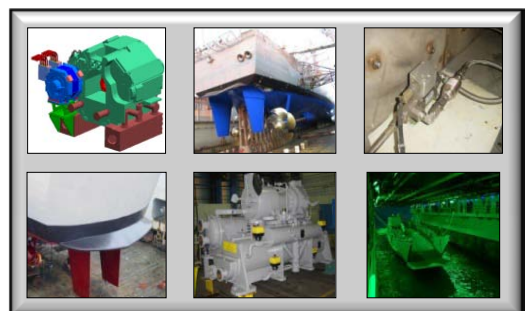
NOTIONAL: Benefit Summary

Evaluate Energy Scorecards

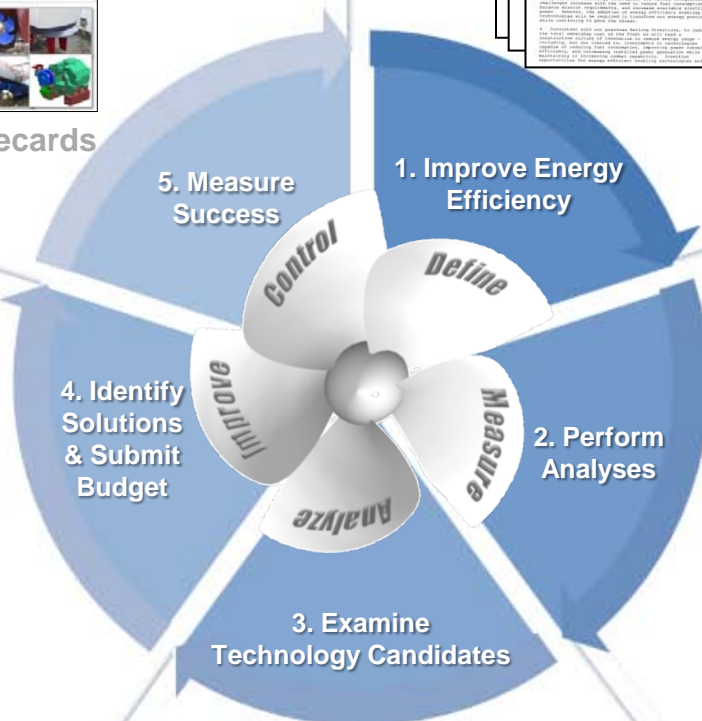


Policy & Guidance

INITIATIVE	2012	2013	2014	2015	2016	FYDP	RS
FFRACOP	1.3	1.4	1.5	1.9	4.0	12.8	Programs
4 MW SSGT / PDSB RDTE	4.1	9.9	16.2	11.0	4.9	46.5	NBS
Energy Storage RDTE	3.5	3.0	3.0	3.0	6.0	20.8	NBS
Smart Voyage Planning / Fleet Scheduler	1.4	0.2	0.2	0.2	0.0	3.4	NBS
Nuclear Studies	2.0	2.1	2.1	2.2	2.3	10.7	NBS
Hull Coatings	2.0	2.4	8.0	4.8	2.8	20.8	O&M
Propulsion Coatings	0.3	0.3	0.3	0.3	0.3	1.4	
Combustion Trim Loop	0.4	0.4	0.4	0.2	0.0	1.4	
L-Ship Directional Stability	0.9	1.8	1.8	1.8	1.8	8.1	NBS
Online OT Waterwash	0.4	1.4	1.4	1.4	1.4	6.2	
Marine Gas Turbine Initiatives	2.4	2.4	2.4	2.4	2.4	12.0	
Solid State Lighting (Amphib)	0.5	1.1	1.6	1.6	1.6	6.8	NBS
Solid State Lighting (Cruises)	3.2	3.2	3.2	3.2	3.2	17.5	NBS
Stern Flaps (LSD)	0.8	0.8	1.6	0.8	0.8	4.8	
HED OPN	0.0	0.0	17.0	46.0	47.0	110.8	OPN
LHX209 Efficiency RDTE	8.0	11.0	2.0	0.0	0.0	16.8	NBS
LHX209 Efficiency OPN	0.0	0.0	0.0	3.0	12.0	28.8	OPN
Energy Dashboard / Hydrodynamics	5.1	1.0	0.8	0.2	1.9	9.8	NBS
TOTAL	38.4	44.3	65.5	92.1	93.5	333.8	



Develop Implementation Plan



5. Measure Success

1. Improve Energy Efficiency

2. Perform Analyses

4. Identify Solutions & Submit Budget

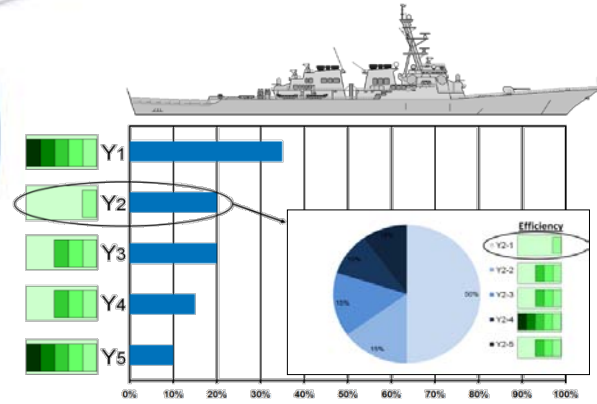
3. Examine Technology Candidates

Determine Possible Solutions

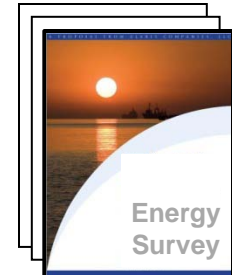
Energy Efficiency Enabling Technologies (E3T)

2012	2016	Future
Hybrid Electric Drive	Hull Hydrodynamic Mods	New Engines and Generators
Alternate Fuels	Generator Mods	Fuel Cells
Solid State Lighting	Heat Energy Recovery	Wind Energy Harvesting
Fuel Release Coatings	High Efficiency Chillers	Solar Energy Harvesting
Online OT Water Wash	Energy Dashboard	Air Film Hull Drag Reduction
OT Efficiency Improvements	Propulsion Mods	
Combustion Trim Loop	Deposure Mods	
Smart Voyage Planning Decision Aid	Acoustic Refrigeration Units	
Stern Flaps	Advanced RO Desalinator	
Variable Speed Drives	Acoustic Motors	
Low Solar Absorption Coatings	Energy Storage Module	

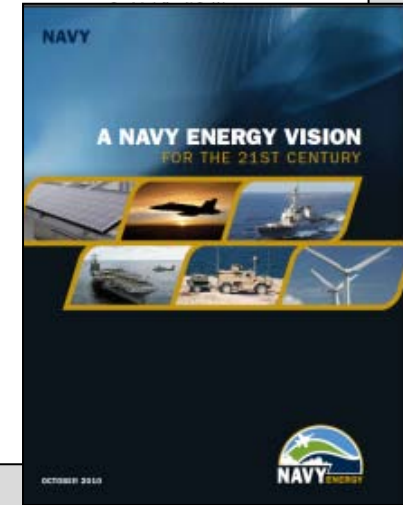
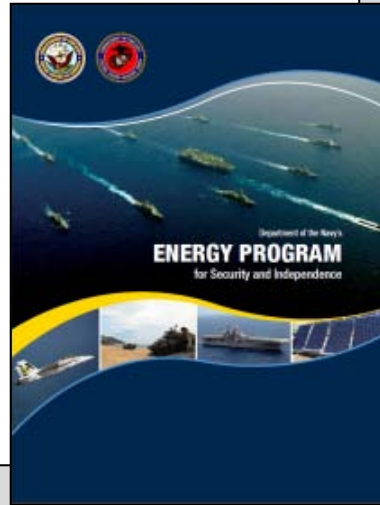
Analyze Fuel Consumption



Identify Inefficiencies



Improve Energy Efficiency



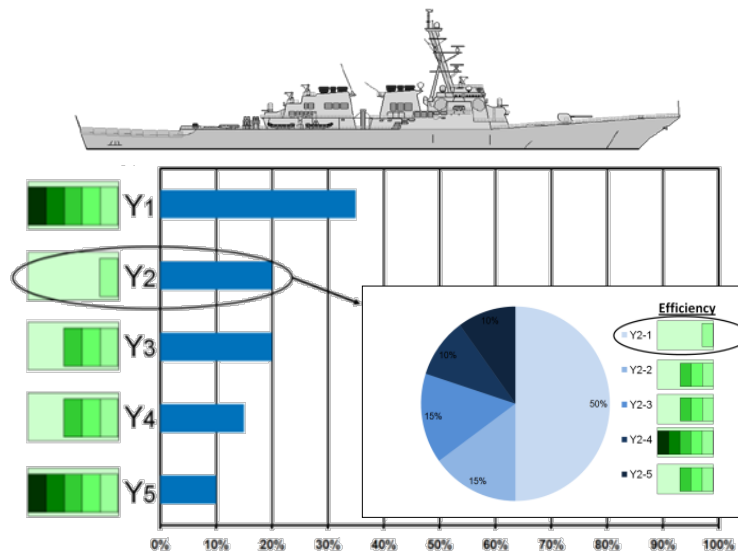
Policy & Guidance

- Sets the tone and goals for framing technology development investment decisions based on cost, technical maturity, risk, and overall fuel savings.
- Navy leadership is increasingly proactive with SECNAV, CNO, and Fleet Goals for fuel savings as Navy technical agents investigate energy efficient ship designs and equipment procurement.

Perform Analyses

Analyzing Fuel Consumption and Identifying Inefficiencies

- Developing a baseline for energy consumption on Ships is key to making meaningful investment decisions in Energy Efficiency Enabling Technologies (E3Ts).
- In the development of a baseline on Ships, inefficiencies and large power consumers will be identified providing a higher fidelity view of the current profile, allowing more informed investment decisions.



Energy Decision Framework

Energy Efficiency Enabling Technologies

Rank	Technology	TRL
1	FLEET - BVP	7
2	AMPHB - Combustion Trim Loop	8
3	AMPHB - Prop Coatings	8
4	CRUDES - Gas Turbine Online Water Wash	8
5	AMPHB - Stern Flaps	8
6	CRUDES - Hull Coatings	8
7	AMPHB - Solid State Lighting	8
8	CRUDES - Solid State Lighting	8
9	CRUDES - MED	8
10	CRUDES - Heat Energy Recovery	4

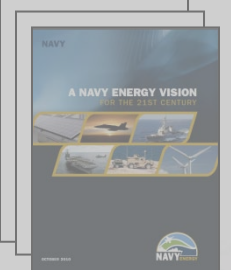
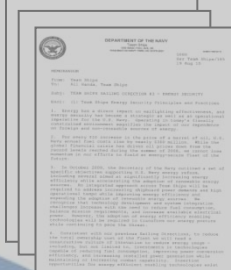
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NOTIONAL: Technology Summary

NOTIONAL: Total Cost Summary Report

NOTIONAL: Benefit Summary

Evaluate Energy Scorecards



Policy & Guidance

**ENABLED BY
MARITIME ENERGY
PORTFOLIO PROCESS**

INITIATIVE

INITIATIVE	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
4 MW SSGT / PDSB RDTB																			
Energy Storage RDTB																			
Smart Voyage Planning / Fleet Sct																			
Nuclear Studies																			
Hull Coatings																			
Propulsion Coatings																			
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Online OT Waterwash																			
Marine Gas Turbine Initiatives																			
Solid State Lighting (AmpHib)																			
Solid State Lighting (CruDes)																			
Stern Flaps (LSD)																			
Stern Flaps (SSG)																			
MED OPN																			
LM2500 Efficiency RDTB	6.0	11.0	2.0	0.0	0.0	16.6	N/A	RDTB											
LM2500 Efficiency OPN	0.0	0.0	0.0	0.0	12.0	26.8	N/A	OPN											
Energy Dashboard / Hydrodynamics	5.1	1.0	0.8	0.2	1.9	6.8	N/A	RDTB											
TOTAL	38.4	44.3	65.5	92.1	93.5	333.8													

Budget

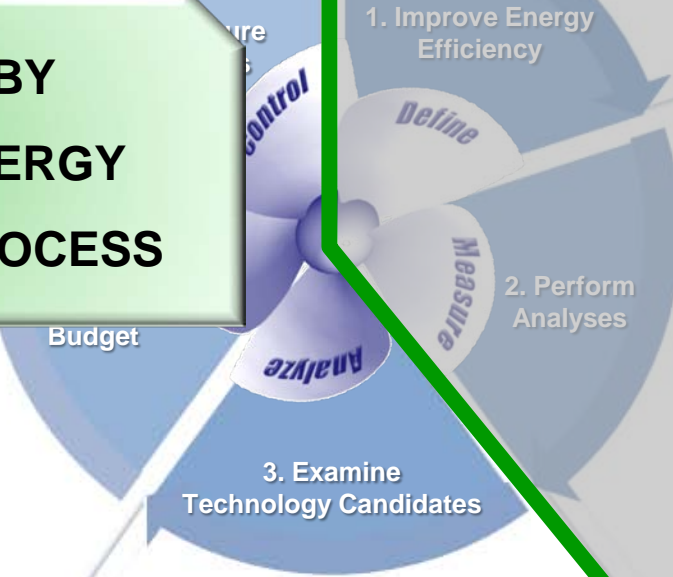


Develop Implementation Plan

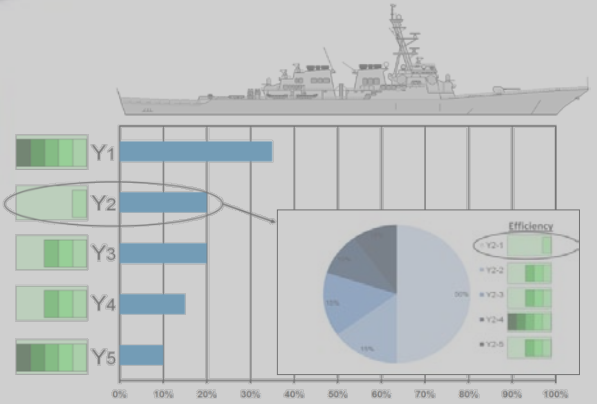
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Stern Flaps	Advanced RO Desalinator	
Variable Speed Drives	Pacific Motors	
Low Solar Absorption Coatings	Energy Storage Module	

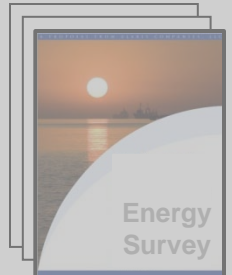
Determine Possible Solutions



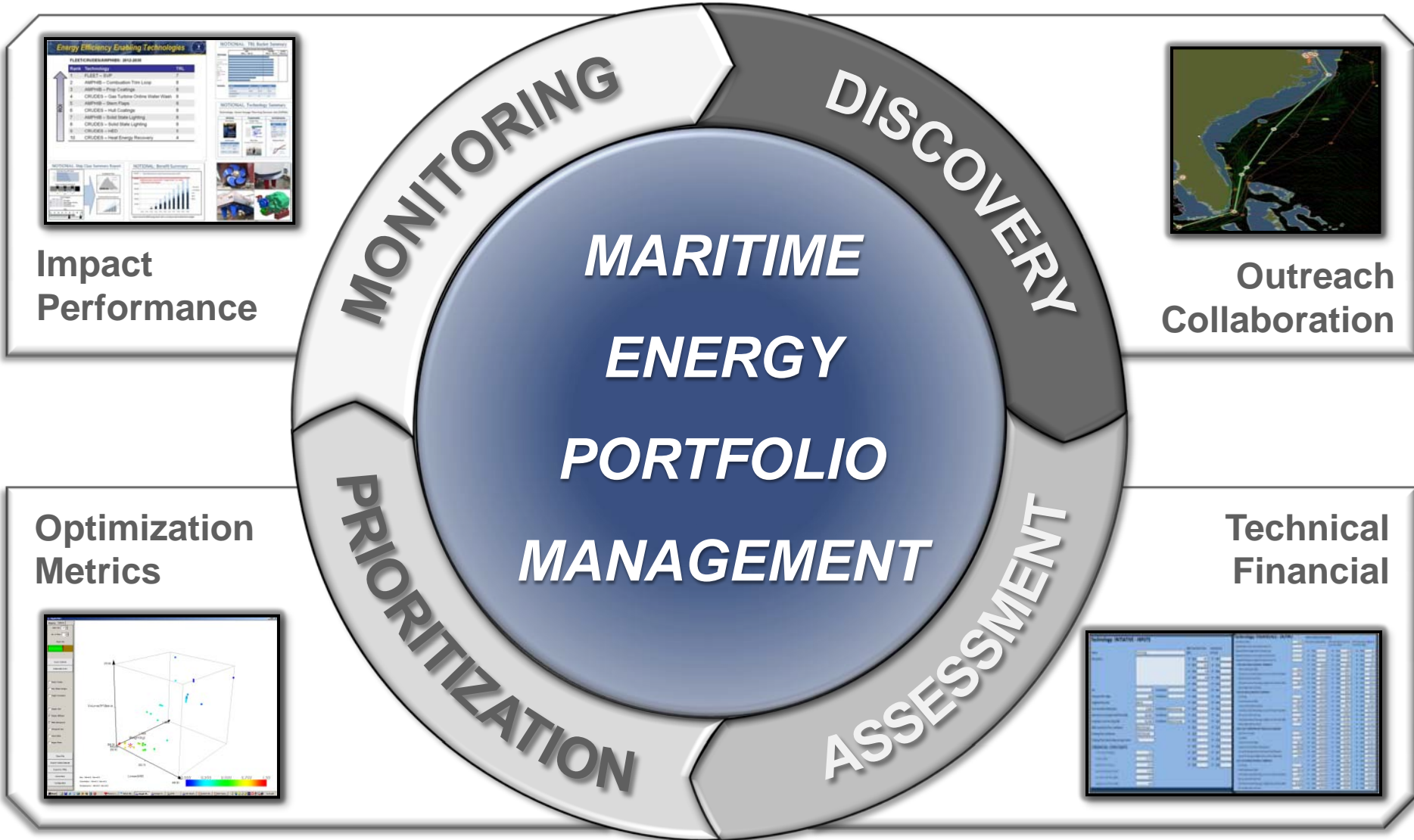
Analyze Fuel Consumption



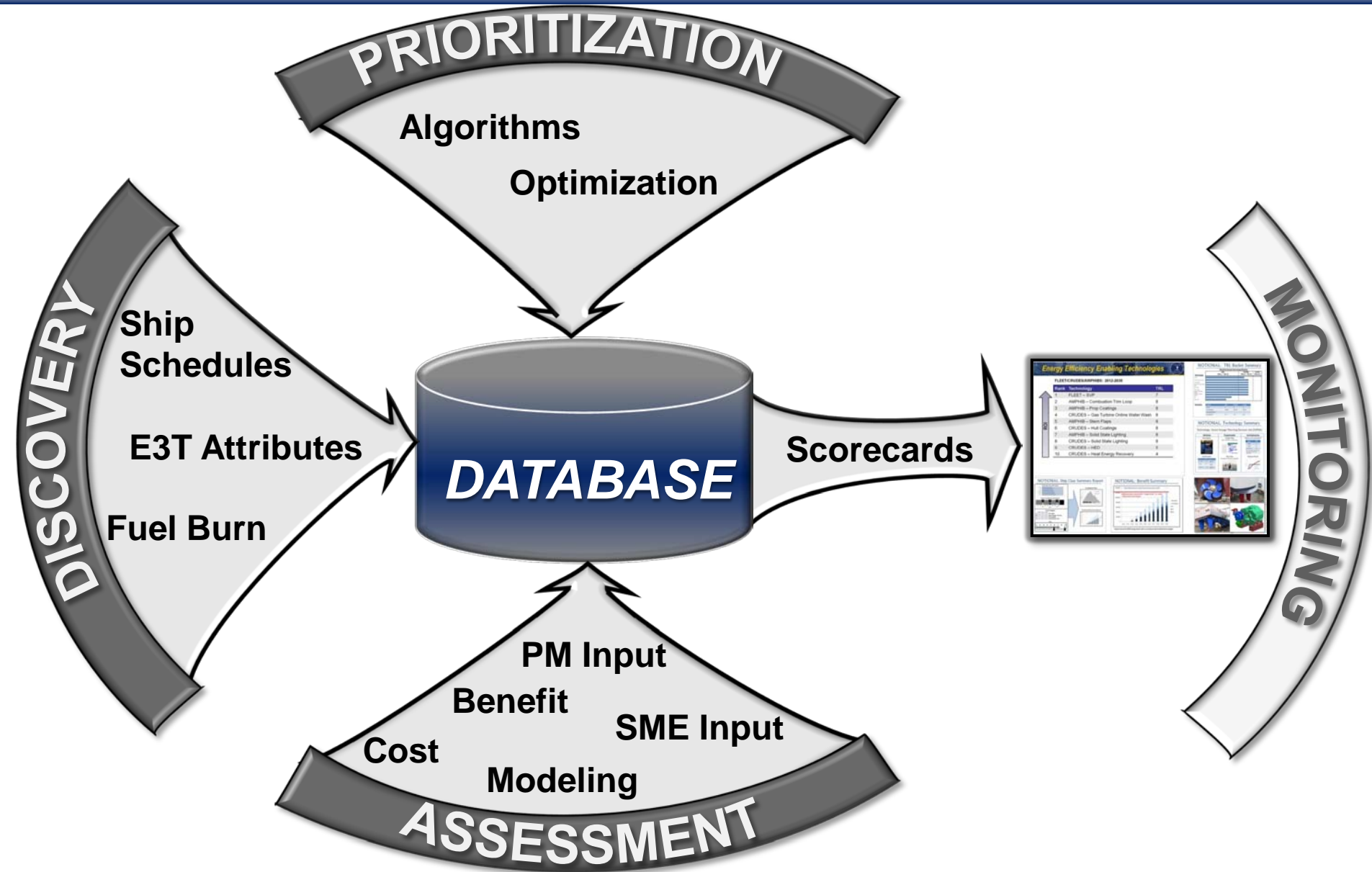
Identify Inefficiencies



Maritime Energy Portfolio Process

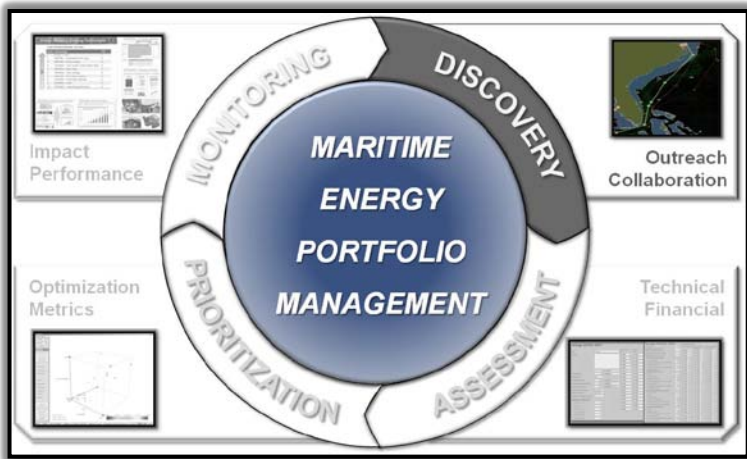


Data Flow



Case Study: Smart Voyage Planning Decision Aid

DISCOVERY



COLLABORATION

Identify technology stakeholders

- Oceanographer & Navigator of the Navy
- METOC Community
- Task Force Energy Maritime Working Group

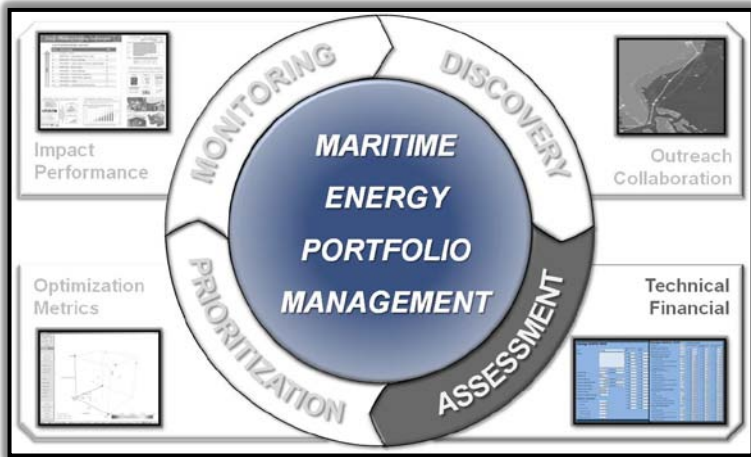
DESCRIPTION

Determine what the technology does and how it operates

- Optimizes ship routing for both maximum fuel efficiency and safety
- Fleet Weather Centers will push fuel efficient routes to all Navy ships
- Reduces energy consumption by considering:
 - Weather
 - Waves
 - Currents
 - Ship specific hydrodynamic data

Case Study: Smart Voyage Planning Decision Aid

ASSESSMENT



TECHNICAL

Perform technical modeling and simulation and receive input from Subject Matter Experts

- Military User Assessment
 - Ashore Demonstration at Fleet Weather Centers
 - At Sea Demonstration on T-AKE 7
- Successful Implementation in Commercial Shipping

FINANCIAL

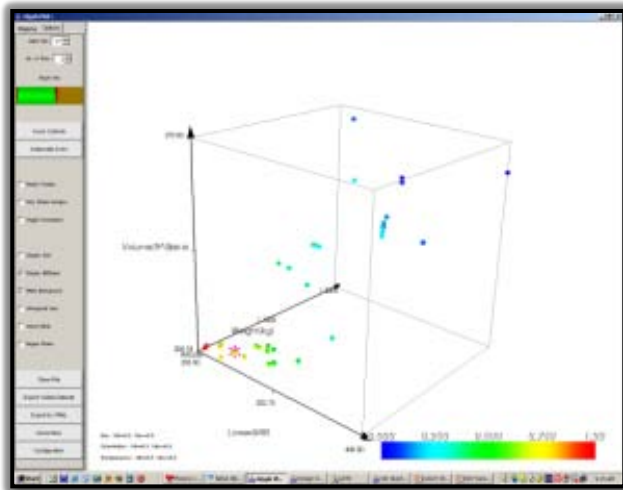
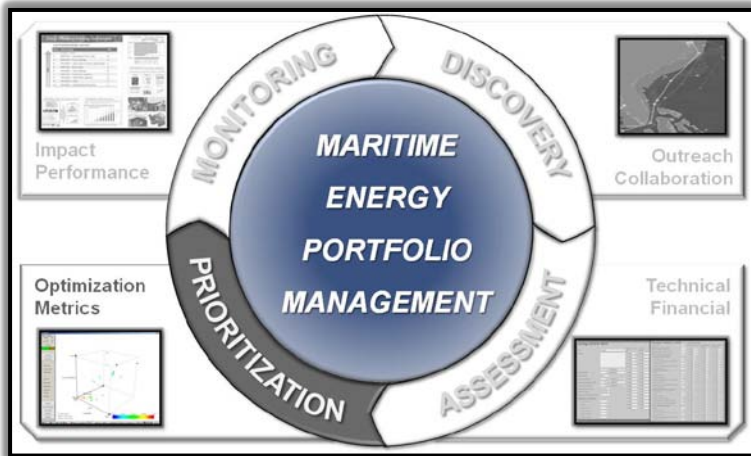
Perform Cost Benefit Analysis and receive input from Program Manager

- Anticipated 3% Fuel Savings Across Navy Ships
- Anticipated Payback Period of Less Than 1 Year

IDENTIFIED AS QUICK-WIN OPPORTUNITY

Case Study: Smart Voyage Planning Decision Aid

PRIORITIZATION



METRICS

Track KPPs to use as algorithm inputs

- Benefit: Fuel Savings
 - 3% Across All Navy Ships
 - 280,000 BBLS Annually
 - 17% of CNO Goal
- Payback Period
 - Less Than 1 Year
- Technical Maturity
 - Technology Readiness Level 6

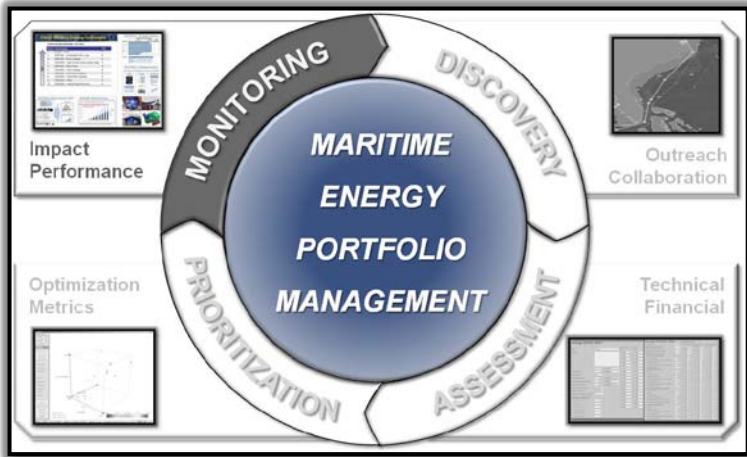
ALGORITHM

Follow algorithm to determine best solutions for achieving Navy Energy Goals

- Implementation Requirements
- Funding Availability
- Product Availability

Case Study: Smart Voyage Planning Decision Aid

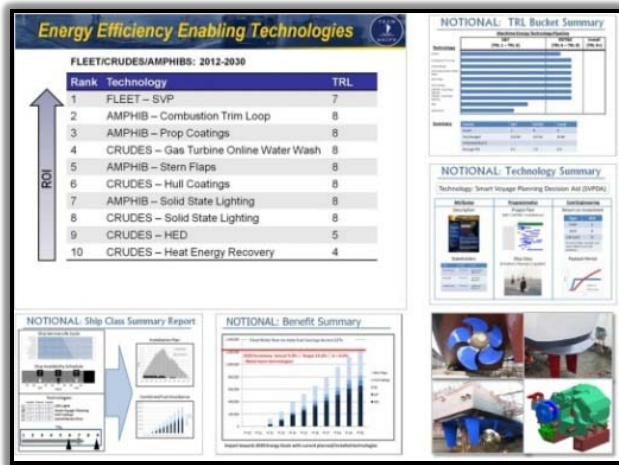
MONITORING



IMPACT – NOTIONAL

Calculate projected impact on Navy Energy Goals of reduced fuel consumption

- 280,000 BBLS Saved Annually
- 17% of CNO Goal



PERFORMANCE – NOTIONAL

Evaluate projected impact against actual impact

- 4% Fuel Savings Realized vs. 3% Projected Fuel Savings
- 375,000 vs. 280,000 BBLS Saved Annually
- 22% vs. 17% of CNO Goal

Conclusions/Next Steps

- Portfolio Infrastructure Allows for Quicker, Repeatable Responses
- Perform Disciplined Cost Analysis to Make More Informed Decisions
- Form Collaborative Relationships to Meet Our Goals of Reduced Energy Consumption and Increased Energy Efficiency



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