“Greening the OPC”

Offshore Patrol Cutter

Innovation Expo | November 2010

CG-9322

Surface Programs

U.S. Coast Guard "White Hull" Fleet

Current fleet

- Patrol Boats (WPBs)
- Medium Endurance Cutters (WMECs)
- High Endurance Cutters (WHECs)

Future fleet

- Sentinel Class - Fast Response Cutters (FRCs)
- **Offshore Patrol Cutters (OPCs)**
- National Security Cutters (NSCs)

OPC to replace the in service WMECs, currently composed of:

- 13 Famous Class, 270-foot (82.3 m), built in 1980s
- 14 Reliance Class, 210-foot (64 m), built in 1960s
- 2 single vessels: 1944 USCGC *ACUSHNET* (former U.S. Navy rescue and salvage ship) and 1968 USCGC *ALEX HALEY* (former U.S. Navy rescue and salvage ship)

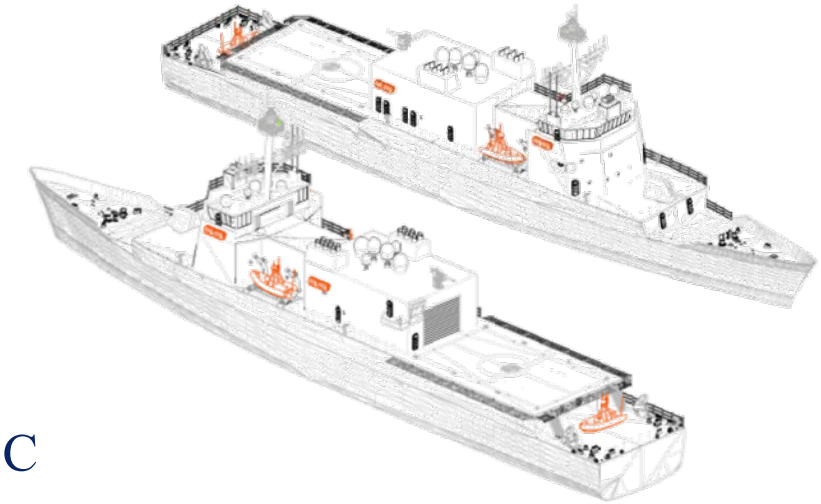
Offshore Patrol Cutter (OPC) Status

Current Status

- Request for Proposal (RFP) being developed
  - System level specification for the design and construction of OPC

OPC Industry Day

- Thursday, November 4 at 1:30 p.m.
- Tampa Convention Center Ballrooms B & C



CONCEPTUAL RENDERINGS OF OPC*

**Disclaimer: The conceptual renderings are for artistic display purposes only and do not convey any particular design, Coast Guard design preferences, or other requirements for the OPC.*

The Coast Guard Environmental Mission

- **The Coast Guard has a long history and large role in environmental support:**
  - **Prevention and Enforcement –** Promote compliance with environmental regulations through vessel boarding and inspection
  - **Response –** The lead U.S. agency for response to environmental emergencies in the marine coastal environment
- **Additionally, the USCG has responsibility to foster with our government and international maritime partners a "green" ship strategy that supports environmental stewardship during design and construction**

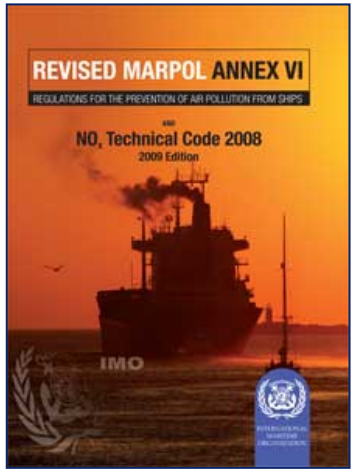
Regulatory Trends and Considerations

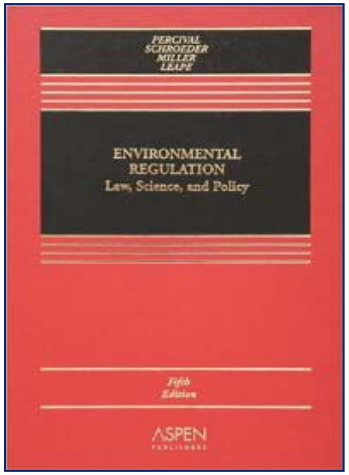
Environmental Policy Impact Assessments of both international and federal government regulations performed by the Coast Guard focused on the following areas:

- Identifying potential impacts of evolving environmental policy
- Forecasting trends for environmental regulations
- Recommending strategies for OPC to remain in compliance throughout acquisition and service life
- Developing a strategy in terms of costs, schedule, ship design considerations and ship performance

These Assessments Determined:

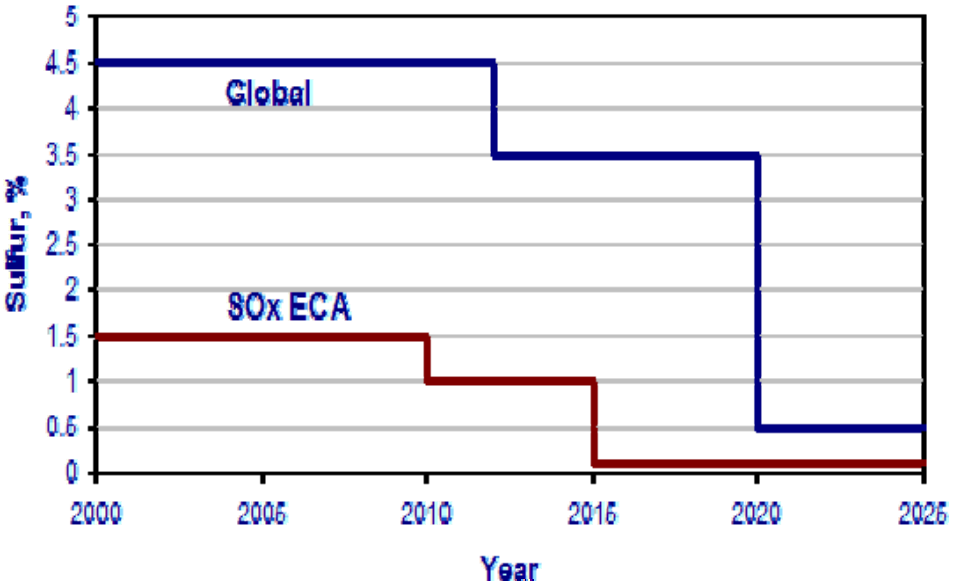
- Significant changes in environmental regulations have occurred in the past two decades that will impact the design of the new Offshore Patrol Cutter (OPC)
- Greenhouse gas emissions and water discharge are key candidates for potential future regulation
- Most current regulations address requirements for the next 20 to 30 years
- "Green" ship considerations in the design of OPC should enable the cutter class to comply with many future regulatory requirements without significant modifications to the ships at a later time





Future Trends - Increased Stringency:

Changing Sulfur Oxides (SOx) Emission Standards



Blue line: SOx emissions controlled by establishing global limits on the content of sulfur in fuel

Red line: SOx ECA – Sulfur content applicable to special SOx Emission Control Areas (ECA)

❑ Air Emissions Compliance

- Sulfur Oxides (SOx) Emission Standards / Nitrogen Oxide (NOx) Emissions Standards

❑ Water Discharges

- Oily Waste
  - MARPOL requires enhanced oil-content monitors, effluent sampling and performance testing of oil-water systems
- Fuel Oil
  - MARPOL Regulations stipulates that each bunker tank fitted in the ship and having a capacity greater than 30 m3 is to be protectively located
- Sewage/Gray Water
  - Uniform National Discharge Standards require discharge control
- Ballast
  - EPA has established guidance for non-military vessels; future regulation anticipated

Analyzing Green Technologies

The Coast Guard conducted a technology study to identify potential "green" technologies for incorporation into our OPC design. This study:

- Grouped equipment into methods /categories
- Filtered out equipment that did not have sufficient data
- Filtered out multiple models for particular pieces of equipment (compared to notional OPC rated capacities)
- Compared data captured to notional OPC characteristics
- Evaluated equipment per criteria
- Applied weighting factors to each criteria score

Identified Design Areas of Opportunity

- **Trade Studies and White Papers developed the following areas of interest for OPC:**
  - Hull design - *Requires early/upfront considerations*
    - Fuel Use and Fuel Storage (carbon footprint)
    - Noise (along with prop)
  - Outfitting – *Modification possible throughout lifecycle*
    - Marine Sanitation System
    - Solid Waste Treatment
    - Marine Diesel Engines
    - Oily Water Separators
  - Consumables – *Provides greatest number of opportunities*
    - Lighting
    - Batteries
    - Hull Coatings
    - Fluids and Lubricants

Technological Analysis Factors

Evaluation Criteria	Weighting	Rationale
Potential Environmental Impact	**40%**	Primary decision driver
Cost	**20%**	Systems that are not technologically matured do not have sufficient data available on cost. The current cost estimate is based on initial procurement costs. Due to limited data reliability and lack of life cycle cost data, cost is weighted lower.
Ship Impact	**20%**	Due to the early stage in ship design, it is still possible to affect design and minimize the ship operational impacts.
Technology Readiness (TRL)	**10%**	Technologies must be able to reach maturity (TRL 9) within the three years of OPC acquisition schedule. While crucial for the OPC acquisition, this criterion has a lower priority.
Vendor Capacity (MRL)	**10%**	Original Equipment Manufacturers (OEMs) must prove their manufacturing readiness (TRL 9) to produce the technology, in the quantity and quality needed by the OPC.

Key Recommended Environmental Requirements

Functional Areas	Areas of Study
Fuel Oil Tanks	Compliance with MARPOL 12A
Diesel Engines	EPA Tier 3 Marine Diesel Engines – Plant configuration for different Operational Mission Needs
Hull Coatings	The most recently developed foul-release anti-fouling coating (IMO guidance available)
Lighting	Efficient Fixtures & Motion Detectors
Ballasting System	Dedicated ballast tanks with a Ballast Water Management System
Oil Pollution Control System	Oil-Water Separator (OWS) achieving IMO MEPC.107(49) and 46 CFR 162.050 requirements.
Solid Waste Pollution Control	Shipboard incinerators for managing various solid waste

Potential OPC Design Considerations

Ballast Management

- The Coast Guard's older cutters can add seawater to empty fuel tanks to improve ship stability. The practice is called "dirty ballast" and requires processing to meet regulations for discharge of ballast and oily waste.
- Possibilities
  - Segregated ballast
  - Install oil water separators (OWS) sized to process ballasting flow rate
  - Design separate tanks for ballasting - "clean ballast"
  - Install ballast water treatment system to protect against non-indigenous species introduction
  - Use shoreside treatment systems for treatment and disposal

Potential OPC Design Considerations

Sewage – Graywater Options

- Commingled holding of sewage and graywater within 12 nm from shore
- Segregated holding of sewage and graywater within 12 nm from shore
- Advanced wastewater treatment of commingled sewage and graywater

Advanced Wastewater Treatment

- Use of "Alaska Cruise Ship standard" certified wastewater treatment equipment in OPC design is good avenue for ensuring compliance
  - Requires treatment of sewage and graywater prior to discharge
  - Prohibits untreated and limits treated wastewater discharges
    - Treated discharge must occur while underway at speeds of 6+ knots
    - Treated discharge must occur greater than one nm from shore

Developing our "Green" OPC Strategy

"Green" OPC Strategy Should Include:

- **Compliance with all applicable regulations, with documentation**
  - Current and anticipated
- **Energy efficient operation**
  - Contributes to reduced lifecycle costs
- **A ship that can be recycled at the end of its lifecycle**
  - Promotes effective reuse of shipbuilding material where practical
- **Proper crew training**
  - Develop institutional expertise in "green" ship practices
- **An entity to monitor ship performance**
  - Ensure "green" technologies and practices are used to maximum advantage

Key Considerations

- Identify return-on-investment and lifecycle costs when considering “green” technologies
- Value efficiency when considering shipboard systems
- Correlate “green” technology performance to mission requirements
- Develop material handling plan

Moving Forward

- How do we balance effectiveness, affordability and practicality in “green” OPC design?
- How do we maximize use of available and future “green” technologies against OPC requirements?
- How do we encourage “green” ship innovation during OPC design?