The Ship as a City: Introduction

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The Ship as a City

Like cities, bringing a ship to realization takes collaboration between investors, designers, project managers, skilled engineers, ship operators, and technicians from many fields within the entire STEM spectrum. But looking a bit deeper reveals another strong similarity between the two: industry standards, rules, and regulations are tightly intertwined within the entire process of production and operation, from the very entry of a new concept into the design spiral to its delivery and operational lifecycle. A typical maritime construction program must meet requirements from various agencies and standards organizations, such as the USCG, CDC, FDA, FCC, US Department of Labor, ABS, IMO, and others.

Program Objectives

Students will be introduced to how standards inform the

- Design
- Construction
- Operation
- Disposal and Recycling

of commercial and government marine vehicles.

Program Outline

STANDARDS AND THE MARITIME INDUSTRY: WHAT STANDARDS ARE USED IN MARINE VEHICLE DESIGN, CONSTRUCTION, AND OPERATIONS, AND WHY AND HOW ARE STANDARDS DEVELOPED IN THE MARITIME INDUSTRY.

THE U.S. COMMERCIAL MARITIME INDUSTRY: COMMERCIAL MARINE VEHICLE SPECIFICATIONS, NATIONAL AND INTERNATIONAL MARITIME REGULATIONS, AND THE PROCESS OF CLASSIFICATION AND COMPLIANCE VERIFICATION.

THE U.S. GOVERNMENT SHIPBUILDING INDUSTRY: GOVERNMENT COMBATANT AND NON-COMBATANT SHIP AND SMALL CRAFT SPECIFICATIONS AND STANDARDS, NATIONAL AND INTERNATIONAL REQUIREMENTS, AND CLASSIFICATION VARIATIONS FOR GOVERNMENT ASSETS.

APPLYING A STANDARDIZATION PROCESS TO INNOVATION: APPLYING STANDARDS TO INNOVATION AND NEW TECHNOLOGY.

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The Ship Design Triangle

Ship Design Process – First Steps

Identify the Need or Mission

Develop a deep understanding of what the ship is to do.

What need is the design intended to satisfy?

Identify the Constraints

As the mission of the design is being developed, any number of design constraints may be identified.

Examples of constraints might include physical limitations such as maximum allowable draft or beam.

Develop the Economic Model

The design must serve the mission and do so in a manner that meets the requirements of the overall economic model.

Factors to consider include costs – capital, operational – reliability, etc.

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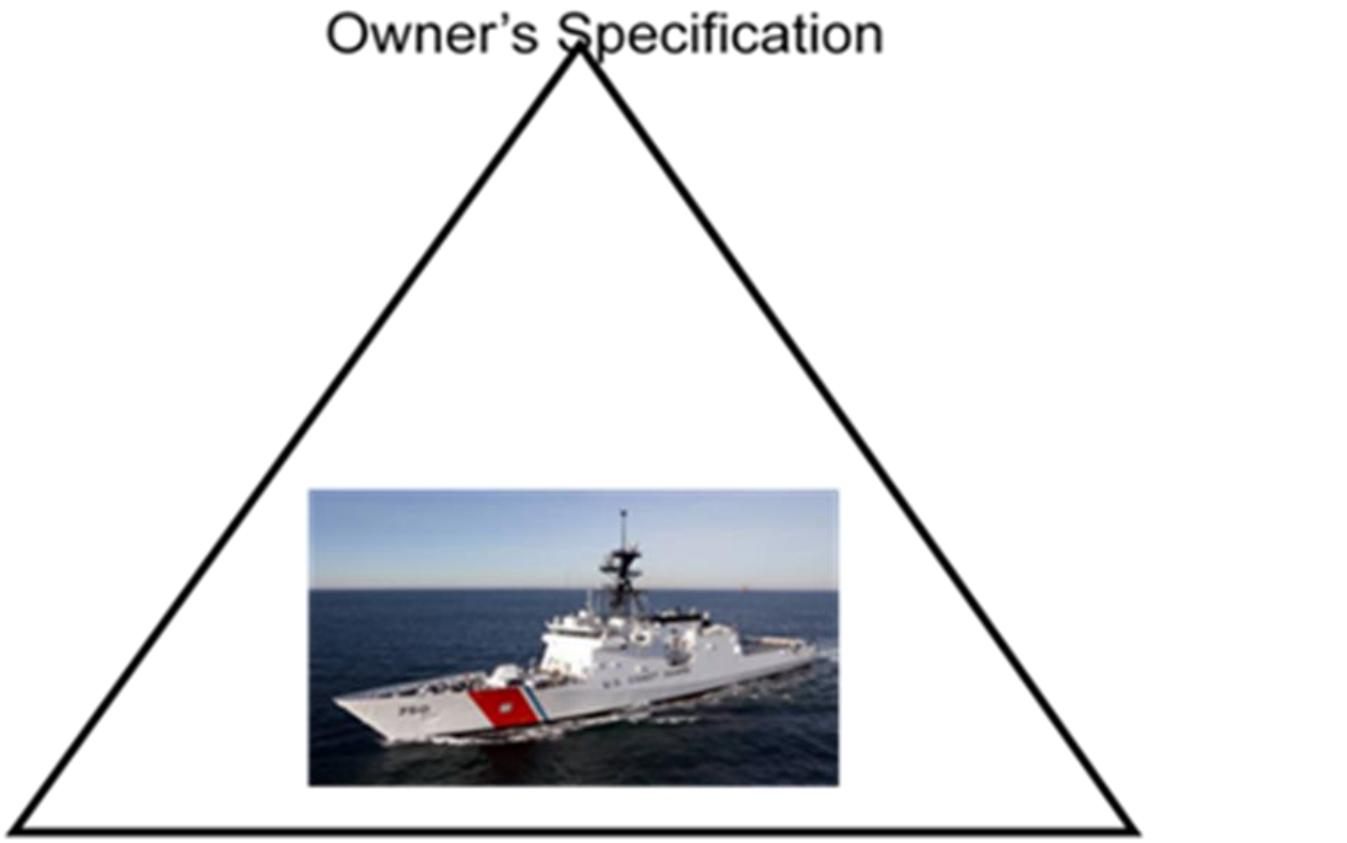
The Ship Design Triangle



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Sources of Requirements on Marine Platform Design, Construction, and Operation

- Owner
- Classification Societies
- Regulatory Bodies
  - International
  - Flag State
  - Port State
- Industry Groups – e.g., Oil Companies International Marine Forum (OCIMF)
- Charterers
- Financial Institutions – Banks, Investors, Insurance Providers

Owner's Specifications

The owner's requirements for the ship design are detailed in the Owner's Specification. The owner's specified capabilities are required to meet the ship's mission, such as operational speed and cargo capacity. In addition, the specifications may specify the owner's preferred machinery and outfitting. More recently, owners have added environmental performance metrics in design requirements.

US Flag, ABS Classed Tanker Example – Owner's Specification

Specification	Example
Flag State	United States of America
Classification Society	American Bureau of Shipping (ABS)
Cargo Type and Capacity	Crude Oil, 170,00 Cubic Meters
Service Speed and Endurance	14.5 knots, 7500 nm
Principal Characteristics	Length Overall (LOA), Maximum Beam, Maximum Draft
Port and Terminal Requirements and Constraints	Worldwide service, Suez Canal, LOOP, Maximum Air Draft
Charterer requirements	Manifold arrangement in accordance with OCIMF guidance, alternative fuel ready, CO_2 emissions reduction systems
Required Equipment and Systems	Twin engine rooms, SOx Scrubbers

Statutory Compliance

Ships designed for domestic and international operations are required to meet statutory regulations that are intended to address safety and risk. These regulations set a baseline for certain design features that must be included in the design. When a ship owner registers a ship with a flag state, minimum requirements are established for features and capabilities primarily related to safety, life-saving, and pollution prevention. International conventions serve to create uniform minimum statutory requirements for ships involved in international trade. The flag state or its designee verifies that the vessel meets regulations at the design, construction, and operation stages.

US Flag, ABS Classed Tanker Example – US Code of Federal Regulations

Title 46, Shipping - Parts 1-199
Tank Vessels (30-40) – Structures, Systems, Equipment
Load Lines (41-17)
• Marine Engineering (50-64)
Documentation and Measurement of Vessels (66-69)
Electrical Engineering (110-113)
Equipment, Construction, and Materials: Specification and Approval (156-165)
Subdivision and Stability (170-174)
Lifesaving Appliances and Arrangements (199)

US Flag, ABS Classed Tanker Example – US Code of Federal Regulations

Title 33, Navigation and Navigable Waters - Parts 151-159 and 164
Pollution Prevention (151-159)
Navigation Safety (164)

Note that as the United States of America is a member state of the International Maritime Organization (IMO), ocean-going ships trading internationally that meet US Flag regulations also satisfy all IMO's international regulations.

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Classification

Classification Societies are non-governmental organizations that serve the marine industry by promoting safety, protection of the environment, and protection of property. This promotion is achieved through developing, verifying, and maintaining rules for the design, construction, and maintenance of ships and other marine-related assets. Ship owners select the classification society that they wish to work with. Once selected, the classification society is involved throughout the vessel's design, construction, and operational life. By selecting a classification society, the shipowner agrees to the society's rules and verification systems.

US Flag, ABS Classed Tanker Example – ABS Class Rules

ABS Rules for Building and Classing Marine Vessels
Part 1 – Conditions of Classification
Part 2 – Materials and Welding
Part 3 – Hull Construction and Equipment
Part 4 – Vessel Systems and Machinery
Part 5A – Common Structural Rules for Bulk Carriers and Oil Tankers
Part 5C, Chapter 1 – Vessels Intended to Carry Oil in Bulk (150 meters (492 feet) or more in Length)
Part 5C, Chapter 13 – Vessels Using Gasses or other Low-Flashpoint Fuels
Part 6, Chapter 3 – Specialized Items and Systems, Exhaust Emission Abatement

Review Questions - Introduction

Identify if each design requirement for an ocean-going containership is best described as specifications, regulations, or classification requirements.

1. The details of the structural arrangement of hatch opening corners are to be analyzed to verify that the stresses and deflections are within acceptable limits.
2. Individual fuel tanks must not have a capacity greater than 2,500 cubic meters.
3. The ship is to have fully enclosed bridge wings.
4. The ship's capacity is to be 10,000 TEU.
5. The ship's emergency generator, its associated transforming equipment, and the emergency switchboard must be located aft of the collision bulkhead, outside of the machinery casing, and above the uppermost continuous deck.

References

- Ship Design and Construction, Volume 1, SNAME 2003
- https://www.ecfr.gov/
- https://ww2.eagle.org/en/rules-and-resources/rules-and-guides.html#/content/dam/eagle/rules-and-guides/current/other/1-rules-building-classing-marine-vessels-2023

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Contacts

Matthew R. Werner

- Dean and American Bureau of Shipping Chair of Naval Architecture and Marine Engineering, Webb Institute
- mwerner@webb.edu

Richard Delpizzo

- Director, Global Government Services, ABS
- rdelpizzo@eagle.org

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