Standards in the Maritime Industry

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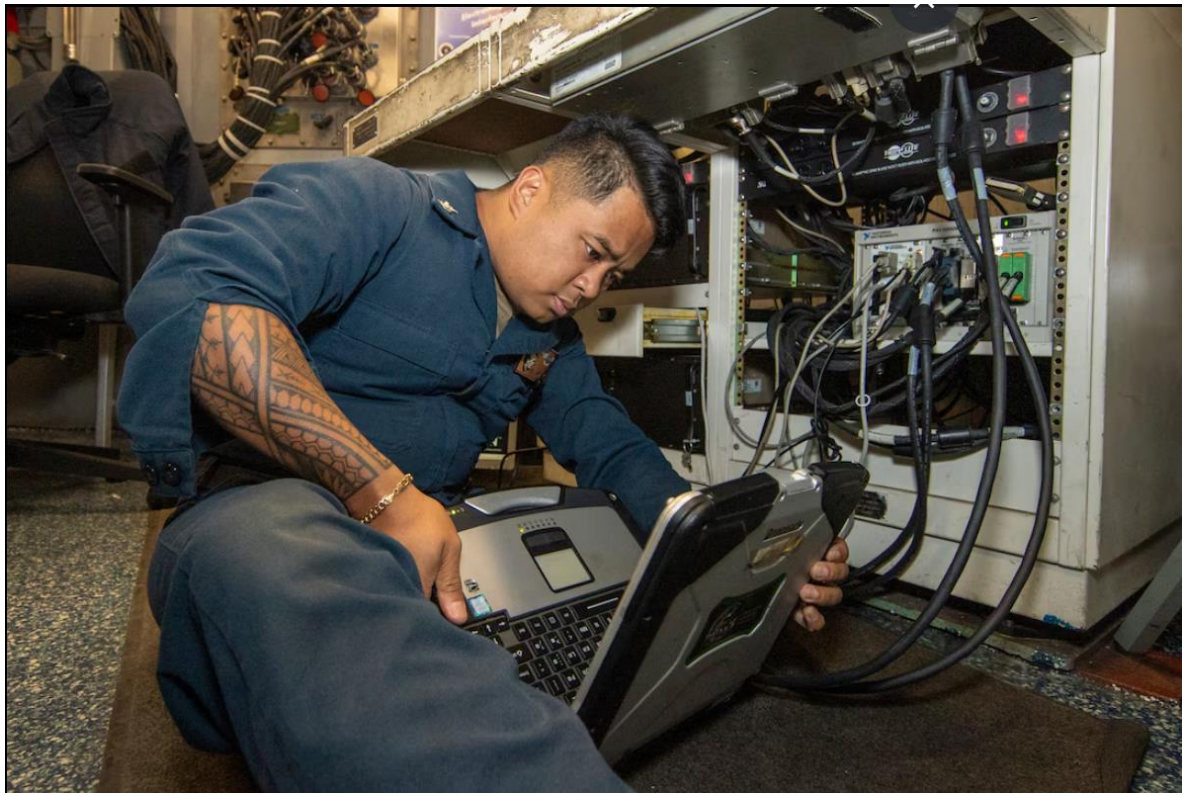
What are Standards?

NIST

- Standards are documented agreements
- These contain technical specifications or other precise criteria to be used consistently as:
  - Requirements
  - Guidelines
  - Definitions of characteristics
- These ensure that materials, products, processes and services are fit for their purpose

ABS

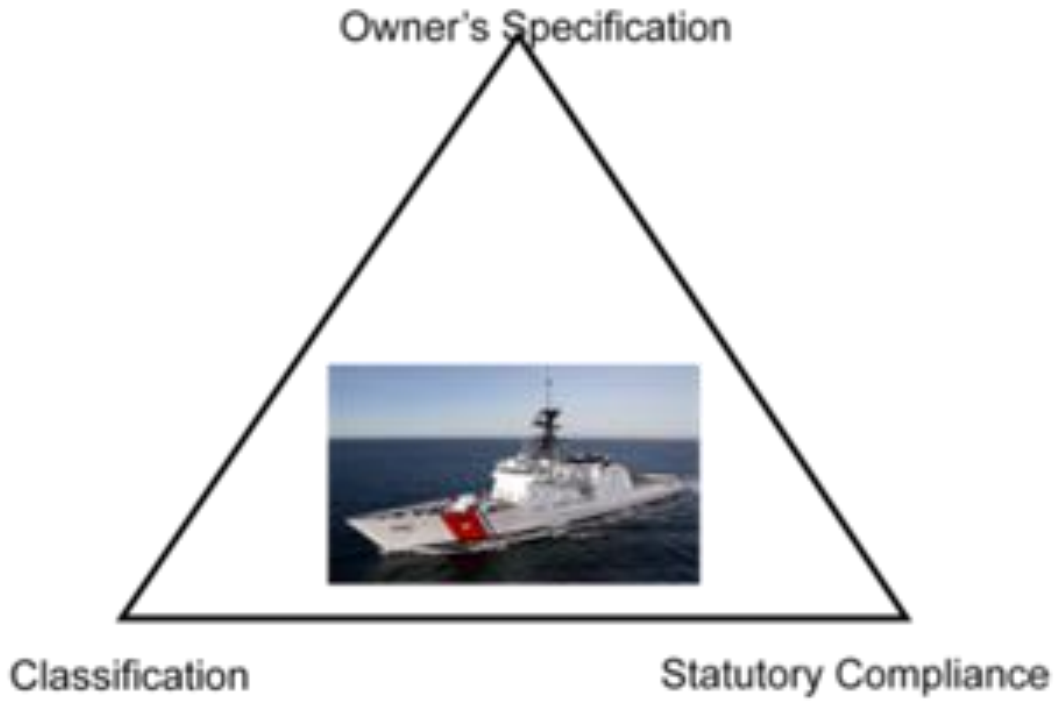
What are Standards?



Credit: Morrison; Navy

- Technical standards may include:
  - Definition of terms
  - Classification of components
  - Delineation of procedures
  - Specification of design
  - Testing methods
- There are dozens of organizations that have developed standards for different aspects
- When developing, organizations have the option to follow the standards of their choice, or dictated by insurance
- Some organizations require certification for compliance

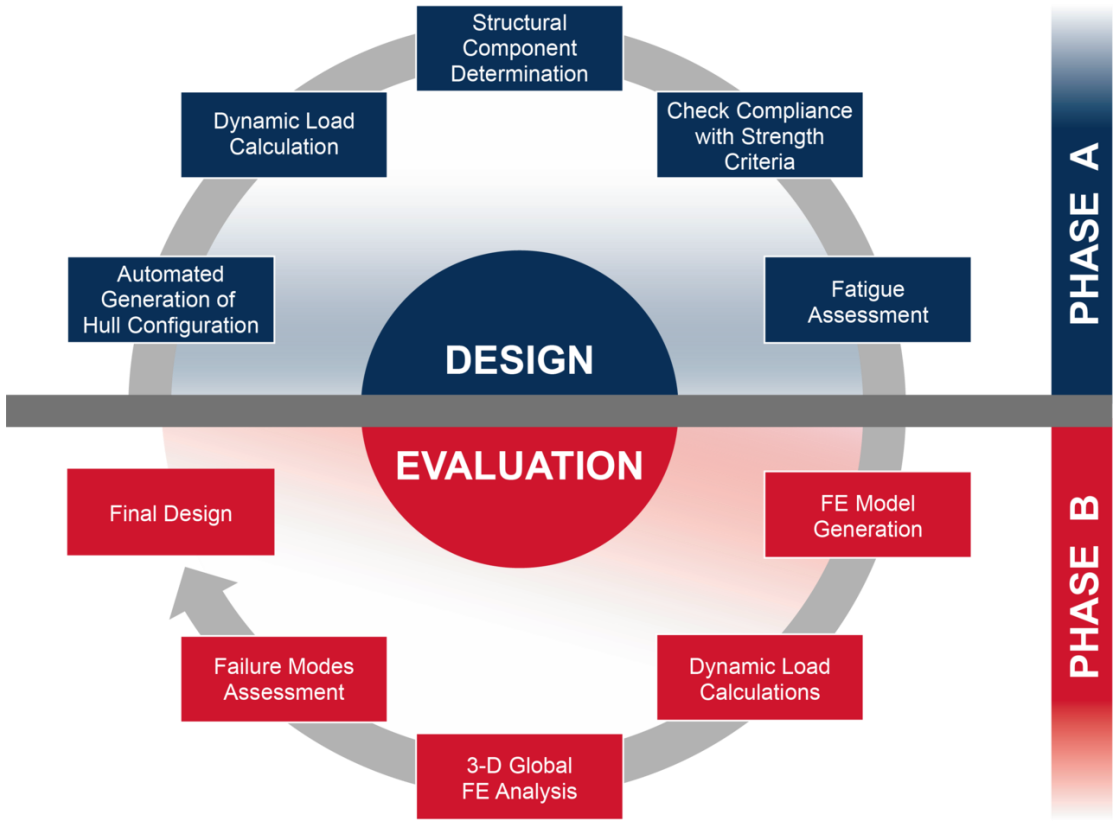
The Ship Design Triangle



The Marine Vehicle Design Triangle

- Standards used in ship design and construction can be divided into 3 categories
- Owner's Specification - Pre-established standards that the primary stakeholder develops for all their standards
- Classification – 3rd party organization that sets rules and requirements for stakeholders to abide by
- Statutory Compliance – Legal requirements set forth by the Flag administration for the stakeholder to conform to
- This is often referred to as:
  - Ship Design Triangle
  - Marine Vehicle Design Triangle

Owner's Specification



- These standards are used during design and construction
- This ensures that processes and products meet the owner's vision and quality expectations
- The application of these standards is optional
- Designers can decide which standards they use and how they implement them
- Some of these standards are specific to the maritime industry
- Many are part of broader manufacturing standards

What is Classification?

- Development and application of technical standards
- Addresses the lifecycle of a ship or offshore asset
- Stakeholder in the network of maritime safety

Classification is NOT:

- A rating of comparative quality
- Concerned with crewing or vessel operations
- An assessment of economic viability
- A judge of employment for intended service

What is Classification?

- Classification societies establish and apply technical standards in relation to the design, construction and survey of marine related facilities including ships and offshore structures

- Independent arbiters of standards
- Standards known as Rules for vessels and offshore structures:
  - Design
  - Construction
  - Operational maintenance

Credit: Gary Blakeley © 123rf

Class and Government

- Classification societies date back to the 19th century
- They collaborate as the International Association of Classification Societies
- The role of classification has been recognized in SOLAS and the International Convention on Load Lines
- Classification societies also act as Recognized Organizations (ROs) performing statutory inspections on behalf of flag States
- This statutory activity is distinct from, but complementary to class requirements

Credit: © IMO

Statutory Compliance

- Statutory Compliance encompasses a broad range of national and international regulations
- Some of these include the U.S. Coast Guard and the International Maritime Organization or IMO
- Compliance with applicable regulations is not optional; vessels must conform to them
- Vessels that are found not to comply may risk losing insurance
- They may also be denied port entry
- Classification Societies act on behalf of Flag administrations to verify statutory compliance

Credit: Library of Congress

Why are Standards Developed in the Shipbuilding Industry?

Why are Standards Developed in the Maritime Industry?

Credit: lifeofpix - bernicestockstill

- Ships "approved" by classification societies are referred to as "classed", while the approval itself is referred to as "class".
- The Classification process consists of 3 main elements:
  - Engineering review of ship design
  - Survey during construction
  - Periodical surveys after construction (for maintenance of class)
  - Ship classification is optional, but it is generally required for insurance. Over 90% of global deepwater shipping is classed by one of the 12 leading classification societies

Importance

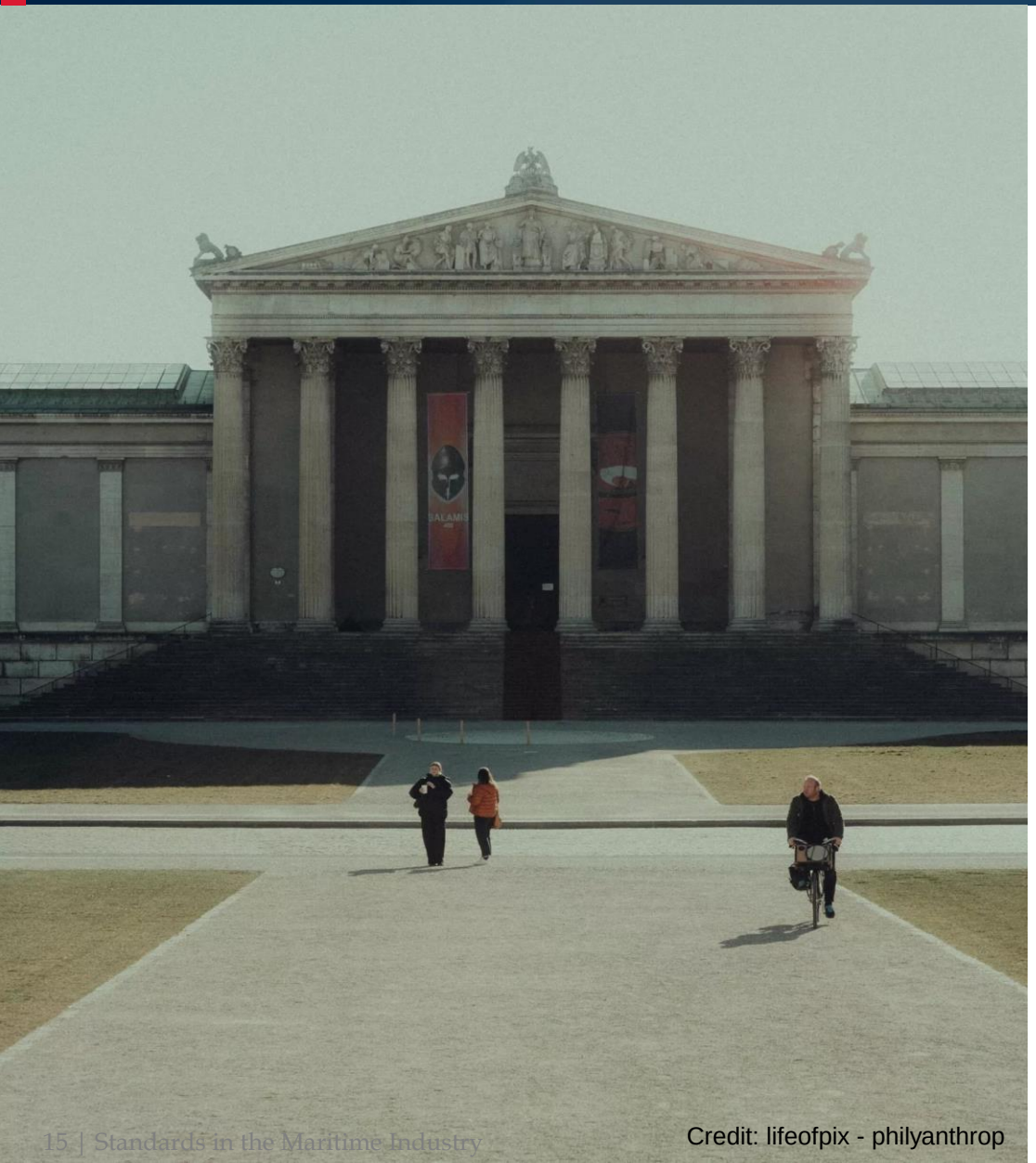
- Importance of Standards
  - Standardization to ensure safety, reliability, and quality
  - Facilitate global trade and compliance with international regulations
- Benefits to Stakeholders
  - Protection for investors, insurers, and operators
  - Confidence for governments and regulatory bodies in maritime safety and environmental protection

"Evolution of Shipbuilding" ABS Wall Mural. Painted by Alton S. Tobey in 1973. 5th panel commissioned and painted by Robert Lloyd for the ABS 150th Anniversary in 2012. © ABS

Benefits

- **Industry Alignment:** Helps manufacturers, operators, and other stakeholders align on best practices, promoting fairness in competition.
- **Innovation Encouragement:** Establishes a framework for introducing new technologies safely into the maritime industry.
- **Insurance and Liability**: Reduces risks, thus impacting insurance premiums and claims related to maritime operations.
- **Cost Reduction:** According to a report by the World Trade Organization (WTO), standardization can reduce production costs by allowing economies of scale and reducing the variety of spare parts required, which is especially relevant in the maritime industry where large quantities of materials and components are used.

Liability



Credit: lifeofpix - philyanthrop

- Proper adherence to established standards helps shipping companies reduce liability risks
- Often this can result in lower insurance premiums and favorable terms
- Standards provide a framework that helps define negligence in maritime operations
- This streamlines legal processes in case of accidents or disputes.
- For the marine industry, this is where Classification Societies come in
- Organizations need to have their systems classed to enter most Flag states

Impact of Standards on Maritime Economics

- **Cost-Benefit Analysis**: Increased safety standards may raise construction costs by up to 10%, but reduce insurance premiums by 15-20%
    - Historical data: Implementation of double-hull tankers reduced oil spill incidents by 60% since the 1990s.

- **Global Trade Facilitation**: Compliance with international standards reduces vessel detention in foreign ports by 30%, enhancing trade efficiency (Source: IMO performance reports).
    - Standardization allows for interoperable parts, lowering maintenance downtime by 25%.

Credit: Unsplash – Ibrahim Rifath

How are Standards Developed in the Shipbuilding Industry?

Stakeholder Collaboration

- **Role of International Bodies:** Organizations like the IMO and IACS coordinate with national governments, industry groups, and NGOs to draft standards
  - The American Bureau of Shipping (ABS) provides insights into the role of technical committees made up of experts from various maritime sectors in drafting and revising standards
- **Industry Input:** Shipbuilders, shipping companies, and maritime technology providers contribute to the standards development process to ensure practical applicability

Credit: IMO

Credit: Unsplash – Werner Hilversum

Development Process

Credit: Unsplash – Scott Graham

Credit: Unsplash – Daniel McCullough

Credit: © ABS

- **Research and Development (R&D):** Based on the latest technological advancements and incident reports.
- **Consultation and Drafting:** Drafts are circulated among stakeholders for feedback.
- **Testing and Validation:** Prototypes and processes are tested to ensure standards are effective and achievable.
- **Implementation and Review:** Once adopted, standards are periodically reviewed and updated to reflect new knowledge and technologies.

Impact Assessments

Credit: Unsplash – Shane Rounce

- Consensus building is the process of developing standards that often involves significant international collaboration.
- This being among governments, industry leaders, technical experts, and international organizations.
- Before new standards are implemented, they undergo rigorous impact assessments.
- This evaluates their effects on various aspects of shipbuilding and operations.
  - Safety implications
  - Environmental impacts
  - Economic considerations

Role of International Organizations and Agreements

- The IMO continuously updates over 50 international legal instruments that govern global shipping
- Key focus areas include:
  - Safety
  - Environmental Protection
  - Facilitation of Maritime Traffic
- There are different types of agreements that can be made such as bilateral and multilateral agreements
  - Some examples include The Paris MOU and Tokyo MOU on port state control effectively enforce standards in European and Asia-Pacific waters, respectively
- Regional agreements like the Caribbean Memorandum of Understanding on Port State Control enhance standard enforcement in specific areas.

Credit: Paris MoU

Compliance and Enforcement

- **Monitoring and Enforcement Mechanisms:**
  - Over 9,500 inspections are carried out annually under the Paris MOU, aiming to ensure compliance with maritime standards (Source: Paris MOU Annual Report).
  - Use of electronic certificates and centralized data systems like Equasis to track ship compliance globally.

- **Challenges in Enforcement**:
  - Differences in enforcement capacity among flag states can lead to "flags of convenience" issues, where ships register under nations with less stringent enforcement.
  - Piracy and armed robbery at sea pose challenges for enforcement of maritime security standards.


Credit: Gary Blakely © 123rf.com

What Type of Standards Exist in the Shipbuilding Industry?

Technical Standards

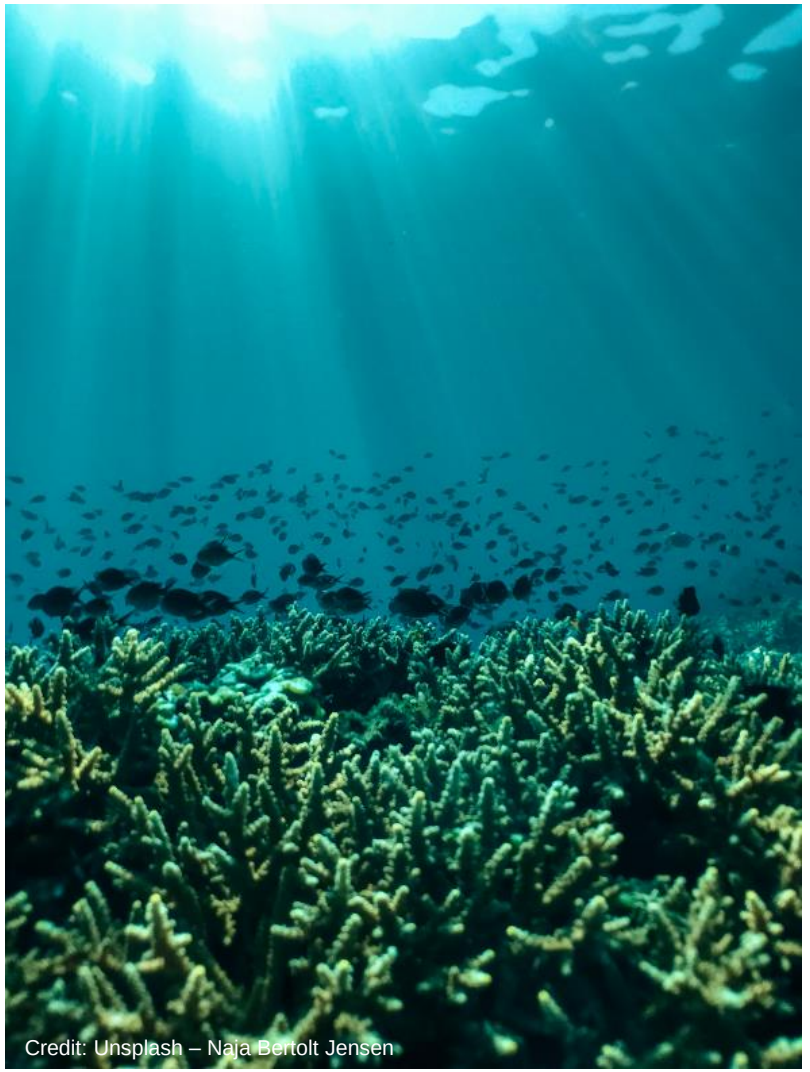
- Structural Integrity: Specifications for hull design, materials, and construction techniques.
- The DNV GL rules for classification outline various standards including structural integrity, machinery and systems, as well as navigational safety.
- These demonstrate the comprehensive range of operational and technical standards applied in shipbuilding.
- Machinery and Systems: Standards for engine performance, electrical systems, and auxiliary machinery.

Operational Standards

- Navigational Safety: Protocols for electronic navigation systems, communication equipment, and operational procedures.
- Emergency Procedures: Standards for evacuation, firefighting, and rescue operations.
- Health Protection Procedures: Standards for the biological safety of all stakeholders involved in the processes required during operation
- Equipment Procedures: Standards for the safe and effective operation of equipment such as:
  - Mechanical
  - Electrical
  - Chemical

Environmental Standards

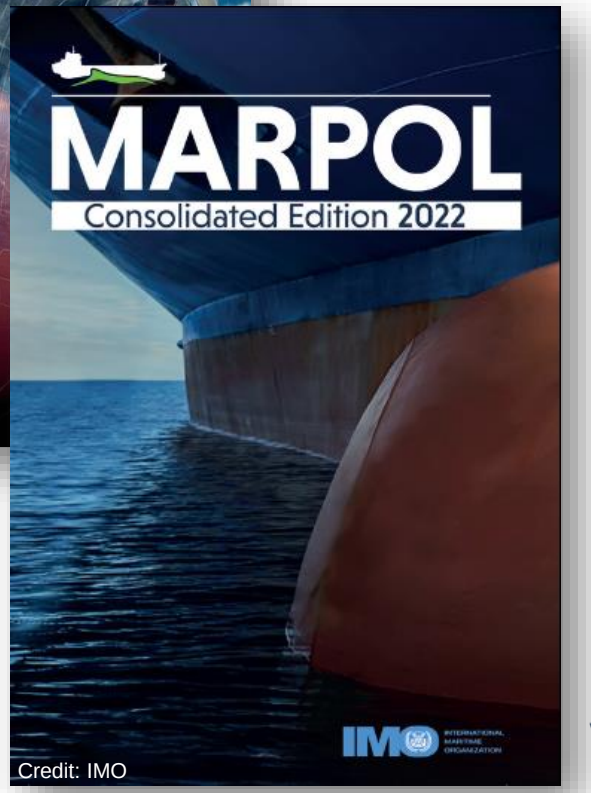
- Emissions and Discharges: Limits on air and water pollutants; rules for handling ballast water and waste
  - The International Council on Clean Transportation (ICCT) provides data on the effectiveness of MARPOL Annex VI, which sets limits on NOx and SOx emissions from ships, showcasing the critical environmental standards in maritime operations
- Environment Protection: Limits navigation and processes in areas where marine life may be affected
- Disposal Regulations: Limits where waste from processes can be done and how it must be done
  - Captured carbon
  - Brine from desalinated water
  - Waste oil


Credit: Unsplash – Naja Bertolt Jensen

What Standards Are Used in Ship Design and Construction?

International Conventions

- SOLAS (Safety of Life at Sea): Comprehensive set of laws governing safety aspects, including fire safety. measures and life-saving appliances.
- SOLAS dictates extensive standards covering everything from ship stability to fire safety measures,
  - This ensures comprehensive safety protocols are followed in ship design and construction
- MARPOL (Marine Pollution Prevention): Standards aimed at preventing pollution from ships due to operational or accidental causes.



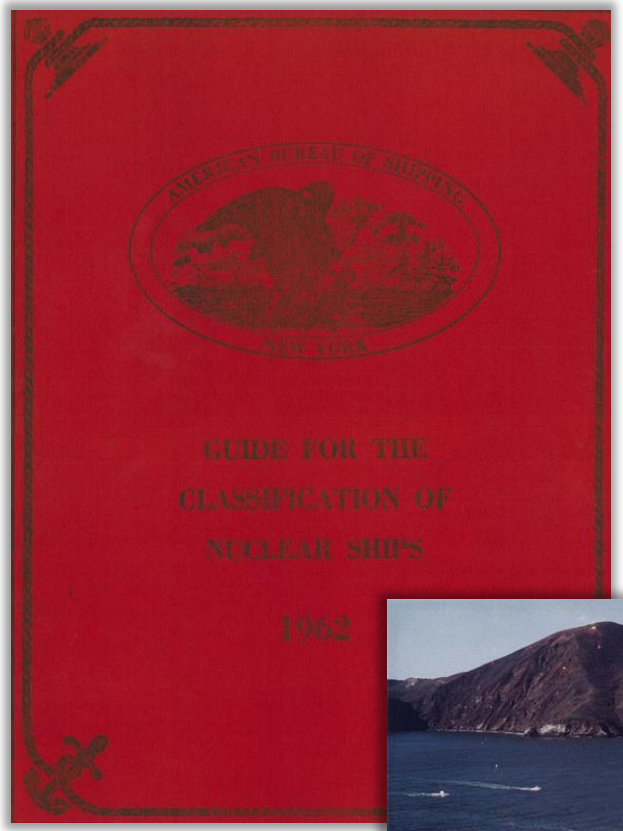
Specific Standards

- ABS (American Bureau of Shipping) Rules: Detailed guidelines on materials, welding, and construction practices.
  - The ABS offers detailed guidelines on material and construction standards
  - Examples include the quality of steel used in hull construction and fire safety materials
  - This ensures structural integrity and safety
- DNV GL Rules: Covers aspects like ship strength, stability, and machinery systems for different ship types and offshore units

History of ABS Nuclear Rules

ABS *Guide for the Classification of Nuclear Ships, 1962*

- Hull based on ABS *Steel Vessel Rules* Sections addressing:
  - Containment
  - Pressure Vessels
  - Control & Instrumentation
- Requires:
  - Nuclear Ship Safety Assessment
  - Nuclear Ship Installation Assessment
  - Consideration of credible accident scenarios
- Classed nuclear ship *Savannah* in 1961



NS (Nuclear Ship) Savannah, enroute to the World's Fair in Seattle, 1962 Credit: US Government - NARA

ABS and Nuclear Power

History & Experience

NS (Nuclear Ship) Savannah, enroute to the World's Fair in Seattle, 1962

- ABS Class

ABS Supporting Services

- Advisory / Publications
- New Technology Qualifications
- Concept & Feasibility Studies
- ABS Group Consulting


Credit: lifeofpix - rawpixel

Industry & Academic Partners

Engaged in research and development solutions

- Government Agencies
- Standards Associations
- Scientific Institutes
- Universities

Project Announcement

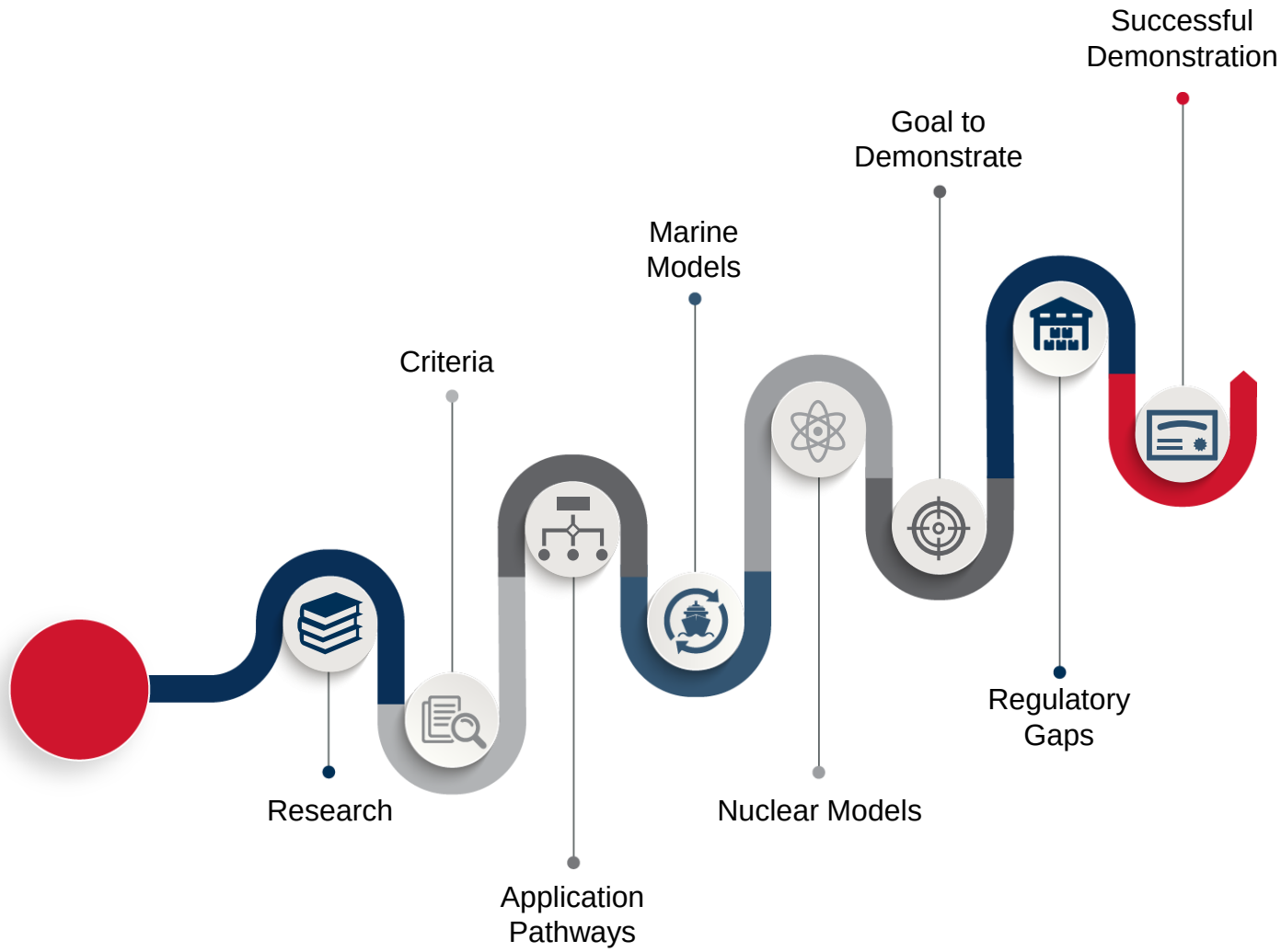
Accelerating Commercial Maritime Demonstration Projects for Advanced Nuclear Reactor Technologies –

American Bureau of Shipping (Spring, TX) will focus on addressing hurdles in the maritime domain so that new reactor technology can be rapidly deployed for commercial applications. Advanced nuclear technology is well-positioned to be one of the strongest tools available to help the industry achieve its aggressive decarbonization goals.

Total Award Value: $793,999

Project Objectives

1. Build demonstration project pathways and business cases
2. Develop models of various advanced reactor technologies integrated with maritime applications
3. Assess the readiness of DOE for supporting demonstration projects
4. Publish guidance for addressing key technical, regulatory and policy issues for maritime demonstration projects
5. Establish training procedures for downstream users to follow

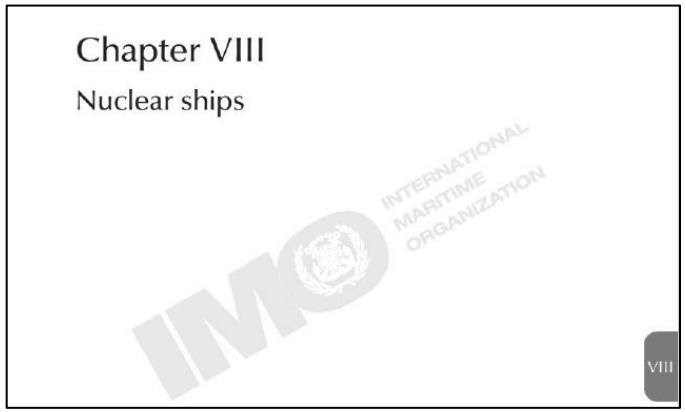


Existing Requirements, Standards, and Regulations

- Statutory Requirements
  - IMO International Code for the Safety of Life at Sea (SOLAS) CH. VIII and Resolution A.491(XII) Code of Safety for Nuclear Merchant Ships, 1981
  - Other IMO Codes for Nuclear Cargo

- National/Industry Standards

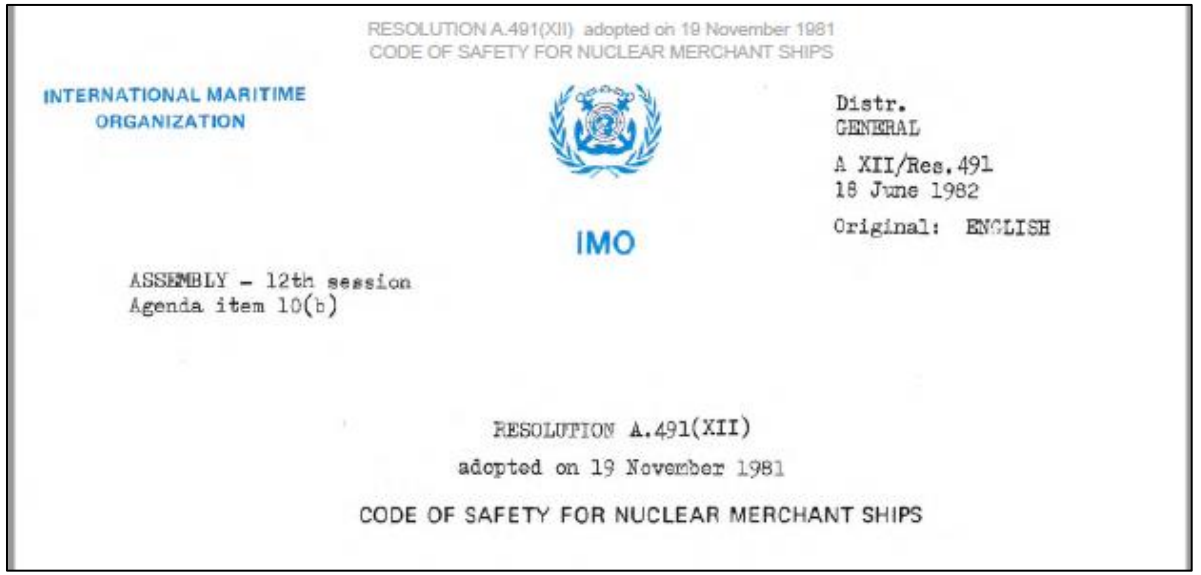
  As applicable:
  - ABS Guide (Retired)
  - NRC Requirements
  - IAEA Standards
  - US CFR Nuclear Regulations in Title 46 (Retired)


Chapter VIII

Nuclear ships

INTERNATIONAL MARITIME ORGANIZATION

VIII


RESOLUTION A.491(XII) adopted on 19 November 1981
CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS

INTERNATIONAL MARITIME ORGANIZATION

IMO

Distr.
GENERAL

A XII/Res.491
18 June 1982

Original: ENGLISH

ASSEMBLY - 12th session
Agenda item 10(b)

RESOLUTION A.491(XII)

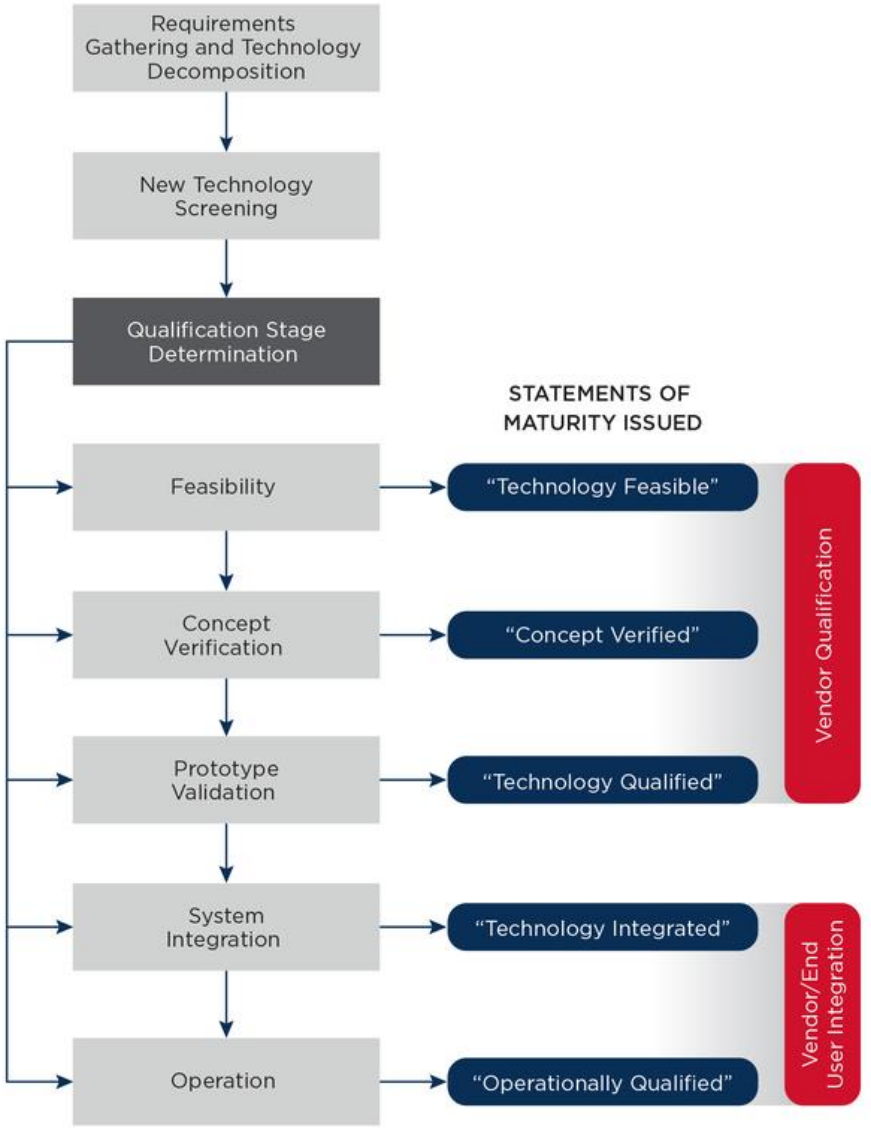
adopted on 19 November 1981

CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS

New Technology Qualification

In December 2020, ABS issued a "New Technology Qualification Feasibility" statement to Seaborg for a compact molten salt reactor to power a commercial power barge.

For more information, click here.



Future Trends and Challenges in Maritime Standards

Overview

Both National and International Standards contribute to making life simpler and increase the reliability and effectiveness of the goods and services used!

Recap of Common Standards Used

SOLAS (Safety of Life at Sea)

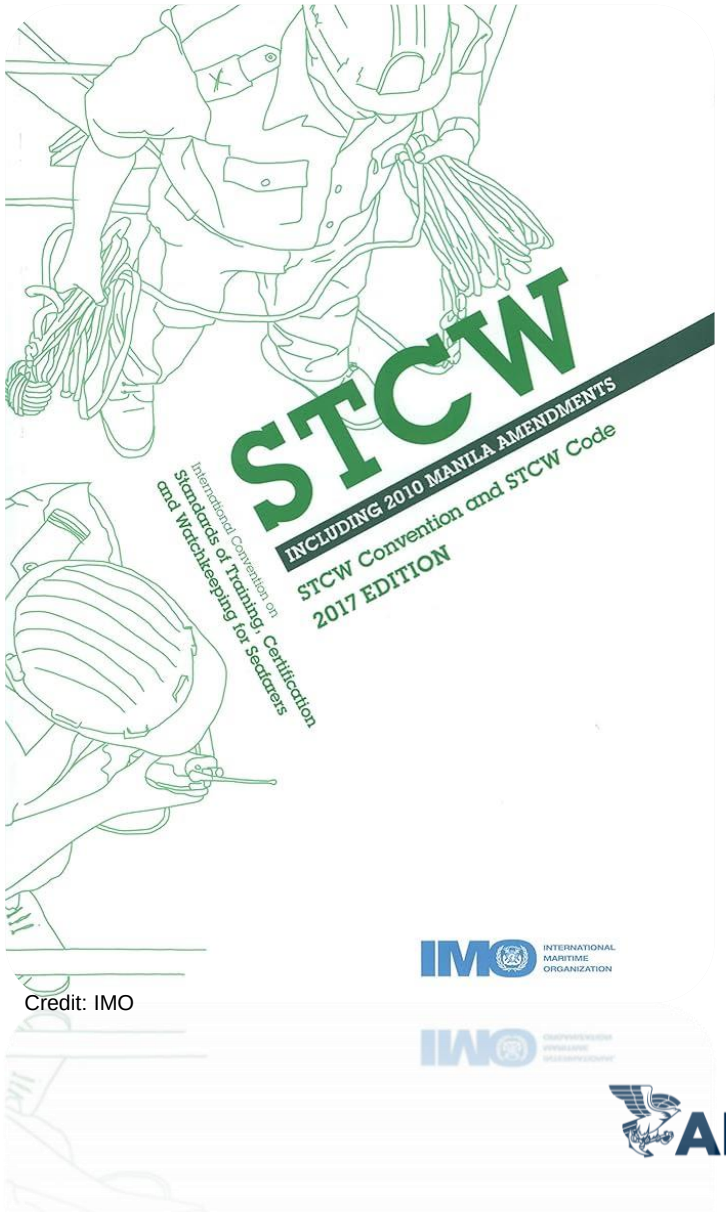
- Synopsis: SOLAS is the most important international treaty concerning the safety of merchant ships. It specifies minimum standards for the construction, equipment, and operation of ships, compatible with their safety. Key regulations include fire protection, life-saving appliances and arrangements, and safety of navigation.

MARPOL (International Convention for the Prevention of Pollution from Ships)

- Synopsis: MARPOL aims to minimize pollution of the marine environment by ships from operational or accidental causes. It includes six annexes that regulate different types of pollutants, including oil, noxious liquid substances, harmful substances in packaged form, sewage, garbage, and air pollution from ships.

STCW (Standards of Training, Certification, and Watchkeeping for Seafarers)

- Synopsis: STCW sets qualification standards for masters, officers, and watch personnel on seagoing merchant ships. It includes detailed requirements on training, certification, and watchkeeping duties to ensure that seafarers are qualified and fit for duties at sea.



Credit: IMO

Recap of Common Standards Used (continued)

ISM Code (International Safety Management Code)

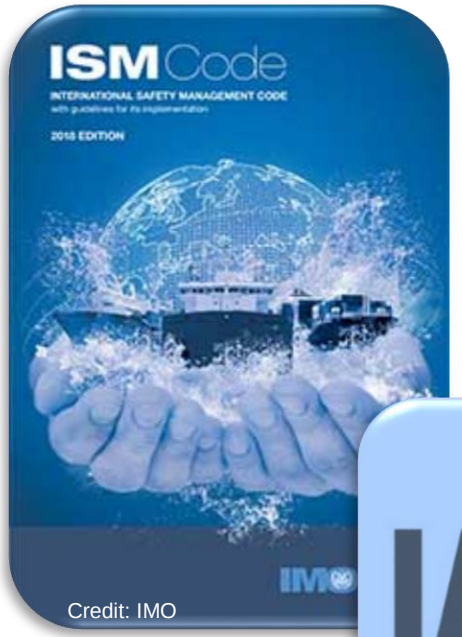
- Synopsis: The ISM Code provides an international standard for the safe management and operation of ships and for pollution prevention. It requires ship operators to establish safety management systems, which include safety and environmental protection policies, emergency preparedness, and continuous improvement practices.

IACS (International Association of Classification Societies) Standards

- Synopsis: IACS promotes high standards of design, construction, and operational maintenance through technical support, compliance verification, and research and development. It produces a wide range of technical standards known as Unified Requirements that are applied by member societies to ensure the safety of ships and their compliance with statutory regulations.

IMO Codes and Guidelines

- Synopsis: The International Maritime Organization issues a variety of codes and guidelines that cover specific aspects of maritime safety and operations. These include the IMDG Code for dangerous goods, the IBC Code for bulk chemical cargoes, and the Polar Code for ships operating in polar regions.



Credit: IMO

Credit: IMO

Credit: IMO

Technological Innovation

- Autonomous Ships: Developing standards for unmanned operations
  - These pose unique challenges for navigation, control, and safety
  - Novel, they are seen as necessary for many types of operations in the future
  - Different health and safety regulations need to be made to accommodate these forms of innovation
- Alternative Fuels: Creating standards for new fuel types like LNG, hydrogen, and biofuels to ensure safe storage, handling, and usage.
  - Class Societies have developed procedures for innovators to follow as they incorporate different fuels into their designs

Credit: © Loco Steve

Environmental Sustainability

Credit: © NOAA

- Decarbonization: Developing new standards to help the industry meet IMO 2050 greenhouse gas reduction targets
  - Reduce CO2 emissions per transport work by 40% (with respect to 2008 levels) by 2030
  - Reduce total annual GHG emissions by 70% by 2040
  - Reach net zero by or around 2050
- Energy Efficiency: Standards for new technologies that improve fuel efficiency and reduce operational costs.
- This to be done through different methods:
  - Enhanced techniques to create higher, sustainable, blend of biofuels
  - Techniques to recapture carbon from existing exhaust technologies
  - Alternative engine designs with higher energy efficiencies

Regulatory Adaptation

- Harmonizing challenges requires aligning regional regulations with international standards to avoid conflicts and confusion
- There is also a need to coordinate with industry stakeholders who stand to be affected by the adaptation the most
- Fast-paced changes involve adapting regulatory frameworks quickly to keep pace with rapid technological advances
- This without compromising safety or environmental protection.

Credit: IMO

Thank You

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