

19 February 2021

8. (a) Define the term *harmonisation system of survey and certification*. (4)
- (b) With reference to a vessel of 500 gross tonnes or more and carrying 12 passengers, list SIX statutory certificates that are required to be carried out in order to demonstrate compliance with the IMO Conventions. (6)

(a) Harmonised System of Survey and Certification (HSSC)

The Harmonised System of Survey and Certification (HSSC) is an international agreement that standardizes the process of surveying and certifying ships for compliance with various maritime safety and pollution prevention regulations. It aims to:

- **Streamline the survey process:** By harmonizing survey intervals and certificate validity periods, the HSSC reduces the administrative burden and cost for both ship owners and classification societies.
- **Improve efficiency:** Surveys can be coordinated more effectively, minimizing downtime for vessels.
- **Enhance safety:** Consistent standards ensure a high level of safety across the international shipping industry.

(b) Statutory Certificates for a Vessel of 500 GT with 12 Passengers

A vessel of 500 gross tonnage or more carrying 12 passengers is likely classified as a passenger ship and requires the following six statutory certificates to comply with IMO conventions:

1. **International Safety Management (ISM) Code Certificate:** Verifies the implementation of a safety management system onboard.
2. **International Load Line Certificate:** Confirms the vessel's safe loading limits based on its size, construction, and operational area.
3. **International Convention for the Safety of Life at Sea (SOLAS) Certificate:** Demonstrates compliance with SOLAS regulations regarding life-saving appliances, firefighting equipment, navigation, and communication systems. (This certificate is renewed annually for passenger ships under HSSC).
4. **International Maritime Organization (IMO) Pollution Prevention (MARPOL) Certificate:** Issued in modules depending on the type of pollution addressed (e.g., Annex I for Oil Pollution, Annex V for Garbage).
5. **International Tonnage Certificate (1969):** Provides the official gross and net tonnage of the ship.
6. **Passenger Ship Safety Certificate:** Confirms the vessel's compliance with SOLAS regulations specific to passenger safety, including life-saving appliances, muster stations, and emergency procedures.

Note: This is not an exhaustive list, and additional certificates may be required depending on the specific trade route, cargo carried, and other factors.

Jan 2024

7. (a) Describe what is meant by Continuous Class Machinery Surveys. ✓ (4)
- (b) State FOUR reasons why the fuel efficiency of a vessel maybe less than the build sea trials data. (4)
- (c) List FOUR typical defects which may reduce the output of a centrifugal pump. ✓ (2)

Vessel Maintenance and Performance

(a) Continuous Class Machinery Surveys (CSM):

Continuous Class Machinery Surveys (CSM) is an alternative classification society survey scheme for ships with propulsion machinery. It differs from traditional special survey approaches in the following ways:

- **Phased Inspections:** Instead of a single extensive special survey every five years, CSM distributes required machinery inspections across a five-year cycle. In each annual audit, a specific portion of the machinery is surveyed by a classification society representative.
- **Planned Maintenance Integration:** CSM encourages integration with the vessel's planned maintenance system (PMS). Classification societies approve the PMS and the chief engineer can conduct certain survey tasks outlined in the approved plan. This reduces surveyor workload and streamlines the process.
- **Reduced Survey Costs:** By distributing workload and potentially utilizing chief engineer expertise, CSM can lead to lower overall survey costs compared to traditional special surveys.

(b) Reasons for Reduced Fuel Efficiency Compared to Sea Trial Data:

Several factors can contribute to a vessel's fuel efficiency falling short of performance during build sea trials:

1. **Operating Conditions:** Sea trials are typically conducted in calm weather conditions with a clean hull and minimal cargo weight. Real-world operation encounters varying sea states, fouling of the hull over time, and fluctuations in cargo load, all of which increase fuel consumption.
2. **Engine De-rating:** Engines may be deliberately de-rated from maximum power output during sea trials to ensure reliability and longer engine life during commercial operation. This reduces fuel consumption compared to trial data.
3. **Anti-fouling Paint Degradation:** Over time, anti-fouling paint on the hull loses effectiveness, allowing marine growth to accumulate. This increased frictional resistance requires more power to maintain speed, leading to higher fuel consumption.
4. **Maintenance Practices:** Improper maintenance of engines and propulsion systems can reduce efficiency. Fouled fuel injectors, worn turbochargers, or improper lubrication can all contribute to increased fuel consumption.

(c) Defects Reducing Centrifugal Pump Output:

Centrifugal pumps are critical components on a vessel used for various applications like bilge dewatering, cooling water circulation, and cargo transfer. Here are four typical defects that can reduce a centrifugal pump's output:

1. **Impeller Wear:** The impeller is the rotating component that generates pump flow. Erosion, corrosion, or wear on the impeller blades can reduce pump efficiency and flow rate.
2. **Casing Wear:** The pump casing directs fluid flow. Wear on the casing can allow internal leakage, reducing pump performance and pressure output.
3. **Shaft Misalignment:** Misalignment between the pump shaft and driver shaft can increase frictional losses and reduce pump efficiency.
4. **Blocked Suction or Discharge:** Blockages in the pump's suction line or discharge line can restrict flow, leading to reduced pump output and potential cavitation damage.

10 sept 2021

10 September 2021

6. Explain the procedures carried out by a Classification Society for a new vessel to be built to class rules, and the class certificate being issued.

(10)

Classification Society Procedures for New Vessel Construction

Classification societies play a vital role in ensuring the safety and structural integrity of new vessels. Here's a breakdown of the procedures they typically follow for a new vessel built to their class rules:

1. Plan Review and Approval:

- The shipyard submits design drawings, calculations, and material specifications to the classification society for review.
- Classification society engineers assess the design against their published rules and regulations, focusing on structural strength, stability, machinery suitability, and safety systems.
- Iterative discussions may occur between the shipyard, designer, and classification society to address any discrepancies or areas requiring modification to comply with the rules.
- Once all aspects of the design are approved, the classification society issues a "Class Approval Certificate".

2. Construction Surveys and Inspections:

- Throughout the construction process, classification society surveyors conduct regular inspections at the shipyard.
- These inspections verify that materials used meet specified grades and that construction methods comply with approved procedures. Welding procedures, material testing, and fabrication techniques all fall under scrutiny.
- The surveyors witness critical construction milestones like keel laying, launching, and machinery installation.
- Any deviations from approved plans or non-conformities identified during inspections must be addressed and re-inspected by the classification society surveyor before proceeding.

3. Testing and Trials:

- Upon completion of construction, the vessel undergoes a series of tests and trials to verify its performance and seaworthiness.
- These may include inclining tests to determine stability, bollard pull tests to assess propulsion power, and navigation and machinery trials to ensure all systems function correctly.
- Classification society surveyors witness these tests and review the results to confirm compliance with class rules and regulations.

4. Class Certificate Issuance:

- Following successful completion of all inspections, tests, and trials, the classification society issues a "Class Certificate".
- This certificate formally recognizes that the vessel has been built to the society's rules and is eligible to carry their classification symbol.
- The class certificate remains valid for a specific period, typically five years, subject to satisfactory completion of regular surveys to maintain class status.

Additional Considerations:

- Classification societies may offer additional services during new vessel construction, such as advisory services on regulatory compliance, environmental impact assessments, and crew training programs.
- The specific procedures may vary slightly between classification societies, but the overall process of plan approval, construction surveillance, testing, and class certificate issuance remains consistent across the industry.

28 may 201

28 May 2021

6. (a) Define a Classification Society. (6)
- (b) State the periods between docking surveys for a vessel less than 15 years old. (4)

9 nov 2018

9 November 2018

5. (a) Define a Classification Society. (6)
- (b) State the periods between docking surveys for a vessel less than 15 years old. (4)

Classification Societies and Docking Surveys

(a) Classification Society Definition:

A Classification Society is an independent organization that sets standards for ship design, construction, and operation. These organizations play a vital role in ensuring the safety and structural integrity of vessels throughout their operational life.

Classification societies achieve this by:

- **Establishing and publishing class rules:** These rules comprise technical requirements for various aspects of shipbuilding and ship operation, covering structural strength, machinery suitability, stability, fire safety, and navigation equipment.
- **Verifying compliance with class rules:** Classification societies review ship designs and conduct surveys during construction and in service to ensure vessels comply with their rules.
- **Issuing class certificates:** Vessels that meet classification society standards are issued with class certificates. This recognition allows ships to operate internationally and obtain port state control clearance.

(b) Docking Survey Periods for Vessels Less Than 15 Years Old:

For vessels less than 15 years old, classification societies typically require a combination of surveys to maintain class and ensure seaworthiness. These surveys can be categorized as follows:

- **Intermediate Survey:** This survey is typically conducted every 2.5 years and focuses on maintenance records review, machinery operation checks, and general hull condition assessment.
- **Special Survey:** This more extensive survey is performed every five years and includes a thorough examination of the vessel's hull structure, watertight doors, life-saving appliances, and cargo handling gear.

It's important to note that these are general guidelines, and the specific survey requirements can vary slightly depending on the classification society, vessel type, and operational profile.

10 sept 2021

10 September 2021

6. Explain the procedures carried out by a Classification Society for a new vessel to be built to class rules, and the class certificate being issued.

(10)

Here's a breakdown of the procedures a Classification Society (Class Society) follows for a new vessel built to their class rules, culminating in the issuance of a class certificate:

1. Plan Approval and Design Review:

- The shipyard submits a comprehensive package to the Class Society, including:
 - **Design drawings:** These detail the vessel's entire structure, including hull, decks, compartments, and machinery arrangements.
 - **Calculations:** Engineers provide calculations to demonstrate the structural strength and stability of the vessel under various loading conditions.
 - **Material specifications:** The shipyard specifies the grades and properties of materials intended for construction.
- Class Society engineers meticulously review these documents against their published rules and regulations. Key areas of focus include:
 - **Structural strength:** Ensuring the vessel can withstand operational stresses and sea states.
 - **Stability:** Maintaining safe upright equilibrium under various loading configurations.
 - **Machinery suitability:** Verifying engine and auxiliary equipment meet performance and safety requirements.
 - **Safety systems:** Confirming fire safety, life-saving appliances, and navigation equipment comply with regulations.
- Iterative communication: Discrepancies between submitted plans and class rules might necessitate modifications. The shipyard, designer, and Class Society engage in discussions to address these concerns and achieve compliance.
- Once all aspects of the design gain approval, the Class Society issues a "Class Approval Certificate." This signifies their formal acceptance of the design for construction according to their class rules.

2. Construction Surveys and Inspections:

- Throughout the construction process, Class Society surveyors become the watchful eyes at the shipyard:
 - They conduct regular inspections to verify that:

- Materials used match the approved specifications.
- Construction methods strictly adhere to approved procedures (e.g., welding techniques, material testing, fabrication processes).
- They witness critical construction milestones:
 - Keel laying (when the first bottom plate is laid)
 - Launching (when the vessel enters the water for the first time)
 - Machinery installation
- Any deviations from approved plans or non-conformities identified during inspections must be addressed and re-inspected by the surveyor before proceeding.

3. Testing and Trials:

- Upon completion of construction, the vessel undergoes a series of rigorous tests and trials to validate its performance and seaworthiness:
 - Inclining tests: These tests measure the vessel's stability characteristics, ensuring it can safely recover from inclining forces.
 - Bollard pull tests: These tests assess the vessel's propulsion power by measuring the pulling force exerted when stationary.
 - Navigation and machinery trials: These trials verify the functionality and performance of all navigation equipment, engines, generators, and auxiliary systems.
- Class Society surveyors witness these tests and scrutinize the results to confirm compliance with class rules and regulations.

4. Class Certificate Issuance:

- After successful completion of all inspections, tests, and trials, the moment of truth arrives:
 - The Class Society issues a formal "Class Certificate." This prestigious document signifies that the vessel has been:
 - Built to the Class Society's rules and regulations.
 - Deemed structurally sound and operationally safe.
 - Eligible to carry the Class Society's classification symbol, a mark of international recognition.
- The class certificate typically remains valid for five years, subject to satisfactory completion of regular in-service surveys to maintain the vessel's class status.

26 feb 2021

26 February 2021

7. With reference to vessel's survey requirements:

- (a) describe FIVE ways in which Government Surveyors will act in maintaining the statutory requirements of a vessel; (5)
- (b) list FIVE ways in which Classification Surveyors can act to maintain the class and statutory requirements of the vessel. (5)

9 nov 2018

9 November 2018

7. With reference to vessel's survey requirements:

- (a) describe FIVE ways in which Government Surveyors will act in maintaining the statutory requirements of a vessel; (5)
- (b) list FIVE ways in which Classification Surveyors can act to maintain the class and statutory requirements of the vessel. (5)

Ensuring Vessel Safety: Roles of Government and Classification Surveyors

(a) How Government Surveyors Maintain Statutory Requirements:

Government surveyors play a critical role in upholding the statutory safety and environmental regulations for vessels. Here are five key ways they achieve this:

1. **Conducting Initial Surveys and Issuing Certificates:** Government surveyors assess new vessels against national and international regulations. Upon successful inspection, they issue statutory certificates like Safety Equipment Certificates (SEC) and International Safety Management Code (ISMC) Certificates, which are mandatory for commercial operation.
2. **Performing Periodic Surveys:** Throughout a vessel's operational life, government surveyors conduct regular surveys to ensure continued compliance with statutory requirements. These surveys may focus on life-saving appliances, fire safety equipment, navigation systems, and pollution prevention measures.
3. **Investigating Accidents and Incidents:** In the event of accidents or incidents at sea, government surveyors may be called upon to investigate the cause. They analyze evidence, interview crew, and assess whether statutory non-compliance contributed to the incident.
4. **Enforcing Regulations Through Port State Control:** Government surveyors conduct port state control inspections on foreign vessels entering national ports. These inspections verify that the vessels comply with international maritime regulations, potentially detaining non-compliant vessels until corrective actions are taken.
5. **Collaborating with Classification Societies:** Government surveyors often maintain close working relationships with classification societies. They may share survey information and work cooperatively to ensure vessels meet both statutory and class requirements.

(b) How Classification Surveyors Maintain Class and Statutory Requirements:

Classification societies supplement government efforts by providing classification surveys that address both class rules and statutory requirements. Here are five ways they contribute:

1. **Plan Review and Approval:** Classification societies review ship designs to ensure compliance with their class rules, which often exceed minimum statutory requirements. This proactive approach enhances vessel safety beyond the bare minimums.
2. **Construction Oversight and Surveys:** Throughout construction, classification surveyors conduct inspections to verify adherence to approved plans and materials. This helps identify potential statutory non-compliance issues early on during construction.
3. **In-Service Surveys and Audits:** Classification societies conduct regular in-service surveys to ensure vessels maintain class and statutory compliance. These surveys can include machinery surveys, hull inspections, and safety equipment checks.

4. **Issuing Class Certificates:** Upon successful completion of surveys, classification societies issue class certificates. These certificates demonstrate a vessel's adherence to higher safety standards than just statutory regulations, potentially leading to lower insurance premiums.
5. **Continuous Improvement and Rule Updates:** Classification societies proactively update their class rules to reflect advances in technology and best practices in maritime safety. This indirectly encourages vessels to maintain a level of safety that may exceed current statutory requirements.

By working together, government surveyors and classification societies create a multi-layered system of checks and balances to ensure that vessels operate safely and in compliance with both statutory regulations and higher industry standards.

3 nov 2020

3 November 2020

7. With reference to Classification Society surveys, describe the purpose of EACH of the following:
 - (a) Annual Surveys; (3)
 - (b) Docking Surveys; (3)
 - (c) Special Surveys. (4)

Classification Society Surveys: Keeping Vessels Safe

Classification societies conduct various surveys throughout a vessel's life to ensure its ongoing seaworthiness and compliance with class rules. Here's a breakdown of the purpose for each type of survey:

(a) Annual Surveys:

- **Purpose:** Annual surveys provide a focused check on a vessel's critical systems and equipment to identify potential problems early on and minimize the risk of major breakdowns at sea.
- **Key areas of focus:** These surveys typically cover machinery operation, safety equipment functionality, navigation systems performance, and general hull condition. Records of maintenance and crew training may also be reviewed.
- **Frequency:** As the name suggests, annual surveys are conducted every year to maintain a consistent level of monitoring between more extensive surveys.

(b) Docking Surveys:

- **Purpose:** Docking surveys are more comprehensive in-depth inspections conducted when a vessel is out of the water in a drydock.
- **Key areas of focus:** These surveys provide a thorough examination of the underwater hull for signs of corrosion, cracks, or deterioration. Internal compartments, cargo handling gear, and piping systems are also scrutinized for damage or wear and tear.
- **Frequency:** Docking surveys are typically conducted every two and a half to five years, depending on the vessel's age and classification society requirements.

(c) Special Surveys:

- **Purpose:** Special surveys are the most extensive and in-depth examinations conducted by classification societies. They serve as a comprehensive renewal assessment of a vessel's class status.

- **Key areas of focus:** Special surveys encompass a broad range of inspections, including a detailed review of machinery systems, electrical installations, navigation equipment, life-saving appliances, and a thorough examination of the hull structure, both internally and externally. Maintenance records and crew competency are also carefully evaluated.
- **Frequency:** Special surveys are typically required every five years, but the exact interval may vary depending on the vessel's age and classification society rules.

In essence, annual surveys provide regular check-ups, docking surveys offer more in-depth inspections, and special surveys serve as comprehensive renewals of a vessel's class status. This multi-tiered approach by classification societies helps ensure the ongoing safety and operational integrity of vessels throughout their service life.

19 nov 2021

19 February 2021

6. With reference to the classification of a vessel:
- (a) describe how the *continuous survey of machinery* may be applied, stating the time interval over which the surveys take place; (4)
 - (b) list SIX types of machinery that would be inspected during a *continuous survey of machinery*. (6)

Continuous Survey of Machinery (CSM) for Vessels

(a) Applying Continuous Surveys:

The Continuous Survey of Machinery (CSM) is an alternative classification society survey scheme for vessels with propulsion machinery. It differs from traditional special survey approaches in its approach to inspections:

- **Phased Inspections:** Instead of a single extensive special survey every five years, CSM distributes required machinery inspections across a five-year cycle. In each annual audit, a specific portion of the machinery is surveyed by a classification society representative.
- **Time Interval:** The specific interval between inspections of individual machinery items depends on their criticality and potential risk of failure. Typically, around one-fifth of the machinery is surveyed each year.
- **Focus on Critical Equipment:** High-risk machinery components like main propulsion engines, auxiliary engines, boilers, and shafting systems are prioritized for more frequent inspections (e.g., annually).
- **Less Critical Equipment:** Lower-risk machinery like pumps, fans, and compressors may be surveyed less frequently (e.g., every two to five years).

(b) Machinery Inspected During Continuous Surveys:

Here are six types of machinery typically inspected during a continuous survey:

1. **Main Propulsion Engines:** These are the workhorses of the vessel, providing propulsive power. CSM focuses on engine integrity, lubrication systems, fuel injection equipment, and control systems.
2. **Auxiliary Engines:** These engines provide electrical power, drive pumps for various services, and may be used for emergency propulsion. Inspections cover engine condition, cooling systems, and control gear.

3. **Boilers:** Boilers generate steam used for propulsion (if applicable) or other purposes like cargo handling or heating. CSM surveys focus on boiler shell integrity, safety valves, and burner systems.
4. **Shafting and Propulsion Systems:** The propeller shaft transmits power from the engine to the propeller. CSM inspects shaft alignment, bearings, and seals for wear and misalignment.
5. **Steering Gear:** The steering gear controls the vessel's rudder for directional maneuvering. Inspections focus on hydraulic systems, ram cylinders, and control mechanisms.
6. **Auxiliaries and Pumps:** A vessel has numerous auxiliary pumps for various functions like bilge dewatering, firefighting, and cargo handling. CSM surveys pump condition, piping integrity, and valve operation.

This list is not exhaustive, and additional machinery specific to the vessel type may be included in the CSM program. The classification society and ship owner work together to develop a tailored CSM plan that ensures comprehensive machinery coverage within the five-year cycle.

10 sept 2021

10 September 2021

8. With reference to vessel's survey requirements:
 - (a) state the possible consequences of either failing to obtain, or failing to renew a Statutory Certificate; (5)
 - (b) state what is meant by the *Harmonisation system of survey and certification*. (5)

Consequences of Failing Vessel Survey Requirements:

(a) Consequences of Failing Statutory Certificate:

Failing to obtain or renew a Statutory Certificate for a vessel can have severe consequences, impacting both safety and legal compliance. Here are some potential outcomes:

- **Detention:** Port State Control authorities may detain the vessel, preventing it from sailing until it obtains the necessary certificate. This can lead to significant delays, financial losses due to missed schedules, and reputational damage.
- **Fines:** The vessel owner or operator may face heavy fines imposed by maritime authorities for operating without a valid statutory certificate.
- **Insurance Issues:** Most marine insurance policies require vessels to maintain valid statutory certificates. Failure to do so may invalidate insurance coverage, leaving the owner liable for any accidents or incidents.
- **Safety Risks:** Operating a vessel without a valid statutory certificate indicates that it has not undergone required safety inspections. This increases the risk of accidents at sea, potentially endangering the crew, cargo, and the environment.

(b) Harmonisation System of Survey and Certification:

The Harmonisation system of survey and certification is an international effort to streamline and standardize maritime safety regulations across different countries. This system aims to:

- **Reduce Duplication:** By having standardized requirements for surveys and certificates, vessels can avoid multiple inspections when entering different ports. This saves time and costs for ship owners and operators.

- **Improve Safety:** Harmonization ensures that vessels meet a consistent level of safety standards regardless of the flag state (country of registration).
- **Facilitate International Trade:** Streamlined survey and certification procedures facilitate the movement of goods across borders without unnecessary delays due to inconsistent regulations.

The International Maritime Organization (IMO) plays a key role in promoting the Harmonisation system by developing and implementing international maritime regulations (IMRs) that are adopted by member states. Classification societies also contribute by developing class rules that often exceed minimum IMO requirements, further enhancing vessel safety.

By promoting harmonization, the maritime industry strikes a balance between regulatory efficiency and ensuring the safety of life at sea and protection of the marine environment.

26 feb 2021

26 February 2021

5. With reference to the classification of a vessel:
- (a) list SIX items that would be inspected during a *special hull survey*; (3)
 - (b) describe how a *continuous hull survey* could be applied. (7)

Special and Continuous Hull Surveys for Vessel Classification

(a) Special Hull Survey Inspections:

A special hull survey is a comprehensive examination of a vessel's hull structure conducted by a Classification Society every five years. Here are six key areas inspected during a special hull survey:

1. **External Shell Plating:** Surveyors meticulously examine the exterior plating of the hull for signs of corrosion, cracks, deformations, or paint failures. Thickness measurements may be taken at critical locations to assess material integrity.
2. **Internal Structures:** Internal compartments of the hull are also thoroughly inspected for corrosion, cracking in frames and bulkheads, and damage to tank coatings. Cargo hold hatch coverings and sealing mechanisms are scrutinized for watertightness.
3. **Ballast Tanks:** Ballast tanks play a vital role in maintaining vessel stability. Special attention is given to inspecting ballast tank coatings for deterioration, checking for any internal structural damage, and verifying the operation of ballast pumping systems.
4. **Anchor and Mooring Equipment:** The anchors, chain cables, and winches used for anchoring and mooring the vessel are rigorously examined for wear and tear, ensuring their reliability in securing the vessel safely.
5. **Watertight Doors and Hatches:** Watertight doors and hatches are critical for compartment subdivision and vessel survival in case of damage. Surveyors check the operation of these closures, ensure watertight seals are in good condition, and verify the availability of remote control systems.
6. **Drainage and Bilge Systems:** The vessel's drainage and bilge systems are essential for removing water from decks and machinery spaces. The survey focuses on ensuring proper pipework integrity, pump functionality, and bilge well cleanliness.

(b) Applying Continuous Hull Survey Methods:

A continuous hull survey is an alternative approach to traditional special surveys, offering more frequent but less extensive inspections spread over a five-year period. Here's how it could be applied:

1. **Phased Inspections:** Instead of a single extensive survey, the continuous method distributes inspections across five years. Each year, a specific section of the hull (e.g., fore peak, cargo holds, engine room bilge) is intensively examined.
2. **Risk-Based Approach:** Areas susceptible to higher wear and tear (e.g., ballast tanks, bow sections) may be inspected more frequently (e.g., annually) compared to less critical areas (e.g., upper decks).
3. **Focus on Critical Zones:** During each annual inspection, surveyors prioritize critical areas like seams, welds, and areas of known historical weakness identified in previous surveys. Thickness measurements may be taken using sophisticated ultrasonic testing equipment.
4. **Data Collection and Trend Analysis:** Continuous surveys allow for data collection over time. Thickness measurements, corrosion rates, and identified deterioration are tracked to predict future maintenance needs and potential areas of concern for subsequent surveys.

By distributing intrusive inspections across a five-year period, continuous hull surveys can minimize vessel downtime compared to a single special survey while