A LEGAL PERSPECTIVE ON AUTONOMOUS SHIPS

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Identifying regulatory barriers to the use of autonomous ships

Figure 3: Regulatory barriers (subdivided thematically)

1. Jurisdictional issues

2. Navigation and regulations for preventing collisions at sea

3. Crew and "seafarers" of the future

4. Protection of the marine environment

5. Construction requirements and technical conditions of ships

6. Liability, compensation and insurance issues

7. Cybersecurity and anti-terror safeguards

Figure 5: Regulatory approaches to autonomous ships (conceptual)

- Regulatory level: IMO, EU, National (or regional) (test) permits
- Selected focus areas: Involve tech providers to demystify and avoid over-implementation, Ensure interoperability to facilitate competition and innovation, Prepare national regulation, and provide an overview of required amendments
Key actors in autonomous shipping
International law of the sea framework

- State control = jurisdiction of flag/coastal/port State
- UNCLOS: intention to address “all issues” on navigation
- UNCLOS rule of reference: “generally accepted/agreed rules and standards” on shipping (GAIRAS) from competent organization (IMO or ILO)
  - Source of regulation on construction, design, equipment and manning (CDEM standards)
- Sources of GAIRAS
  - MARPOL
  - SOLAS
  - STCW
  - BWM
  - AFS
  - ...
- Package changes to GAIRAS
  - ISPS code (port security)
  - Polar code (ice-covered areas)
  - MASS code (autonomous ships)
1. Every State shall effectively exercise its jurisdiction and control in administrative, technical and social matters over ships flying its flag.

2. In particular every State shall:

   (a) maintain a register of ships containing the names and particulars of ships flying its flag, except those which are excluded from generally accepted international regulations on account of their small size; and

   (b) assume jurisdiction under its internal law over each ship flying its flag and its master, officers and crew in respect of administrative, technical and social matters concerning the ship.

3. Every State shall take such measures for ships flying its flag as are necessary to ensure safety at sea with regard, inter alia, to:

   (a) the construction, equipment and seaworthiness of ships;

   (b) the manning of ships, labour conditions and the training of crews, taking into account the applicable international instruments.

   (c) the use of signals, the maintenance of communications and the prevention of collisions.

4. Such measures shall include those necessary to ensure:

   (a) that each ship, before registration and thereafter at appropriate intervals, is surveyed by a qualified surveyor of ships, and has on board such charts, nautical publications and navigational equipment and instruments as are appropriate for the safe navigation of the ship;

   (b) that each ship is in the charge of a master and officers who possess appropriate qualifications, in particular in seamanship, navigation, communications and marine engineering, and that the crew is appropriate in qualification and numbers for the type, size, machinery and equipment of the ship;

   (c) that the master, officers and, to the extent appropriate, the crew are fully conversant with and required to observe the applicable international regulations concerning the safety of life at sea, the prevention of collisions, the prevention, reduction and control of marine pollution, and the maintenance of communications by radio.

5. In taking the measures called for in paragraphs 3 and 4 each State is required to conform to generally accepted international regulations, procedures and practices and to take any steps which may be necessary to secure their observance.

6. A State which has clear grounds to believe that proper jurisdiction and control with respect to a ship have not been exercised may report the facts to the flag State. Upon receiving such a report, the flag State shall investigate the matter and, if appropriate, take any action necessary to remedy the situation.

7. Each State shall cause an inquiry to be held by or before a suitably qualified person or persons into every marine casualty or incident of navigation on the high seas involving a ship flying its flag and causing loss of life or serious injury to nationals of another State or serious damage to ships or installations of another State or to the marine environment. The flag State and the other State shall cooperate in the conduct of any inquiry held by that other State into any such marine casualty or incident of navigation.
Existing compromise (2023)

- There should be a human master responsible for a MASS, regardless of mode of operation or degree/level of autonomy;
- The master may not need to be on board, depending on the technology used in the MASS and the human presence on board, if any;
- Regardless of mode of operation or degree or level of autonomy, the master of a MASS should have the means to intervene when necessary;
- Only a single master should be responsible for a MASS at any one time, although several masters could be responsible for a MASS on a single voyage, under certain conditions; and
- A detailed discussion is needed about the circumstances where a master of a MASS could be responsible for several MASS.
MASS Code roadmap 2023-2032

- May 2025 – finalize and adopt non-mandatory MASS Code
- First half of 2026 – develop framework for an experience-building phase (EPB)
- 2028 – commence development of the mandatory MASS Code, based on the non-mandatory Code, and consider amendments to SOLAS (new chapter) for the Code’s adoption
- By 1 July 2030 – adoption of the mandatory Code, for entry into force on 1 Jan 2032

- **LEG 112** (Spring, 2025): assess the finalized non-mandatory MASS Code and consider a need for amendments to, or interpretations of, treaties under the purview of the Legal Committee based on the outcomes of the MASS-JWG, MSC and FAL; consider proposals to develop guidelines on the implementation of LEG instruments by MASS;
- **LEG 113** (Spring, 2026): assess the approved mandatory MASS Code and consider a need for amendments to, or interpretations of, treaties under the purview of the Legal Committee;
- **LEG 114** (Spring, 2027): adopt or approve amendments to, or interpretations of, treaties under the purview of the Legal Committee.
International cooperation outside IMO

The Danish Maritime Authority enters a new North Sea cooperation on promotion of digital technologies and autonomous systems on board ships

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The Danish Maritime Authority has signed a "Memorandum of Understanding" (MoU) with the United Kingdom and Belgium, with the aim to enhance collaboration on facilitating the increased use of novel digital technologies and autonomous systems on board ships.


1. Identifies the main areas of cooperation.
2. Establishes the framework for future joint projects.
3. Aligns the efforts of the three countries to advance the adoption of autonomous vessels in the North Sea.

4. Develop a mutual understanding and consistent policy, where feasible, to undertake a joint approach to address key overarching issues for MASS operations, such as Remote Operation Centres, Jurisdiction, and Liability.
University-industry research on MASS

- Advanced, Efficient and Green Intermodal Systems
- Develop a new waterborne transport system for Europe
  - Short-sea shipping
  - Inland waterway transport
  - Small and medium-sized ports
- Technological change
  - Alternative fuels (and respective infrastructure)
  - Autonomous vessels
  - Autonomous cargo handling
- Outcome: autonomous shipping is feasible and offers a solution to shift cargo from road to sea.

https://aegis.autonomous-ship.org/