WHITE PAPER

AUTONOMOUS SHIPS
TERMS OF REFERENCE FOR RULE DEVELOPMENT

ONE SEA
Autonomous maritime ecosystem

Contents

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Foreword

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Pressing priorities: waypoints needed

The IMO Conventions which provide the safe operating framework for the entire shipping industry have been developed over many years and amendments to accommodate autonomous ship operations demand painstaking work. Experts in digital technologies and seafarer welfare groups suggest that shipping should therefore establish not only priorities but a series of waypoints on its voyage towards autonomy, to support efficient and safe ship operation in the near-term.

Most seafarers already work in conditions that would not be admissible in land-based industries. These include seven-day working and long tours of duty which, in recent months, have often exceeded the 11-month maximum laid down by the UN agency, International Labour Organization. On board ships, seagoing personnel live and work in the same place, have irregular sleep patterns and are regularly subjected to the extremes of the weather.

There are many opportunities for digital developments and autonomy to ease the workload that seafarers face. As regulations continue to tighten – on fuel quality, monitoring, reporting, verification (MRV), ballast water system compliance, scrubber data, just-in-time arrival information and so on - the administrative burden on seagoing staff could become overwhelming.

In some of these areas, digital technologies are already supporting routine requirements from ships. Real-time connectivity and advanced satellite communications have enabled a small number of advanced ships to become an extension of the shoreside operation, rather than an independent entity which is out of touch for prolonged periods.

Easing the administrative and compliance burdens of seagoing personnel would make an enormous difference to their working lives. Less time spent on mundane tasks could mean more reasonable working hours, more time for social intercourse, and more humane conditions.

Introduction

Already burdened with a reputation for lack of transparency, shipping's sector-specific terminology often creates an additional barrier to engagement. As an industry, specialized language, acronyms, and abbreviations can be so pervasive that new employees entering the professions sometimes absorb terms into usage without being able to explain their meaning, let alone their derivation.

Citing its responsibility for carrying 90% of world trade, shipping often complains that its voice is not heard, or that public attention only comes its way 'when things go wrong'. Whether or not this is so, to merit a fair hearing, the shipping industry itself must take responsibility for speaking in clear terms.

Few issues in shipping's recent past have generated such an urgent need for clarity as the autonomous ship. Driven by rapid progress in technology, autonomous ship technology has required immediate regulatory attention, even before the stakeholders have agreed to common terms of reference.

The increasing use of autonomous ship technologies and the prospect of supporting functionality ashore - including elements of control - has far-reaching consequences for operating ships, but also for surrounding ships, insurers and the wider public.

In May 2021, an International Maritime Organization intersessional working group submitted its 'regulatory scoping exercise' report to the Maritime Safety Committee. While progressive, the report also distilled the scale of the task ahead. It highlighted how much the maritime safety regulations are based on the human presence onboard. In addition, the RSE pointed out that the definitions for the "degrees" of autonomous ship operation have not been agreed, causing trouble for the development of new safety rules.

Who needs definitions?*

Owners and operators: to have a collective understanding of what is available and what they want, based on an accepted hierarchy of autonomous ship capabilities.

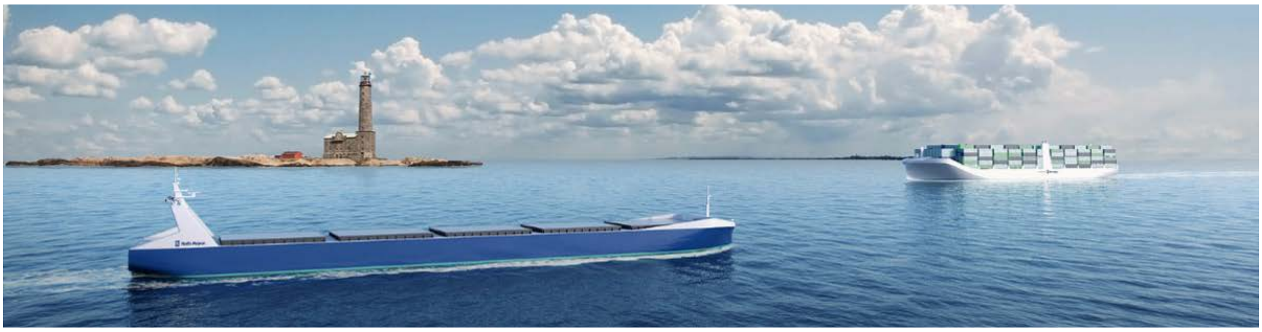
Designers, suppliers, etc: to offer solutions/products to market based on collective understanding of terms/capabilities.

Regulators: to be able to define rules, regulations and certification that fit the task at hand.

Infrastructure providers: to be able to provide suitable infrastructure solutions.

For the assurance bodies: to reduce the need to evaluate every system from the start and base acceptance on already preformed acceptances.

Other maritime users and the general public: to understand what is going on in line with industry goals on transparency.



***NB:** *This paper does not cover any assurance process concerning the safe design, build and maintenance of Unmanned Marine Systems needed by owners or operators to achieve certification acceptable to Flag States, local regulators, and other parties.*

1 | Automotive precedents

Accepted practice defines levels of automation in relation to system or operational function. Therefore, while set-ups are different for vehicles operating on land and sea, the Society of Automotive Engineers' J3016 Recommended Practice: Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles provides extensive food for thought.

SAE offers an industry-standard scale from zero to five to describe this continuum, commonly referenced as the *SAE Levels of Driving Automation*. The accepted explanations of SAE levels of driving automation are summarised as follows:

Level 0: No Automation. The driver is completely responsible for controlling the vehicle, performing all steering, braking, accelerating, etc., but additional safety features can be incorporated as backup. These may include cameras, collision warnings and even automatic emergency braking that is applied in the event of an imminent collision.

Level 1: Driver Assistance. Automated systems take over aspects of control in specific situations, but do not take full control of the vehicle. An example is adaptive cruise control, which controls acceleration and braking on the highway, meaning drivers can take their feet off the pedals.

Level 2: Partial Automation. At this level, the vehicle can perform more complex functions that pair lateral control (steering) with longitudinal control (acceleration and braking, thanks to a greater awareness of its surroundings.

Level 3: Conditional Automation. At Level 3, drivers can disengage from the act of driving in specific situations and focus on other tasks. Nevertheless, the driver is expected to take over when the system requests it. In this case, the vehicle would also monitor whether driver has resumed control, and come to a safe stop, if this is not the case.

Level 4: High Automation. The vehicle's autonomous driving system is fully capable of monitoring the driving environment and handling all driving functions for routine routes and conditions defined within its operational design domain. The vehicle alerts the driver when it is reaching its operational limits in conditions that require human in control.

Level 5: Full Automation. Level 5-capable vehicles are considered fully autonomous. No driver is required behind the wheel at all. In fact, Level 5 vehicles might not even have a steering wheel or pedals.

The explanations as such have received criticism for being too vague in some respects. In May 2021, SAE International and the International Organization for Standardization (ISO) jointly released a significant update, which included clarification of Levels 0-2 as "driver support features" because the driver is still heavily involved with vehicle operation, with Levels 3-5 distinguished as "automated driving features".

2 | Maritime equivalence?

2.1 IMO considerations

IMO initially derived a conception of four ‘degrees’ of autonomy for ships. These degrees were only created for the purpose of/to facilitate the process of the IMO regulatory scoping exercise (MSC 99/WP.9), although many have interpreted them to be a general IMO definition since then. During the regulatory scoping exercise, relevant flag states acknowledged that these levels required further consideration and work in order to apply to regulatory purposes.

While they exhibit progressive levels of automation and decision support, with the highest degree defined as the fully autonomous ship, the formulation does away with ‘Level 0’ as this was not within the scoping exercise.

In a 1-4 scale, IMO’s scale for the regulatory scoping exercise is given as:

1. **Degree one**: ship with automated processes and decision support: Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated and at times be unsupervised but with seafarers on board ready to take control.

2. **Degree two**: remotely controlled ship with seafarers on board: The ship is controlled and operated from another location. Seafarers are available on board to take control and to operate the shipboard systems and functions.

3. **Degree three**: remotely controlled ship without seafarers on board: The ship is controlled and operated from another location. There are no seafarers on board.

4. **Degree four**: fully autonomous ship: The operating system of the ship is able to make decisions and determine actions by itself.

2.2 Class comparison

For comparison, the following definitions for levels of autonomy in a ship's navigation functions by classification societies provide different and more nuanced approaches to gradations in ship systems autonomy.

From **DNV:**

M Manually operated function.

DS System decision supported function.

DSE System decision supported function with conditional system execution capabilities (human in the loop, required acknowledgement by human before execution).

SC Self-controlled function (the system will execute the operation, but the human is able to override the action. Sometimes referred to as 'human in the loop').

A Autonomous function (the system will execute the function, normally without the possibility for a human to intervene on the functional level).

From **Lloyd's Register:**

AL 0 Manual – No autonomous function. All action and decision making performed manually (NB systems may have level of autonomy, with human in the loop.), i.e., human controls all actions.

AL 1 On-board decision support – All actions taken by human operator, but decision support tool can present option or otherwise influence the actions chosen. Data is provided by systems on board.

AL 2 On/off board decision support – All actions taken by human operator, but decision support tool can present options or otherwise influence the actions chosen. Data may be provided by systems on or off-board.

AL 3 Active human in the loop – Decisions and actions are performed with human supervision. Data may be provided by systems on or off-board.

AL 4 Human in loop/supervisory – Decisions and actions are performed autonomously with human supervision. High impact decisions are implemented in a way to give human operators the opportunity to intercede and over-ride.

AL 5 Fully autonomous – Rarely supervised operation where decisions are made entirely and actioned by the system.

AL 6 Fully autonomous – Unsupervised operation where decisions are made entirely and actioned by the system during the mission.

From **Bureau Veritas:**

Degree A0 Human operated: The system or ship can perform information acquisition, but cannot analyse information, take decisions, and execute operations on behalf of human. Human makes all decisions and controls all functions. Human is located aboard (crew).

Degree A1 Human directed: The system or ship can perform information acquisition, information analysis and suggest actions but cannot take decisions and execute operations on behalf of human. Human makes decisions and actions. Human can be located aboard (crew) or remotely.

Degree A2 Human delegated: The system or ship can perform information acquisition, information analysis, take decisions and initiate actions, but requests human confirmation. System invokes functions waiting for human confirmation. Human can reject decisions. Human can be located aboard (crew) or remotely.

Degree A3 Human supervised: The system or ship can perform information acquisition, information analysis, take decisions and execute operations under human supervision. System invokes functions without expecting human confirmation. Human is always informed of the decisions and actions and can always take control. Human can be located aboard (crew) or remotely.

Degree A4 Full automation: Self-operating system or ship at defined conditions and in specific circumstances. The system or ship can perform information acquisition & analysis, take decisions, and executes operations without the need of human intervention or supervision. System invokes functions without informing the human, except in case of emergency. Human can always take control. The supervision can be aboard (crew) or remote.

One reason for laying out these different summaries is to highlight the variations in class definitions – and the absence of common IACS definitions. Another is to contrast the clear distinctions offered with the broad scope allowed by of IMO 'degree one', whose lack of firm boundary against 'degree two' is especially evident in the phrase 'some operations may be automated and at times be unsupervised'.

Another focus - beyond noting the five degrees of autonomy given by Class - is DNV's helpful step of dispensing with the descriptive qualifiers which feature in the SAE definitions where system functionality is concerned. However, the *quid pro quo* is that these definitions allow a conditionality which lacks clarity on what the 'human in the loop' is actually doing.

2.3 A path to progress?

For context, in 2018, Standard Club's Senior Claims Director, Heather Maxwell, wrote: "The predicted degrees of ship automation and the timeframes to implementation can vary dramatically, but the simple fact is that the current legal framework lacks the basic language required to account for autonomous ships in any capacity." In doing so, Maxwell highlighted the way the IMO's Convention on the International Regulations for Preventing Collisions at Sea 1972 (COLREGS) provides navigation rules for ships to follow to prevent collisions. Citing COLREGS Rule 5 (Lookout) for its insistence on perception and judgement to make a full appraisal of the risk of collision, Maxwell observed: "Whilst it is feasible that ships remotely operated or monitored from ashore could satisfy these conditions, it is difficult to see how a fully autonomous ship ever could."

These negative points are surely powerful, but implicit in them appears to be a way forward for autonomous ship regulation. On the one hand they demonstrate how current maritime safety regulation is based on concepts of 'the master' and 'crew'; on the other they highlight that the activities of the human in the loop may not necessarily be tied by location.

> *If functionality is indeed the measuring stick of automation, the more relevant question as far as humans interacting with ship systems therefore appears to be:*
>
> ***What level of human attention/attendance supports safe operation?***
>
> *Looked at from this perspective, levels of autonomy could be assessed on a scale based on the **need for human attention/attendance***

3 | The human in the loop

Experts attending IMO meetings have also suggested the starting point for rule development towards greater ship autonomy should be the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW). STCW establishes minimum qualification standards for masters, officers and watch personnel on seagoing merchant ships and large yachts.

Circulated at the end of 2020, for example, recommendations within The UK Maritime Autonomous Systems Regulatory Working Group envisaged 'MASS Operators' trained and certified to standards equivalent to counterparts on crewed vessels. However, IMO's Inter-sessional Working Group (ISWG) on Maritime Autonomous Surface Ship (MASS) acknowledged that the STCW Convention is only applicable to seafarers that are actually on board an 'autonomous' vessel: even amended, it would not be able to accommodate the concept of the remote operator.

One Sea companies are of the opinion that remote monitoring or operation should not be confused with automation. The location of the human operator in the loop is not relevant for the taxonomy of automation and autonomy. Human operators can be situated in various locations - on the ship, on board another ship or on shore. Remote operations can also be performed on ships of various levels of automation; hence the need for separate definitions.

The ISWG on MASS concluded that legal provisions such as SOLAS would need to be revisited to consider crewing definitions. Where automation and automated systems interface with those working at sea today, the following general statements appear self-evidently true:

Conditions: the lower the level of automation, the greater will be the need for more continuous human attendance/attention, even during 'easy' conditions.

Situation: the lower the level of automation, the greater will be the need for more continuous human attendance/attention, even for 'simple' situations.

Time: lower levels of automation either cannot work safely without continuous human attention/attendance or can do so only for a short time.

NB: *Conditions affect perception where time periods are concerned: a short time operating in calm seas on open water may be perceived as a significant period in close manoeuvring.*

The task at hand therefore involves fitting generalities on human attendance/attention coherently together with accepted functional standards covering automation/ autonomy.

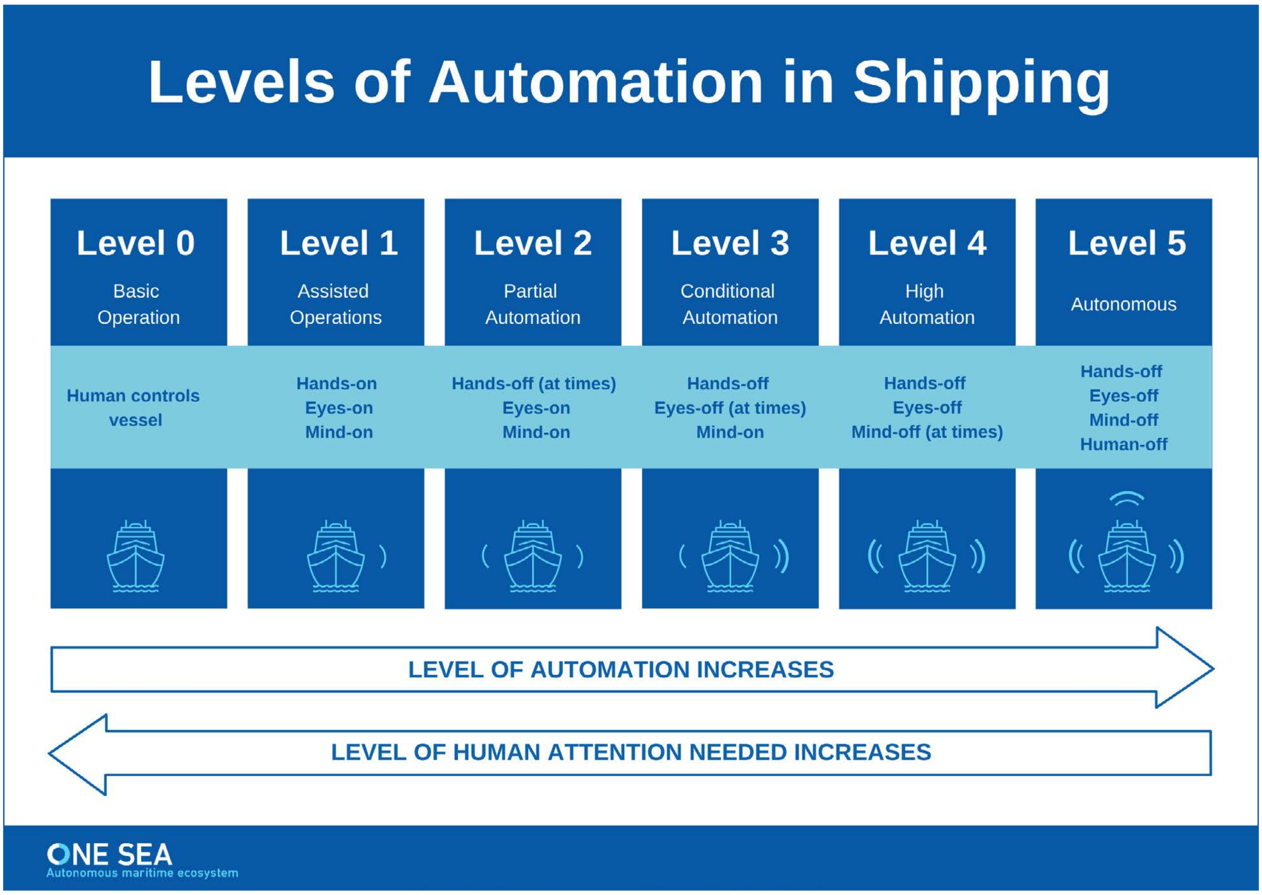
Work by the main technology companies involved in developing, verifying, and trialling autonomous ship technologies has included an evolving understanding of the regulatory instruments and challenges facing their adoption. The work, which went on before, during and after IMO's formative scoping exercise, is based on experiences involving autonomous technologies on board real-life ships, owners, and crews, operating in actual sea conditions.

As a general principle the companies urge caution against combining manning with technology levels. Manning principles are in general not affected by automation; to avoid unnecessary complications, the two matters should be considered separately.

The resulting construct takes a different approach to 'degrees' of autonomy to that created at IMO. Following two years of work, the formulation has been approved by all companies within One Sea.

The definitions apply to different ship systems or operations or in extreme cases an entire ship. Their basis is a scale of equivalence based on a modified version of the *SAE levels of automation* by the Society of Automotive Engineers. Having offered this construct, subsequent sections will offer further thoughts on definitions of terms and use of terminology to support rule development. *Figure 1* offers a scale of automation supplemented to include required levels of human attention.

Figure 1: Levels of automation (modified from SAE-levels)



4 | Automation and the autonomous ship

Three quarters of marine insurance claims are linked to human error (Wärtsilä White Paper: The Future of Smart Autonomy is here, 2021). Many relate to collisions.

At the same time, autonomous systems are already increasing vessel safety today by providing faultless and consistent data on a 24/7 basis, regardless of prevailing conditions or physical obstacles. Systems also monitor different parameters simultaneously - a significant limitation of the human brain.

One Sea member Kongsberg draws attention to the way autonomous ship technology is "removing humans from hazardous working environments onboard vessels, reducing the likelihood of human error by introducing smarter systems that are highly automated and autonomous to various degrees, (and) improving the internal and external situational awareness". Autonomous technologies could also provide the means for improved working conditions and efficiency.

In a topical instance, a recent Tradewinds article revealed that the ultra large container ship, *Ever Given*, which caused one of shipping's highest-profile accidents in March 2021 when she grounded and blocked the Suez Canal, actually had two pilots on board at the time. Interviewed by the newspaper, Capt. John Dolan, Standard Club's Deputy Director of Loss Prevention, and head of the International Group of P&I Clubs' subcommittee on pilot safety, said that vessel monitoring technology could play a role in reducing accidents and aid the communication challenges between ship masters and pilots.

In keeping with *Figure 1*, it is therefore useful to offer a recap of distinct levels or degrees of ship automation in the context of existing systems which help human beings make better decisions today and envision operations that go beyond today's technology.

4.1 Levels of autonomy

Level 0: Basic operation / Human controls the vessel.

Description

In its simplest form, automation is used to control a process according to set points, which in turn control a variable. A human controls the vessel manually or establishes desired 'setpoints' so that automation can achieve the desired outcome. The automated part of functionality is limited to internal monitoring and counteracting deviations between the desired setpoints and received information. This is a closed-loop system.

Example

The officer of the navigational watch (OOW) sets the desired heading on the autopilot. Control of the rudder angles is automated until the ship's heading corresponds to the setpoint. Information is also received from the compass, so that the vessel's rudder and heading adjust to match the setpoint entered into the autopilot. Automation maintains the setpoint until a human enters a new setpoint; the system cannot change the setpoint based on surroundings or any changes in conditions.

Level 0 is considered as reflecting the current state of maritime regulations in force.

Level 1: Assisted operations / Hands-on, eyes-on, mind-on.

Description

A human operating the ship's functions assesses and takes decisions based on information received, entering, or adjusting setpoints by way of response. System automation assists the human operator by providing observations/updates and/or automating basic and simple tasks that are logical extensions of decisions made.

Example

A Dynamic Positioning (DP) system used in offshore operations can automatically control a vessel's position and heading using active thrust. The operator can either control or manoeuvre the vessel manually using a joystick for position and heading control, automating the process based on continuous setpoint updating. The operator may select automatic control of one or two of the vessel's axes of motion - surge, sway, and yaw.

Level 1 is consistent with current maritime regulations in force with respect to systems automation.

Level 2: Partial automation / Hands-off (sometimes), eyes-on, mind-on.

Description

The operation of at least one complete function/operational mode is automated. The system monitors the actual situation and can perform actions to achieve the setpoint or result required. The system informs the human operator of relevant observations and the actions identified as needing to be performed. However, action may need to be confirmed beforehand by the human operator.

Example

An example is Track Control (also referred to as Track steering) which combines the Autopilot with the Electronic Chart Display and Information System (ECDIS). The OOW can program a voyage plan into the ECDIS that contains one or more tracks, with the autopilot receiving its orders from the ECDIS and transmitting commands to the steering system. The Track Control system may be controlled by the OOW or offer alerts that required actions are pending and ask for confirmation to execute. The OOW can take control at any point to deviate from the track, e.g., to avoid objects.

Level 2 is consistent with IEC 62065:2014 as it relates to maritime navigation and radio-communication equipment and systems - Track control systems - Operational and performance requirements, methods of testing and required test results.

Level 3: Conditional automation / Hands-off, eyes-off (sometimes), mind-on.

Description

Here too, the operation of at least one full functional/operational mode is automated. When certain operational conditions are fulfilled, the system monitors the process according to the setpoints and automatically takes action to maintain the setpoints.

The task may be performed without human control for a limited time, determined by operational conditions/location.

Example

An automated docking system is a typical example of conditional automation. On the master's command, the ship un-docks and departs from the quay, manoeuvres out of the harbour, sails to the next port, manoeuvres into the harbour and docks alongside the quay under supervision, but without human intervention. The system avoids potential errors resulting from humans having to perform repeated technical manoeuvres and allows the OOW to concentrate on surrounding traffic and situational safety.

Level 3 Some aspects might be in a grey area beyond the scope of current maritime regulation although technical minimum standards exist.

Level 4: High automation / Hands-off, eyes-off, mind-off (sometimes).

Description

This is the highest level of 'human-attended' automation. The functional/operational task is performed to a large extent automatically without human attendance. The system alerts the human operator when intervention is needed if a situation arises when it cannot perform the action within its parameters to achieve the setpoints.

Example

A track control or automated docking system where an automated navigational system may be unattended for a length of time, as defined by surrounding operational conditions. All navigational watch-related functions and collision avoidance are performed by the system, which will alert the human operator of any irregularities/observations that need attention. The OOW may check the operation of the system at certain intervals and monitor the operation of the system in situations when a heightened level of safety is required. In certain conditions, human oversight of operations will be absent, for example on the open sea, in the daytime during good weather.

Anti-heeling system: the system enables automatic detection of the heeling angle and compensation. Pneumatic or water pump operations are used to compensate connected ballast tanks, regulated by automatic valves and control systems. These automated systems operate within current regulations.

The main difference between levels 3 and level 4 is that in the latter case, under certain conditions, human oversight of specific automated operations is not needed; if the conditions persist, operations can continue on an 'eyes-off, mind-off' basis. The system will identify when the situation is no longer manageable.

Level 4 Today, some systems are on this level. However, systems or functions requiring human attendance and combining of observations and information are directed by regulations and constrained by minimum requirements.

Level 5. Autonomous / Hands-off, eyes-off, mind-off = human-off.

Description

Autonomous operations replace all human supervision; human attendance or interventions are not required. The goal set for operations is predetermined but requires autonomous problem solving to deal with situations encountered. These solutions will be based on information gathered and the ability to understand the apparent situation. Technology observes, identifies, interprets, and responds to situations so that the ship and its equipment operate in a compliant and safe way.

Example

Fully autonomous navigation and collision avoidance replaces all functions of a navigational watch. The autonomous system keeps the vessel on its calculated and most efficient route and make adjustments to routing and speed based on conditions (e.g., wind, waves and currents forecast) for just-in-time arrival. The system observes and identifies objects and vessels in the vicinity, assesses risks and takes action to solve close quarter situations, adjusting course and/or speed according to the rules of the road.

The main difference between level 4 and level 5 is that, in fully autonomous mode, the system will be capable of coping with exceptions, unforeseen situations, anomalies, faults, etc., without needing human oversight.

4.2 ONE SEA commentary

Proactive ship owners and operators have already adopted a range of digital remote autonomous technologies for existing vessels and plan to adopt similar systems on new vessels. Digitally enabled voyage reporting is the most obvious example. Adopted by a growing number of owners, these systems replace the time-consuming and sometimes 'fudged' noon report used by shore-based personnel to monitor ship performance.

However, standardisation and integration are often lacking because original equipment manufacturers have developed function-specific systems to measure metrics such as torque on the shaft, for example, to manage fuel burn or project time to next port. As yet, there is no common interface.

Vessels that could qualify for higher degrees of automation (such as OS Levels 4 and 5) are, so far, mostly experimental and confined to the territorial waters of one coastal state. These include harbour tugs and commuter ferries. For deep-sea cargo vessels, isolated tests of specific technologies have been performed, and more are in progress. Full scale application of higher levels of automation technology has not yet been implemented on these vessels, mainly because such ships would fail to meet the requirements in force for ship safety and safe operation.

The 120-TEU *Yara Birkeland,* which had its first voyage 19th November 2021, is an example of a ship with a higher degree of automation. The ship navigates solely through Norwegian inshore waters. Within two years, Yara hopes that the vessel will operate autonomously on the route, with no crew.

5 | Conclusions

5.1 Summarizing the main conclusions

Remote control or operations can be applied to ships encompassing systems with various levels of automation, which is why remote control and operations should not be confused with the levels of automation. One Sea underlines that the location of the human operator is not relevant for the taxonomy of automation and autonomy.

In addition, mixing manning levels with levels of automation is misleading. Manning principles are applied by authorities determining the minimum crew for a vessel. Vessels can comply to these principles regardless of the level of automation of the systems on board the ship.

This paper proposes that levels of autonomy could be defined on a scale based on the need for human attention/attendance. It describes six levels of automation that are explained in detail in chapter 4. The proposed levels can be applied to various ship operations or the entire ship. Only the last level is referred to as autonomous, meaning that a human operator is not needed for operations, which are automated.

5.2 Why does the discussion need these terms of reference?

One Sea prioritizes the development of international regulations, in order to ensure safe global operations utilizing modern technologies. The Maritime Safety Committee decided, at its 104th session on a new output on "Development of a goal-based instrument for maritime autonomous surface ships (MASS)", with a target completion year of 2025. The Committee agreed that the final goal would be a mandatory instrument.

In light of the work to create an instrument to enable the use of MASS commencing at the MSC 20th to 29th April 2022, it is necessary to clarify what we are discussing when we talk about MASS - specifically when it comes to levels of automation technologies. Precise terminology is essential because ambiguity is currently causing misunderstandings regarding scope, application and the functions of different technologies and concepts.

To enable use of these technologies at a larger scale, regulators, owners and operators, designers, suppliers, infrastructure providers, assurance bodies, other users, and the general public need to have a collective understanding based on an agreed terminology.

Appendix: Terminology relating to autonomous ship systems

5.1 - Auto in context

The implementation of processes by automatic means (ISO/TR 11065).

As a noun, automation refers to the automatic control functions in the autonomous ship systems.

5.2 - Control in context

Purposeful action on or in a process to meet specified objectives (IEC 60050-351).

The term control does not preclude that the action is only to monitor the process, e.g., to raise an alarm or to request intervention. Control can be exercised by a human or by automation."

5.3 – MASS in context

At its 100th session held on December 3-7, 2018, IMO's Maritime Safety Committee defined a Maritime Autonomous Surface Ships (**MASS**) as a ship which, to a varying degree, can operate independently of human interaction.

Afterword

One Sea is a collaboration of stakeholders including shipping companies, technology developers and enablers, autonomy experts, and IT specialists. Its aim is to assist in the development of safe autonomous systems in global shipping that could lead towards an effective operational maritime ecosystem by 2025.

As a priority, we seek to engage in constructive dialogue with the regulators, insurers, representatives of maritime labour, training establishments, flag administrations and classification societies to help shape the future of autonomous shipping for the satisfaction of all. We invite all stakeholders to participate in the transparent discussions which can achieve standards to enhance maritime safety, reduce carbon emissions, improve social and working conditions and open new commercial opportunities for shipping.

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