Future Trends in Autonomous Shipping: Discussing the Impact of Artificial Intelligence (AI) Applications

Dr. Dimitrios Dalaklis, Professor (Safety and Security)
Outline

- Introduction (WMU’s mission and “Industry 4.0”);

- Main findings of “Transport 2040” related Reports;

- Elaborating on the framework of “Definitions”;

- Maritime Autonomous Surface Ships (MASS) and a discussion of the role of Artificial Intelligence (AI) in future operations;

- Questions & Answers…
World Maritime University
A Specialized UN Institution in Sweden
ABOUT WORLD MARITIME UNIVERSITY (WMU)

Established in 1983 within the framework of the International Maritime Organization (IMO), a Specialized Agency of the United Nations…

(IMO is the United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine and atmospheric pollution by ships)

MISSION

To be the world centre of excellence in postgraduate maritime and oceans education, professional training and research, while building global capacity and promoting sustainable development.

VISION

To inspire leadership and innovation for a sustainable maritime and oceans future.
Stages of “Industrial Revolution”:

• The first stage (18th and 19th centuries), involved a change from mostly agrarian societies to greater industrialization, as a consequence of the steam engine and other technological developments.

• The next technological stage (second industrial revolution), was driven by electricity and involved expansion of industries and mass production as well as technological advances.

• The third stage of industrial revolution, sometimes called the digital revolution, involved the development of computers and IT (information technology) since the middle of the 20th century...
Stages of “Industrial Revolution”:

• The fourth stage of the industrial revolution is growing out of the third one, but it is also considered as a “new era” rather than a continuation because of the explosiveness of its development and the disruptiveness of the associated technologies.

• The term fourth industrial revolution (Industry 4.0) is describing the current and foreseeable environment in which disruptive technologies and trends, i.e. Internet of Things (IoT), robotics, virtual reality (VR) and artificial intelligence (AI) are changing how we live and work.
Industry 4.0: A New Operating “Paradigm”?

THE DAWN OF THE
FOURTH
INDUSTRIAL
REVOLUTION

INDUSTRY 4.0

1. Digitization / Integration of value chains
2. Digitization of product and service offerings
3. Digital business models and customer access

What is AI?

- There is no widely accepted definition of Artificial Intelligence, therefore all AI definitions are grouped into four categories:
- Systems that think like humans (e.g. Cognitive Modeling)
- Systems that act like humans (e.g. Turing’s test)
- Systems that think rationally (e.g. Deep Blue)
- Systems that act rationally (e.g. Robots)
Gradual (Step-by-step) vs Disruptive...

- 5th Avenue in New York, Easter of 1896:
  - Only one car (quite difficult to spot)!
  - 10 years later: only cars, no carriages!!
  - Obviously, a quite disruptive mode of change!!!
Impact on future work profiles?

• The world of work is changing fast; recognizing and mapping “new work models” will be essential for channelling that change into the creation of stronger labour markets.

• Job creation is a constant on the global agenda, as are policies/regulations intended to ensure greater protection for both workers and their employers.
TRANSPORT 2040: AUTOMATION, TECHNOLOGY, EMPLOYMENT - THE FUTURE OF WORK

1st Research Project Generously Financed by the International Transport Workers' Federation (ITF)

A detailed assessment that investigated how the global transport industry will change as a result of automation and advanced technologies, forecasting and analysing trends and developments in the major transport sectors - seaborne, road, rail and aviation - to 2040 with an emphasis on the implications for jobs and employment for transport workers.

Source: (https://commons.wmu.se/lib_reports/58/)
The “New” Shipping Paradigm:

- **Conventional ships**
  - Increasing digitalisation

- **Autonomous ships**
  - as Yara Birkeland

- **Smart ships**
  - Increasingly digital
TRANSPORT 2040 - IMPACT OF TECHNOLOGY ON SEAFARERS

2nd Research Project Generously Financed by the International Transport Workers' Federation (ITF)

- Continuous Assessment of Trends in Automation and Technology (Technology Evolution and Technology Roadmap)
- Future Maritime Skills, Competencies and Career Opportunities
- Case Studies (x4): Occupational Health and Safety
- Country Maritime Profiles…
SKILLS AND TECHNOLOGY FORESIGHT METHODOLOGY (ILO INPUT)

CHAPTER 2 - CONTINUOUS ASSESSMENT OF TRENDS IN AUTOMATION AND TECHNOLOGY

- Trends
- Hard/Soft Technologies
- STEEP Literature Review
- Trend Survey
- Technology Roadmap (Technologies, Policies, Opportunities, Threats)

CHAPTER 4 - COUNTRY PROFILES

- Maritime Leaders Opinion Survey
- Country Profiles (x23)
- Annexes D & E

CHAPTER 5 - COUNTRY REPORTS: OCCUPATIONAL SAFETY AND HEALTH

- Field Studies; Semi-Structured Interviews
- Country Report 1: (Australia)
- Country Report 2: (Denmark)
- Country Report 3: (Panama)
- Country Report 4: (Sweden)

CHAPTER 3 - FUTURE MARITIME SKILLS, COMPETENCIES AND NEW CAREER OPPORTUNITIES

- STF Workshops (Technology)
- Maritime Future Job Survey
- Seafarers' Skill Survey
- STF Workshops (Skills and Competencies)
- Technical Skills
- Skill Foresight
- Short Term (2022 - 2026)
- Mid Term (2027 - 2039)
- Long Term (2041 - 2049)
- Soft Skills
- MET Gap Analysis
- Up-Skill Re-Skill
- Lifelong Learning
- Future Jobs
- Future Maritime Careers
- Seafarers' Demographic and Logistical Trend Analysis

+ Annexes B & C

+ Annex A
FUTURE SHIP EVOLUTION

Source: (https://commons.wmu.se/lib_reports/78/)
## AUTOMATION TECHNOLOGIES

<table>
<thead>
<tr>
<th>Main category Techs (Cluster 1)</th>
<th>Sub-category Techs (Cluster 2)</th>
<th>Examples of enabling/enabled technologies</th>
<th>Description (Cluster 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Automation technologies</strong></td>
<td><strong>Artificial Intelligence (AI) algorithms</strong></td>
<td>AI enables the following functions and systems: - Autonomous navigation (virtual captain, sensor fusion, dynamic positioning) - Remote operation and maintenance and repair - Vehicle health management system, condition-based maintenance, - Artificial Intelligence Engineer - Automatic cargo management software - Automatic seaworthiness and stability management software</td>
<td>AI enables machines to perform tasks while exhibiting human behaviour with functions where there is otherwise little or no human intervention. AI processes information by machine and deep learning algorithms and makes decisions autonomously and timely</td>
</tr>
</tbody>
</table>

### Situational awareness and monitoring sensors (SA)

| **Situational awareness and monitoring sensors (SA)** | The following technologies enable SA: LIDAR, underwater sensors, sound sensors, day and night vision cameras, VR and AR equipment, robots, drones, alarm sensors | To sense, gather, and process data form internal systems and external environments using LIDAR, underwater sensors, sound sensors, day and night vision cameras, VR and AR equipment, robots, drones, and alarm sensors |

### Advanced Actuators (AA)

| **Advanced Actuators (AA)** | AA enables the automatic following functions and systems: Machinery, generators, and engine room equipment, cargo handling and anchoring (e.g., thrusters, motor drivers, steering pumps, autopilots, fuel valves, and fire extinguishing systems) | Devices that can make something move or operate based on electronic signals (e.g., thrusters, motor drivers, steering pumps, autopilots, fuel valves, and fire extinguishing systems) |

### Shore Control Centres (SCC)

| **Shore Control Centres (SCC)** | SCC enables remote control and operations | SCC is site-remote entities from where monitoring and/or control of some or all ship functions can be executed. SCC is indispensable for MASS |

### Advanced Designs (AD)

| **Advanced Designs (AD)** | The following technologies enable AD: - Modular engine designs - Self-regulating, redundant, and fault-tolerant equipment - Smaller and flexible hull designs to enable integration of sensors, docking and undocking and prevent piracy | New designs are required to take into account reduced onboard staffing, future changes in ship structures and equipment to enable the integration of various sensors, docking and undocking technologies and piracy countermeasures |

### System integrator

| **System integrator** | System integrators enable the integration of all ships systems and subsystems: - Cargo-handling/stowage - Operational control, navigation technologies - Remote and automated operation of machinery - Automated and remote maintenance and repair, and - Communication systems | System integrators integrate several components from various manufacturers to achieve a unified system. System and subsystem integration is indispensable for automation as subsystems integration is essential for safety and interoperability |

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**Source:** [https://commons.wmu.se/lib_reports/78/](https://commons.wmu.se/lib_reports/78/)
DIGITAL AND INTELLIGENT INFORMATION TECHNS (DIGITALISATION)

<table>
<thead>
<tr>
<th>Digital and intelligent information technologies (digitalization)</th>
<th>Internet of Things (IoT)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Use of the Internet to interconnect sensing and monitoring devices (cargo, machinery, navigation, etc.), thus enabling the collection, sharing and exchange of data for processing internally and externally (ship-to-ship/to-shore), which ultimately facilitates intelligent applications that enhance safety, route planning and optimization, collaborative decision-making, environmental monitoring, and energy-efficient operation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital and intelligent information technologies (digitalization)</th>
<th>Big Data Platforms (BDP) &amp; analytics, Cloud services (storage, IT services, edge computing)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>BDP store and process data generated by sensors, devices and other objects, thus supporting in-depth analysis/ analytics (e.g., statistical analysis, data mining, market trends). It also expands data capacity and provides infrastructure to automate decision making</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital and intelligent information technologies (digitalization)</th>
<th>Blockchain</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Blockchain authenticates and validates information transfer in a secure real-time way. It facilitates digital transformation through enabling trust, data integrity, traceability and transparency and smart contracts</td>
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</table>

<table>
<thead>
<tr>
<th>Digital and intelligent information technologies (digitalization)</th>
<th>3D and 4D printing</th>
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<tbody>
<tr>
<td></td>
<td>Analogue scale models (virtual replicas of physical items) that replicate actual physical assets with the added functionality of integrating processes, people, systems, and devices</td>
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<table>
<thead>
<tr>
<th>Digital and intelligent information technologies (digitalization)</th>
<th>Augmented Reality (AR) and Virtual Reality (VR)</th>
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<tbody>
<tr>
<td></td>
<td>VR creates a 3-D computer-generated environment that a user can explore and interact with. AR connects the real world with a virtual one with the aid of a device, where data from virtual system (e.g., a digital twin) are inserted precisely where necessary</td>
</tr>
</tbody>
</table>

Source: (https://commons.wm.se/lib_reports/78/)
# LOW AND ZERO-EMISSION TECHNOLOGIES

<table>
<thead>
<tr>
<th>Low and zero-emission technologies</th>
<th>Alternative fuels</th>
<th>Electric propulsion systems and hybrids</th>
<th>Renewable energy</th>
<th>Exhaust treatment technologies</th>
<th>Alternative fuel Bunkering</th>
</tr>
</thead>
</table>
|                                   | Alternative fuels: Biofuels, e.g. Hydro-treated Vegetable Oils (HVO), Fatty Acid Methyl Ester (FAME) and bio-ethanol, methanol, hydrogen and marine fuel cells, ammonia | The following technologies enable electric propulsion and hybrids:  
  - Batteries  
  - Supercapacitors | The following technologies enable capture of renewable energy:  
  - Solar  
  - Wind | - Methane catalyst reductor  
  - Carbon capture and storage | Shore-side bunkering infrastructure, particularly in ports, supply alternative fuels to calling ships |
|                                   | Neutral and zero-carbon emission fuels, such as biofuels, bio-ethanol, methanol, hydrogen and marine fuel cells, ammonia | Use of electric motors and generators. Batteries and supercapacitors are indispensable | Use of sustainable energy, such as solar and wind to provide power | Technologies that treats CO, exhaust emission, such as the methane catalyst reductor and carbon capture and storage |

Source: [https://commons.wmu.se/lib_reports/78/]
### ADVANCED MATERIALS/SENSORS & ROBOTICS AND DRONES

| Advanced materials | Advanced materials | Advanced materials:  
- Microscale, nano-scale materials, composite materials, such as polymer matrix composites, and carbon fibre reinforced plastics  
- Bio-inspired and bio-based materials | Advanced materials (e.g. metallic, ceramic, polymeric and composite materials) aim to deliver specific physical properties and improve capabilities, such as strength, toughness, and durability. Functional properties can also be improved, e.g. environmental sensing, self-cleaning, self-healing, enhanced electrical conductance and shape modification |
|---|---|---|
| Sensors | Advanced sensors | Advanced sensors:  
- Semiconductors  
- Micro-Electrical-Mechanical-Systems (MEMS)  
- Remote sensing sensors | Use of robust and wireless sensors, such as the new generation of micro- and nano-mechanical sensors. Sensors are capable of remote sensing, embracing different characteristics (e.g. self-calibration, fault tolerance, high transmission capabilities, wireless capabilities, environmentally friendly materials for easy disposal) |
| Robotics and drones | Robotics and drones | Robotics and drones enable the following technologies:  
- Robots on board: e.g. sniffers that monitor ship’s emissions, Onboard robots: e.g. dispensers that do housekeeping tasks,  
- Wearables: e.g. aiding crews to lift heavy items, firefighting, and maintenance tasks such as welding, cutting and fitting | Robot and drones can accomplish multifaceted and complicated tasks automatically with various capabilities, i.e. Cognition, versatility (flying, swimming, climbing), Imitation (human and animal actions), Senses (speaking, touching, listening), Adaptability (working in different environmental conditions, and wirelessly and battery driven) |

Source: (https://commons.wmu.se/lib_reports/78/)
### HCI AND HUMAN AUGMENTATION

<table>
<thead>
<tr>
<th>Human-Computer Interaction (HCI)</th>
<th>Human-Computer Interaction</th>
<th>HCI technologies design the interface between human and computers. HCI enables human to interact with computers smartly so computers can recognize human requirements, commands, and preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human augmentation</td>
<td>Human augmentation</td>
<td>The technology aims at increasing human performance and cognitive capability far beyond typical levels. For example, in ships, lightweight modular exoskeleton devices could be used to increase the strength of crew members in some operations, such as carrying heavy loads, thereby reducing fatigue and injuries</td>
</tr>
</tbody>
</table>

Source: (https://commons.wmu.se/lib_reports/78/)
TECHNOLOGY ROADMAP

Increasing e-commerce and digital consumption
Increasing concerns and solutions for cybersecurity and digital transparency
Increasing geopolitical volatility
Expanding green economy
Expanding role of the blue economy
Rise of new business models and ecosystems driven by technology
Increasing use of smart ships
 Widening economic and skills inequalities
 Rising importance of autonomous ships

Source: (https://commons.wmu.se/lib_reports/78/)
Issues to Consider (Industry 4.0):

• Shipping “In the Era of Digitalisation”/possible changes?

• Disruptive trends (i.e. Artificial Intelligence (AI) and Big Data (among others)) that look set to change already established practices;

• Drivers like efficiency, adapting the new-upcoming regulations, or simply “to keep up with competition”…
Favourite Academic Topic: Definitions!

- **What is artificial intelligence?**
  It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.

- **Yes, but what is intelligence?**
  Intelligence is the computational part of the ability to achieve goals in the world. Varying kinds and degrees of intelligence occur in people, many animals and some machines.

- **Isn't there a solid definition of intelligence that doesn't depend on relating it to human intelligence?**
  Not yet. The problem is that we cannot yet characterize in general what kinds of computational procedures we want to call intelligent. We understand some of the mechanisms of intelligence and not others.

- **More in:** [http://www-formal.stanford.edu/jmc/whatisai/node1.html](http://www-formal.stanford.edu/jmc/whatisai/node1.html)

> « The capacity given by humans to machines to memorize and learn from experience, to think and create, to speak, to judge and make decisions »

©IntoTheMinds.com

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Human Brain vs Artificial Intelligence (AI):

**Reasoning**
- Ability to reason (deductive or context-driven)
- Ability to draw inferences based on situational awareness

**Problem Solving**
- Capable of analyzing and solving complex problems in specific-purpose domain
- General-purpose

**Big Data**
- Capable of processing massive amounts of structured and unstructured data
- Ability to learn based on historical patterns, expert input, and feedback

**Learning**
- Capabilities that can change over time

**Artificial Intelligence**
- Ability to sense, reason, engage, and learn
- Natural Language Processing
- Vision
- Robotics & motion
- Planning & optimization

**Machine Learning**
- Ability to learn
- Unsupervised learning
- Supervised learning
- Reinforcement learning

**Methods**
- Ability to reason
- Regression
- Decision trees
- Etc.

**Technologies**
- Physical enablement
- Platform
- UX
- APIs
- Sensors
- Etc.

Source: [https://www2.deloitte.com/se/sv/pages/technology/articles/part1-artificial-intelligence-defined.html](https://www2.deloitte.com/se/sv/pages/technology/articles/part1-artificial-intelligence-defined.html)
Points to note:

• MOVING FAST! During the previous stages of industrial revolution, it has often taken decades to build the training systems and labour market institutions needed to develop new skillsets on a large scale.

• Artificial intelligence is already all around us, from self-driving cars and drones to virtual assistants and software that translate or help us to invest.

• Microsoft is using AI in its “Bing” search engine…
The savings robot Nora – fund saving with digital advice

Our savings robot Nora, or fund robot as she is also called, is a digital advisor that helps you find an automatic fund saving that is adapted just for you. You are up and running in a few minutes and can start saving from SEK 100.

Start a fund saving with the help of Nora

Save both time and money
Influencing Education Choice:

Newcastle University Scholarships

Find out more about scholarship opportunities:

- Subject scholarships
- Sports scholarships
- Opportunity Scholarships
- Vice-Chancellor’s EU Scholarships – Undergraduate
- Vice Chancellor’s International Scholarships
- Vice Chancellor’s Excellence Scholarships
- Vice Chancellor’s Excellence Scholarships - Europe
- Vice Chancellor's Business Excellence Scholarships - Europe
- Vice Chancellor's Global Scholarships
- International Foundation Scholarship (INTO Newcastle University)
- St Nicholas’ Educational Trust Scholarship
An Indicative Example for Shipping?

• **WEATHER ROUTING:** Improve operational efficiency by “optimizing” route and speed profiles for any sea passage....

• The wider portfolio of “weather routing”, is usually considering the “right data” about wind, wind waves and swell, sea currents, water depth, tropical storms, as well as certain important safety parameters in relation to the concerned vessel (The app will choose on our behalf...)

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[World Maritime University Logo]

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Robots and Humanoids (Machines)?

• Remember: It is just a system “behaving similar” to humans (or in a kind of “predefined manner”?)
Machines?

• Remember: It is just a system “behaving similar” to humans (or in a kind of “predefined manner”?)
How many “Humans” are needed here?
“Humans” will still be needed!

Technological advances may disrupt labour markets as traditional jobs change or disappear, even as the number of young job-seekers continues to grow. Re-training will be needed at previously unimaginable scales. Education must adapt, from the earliest grades. And the very nature of work will change.”

António Guterres, United Nations Secretary-General
Address to the General Assembly, 25 September 2018
# IMO MASS Scale

<table>
<thead>
<tr>
<th>DEGREE</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>ONE</td>
<td>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.</td>
</tr>
<tr>
<td>TWO</td>
<td>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.</td>
</tr>
<tr>
<td>THREE</td>
<td>Remotely controlled ship without seafarers on board. The ship is controlled and operated from another location. There are no seafarers on board.</td>
</tr>
<tr>
<td>FOUR</td>
<td>Fully autonomous ship. The operating system of the ship is able to make decisions and determine actions by itself.</td>
</tr>
</tbody>
</table>

Adapted from MSC 100/WP.8, IMO (2018).
Future Regulatory Developments?

- The roadmap for a “goal-based” MASS Code has been developed to be further implemented through the work plan in the following MSC sessions:

<table>
<thead>
<tr>
<th>MSC Session</th>
<th>Work Plan</th>
</tr>
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<tbody>
<tr>
<td>MSC 106, November 2022</td>
<td>- Consideration of key principles and common understanding of the purpose and objectives for the new instrument&lt;br&gt;- Commence consideration of the common potential gaps and/or themes identified during the Regulatory Scoping Exercise (RSE) starting with the high priority items&lt;br&gt;- Commence development of glossary/terminology, to be further developed throughout the process of drafting&lt;br&gt;- Commence consideration of the scope and framework of the mandatory and/or non-mandatory instrument to be developed&lt;br&gt;- Commence development of a non-mandatory goal-based MASS Code</td>
</tr>
<tr>
<td>MSC 107, 1st half 2023</td>
<td>- Continue consideration of potential gaps, glossary/terminology or identifying issues, if necessary&lt;br&gt;- Continue the development of the non-mandatory MASS Code&lt;br&gt;- Consider the impact and identify changes to existing IMO instruments and make recommendation on how to address the changes to those instruments, as appropriate&lt;br&gt;- Consider the involvement of sub-committees</td>
</tr>
<tr>
<td>MSC 108, 1st half 2024</td>
<td>- Continue consideration of potential gaps, glossary/terminology or identifying issues, if necessary&lt;br&gt;- Continue the development of the non-mandatory MASS Code&lt;br&gt;- Decision on the means to adopt the mandatory instrument (Code): implementation through one Convention or through several conventions&lt;br&gt;- Finalize the non-mandatory MASS Code as annex to a draft MSC resolution&lt;br&gt;- Consider the procedures for amending existing IMO instruments</td>
</tr>
<tr>
<td>MSC 109, 2nd half 2024</td>
<td>- Finalization and adoption of the new non-mandatory MASS Code&lt;br&gt;- Finalization of the draft mandatory MASS Code, based on the approved non-mandatory MASS Code&lt;br&gt;- Finalization and approval of amendments to existing instruments necessary for the entry into force of the new instrument&lt;br&gt;- Identification of future work</td>
</tr>
<tr>
<td>MSC 110, 1st half 2025</td>
<td>- Adoption of a mandatory MASS Code and associated Convention(s) giving effect to the new MASS Code&lt;br&gt;- Adoption and/or final approval of amendments to existing instruments necessary for the entry into force of the new instrument&lt;br&gt;- Finalize the review of existing IMO instruments with a focus on those classified as “High-priority” during the RSE; and agree on remaining future work and the way forward</td>
</tr>
</tbody>
</table>

The Committee agreed to establish an intersessional correspondence group to begin development of a non-mandatory goal-based MASS Code, and work will progress at MSC 106 (Nov-2022). The plan as currently set forth is aimed toward entry into force of a mandatory MASS Code by 1 January 2028.
A Few Definitions?

- The majority of literature on current technological developments and research use “unmanned” and “autonomous” ships interchangeably!

- An unmanned ship is one which has no crew or human operator on-board (how will we intervene if/when things go wrong?)

- This type of ship may be controlled or monitored remotely from the shore or another mobile station (i.e. another vessel)...
A Few Definitions?

- An “autonomous” ship, by contrast, is one which is equipped with (suitable) systems that can steer the ship and make decisions about any change in control settings **without human intervention!!!**

- The use of Artificial intelligence (AI) can deliver the necessary decision supporting tool...

- “Autonomous” ships may be manned or unmanned!
Points to note:

• The shipping industry is following a “risk adverse” behaviour; it is more likely to follow a step-by-step pace of change rather than a very abrupt one!

• The regulatory discussion of Maritime Autonomous Surface Ships (MASS) and the implementation efforts of the E-Navigation Strategy by the IMO are two indicative examples that shipping has already entered the “Era of Digitalization”!

• A certain level of disruption for “Jobs and Skills”!!!

• Applications of “Artificial Intelligence” and “Robotics” will work together with humans and complement their efforts (“partners”, not competitors)…

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Summary & Conclusion

- Digitalization provides new opportunities to enhance the productivity and efficiency of shipping operations beyond their traditional limits...

- A reduced number of crew is already the norm in today’s partially automated socio-technical system on board; crew number will be further reduced!!!

- There will be periods when unmanned (autonomous or remote controlled ships) ships will operate together with regular “manned” ships; these mixed traffic scenarios seem to be especially challenging in terms of safety (issue of confidence/trust).

- What about the “efficiency” of the vessel traffic flow?
Autonomous Vessels and AI?

• AI can be defined as the effective simulation of human intelligence processes by machines, especially a certain number of relevant computer systems.

• Indicative examples of AI include expert systems, natural language processing, speech and/or image recognition, as well as machine vision!

• Today, it is clear that the hardware element of sensors on board contemporary ships has already “exhausted” the room of further improvement; the use of advanced software applications and utilisation of AI tools to improve more the capabilities of the various systems used to support the conduct of navigation seems can be viewed as the best alternative way forward.
Autonomous Vessels and AI?

- AI tools can pave the way towards “real” autonomous systems and eventually to (fully) unmanned ships.
- In the not so distant future, “humans” and “machines” will effectively collaborate together in the same working environment...
- Image and/or Speech Recognition applications are looking today as the most promising solutions; at the same time, there still challenges that must be resolved!
“Real” Autonomous Vessels?

- Systems that will be able to make decisions by “themselves”, requiring no human input.
- Building, improving and running AI applications requires immense computing power; a Cloud-based architecture offers that in a flexible and scalable environment (at relatively low-cost and without huge initial investments).
- Big data is a prerequisite for AI and AI is the solution to process unstructured data and derive insights from it.
THANK YOU!