



New skills and new training – Where will our employees end up?

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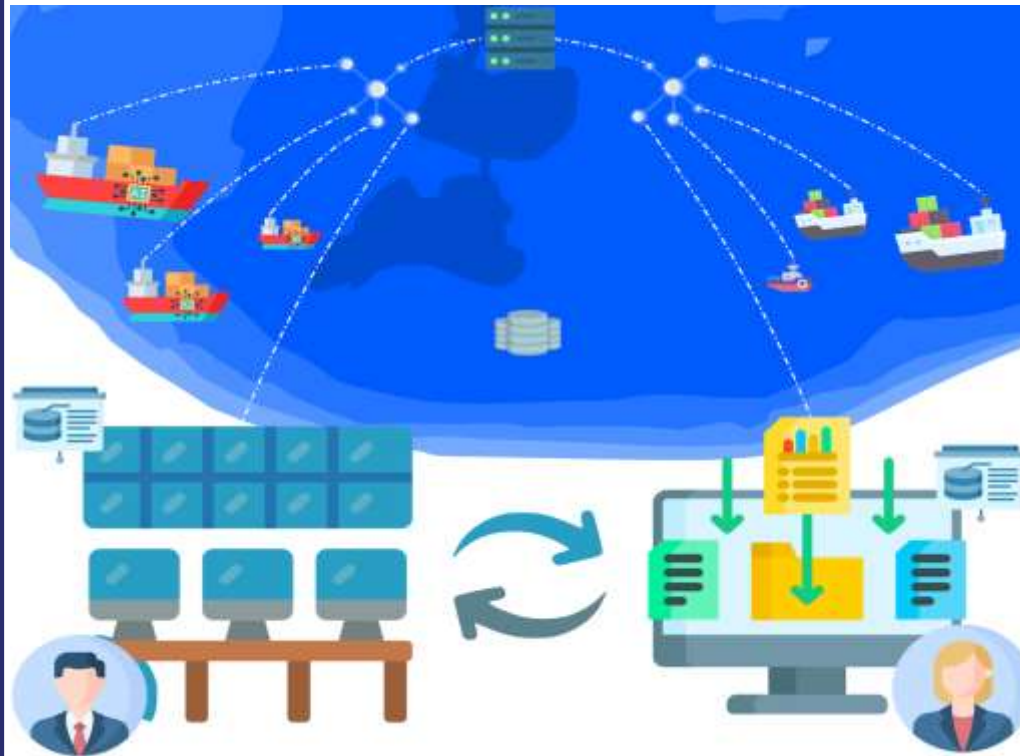
Navigating the Future of European Waters with Autonomous Innovation

7 November 2023, Rotterdam



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Autonomous Ships Ecosystem



	Own ship(s) AL4
	Conventional ship(s)
	Tug boat(s)
	AIS system
	Connectivity
	Real data (bathymetry, weather conditions, sea state)
	Virtual data (bathymetry, weather conditions, sea state)
	RCC (situation awareness, path following, collision avoidance)
	iVTS (situation awareness, traffic flow scenarios generation, op
	RCC to VTS (actual and intended path)
	VTS to ROC (recommended path, guidance on obstacle avoidar
	Human machine interactions
	Ship operators
	Port operators



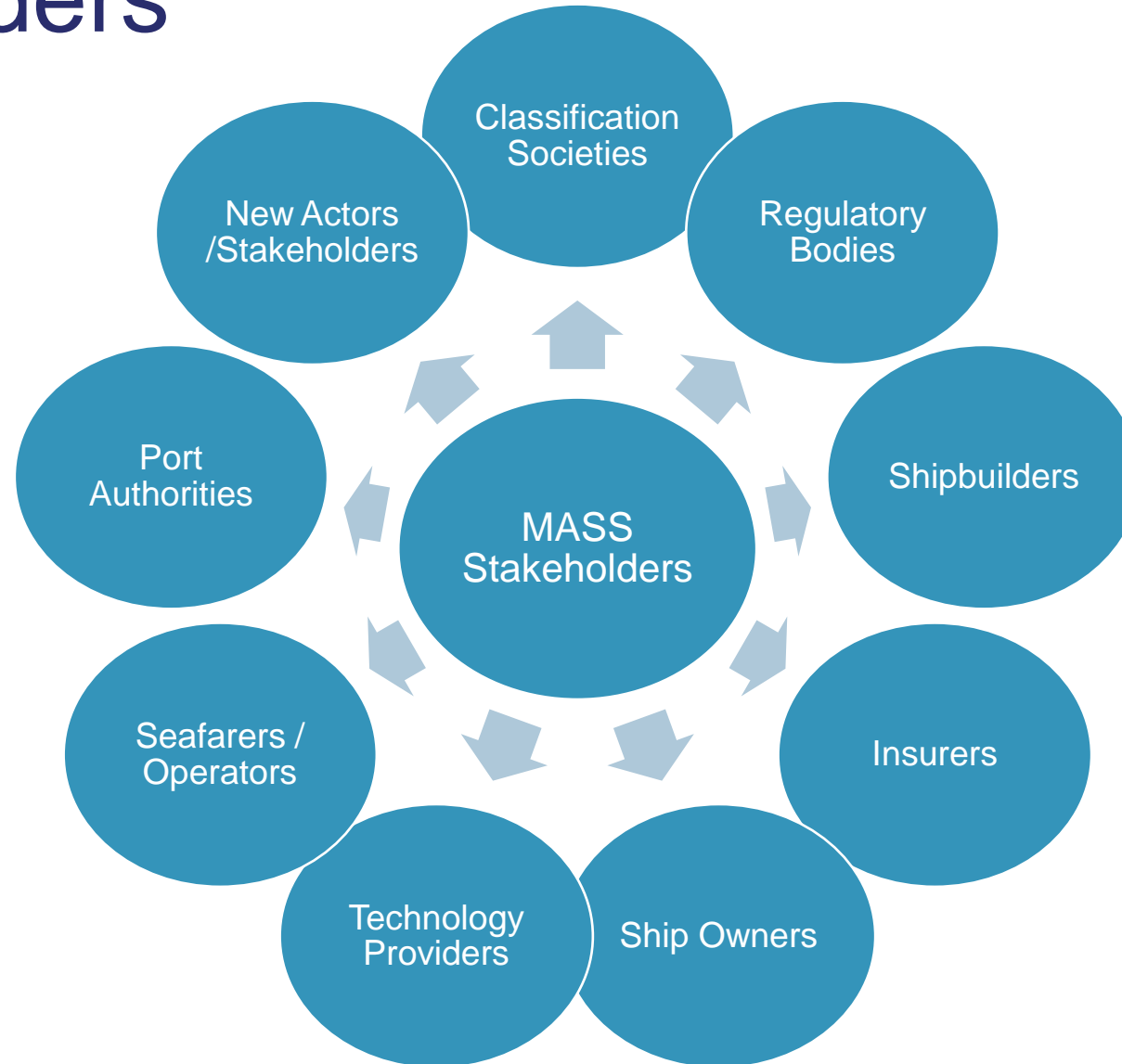
MASS Training



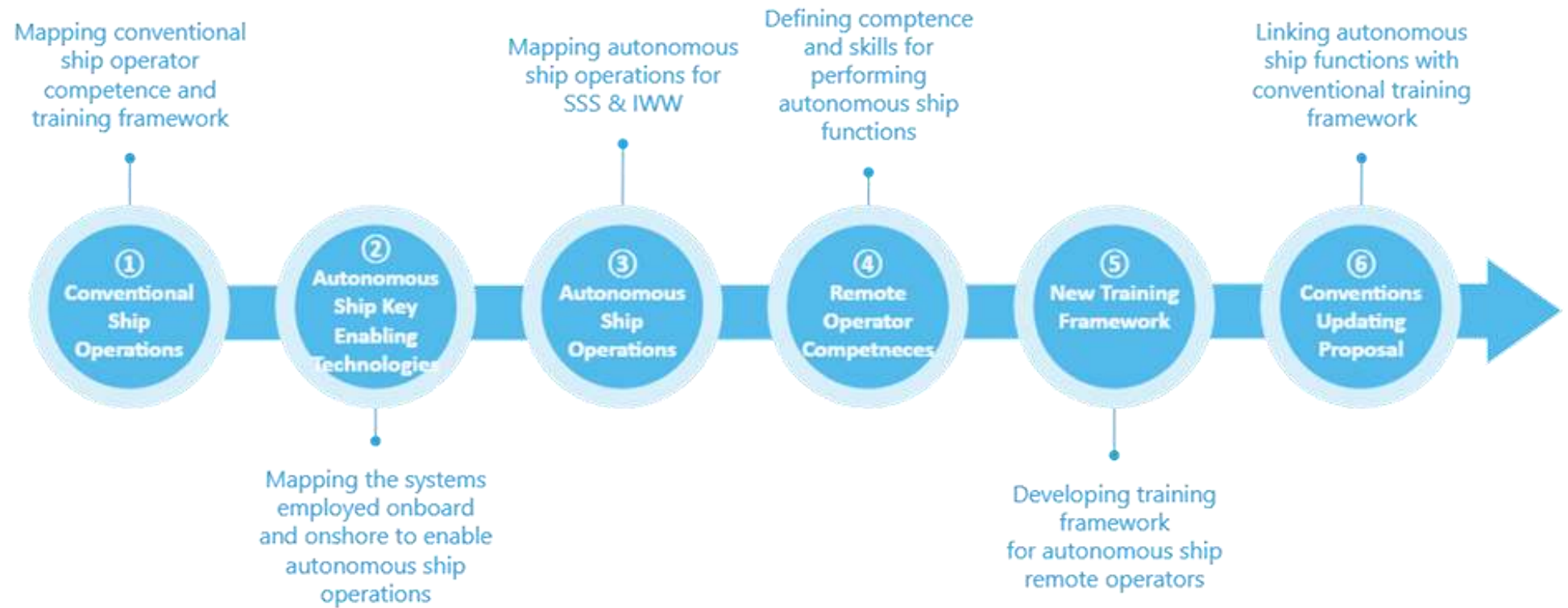
Phases	Stakeholders	Tasks / Activities	Additionally Required Skills	Training Providers
Design	Ship Owners, Technology Providers	Concept Design, Basic Design, Detail Design	Autonomous Systems/KETs Regulations for MASS	Universities
Approval & Certification	Regulatory Bodies, Classification Societies	Approvals, Inspections, Surveys	Autonomous Systems/KETs Regulations for MASS Autonomous Operations	Universities, Training Institutes, Class Societies, Regulators
Building	Shipbuilders, Technology Providers	Procurement, Construction, Installation, Commissioning	Autonomous Systems/KETs	Training Institutes, Technology Providers
Operation	Seafarers / Operators, Insurers, Port Authorities	Navigation, Cargo Operation, Maintenance	Autonomous Systems/KETs Autonomous Operations	Maritime Academies, Training Institutes, Technology Providers



Stakeholders



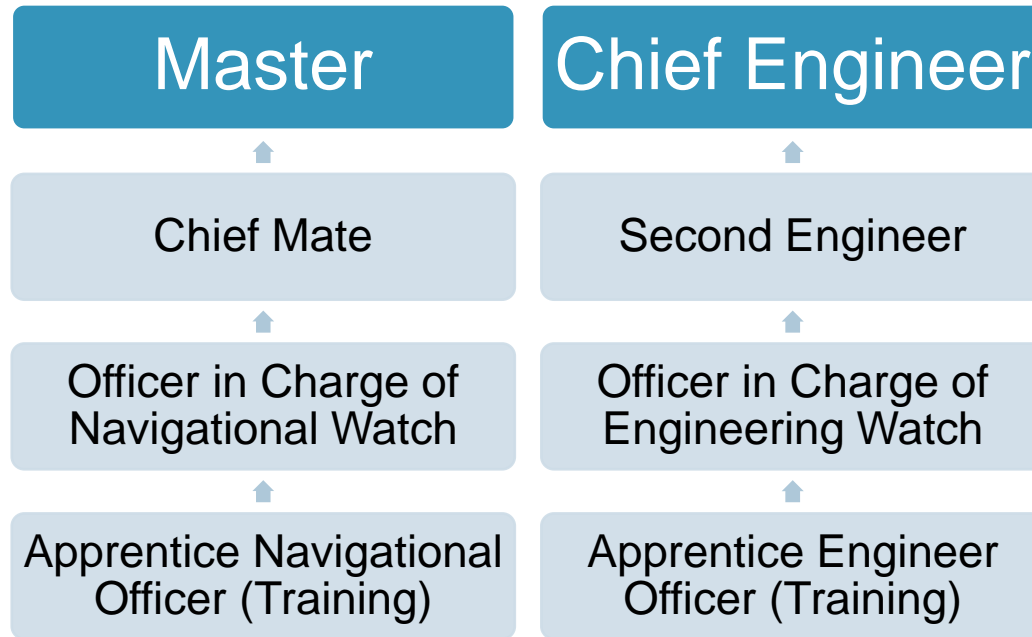
Training framework development





Operators roles

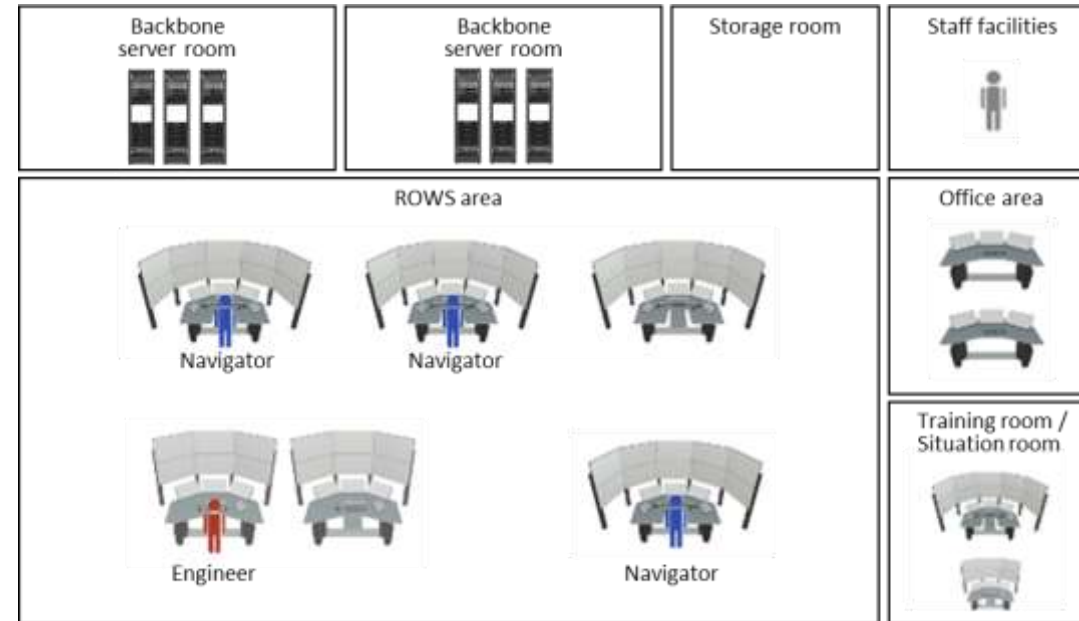
Conventional Ships



Navigators: Navigation, Bridge Watchkeeping, Deck/Cargo Operations

Engineers: Machinery Operations, Engine Room Watchkeeping, Maintenance

Autonomous Ships



Remote Operators: Operation Planning, Monitoring, Remote Control, Fallback Handling

Onboard Crew: Emergency Response

Maintenance teams: Maintenance at ports



Required Skills for ROC/RCC Operators



Remote Operators

- **Operation Planning**
 - Knowledge/Experience of ship operations (Navigation, Deck, Machinery, and Cargo)
- **Remote Monitoring & Control**
 - Digitalised information interpretation
 - Computer/Software management skills
- **Fallback Handling**
 - Decisiveness & Quick-thinking skills

Crew

- **Emergency Response**
 - Knowledge/Experience of ship operations (Navigation, Deck, Machinery, and Cargo)

Common Requirements

- Team-working Skills
- Communication Skills



Training framework – Competences and Skills for RCC Operators



Competence	Knowledge, understanding and proficiency	Methods for demonstrating competence	Criteria for evaluating competence	Covered by existing trainings / new training is required
Electronic equipment functionality	Knowledge of electronics Knowledge of electric equipment operations	Written/Practical Examination	The condition of electronic equipment is accurately checked. Proper actions are taken to maintain the electronic equipment availability.	New training courses are required for the new position (Marine IT officer, computer scientist)
Computer systems operation	Computer literacy Knowledge of software, hardware	Written/Practical Examination	The condition of computer system is accurately monitored and managed. Proper actions are taken to maintain the computer system availability.	
Management of Connectivity (Router), communications (Wi-Fi, 4G, 5G), Networks (LAN, VPN), Cloud computing	Knowledge of Information Technology Computer literacy	Written/Practical Examination	Vessel system is well connected with shore-based systems. Proper actions are taken to maintain the vessel connectivity.	



Training framework

Training	Duration	Priority	Potential training provider / accreditor body	Characteristics
Software-based remote navigation including: camera operations, Area surveillance, voyage management	5 days	High	Automated navigation system provider	Interpreting video and sensing data Customisation/familiarisation on sensors and use of pertinent technologies Visualisations, sound Interpretation of surrounding area Manage the voyage with remote systems Understanding floating mechanism at sea
Remote Engine room operation	3 days	Medium	Automation system provider	Intelligent machinery management, spare/store management Bunker planning Electric power management
Ship remote controls including: Navigation, Deck operation, Cargo operation,	3 days	Medium	Automation system provider	Remote control functions Remote control interface familiarisation Caro space monitoring Machinery space monitoring

Machinery operation				Ballast system operations during cargo/bunkering operations
Advanced Communication Systems	5 days	Medium	Communication system provider	Communication with Automatic systems Global communication Degradation of communication Ship connectivity and communication system Multiple communication system including redundancy
Remote ISPS system	5 days	High	Local authority Autonomous ship operating company	Remote response for unauthorised access
Remote Emergency response including: Collision, grounding, Machinery failure, blackout, flooding and firefighting	5 days	High	Local authority Automation system operating company	Remote risk management Remote damage mitigation Remote machinery recovery Remote firefighting procedure
Remote supports for surrounding ships	3 days	Mid	Local authority	Remote Area surveillance Remote Lifesaving equipment operation Remote Search and Rescue
Remote pollution prevention	5 days	Mid	Local authority	Pollution monitoring Remote antipollution procedure Remote emission monitoring including FO & LO consumption Remote waste monitoring including bilge and ballast water

STCW Amendments for Navigators

Operations	Conventional training coverage	Amendments for crewless autonomous shipping
Navigation	Onboard navigation skills (Geographical and Celestial Navigation with Electronic navigational aids)	Remote navigation (Digital Bridge familiarisation / Remote control properties / Global communication)
Deck Operation	Berthing and Unberthing Deck machinery operation	Remote mooring system (line throwing, winch operation, Pipe connection, cable connection) Remote Deck machinery operations
Emergency	ISPS	Remote ISPS (Assess block / Hijacking) Cyber Security (Cyberattack)
	Emergency Responses	Remote damage monitoring and control Remote system recovery Remote firefighting
Environment protection	Ballast - Pollution prevention, Operation records.	Remote discharge monitoring Remote troubleshooting Record waste management
	Antipollution	Remote equipment operation (Oil absorbent) Report procedure
Communication	Localised communication (Radio/VHF)	Global communication system Redundant communication system
IT Operation	-	Intelligent systems Software version check Firewall, Network management



MASS Training framework



Phases	University of Strathclyde: specialised MSc course			Required	Training Providers
Design	<p><i>Marine Engineering with specialisation on AMV</i></p> <p>4 MSc modules (also offered as CPDs)</p> <p><i>digital twins & AMV design, data-analytics & ML engineering applications, modelling & simulation, cyber-security</i></p>			ms/KETs SS	Universities
Approval Certification		Surveys	Autonomous Operations	ms/KETs SS	Universities, Training Institutes
Building	Shipbuilders, Technology Providers	Procurement, Construction, Installation, Commissioning	Autonomous Systems/KETs		Training Institutes, Technology Providers
Operation	Seafarers / Operators	Navigation, Cargo Operation, Maintenance	Autonomous Systems/KETs Autonomous Operations		Maritime Academies, Training Institutes, Technology Providers

**AUTOSHIP D7.2:
Training framework**



Closure

Who will train the trainers?





Thank you

Rotterdam Ahoy
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