Cyber-SHIP Lab

SECURING MARITIME

Nor Shipping 2022

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Software
Hardware
Information
Protection

- **Hardware-based** platform (or testbed) cyber risk-assesses and audit any ship's bridge
- **Endlessly configurable** research, software development and training facility
- Combines maritime tech with leading-edge cyber security research and practice
- Enhances understanding of maritime systems' cyber vulnerabilities
- **Actionable outputs**: knowledge and tools

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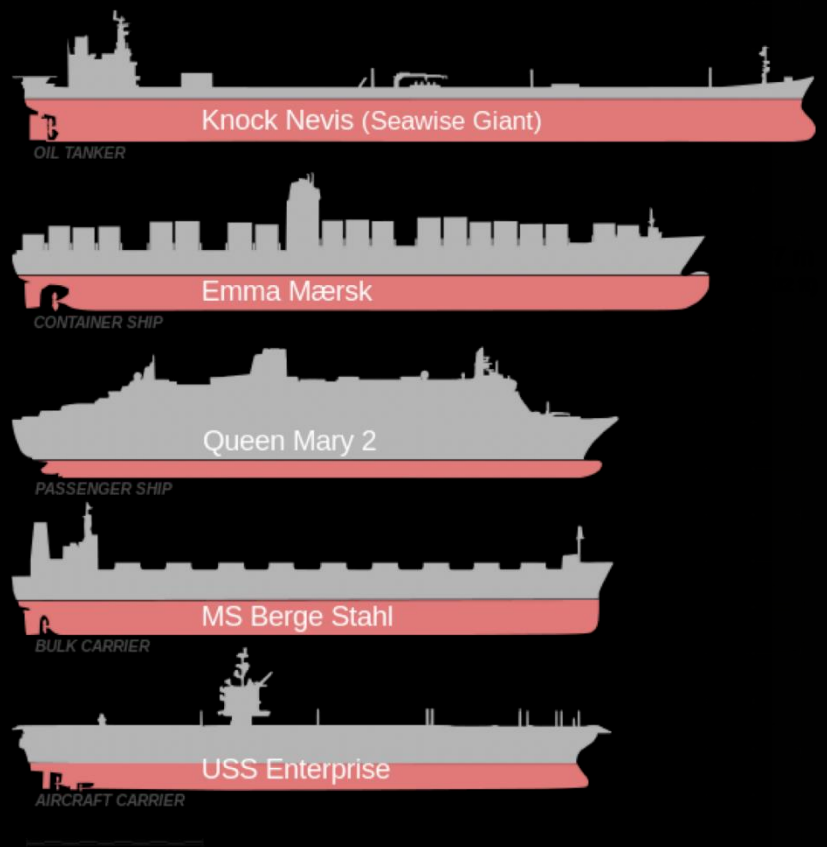
Ships and technology



- Ships have different functionalities
- Ships are equipped with different systems
- Ships travel through different locations
- Attackers have different interests
- Attackers have different resources levels

Each vessel has a dynamic risk profile that changes depending on circumstances and different vulnerabilities

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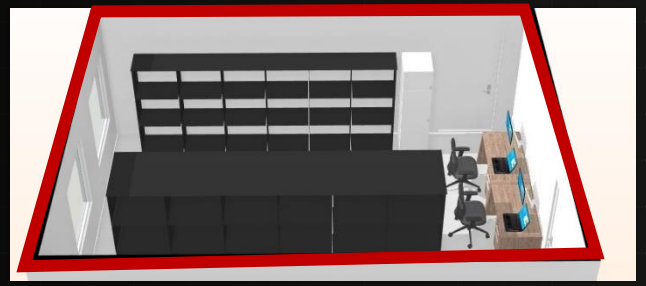

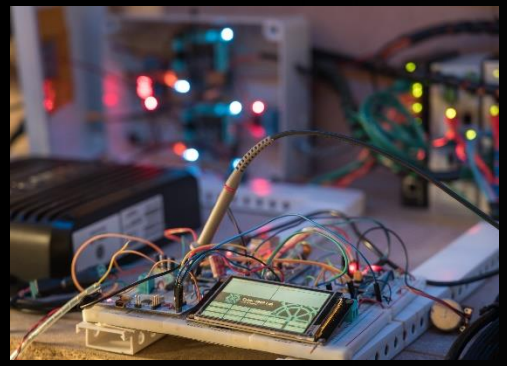

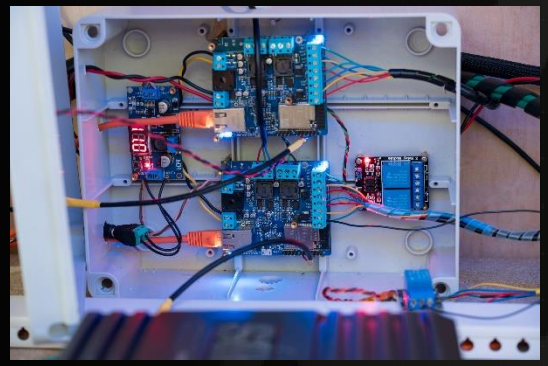

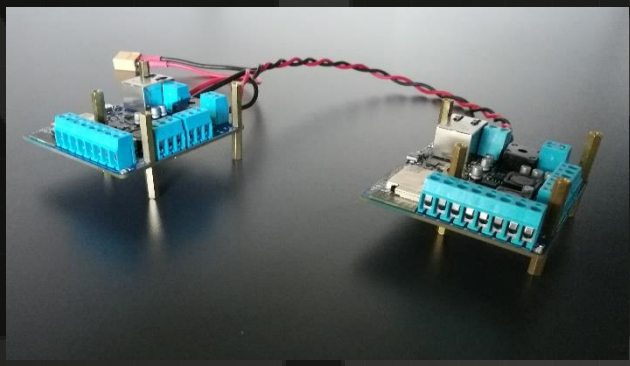

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New Equipment here/arriving very soon

- 3 different **ECDIS** systems (WECDIS WAIS)
- Integrated Wartsila portable simulation
- Networking gear
- Secure storage (physical and digital)
- **Autonomous drones** (1 aquatic, 1 aerial)
- **Satellite connection** (Iridium)
- **AIS** (Automatic identification system) systems
- **VHF** (Very high frequency) Radios
- **PLCs** (programmable logic controller)
- Dedicated industrial Computers
- Reconfigurable **firewall** (different OS)
- New serial to Ethernet converters
- Custom designed electronics interfaces
- Visual and Audio devices for human-machine interactions
- USB Rubber ducky

Pen-testing Audit Suite

- Mostly manual but with **some automation**
- Currently testing on devices in the lab and **finding published vulnerabilities**
- A GUI to **scan the network**, **detect open ports** and generate html report as well as writing to a database
- **Executing exploits** for possible vulnerabilities to check if the execution is successful and how the system deals with it
- **Predicting attack paths**, finding vulnerabilities and obtaining a cyber security maturity level for the ship configuration (Future research)

Configuration System

- Currently researching into **electronically controlled communication links**
- Attempting to **physically switch communication** links through multiplexing techniques.
- Protocols to be switched include (but not limited to) Ethernet, HDMI, USB, RS232, RS485 and CAN bus.
- **Eventually leading to a fully configurable system at the touch of a button**, dynamically and physically linking ship/bridge equipment to create any bridge configuration over the network.
- Looking to expand this research to other sectors such as Aerospace

Projects – EC H2020 Cyber-MAR

- Proposal Title: Cyber preparedness actions for a holistic approach and awareness raising in the maritime logistics supply chain {Cyber-MAR}
- Cyber-MAR is developing an innovate simulation environment for maritime logistics, combining a knowledge-based platform and decision support tool, incorporating novel risk analysis and econometric models.
- 13 Maritime logistics organisations will increase cyber awareness and validate their business continuity management in a six-million Euro Project
- Why ports? A recent hypothetical cyber attack on 15 major ports across Asia Pacific, estimate losses up to £90 billion (see; https://www.lloyds.com/news-and-risk-insight/risk-reports/library/technology/shen-attack-cyber-risk-in-asia-pacific-ports).

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Scenario Demo

- Combination project with **Cyber-MAR** project
- Pulled in expertise in **cargo ship** and **container port operations**

Cyber MAR

Research aims

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Cyber attacks are going unnoticed

- Harden systems from tampering
- Collect forensics to detect attacks
- Use data to create investigation and AI-based intrusion tools
- Assess risks to prioritise vulnerabilities
- Compliance/audit suite—regulator and insurance-ready tools

IT/OT **convergence** significantly increases risks

- Holistic understanding of connected *systems-of-systems*
- Examine OT **and** IT
- Examine security across hardware, software and people

Cyber attacks encroaching into maritime sector

- Smart ports / smart port cities
- Autonomous ships
- Internet-of-things; BYO-devices
- Ship-to-shore and ship-to-ship interactions

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The Plymouth "ecosystem"

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Shipping operators (civil and defence), equipment manufacturers, regulators, insurers

Cyber-range labs

Exploits Tools

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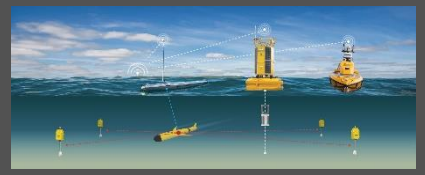
Database

Ship simulators

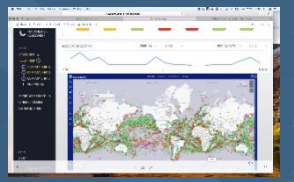
Scenarios Training



Smart Sound

Autonomous/Remote control

Drones MAS



Profiles Reports

MaCRA

Risk assessment

Shipping operators (civil and defence), equipment manufacturers, regulators, insurers

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Thank you

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