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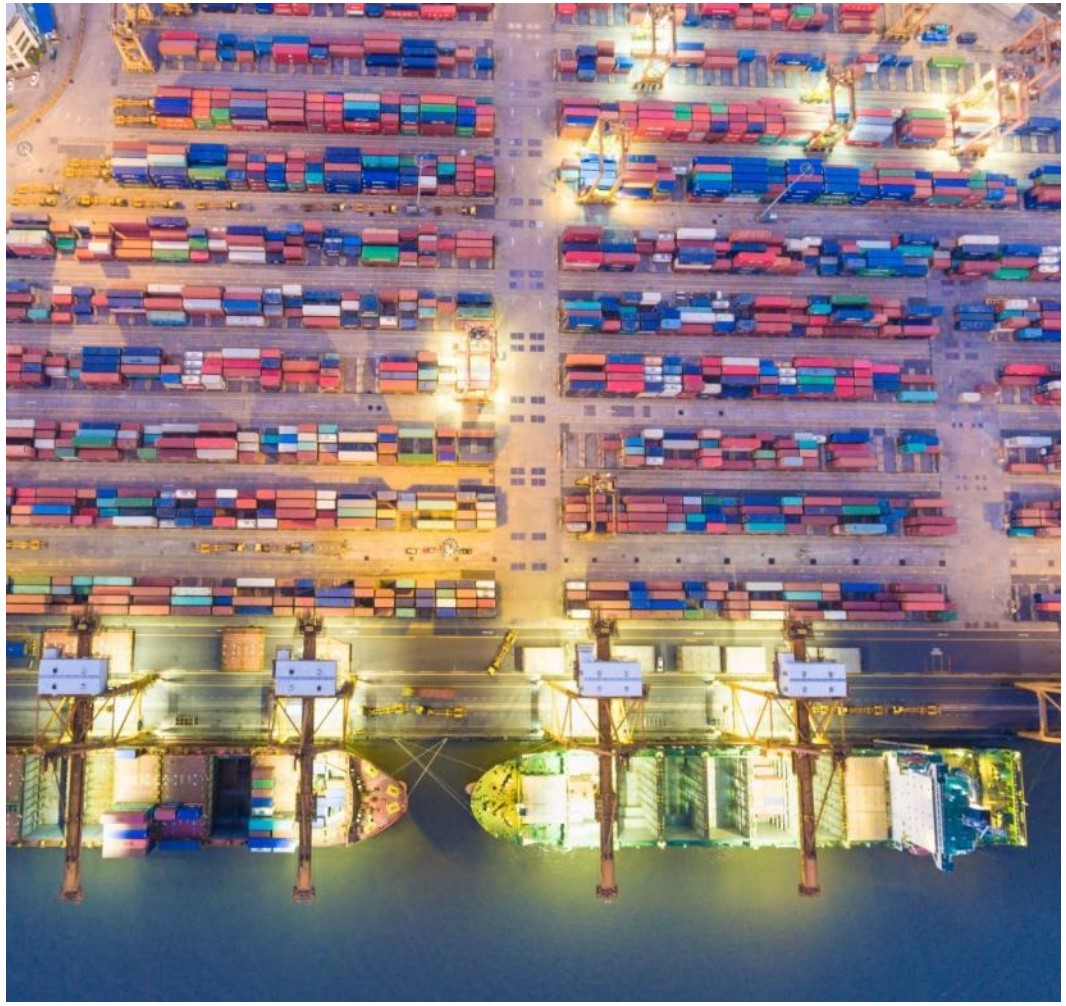
Maritime Cyber Security:

In line with LR Classification

Overview



- Who are we
- Cyber Ships – At present
- Technology
- Existing Ships
- Understand the risks
- Cyber enabled ships Procedure
- Cyber Assessment
- Regulation Challenges
- A view of the future

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Who are we

Who we are
We are a leading global provider of engineering and technology-centric professional services that improve the safety and performance of complex, critical infrastructure for our clients and for society.

Social business
Our profits fund the Lloyd's Register Foundation, a charity dedicated to research and education in science and engineering.

History
Founded in 1760 as a marine classification society.

What sets us apart
Social business
Technical expertise
Independence
Breadth of service
Global reach

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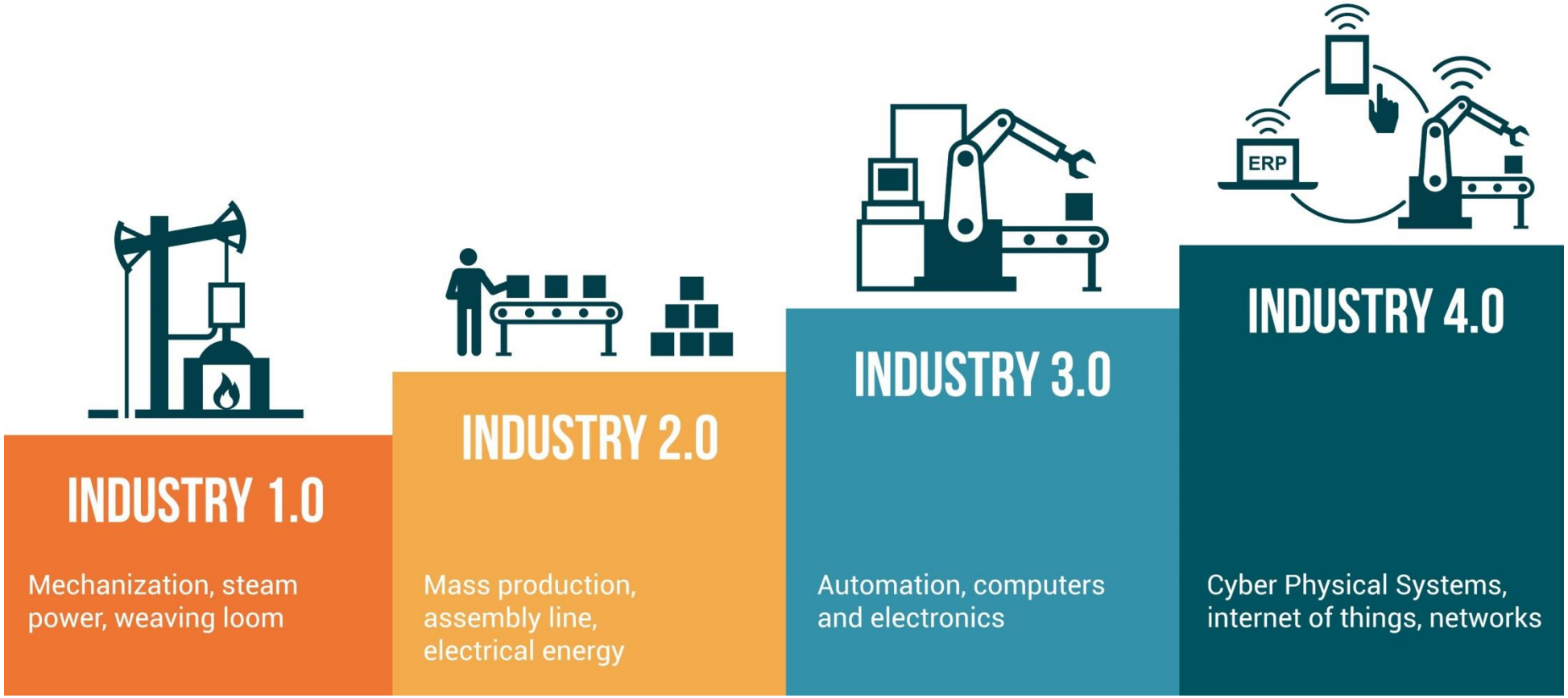
Lloyd´s Register began in the 1st Industrial revolution



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Cyber Ships – At present

- We are at the beginning
- Rapid advance in technology
- Disruptive technology is going to change the industry (Industry 4.0)
- Cost and low resource of personnel are pushing technology forward
- Making ships cyber safe is of paramount importance
- IMO is looking into the challenges

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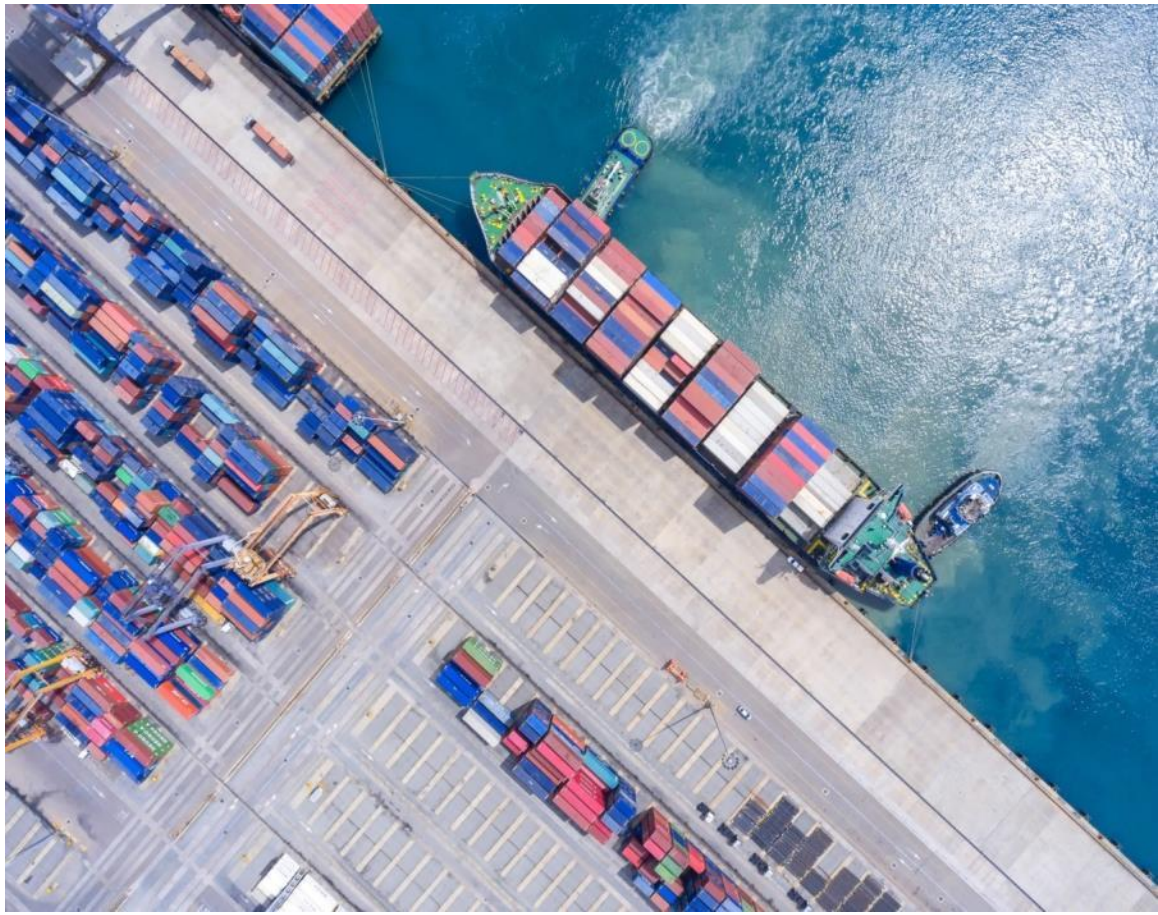
Technology

What we are seeing and what is coming

- Connectivity
- Energy Management and Sustainability
- Cyber Security
- Sensors and Situational Awareness
- Artificial Intelligence



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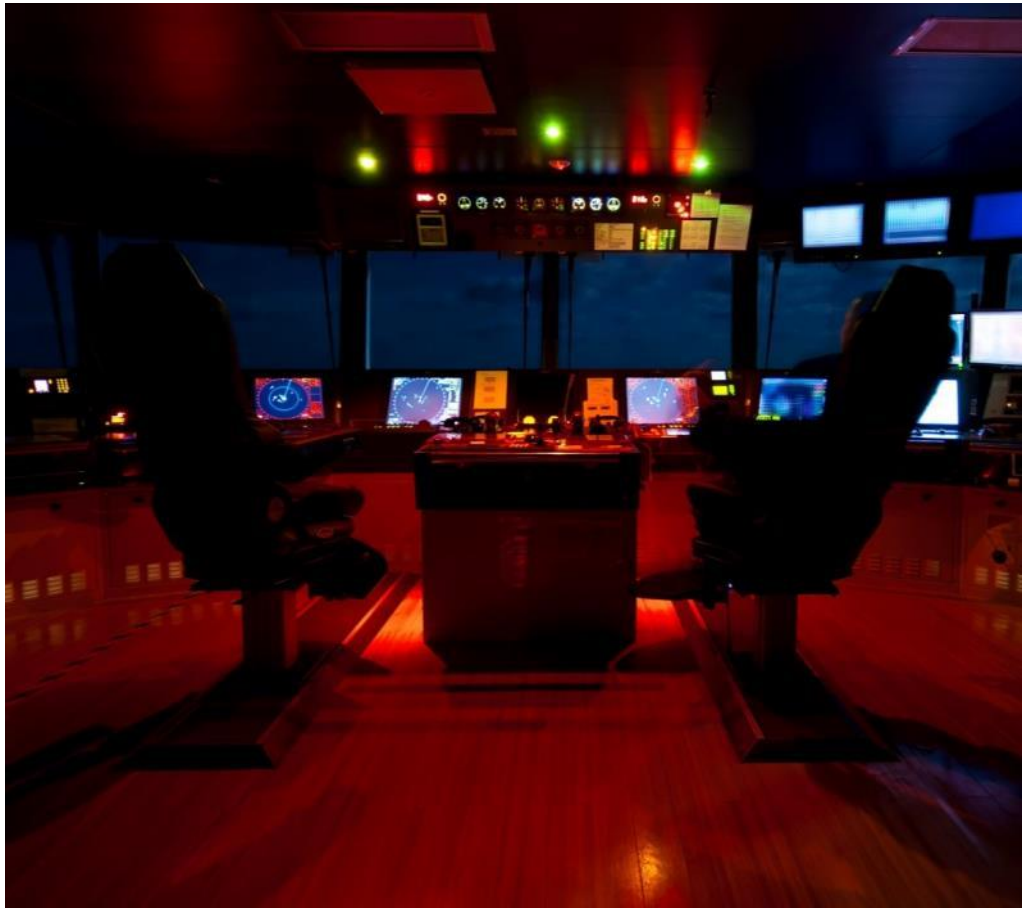
Technology – Cyber Security

- Cyber security needs to protect systems, networks and data
- Cyber attack can disable or take control of manned and unmanned ships
- As connectivity increases so does exposure
- Insurance excludes cyberattack
- Future:
  - Adaptive Security Architectures
  - AI enabled reactive security
  - Maritime must proactively manage the risk

Existing Ships



- Ships are increasing the amount of Cyber enabled systems.
- These include:
- Propulsion, PMS, IAS
- Pumps, ballast tanks
- Emergency Systems

- These systems can be controlled, adjusted and maintained remotely to optimise their functionality.

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Existing Ships – What is different?

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Existing Ships – What is different?

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Existing Ships – They are connected

Understand the Risks

6 Key Areas:

- Consideration of the System
- Consideration between Personal & Systems
- Network & Communication
- Software
- Data security
- Cyber Security

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Cyber Enabled Ships – ShipRight Procedure

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For a safer world

Cyber-enabled ships

ShipRight procedure for assignment cyber descriptive notes for autonomous/remote access ships

A Lloyd's Register guidance document

Version 2.0, December 2017

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Cyber Assessment – Cyber Descriptive notes

Cyber *Scope of cyber functionality* *Scope of cyber assessment* *(Scope of cyber enabled systems)*

Identifies the scope of the cyber enabled system(s)

Identifies the scope of cyber assessment carried out (see 2.4)

Identifies the scope of the cyber functionality provided (see 2.3)

Indicates that one or more of the ship's system(s) are cyber enabled and assessed by LR (see 2.2)

Cyber Assessment – Cyber Descriptive notes

- Cyber SAFE
- Cyber MAINTAIN
- Cyber PERFORM
- Cyber SECURE

Cyber Assessment – Cyber Descriptive notes

SAFE	Systems providing functions essential for the operation of the ship.
MAINTAIN	Systems providing functions for the maintenance of the ship.
PERFORM	Systems providing functions for the optimisation of the ship.
SECURE	Systems providing functions for the security of the ship.

Cyber Assessment - Accessibility levels

AL0

- Manual – no autonomous function

AL1

- On-ship decision support

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Cyber Assessment - Accessibility levels

AL0
- Manual – no autonomous function

AL1
- On-ship decision support

AL2
- On and off-ship decision support

AL3
- 'Active' human in the loop

AL4
- Human on the loop – operator/ supervisory

AL5
- Fully autonomous (& rarely supervised)

Cyber Assessment – Examples

Cyber SAFE AL2 (Propulsion)

Propulsion system cyber-enabled

Cyber access for autonomous/remote monitoring assessed

Cyber access of systems providing essential operational functions provided

One or more of the ship's system(s) are cyber-enabled and assessed by LR

Cyber Assessment – Cyber Descriptive notes

Cyber **MAINTAIN** **AL3** (HVAC)

HVAC system cyber-enabled

Cyber access for remote or autonomous monitoring and adjustment (onboard permission is required, onboard overrise is possible) assessed

Cyber access of systems providing maintenance functions provided

One or more of the ship's system(s) are cyber enabled and assessed by LR

Cyber Assessment – Cyber Descriptive notes

Cyber AL2 SAFE SECURE (Steering)

Steering system cyber enabled

Cyber security of cyber enabled systems assessed

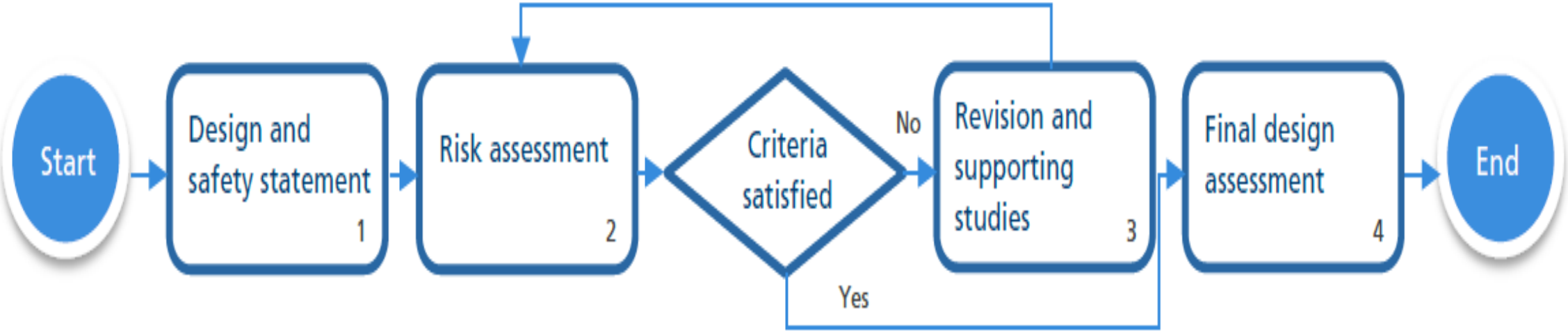
Cyber access of systems providing optimisation functions assessed

Cyber access for remote or autonomous monitoring provided

One or more of the ship's system(s) are cyber enabled and assessed by LR

Cyber Assessment – The Process

- Risk Based Design (RBD) Assessment



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Cyber Assessment – The Process – 4 Stages

- **Stage 1**
- Concept of Operation
- Context of Use
- System operational concept
- Cyber functionality

- **Stage 2**
- Human Interaction
- Data Quality
- System Architecture
- Hardware

- **Stage 3**
- Revisions of projects
- Supporting studies

- **Stage 4**
- Final Design Assessment

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Cyber Assessment – Minimise the Risk

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Cyber-enabled ships

ShipRight procedure for assignment cyber descriptive notes for autonomous/remote access ships

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Version 2.0, December 2017

- 1. Understand the required notation
- 2. The requirements of the ship
- 3. The design concept
- 4. Evaluation process to consider the following:
- Consideration between Personnel and Systems
- Software
- Security of Data
- Executive Decisions
- Cyber Security

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Regulation Challenges

- Regulation of Emergent Technology
  - **Regulation lags technology**
- Overcoming the Psychology of Regulation
  - **Needs to manage risk not avoid it**
- **Regulation can:**
  - **Safeguard against low cost low quality competition**
  - **Reduced perceived risks to investors**

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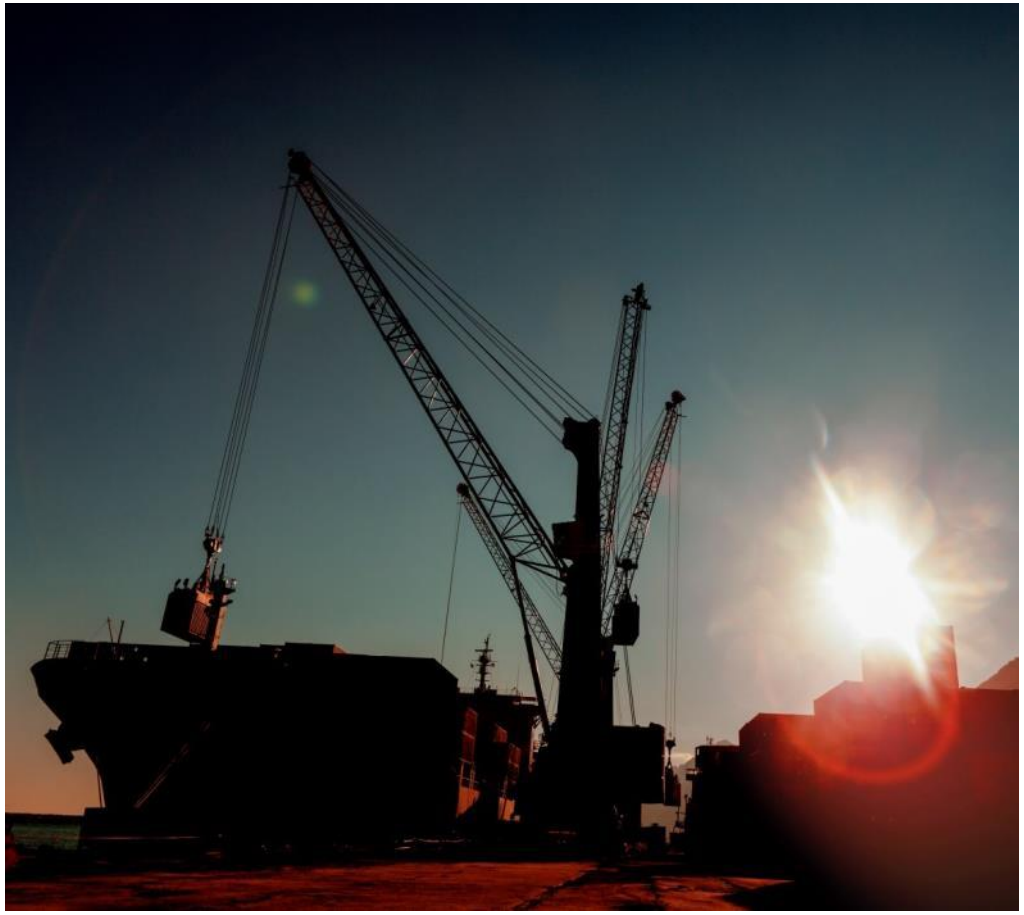
A View of the Future

- Commercial shipping and the advent of ‘Smart Ships’
  - Enhanced Safety
  - Lower Operating Costs
  - Exploiting data and analytics
  - New disruptive business models
- Naval Defence
  - Increasing applications
  - Ethical Issues
  - Skills and Training
- Ocean Space
  - New frameworks for exploration
  - Long term monitoring
  - Access to ocean resources



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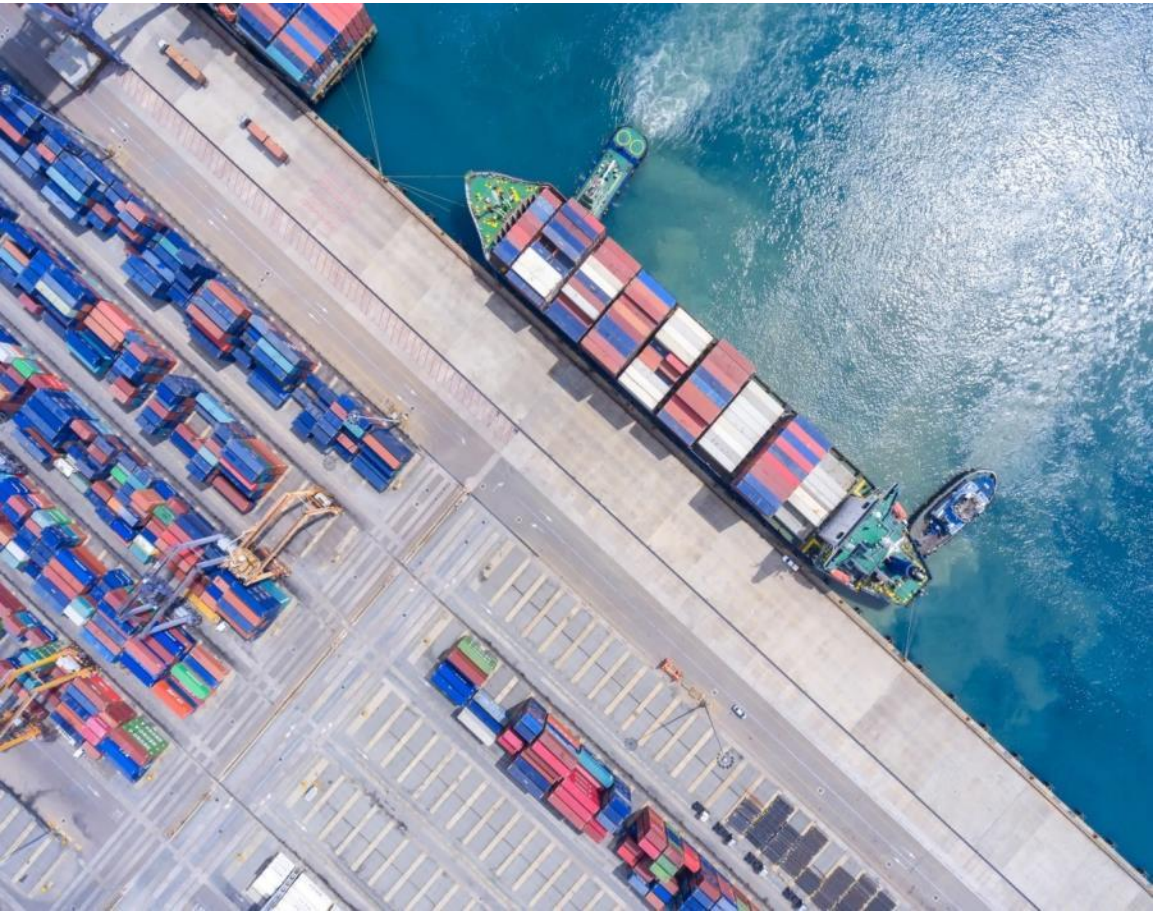
Final Thoughts



- Cyber technology is developing rapidly and these technologies are being used by the maritime world.
- Lloyd's Register can guide ship-owners on the right path for the technological advances to ensure cyber security via the ShipRight Procedure – Cyber enables Ships
- Lloyd's Register uses a risk based method to future proof the safety of the ship and the environment.

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