

# IMO's plan to lead shipping into a new digital era

**National e-navigation and innovation  
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# IMO – the International Maritime Organization

- Specialised UN agency
- Headquarters in UK since 1958
- Annual budget £30+ million
- Secretariat – 265 staff, more than 50 nationalities



## Ten largest contributors to IMO in 2016. Assessed contributions based on flat base rate with additional components based on ability to pay and merchant fleet tonnage.

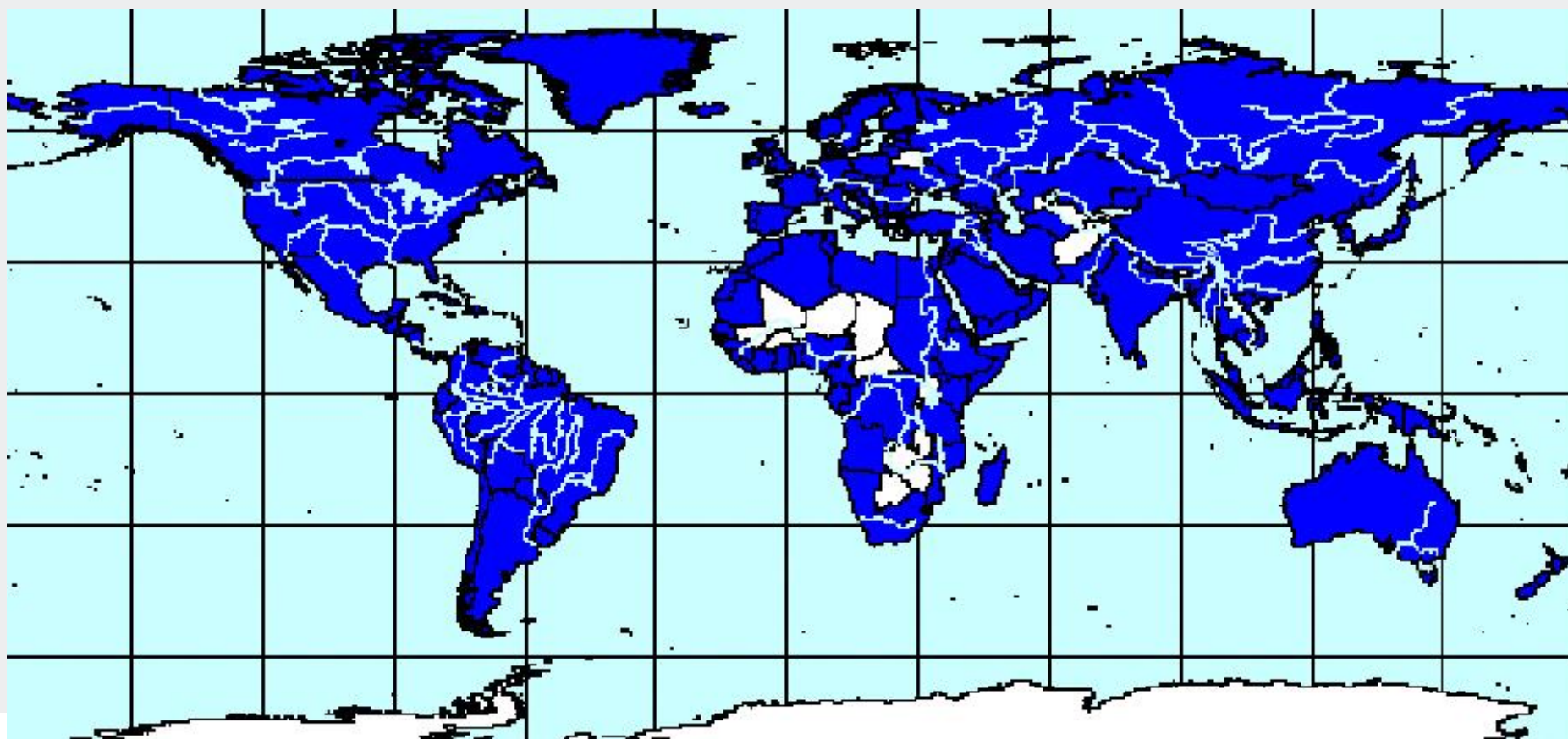
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Panama	£4.95m	16.42%
Liberia	£2.93m	9.72%
Marshall Is.	£2.64m	8.76%
Singapore	£1.83m	6.08%
Malta	£1.32m	4.37%
Bahamas	£1.28m	4.27%
UK	£1.22m	4.07%
China	£1.16m	3.87%
Hong Kong, China	£1.10m	3.65%
Greece	£0.98m	3.25%

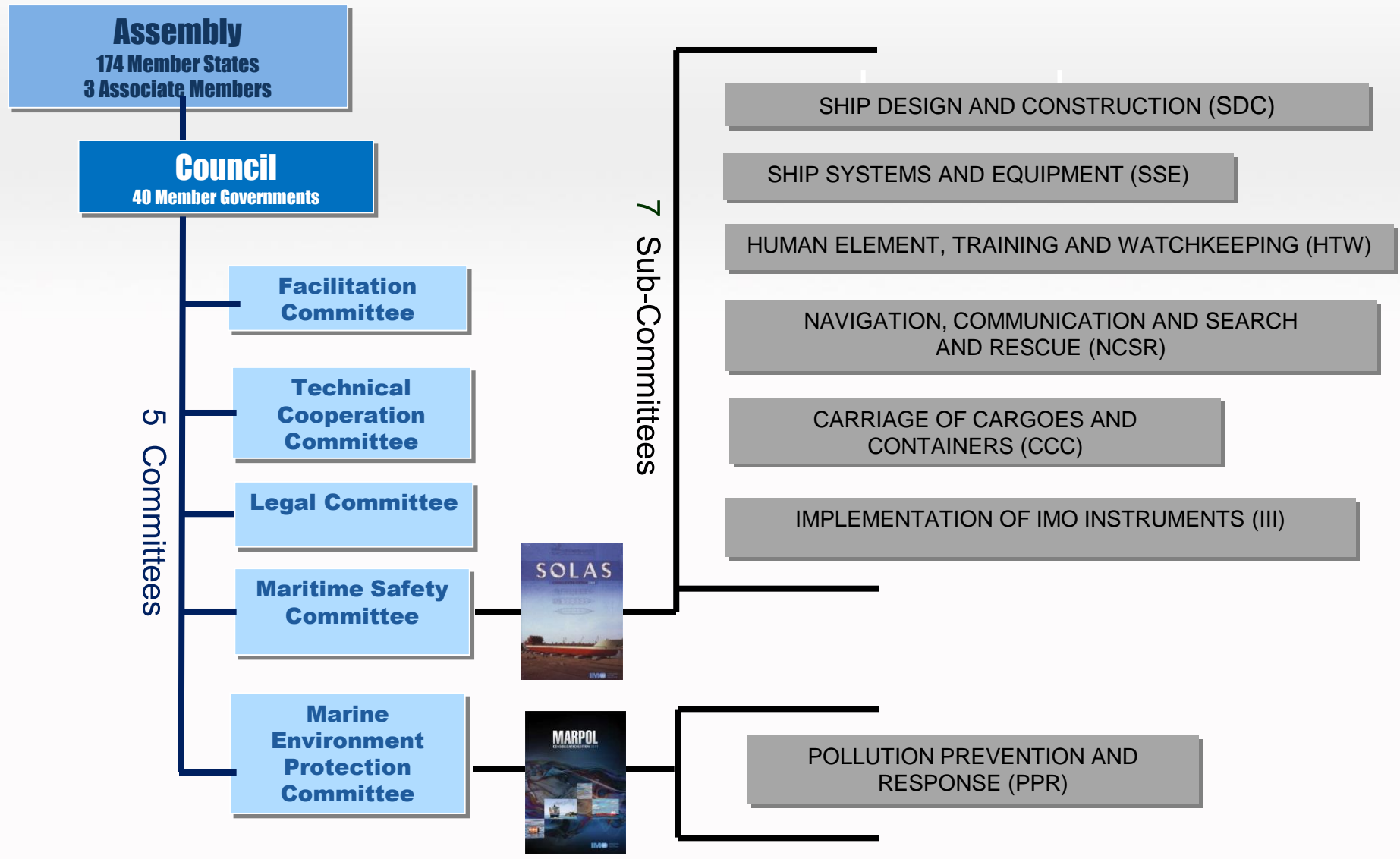
# IMO - global coverage

174 Member States, three associate members

IGOs and NGOs participate as observers



# IMO Structure



# Progress of measures at IMO



- **Proposals for new, or amendments to existing, mandatory instruments - a compelling need** for such amendments should be demonstrated by the proponent(s), and an analysis of the implications of such amendments, particularly those with far-reaching implications and consequential proposals for other amendments, having regard to the costs to the maritime industry, the legislative and administrative burdens involved and benefits which would accrue therefrom, should be provided.....

# Contents of this presentation

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- IMO's regulatory scoping exercise on Maritime Autonomous Surface Ships (MASS).
- E-navigation and the Strategy Implementation Plan (SIP), including developments on ship communications and data management.
- Cyber security and maritime cyber risk management.

# Autonomous ships

## IMO's regulatory scoping exercise on MASS

The ninety-eighth session of the Maritime Safety Committee (MSC 98), agreed to work on a "**Regulatory scoping exercise for the use of Maritime Autonomous Surface Ships (MASS)**", with a target completion year of 2020.



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**IMO takes first steps to address autonomous ships**



# Autonomous ships

## IMO's regulatory scoping exercise on MASS

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### MSC 98 (June 2017)...

- The Organization should be proactive and **take a leading role on this issue**;
- The regulatory scoping exercise would be a complex issue that affected the whole Organization and impacted on many areas including **safety, security, interactions with ports, pilotage, responses to incidents and marine environment**;
- The need to take into consideration the **human element** and **legal aspects**;

# Autonomous ships

## IMO's regulatory scoping exercise on MASS

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### LEG 105 (April 2018)...

Agreed also to include a new output entitled "**Regulatory scoping exercise and gap analysis of conventions emanating from the Legal Committee with respect to Maritime Autonomous Surface Ships (MASS)**", with a target completion year of 2022.

- Limited to conventions under the purview of the LEG Committee to complement the work of MSC;
- Provision of legal assistance to other committees, where appropriate;
- Need for a coordinated approach.

# Autonomous ships

## IMO's regulatory scoping exercise on MASS

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### MSC 99 (May 2018)...

- 19 documents considered;
- Working Group on MASS established;
- **Preliminary framework** for the regulatory scoping exercise on MASS agreed;
- Preliminary framework to be tested by a Correspondence Group, results to be reported to MSC 100;
- MSC 100 to consider proposals related to the development of **guidance for MASS trials**.

# Autonomous ships

## IMO's regulatory scoping exercise on MASS

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### Preliminary framework

**Aim:** to determine how safe, secure and environmentally sound **MASS operations** might be addressed in IMO instruments.

For the purpose of the regulatory scoping exercise, MASS is defined as:

**“a ship which, to a varying degree, can operate independent of human interaction”**

# Autonomous ships

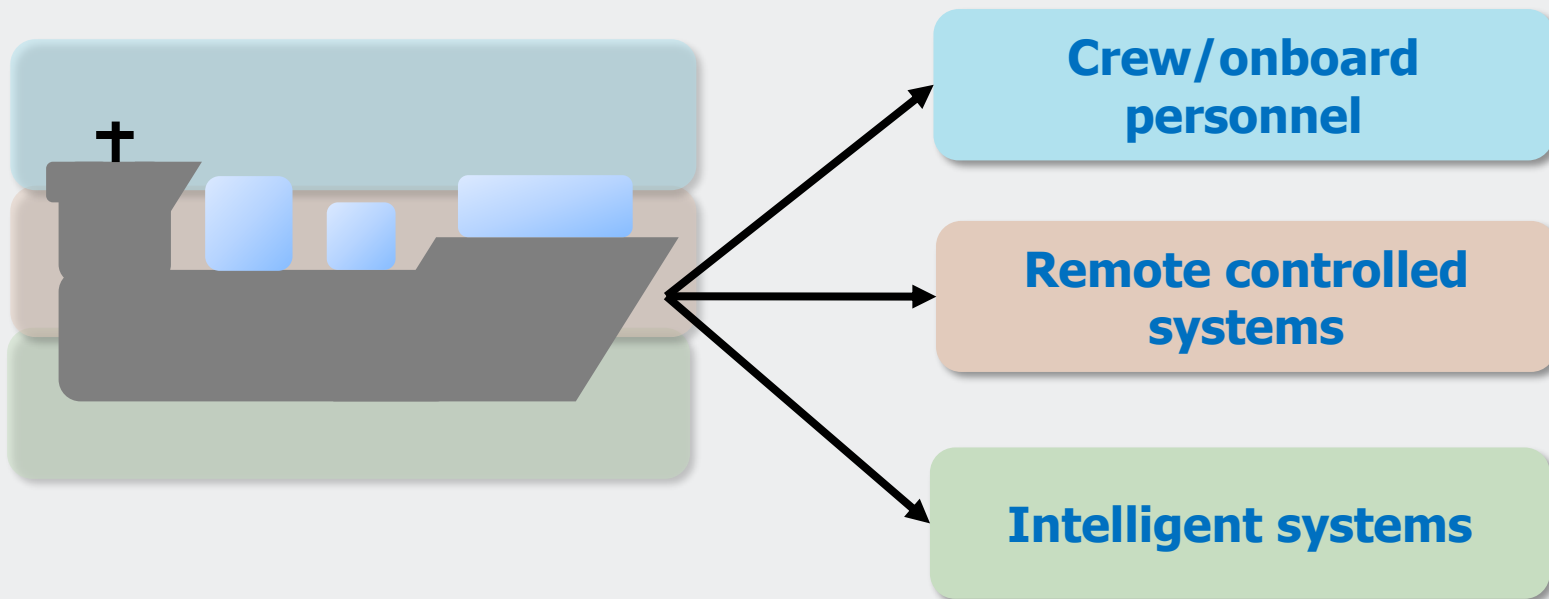
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## Degrees of autonomy

- 1** ***Ship with automated processes and decision support.*** Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated.
- 2** ***Remotely controlled ship with seafarers on board.*** The ship is controlled and operated from another location, but seafarers are on board.
- 3** ***Remotely controlled ship without seafarers on board.*** The ship is controlled and operated from another location. There are no seafarers on board.
- 4** ***Fully autonomous ship.*** The operating system of the ship is able to make decisions and determine actions by itself.

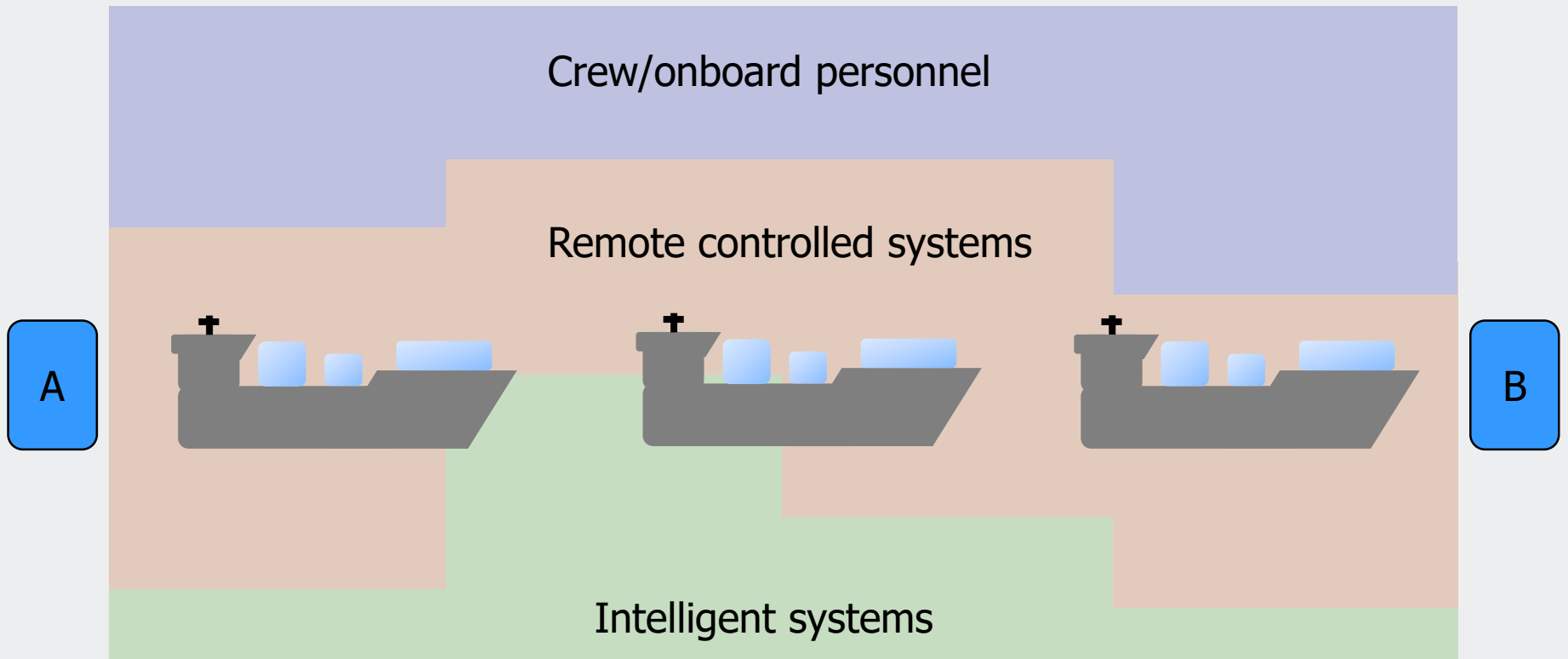
# IMO regulatory scoping exercise on MASS

Degrees of autonomy



# Autonomous ships

## Definition and degrees of autonomy



# Instruments to be considered

COLREG 1972  
CSC 1972  
LL 1966  
LL PROT 1988  
SAR 1979  
SOLAS 1974  
SOLAS AGR 1996  
SOLAS PROT 1978  
SPACE STP 1973  
STCW 1978  
STCW-F 1995  
STP 1971  
TONNAGE 1969

MARPOL 73/78  
FAL 1972  
SUA 2005  
SAVAGE 1989  
OPRC 1990  
CLC 1969  
NUCLEAR 1971  
HNS 1996

...





# Autonomous ships

## IMO's regulatory scoping exercise on MASS

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### MSC 99 ...

- **Not a “drafting exercise”;**
- Need for application of a consistent framework by all bodies involved to ensure consistent results;
- The work on MASS should be **user-driven and not technology driven;**
- Take a holistic approach, taking into account the **human element, procedures and technology;**
- MSC to review only instruments under its purview;
- Invited **MEPC and the FAL Committee to contribute;**
- MSC to take a coordinating role;

# Autonomous ships

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## Methodology

**First step:** identify provisions in IMO instruments which, as currently drafted:

- .1 **apply** to MASS **and preclude** MASS operations; or
- .2 **apply** to MASS **and do not preclude** MASS operations and require no actions; or
- .3 **apply** to MASS **and do not preclude** MASS operations **but may need to be amended or clarified**, and/or may contain gaps; or
- .4 **have no application to MASS operations.**

# Autonomous ships

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## Methodology

**Second step:** conduct an analysis to determine the most appropriate way of addressing MASS operations, taking into account, inter alia, human element, technology and operational factors, by:

- .1 **equivalences** as provided for by the instruments **or developing interpretations**; and/or
- .2 **amending** existing instruments; and/or
- .3 developing **new instruments**; or
- .4 **none of the above**, as a result of the analysis.

# Autonomous ships

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## Example

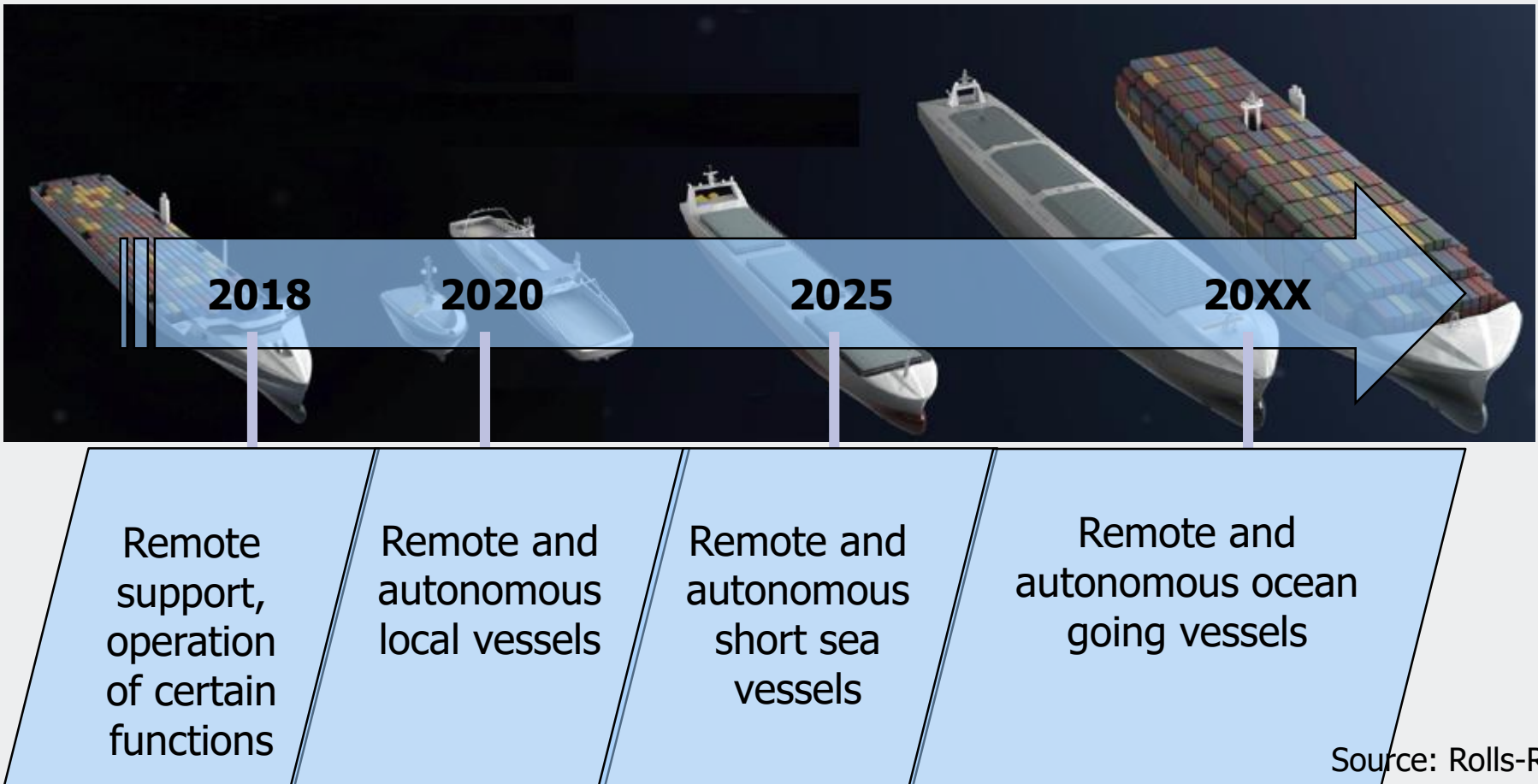
### **SOLAS regulation V/11 – Ship reporting systems**

7 The master of the ship shall comply with the requirements of adopted ship reporting systems and report to the appropriate authority all information required ...

- 1 Some operations are automated, seafarers are on board.
- 2 Ship operated remotely, seafarers are on board.
- 3 Ship operated remotely, no seafarers on board.
- 4 Fully autonomous ship.

# Autonomous ships

## Industry vision – ongoing work

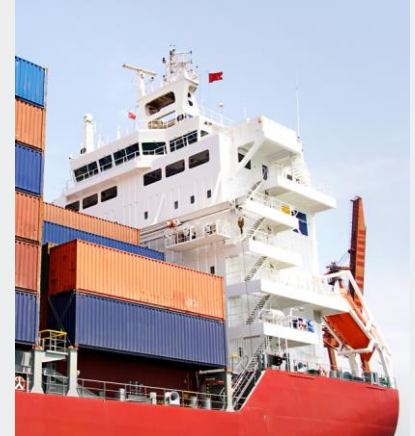
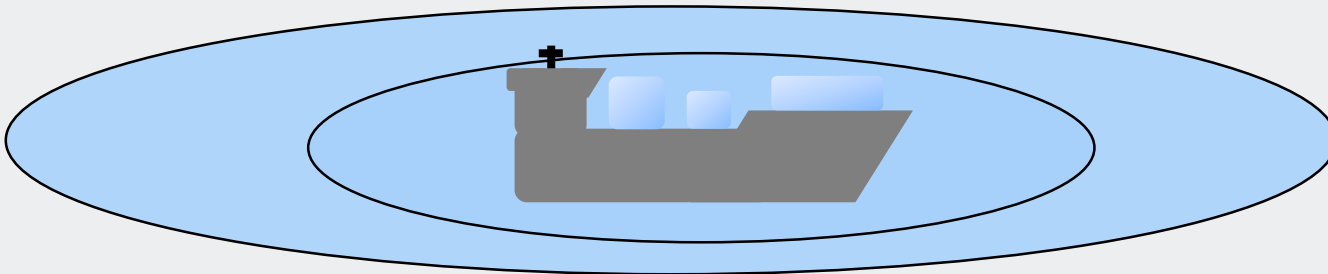


Source: Rolls-Royce

# Autonomous ships

## Technology developments

- Sensors
- Situational awareness
- Connectivity
- Communications
- Digital Shore services / infrastructure
- Remote operation
- Artificial Intelligence (AI)



# Autonomous ships

## Plan of work for the regulatory scoping exercise (MSC)

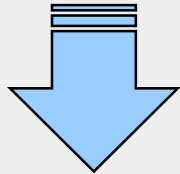
Task	MSC 99 WG	ICG	MSC 100 WG (3-7 Dec 2018)	MSC 101 WG ([5-14 June 2019])	ICG/WG	MSC 102 WG ([May]2020)	MSC 103 WG (Nov/Dec 2020)
Framework (definitions, list of instruments, etc.)	X		X				
Consolidated document based on submissions to MSC 99 (to be prepared by the Secretariat)			X				
Correspondence Group to test the methodology		X					
First step (identification of provisions in IMO instruments)			X	X	X <sup>1</sup>	X <sup>1</sup>	
Second step (analysis to determine the most appropriate way of addressing MASS operations)				X	X <sup>1</sup>	X	X <sup>1</sup>
Interim guidelines for MASS trials	X <sup>2</sup>		X <sup>3</sup>				

**Notes:**

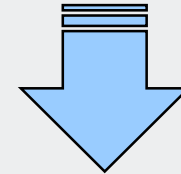
- 1 If required
- 2 Invite submissions
- 3 Consideration

# E-navigation

**E-navigation Strategic implementation plan (SIP)  
(MSC.1/Circ.1595)**

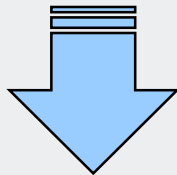


**Main focus**

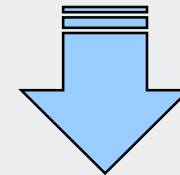


**Bridge design, equipment and  
navigational information**

**Ship reporting and  
communication systems**



**Coordinated  
approach**



**To guide the work of IMO, Member States, the industry and  
other organizations (IALA, IHO, ISO, IEC, etc.)**



# E-navigation and other related developments

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- **Ship communications:**
  - More bandwidth
  - **More VHF, MF, HF frequencies?**
  - More **reliable and cost/effective** communications (ship-to-ship, ship-to-shore and shore-to-ship)
    - New recognized mobile satellite service providers
    - Regional satellite service providers
    - Developments on VDEs
    - Satellite AIS

# E-navigation and other related developments

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- **Ship reporting:**
  - Revised Guidelines and criteria for **ship reporting systems** (resolution MSC.433(98))
  - **Maritime Single Window**, amendments to the FAL Convention adopted by resolution FAL.12(40), New Standard 1.3 bis: *Public Authorities have to establish systems for the electronic exchange of information by 8 April 2019*
  - Reduce/avoid **voice communications**
  - Increase **automatic communications**

# E-navigation and other related developments

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- **Position Navigation and Timing (PNT):**
  - MSC.1/Circ.1575 on Guidelines for shipborne position, navigation and timing data processing
  - Recognition of new components of the World-Wide Radio Navigation System (WWRNS)
  - MSC.401(95), as amended by res.MSC.432(98) Performance standards for multi-system shipborne radionavigation receivers
  - **Use of terrestrial systems?**

# E-navigation and other related developments

- **Maritime service portfolio (MSP):**
  - Guidance on definition and harmonization of the format and structure of Maritime Service Portfolios (MSPs)
    - 1 VTS Information Service (INS)
    - .2 Navigational Assistance Service (NAS)
    - .3 Traffic Organization Service (TOS)
    - .4 Local Port Service (LPS))
    - .5 Maritime Safety Information Service (MSI)
    - .6 Pilotage service
    - .7 Tug service
    - .8 Vessel Shore Reporting
    - .9 Telemedical Assistance Service (TMAS)
    - .10 Maritime Assistance Service (MAS)
    - .11 Nautical Chart Service
    - .12 Nautical Publications Service
    - .13 Ice Navigation Service
    - .14 Meteorological Information Service
    - .15 Real-time hydrographic and environmental information Service
    - .16 Search and Rescue Service

# E-navigation and other related developments

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- **Systems and software:**
  - MSC.1/Circ.1512 on **Guideline on Software Quality Assurance and Human-Centred Design for e-navigation**
  - ECDIS
  - More **focus on software** needed?

# E-navigation and other related developments

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- **Display, presentation and portrayal of information:**
  - **MSC.1/Circ.1593 on Interim Guidelines for the harmonized display of navigation information received via communications equipment**
  - **Amendments to the INS Performance standards**
  - **Guidelines on standardized modes of operation, S-Mode**

# Cyber Security

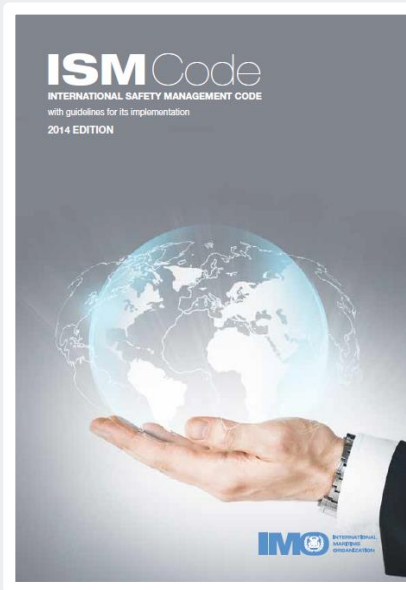
**MSC-FAL.1/Circ.3 on Guidelines on maritime cyber risk management:** Provide **high-level recommendations** on maritime cyber risk management to safeguard shipping from current and emerging cyberthreats and vulnerabilities. The Guidelines also include **functional elements** that support effective cyber risk management.



**Resolution MSC.428(98) Maritime cyber risk management in safety management systems:** Cyber risks to be appropriately addressed in safety management systems no later than the **first annual verification of the company's Document of Compliance after 1 January 2021.**

# Maritime cyber risk management

To address the rapidly evolving technologies and changing threats, IMO recommended a risk management approach to cyber risks that is resilient and evolves as a natural extension of existing **safety and security management practices** established by this Organization.





# Recap

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- Regulatory scoping exercise on Maritime Autonomous Surface Ships (MASS)
- E-navigation related developments, maritime single window and review of the GMDSS
- Maritime cyber risk management

Participation of all stakeholders is required: IMO, ship owners, industry, Administrations, shore services, other international organizations, amongst others.

## International Maritime Organization

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