# 智能船舶规范与IMO MASS CODE进展

## Development of CCS Rules for Intelligent Ships and IMO MASS Code

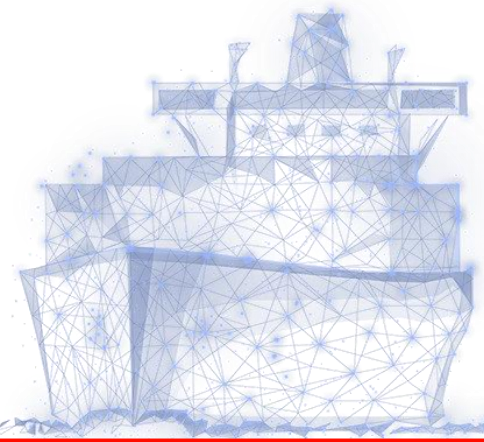
Sun Wu,CCS Shanghai Rules and Research Institue

Ning Bo, 2023.07.18


1. CCS Rules for Intelligent Ships

2. MSA Provisional Code for Test and Survey of Autonomous Navigation of Ships

3. IMO MASS Code

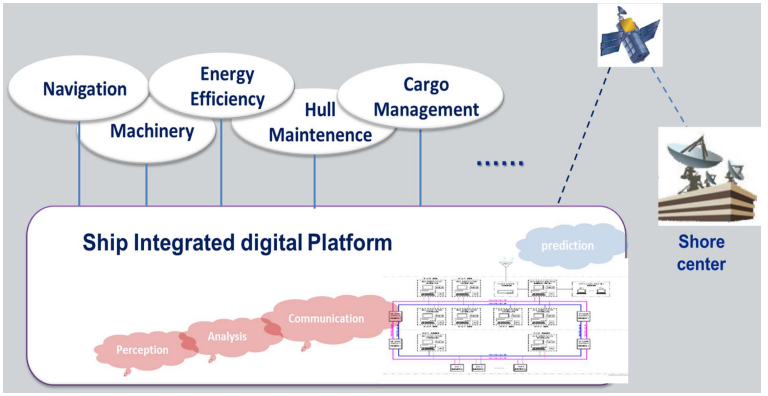


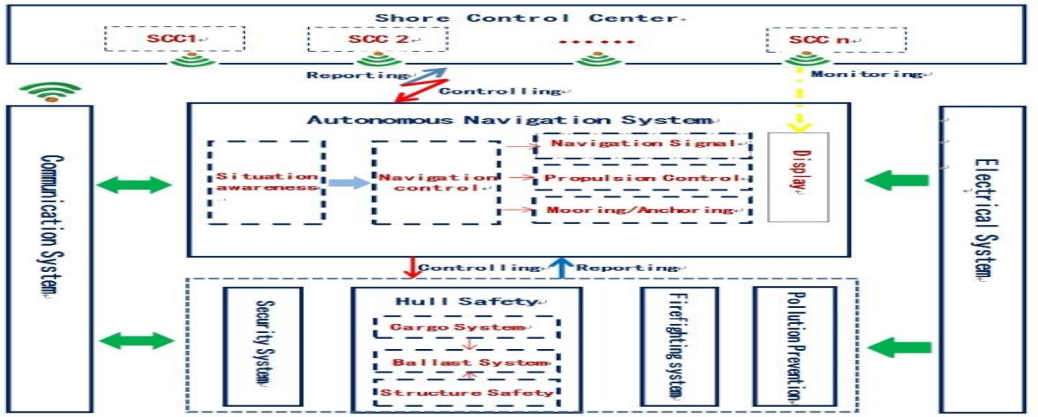
# 1 CCS Rules for Intelligent Ships

- In 2015，Based on the concept of Intelligentization, through Risk Assessment, CCS issued 1st version of “Rules for Intelligent Ships”
- The Rules focus on Functions and Systems
- The Rules propose a “1+N” model

  1 -- ship integrated digital platform

  N– functions (class notations)




digitalization

integration

Decision support

Ship-shore interaction

Partial autonomy

Semi-autonomy (human surveillance)

Full autonomy

# Class Notations for Intelligent applications

After 7 years of development, CCS has developed a series of Class Notations according to the “1+N” model

**i-Ship (Ai ,Ri, Nx, Hx, Mx, Ex, Cx, I, Dx, SRx)**

**Ai — Autonomous operation**

**Ri — Remote Control**

**Nx — Navigation**

**Hx — HuLL**

**Mx — Machinery**

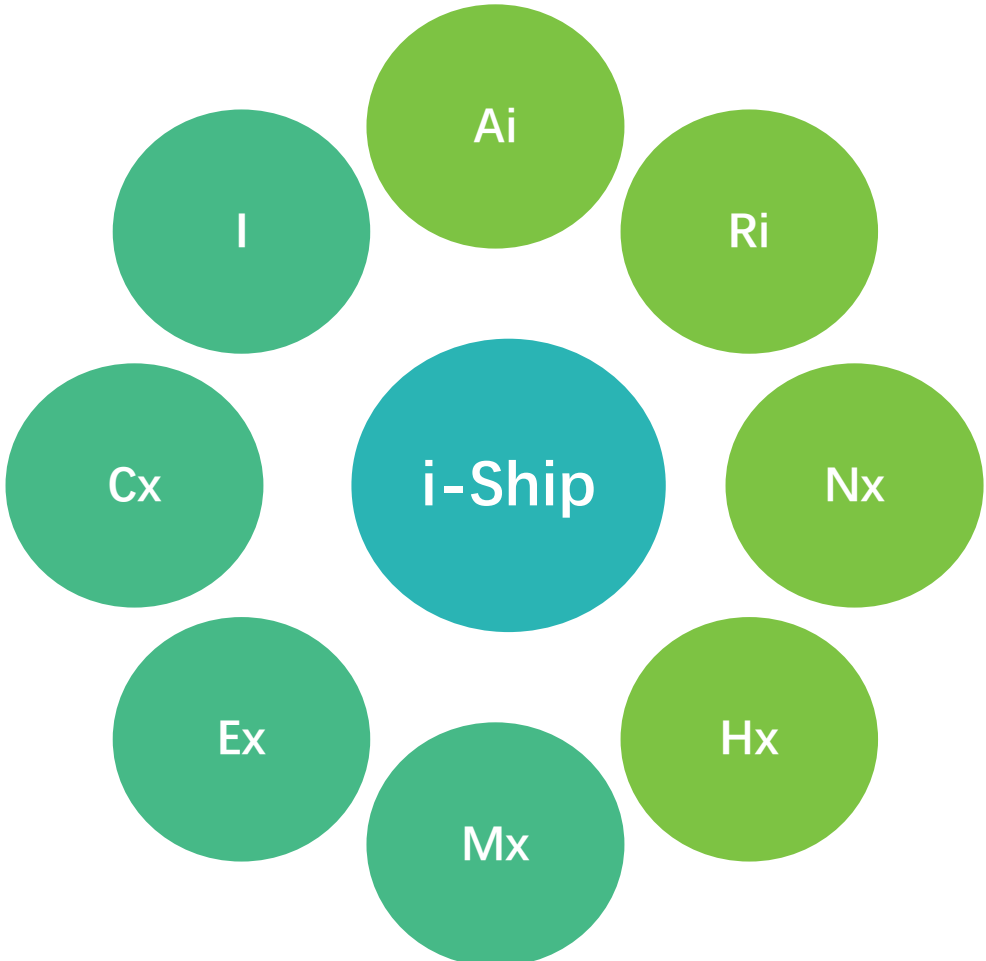
**Ex — Energy management**

**Cx — Cargo handling**

**I — Integrated digital platform**

**Dx—Dreger**

**SRx—Science Research**



# Practices of China

- In the past 7 years, **more than 200 ships** have passed CCS drawing approval, survey and certification, and obtained the Class notations of Intelligent Ship (i-Ship). The ship types not only cover bulk carrier, Tank and container ship, but also include LNG ships, polar icebreaking research ships, PCTC and  others.

- **18 models** of intelligent systems obtained CCS approval.

- *CCS has established a simulation laboratory of collision avoidance algorithm.*

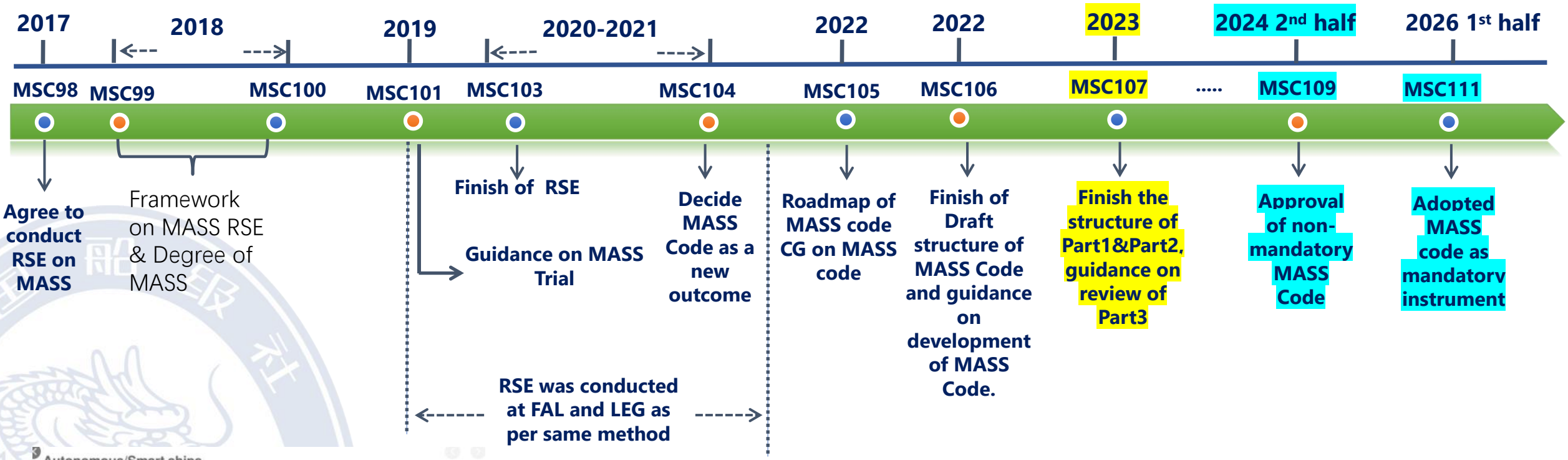
- *Requirements and performance for ship video sensing systems including lidar, infrared system etc.*

# 2 MSA Provisional Code for Test and Survey of Autonomous Navigation of Ships

Goal:
Ensure the safety of ship with autonomous/remote control functions.

- General — Ch.1
- Application — Ch.2
- Autonomous Navigation — Ch.3
- Remote control center — Ch.4
- Process of trial — Ch.5

# 3. IMO MASS CODE





# Framework of MASS Code

| | | |
|---|---|---|
| **Part 1 GENERAL** | 2.5 System design principles(EC) | 3.7 Management if Safe Operations(Germany) |
| 1.1 Introduction (Purpose, Principles) (Marshall island) | 2.6 Software principles(UK) | 3.9 Security(Spain) |
| 1.2 Application(Danmark) | 2.7 Connectivity(China)<br>2.7bis Alert management(Norway) | 3.10 Search and Rescue(Spain) |
| 1.3 Code Structure and relationship to other IMO Instruments(to be decided) | 2.8 Human element(ITF) | 3.11 Cargo Handling |
| 1.4 Terminology and Definitions(to be decided) | **Part 3** GOALS, FUNCTIONAL REQUIREMENTS AND PROVISIONS | 3.12 Personal Safety and comfort(ITF) |
| 1.5 Certificate and Survey(Danmark) | 3.1 Navigation (Japan) | 3.13 Towing and Mooring(Canada) |
| **Part 2 MAIN PRINCIPLES FOR MASS AND MASS FUNCTIONS** | 3.2 Remote Operations(UK) | 3.14 Marine Eengineering/Machinery Installations(USA) |
| 2.1 Operational context(Germany) | 3.3 Communications (China) | 3.15 Electrical and electronic engineering(USA) |
| 2.2 Safe states for the ship(Germany) | 3.4 Subdivision, Stability and Watertight Integrity | 3.16 Maintenance and Repair(Australia) |
| 2.3 Functions Required for MASS(TBA) | 3.5 Fire Safety(Norway) | 3.17 Emergency Response(Korea) |
| 2.4 Risk Assessment(China) | 3.6 Life-Saving Appliances and Equipment (Canada) | **Annex Interim guidelines for MASS trial** |

# IMO MASS Code (Progress)

**MASS Code was developed by splinter groups leading by volunteer IMO members in CG on MASS Code and discussed by following work groups:**

- MSC WG on MASS
- CG on MASS
- MSC ISWG on MASS
- MSC-LEG-FAL JWG： discussing common issues related to three committees.

**Points were agreed:**

- Follow GBS methodology(MSC.1/Circ.1394/Rev.2), covers goal and functional Requirements(Tier 1 and Tier II)
- a supplement to other IMO instruments, such as SOLAS, provides a regulatory framework for the performance of remote control and autonomous operation of key functions, as applicable
- Code should be implemented for individual remotely controlled or autonomous functions even where persons are on board to handle other functions.
- ensure achievement of a level of safety at least equivalent to that expected of a conventional ship;

# IMO MASS Code (progress)

## Points were agreed(continue):

- to safely coexist without impeding or negatively impacting each other
- Apply to cargo ships at the begin then consider to apply to passenger ships
- A ship may move between modes of operation during one voyage
- there should be a human master responsible for a MASS, regardless of mode of operation or degree or level of autonomy, the master of a MASS should have the means to intervene when necessary.
- on the circumstances where a master of a MASS could be responsible for several MASS was needed
- several masters may be responsible for a MASS on a single voyage, under certain conditions. And that only one master should be responsible at any given time
- there was **no need to amend the COLREGs** and that Convention can be applied in full to any MASS but that the MASS Code needed to address how COLREGs need to be applied to MASS.

# IMO MASS Code (progress)

**Points were agreed(continue):**

- no specific risk assessment methodology should be recommended to be used in the MASS Code

**Points to be agreed:**

- Definition of MASS, Terminology such as operational envelope(OE),Modes of operation, Concept of Operations etc.
- Competence and qualification of MASS Crew
- Pilot for MASS
- SAR responsibility of MASS
- How to verify the performance of MASS system
- jurisdiction and responsibility with respect to the location of ROCs
- ……

# Joining Hands in Promoting the Development of Intelligent Ships


No.1234,Pudong Avenue, Shanghai 200135,China
Tel: (021)61089538
E-mail: wsun@ccs.org.cn