

Autonomous Ship and COLREGS



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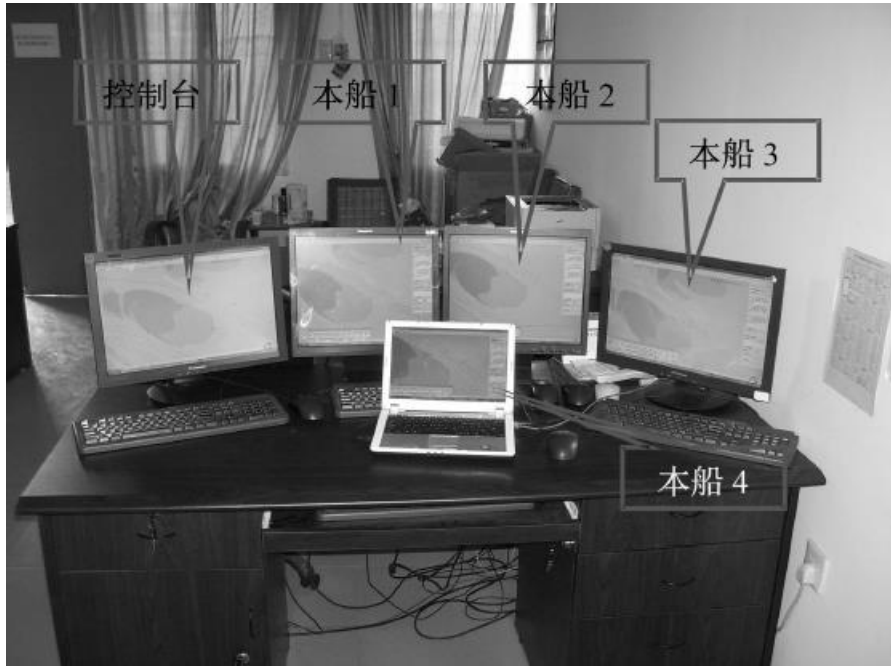
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Autonomous Ship and COLREGS

- 1 Autonomous Ship Update in China
- 2 International Autonomous Ship
- 3 Autonomous Ship Features
- 4 Challenges and Impacts of Autonomous Ship
- 5 COLREGS
- 6 Ways Forward

1 Autonomous Ship Update in China

Research of Intelligence Collision Avoidance



Simulator of ship automatic collision avoidance

- Platform of ship automatic collision avoidance simulator developed
- Verification of multi ship collision avoidance decision making
- Study on ship-people collision avoidance decision making

Rules for Autonomous Ship



中国船级社

智能船舶规范

2015

2016年3月1日生效

- Rules for Autonomous Ship have been published by China Classification Society (CCS) in Dec. 2015
- the Rules have entered into force since 1 March 2016
- the first standards for autonomous ship in China

Rules for Autonomous Ship



Smart Ship

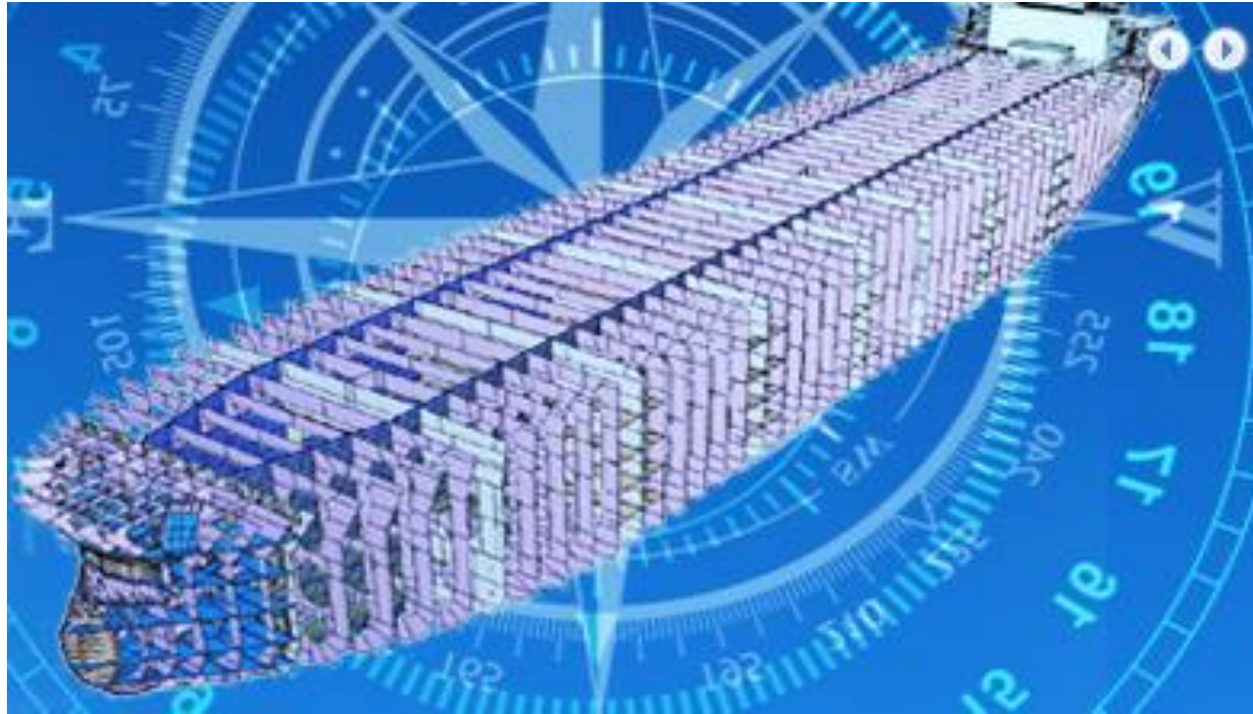
- Intelligence in
 - ✓ ship hull
 - ✓ engine room
 - ✓ energy efficiency management
 - ✓ cargo management
 - ✓ integrated platform

CAD for Autonomous Ship & Construction



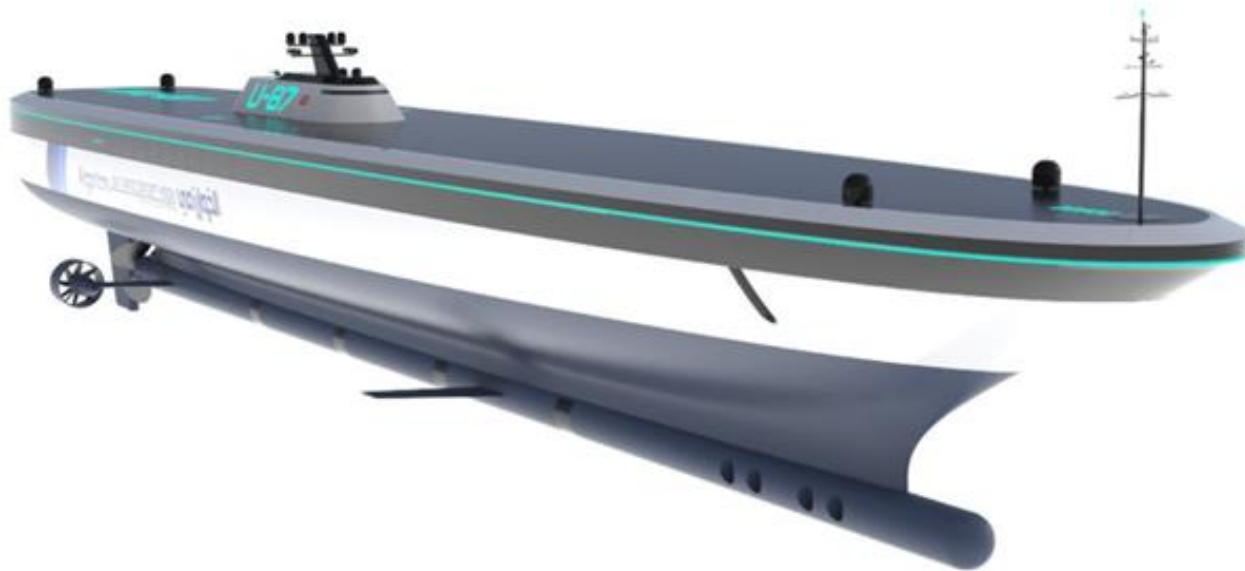
Siemens PLM Software

SIEMENS



COMPASS Software

R&D for Autonomous Ship



Engine Room Remote Control



Energy efficiency

Remote control

Fault diagnosis on-line

Construction of Autonomous Ship



Name: I-Dolphin

DWT : 38,800

Type: bulk carrier

Date:

construction

- Sept. 2016

delivery

- 2017



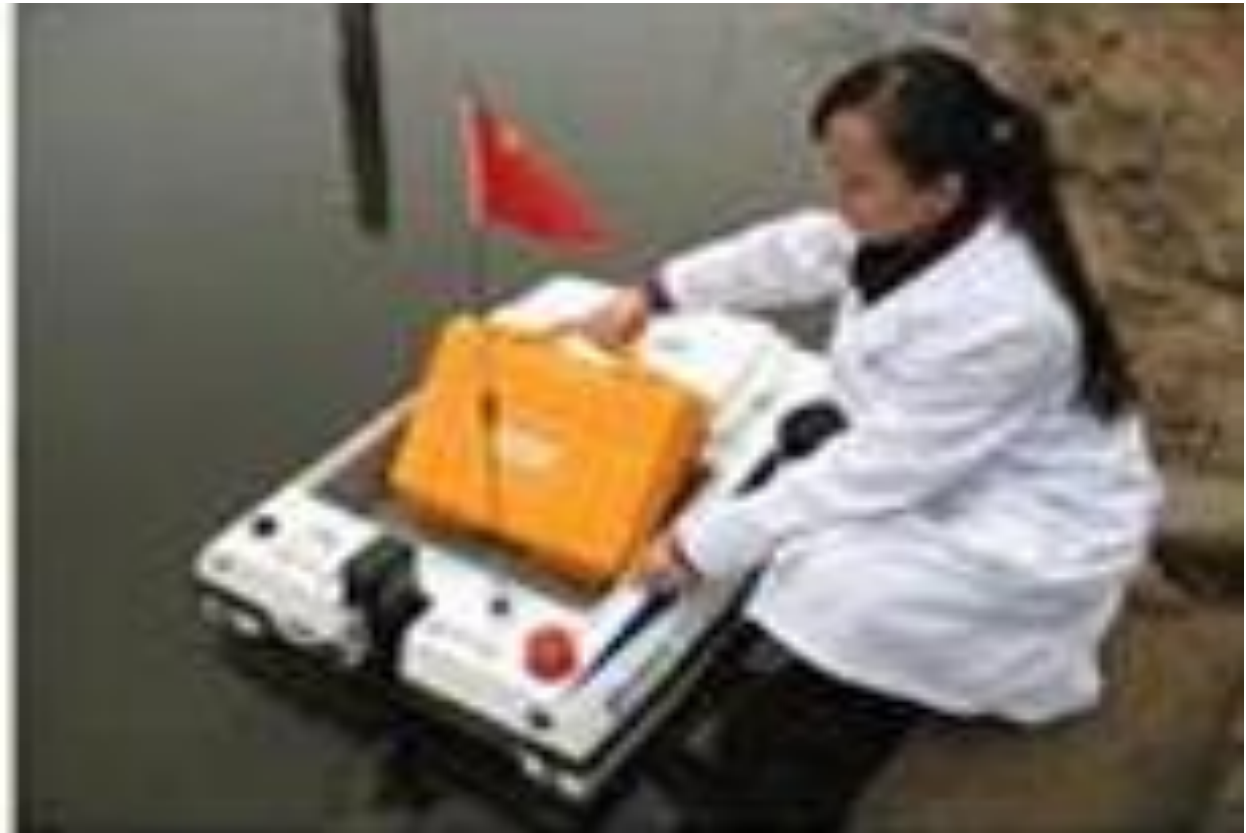
中国船舶工业集团公司

CHINA STATE SHIPBUILDING CORPORATION

Wide Application of small Autonomous Ship



Meteorological Observation



Hydrography

Wide Application of Small Autonomous Ship



Water Policing



Military Surveillance



Passage Clearance

2 International Autonomous Ship

International Autonomous Ship



Mayflower Autonomous Research Ship (MARS)
to cross Atlantic Ocean in 2020 by UK



Autonomous Ship by the Netherlands

International Autonomous Ship



Advanced Autonomous Waterborne Applications Initiative (AAWA) Project, By Rolls Royce



Autonomous Ship for Bridge Construction In the Netherlands

International Autonomous Ship



Autonomy Levels for Ship Design and Operation
by Lloyds Register



First Unmanned Maritime Products by 2025
by Finland

International Autonomous Ship



Research and development of autonomous ship is being conducted in

- Denmark
- Norway
- Finland
- Republic of Korea
- United Kingdom
- United States
- China

3 Autonomous Ship Features

Intelligent Navigation and Collision Avoidance



- AIS
- ECDIS
- Sensing
- Satellite communication
- E-navigation
- GPS/GLONAS/BDS
- Intelligent navigation and collision avoidance

Simplified Structure, Equipment and System



- Simplified structure, equipment & system
- Reduction in self weight
- Optimisation in internal space arrangement

Safer, Greener and more Efficient



- Human element
- Marine environment protection
- Operational cost

Shore-based Management for Autonomous Ship



- Port captain to monitor and manage autonomous ships
- Smart operation pattern
- Less manning to Zero manning

4 Challenges and Impacts of Autonomous Ship

Maritime Safety Administration V Autonomous Ship

Challenges Maritime Safety Administration may face:

- Legal regime and standards to regulate autonomous ship
- Traffic environment for safe operation of autonomous ship
- Monitoring of autonomous ship

Challenges of Collision Avoidance Autonomous Ship Faces at Sea

Challenges the shipping industry may face:

- Rules of collision prevention between manned ship and unmanned ship
- Unified standard performance of autonomous ship system developed by different country and company
- Liability in case of collision accident

Unified Standard for Industry

- Unification of rules of construction
- Unification of standard of survey
- Unification of rules and standard for certification and renewal

Other Challenges

Other challenges

- Human elements in remote control
- Navigation
- Pilotage
- Berthing and unberthing
- Traffic separation scheme

**5 International Regulations
for Preventing Collisions at Sea
(COLREGS), 1972**

COLREGS, 1972

- International Regulations for Preventing Collisions at Sea (COLREGS), 1972 are broken down into six Parts and four Annexes.
- The essential Part is Part B, the Steering and Sailing Rules, which is further divided into three Sections.

COLREGS, 1972

- The rules in Section I, applying in all conditions of visibility, are of a general nature relating to lookout, safe speed, risk of collision and actions to avoid collision etc.
- The rules in Section II apply only to vessels that are in sight of one another.
- Section III, i.e. Rule 19, applies only to vessels navigating in or near an area of restricted visibility which are not in sight of one another.

COLREGS, 1972

Difference between Sections II and III

- Under the set of rules applicable to vessels in sight of one another (Section II), distinctions are made between collision encounters (head-on, crossing and overtaking), give-way vessel and stand-on vessel, and various categories of vessels.

COLREGS, 1972

Difference between Sections II and III

- Under the set of rules applicable to vessels **NOT** in sight of one another (Section III), no such distinctions are made.
- For the application of the COLREGS, “whether or not in sight of one another” matters very much!

COLREGS, 1972

in sight of one another

- Rule 3(k) states that: Vessels shall be deemed to be in sight of one another only when one can be observed visually from the other.
- It means that two vessels see each other with human eye, not by radar or AIS.
- However, unmanned ships do not have a human eye.

COLREGS, 1972

Unmanned ships, how?

- Unmanned ships cannot see visually another vessel
- Current COLREGS are basically for observance by human mariners only, with the application of the conduct of vessels in sight of one another being human visual sight-based

COLREGS, 1972

Unmanned ships, how?

- Current COLREGS do not apply to unmanned ships
- We need a set of new collision regulations that apply to unmanned ships

COLREGS, 1972

Collision avoidance regime

- Interaction between an unmanned ship and a manned ship, how ?
- Interaction between two unmanned ships, how ?
- Involvement in a multi-ship encounter, how ?

COLREGS, 1972

Lights and shapes

- How an unmanned ship exhibits lights and shapes?
- How to sound the sound signals required by COLREGS?
- Will unmanned ships be exempted from the requirements?

COLREGS, 1972

Function and status of a shore-based navigator

- What is the legal status of a shore-based navigator who controls an unmanned ship in terms of collision avoidance?
- What is the qualification and certification required?
- What is the legal responsibility in the event of a collision?

6 Ways Forward

Considerations for COLREGS to be reviewed

COLREGS

Rule 1 - Application

Rule 2 - Responsibility

Rule 3 – General definitions

Considerations for COLREGS to be reviewed

Part B – Steering and sailing rules

Rule 4 – Application

Rule 5 – Look-out

Rule 6 – Safe speed

Rule 7 – Risk of collision

Rule 8 – Action to avoid collision

Considerations for COLREGS to be reviewed

Communication Coordination between Ships

Part C Lights and shapes

Part D Sound and light signals

Considerations for COLREGS to be reviewed

Definition of Navigational Watch

navigational watch

look-out

Considerations for COLREGS to be reviewed

Measures for transition period from

manned ship

to unmanned ship

Considerations of COLREGS to be reviewed

Ways forward

marine industry

shipping companies

shipbuilding and marine equipment manufacturer

maritime administration and member government

Proposals to International Maritime Organization

Thank You

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