CCS Practices on Intelligent Ships and MASS

China Classification Society
Sun Wu

CONTENT

- CCS Rules for intelligent Ships 2015

- CCS Guidelines for Autonomous Cargo ships

- IMO MASS Regulatory Scoping Exercise
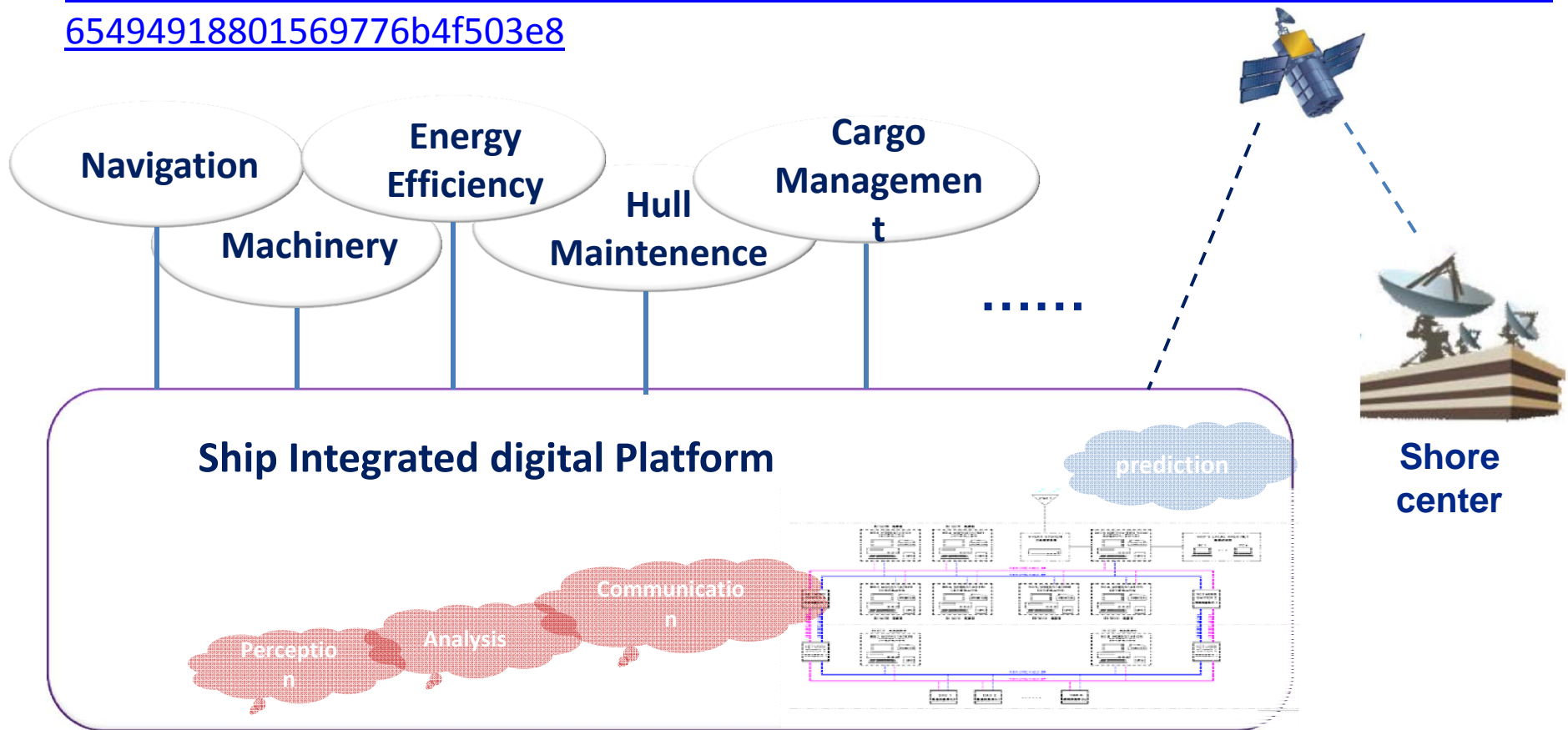

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1 Rules for intelligents ships

Rules for intelligent ships(2015)

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Navigation

Energy Efficiency

Cargo Management

Machinery

Hull Maintenence

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Ship Integrated digital Platform

prediction

Communication

Perception

Analysis

Shore center

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1.1 Main Functions

Provide decision support. Automated process and autonomous operation to ships with seafarers onboard, including:

- Fault Diagnosis, decision support and **C**ondition **B**ased **M**aintenance for Machinery;
- Lifecycle management and monitoring for ship Hull;
- Online monitoring and analysis of ship fuel consumption;
- Speed optimization;
- Trim optimization;
- Route and speed design and optimization;
- Autonomous navigation in open sea, in narrow route;
- Automated docking and undocking;
- Automated loading and unloading;

Using class notations reflecting different functions: i-Ship(Nx,Hx,Mx,Ex,Cx,I)

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1.2 Pilot projects

CSSC 38800DWT bulk carrier
Delivered in the end of 2017
CCS class notations: **i-Ship(N,M,E,I)**

40kDWT VLOC
Delivered on 28 Nov. 2018
CCS class notations: **i-Ship(N,M,E,I)**

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2 Guidelines for Autonomous Cargo Ships(2018)

Principle and Methodologies

- Mainly focused on IMO MASS Degree 3&4;

- Aim to reach the equivalent safety and environmental protection level as conventional ship;

- Develop based upon risk assessment;

- Utilizing a goal-based approach:

 Goal ➔ Functional Requirements ➔ verification requirements…

Purpose

- ➤ Specify requirements for autonomous ship and related systems;

- ➤ Provide basis for autonomous cargo ship design and construction;

- ➤ Facilitate the development and trial of autonomous ship;

It was issued on 4 Sept. 2018 in SMM 2018, download address:http://www.ccs.org.cn/ccswzen/font/fontAction!downloadArticleFile.do?attachId=4028e3d6654599640165e6776fce0166

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2.1 Principle and Methodologies of the Guideline

Principle and Methodologies

- Mainly focused on autonomous degree 3&4 above;

- Aim to reach the equivalent safety and environmental protection level as conventional ship;

- Develop based upon risk assessment;

- Utilizing a goal-based approach:

   Objectives→ Functional Requirements → verification requirements…

Purpose

➢ Specify requirements for autonomous ship and related systems;

➢ Provide basis for autonomous cargo ship design and construction;

➢ Facilitate the development and trial of autonomous ship;

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2.2 Autonomous Cargo Ship Architecture

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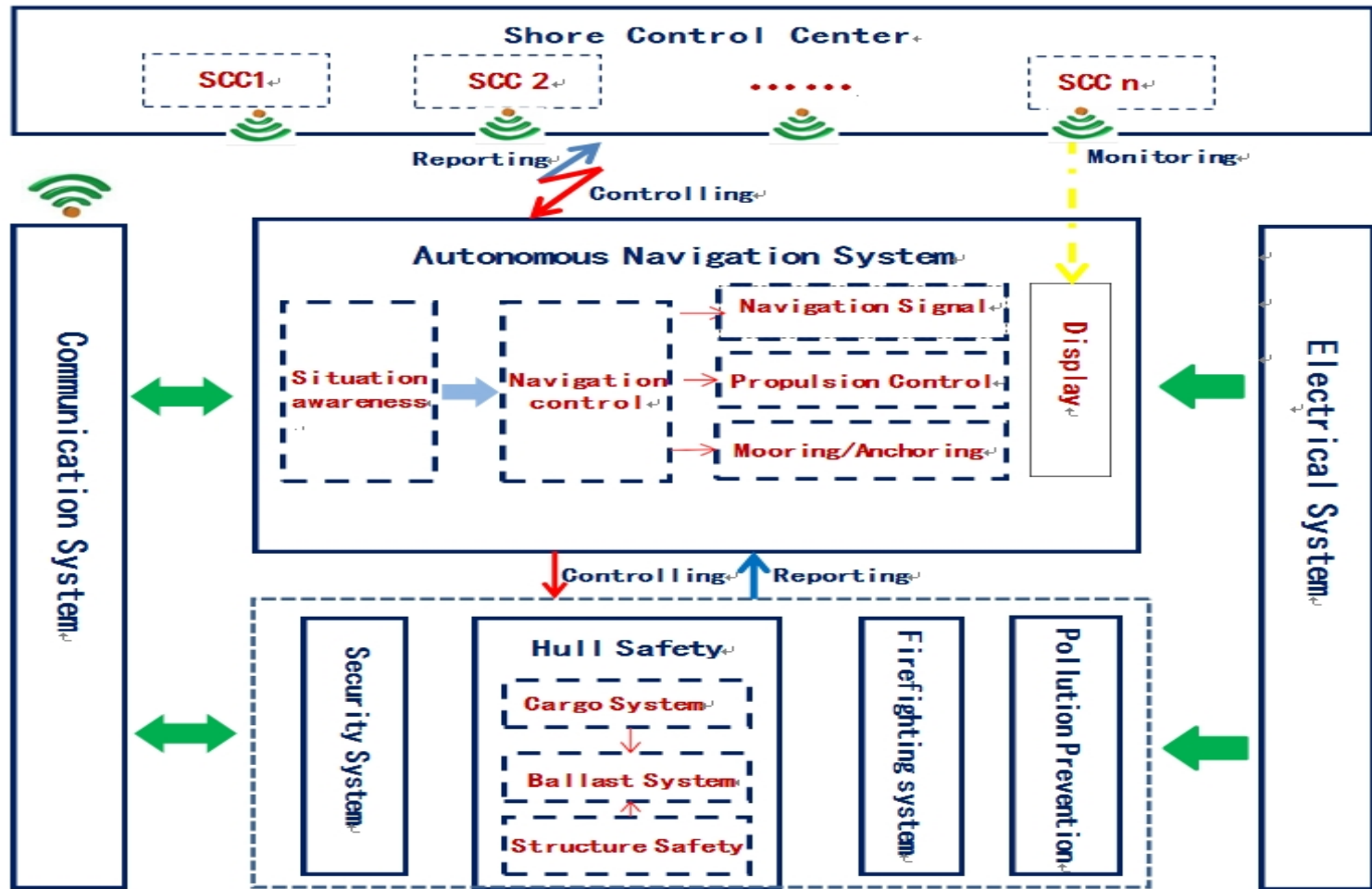
2.3 Operation Modes

1. Berthing/unberthing; entering/leaving port

   Autonomous or remote control or both

2. Ocean voyage

   autonomous operation; and

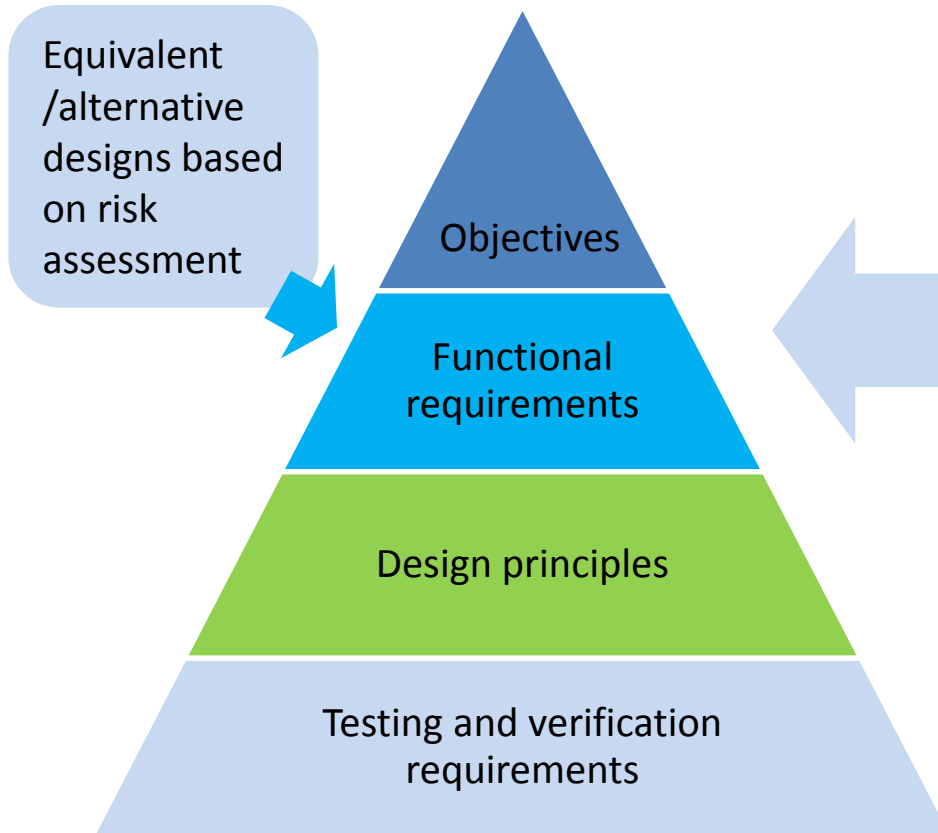   monitored by SCC, necessary SCC can take
over operation;

2.4 Chapters

Requirements developed based upon Goal Based Methods

Equivalent /alternative designs based on risk assessment

Objectives

Functional requirements

Design principles

Testing and verification requirements

CH1	**General Requirements**
CH2	Situation Awareness
CH3	Navigation Control
CH4	Machinery Installation
CH5	Mooring and Anchoring
CH6	Electrical and electronic installation
CH7	Communication and signal
CH8	Structural safety
CH9	Fire protection
CH10	Environmental protection
CH11	Security
CH12	Remote operation center
CH13	Cyber security
CH14	Survey & Certification

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MASS project

500GT Cargo Ship，coastal voyage, under designing

Test Area

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3 IMO MASS Regulatory Scoping Exercise

There are 4 Degrees of MASS according IMO Framework, before conducting RSE, the following need to be defined:

1. exact functions of ship and its systems;

2. Duties of seafarers onboard;

3. exact functions of remote control stations, duties of remote operators ;

4. How to deal with failures, by manual backup or by redundant systems;

5. Which system is of autonomous operations, which is be remote controlled.

IMO members can conduct RSE according to their own understandings and provide reasons in the remark column

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3.1 Method of RSE

1. High level is preferred,

Regulation by Regulations, sometimes chapter by Chapter.

2. Step 2 connected to Step1

3. At many cases, the persons for conducts RSE should propose their assumptions. The output are predictable, variety.

3.2 RSE Degrees 1

"decision support", "some operations" are not specific, assumptions are needed for them.

Duties of the seafarers are also to be defined.

Time consuming job, recommend to consider it when specific function for "decision support" or "some operations" are fixed.

3.3 RSE Degrees 2

- Degree 2

  Followings are to be developed:

  ➢ Functions of remote control center(RCC),

  ➢ Situation awareness of ships

  ➢ Communications between ship and RCC

  ➢ competent requirements for remote operators

  ➢ Which operations are automated

3.4 RSE Degrees 3

Degree 3

➢ Almost existing regulations are not applicable.

➢ Functions of remote control center(RCC),

➢ Situation awareness of ships

➢ Communications between ship and RCC

➢ Competent requirements for remote operators

➢ All system on board shall be automated?

3.5 RSE Degrees 4

- Definition of Fully autonomous? Without remote control center, Ship can operate automatically when destination was decided.

- Almost existing regulations are not applicable;

Ways for ahead

- Base on experiences from actual projects;

- Using risk methodology;

- Develop dedicated instruments for MASS, especially for Unmanned MASS.

- Principle for equivalent safety level existing man operated ships

- Unified Verification requirements/methods.

Thanks!

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