2023/11/5

CSSC 上海船舶研究设计院

SDARI低碳设计与船型发展
Low Carbon Design and Ship Development

Shanghai Merchant Ship Design & Research Institute
(SDARI)

CONTENTS 目录

01 SDARI简介
SDARI Introduction

公司概述
Company Introduction

上海船舶研究设计院（SDARI），创建于1964年，隶属于中国船舶集团有限公司（CSSC）。

Shanghai Merchant Ship Design & Research Institute (SDARI)，established in 1964, subordinated to the China State Shipbuilding Corporation Limited (CSSC).

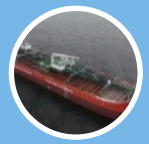
坐落在上海浦东新区张江高科技园区

SDARI is located in Zhangjiang Hi-tech Park in Pudong, Shanghai.

主要设计品种
Major Designs


BULK CARRIER


CONTAINER VESSEL


TANKER


MUTI-PURP. VESSEL


RORO/PCTC ROPAX


GAS CARRIER

TRANSPORTATION SHIPS

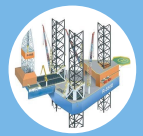

OCV/SSHLV


AHTS/PSV


SALVAGE VESSEL

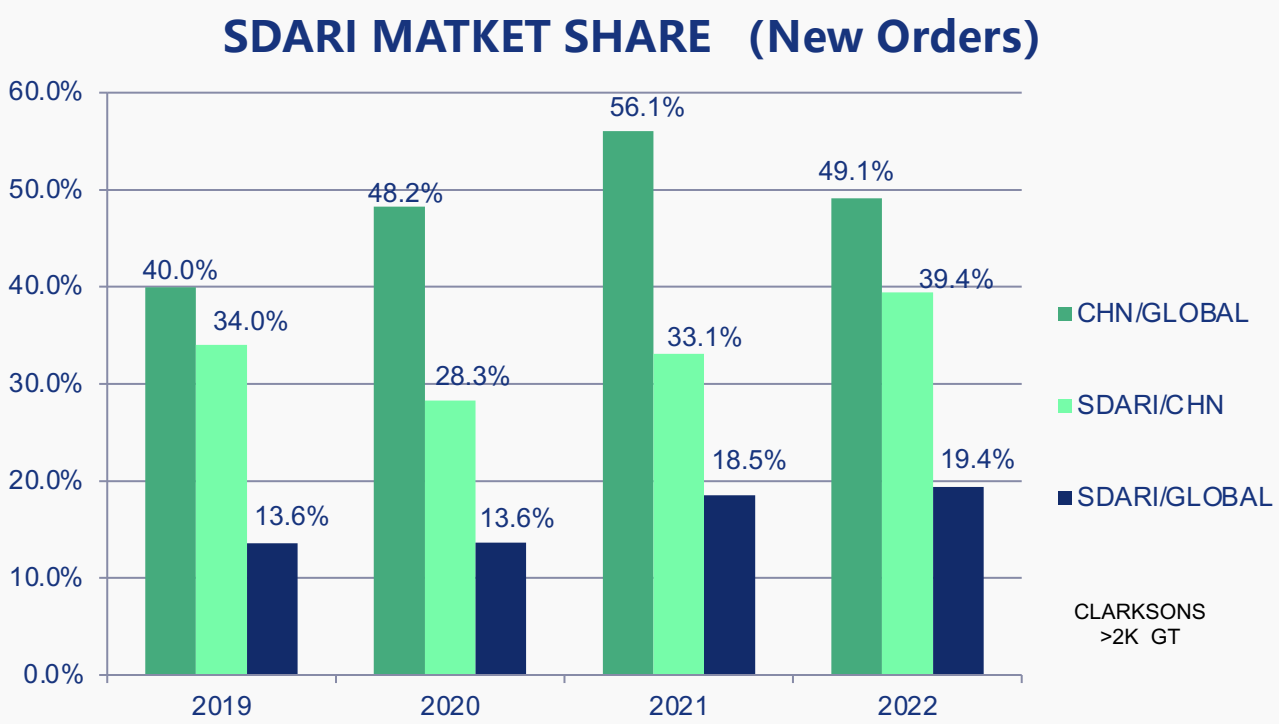

PUBLIC SERVICE VESSEL


ENGINEERING SHIP


PLATFORM

OTHER PRODUCTS

市场份额
Market Share



17%

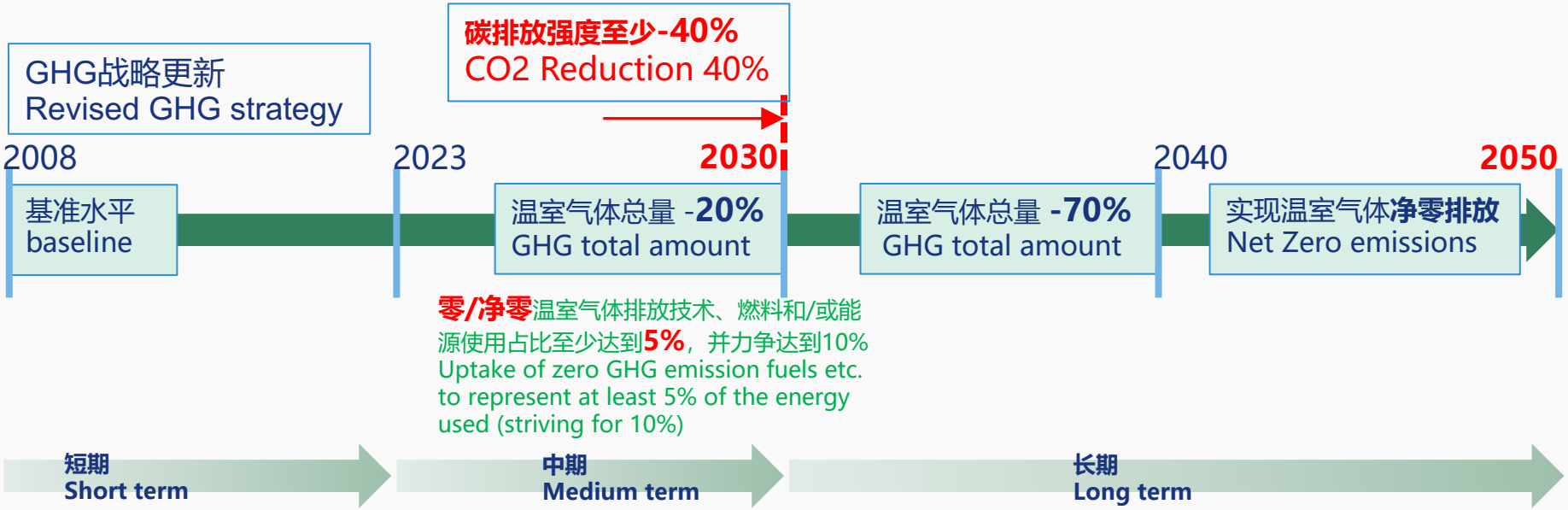
过去三年全球平均市场份额
Global average share
over the last three years

34%

过去三年国内平均市场份额
Domestic average share
over the last three years

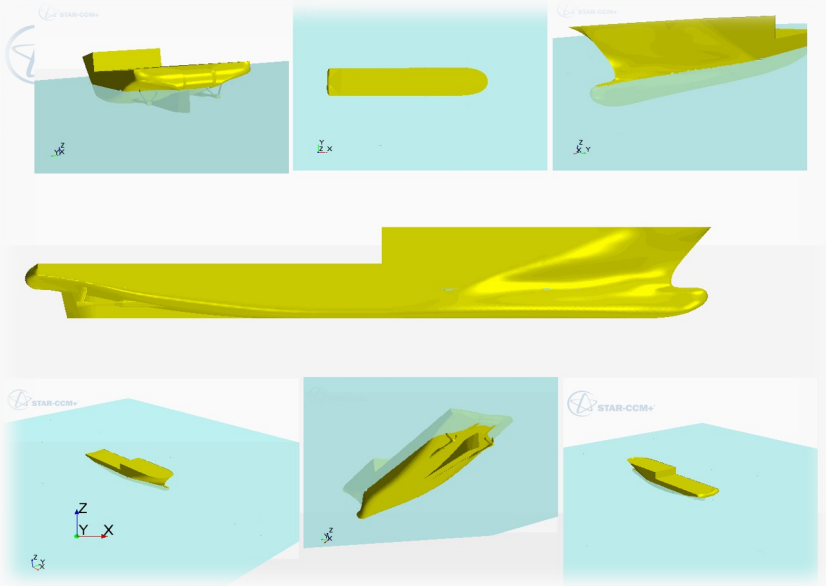
02 低碳设计
Low Carbon Design

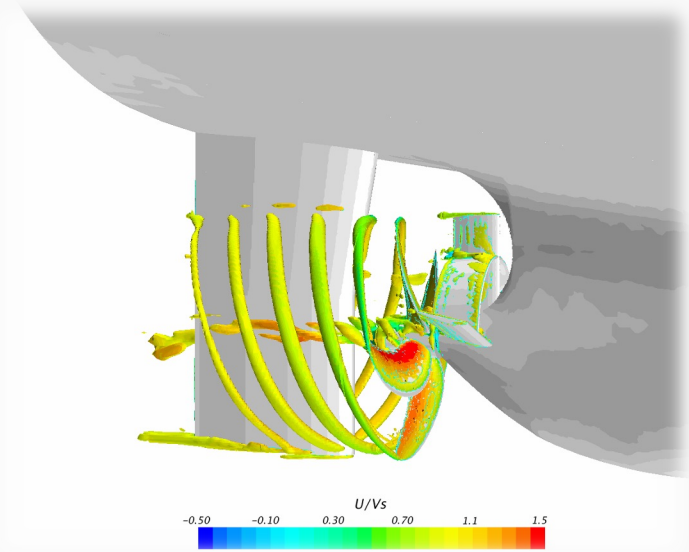
国际海事组织战略目标更新
MEPC 80 updated



为应对GHG新战略，新船能效和船舶营运能效需要大幅提升！
To address GHG new strategy, EEDI and CII need to be significantly enhanced!

船舶阻力及自航仿真应用
Resistance & Self-propulsion simulation





- 船模阻力仿真 Model ship resistance
- 实船有限功率评估 Real ship effective power

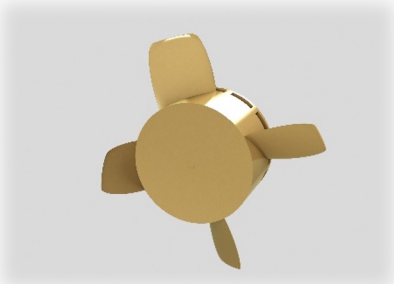
- 采用SDARI 多元化自主研发节能产品，一体化集成优化，实现综合能效国际领先

Much efforts on integrated propulsion system optimization considering interaction effect of hull, propeller and appendage

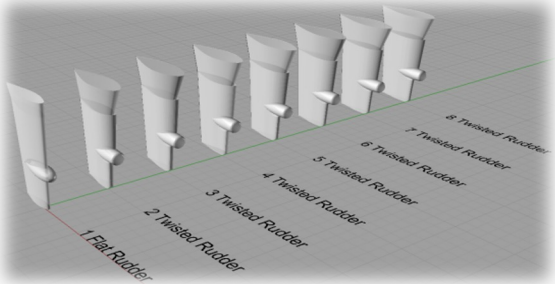
水动力节能产品研发
Development of Hydrodynamic Energy Saving Device

- 螺旋桨
  Propeller

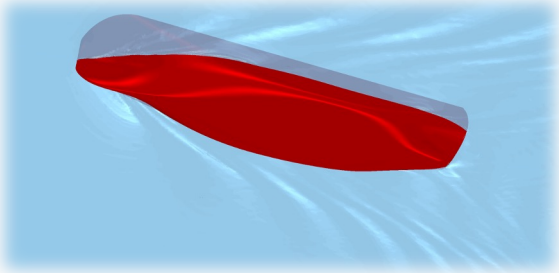
- 预旋导管
  Fan Duct



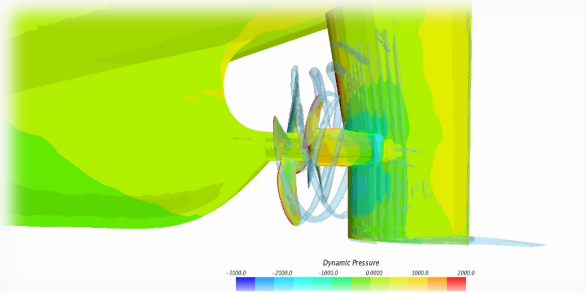
- 节能毂帽
  Fan Cap



- 扭曲舵
  SATR rudder

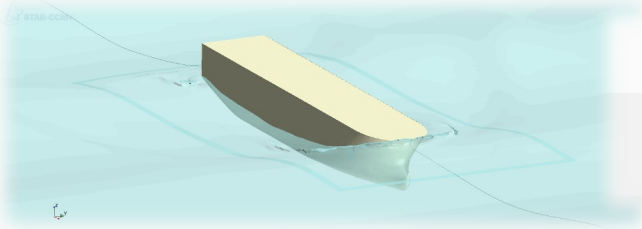


- 微气泡空气润滑系统
  Bubble lubrication system



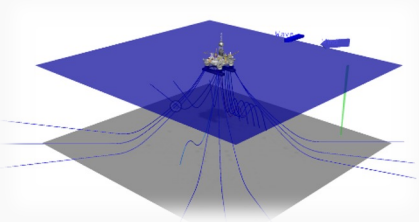
- 对转桨
  Contra-rotating propeller(CRP)

其他水动力性能评估
Other Hydrodynamic Performance Evaluation

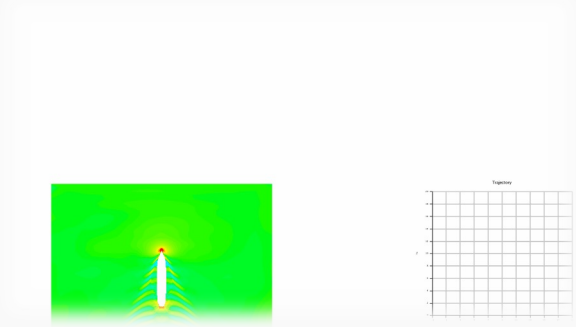


- 波浪中性能表现
  Performance in wave

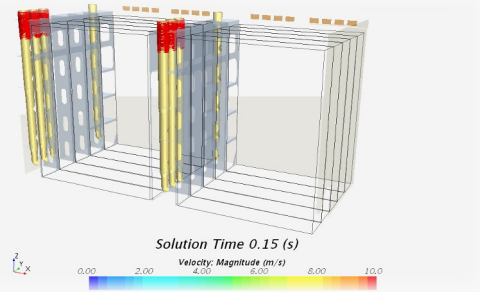
- 螺旋桨空泡
  Cavitation



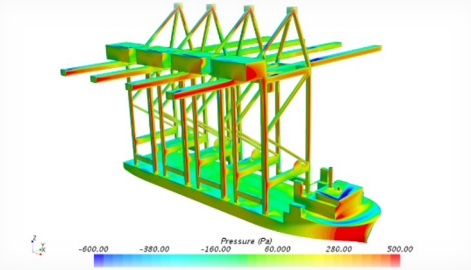
- 系泊定位分析
  Analysis of mooring positioning



- 船舶操纵性评估
  Maneuverability

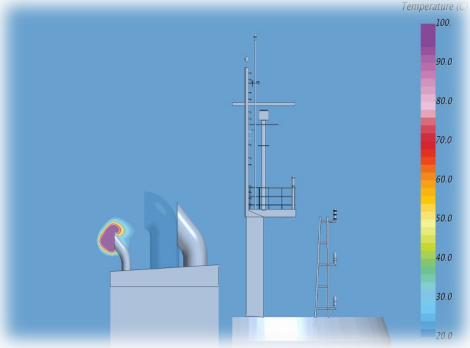


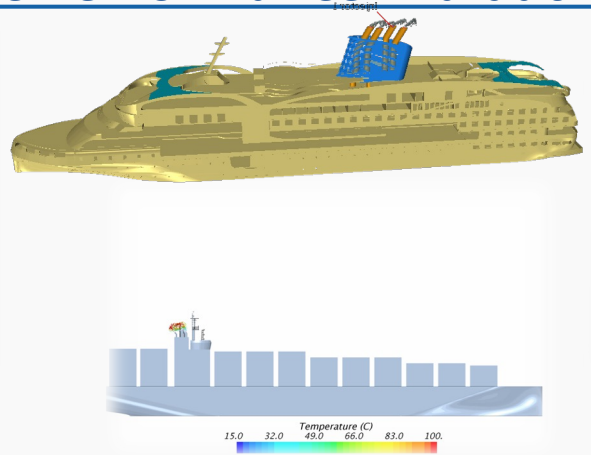
- 货舱通风仿
  Simulation of ventilation

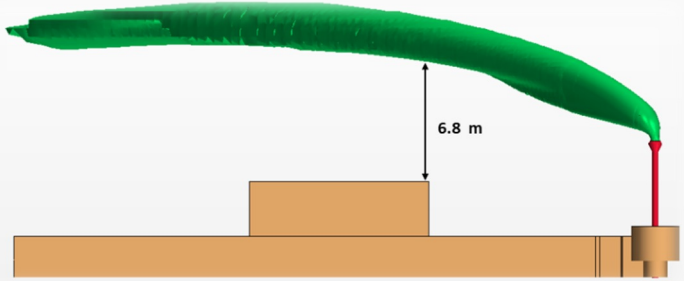


- 风载荷分析
  Analysis of wind load

其他水动力性能评估
Other Hydrodynamic Performance Evaluation

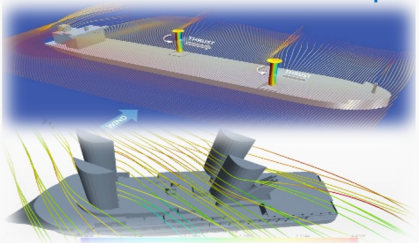


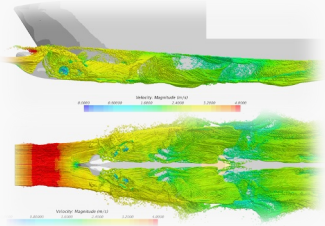


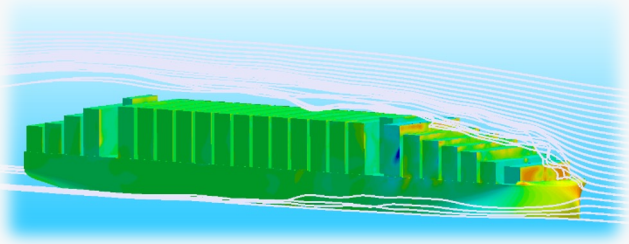


- 烟气弥散及温度场分析
Smoke dispersion and temperature

- 透气桅气流溢出分析
Spillage of breathable mast





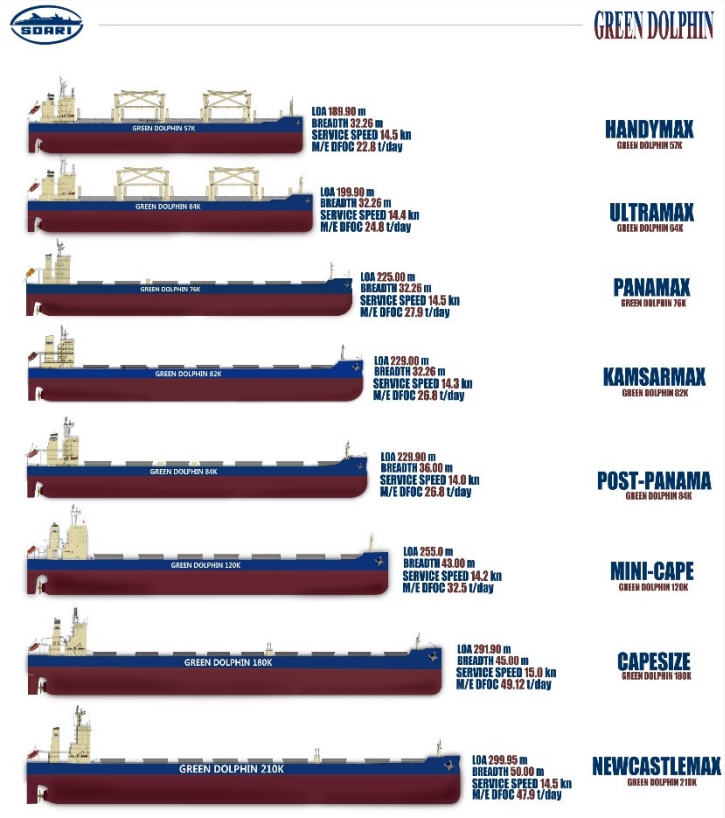


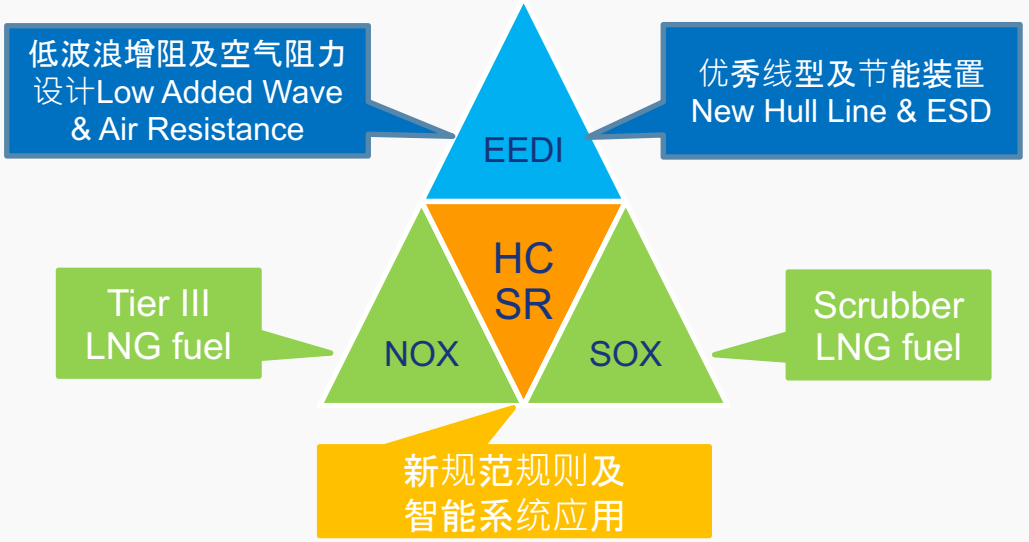
- 风力助推评估
Wind assistance

- 船底气泡流向分析
Air bubbles at bottom area

- 风阻分析
Wind resistance analysis

BULKER





安全高效的营运 Safe & Efficient Operation
大载重吨和舱容 Larger Dwt & Cargo Capacity
更加绿色环保 Better Emission Performance
更低综合油耗 Lower Combined FOC

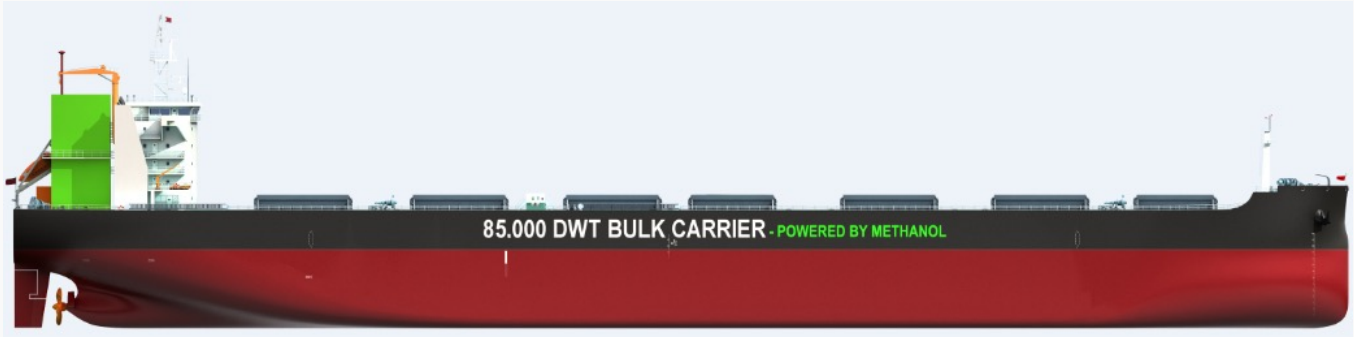
绿色智能海豚散货船
iDolphin BC

Dolphin 64,000DWT散货船方案 (新一代设计，常规燃料)
Dolphin 64K BC (New Generation, Conventional fuel)

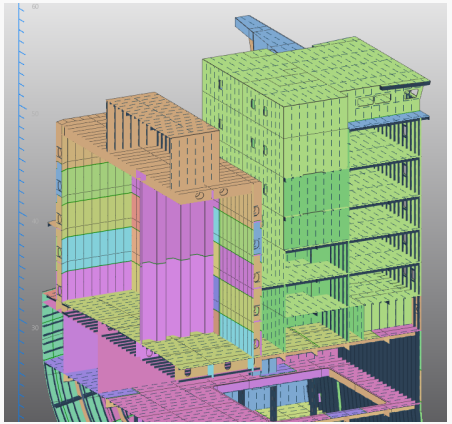
New Generation Ultramax

- 载重量增加至64000dwt，DWT is increased from 63500t to 64000t
- 油耗降至20t/day以下，FOC less than 20t/d
- 通过增加吃水可达到66000dwt，Reaching 66000t by deeper draft
- 可选用气泡润滑及风帆转筒技术，Option: BLS system:3-5%; Rotors: 3-5%
- 可选用替代燃料，Alternative fuels (Methanol, Ammonia, LNG)

Dolphin 210000吨及85000吨甲醇双燃料散货船
Dolphin 210K & 85K BC Methanol Fueled (EEDI -40%)



- 设置简单方舱作为甲醇储存舱
  Methanol tank - a simple cube;
- 甲醇舱材料采用普通碳钢，对舱内壁进行特涂
  Material of methanol tank is carbon steel, coating on internal surface of tank
- 甲醇作为主燃料，Methanol as prime fuel



APPROVAL IN PRINCIPLE

ABS

as requested by:

SDTR Marine PTE. Ltd.

Shanghai Merchant Ship Design & Research Institute

Date of Issuance:13 Dec. 2021

Certificate Number: T2199638

ABS has reviewed the documentation as specified in the ABS letter dated 30 Nov. 2021,7 Dec. 2021, 8 Dec. 2021, 26 Nov. 2021 (Task Nos.: T2190306, T2190308,T2190284, T2190289) in accordance with the ABS 2017 *Guidance Notes on Review and Approval of Novel Concepts*, and considers that the conceptual engineering as proposed is feasible for the intended application, and the facilities as presented are, in principle, in compliance with the applicable requirements of the ABS Marine Vessel Rules 2021; The International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels; MSC.1/Circ.1621,the Interim Guide for the Safety of Ships Using Methyl/Ethyl Alcohol as Fuel.

Facility: Methanol as Marine Fuel on BC

Description: Approval in Principle for Methanol as Marine Fuel on 85000 DWT Bulk Carrier

New Technology Maturity Level: Concept Verification Stage

To achieve final class approval of the subject design, the conditions and requirements as specified in the Approval Road Map (Task No. T2199638) must be satisfied.

Bing-Hong Wang
Director of Engineering, ABS

By: *Nanchun Li*

Nan-Chun Li
Managing Principal Engineer, ABS

Note: This certificate evidences compliance with one or more of the Rules, Guides, standards or other criteria of American Bureau of Shipping or a statutory, industrial or manufacturer's standards and is issued solely for the use of the Bureau, its committees, its clients or other authorized entities. Any significant changes to the aforementioned product without ABS approval will result in this certificate becoming void. This certificate is governed by the terms and conditions in the ABS Rules.

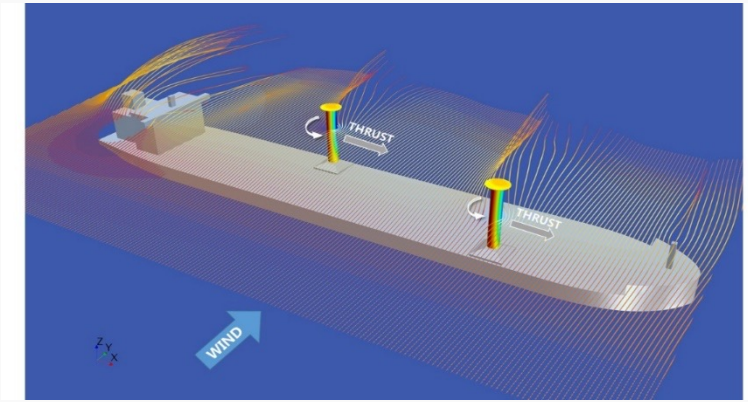
ENG-ATT-00307 Revision 0 Page 1 of 1

SDARI

新型节能装置在散货船上的评估
Energy Saving System on Bulker

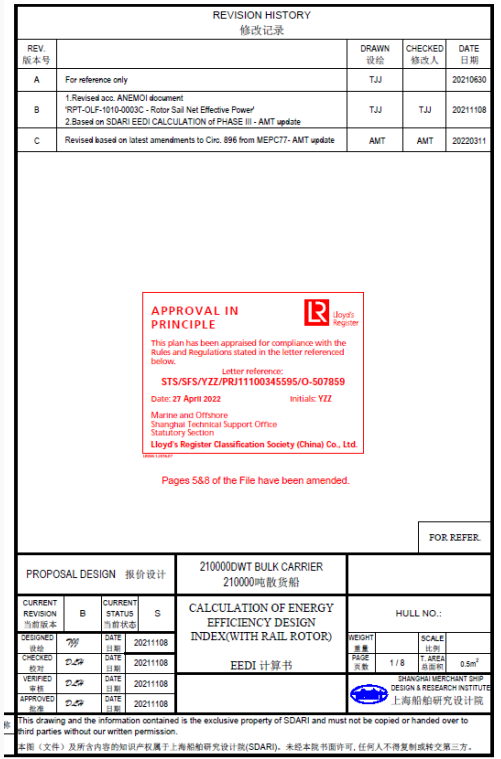
64000dwt散货船实船配置4套风筒系统，节能效果达到2-9%。

Ultramax fitted with 4 smaller 2x16m Rotor Sails on a Rail Deployment in 2018. The vessel sees savings of **2-9%** depending on the route (tramping).



210000dwt散货船实船配置4套风筒系统，EEDI数值提升约10%。

Newcastlemax fitted with 4 no. 5x35m Rotor Sails. The EEDI has improved by **10%**, and has been approved by LR.



REVISION HISTORY
修改记录

REV. 版本号		DRAWN 设绘	CHECKED 修改人	DATE 日期
A	For reference only	TJJ		20210630
B	1.Revised acc. ANEMOI document 'RPT-QLF-1010-0003C - Rotor Sail Net Effective Power' 2.Based on SDARI EEDI CALCULATION of PHASE III - AMT update	TJJ	TJJ	20211108
C	Revised based on latest amendments to Circ. 896 from MEPC77- AMT update	AMT	AMT	20220311

APPROVAL IN PRINCIPLE

This plan has been appraised for compliance with the Rules and Regulations stated in the letter referenced below.

Letter reference:
STS/SFS/YZZ/PRJ11100345595/O-507859

Date: 27 April 2022 Initials: YZZ

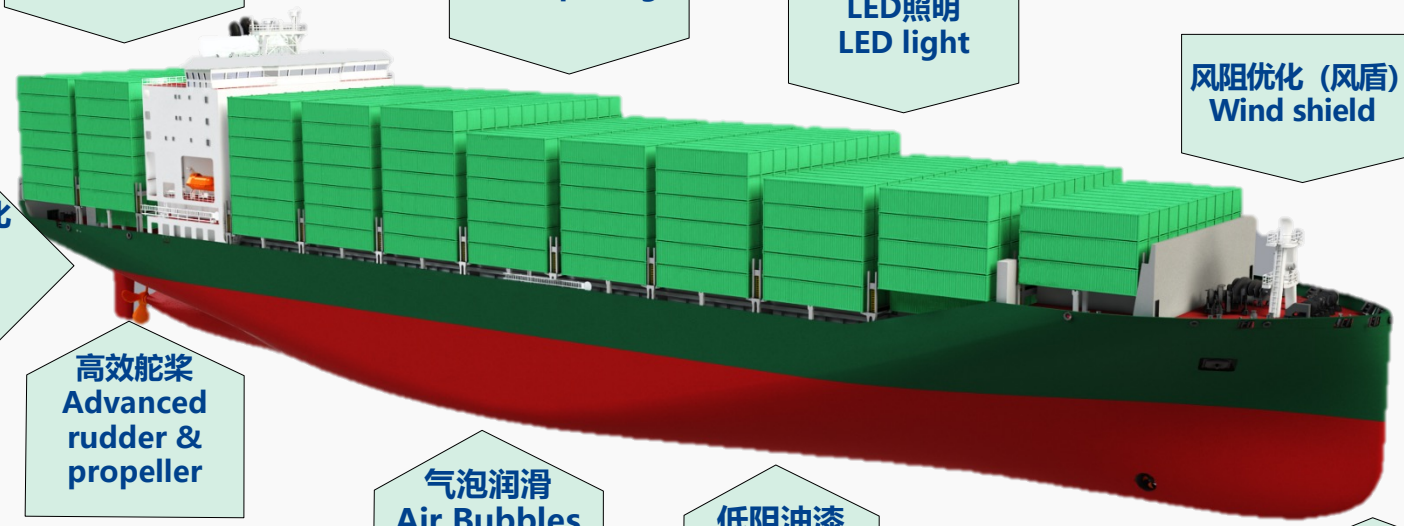
Marine and Offshore
Shanghai Technical Support Office
Statutory Section
Lloyd's Register Classification Society (China) Co., Ltd.

Pages 5&8 of the File have been amended.

FOR REFER.

PROPOSAL DESIGN 报价设计		210000DWT BULK CARRIER 210000吨散货船			
CURRENT REVISION 当前版本	B	CURRENT STATUS 当前状态	S	CALCULATION OF ENERGY EFFICIENCY DESIGN INDEX(WITH RAIL ROTOR) EEDI 计算书	HULL NO.:
DESIGNED 设绘		DATE 日期	20211108		WEIGHT 重量 / SCALE 比例
CHECKED 校对		DATE 日期	20211108		PAGE 共数 1 / 8 / T. AREA 叁面积 0.5m²
VERIFIED 审核		DATE 日期	20211108		
APPROVED 批准		DATE 日期	20211108		SHANGHAI MERCHANT SHIP DESIGN & RESEARCH INSTITUTE 上海船舶研究设计院

集装箱船发展趋势
Development Trend of CV



主辅机废气回收
Exhaust gas recovery from G/Es

船舶大型化
CVs upsizing

LED照明
LED light

风阻优化（风盾）
Wind shield

冷却系统优化
Optimized cooling system

高效舵桨
Advanced rudder & propeller

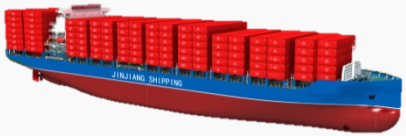
气泡润滑
Air Bubbles Hull Lubrication

低阻油漆
Improved hull paint

线型优化
Optimized hull form

海狮系列集装箱船
Sealion Container Vessel (2021-2022)

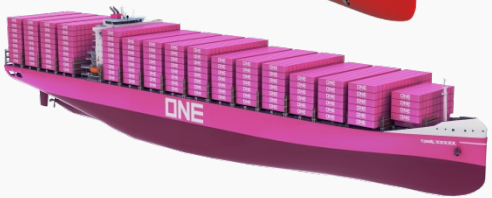
Conventional fuel with alternative fuel ready



- Sino Japan 1100TEU

- Yangon max. 1600TEU
- Bangkok max. 1800-1900TEU (Methanol ready)

- Chittagong max. 2400-3000TEU (Methanol ready)
- Post Panama 5500TEU
- Post Panama 7000TEU
- Post Panama 7100TEU (Methanol/NH3 ready)



- Open top 1800TEU (Methanol ready)
- Open top 3700TEU (Methanol ready)

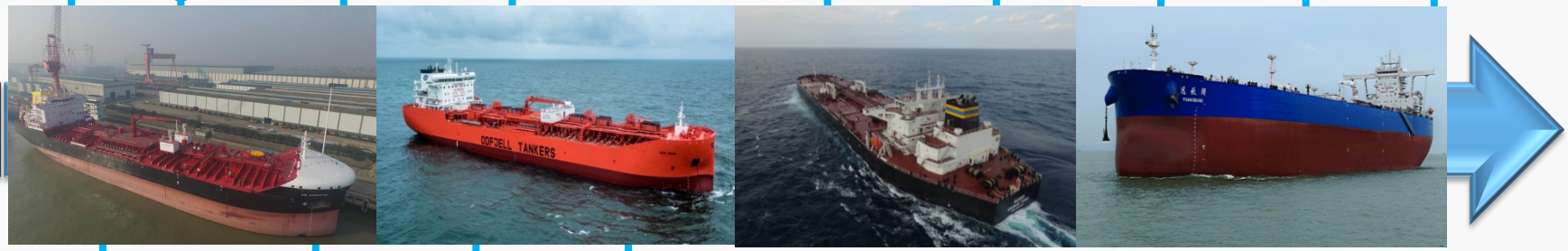
Green Pathway

…Zero Emission

- Langh 1200TEU scrubber & OCC ready
- MPCC Open top 1300TEU Methanol Dual Fuel
- MSC 8100TEU LNG Dual Fuel (NH3 ready)
- PIL 8200TEU LNG Dual Fuel (NH3 ready)
- MSC 11400TEU LNG Dual Fuel (NH3 ready)

油轮发展趋势
Development Trends of Tanker

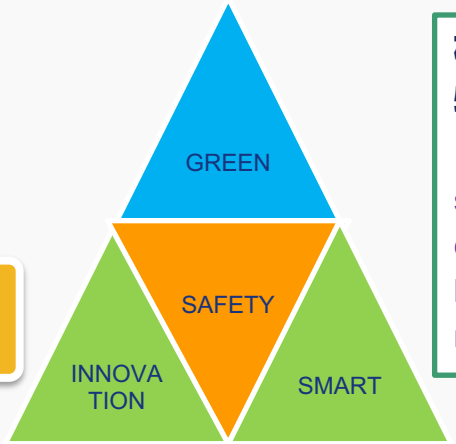
38k 40k 50k 56k 75k 115k 159k 308k 320k



38.8k 40k 41k 49k

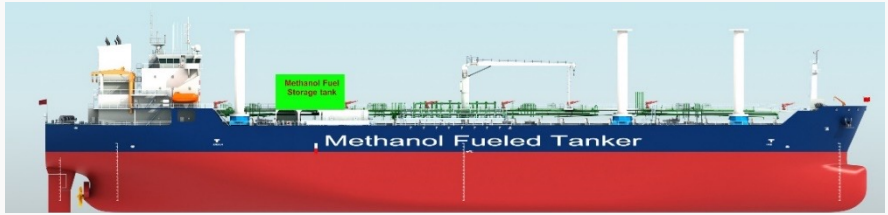
以安全为基石 Safety as cornerstone
以创新为导向 Innovation oriented
以绿色为标准 Green design as standard
以智能为追求 Smart design oriented

SDARI WHALE OT



标准船型求创新，特殊船型定制化
Innovation for standard tanker and customized design based on owner's requirement.

油轮的绿色发展
Green Development of Tanker

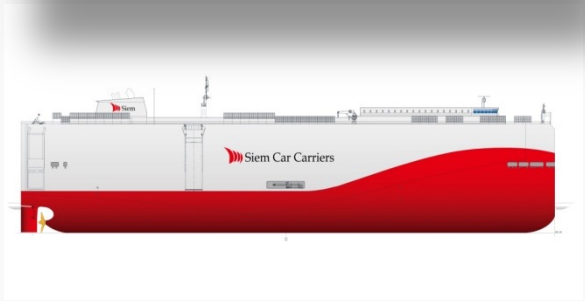


EEDI基线降低比例	燃油	LNG	LPG	甲醇
MR	34.9%	50.1%	42.2%	39.7%
LR1	34.8%	50.0%	42.0%	*
AFRA	31.3%	46.9%	38.5%	*
SUEZ	32.0%	47.7%	39.2%	*
VLCC	30.0%	46.0%	*表示暂无此主机型号	~35%

全系列LNG/氨/甲醇双燃料方案储备
LNG/methanol/ammonia dual fuel design for all series of tanker.
甲醇双燃料MR获RINA/CCS AIP
RINA/CCS AIP for methanol fuelled MR
氨双燃料MR获RINA AIP
RINA AIP for ammonia fuelled MR

汽车运输船系列
Pure Car & Truck Carrier Series

1	2000 CEU PCTC
2	3000 CEU PCTC
3	3600 CEU PCTC(DF)
4	3800 CEU PCTC
5	4100 CEU PCTC
6	5400 CEU PCTC
7	6700 CEU PCTC
8	7000 CEU PCTC(DF)
9	7500-8600 CEU PCTC(DF)
10	8500 CEU PCTC
11	9200 CEU PCTC
12	10000 CEU PCTC



UECC LNG+电池混动 3600CEU
UECC LNG Battery Hybrid 3,600 CEU

2022 Shippax Award

RINA Significant Ships 2021

USA《Maritime Reporter and Engineering News》2021

Siem LNG双燃料 7500CEU
Siem (VW) LNG-Fueled 7,500 CEU

2021 Shippax Award

RINA Significant Ships 2020

NYK LNG+电池混动 7000CEU
NYK LNG Battery Hybrid 7,000 CEU

- 首制船JASMINE LEADER号已于2023年2月成功交付
- 1st vessel “JASMINE LEADER” in the series successfully delivered on Feb. 2023

7000车位级别船型(7,000-7,800ceu)
7,000ceu Class PCTC (7,000-7,800ceu)

- LNG作为主燃料考虑氨燃料ready模式
  LNG as major fuel + Fuel ammonia ready
- 满足EEDIphase3要求，EEDI Phase 3 fulfilled
- 电池包加太阳能混动模式
  “Battery pack + Solar panel” hybrid solution
- 最小压载水设计理念，Minimum ballast water design

- 各种替代燃料READY设计思路
  LNG / Methanol / Ammonia design: ready for NB

9000车位级别船型(8,600-9,700ceu)
9,000ceu Class PCTC (8,600-9,700ceu)

- 灵活的替代燃料策略，Flexible alternative fuel strategy
- 资本成本和运营成本分析辅助业主决策
  CAPEX & OPEX analysis assisting Owner’s decision-making
- 优化燃油效率及装货收益率，Optimized fuel efficiency & payload ratio
- 增强高、重车辆及新能源车装载能力
  Enhanced H&H cargo and capability for EV loading

□ 常规燃料加替代燃料Ready模式，Conventional fuel with ammonia/methanol ready: ready for NB

零/净零燃料和减排技术现状
Status of Zero/Net-Zero Fuels

CSSC

技术成熟 Mature and Proven | 方案可行 Solutions identified | 存在困难 Major Challenges

	Feedstock	Production	Storage and Bunkering	Onboard Conversion	Safety and Management	Regulation	2022	2024	2026	2028	2030	2032	2034	2036
Fossil fuel														
E-Hydrogen														
Blue-Hydrogen														
E-Ammonia														
Blue-Ammonia														
E-Methanol														
Bio-Methanol														
E-Methane														
Bio-Methane														
Bio-Fuel														

Source: MMM Center for Zero Carbon Shipping

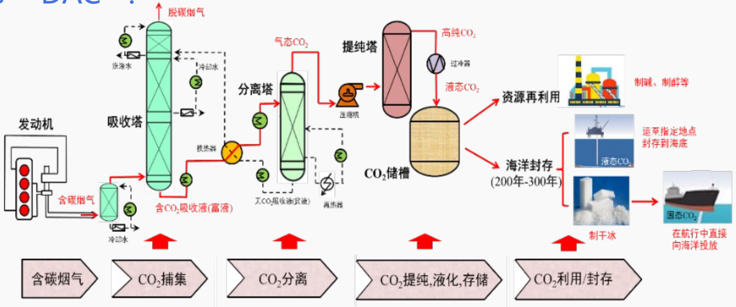
多种零碳燃料技术将长期共存

Various zero-carbon fuel solutions will coexist in the long term

碳捕捉技术
Technology of Carbon Capture

CO2既可以从船用发动机的废气中去除，也可以从大气中直接去除，这种方法通常称为“直接空气捕获”。

CO2 can be removed from Engine exhaust, and also from atmosphere, which is known as “DAC”.

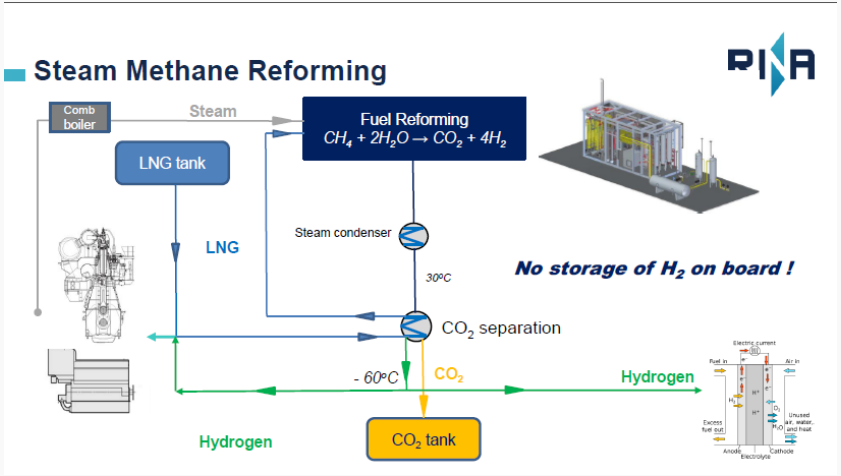


分离出CO2需要两个步骤：捕获和解吸/再生
Tow steps of CO2 separation : Capture & desorb/regenerate

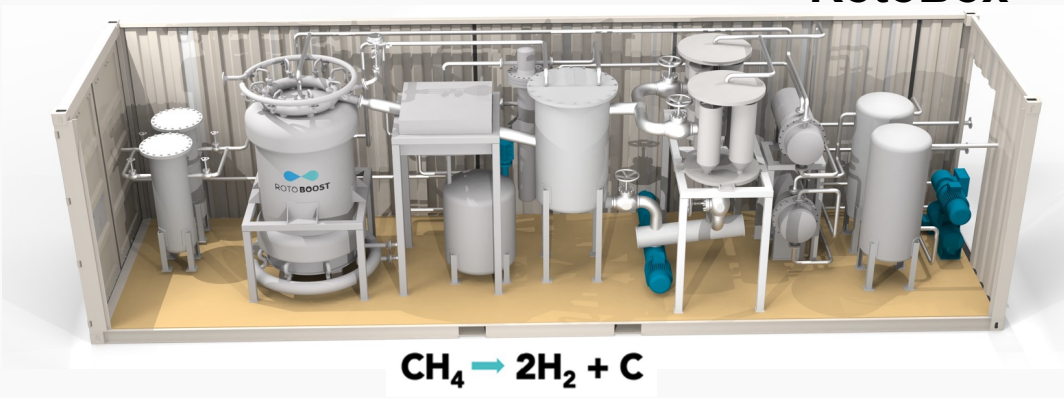
- 在捕获过程中，二氧化碳源与吸收器接触，CO2被吸收为固体或液体
  Capture: Origin of CO2 to be exposed to the absorber, to be absorbed as solid/liquid.
- 在解吸/再生步骤中，CO2被选择性地从吸收器中解吸，产生纯二氧化碳气体，原始的吸收器被再生以供进一步使用
  Desorb/regenerate: CO2 to be desorbed selectively by absorber, pure CO2 gas generated, the original absorber to be regenerated for further using.

中国每年103亿吨碳排放量，全球CCS每年永久封存400万吨，中国CCUS每年170万吨
The average carbon print: 1030 million tons in China，Permanently storage: 4 million tons/per year for Global CCS， 1.72 million tons/per year for China CCUS

重整制氢技术
LNG TO H2



RotoBox



LNG重整制氢

Steam Methane reforming for Hydrogen production

LNG裂变制氢

Methane Fusion and fission for Hydrogen production

实现氢和其他燃料的混烧或者为燃料电池提供氢

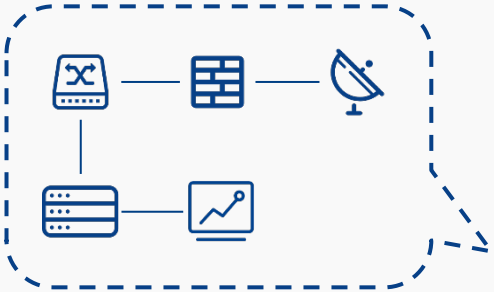
- Mix-burning with other fuel oil
- Provide hydrogen for Fuel cells

船舶数字营运支持系统DOSS
Digital Operation Support System （DOSS）

平台+应用模式
Platform + Apps

船岸同步
Onboard & Onshore Synchronizing

数字孪生
Digital Twin



- 数据可视化
  Data visualization
- 决策支持
  Decision support

DOSS 船基

DOSS Onboard

- 数据轻量级及数据加密
  Data lightweight, Data encryption

DOSS岸基

DOSS Onshore

- 船队管理
  Fleet management
- 数据服务
  Data service

DOSS系统家族成员
DOSS Apps

船基 Onboard

DOSS-I
智能集成平台
Integrated Platform

DOSS-E
智能能效管理
Energy Efficiency Management

DOSS-V
智能视频管理
Video Management

DOSS-M
设备健康管理
Machinery Health Management

DOSS-N
航行辅助决策
Navigation Assisted Decision

DOSS-C
智能货物管理
Cargo Management

岸基 Onshore

DOSS-Fleet
船队管理
Fleet Management

DOSS-Mobile
移动端管理
Mobile Management

数据分析服务
Data Analysis Services

碳排放管理
Carbon Emission Management

船期优化
Schedule optimization

更多应用
MORE APPS

零碳燃料及技术适应力
Zero-carbon fuel and technology adaptability

	Zero Carbon Fuel		Carbon-neutral fuel	Battery		CCUS	LNG to H2
	Ammonia	Hydrogen		Battery	Fuel Cell		
Applicable Ships	Large and medium-sized Ships	Large and medium-sized Ships	As conventional fuel	Short-range small vessel	Short-range small vessel	Large and medium-sized Ships	Large and medium-sized Ships

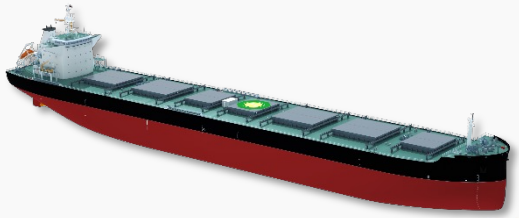
LNG Powered

Methanol Powered

Ammonia Powered

Battery(Super-capacitor)

CCUS



结语
Last but not the least

- 在脱碳的道路上，挑战总是存在的；脱碳需要行业内的合作，因为这个过程属于每个人； 作为船舶设计者，SDARI 将是零碳航运发展过程中一个值得信赖的技术合作伙伴。
- Challenges are always there on the way of decarbonization. Decarbonization needs collaboration in the industry, as the journey belongs to everyone. As a ship designer, SDARI would be a trustworthy technical partner for everyone in the journey to Zero Carbon Shipping.

CSSC 上海船舶研究设计院

谢谢!

Thanks for your attention

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