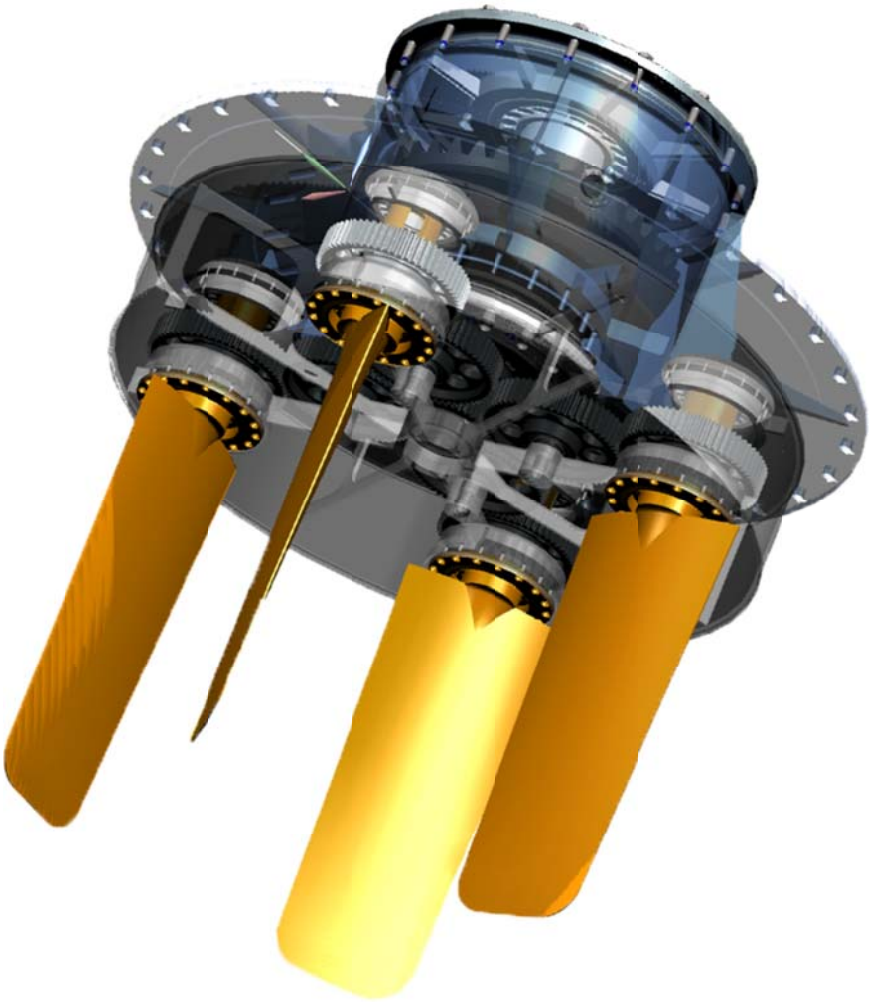
高效能船舶推进装置

HIGH-PERFORMANCE MARINE PROPULSION DEVICE

直 翼 舵 桨

STRAIGHT WING PROPELLER



浙江风神海洋工程技术有限公司

ZHEJIANG FENGSHEN OCEAN ENGINEERING TECHNOLOGY CO.LTD

公司概况 ABOUT US

公司简介 Company Profile

浙江风神海洋工程技术有限公司是专业制造船用推进装置的高新技术企业，公司研发的船用直翼推进装置-直翼舵桨为国内首创，并获得了欧洲发明专利及多项国家发明专利。

Zhejiang Fengshen Ocean Engineering Technology Co., Ltd., is a high-tech enterprise that develops and manufactures high-efficiency ship propulsion devices. The company's marine straight-wing propulsion device, the straight-wing rudder propeller, is the first in China and has obtained European patents and many National invention patents.

专利技术 Patents

新产品新技术 Products

高效能 船用直翼推进器

HIGH SFFICIENCY Marine straight-wing propeller

全航速 船舶直翼减摇器

ALL SPEEDS Marine straight wing stabilizer

矢量型 深潜器推进装置

THRUST VECTORING Deep submersible propulsion device

大推力 直翼侧向推进器

LARGE THRUST Straight wing lateral thruster

试验及制造 TESTS AND MANUFACTURE

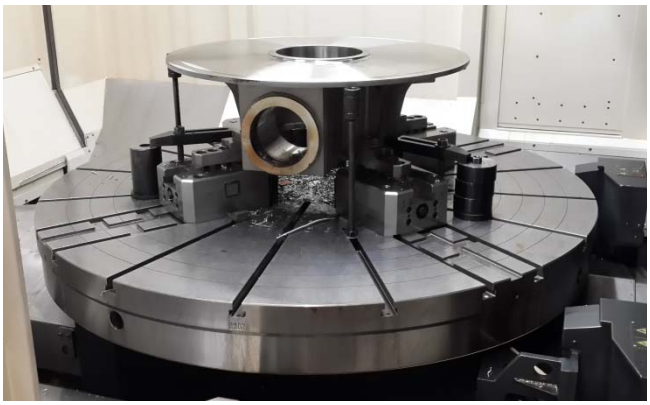
产品试验 Product tests

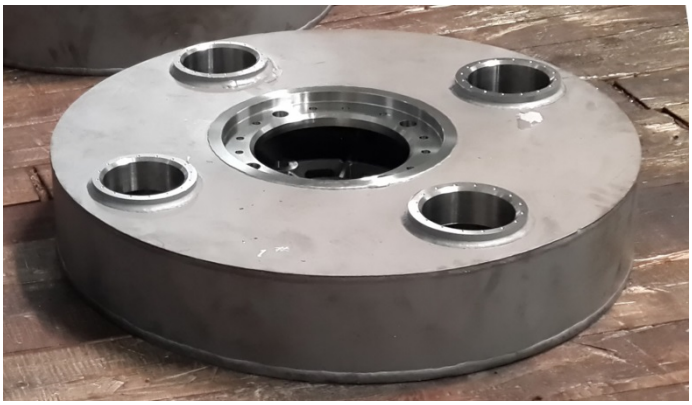
Rally test & Reliability test

Tank test for straight wing propelle

试验及制造 TESTS AND MANUFACTURE

产品制造 Product manufacturing





Parts processing

Bench scale test

产品概况 PRODUCT OVERVIEW

直翼推进是一种古老的船舶推进技术，传统的直翼推进器多采用连杆机构控制桨叶摆动，其具有极为优良的船舶操纵性。但直翼推进器的价格昂贵、推进效率不高，目前仅有少数特殊用途的船舶选择应用。

The straight-wing propulsion is an old marine propulsion technology. Traditional straight-wing propellers frequently use the connecting rod configuration to control the blade swing, which has excellent maneuverability. However, traditional straight-wing propellers have a high cost while a low propulsion efficiency. Nowadays only a few special-purpose vessels are selected for such application.

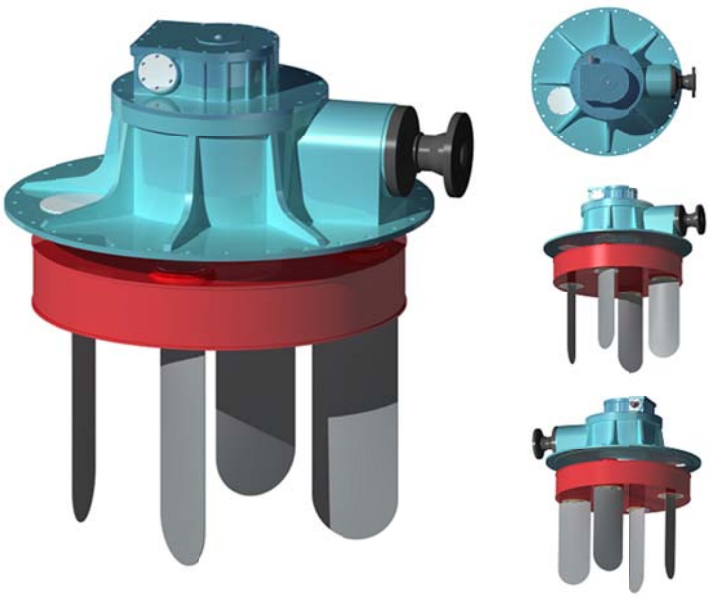
直翼舵桨装置采用行星齿轮传动机构控制桨叶运动，在具有优良操纵性的同时，桨叶还可获得高效的水动力特性。

The straight-wing rudder propeller adopts the planetary gear transmission mechanism to control the blade movement. While having excellent maneuverability, the blade can also achieve a high-efficient hydrodynamic performance.

直翼舵桨装置改变了传统的螺旋桨推进方式，为船舶提供了一种性能更优的推进技术。

The straight-wing rudder propeller reinvents the traditional propeller propulsion method, and provides a better propulsion technology for ships.

产品展示 3D product viewing



产品概况 PRODUCT OVERVIEW

产品特点 Features

☞ 推力面积大，吃水浅，推进效率高；
Large thrust area, shallow draft, high propulsion efficiency;

☞ 操纵性能优异，可对船舶进行定位并精确控制；
Excellent maneuverability, accurate positioning and control of the ship;

☞ 机构运转平稳、振动小、噪音低；
Smooth operation, small vibration, low noise;

☞ 高速运动时空泡性好，水动力效率高；
Excellent cavitation performance at high speeds, high hydrodynamic efficiency;

☞ 推进系统集成化程度高，占据船舶空间小；
High integration of the propulsion system, better use of the ship space;

☞ 便于安装、保养与维修。
Hassel-free installation, maintenance and repair

产品概况 PRODUCT OVERVIEW

产品技术优势 Product Technical Features

采用直翼舵桨推进的船舶比传统螺旋桨船舶在同等尺度下船舶的甲板面积及货舱舱容更大，同等航速下船舶推进所消耗的功率更少。

The straight wing rudder propeller system would offer a larger deck area and cargo cabin capacity within the same mechanical envelope as well as consume less power at the same speed compared to the use of conventional propeller in vessels.

船舶布置的主要特点：

Vessel Benefit Highlights:

☞ 可省却螺旋桨推进系统的尾轴、螺旋桨以及船舵，采用调速变距直翼舵桨还可省却船用齿轮箱和离合器；

Eliminate the tail shaft, propeller and rudder within the conventional propulsion system as well as mechanical differentials such as gearbox and clutch through the adoption of variable-speed pitch-regulated straight wing rudder system;

☞ 节省船舶推进系统的布置空间，有效提高船舶的使用面积或增加舱容；

Enable a save in the propulsion system space and maximize the vessel usage area as well as the cabin capacity;

☞ 船舶尾部线型简洁、流线型好，可节省船体建造费用及周期；

Offer a simplified and stream-lined vessel tail which then minimizes the construction cost and period;

☞ 直翼舵桨可在船上起吊进行维护或更换，船舶不必上排或进坞，节省维修费用；

Enable an on-board maintenance and replacement for the cost reduction;

☞ 由于直翼舵桨可以精准操控船舶，船舶更易实现自动驾驶功能。

Unlock the potential of autonomous function due to the better vessel control.

产品概况 PRODUCT OVERVIEW

产品的控制 Product Control

采用直翼舵桨的船舶其控制系统具有自动化程度高、操纵灵活、反应灵敏、可靠性好的特点。使船舶不但具有良好的操纵性，还可根据需要进行侧向移动、原地回转、倒航等各种复杂运动。

The straight wing rudder propeller would provide the ships with a better control capability being more automatic, flexible, responsive and reliable. It can not only enable an excellent daily maneuverability also facilitate the ship overcoming various maneuver challenges such as side-to-side, translational, in-situ gyration, and caving back

对于动力定位的船舶，计算机定位系统可以向直翼舵桨发出控制指令来调整推力的大小及方向，精确控制船舶。

For the dynamic positioning vessel, the straight wing rudder propeller would be able to adjust the thrust magnitude and direction in response to the positioning system's instruction and hence deliver an accurate ship control .

适用的船舶 Vessel Application Overview

柴油机动力船舶 Diesel-powered ship

采用直翼舵桨的船舶可以省却普通柴油机推进系统的尾轴、螺旋桨以及船舵，并有效提高船舶的使用面积或增加货舱舱容，船舶可获得更为良好的经济性。

The use of the straight wing rudder propeller would eliminate the tail shaft, propeller and rudder in conventional diesel propulsion system, increase the vessel usage area / cabin capacity and hence offer a cost-effective propulsion solution for diesel-powered ships.

电力推进船舶 All electric marine

电力推进是船舶推进技术发展的方向之一，电力推进船舶的推进电机目前大多采用变频调速技术。但变频调速系统特别是大功率电力推进系统的成本很高，制约了电力推进技术在船舶上的推广应用。利用直翼舵桨的调速变距功能，推进电机可采用普通电机取代变频调速电机，从而大幅降低动力系统的投资成本。因此，电力推进船舶采用直翼舵桨装置具有十分良好的经济性、实用性及应用前景。

The electric propulsion serves as a key enabling ship propulsion technology where variable frequency/speed drive is being mostly used. The variable frequency/speed drive especially for high power electric propulsion system is very costly which demotivate its use on ships. The unique feature of variable-speed pitch regulation in the straight wing rudder propeller could significantly reduce the capex in power train due to the variable frequency motor drive being replaced with normal motors. Therefore the straight wing rudder propeller could unleash the potential of electric propulsion system for vessels with a good prospect of the economy, practicality and application.

对操纵性要求高的船舶 High maneuverable ship

扫雷舰船、登陆舰艇、海洋平台、公务船、拖轮、工程船舶、车客渡轮等船舶需要具有良好的操纵性和动力定位功能。而直翼舵桨的推力大小及方向可以获得精准控制，因此直翼舵桨具有优良的操控性能以及动力定位能力。

The mine sweepers, landing ships, ocean platforms, law enforcement official vessels, tugboats, engineering ships, and vehicle-passenger ferry are required to have good maneuverability and dynamic positioning. The thrust magnitude and direction of the straight wing rudder propeller can be well regulated, landing itself into excellent maneuverability and dynamic positioning capability.

浅水船舶 Ship in shallow water

浅吃水船舶的推进效率不高且操纵性不佳，特别在急流顺水航段航行的船舶其船舵操纵力极低，对船舶航行带来严重的安全隐患。

The shallow draft vessels have a poor propulsion efficiency and maneuverability especially when the ship cruises in strong current down the stream which results in a severe ship safety violation.

直翼舵桨的直径可以较少受船舶吃水的限制，其线型也更为简单。因此在浅吃水和超浅吃水船舶上具有比螺旋桨更高的推进效率、更低的船舶阻力、更为优良的操纵性能。特别对在急流航道航行的船舶来说直翼舵桨将提供更为强大的推进力和操控力。

The straight wing rudder propeller could enable a higher propulsion efficiency, lower ship resistance and better maneuverability on shallow and ultra-shallow draft ships due to the much-simplified line shape and less draft restriction on the rudder diameter. It could also deliver a much more powerful propulsion and better maneuverability for the vessels in particular sailing on the strong current route.

高速船舶 High-speed ship

目前高速船大多采用螺旋桨推进，高速船螺旋桨的特点是输入功率大、转速高、轴线倾角大。这些因素将使螺旋桨产生严重的空泡现象，它能导致螺旋桨的效率下降、结构损坏以及高量级的噪声和振动。为了改善推进器的空泡现象，许多高速船采用喷水推进装置。但喷水推进器的喷口面积较小，水流从船底进入喷管后需要进行提升做功损失能量，导致其推进性能特别在低速状态下推进效率不高。

Nowadays, the high-speed ships are mostly using propellers, and the high-speed ship propeller manifest itself in large input power, high rotational speed and large axial inclination. These characteristics would result in a severe cavitation which could reduce the propeller efficiency, cause the structural damage, and a bad NVH performance. In order to address the cavitation issue, many high-speed ships employ the water jet propulsion device. However, the relative small ejector nozzle necessitates an additional power input to facilitate the water flow from the bottom of the ship to the nozzle, resulting a poor propulsion performance especially a low efficiency at low speed operation.

采用直翼舵桨可以很好地改善上述问题并可获得满意的推进性能及更高的推进效率：

The use of straight wing rudder propeller could be a good solution to the above

problems and enable a satisfactory propulsion performance and higher efficiency.

直翼舵桨的推进面积一般大于普通螺旋桨，而转速仅为螺旋桨的 1/2-1/3 左右，可有效降低推进器的推力负荷及线速度，因此具有更高的推进效率及优良的空泡性能。

The propulsion area of the straight wing rudder propeller is generally larger than that of the ordinary propeller while the rotation speed is only about 1 / 2-1 / 3, which can effectively reduce the thrust load and speed of the propeller and hence enable a higher propulsion efficiency as well as excellent cavitation performance.

直翼舵桨在工作时几乎不存在斜流，完全是顺流状态，其振动与噪声要优于螺旋桨。

The straight wing rudder propeller exhibits a full downstream status with a rare oblique flow in operation. In addition, It performs better in NVH than the conventional propeller.

直翼舵桨无水下附体，在船舶高速运行时不会增加额外阻力。

The straight wing rudder propeller has no underwater body, which ~~will not~~ add no extra resistance while cruising at high speeds.

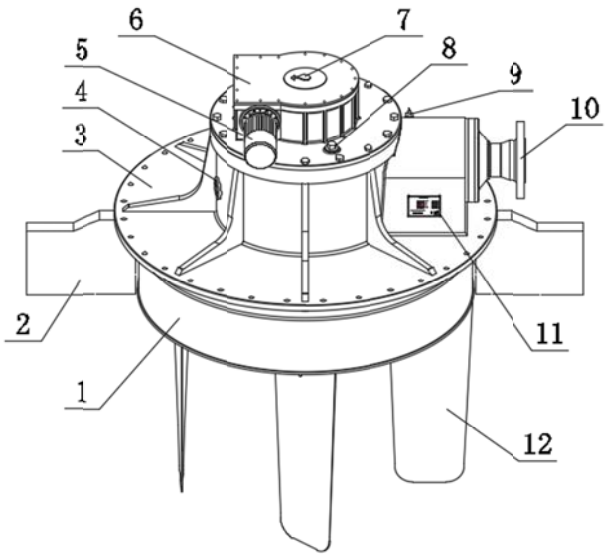
直翼舵桨的推进面积可远大于喷水推进装置，在运行过程中不易缠绕阻塞。

The propulsion area of the straight wing rudder propeller could be much larger than that of the water jet propulsion device, enabling a clog-free operation.

理论计算及实船对比试验表明：直翼舵桨在浅水中的推进效率可比螺旋桨提高15%以上。

Theoretical calculations as well as benchmarking tests on real ships demonstrate that propulsion efficiency of the straight wing rudder propeller can be over 15% higher than that of propeller in the shallow water.

产品型号参数　TECHNICAL DATA



1 转筒（含主轴）　2 船体基座　3 减速箱　4 油标　5 舵机　6 转舵减速箱
7 舵角指示装置　8 注油螺塞　9 传感器　10 动力输入法兰　11 铭牌　12 桨叶

序号 No.	型 号 Model	输入功率 Power P(kW)	输入转速 Input speed N(rpm)	桨叶数 Number of blades Z.	桨径 Diameter of paddle Φd(mm)	桨叶长 Length of blade L(mm)	重量 Weight W(kg)
1	*ZYDJ-2*	*2*	*1500*	*4*	*196*	*190*	*10*
2	*ZYDJ-5*	*5*	*1200*	*4*	*390*	*300*	*80*
3	*ZYDJ-11*	*11*	*975*	*4*	*448*	*400*	*145*
4	*ZYDJ-30*	*30*	*1280*	*4*	*504*	*400*	*190*
5	*ZYDJ-75*	*75*	*700*	*4*	*560*	*490*	*320*
6	*ZYDJ-90*	*90*	*1500*	*4*	*560*	*490*	*350*
7	*ZYDJ-160*	*160*	*980*	*5*	*1182*	*1250*	*3200*
8	*ZYDJ-550*	*537*	*2300*	*4*	*672*	*450*	*550*
9	*ZYDJ-800*	*800-1000*	*800-1000*	*5-6*	*1240-2208*	*750-1500*	*≥6000*
10	*ZYDJ-1200*	*1200-1500*	*500-800*	*5-6*	*1560-3040*	*1100-2200*	*≥12000*
11	*ZYDJ-2000*	*1600-2000*	*480*	*6*	*2688*	*2100*	*26000*

说明：黑体标注数据的为实桨或在研发中的直翼舵桨（其中 *ZYDJ-550 为高速船用桨*）
Note: The data marked in bold are the existing products or products under development (ZYDJ-550 is a high-speed marine propeller)

应用案例 ACHIEVEMENT

上海迪士尼 90 客观光渡船

船　　长	Length overall	20 m
船　　宽	Breadth moulded	4.5 m
吃　　水	Draft designed	0.62 m
推进功率	Rated power	2×10 kW
推进装置	Propeller type	直翼舵桨
航　　速	Design speed	12 km/h
节能（与螺旋桨船相比）Energy savings（compared to propeller boats）		> 10%

广西漓江 80 客位浅吃水豪华客轮

船　　长	Length overall	32 m
船　　宽	Breadth moulded	6 m
吃　　水	Draft designed	0.52 m
推进功率	Rated power	2×75 kW
推进装置	Propeller type	直翼舵桨
航　　速	Design speed	18 km/h
节能（与螺旋桨船相比）Energy savings（compared to propeller boats）		> 15%

桂林 38 客位纯电动游览船

船　　长	Length overall	16.2 m
船　　宽	Breadth moulded	3.8 m
吃　　水	Draft designed	0.45 m
推进功率	Rated power	2×10kW
推进装置	Propeller type	直翼舵桨
航　　速	Design speed	14 km/h
节能（与螺旋桨船相比）Energy savings（compared to propeller boats）		> 15%

桂林 42 客位纯电动游览船

船　　长	Length overall	16.5 m
船　　宽	Breadth moulded	3.9 m
吃　　水	Draft designed	0.46 m
推进功率	Rated power	2×11 kW
推进装置	Propeller type	直翼舵桨
航　　速	Design speed	14 km/h
节能（与螺旋桨船相比）Energy savings（compared to propeller boats）		> 15%

应用案例 ACHIEVEMENT

内河航道清淤船

船　　长	Length overall	15 m
船　　宽	Breadth moulded	3.8 m
吃　　水	Draft designed	0.62 m
推进功率	Rated power	4×11 kW
推进装置	Propeller type	直翼舵桨
航　　速	Design speed	8 km/h
节能（与螺旋桨船相比）Energy savings（compared to propeller boats）		-

23 米浅水海事巡逻船

船　　长	Length overall	23.9 m
船　　宽	Breadth moulded	5.0 m
吃　　水	Draft designed	0.50 m
推进功率	Rated power	2×90 kW
推进装置	Propeller type	直翼舵桨
航　　速	Design speed	20 km/h
节能（与螺旋桨船相比）Energy savings（compared to propeller boats）		> 15%

漓江 27 米浅吃水游览船

船　　长	Length overall	27.5 m
船　　宽	Breadth moulded	4.4 m
吃　　水	Draft designed	0.45 m
推进功率	Rated power	2×28 kW
推进装置	Propeller type	直翼舵桨
航　　速	Design speed	14 km/h
节能（与螺旋桨船相比）Energy savings（compared to propeller boats）		> 20%

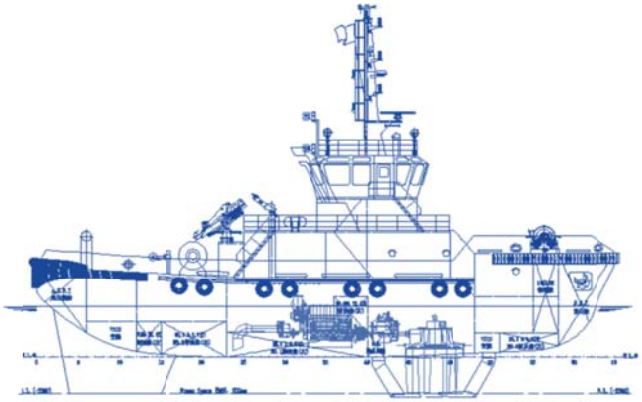
2000 吨级内河纯电动自卸散货船

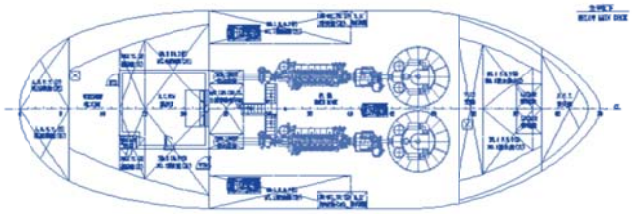
船　　长	Length overall	70.5 m
船　　宽	Breadth moulded	13.9 m
吃　　水	Draft designed	3.3 m
推进功率	Rated power	2×160 kW
推进装置	Propeller type	直翼舵桨
航　　速	Design speed	13 km/h
节能（与螺旋桨船相比）Energy savings（compared to propeller boats）		> 20%

应用案例 ACHIEVEMENT

560TEU 集装箱船（侧向推进器）

船　　长	Length overall	120 m
船　　宽	Breadth moulded	21.8 m
吃　　水	Draft designed	5.2 m
额定功率	Rated power	160 kW
推进装置	Propeller type	直翼侧向推进器 Straight wing lateral thruster
推力（与螺旋桨侧向推进器相比） Thrust (compared to lateral thruster)		> 5%



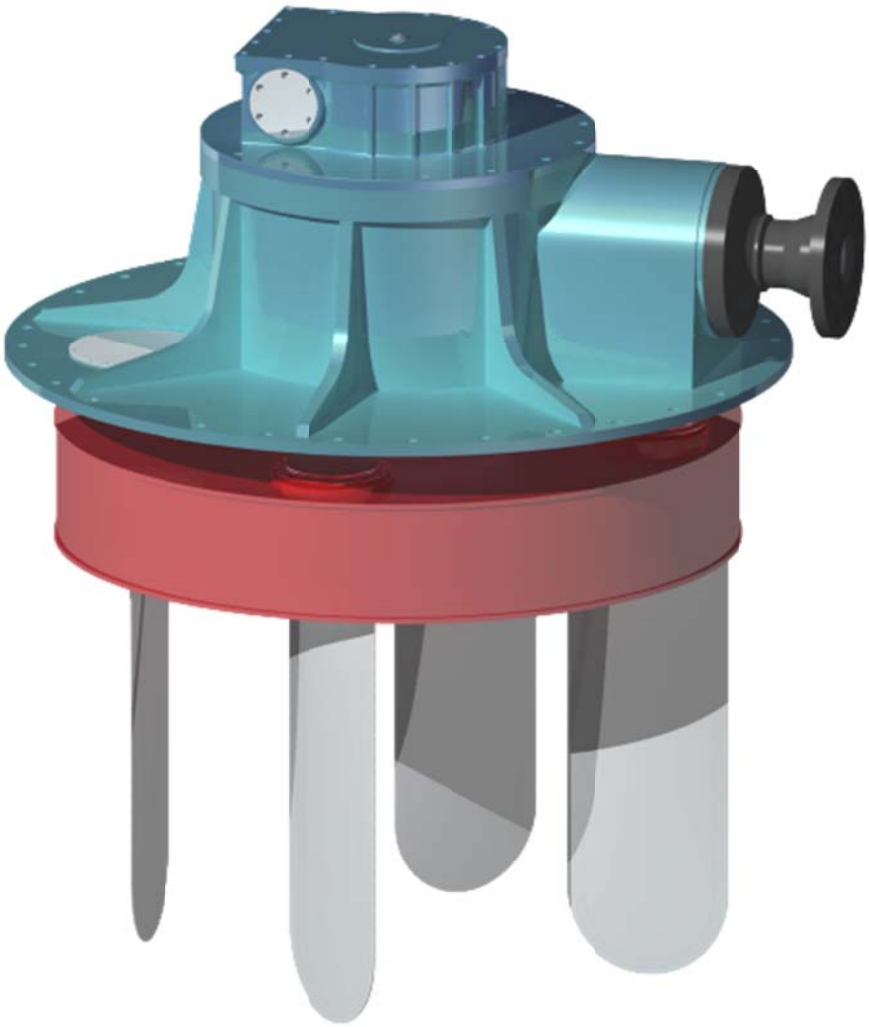


35 米级拖船（技术论证）

船　　长	Length overall	35 m
船　　宽	Breadth moulded	12 m
吃　　水	Draft designed	3.0 m
额定功率	Rated power	2×1920 kW
推进装置	Propeller type	直翼舵桨 Straight wing propeller
推力（与同类型船相比） Thrust (Compared to similar ships)		> 5%

浙江风神 • 直翼舵桨

ZHEJIANG FENGSHEN • STRAIGHT WING PROPELLER



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