

**VOITH**

Matching the Requirements  
of Offshore Support Vessels.  
Voith Schneider Propellers



# Voith Propulsion Technology for All Kinds of Offshore Applications





Voith Turbo Marine is an expert in propulsion systems.

Voith Turbo, the specialist in hydrodynamic drive, coupling and braking systems for road, rail and industrial applications as well as for ship propulsion systems, is a Group Division of Voith GmbH.

With nearly 40 000 employees and sales of € 5.2 billion during the fiscal year 2009/2010, Voith is one of the large family-owned companies in Europe. The company is active in the energy, oil, gas, paper and raw material markets, as well as in the transportation and automotive industry.





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## The Offshore Industry's Demand

An ever growing number of operators benefit from using the Voith Schneider Propellers (VSP) on their offshore vessels. The ability to carry out operations in adverse sea conditions has been proven on many occasions: when other vessels were unable to approach or even had to turn back, the VSP propelled vessels safely completed their task. To operate in harsh sea conditions whilst maintaining both the safety of the vessel and the crew, the vessel needs to keep position and provide a stable platform on which the crew can work. The VSP and its unique feature of the Voith Roll Stabilization in combination with DP control provide unequalled performance. The captain and crew must have the confidence that the vessel will perform predictably and reliably under all conditions, and the Voith Schneider Propeller offers this security of operation. Voith has developed an effective solution for offshore

vessels and for several years now the superior capabilities of the VSP have been proven on many vessels operating all over the globe. Voith engineers have extensive experience and are able to assist and support during the design phase of any project, through to commissioning. As a global company, Voith has a full support network of own offices and associated shipyards throughout the world.

The VSP is available in a range of power options up to 4.0 MW for diesel or electric motor drive. The units are approved by all major class societies and available for use in ice.



2 Courtesy of the builder Gondan Shipyard, Spain



3 Courtesy of the builder Gondan Shipyard, Spain

- 1 Windfarm Installation Vessel Windcarrier
- 2 Platform Supply Vessel Edda Fram
- 3 Stern Arrangement of Edda Fram



The smallest and largest VSP

Voith Schneider Propellers are the steerable thrusters that do not suffer from gear failures. Their superior performance is demonstrated:

- By minimizing ship's rolling in heavy seaways
- By excellent DP behaviour
- By efficient fuel consumption while sailing or at station keeping
- By reducing the danger of shock loads due to ventilation
- By trouble free operations and maximum availability.



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1 Inspection, Maintenance and Repair Vessel Edda Flora

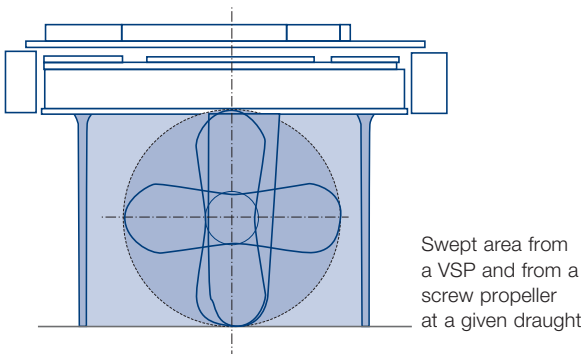
2 Windfarm Installation Vessel Sea Installer

# Efficiency

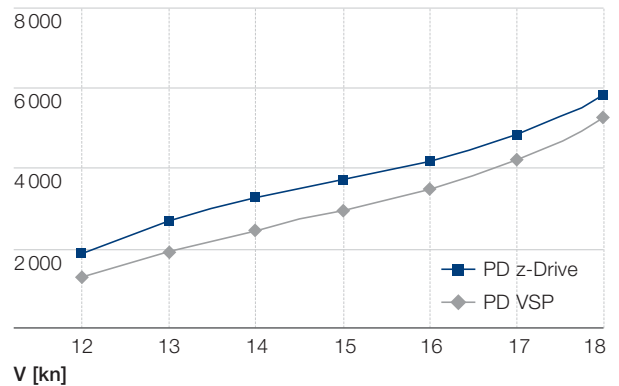
With numerous model tests performed by major tank test facilities in Europe it has been proven that the VSP offers a higher efficiency compared to other steerable thrusters while sailing. This fact can physically be explained by the larger swept area of the rectangular blade area of a VSP compared to the circular blade area of a screw propeller at same diameter. The larger swept area leads to lower wake velocity of the propeller, thus resulting in higher propulsion efficiency. Additionally, there are no elements like struts, hubs etc. which give a parasitic resistance.

The difference between steerable thrusters and the Voith Schneider Propeller is about 10 % less power requirement for sailing at speeds up to 16 kn. This leads to considerable fuel savings while sailing and reduces exhaust gases significantly.

## Comparison of the swept area



## Model test results of power at the propeller





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3 Diving Support Vessel Windermere

4 Deep Recovery Vessel Seabed Worker

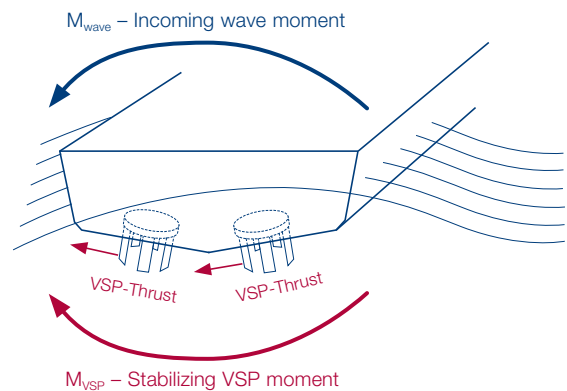
# Voith Roll Stabilization

The Voith Schneider Propeller generates both, propulsion and steering forces. The thrust can quickly be adjusted in terms of magnitude and direction. This very rapid thrust variation and generation of very high moments facilitates the use of the VSP for effective reduction of the ship's rolling motion. When the vessel encounters an incoming wave, sensors measure the angular acceleration and the system immediately calculates and applies the restoring force to counteract the rolling motion of the vessel. The captain on the bridge can preselect the power range to be applied to roll stabilization. This unique way of stabilization works at zero speed, being under DP or while sailing. As the feature of roll stabilization is incorporated into the propeller, it requires only some additional equipment. Roll stabilizing tanks are no longer required and thus no reduction of payload has to be encountered.

Voith Roll Stabilization (VRS) has proven its excellent performance on board numerous offshore vessels in harsh weather conditions. A more than 75% reduction of roll angles has been achieved, all in accordance to the predictions in early design stage.

Extending the operational window with Voith Roll Stabilization generates additional income for the ship owner due to more working days as VRS facilitates safe offshore support operations even at severe weather conditions. It also increases the comfort of the crew: their demanding jobs require health and well-being. Additionally, the safety of cargo, ship and crew is enhanced.

## Moments and forces during ship's rolling





- 1 Inspection, Maintenance and Repair Vessel Polar King
- 2 Accommodation and Service Vessel Edda Fides
- 3 IMR Edda Flora
- 4 Partly emerged nozzle propeller
- 5 Partly emerged VSP
- 6 Captain during operations



1 Courtesy of C.N.P. Freire, Spain



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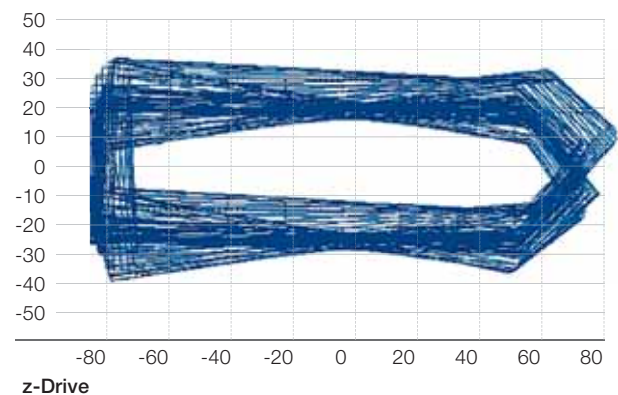
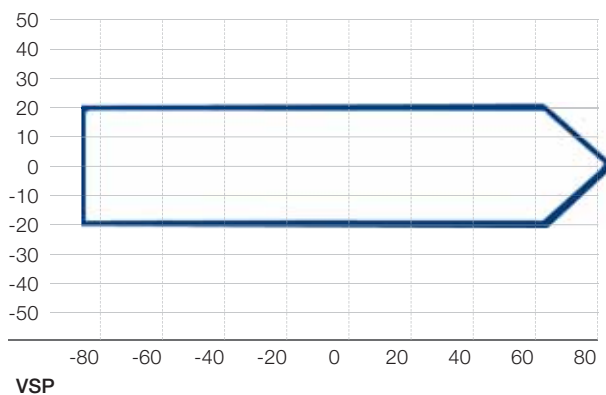
## DP Performance

Keeping the watch box under DP with lowest mechanical impact on the thrusters and low power consumption is the operational behavior proven by all VSP driven offshore vessels. Due to the fast steering response time it is easily possible to react immediately when the ship starts moving away from its position. The VSPs simply continue rotating while pitch is automatically adjusted to counteract the wind, waves or current. As the VSP is designed and built for such operations there is no special impact on wear and tear of the gears.

The control system pertaining to the VSPs as well as the VSPs themselves have been approved by major class societies to be DP3 compliant.

The excellent DP performance of a VSP propelled vessel reduces fuel consumption during DP which leads to cost savings.

### Keeping the watch box



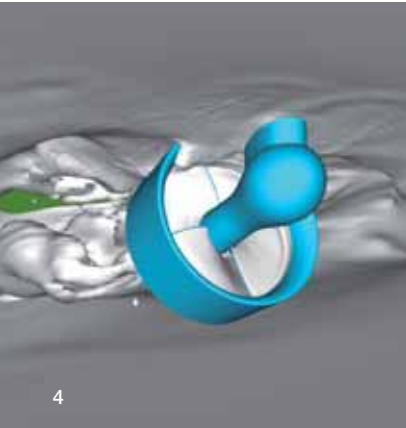




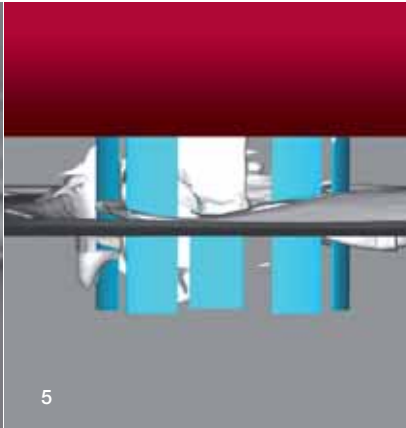
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# Ventilation

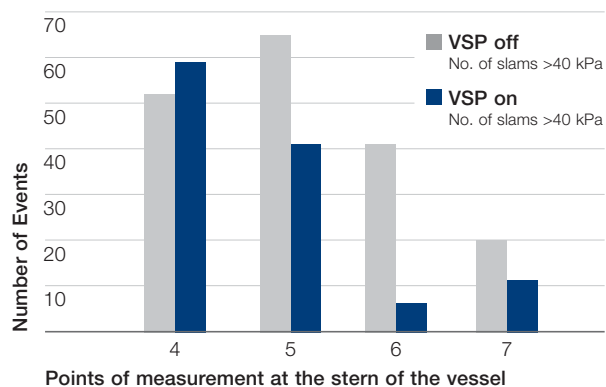
A modern offshore support vessel should be able to handle severe working conditions, like rough weather with high waves; this is no problem for a VSP driven ship. The VSP is very little affected by ventilation and slamming because of its unique physical principle for thrust generation. While turning, even at zero pitch, it creates a kind of water cushion at the stern, thus reducing the danger of emerging propellers and slamming loads. This feature has been proven in tests with sensors at the ship's model around the propeller.

Even in case of a partly emerged propeller, the drop in thrust is by far less compared to azimuth thrusters. This results from the uniform pressure distribution over the length of the vertical blades. Pressure distribution of a screw propeller is much more sensitive against ventilation.

Furthermore, the VSP has a much higher moment of inertia compared to azimuth thrusters; this means that there are no shock loads on the gear to be expected at the VSP due to ventilation. With azimuth thrusters this can lead to tooth internal fatigue failure (TIFF).

In bad weather condition on DP or in transit, even if the propeller is only partly submerged, the thrust losses are minimal and damages of the gears are avoided. This results in low service costs and a high availability. The physical principles also result in less noise and vibrations due to slamming, thus increasing the crew's comfort; it is a unique physical effect which only the VSP offers.

## Reduction of slamming by VSP



# Arrangement of the Voith Schneider Propeller

The conventional arrangement of two VSPs aft has been realized on PSVs like Edda Fram and Offshore Construction Vessels (OCV) like Windermere and Seabed Worker. It is the solution for power demands up to 8 MW, typically for vessels up to 100m length and speed range of 16 kn.

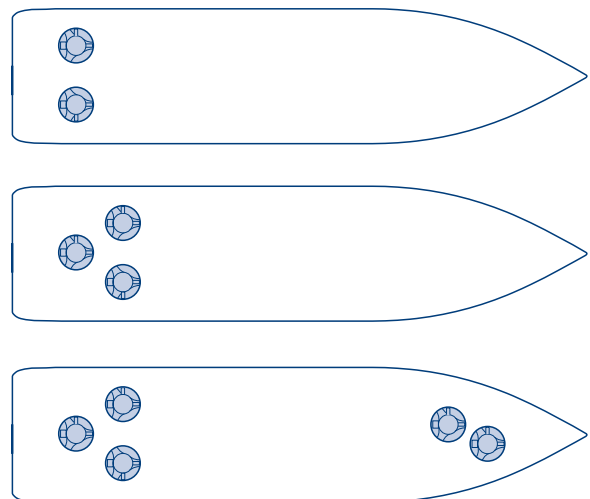
On larger ships three VSPs aft have been installed, e.g. on wind farm installations vessels like Windcarrier. All three propellers contribute to the Voith Roll Stabilization and thus generate a safe and stable working environment on board.

The largest ships ever built with VSP propulsion measure up to 160m in length, as the OCV North Sea Giant. Such ships have even five VSPs with a total installed power up to 19 MW. Three VSPs are installed aft, and two in a recess in the bow.

Voith Schneider Propellers can easily be integrated in any ship design. With the flexibility in selected power and location it offers a wide range of possibilities to ensure optimal installation and usage.

## Arrangement of the VSPs

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# Working Principle of the Voith Schneider Propeller

The VSP rotates around its vertical axis and generates thrust through four, five or six blades that oscillate around their shaft. Like the tail fin of a dolphin, the propeller blades generate thrust as they move through the water at an optimum angle. From this unique arrangement several important features follow:

- The thrust from a VSP can be vectored through 360° according to the x/y-logic providing propulsion and steering in one unit, thus eliminating the need for rudders.
- The thrust from a VSP can be directed through 180° within a few seconds which gives the vessel extremely good maneuverability. The ability to use the fast response time is exploited under dynamic positioning (DP) to achieve extremely good control.
- In addition, the VSP can provide active roll stabilization either when in transit or when on station, eliminating the requirement for internal tanks.

The VSP is a slow rotating machine, thus offering high reliability and excellent availability. With proven low through life costs the VSP provides efficient propulsion, excellent maneuverability and high seaworthiness for demanding applications.

## Voith Schneider Propeller Kinematic

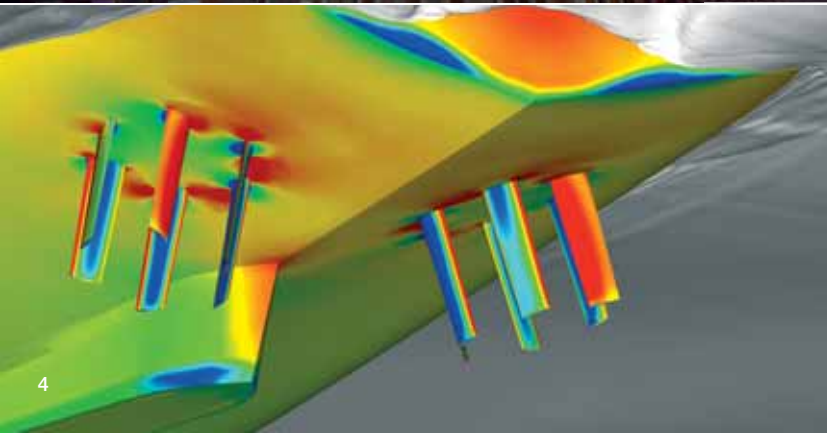
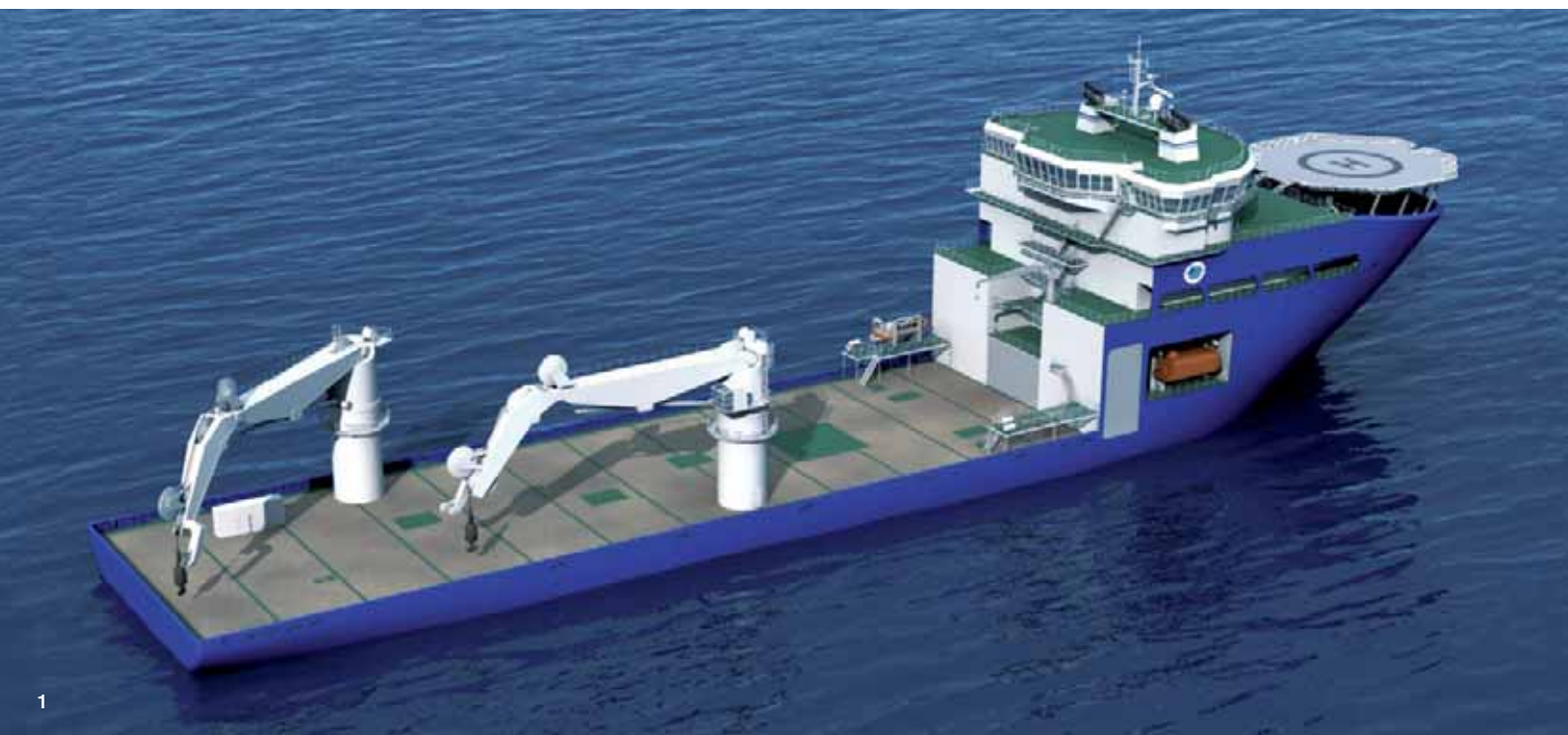


1 VSP with electric motor and hydraulic power pack

2 Bow arrangement of two VSPs







# Design Assistance and Engineering Support

Voith Turbo Schneider Propulsion is always at the edge of technological development. With its own highly competent staff and engineers, customers are supported with services such as:

- Roll performance prediction
- Extensive experience in VSP application and optimal integration into the ship design
- Advanced CFD and FEM methods for optimization of hull lines and propeller arrangement
- Model propellers for tank tests incl. technical support during the tests
- Simulator training and maneuver validation
- Nautical and technical training.

During installation of the units on board the shipyard is supported by:

- Installation of the VSP blades
- Setting-to-work of the propellers
- Setting-to-work of the control system
- Final sea acceptance trials.

The design assistance as well as engineering and installation support guarantees:

- Reliable performance prediction of the vessel
- Optimum design of hull
- Efficient and robust design of propeller foundations
- Short and efficient commissioning of the vessel
- Optimum knowledge of the capability of nautical personal
- Efficient on board inspection and maintenance processes of technical personal on board.

- 1 Offshore Construction Vessel North Sea Giant
- 2 Stern arrangement of three VSPs
- 3 Ship handling simulator at Voith
- 4 CFD analysis
- 5 Installing a VSP on board an OSV



# Reliability and Availability

The VSP rotates at about one third of screw propellers' revolutions. This low rotational speed results in high torques, which calls for a robust design. In turn this leads to a higher weight. However, the low rotational speeds of the VSP combined with the low mechanical gear loads during DP have significant advantages:

- High availability and reliability
- No gear failures
- The blades are drop forged, high tensile stainless steel
- The blades are free of any harmful cavitation up to a speed of 18 kn
- Low life cycle costs
- Reduced vulnerability to obstacles such as driftwood and ice. The blades generally strike such objects with their leading edge, kicking them aside instead of sucking them in.

## **In-house Production of all Major Components**

Our customers expect highest quality and a long, trouble free life time of the propulsion units. We meet these requirements by keeping the production of the major components – and of course the assembly – in our facilities in Southern Germany. From gear cutting on one of these largest bevel gear cutting machines to welding and finally testing the units on our test beds, it is all German quality at its highest standard.





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1 Platform Assist Vessel Forte

2 Propeller wash of a VSP

The high quality and reliability of the VSP leads to:

- Higher operating hours due to the high availability, thus generating extra income
- The robustness reduces the risk of damages on the propeller increasing availability and reducing down time and repair costs
- Long service intervals minimizing service and maintenance cost therefore life cycle costs are reduced.

# Service

High availability and trouble-free operation of all systems are of vital importance during offshore operations. The worldwide service of Voith Turbo Marine ensures:

- 24/7 hotline
- Regular health checks
- Highest availability
- Offshore-qualified service technicians
- Global service network
- Availability of spare parts and key components.

Service technicians wherever and whenever needed are the cornerstone for minimum downtime and maximum working hours of offshore vessels.









Voith Radial Propeller in the workshop

# Beyond the VSP Voith Turbo Marine Offers Various Other Propellers and Services to the Offshore Industry:

- The Voith Radial Propeller (VRP) is a nozzled L-drive, 360° azimuth steerable thruster with a tilted propeller axis to minimize thruster-hull interaction. It's available in the power range of 4.5 to 5.5MW.
- The Voith Inline Thruster serves as tunnel thruster or can be built as nozzled steerable propeller, called Voith Inline Propulsor. It is a combination of an electric synchronous ring motor and propeller in one unit, without the use of shaft or gearbox. The outstanding features are an optimized thrust/input power relationship with silent operation, exceptional efficiency and versatile installation options in any kind of vessel. Power range varies from 50kW to 1.5MW.
- Voith Turbo Marine Engineering works as a think tank for the offshore industry and develops new conceptual designs, such as the Voith Offshore Shuttle.

Whatever propulsion requirement the offshore industry defines, Voith Turbo Marine has the right product to offer.



Voith Inline Thruster



Voith Offshore Shuttle

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Engineered Reliability