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Unique features of Voith-Schneider-Propellers (VSP) for research vessels

Dr. Dirk Jürgens, Michael Palm | 2023-10-17

Content

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Voith Propelled Ship

Voith propelled ships

VWT, Double-ended Ferries, OSV, Passenger Vessels, Yachts, Research Vessel

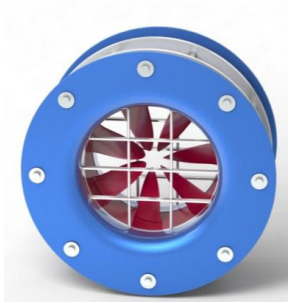
Voith propelled ships

VWT, Double-ended Ferries, Minehunters, OSV, Passenger Vessels, Yachts

19 kn speed

Voith propelled ships

VWT, Double-ended Ferries, OSV, Passenger Vessels, Yachts , Research Vessel



Voith propelled ships

VWT, Double-ended Ferries, OSV, Passenger Vessels, Yachts , Research Vessel

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VWT, Double-ended Ferries, OSV, Passenger Vessels, Yachts , Research Vessel

Voith propelled ships

VWT, Double-ended Ferries, OSV, Passenger Vessels, Yachts , Research Vessel

2 x VSP ECR 6/300-2

Lpp = 110 m

We are gaining lots of experience with the VSP. The bridge officers are amazed and I am still amazed too, about the low vibrations and low noise.

Dan Buehler
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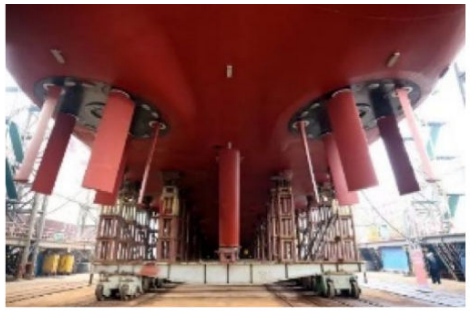
Voith propelled ships

VWT, Double-ended Ferries, OSV, Passenger Vessels, Yachts , Research Vessel

Da Yang Hao ("Oceanic")



- First RV in China with variable-speed generators and DC-bus .
- Equipped with very unique Voith Schneider propellers (VSP) .
- Dual suite of multibeam (EM122 & EM710, blister installation).

2 x VSP 32 RCS/265-2

General specifications

Overall length	98.5 m
Beam	17.0m
Draft (T)	5.4 m
Gross Tonnage	4780
Operational speed	12 knots
Maximum speed	>16 knots
Range	14,000 nm
Endurance	60 days
Working Deck	400 m^2
Labs	>360 m^2
Capacity	60(22 + 38)

Owner: China Ocean Mineral Resources R & D Association (COMRA)
Launch: 11th November, 2018 **Delivery:** 26th July, 2019

Voith propelled ships

VWT, Double-ended Ferries, OSV, Passenger Vessels, Yachts , Research Vessel

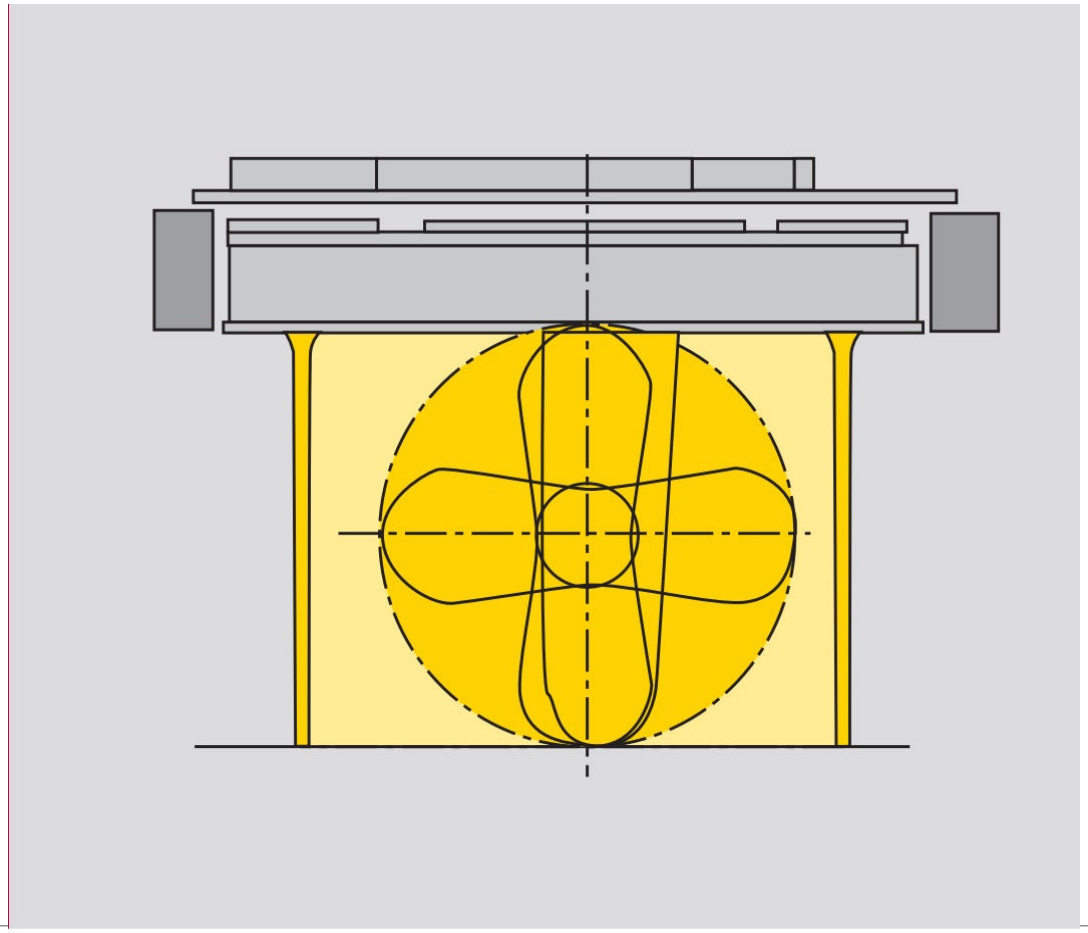
2 x VSP 28 RCS/234-2

Voith propelled ships

VWT, Double-ended Ferries, OSV, Passenger Vessels, Yachts, Minehunters,

Voith Schneider Propeller

Can be used very advantageously in shallow water



VSP for optimal sonar usage

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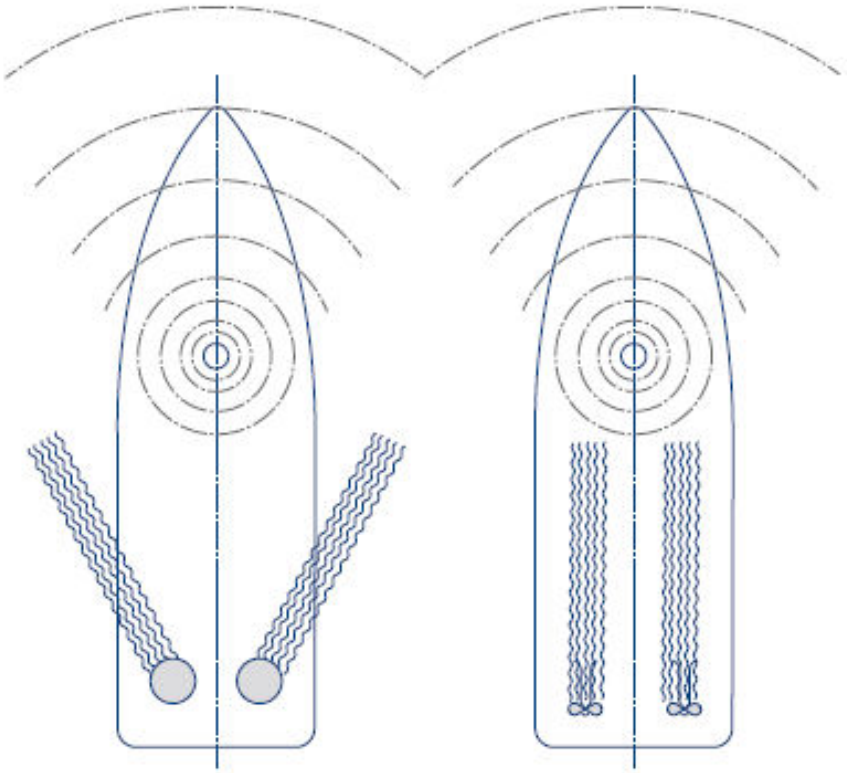
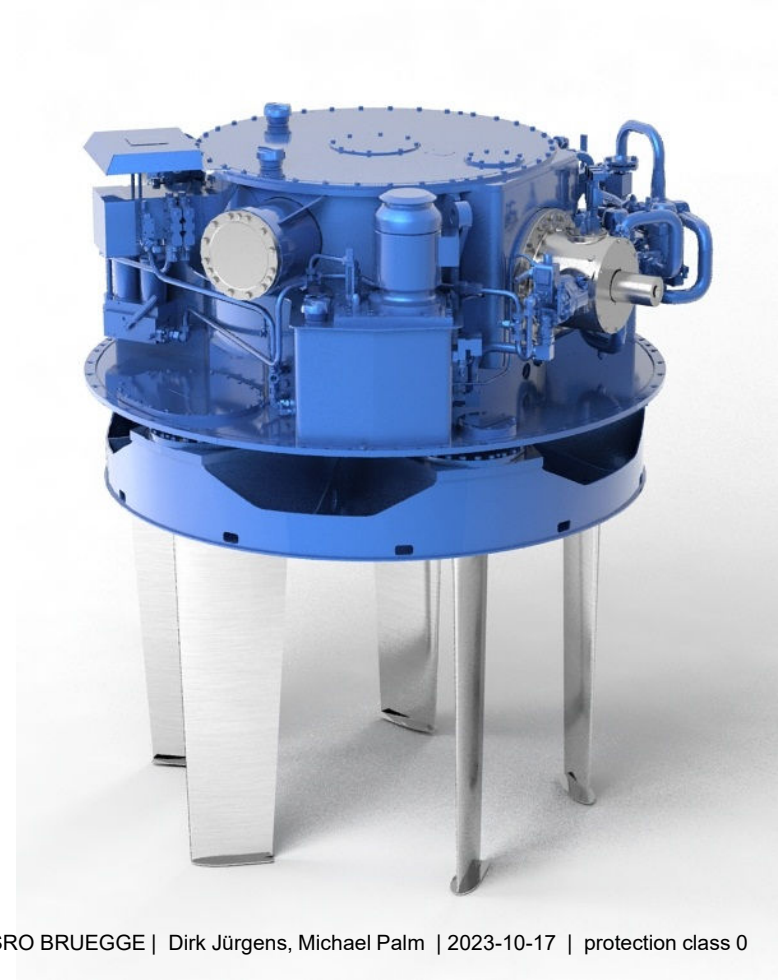
influence of astern jet stream of propellers on the sonar



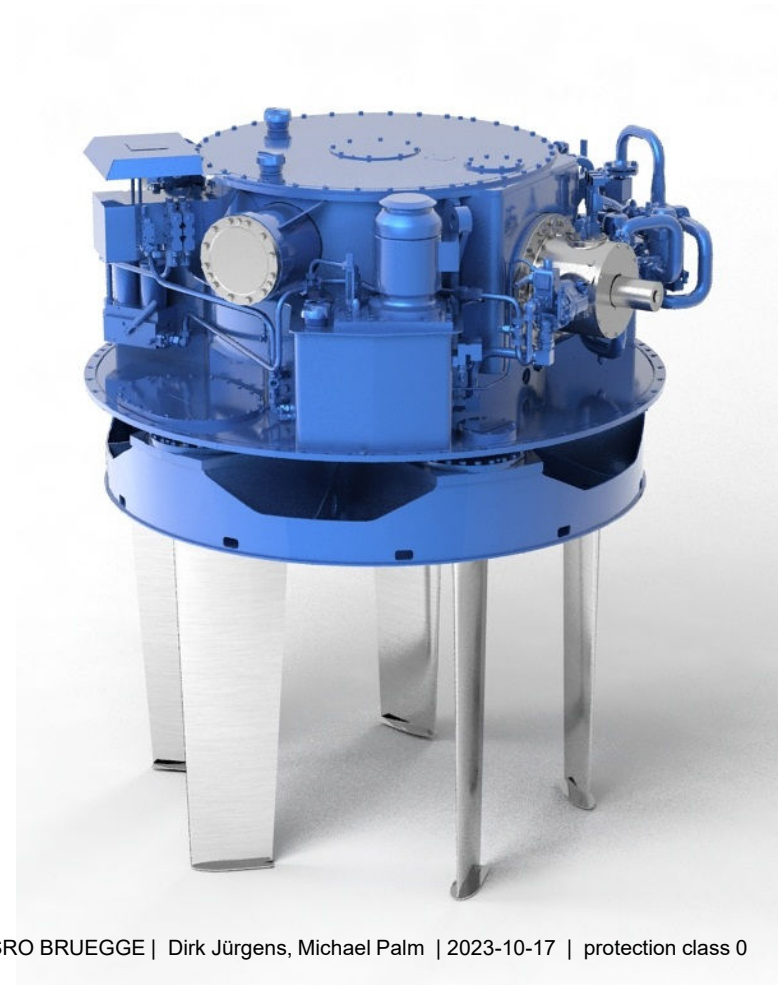
Physic and Technology of the VSP

Voith Schneider Propeller

Video

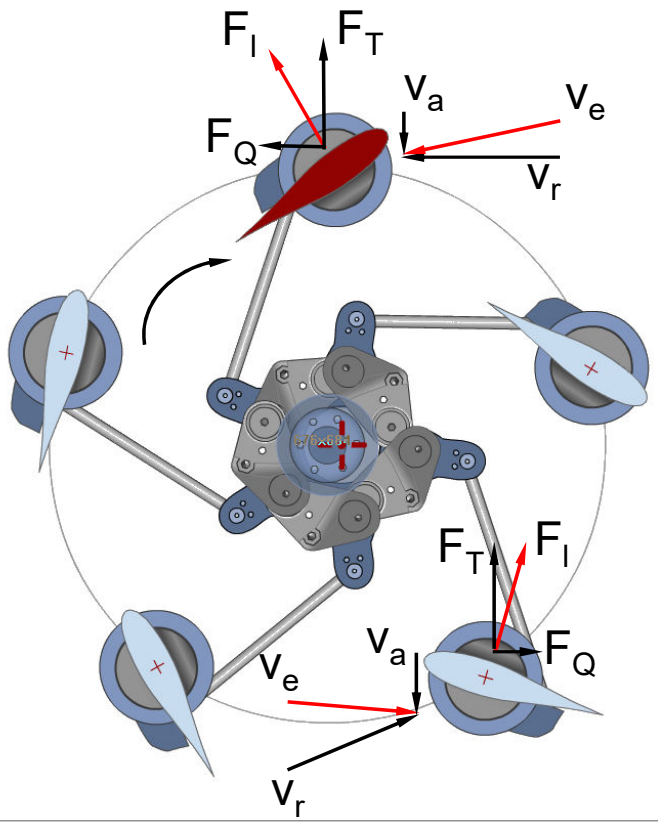


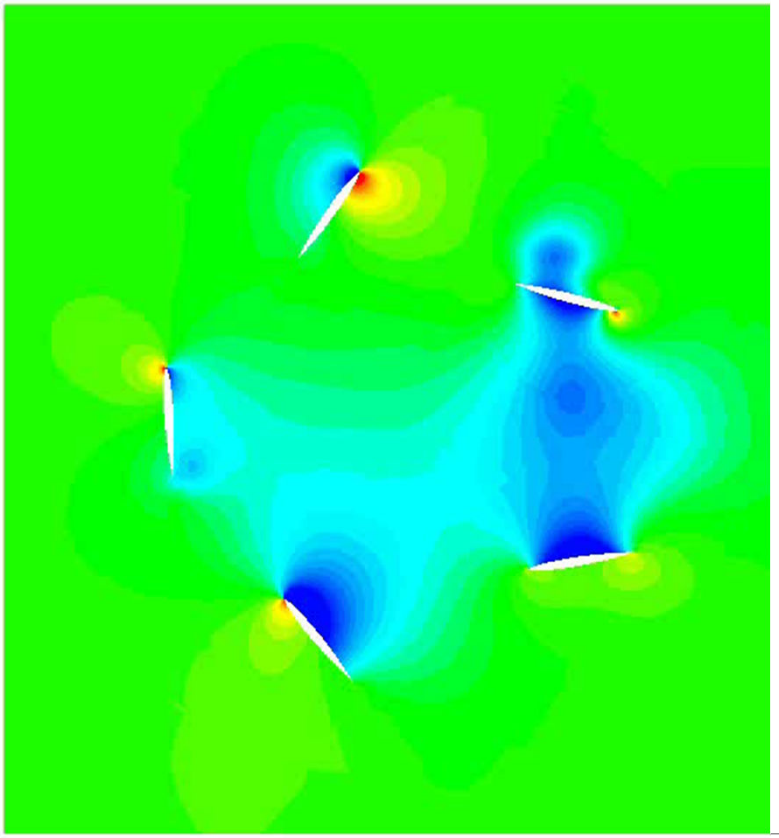
Voith Schneider Propeller

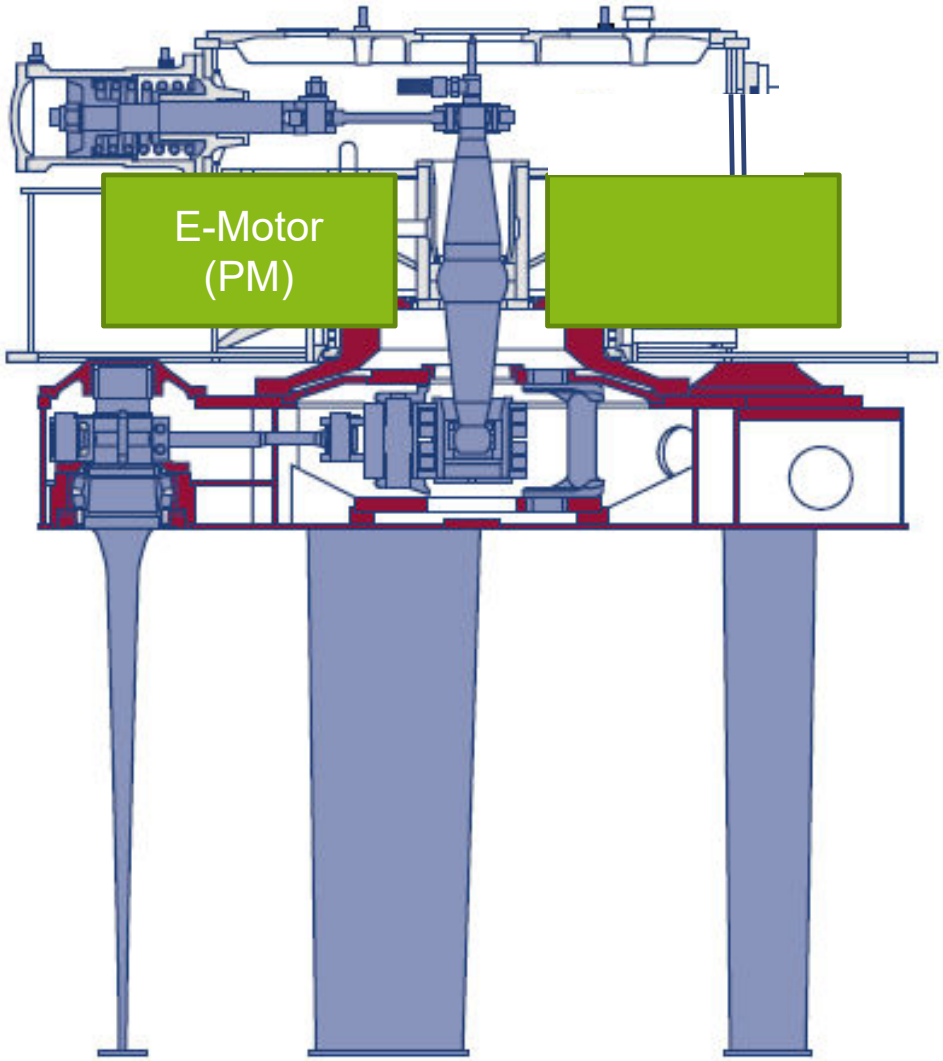


Film

Thrust generation of the Voith Schneider Propeller







eVSP

- High efficiency
- Easy to install
- Less components
- Less total costs
- Gearless:
  - low noise,
  - less wear and tear
- Proven technology

eVSP – modular concept

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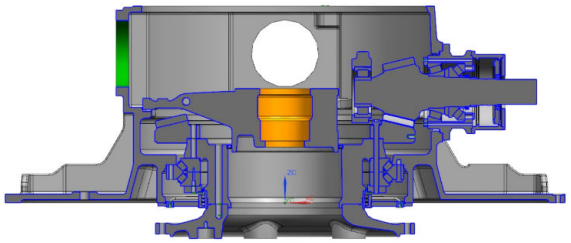
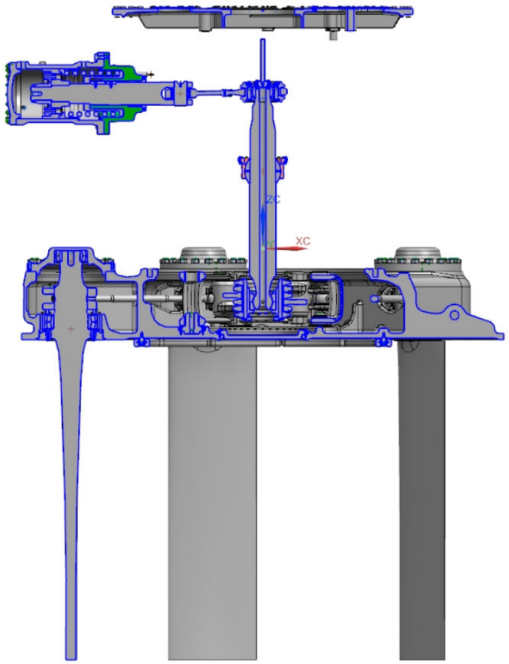
VSP (mechanical)

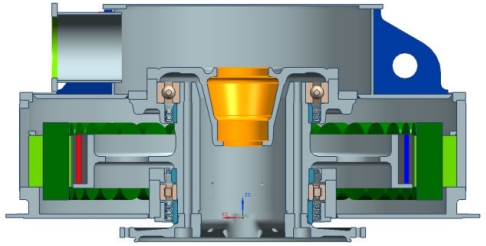


- Solution for mechanical driveline concepts (mainly tugs but also ferries)
- To be configured with all standardized modules (rotor, blades, blade actuating, control rod, housing cover)

Identical Modules

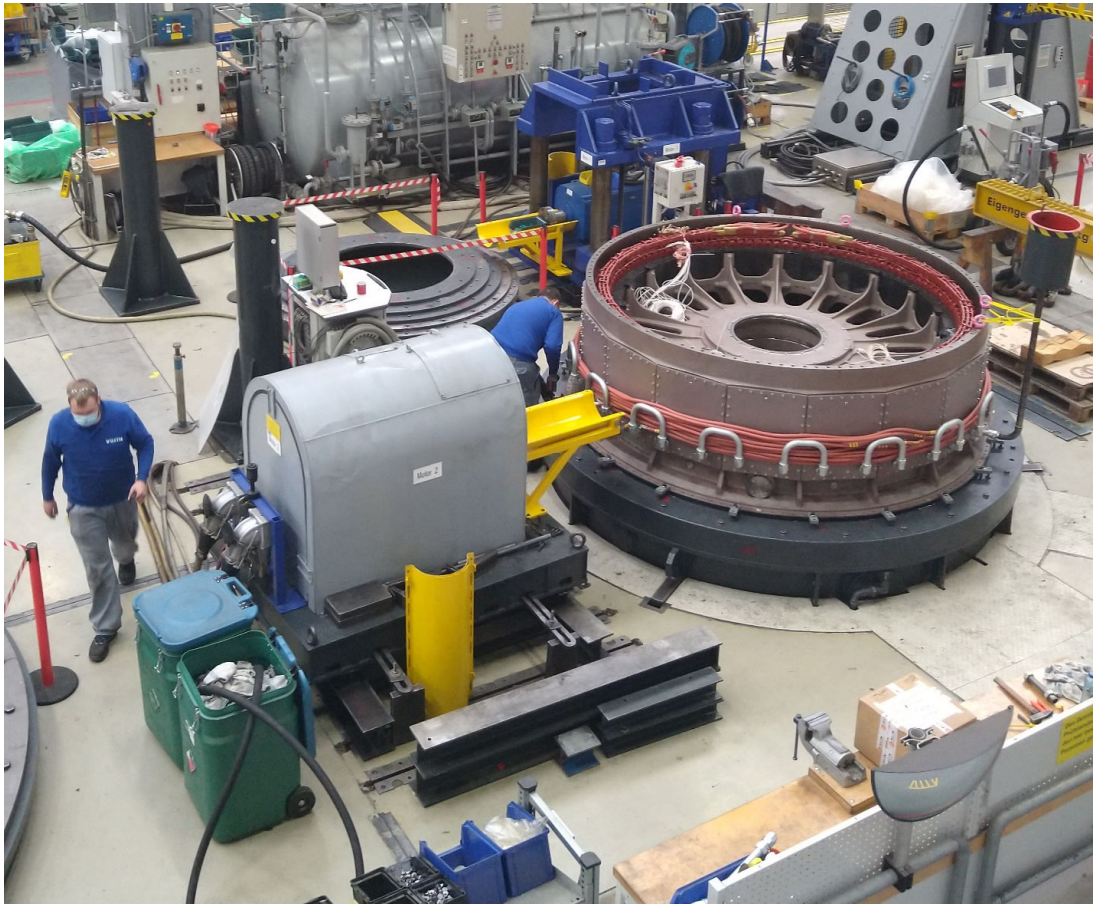


eVSP



- Solution for electric driveline concepts (mainly offshore and ferry application, hybrid tugs also possible)
- To be configured with all standardized modules (rotor, blades, blade actuating, control rod, housing cover)

Impressions - production of the eVSP



Impressions - installation of the eVSP

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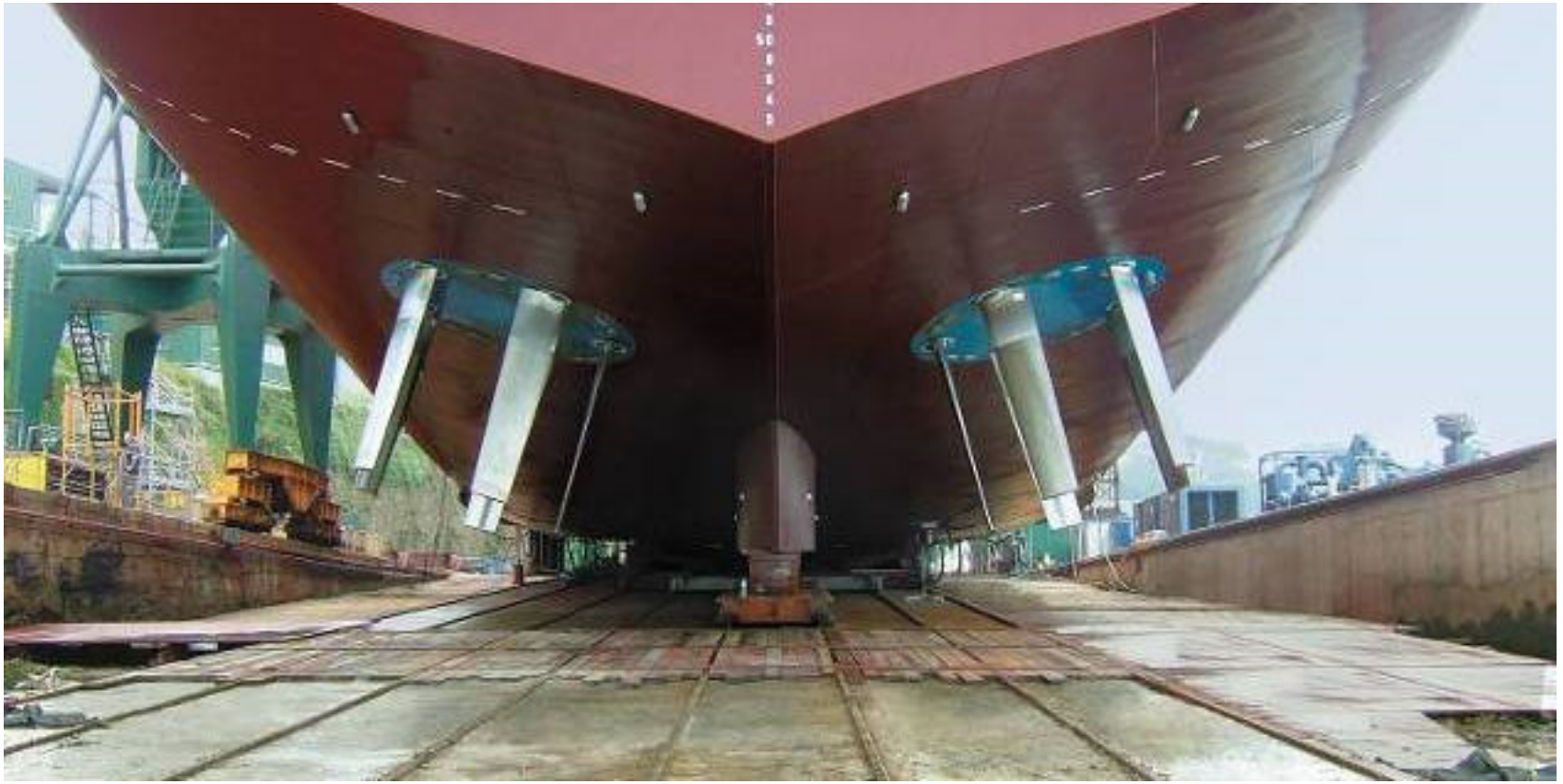
Dynamic Positioning and Voith Roll Stabilization

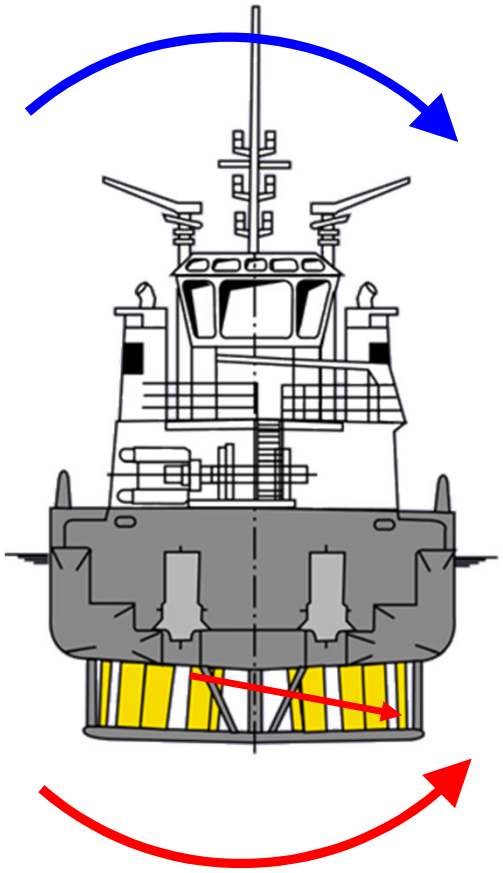
VSP Type 32 R5 EC/300-2
VSP HARDANGER



Voith Roll Stabilisation (VRS)

High responsiveness enables the propellers to be used as active roll damping system at all speeds

M_{wave} - Exciting wave moment



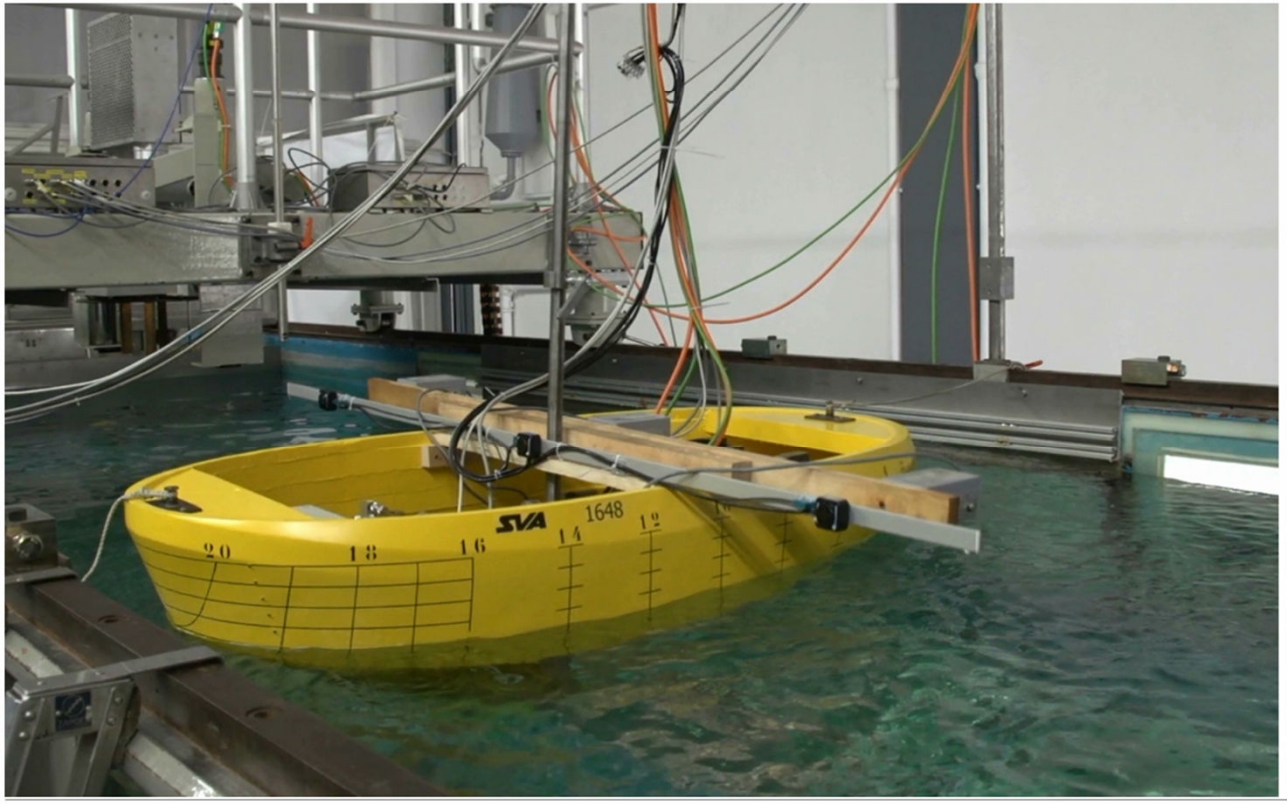
VSP Thrust

M_{VSP} - Stabilizing Moment by the VSP


EDDA FRAM
ostensjo.no
ST-215

Voith Roll Stabilization (VRS)
Latest model tests (optimized control algorithm)

VOITH



Results of model tests

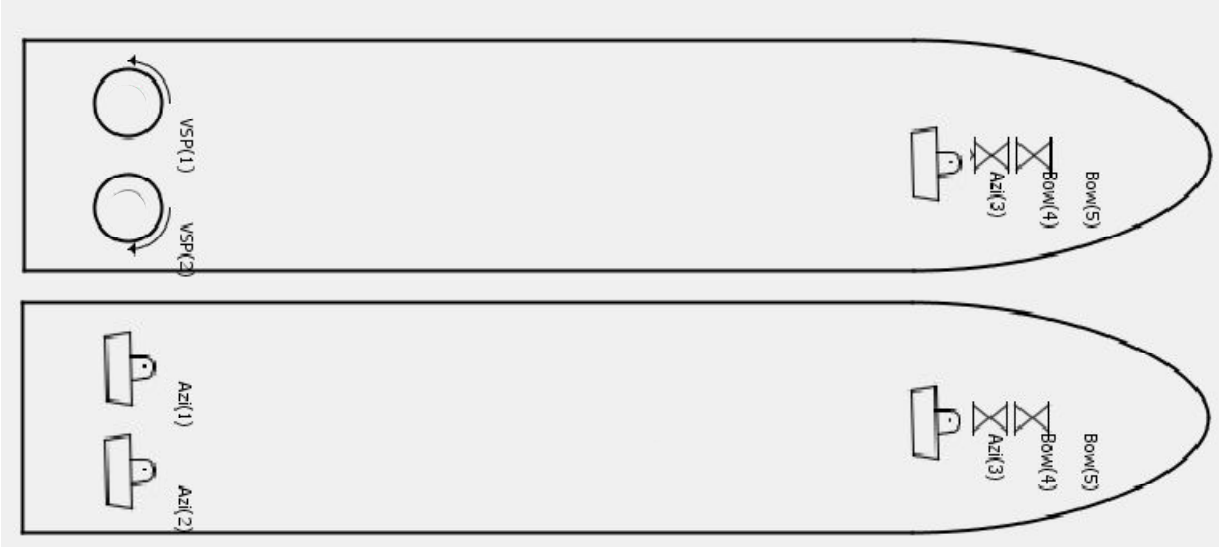
- The optimized control algorithm was tested in many model tests before it was approved for use
- The roll stabilization is inactive

Video

Vessel configuration

Service Operation Vessel

Length	80m
Breadth	18m
Draught	6m
Displacement	6500t

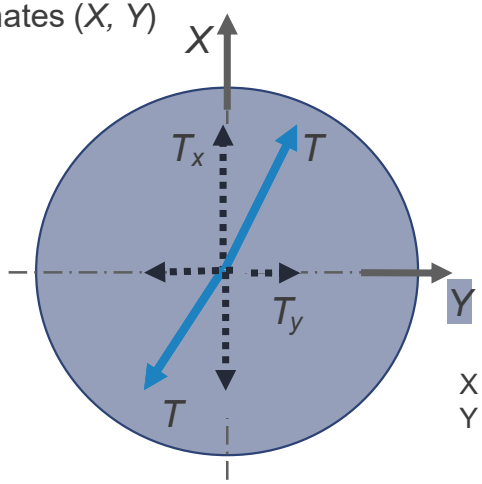


Propulsion aft:
2 VSP28/234
or
2 Azimuth Thruster CPP D=2.4m, Azimuth speed 3rpm

Propulsion bow:
2 tunnel thruster D=2.2m 1200kW and
1 Azimuth Thruster CPP D=1.6m 850kW

General Characteristics
Comparison of thrust controls

VSP
according to rectangular coordinates (*X, Y*)

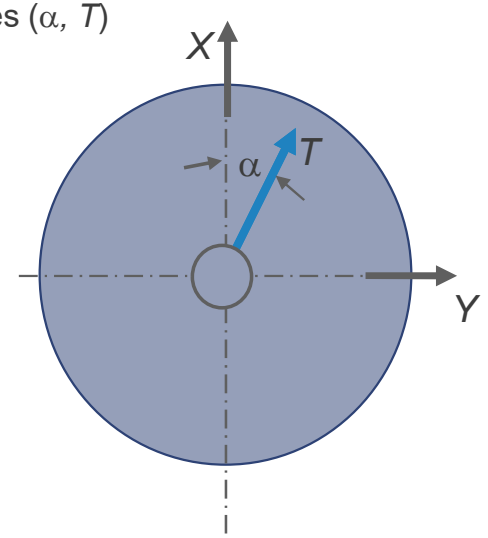


X = longitudinal ship axis
Y = transversal ship axis

Steering through 0-position

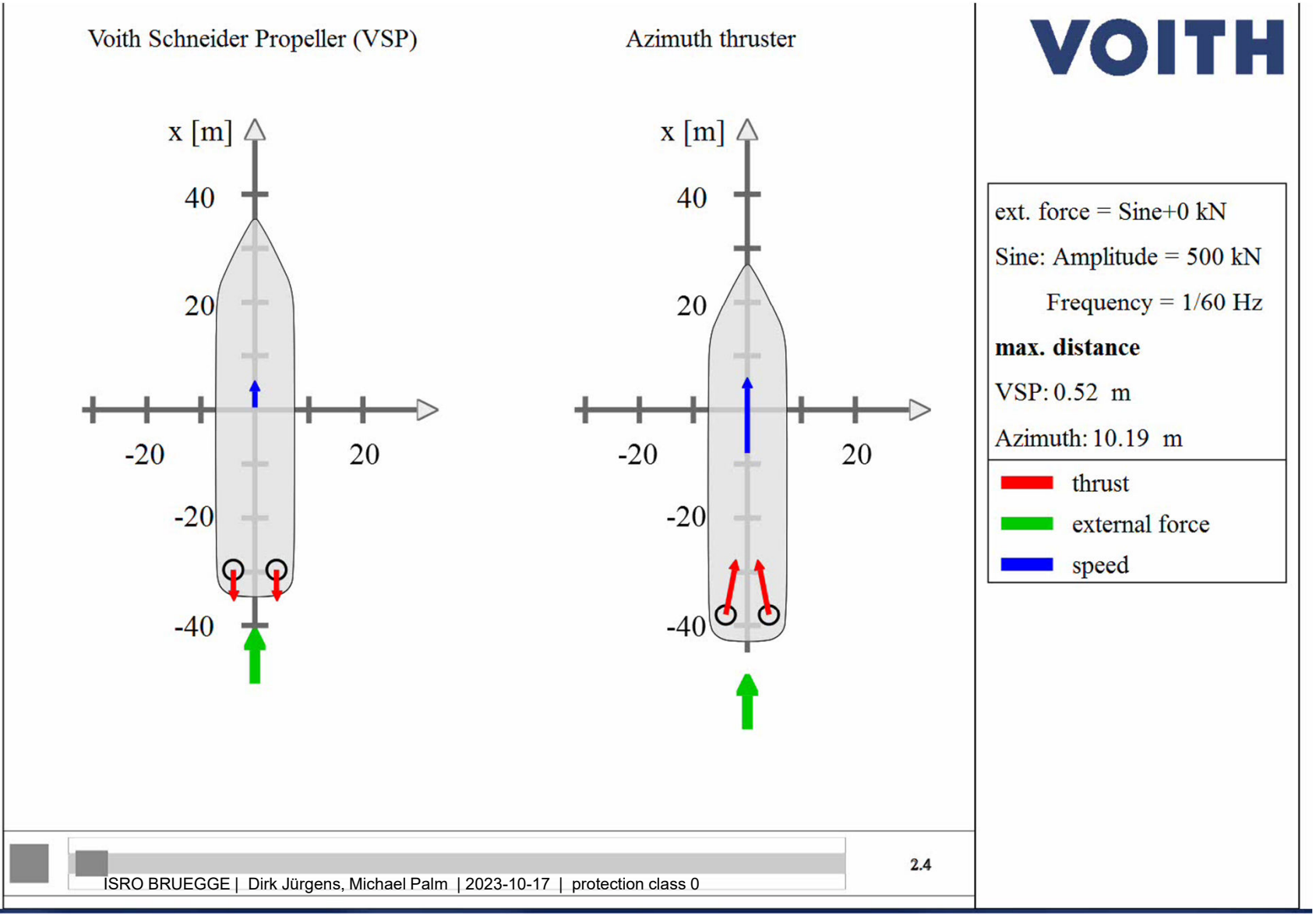
without undesired side thrust,

Z-Drives
according to polar coordinates (α, *T*)



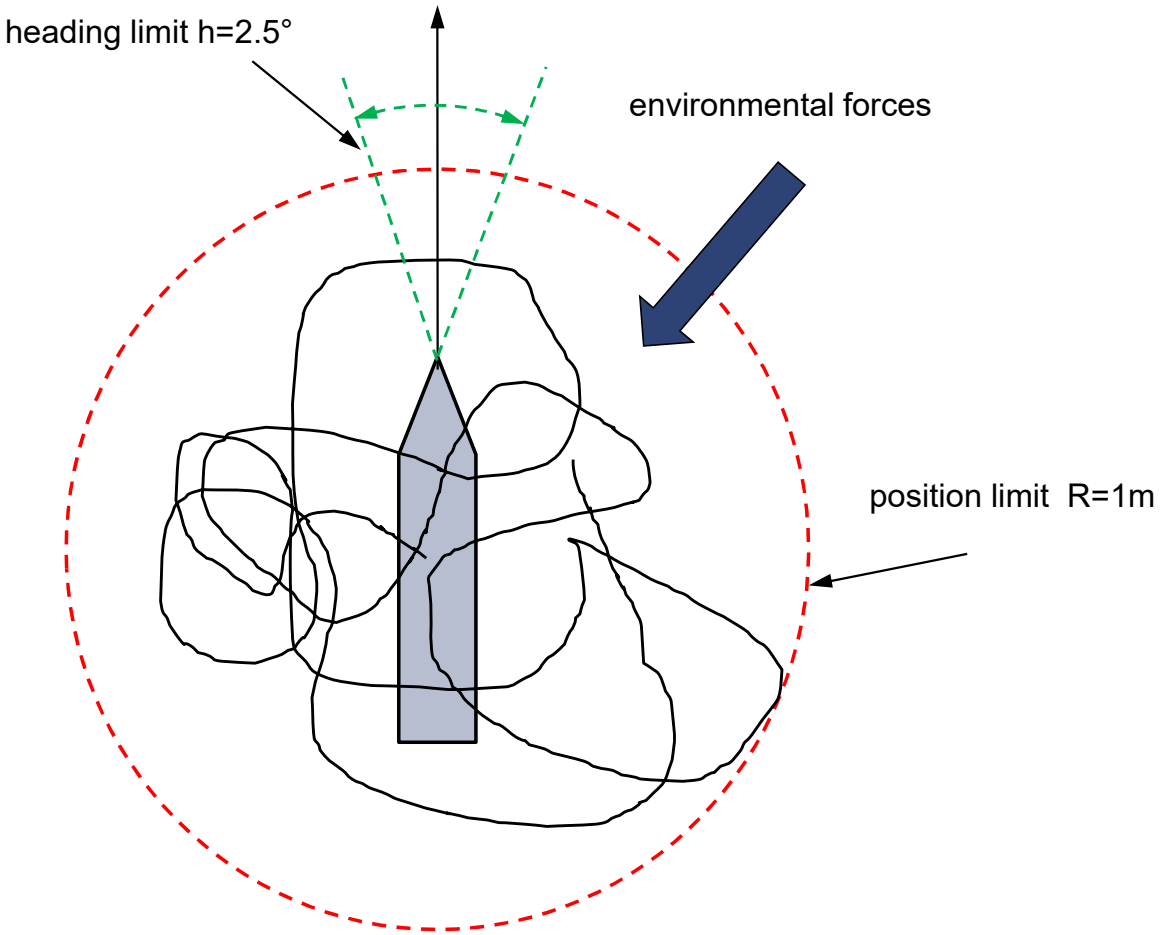
Steering **with** undesired **side thrust**

sinusoidal force with amplitude of 500kN and period of 60sec

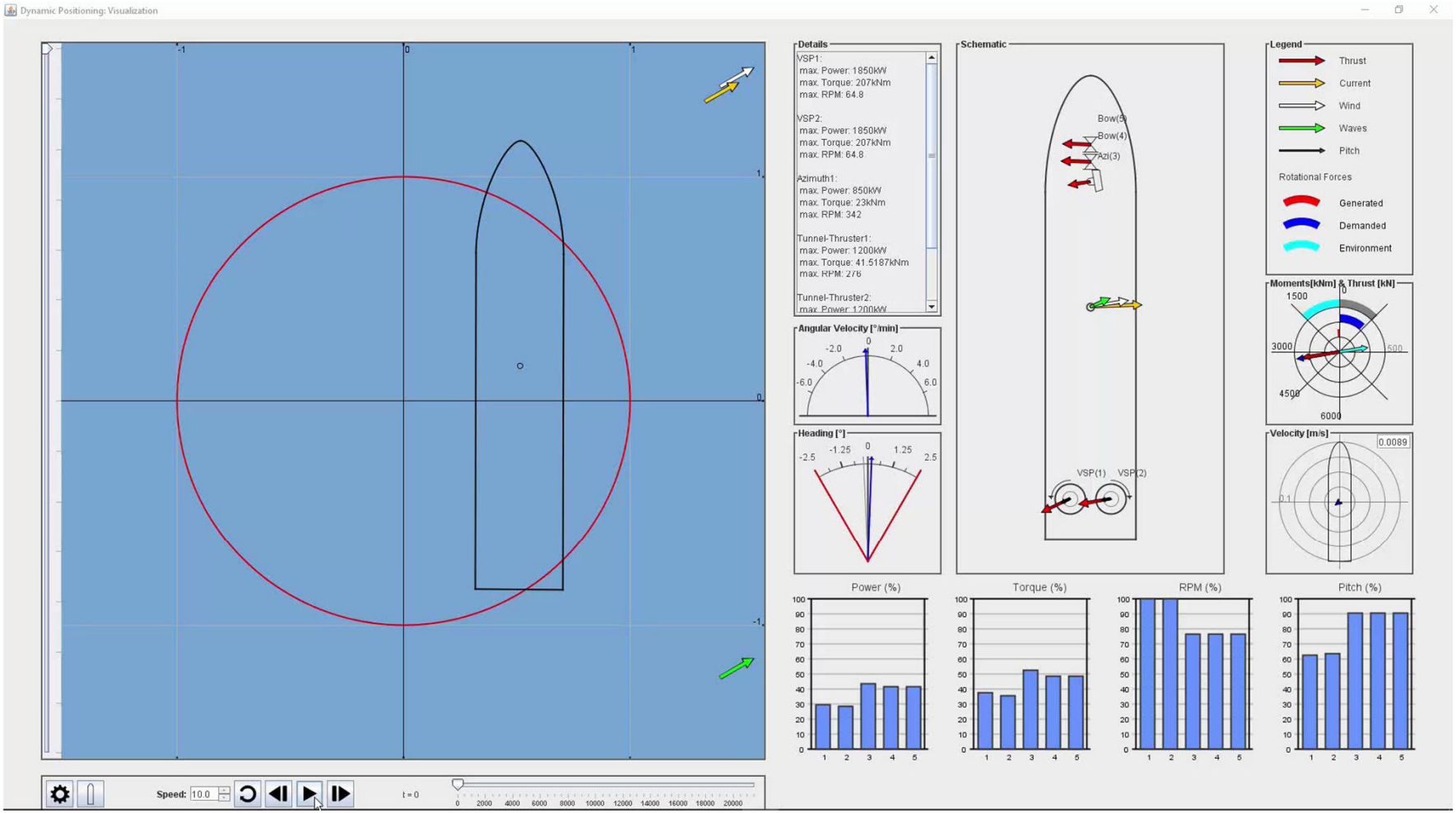


Video

Dynamic DP simulation

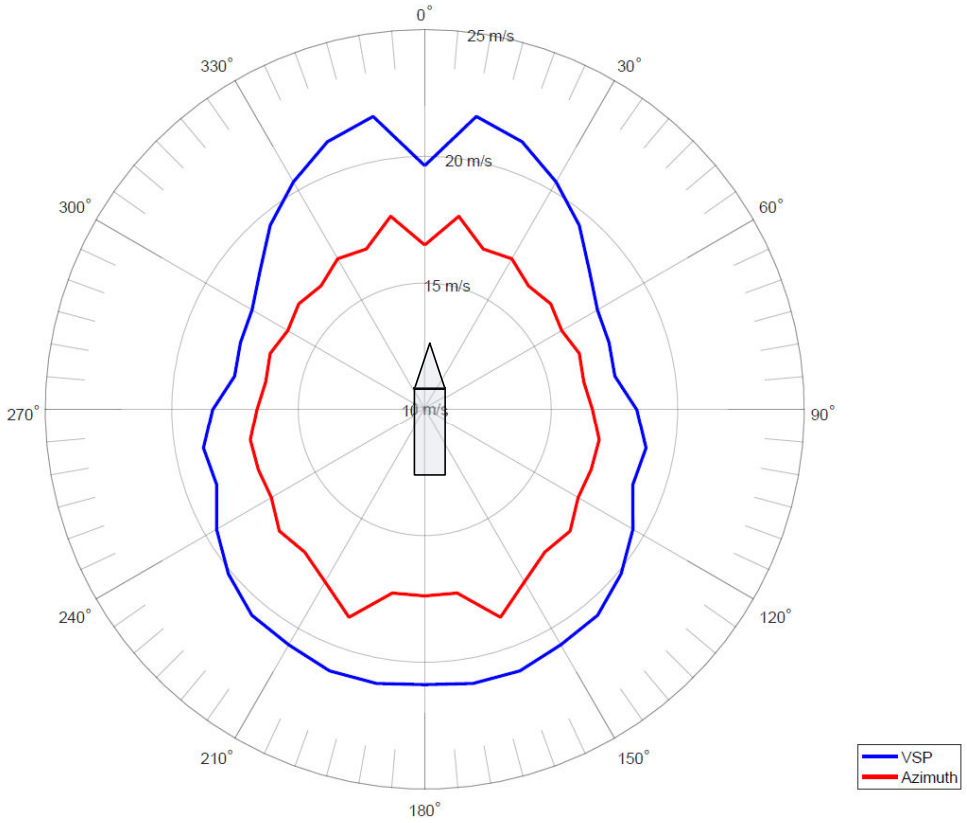


Visualization of transient DP simulations

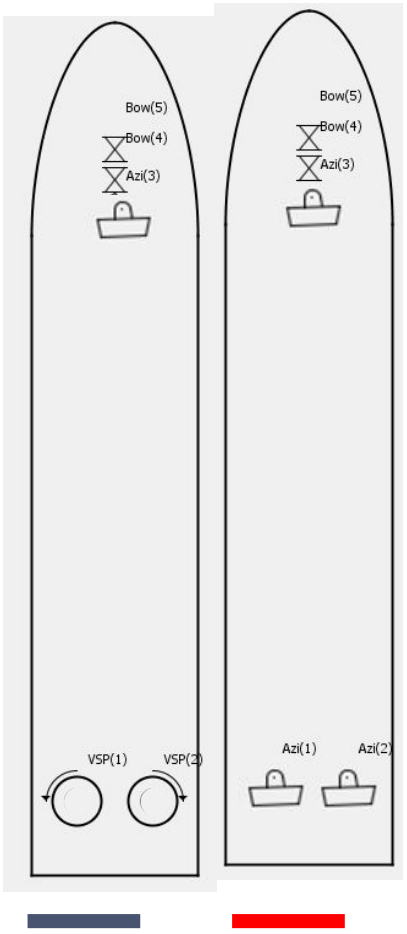


Wind envelope for azimuth and VSP

Dynamic analysis

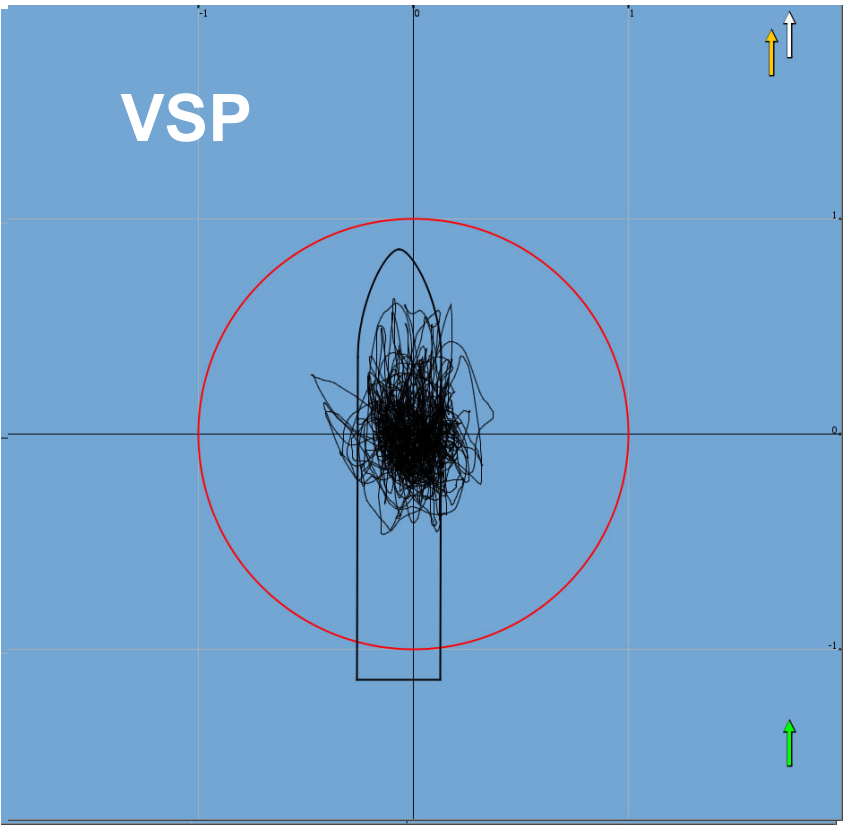


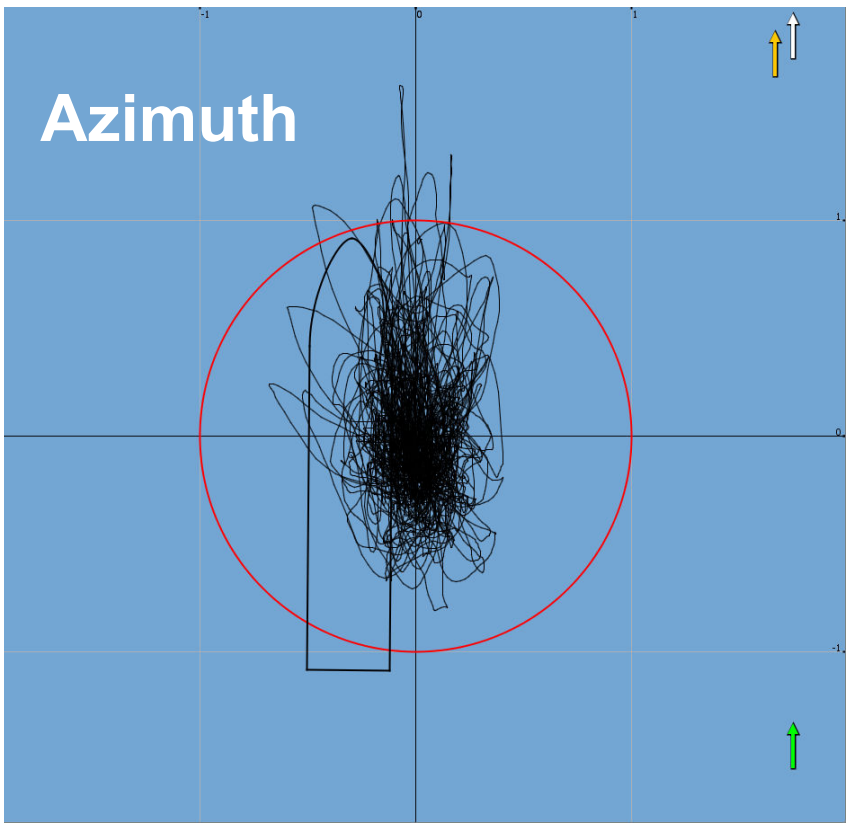
ΔV_w of 3m/s ≈ ΔH_s=1m

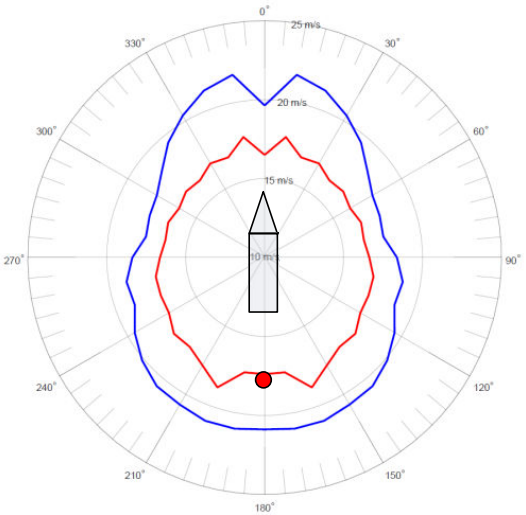


Foot print based on dynamic DP runs

18m/s wind, stern on







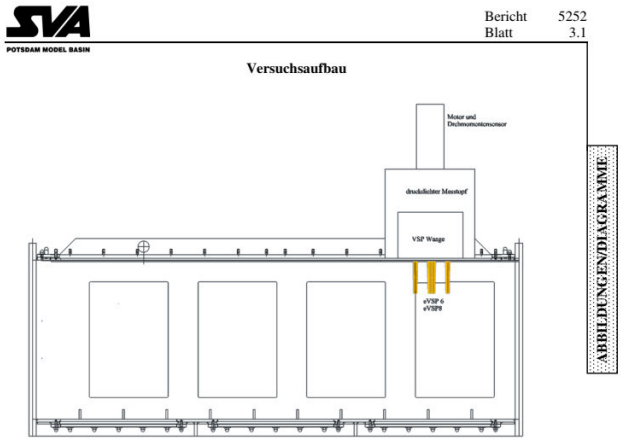
VSP vessels servicing the Brent fields

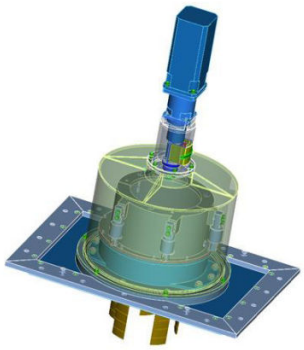
PSV «Edda Frende»
Brent fields – North Sea
06.09.2015 Deck load operations
VRS on
H_s 3,2m – H_{max} 5-6m – Wind 30 kn
Weather direction 90° - 135°

VOITH

Hydroacoustic Measurements in Model and Full Scale

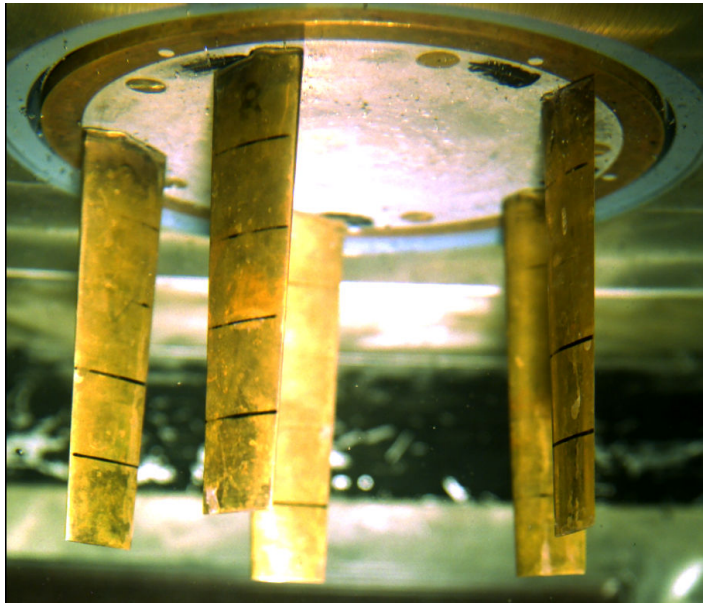
Cavitation Test and Noise Measurements at SVA Potsdam



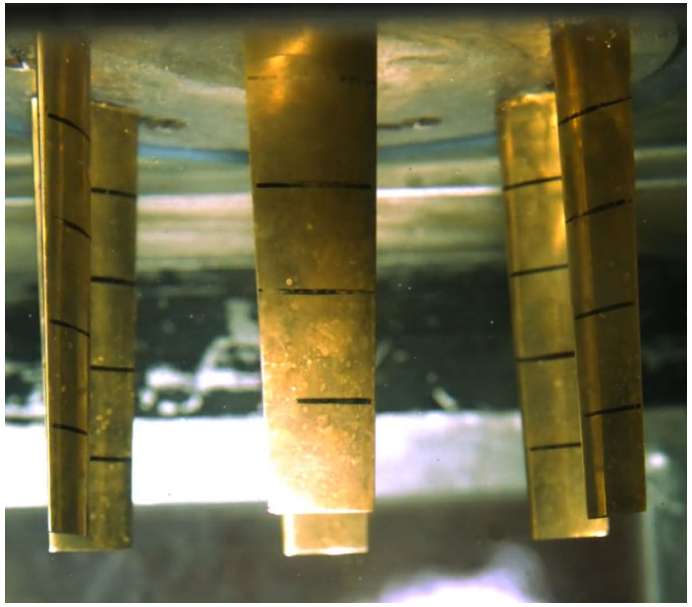


Cavitation Test and Noise Measurements at SVA Potsdam

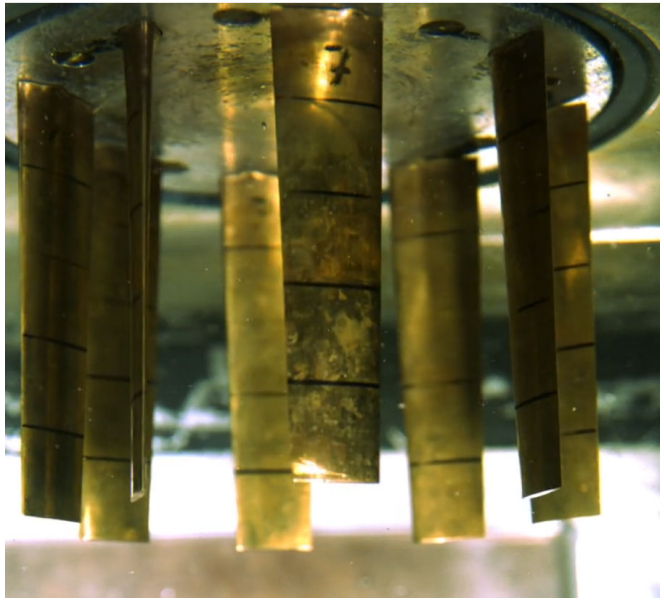
5 Blades



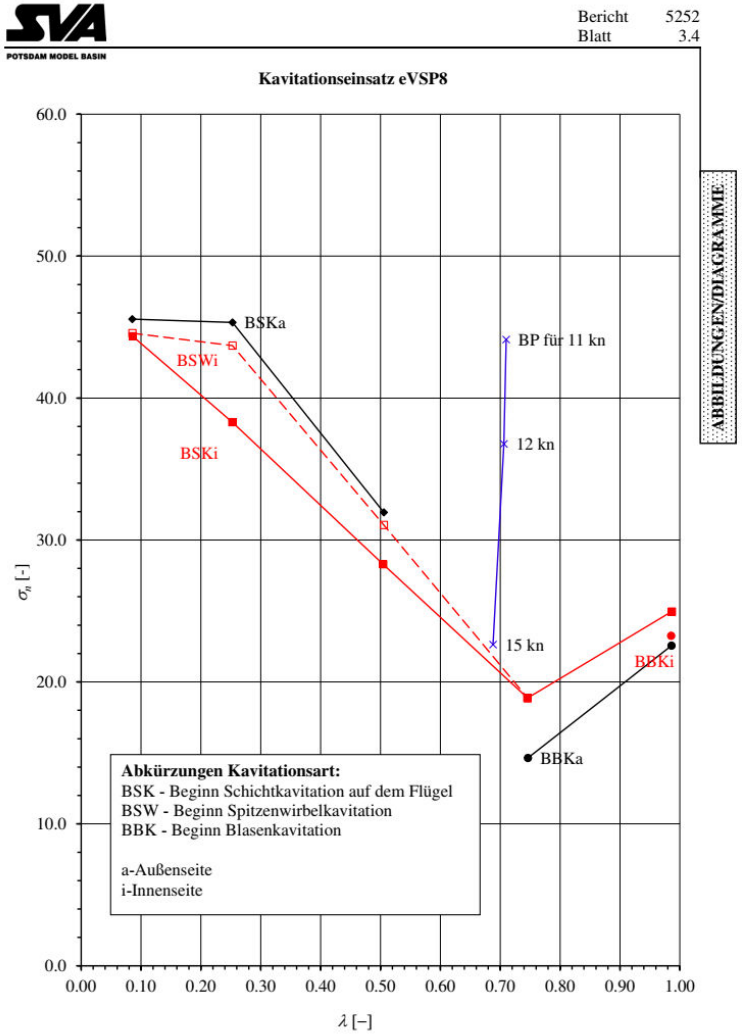
6 Blades



8 Blades



Cavitation Test and Noise Measurements at SVA Potsdam



Cavitation Test and Noise Measurements at HSVA

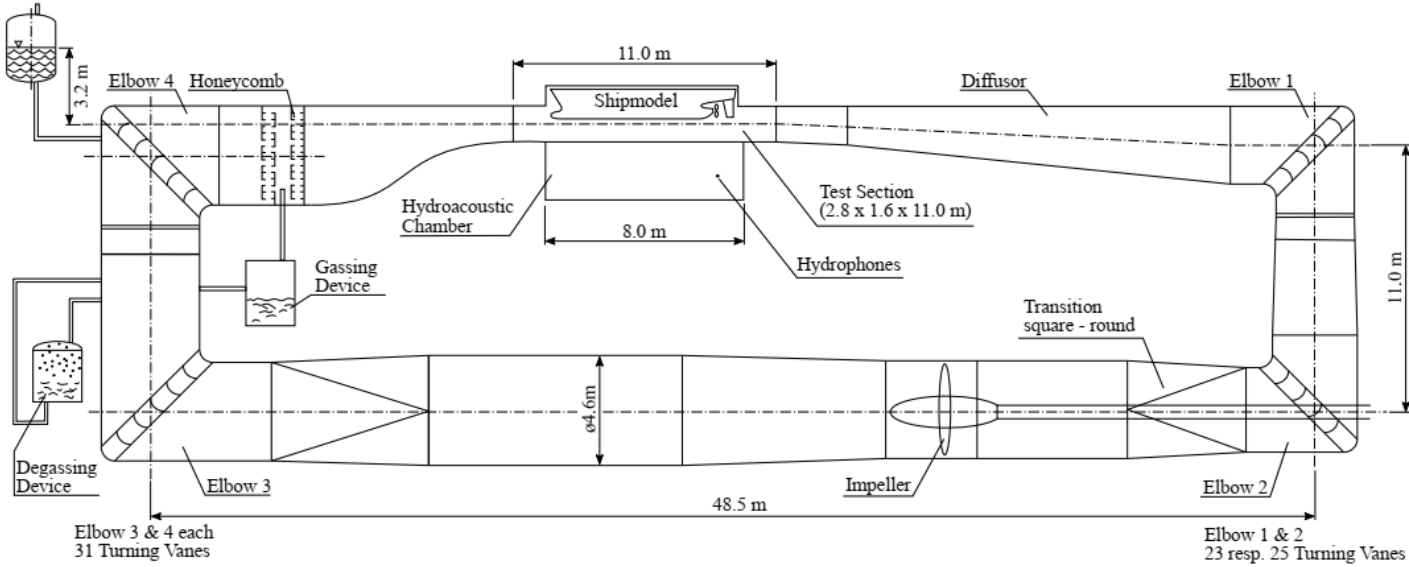
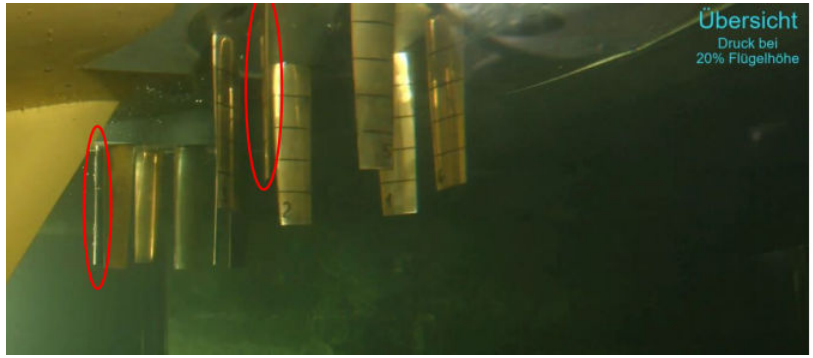
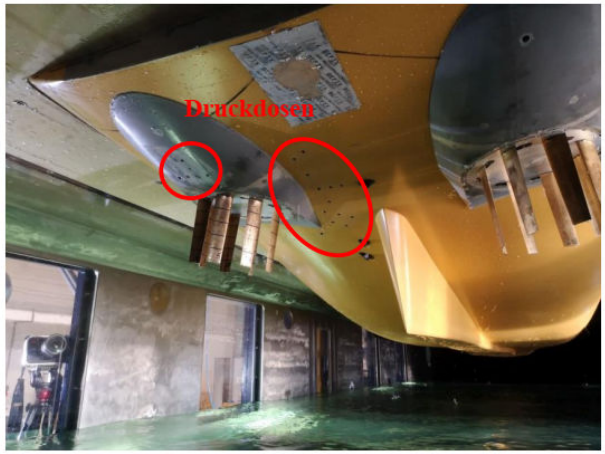


Abbildung 2.1: Hydrodynamik- und Kavitationstunnel (HYKAT)

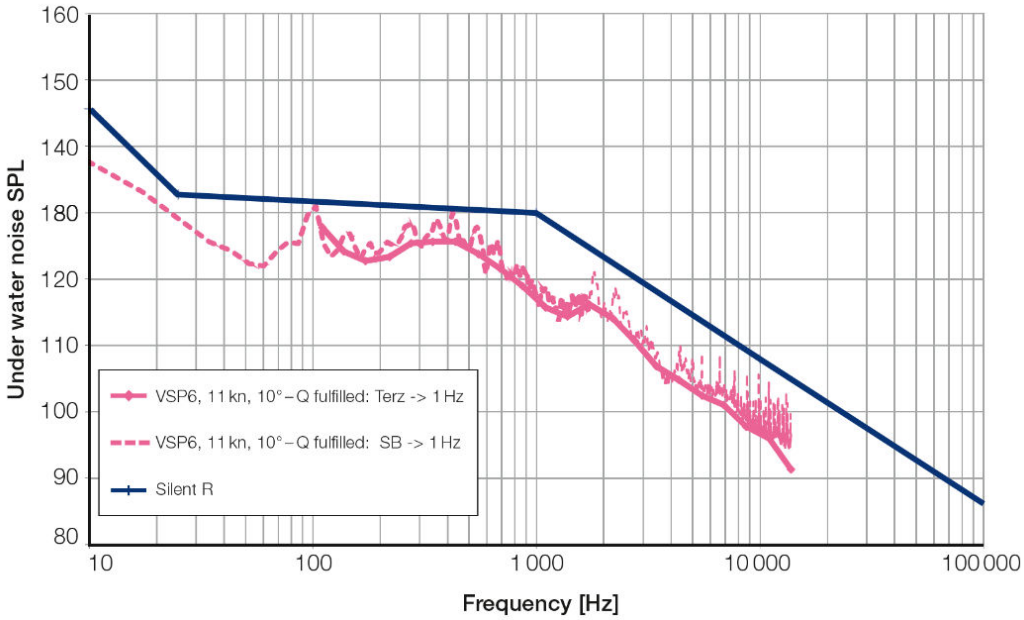


Cavitation Test and Noise Measurements at HSVA



Research vessel „Meteor IV“ to be equipped with VSP

Fulfils Silent R requirement



Full Scale Measurement SOV EDDA BREZE
Measured by DW-ShipConsult

2 Technical details of the *Edda Breeze*

Technical details of the Edda Breeze, see Figure 1, are given in Table 1.

Table 1: Main particularities of the ship

Year built	2022
Length	88.30 m
Breadth	19.70 m
Draft (Summer)	5.30 m
Engine type	3x Caterpillar 3512E
Mounting	Engine resiliently, Alternator rigidly
Propulsion	2 x Voith Schneider eVSP
Number of blades	5

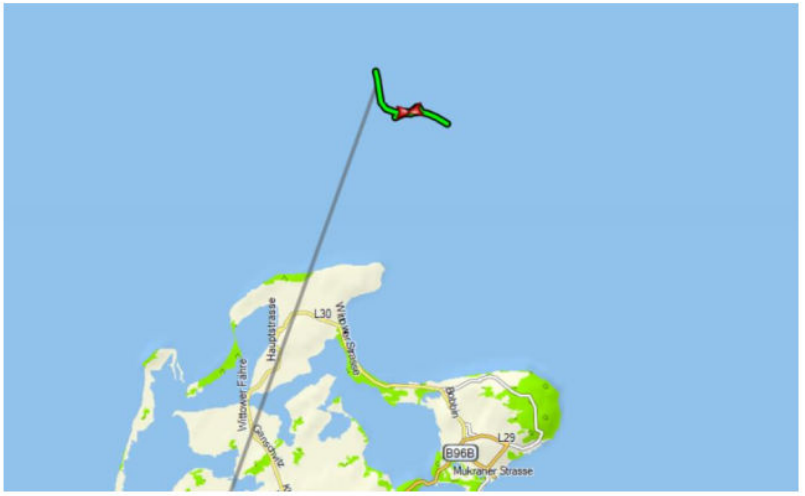


Figure 2: Track of Edda Breeze during the measurements near Rügen, Germany provided by VOITH

3.1 Environmental condition

Wind speed and wave height decreased during the measurements. The maximum wind speed of 20.5 kn reduced to 12.3 kn, while the wave height decreased from 1 meter to 0.5 m. The local conditions are summarized in Table 2, wind speed during each measurement run is documented in Table 3.

Table 2: Environmental conditions

Sea area	Germany
Water depth	~44-46 m
Wind speed	3-4 bft / Max. gusts 20.5 kn
Wind direction	~270°
Wave Height	0.5-1 m
Precipitation	No rain, cloudy

Summary

VOITH

- **Unique physics: thrust accordingly to a X/Y – logic (cartesic coordinates)**
- **High efficiency**
- **Ideal for Dynamic Positioning**
- **Reduction of roll motions (VRS)**
- **Low underwater noise (fulfills silent R requirements)**


VOITH
Inspiring Technology
for Generations