SHIP DESIGN

Efficiency of scale

< 4%

A larger ship will in most cases offer greater transport efficiency – "Efficiency of Scale" effect. A larger ship can transport more cargo at the same speed with less power per cargo unit. Limitations may be met in port handling.

Regression analysis of recently built ships show that a 10% larger ship will give about 4-5% higher transport efficiency.

Tanker Container Ro-Ro Ferry OSV

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Reduce ballast

< 7%

Minimising the use of ballast (and other unnecessary weight) results in lighter displacement and thus lower resistance. The resistance is more or less directly proportional to displacement of the vessel. However there is need to have enough ballast in order to immerse the propeller in the water, sufficient stability (safety) and acceptable sea keeping behaviour (slamming).

Removing 3000 ton of permanent ballast from a PCTC and instead achieving the same stability by increasing the beam 0.25 m will reduce propulsion power demand by 8,5%.

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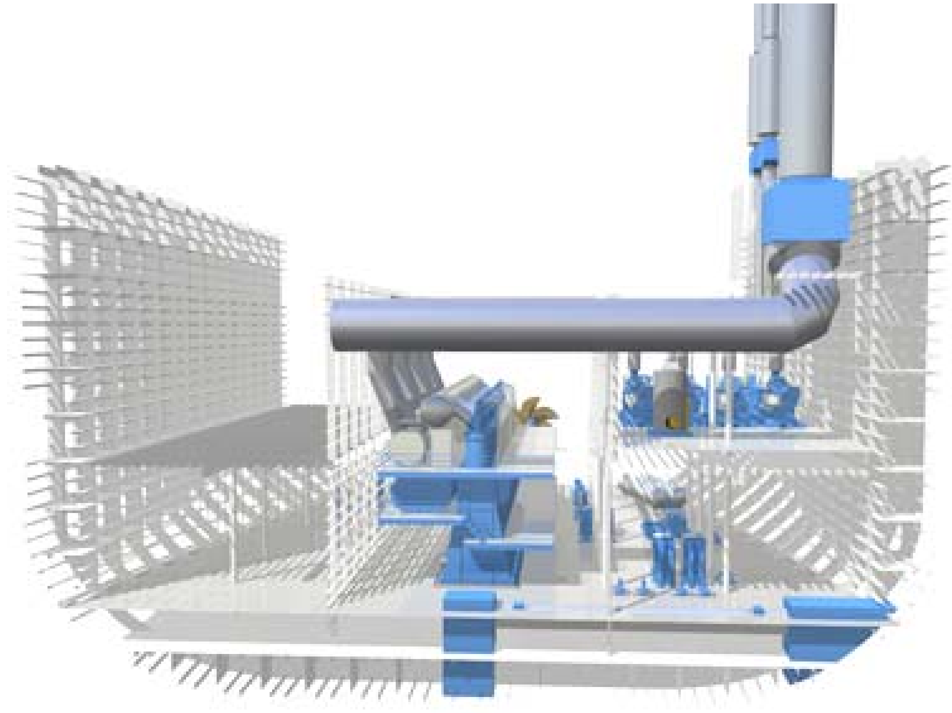
Lightweight construction

< 7%

Use of lightweight structures can reduce the ship weight. In structures that are not contributing to ship global strength use of aluminium or some other lightweight structure may be an interesting solution.

Also the weight of steel structure can be reduced. In a conventional ship, the steel weight can be lowered by 5-20%, depending on the amount of high tensile steel already in use.

A 20% reduction in steel weight will give ~9% reduction in propulsion power. However, a 5% saving is more realistic, as high tensil steel is already used to some extent in many cases.



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Optimum main dimensions

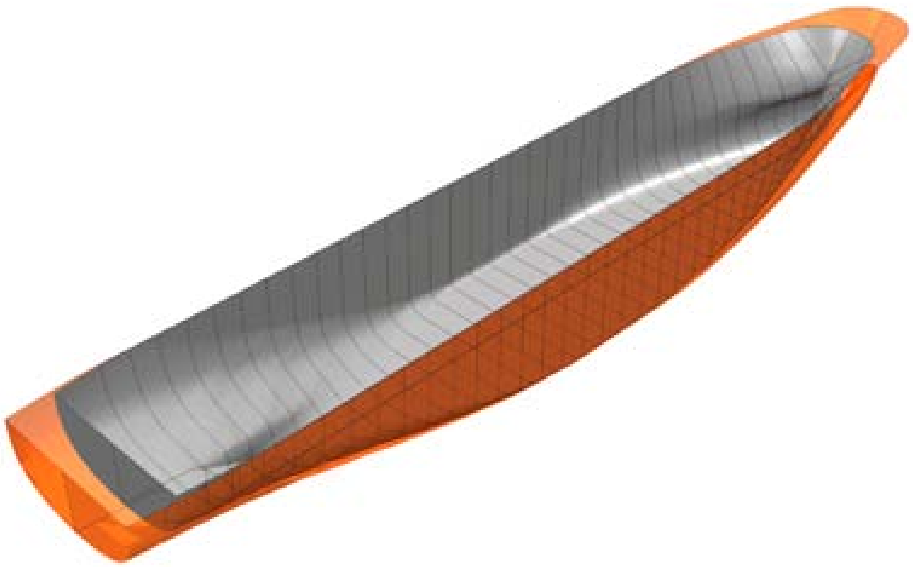
< 9%

Finding the optimum length and hull fullness ratio (Cb) has a big impact on the ship resistance.

Large L/B ratio means that the ship will have smooth lines and low wave making resistance. On the other hand increasing length means increased wetted surface, which can have negative effect on total resistance.

A too high block coefficient (Cb) makes hull lines too blunt and leads to increased resistance.

Adding 10-15% extra length to a typical product tanker can reduce the power demand by more than 10%.



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Interceptor trim planes

< 4%

The Interceptor is a metal plate that is fitted vertically to the transom of a ship, covering the main breadth of the transom. This plate bends the flow over aft-body of the ship downwards creating a similar lift effect as a conventional trim wedge due to high pressure area behind the propellers. Interceptor is proved to be better than conventional trim wedge in some cases, but so far it's used only in cruise vessels and RoRos. Interceptor is cheaper than a trim wedge as a retrofit.

1-5% lower propulsion power demand.
Corresponding improvement up to < 4%
in total energy demand for a typical ferry.

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Ducktail waterline extension

< 7%

Ducktail is basically a lengthening of the aft ship. It is usually 3-6 meters long. Its basic idea is to lengthen the effective waterline and make the wetted transom smaller. This has positive effect on the resistance of the ship. In some cases best results are achieved when ducktale is used together with Interceptor.

4-10% lower propulsion power demand. Corresponding improvement 3-7% in total energy consumption for a typical ferry.

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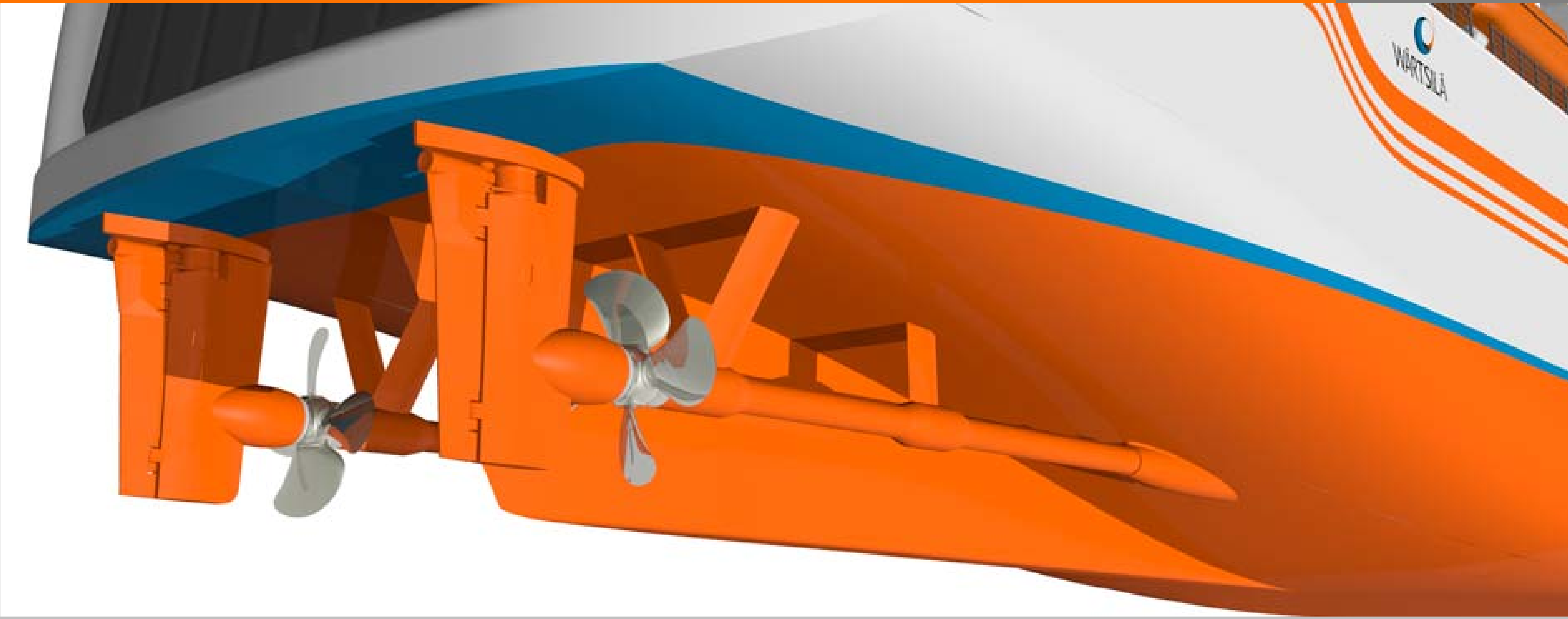
Shaft line arrangement

< 2%



Shaft lines should be lined in streamline direction. Brackets should have a streamlined shape. Otherwise the resistance will increase and the flow to propeller is disturbed.

Up to 3% difference in power demand between poor and good design. Corresponding improvement up to 2% in total energy consumption for a typical ferry.

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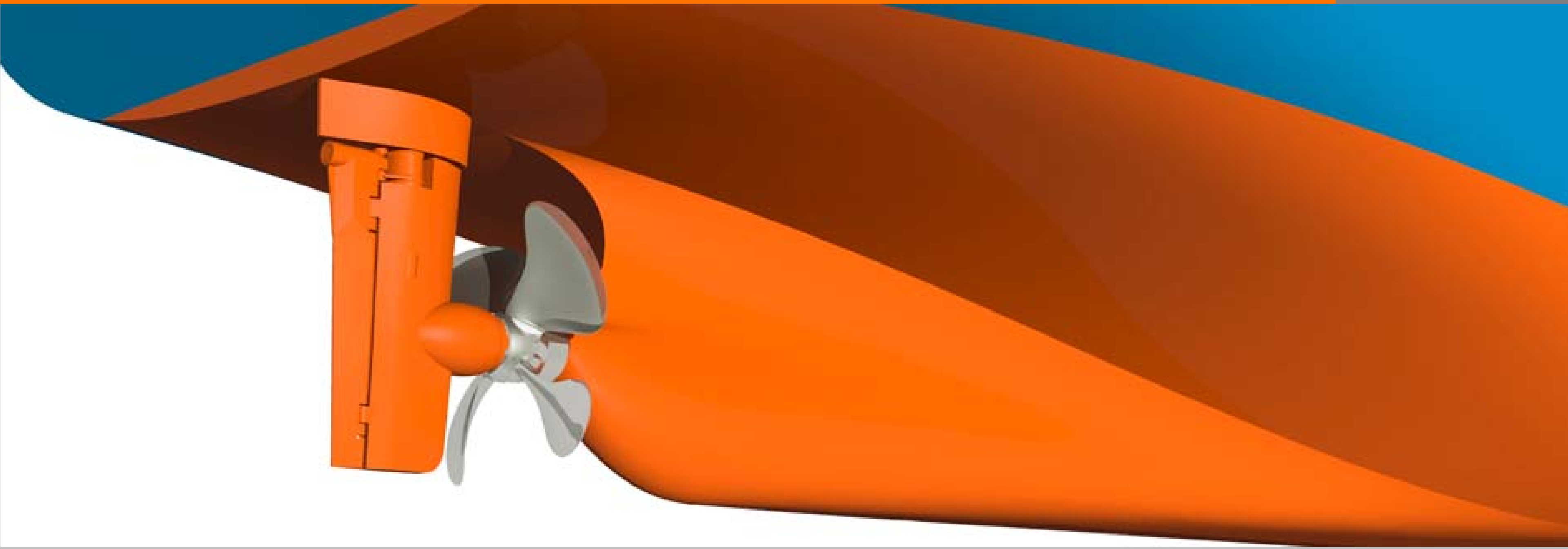
Skeg shape / trailing edge

< 2%



The skeg should be designed to direct the flow evenly to the propeller disk. At lower speeds it is typically beneficial to have more volume on the lower part of the skeg and as thin as possible above the propeller shaftline. At the aft end of the skeg the flow should be attached to skeg, but with as low flow speeds as possible.

1.5%-2% lower propulsion power demand with good design. Corresponding improvement up to 2% in total energy consumption for container vessel.

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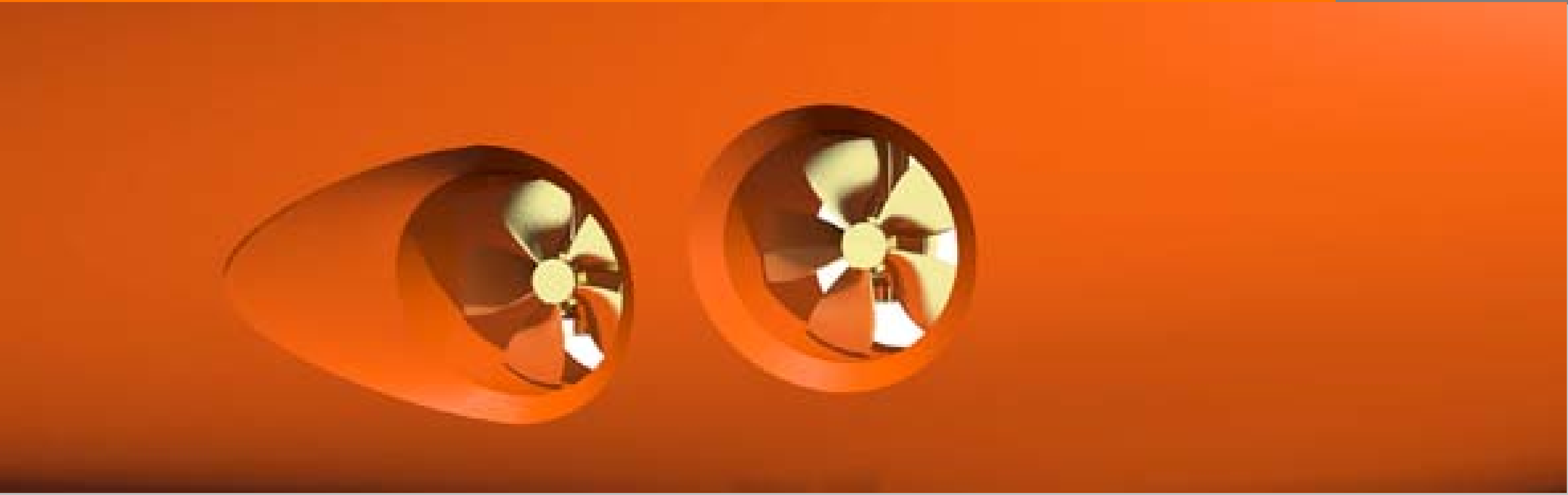
Minimising resistance of hull openings

< 5%



The water flow disturbance from openings to bow thruster tunnels and sea chests can be high. It is therefore beneficial to install scallop behind each opening. Alternatively a grid that is perpendicular to the local flow direction can be installed. The location of the opening is also important.

Good design of all openings combined with proper location can give up to 5% lower power demand than with poor designs. For container vessel corresponding improvement in total energy consumption is almost 5%.

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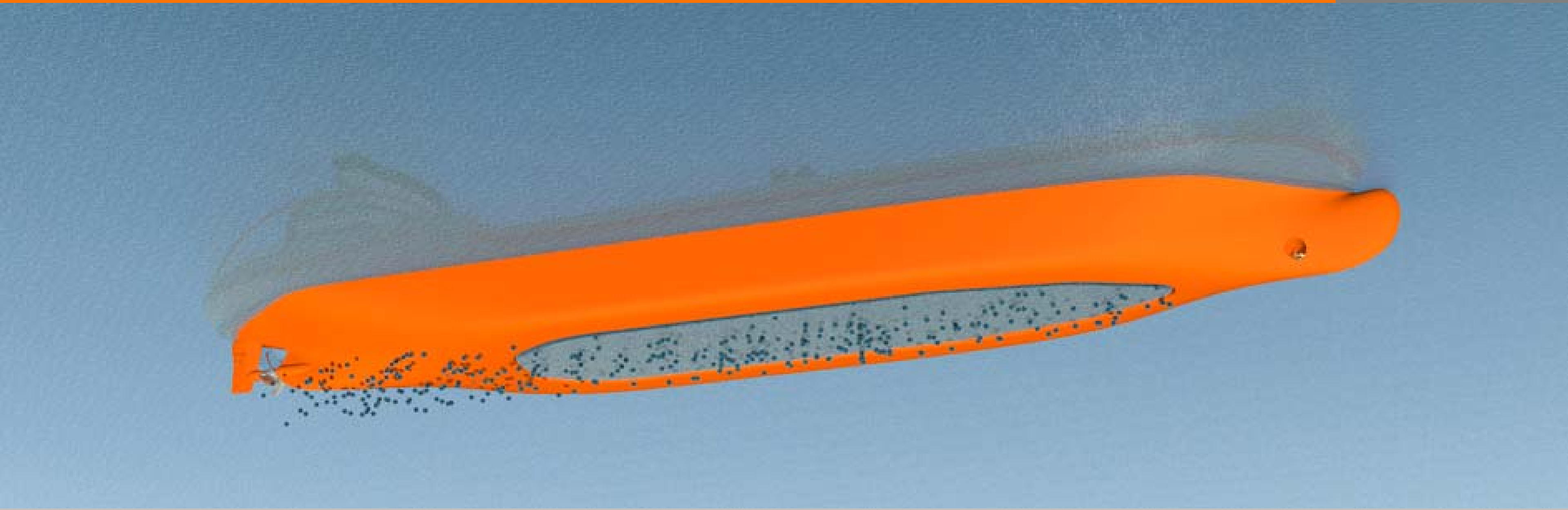
Air lubrication

< 15%



Compressed air is pumped into a recess in the bottom of the ship's hull. The air builds up a "carpet" that reduces the frictional resistance between the water and the hull surface. This reduces the propulsion power demand. The challenge is to ensure that the air stays below the hull and does not escape. Some pumping power is needed.

Fuel consumption save:

Tanker:	~15 %
Container:	~7,5 %
PCTC:	~8,5 %
Ferry:	~3,5%

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Tailoring machinery concept for operation

< 35%

This OSV design combines the best of two worlds. The low resistance and high propulsion efficiency of a single skeg hull form is combined with the manoeuvring performance of steerable thrusters. Singe screw propulsion is used for free running while retractable thrusters are used in DP mode when excellent manoeuvring is needed.

The machinery also combines mechanical propulsion in free running mode with electric drive in DP mode. Low transmission losses with mechanical drive. Electric propulsion in DP mode for optimum engine load and variable speed FP propellers give best efficiency.

The annual fuel consumption of typical supply vessel is reduced by 35% compared to a conventional vessel with diesel-electric machinery and twin steerable thrusters.

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