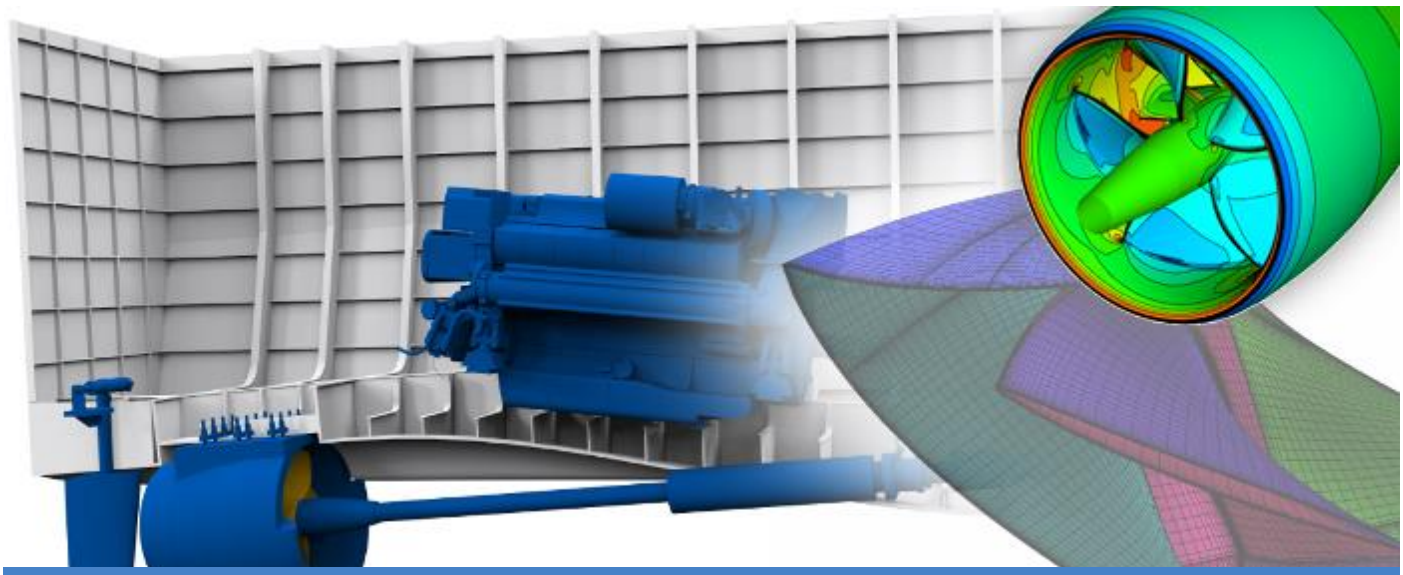


CUSTOMER CASE STUDY

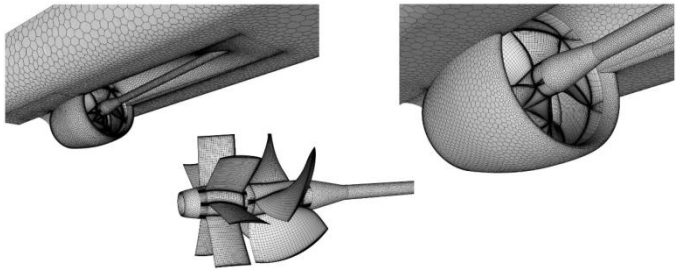
DESIGN AND OPTIMIZATION OF THE VOITH LINEAR JET (VLJ)

The VLJ combines the best properties of propellers with the best properties of waterjets. For this product, one of the most important design challenges is to maintain a high efficiency across a wide operating range while delaying the onset of cavitation.

In particular, the VLJ provides the following key benefits:

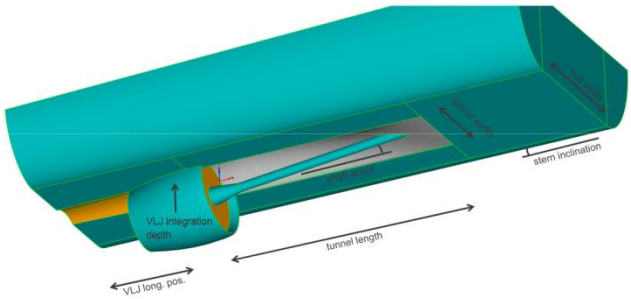
- Sustained high efficiency across the vessel's speed range
- Reduced cavitation, results in low noise and vibrations
- Ideal propulsor for ships with mixed operating profile between low and high speeds like yachts, workboats, and patrol vessels

VOITH Turbo makes intensive use of CAESES® to design the full VLJ system which includes the tunnel and hull geometries as well as the rotor/stator geometries.



INTEGRATION OF THE VLJ

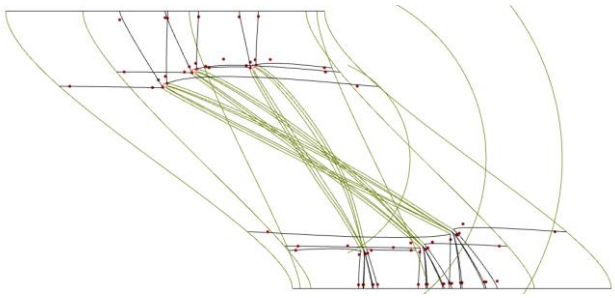
The optimal integration of the VLJ into the ship hull is realized by a separate CAESES® geometry model.
In order to find the best shape that meets the customer specifications, a set of geometric parameters (tunnel length, integration depth etc.) is created and used in a simulation-driven, highly automated workflow. These parameters are changed automatically while – at the same time – the rotor, stator and nozzle geometries are also varied. This makes sure that the hull shape and the VLJ are a perfect match.



CAESES geometric parameters to integrate the VLJ into the ship hull

ROTOR AND STATOR GEOMETRY OF THE VLJ

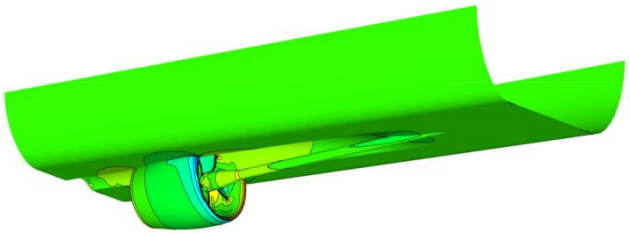
The blade parameters are defined on cylindrical sections. Typical parameters are radial distributions for chord, thickness, camber, skew, pitch and rake. For the block-structured meshing process, additional parametric support geometry is created.



Parametric support geometry for the automated block-structured meshing

FULLY AUTOMATED DESIGN STUDIES

Based on this geometry, the meshing process can be fully automated in order to be used in design studies and shape optimizations. The surface mesh itself has a high density in regions of interest, such as leading edge, trailing edge and the gap between nozzle and blade tip.



Assess CFD results for a large set of design candidates

The parameters of the blades, the nozzle, the hull and the tunnel can be varied automatically by using the in-built CAESES® strategies for design studies and shape optimizations. The simulations run on the internal HPC systems at VOITH Turbo. The huge amount of computational power plus the automated design process with variable & robust geometry allows VOITH Turbo to investigate a large set of different VLJ systems, to finally pick the best design candidate for the customer.

> ***"CAESES® is a core component in the design department, and nowadays it drives all new product developments to ensure the very best performance"***
> *— David Bendl, Development Engineer at VOITH Turbo*

VOITH