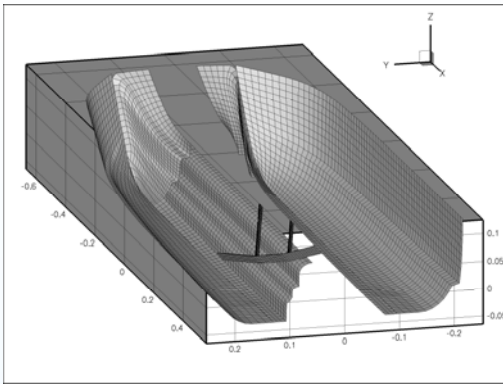


Vessel Optimization & Hull Design

The goal of the vessel optimization study is to design a new low-wake, high-speed research vessel that can be used for the study of wakes and wake impacts along the Seattle-Bremerton ferry route and other potential POFF routes in the region. In-situ testing results are being used to calibrate CFD models being used in designing the vessel.



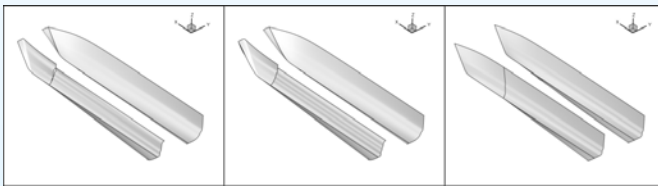
Computational Fluid Dynamic (CFD) Modeling

The POFF study team selected a combination of both viscous and non-viscous codes as the best approach for CFD modeling for wake, resistance, and optimization studies.

- **Phase 1** – model calibration and validation with trial data from *Spirit* and *1060*
- **Phase 2** – primary optimization of foil assisted catamaran including hull spacing, length, foil position using *INSEAN's* Potential Flow Model
- **Phase 3** – shape optimization including hull shape and foil shape to confirm results from Potential Flow with *CFDShip Iowa* RANS model
- **Phase 4** – seakeeping calculations using optimized hull form

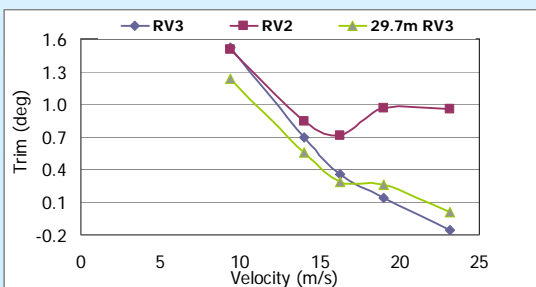
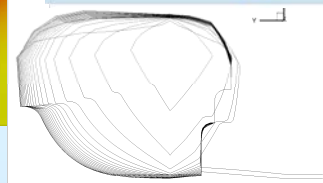
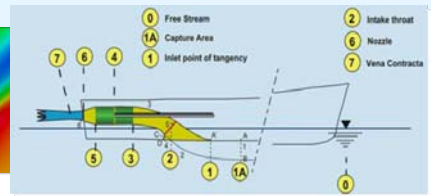
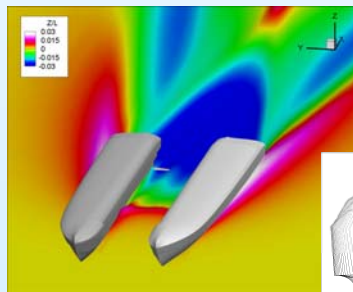
Methodology and Progress

Model simulations have been conducted with the Teknikraft designed vessels *Spirit* and *1060* for validation with full-scale measurements. Preliminary sensitivity studies and optimization with the fast and efficient potential flow computer model were conducted in 2007 to develop the hull form, foil shape and position for a new research vessel design, *RV2*. The more computationally intensive viscous flow models were then applied to the preliminary hull forms to produce a third generation hull design, *RV3*. CFD modeling to optimize the *RV3* hull in terms of wakes and resistance has been completed and Teknikraft Design's naval architect is now busy with the detailed vessel design.



Optimization process involves application of an automated system based design environment that involves several independent computer programs that are run in sequence. Starting from a set of three initial designs, a new set of hull shapes and foil configurations is automatically generated.

CFD models are being validated against full scale measurements of vessel trim, draft, and wake wash for a range of speeds and displacements. In addition, CFD model development work to incorporate realistic simulation of waterjet propulsors that are used on the foil assisted catamarans, has improved agreement with vessel power, sinkage, and trim measurements.



The CFD optimization process indicated that a 30 m hull form achieved the best compromise between wave making and total resistance. The figures show trim, resistance, and wave height for *RV2*, the preliminary hull form, *RV3* an optimized version of *RV2* (both 27 m in length) as compared to the final hull *RV3* 29.7 m in length.

The CFD modeling team is currently evaluating the seakeeping performance of the new research vessel using a matrix of conditions based on wind wave conditions anticipated on the ferry route in Puget Sound.

