When Performance Becomes Visible: Refining Running Trim with Orca3D

Bayliss Boatworks is a premier builder of custom cold-molded sportfishing yachts based in Wanchese, North Carolina. Renowned for precision craftsmanship and performance-driven hulls, the company has been conducting an ongoing design research initiative focused on understanding how subtle changes in hull geometry and longitudinal center of gravity (LCG) influence running trim angle and stagnation line placement.

Led by Design Manager Pete Buescher, this study explores how boats behave visually and hydrodynamically when running at speed. Rather than relying solely on resistance and lift metrics, the Bayliss team is using simulation to observe spray origin, flow separation, trim attitude, and the sharpness and location of the stagnation line – all critical elements in both performance and perceived quality.

Bayliss sportfishing yacht deck plan and profile showing general arrangements.

DESIGN PHILOSOPHY: PERFORMANCE YOU CAN SEE

For Bayliss Boatworks, great performance extends beyond technical optimization. It is equally about visual refinement. As Buescher explains, the team cares deeply about what their boats look like when running, particularly the trim angle and the shape and placement of the stagnation line.

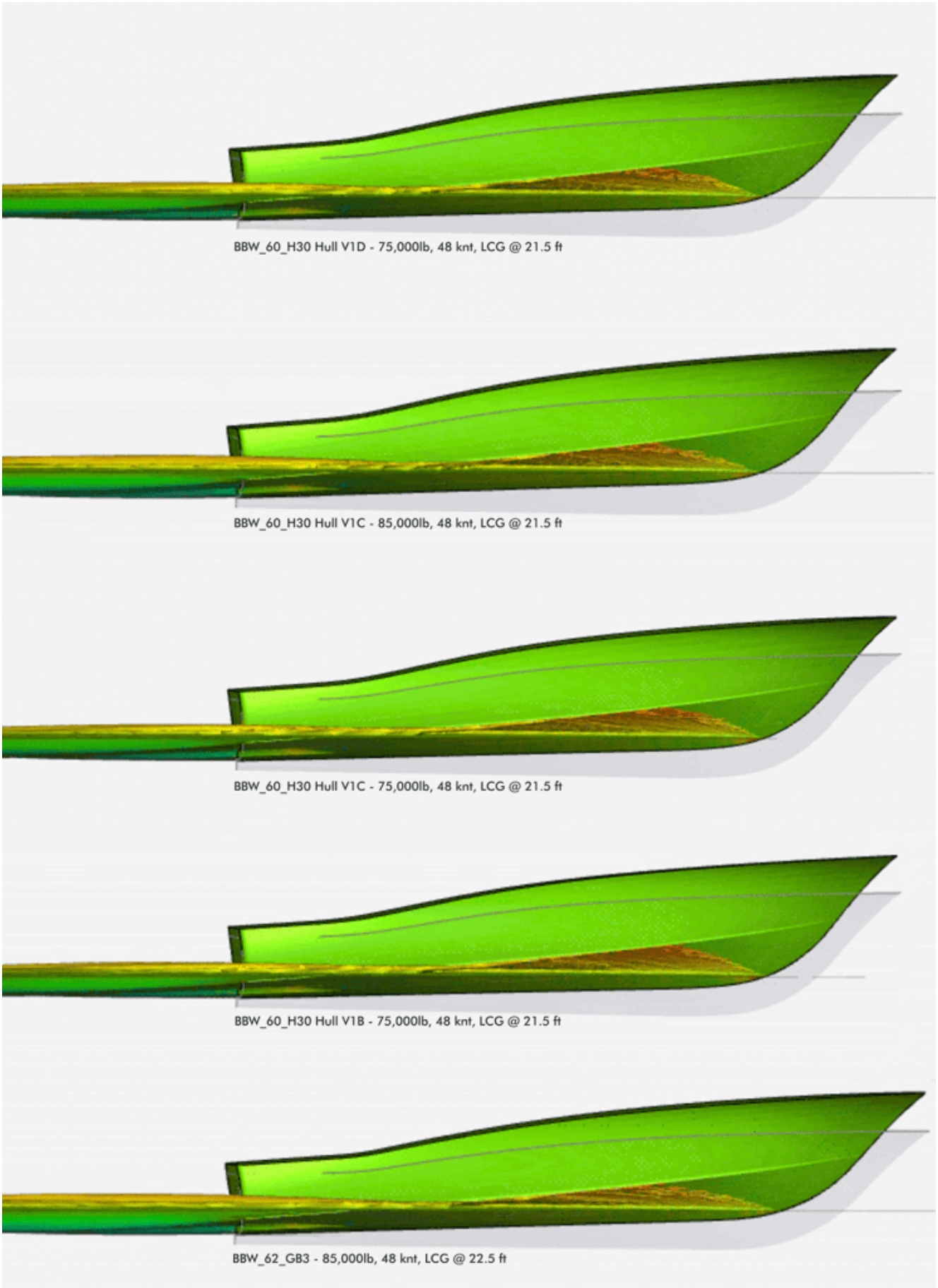
The design goal is clear: achieve a low, far-aft, and well-defined stagnation line while preserving the brand’s signature hull forms. Since 2022, this research has been evolving into a growing performance matrix that informs future hull designs and supports consistent decision-making across custom projects.

VESSEL PROFILE

Bayliss specializes in fully custom sportfishing yachts, typically characterized by:

- Length overall: 60 to 90 feet
- Beam: 18 to 23 feet
- Construction: Cold-molded wood, foam, and fiberglass
- Propulsion: Twin diesel engines with fixed-pitch propellers

Each vessel is designed and built from the keel up, tailored to the specific requirements of offshore anglers.



CFD output comparing multiple design variants, illustrating running trim and stagnation lines.

USING ORCA3D INSIDE RHINO

To support both day-to-day design work and the stagnation line study, Bayliss relies on several core modules within the Orca3D suite, all operating directly within the Rhino environment.

WEIGHT TRACKING

Accurate weight modeling is foundational to the process. Orca3D’s weight tracking tools are used on every hull to estimate structural and equipment weights early, model variable loading scenarios, and predict center of gravity shifts as layouts evolve. Reliable weight data upstream has proven essential for meaningful CFD results downstream.

HYDROSTATICS

Orca3D’s hydrostatics tools provide rapid feedback on displacement, trim, and heel, allowing the team to quickly understand the implications of design changes, particularly when adjusting internal arrangements or hull geometry.

See Also

INTRODUCTION TO ORCA3D

MARINE CFD

Marine CFD has become a key tool for visualization and exploration in marine applications. Bayliss uses it to study how LCG shifts and bottom shape variations affect running trim and stagnation line visibility at planing speeds. Rather than waiting for physical testing, the team can quickly evaluate “what-if” scenarios and explore non-standard hull variations cost-effectively.

This combination of quantitative outputs and qualitative visualization enables designers to observe how the hull performs at speed, how cleanly the spray separates, and how subtle design changes manifest on the water.

Concept rendering of a Bayliss design in still water.

INSIGHTS FROM SIMULATION

One of the most significant takeaways from the study has been the sensitivity of running attitude and stagnation line placement to relatively small changes in LCG and bottom geometry. Seeing these effects so clearly in simulation helped validate the fidelity of Orca3D's CFD solver at planing speeds and reinforced the importance of accurate weight modeling earlier in the design process.

The ability to generate clean pressure plots, free-surface visualizations, and flow streamlines directly on the hull has also influenced how results are documented and interpreted, making CFD outputs easier to read alongside traditional hydrostatics and weight data.

CHALLENGES & ONGOING DIRECTION

Because each Bayliss yacht is custom, one of the main challenges has been allocating time to run a large matrix of design variations. While the full matrix is still in development, Orca3D has already enabled

efficient exploration of key parameters, building confidence in how design decisions translate to real-world performance.

Looking ahead, the team plans to expand its use of animations and comparative visualizations to more clearly correlate design changes with stagnation line behavior and trim angle, further integrating CFD into its workflow.

Photorealistic rendering of a Bayliss design in still water.

IMPACT & DESIGN WORKFLOW

Orca3D has streamlined Bayliss's internal design process by improving weight accuracy across all design stages, accelerating predictions of trim and stability changes, and enhancing the ability to visualize spray and stagnation behavior before on-water testing. As CFD capabilities continue to evolve, the tool is becoming increasingly central to both technical analysis and design refinement.

CONCLUSION

Bayliss Boatworks demonstrates how traditional craftsmanship and advanced digital tools can work together to elevate yacht design. By integrating Orca3D's weight tracking, hydrostatics, and Marine CFD tools within Rhino, the team is refining not only how their boats perform, but how they look and feel at speed.

This ongoing research highlights how seemingly small details, such as trim angle and stagnation line placement, can have a significant impact, and how visualization-driven tools like Orca3D help make those refinements visible early in the design process.

CREDITS

Project: Bayliss Boatworks Running Trim and Stagnation Line Study
Software: Rhino, Orca3D (Weight Tracking, Hydrostatics, Marine CFD)