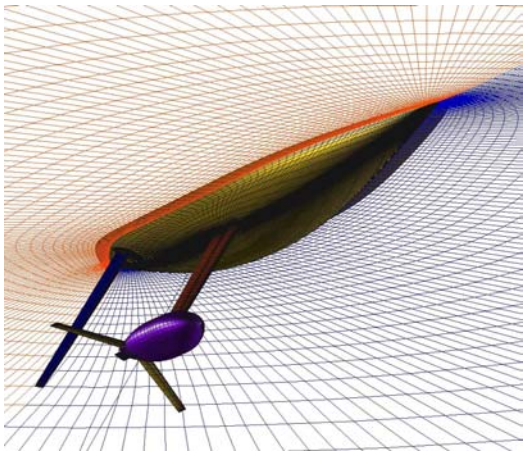
CFD Design Studies for America's Cup 2000

Computational Fluid Dynamics (CFD) plays an increasingly important role in the design and analysis of racing sailboats, particularly in the design of the America's Cup yachts. Two of the U.S. syndicate entries who use CFD in their design, *Young America* and *AmericaOne,* recently competed in the America's Cup 2000 in Auckland, New Zealand.

The use of CFD in the design process of both vessels demonstrated the wide range of CFD applications for sailboat design, concentrating on the hull and underwater appendage design, the aerodynamics of the sails, mast and rigging and the structural optimization of the hull. Additionally, CFD was used for sailing performance simulations and statistical racing analysis.

CFD applications have been used for years in the aircraft industry. CFD for yachts started to gain importance after the U.S. 1983 America's Cup entry, *Liberty*, lost to the *Australia II*. A revolutionary winged-keel design, which was kept hidden from view until the races were over, had given Australia II the edge. Even more advanced design technology, including CFD, was sought to bring the Cup back to the U.S.A. and each competition since then has seen increasing use of CFD and other computer aided design and analysis techniques.

Bruce Rosen, Joseph Laiosa, and Warren Davis have been actively involved in the use of CFD in every multi-challenge Cup cycle since 1987. Their primary focus has been the development and application of the unique SPLASH free-surface panel code. In addition, they bring to the yacht design process a host of other advanced CFD codes, such as Navier-Stokes flow solver OVERFLOW, more commonly used to simulate complex flow fields in the aerospace industry. The integration of these methods into the overall design process has made it possible to screen and rank very large numbers of configurations in the shortest time and at the lowest cost. Using Gridgen, as both an input geometry database preprocessor and an Overset grid generator, they have been able to refine the accuracy of their free-surface flow simulations. All of this allowed for considerable cost savings over expensive physical tank and full-scale testing. CFD is used to provide accurate performance predictions, while physical testing is used to back up those predictions.



Gridgen excels at high Reynolds number (highly stretched) grids used for viscous analysis of hull and appendages.

From AIAA paper 2000-4339, "CFD Design Studies for America's Cup 2000", by Bruce S. Rosen of South Bay Simulations, Joseph P. Laiosa of Fluid Motion Analysis, Inc., and Warren H. Davis.

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