

CHESAPEAKE SECTION

Design and Development of Volvo Open 70 Ocean Racing Yachts

by Britton Ward and Chris Bassler

The Chesapeake Section (recently awarded a SUPER Section) met on October 27, at the Severn Sailing Association, in Annapolis, MD, for a presentation by Mr. Britton Ward on the design and development of second generation Volvo Open 70 racing yachts. More than 30 members and guests attended.

Farr Yacht Design of Annapolis has had a long association with the Volvo Ocean Race and its predecessor, the Whitbread Race. From 1985 to 2002, Farr designs have won every race on elapsed time or handicap in both the IOR Maxi class, and in three editions of the race where the Volvo 60 competed. For 2005-06, Farr's presence included four new canting keel Volvo Open 70s competing in the race. In that edition of the race, Farr's design finished second, but learned many lessons to improve performance in future races. For the 2008-2009 race, Farr Yacht Design for the first time decided to design boats on an exclusive basis. Despite only a nine month design period, research efforts were dramatically expanded to thoroughly explore the Volvo Open 70 design.



Chesapeake October Meeting. Vice-chair, Dave Helgerson presents Britton Ward with a certificate of appreciation; note the SUPER Section banner behind Dave

Over the course of the nine months, designs were analyzed using an array of state-of-the-art tools. Ten 1/7th scale fully appended models were tested at Steven's Institute. Each design was tested over a large matrix of conditions, including speeds from 3 – 30 knots, multiple heel and yaw angles, and a range of appendage settings. In parallel, thirty design candidates were analyzed using RANS computational fluid dynamics simulations to predict both forces and provide flow visualizations for each of the designs. Extremely detailed flow simulations, incorporating prediction methods for laminar to turbulent flow transition and associated drag effects, were completed

for a range of keel bulb shapes. The simulation results were used to develop performance estimates using a Velocity Prediction Program. Then the race performance was modeled using weather routing simulations for sixteen years of weather data over the global race course. Extensive structural analysis and refinement was performed on the global yacht model, as well as more highly detailed areas, such as the keel head attachments.

The final designs are some of the most distinctive yachts in the race, featuring broad open cockpits, which lowered the stacked sails, improving stability and reducing windage drag. The hulls include power-boat like “strakes” on the forebody to lift the bow at high speed and improve handling. The mast design is unique in the fleet, eliminating the jumper struts normally used to limit the topmast deflections, providing a reduction in windage drag and improved sail handling. Finally, the structure of the boat was optimized to allow clear and unfettered access below, easing the burden of moving 2000 kg of sails about the boat to adjust trim and righting moment.

Mr. Ward is a Senior Naval Architect at Farr Yacht Design. His responsibilities include management and implementation of research projects, which encompass tank and wind tunnel experiments and the application of CFD and other simulation tools, for conceptual design and hull shape development.