AeroMarine Research
TBPNews - Performance Report

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TBPNews #88 - October 8, 2005

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>>>>>> Tunnel Boat Performance News >>>>>>> (now over 7000 members!)

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******************** TBPNews *******************

1) Direct Injection: Next Generation Outboard Performance

"Lean and Green: Evaluating Mercury Racing's OptiMax 2.5XS" - excellent article on the Mercury 2.5XS Optimax motor. Article by Greg Terzian, Photos by Maureen Murphy; Scream and Fly on-line magazine.

Full article on Scream&Fly at:
http://www.screamandfly.com/home/evaluations/mercury_2.5xs/1.htm

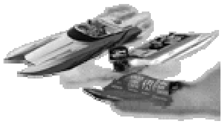
******************** TBPNews *******************

2) Feature Article - "Step by Step" (step design in powerboats)

We have had many questions regarding the design and implementation of steps in performance hulls.

Like airplane wings, most planing boats tend to generate their best lift/drag numbers at about a 3 to 4 degree angle of attack, and tend to generate most of that lift along the leading edge of the wetted surface. An issue with planing performance hulls is that the faster one goes the more the hull lifts out of the water and the farther aft this leading edge moves, altering the trim angle of attack. A boat without a step relies mostly on the longitudinal CofG (distance of the center of gravity forward of the transom) – helped by trim tabs or trimmable outdrive/lower units - to maintain its proper planing angle. For every hull shape and speed there's an optimum LCofG, but as speed increases the optimum LCofG moves aft.

Stepped hulls have two advantages – 1) they can maintain near optimum angle of attack throughout a wider speed range, and 2) they can reduce the amount of wetted surface that is not near the leading edge (and is therefore not producing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efficient lift). While there are many challenges in designing a hull with an efficient step, the simplest design (and thus, I suggest, the most reliable approach) is a single step forward of the LCofG, so that the running trim angle is more dependent on the size of the step than on the exact location of the LCofG. This is important because the LCofG is constantly changing with velocity, and thus makes it difficult to optimize for.

Step Design…
The design of an effectively performing step is VERY difficult - and will most always achieve optimum 'benefit' (more than the losses) at only one planing velocity. A step design is only good for a single angle of attack with a single center of gravity (CofG). That is why it is so complicated to find a step design that can "help" the performance throughout the speed range of a performance boat.

For example, the design and manufacturing tolerances are far more critical in stepped hulls than in non-stepped hulls. A slight change in plane angles, particularly the angles of the aftermost plane, has a marked effect on the running of the boat. Changing the after step dimension by only one-eighth of an inch can change the boat performance from one that runs smoothly to a porpoising hull.

Even the change in weight of passengers, or fuel weight can be enough to throw off the CofG so that the step design no longer works.

It gets worse, too! When a stepped hull turns, the wetted surface of the stepped portion can change, which changes the center of pressure of the lifting surface, which changes the dynamic CofG of the hull - stymied again!

The theory...
On a planing hull, the highest-pressure water is just aft of the leading edge, so we want to take advantage of as much of that pressure (lift) as possible without the drag penalty of the low-pressure water farther aft. The efficiency of a planing surface is a strong function of its aspect ratio, (the relation of the width to length). The most efficient planing hull is one that is very wide, but very short. (The aspect ratio of a fast prop-driven airplane is perhaps 8:1, while the aspect ratio of a non-stepped planing hull is on the order of 0.5:1)

Now, the design of a simple non-stepped hull, we must select a built-in angle of attack and the center of gravity. We can control the angle of attack by specifying keel camber, deadrise, and chine warp (all of which may vary over the hull length). Stepped hull design includes all these considerations, but now we ALSO have to balance the angle of attack of each step section with the distance between the step and the transom or between multiple steps!

At speeds that are different than the speed that the step is designed for, the steps are often entirely immersed, so each step actually adds drag to the hull.

Air Bubbles and Pad Design...Another suggestion that is sometimes presented…Introducing "air bubbles" to the running pad surfaces? Most experimental data leads designers to say that this is a misnomer. A myth about stepped hulls is that the introduction of air into the water that flows under the hull

reduces the viscous drag and makes a stepped hull go faster than a non-stepped hull. But in reality, running on air bubbles doesn't reduce the frictional resistance at all. The hull lifts on the water, not the bubbles. So bubbles or "two-phase flow" (water and air) will actually increase the drag. The "venting" of steps is usually added to designs in an effort to reduce the tendancy to "trip" in cornering or heavy waves.

Multiple Steps... And finally, there is the question of "multiple steps". There are two problems with multiple steps.
1) If the steps are located too close to each other, the water attaching to the second step is "contaminated" by the aerated low-density water from the first step (as per my explanation above), so the aft step does not produce the high lift forces desired.
2) Where do we locate the center of weight (CofG) so that the weight is balanced across the steps? Remember, the running trim angle of your boat changes dramatically as you go from zero to full speed, and this makes a huge difference in the lift-force distribution on your steps. It takes only a small change in the relative locations of the dynamic CofG (and the center of pressure) to change your boat from a stable, efficient boat to one that porpoises at several velocities.

OK...I've already written too much on this. Steps is really complicated design issue. They are difficult to design effectively, and thus, most don't work very well...and it should be easy to see why. When you read about, or experience the many boats that behave in a really nasty way with steps, we can appreciate how they got there - the steps were probably not 'designed' at all!
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3) Powerboat Racing on TV

- Saturday, October 15, 2005 Time: 5:00 PM EDT; Outdoor Channel (TOC) SpeedZone - ChampBoat Series From Windsor, CO
- Saturday, October 22, 2005 Time: 5:00 PM EDT; Outdoor Channel (TOC) SpeedZone - ChampBoat Series From San Diego, CA
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4) Boating Magazine Spins Off Speedboat

Boating, published by Hachette Filipacchi Media, will spin off SpeedBoat—Life At Full Throttle, a magazine that will showcase reviews, trends and new products in high-performance boating. SpeedBoat debuted in July/2005 with a $5.99 cover price.

Eric Colby, who is now Boating's senior technical editor, will be SpeedBoat's editor in chief, while Wade Luce, vp/publisher of Boating, will serve as SpeedBoat's vp/publisher. Advertisers include a number of high-performance boat builders, and boat accessories manufacturers.
********** TBPNews **********

5) Water Channel creator to sponsor NMMA shows

MCE Television Networks, Inc. has signed on as a corporate sponsor of the National Marine Manufacturers Association boat shows.

MCE Television, headquartered in Everett, Wash., created the Water Channel, which debuts Oct. 17 on the Dish Network with a lineup of 30- and 60-minute programs about water-oriented topics.

Water Channel producers attended the Norwalk International Boat Show Sept. 22-25 to get footage for a feature show on the Northeast boating lifestyle. Testimonials from show visitors filmed by Water Channel will be provided to NMMA for use throughout the winter boat show season, including the New York National Boat Show in January and the Miami International Boat Show in February.MCE also is offering a discount to NMMA members who advertise on the Water Channel and will contribute a portion of its ad revenue to the Grow Boating Initiative.
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6) Nooitgedacht Dam roars with F1 controversy

The Nooitgedacht Dam was a scene of controversy and action in the Formula 1 Powerboat Grand Prix held at Morula Casino and Hotel on Sunday, October 2, 2005.

For the first time in the history of F1 Powerboat racing, the 50% rule was applied. Only 50% of the points were allocated after drama which included a flip, a collision, race restarts, a protest, an engine lost in the dam, five fines and two disqualifications at the second round of this national series.

After a relatively incident-free first race, aside of Elzane de Jager's engine being lost into the depths of the Nooitgedacht Dam, the real action started in the second of three 15-lap heats when a course buoy was taken out. In an almost repeat manoeuvre of the first race, Russell Chard, avoided an accident with defending champion Paul Shepard and Brendan Kelly. The brilliant evasive action left the spectators with their hearts in their throats.

Half a lap further Russell, then chasing Paul, reared into a massive corkscrew, spinning into the reeds where he disappeared. The race was again stopped but a third start not permitted. As 75% of the race had still not been completed, only 50% of the points were allocated, with Anton de Jager taking second to Paul and Brendan third. The action continued in the third heat. After a fierce duel in the front between Paul and Anton, Meiring van der Merwe cut off 18-year old woman pilot Sonja Brits, who barrel-rolled over him.

Meiring, who hails from Witbank, was disqualified for the second time. He had also received a yellow card the previous day for not obeying a red flag. The third heat was restarted without Anton, who was having battery problems and Paul, with his main opposition Russell, Anton and Sonja out the way, took an easy race victory, giving him a hat-trick of wins for the day and overall race honours.

He now has a convincing lead in the series on forty championship points, with three pilots jointly lying second: Anton de Jager, Russell Chard and Brendan Kelly, each on 28 championship points. Adding to all the controversy and action, the race

officer, SJ Muller, fined five drivers R1 000 each for being late for drivers' briefing. The third round of the series will be the National Ports Authority Grand Prix taking place on Sunday, November 6 at the Rynfield Dam in Benoni.

******************* TBPNews ******************

7) Jimboat writes NEW Feature article in F&PB magazine

*** NEW ***
Jimboat writes Feature article in Family & Performance Boating magazine. 'The Bottom Line'-"Why does a Pad make a vee Hull faster?" is the FEATURE in the F&PB September 2005 issue.

Get your copy of the full article at:
http://www.aeromarineresearch.com/adverts/Vee%20Pad%20Design.html
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and Recently published...

Jimboat writes Feature articles in HOTBOAT & F&PB magazine
"10 Smokin' Speed Secrets Revealed..." - Jimboat has new article in February 2005 HOT BOAT magazine. "If you don't want to make expensive modifications to your hull or engine setup, then here are some tips for getting the most performance from your current setup. By Jim Russell, author of "Secrets of tunnel Boat Design" [editor-HB]
Check it out at: http://www.aeromarineresearch.com/adverts/HB_Feb2005.html

and Recently published...

"Winterizing your Performance Outboard" - Jimboat has new article in Jan2005 issue of Family & Performance Boating. Check it out at:
http://www.aeromarineresearch.com/adverts/F&PB_Jan05.html

"What a Drag" - Trim Angle & Engine Height Can Reduce Drag and Increase Speed", by Jim Russell, author of "Secrets of Tunnel Boat Design book [editor-HB]. See September 2004 issue of HOT BOAT Magazine. Or get your own copy of the feature article at:
http://www.aeromarineresearch.com/adverts/HotBoat_Sept2004.html

"10 Safety Tips" - The author of "Secrets of Tunnel Boat Design" offers ten safety ideas for high performance go-fast boats [editor-HB]. See August 2004 issue of HOT BOAT Magazine. Or get your own copy of the feature article at:
http://www.aeromarineresearch.com/adverts/HotBoat_August2004.html
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See you next time!

/Jimboat
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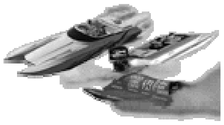

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Note: Some of the articles presented in TBPNews are edited excerpts from the "Secrets of Tunnel Boat Design" book, “Secrets of Propeller Design” book, “History of Tunnel Boat Design” book, by Jim Russell, published by AeroMarine Research. The STBD book explains the theory in full, and outlines example design calculations, step-by-step. The "Tunnel Boat Design Program", software, does all the force calculations, dynamic force balances at all speeds, and reports the analysis automatically, including complete graphical performance results for any tunnel or modified vee-hull design.

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Let us know any ideas you have, requests for articles, questions or comments on our TBPNews. Send your comments to TBPNews@aeromarineresearch.com
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Get your full, illustrated, NEW 12th edition copy of the world known "Secrets of Tunnel Boat Design" book. GO TO: http://www.aeromarineresearch.com/stbd.html

Also, the publications "History of Tunnel Boat Design" book, "Secrets of Propeller Design" book, the "Tunnel Boat Design Program" software, and the "PropWorks2" software for speed prediction and propeller selection at the AeroMarine Research web site. GO TO: http://www.aeromarineresearch.com

"Secrets of Tunnel Boat Design" book
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