International Hydrofoil Society Correspondence Archives...

Bigger Wakes For Wakeboards

(Last Update: 5 May 03)

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[5 Oct 99] I am trying to build a hydrofoil to mount on a competition ski boat to make a bigger wake. Wake Boarders are currently using a device called a Fat Sack to add weight to the rear of the boat. Fat Sacks are filled with water and add 500 to 1000 pounds of weight to the back of the boat. the boat I have is a 20' inboard. skiing speed is 18-23 mph. The foil would have to mount on the transom behind the rudder. I have a plan to adjust the attacking angle. Any advice on size and shape would be greatly appreciated. -- Doug Ward (STLINE@aol.com)

Follow up...

[7 Oct 99] I hope I do not sound too simplistic, but, Fat Sacks do work in competition ski boats. The foils I want to build just needs to pull down with a force between 500 to 1000 lbs. I was planning to build a foils 36 in X 6 in. This could fold up under my swim deck when not in use. How thick would the foil need to be to achieve the desired results? What would be the optimum attacking angle? Help on size and shape would be greatly appreciated. -- Doug Ward (STLINE@aol.com)

Response...

[7 Oct 99, updated 3 Jun 02] Here are some links to publications and to products designed to increase the size of a boat's wake for purposes of wakeboarding (Note: IHS does not endorse or recommend commercial products. These links are given for information only; the value or effectiveness of these products had not been evaluated by IHS):

- Lead Foot - ballast or counter weight system designed to "PHATTEN your WAKE and HANGTIME." *[webmaster's note: this one seems to have dropped off the internet]*
- Air Boom *[Editor's Note: The Air Boom website seems to have dropped off the internet as of 5/5/03]*
- Wake and Skate - (http://www.wake-skate.com/) Wakeboarding Website *[Editor's note: this site now requires a userid and password... do not know how to get one.]*
- Wake World - WakeBoarding Website
- X-It Products, makers of Phat Budde Wake Systems
- Skylon Wake Enhancers Phat Boy and Phat Buddies available from various sellers such as Bart's Water Sports

2nd Response...

[8 Oct 99] I know that this might not be the hydrofoilers' answer, but why use a foil? I suggest that you use ballast. Just fit a water tank and fill it as required. The cooling water pumps from the boat can be used to put 1000lbs of water into a tank in a minute or two, and the big plastic barrels don't cost much or weigh much when trailering the boat. There is no drag from ballast, apart from the additional hull drag that you will get anyhow. However ballast will reduce roll stability. If you can't fill the tanks while moving, ballast will reduce acceleration.

- If you want to use a foil, it is the area that is important. The thickness should be about 1/10th of the chord (front to back length) but the strength of the foil is a major consideration for deciding the thickness.
- As for foil size, a 36" x 6" foil will give up to about 1000lbs of downforce at about 18 knots, but that needs a biggish lift coefficient, so you need a big angle of attack (10 degrees or so) and a larger foil would be easier to get a good water flow over.
- The downforce could be difficult to control. The force will be proportional to the square of the speed, and it will change quickly with angle of attack. The force will alter the angle of the boat, and therefore alter the force. I think that it will tend to be stable if the foil is at the back of the boat, because pulling the boat down at the back will point the bow up, and point the front of the foil up, reducing downforce. You will certainly want to be able to alter the angle of attack, preferably at speed. Pivot the foil about 1/4 chord (1.5" from the front for a 6" chord) to minimise the force on whatever mechanism changes the angle
- The exact form of the foil is not too important. It must be thick enough not to bend when loaded, and there must not be any sharp changes in surface angle. Look at the skeg of an outboard or the propellor blades. The top surface would be near flat, and the thickest part would be about 35% of chord (2" from the front if you have a 6" chord). The front should be rounded, and the back sharp, just like an aeroplane wing upside down.

Harry Larsen's *TALARIA III* has a rear foil made from 1" aluminium plate, milled to about the right shape with a few flat cuts, and finnished with a hand grinder. -- Malin Dixon (gallery@foils.org)

[8 Mar 99] I wakeboard a lot (like snowboarding but being towed by a boat) and use the wake to perform tricks, using it as a ramp. For the project that I am making in my Design and Technology course at Ashville College, I have decided to make a device which will attach to the back of a speedboat which will increase the size of the wake to allow me to perform more tricks due to the increased size of the ramp. At the moment I am thinking about using a hydrofoil with the blade angled downwards to pull the back of the boat down into the water which will increase the size of the wake because of the greater displacement of the boat. I am hoping to be able to use the water to make the size of the wake bigger instead of just increasing the water displaced by the boat to make the wake bigger. I am hoping to be able to find a way to channel the water that would be wasted, make the wake of the boat bigger. For example, smaller wakes are generated by a speedboat during speeds of around 18 mph and I want to be able to get rid of

these smaller wakes, using them to make the main wake bigger. I am trying to find a diagram showing where each component of the boat wake comes from in order that I might be able to develop a way of using the smaller wakes in a different way. -- Andy Padgett (Padgett@btinternet.com)

Response...

[14 Mar 99] Andy, I am not a hydrodynamicist nor a boat designer so I may not use the proper terms in my reply to you. My background is in the construction and evaluation of hydrofoil ships and systems for the US Navy's research center. The problem you present is not necessarily a hydrofoil related solution. Mainly, a wake is a product of a pressure wave caused by the hull or in case of the hydrofoils, the foils carrying the weight of the ship. My understanding is that the more harder the chine and flatter the bottom, generally you get larger wakes. But then so much is involved especially since you apparently want to place this wake at a distance from the boat for the wakeboard. I don't know what type of hull your boat has, but I am not sure that adding a foil section to pull the hull down will do much toward your goals. I feel that adding weight on the stern would accomplish the same thing. Before we go any further, lets look at other considerations. Are you going to accept the increased drag which relates to requiring more speed to plane the boat? This will also decrease the top speed. Does your engine have the additional horsepower to overcome the increased load? Are you willing to play with the propeller i.e. diameter and pitch to obtain optimal performance? Handling characteristics would also change, most likely contributing to wandering condition. Many I/O boats exhibit this characteristic before coming up on plane due to the heavy weight of the engine at the stern. Boat designers take all of these factors into consideration when designing boats, especially when they try to reduce the wake for water skiing, which is opposite of what you would like to do. I don't think you will find an easy fix. It could be that a new hull form would give you the most gain. -- Sumi Arima (arimas1@juno.com)

2nd Response...

[9 Apr 99] Andy, Have you seen the April 1999 issue of Trailer Boats? On page 64, they report on a test of a Correct Craft Pro Air Nautique, which is a modified Nautique to induce wake for wakeboarders. They also mentioned installing a bladder to carry water for ballast to enhance the wake. Checking the magazine, subscription/back issues manager can be contacted at "tbmcirc@aol.com". -- Sumi Arima (arimas1@juno.com)

Hydrofoil Wakeboard...

[23 Aug 98, updated 11 Nov 01] I'd appreciate any suggestions... I am initially working on a towable hydrofoil with basically 3-axis aircraft-like control to allow the craft to jump without a wake to cross. (Jumping another boat's wake can be dangerous and illegal.) Additionally, long rides in choppy water will really beat you up. Especially if you are 40+ like me. An adjustable foil would allow you to use your energy when you really want to perform vs. travel. I am working on a recumbent seating system with dual front foils having individual spoileron controls and a separate rear skeg (rudder). The spoileron controls should allow bank control, counteract tow forces and control the height. The rudder should control yaw. If this works out well enough,

the next version will be powered. I'd appreciate any suggestions. Such as: The front foils need control, should I rotate the entire horizontal surface of the foil? Can I instead have trailing control surfaces like an airplane's flaps? I'm planning on building the foils in from flat aluminum. -- Barry Steele (barry_steele@yahoo.com)

Response...

[4 Jun 02] Just a quick note to see how you're going. I am thinking of the same sort of idea after seeing Laird Hamilton with the air chair board. We do a bit of tow in surfing on a wakeboard behind a rubber duck on the gold coast in Australia. I have been trying to get some nut with a airchair out there but have yet to find some one with enough nuts to do it. Don't blame them really but after looking at this page there seem to be some very real possibilities with the foils on Windsurfers etc. The fellow suggested it would only need 1-2hp if it was towed up on a plane and let go, which is the idea. This is a top page for info. Drops us a line. Duncan Warth (duncanwarth@austarnet.com.au)

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