

## Adding Hydrofoils To Sailboats (Kits?)

Descriptions, Advice, Sources of Information, and Requests For Help

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### Correspondence

#### New 12-Meter Hydrofoil Sailing Craft

[17 Feb 02] [Take a look at the BDG Marine twin-rig Spitfire12M](#)...It is quite the craft! Tapered foils, vertical dagger on the bottom. Looks like modification of the 1978-80 foils that the Brits used on the big biplane Tornado. Sails look a bit odd when you look at the weather side. I see sort of reaching going on with booms out a ways in these pictures, not really going to weather.

Material of construction is not mentioned. Method for deploying and retrieving foils appears to be an old manila rope... I expect that will change! -- Dave Carlson ([dcarlson@gainesville.usda.ufl.edu](mailto:dcarlson@gainesville.usda.ufl.edu)); website: <http://www.fast sail.com/catcobbler>

### **Adding Foils to 27-ft Catamaran**

[2 Feb 02] I am interested in adding hydrofoils to a 27-foot stiletto catamaran. Can you send me any information on how to start designing the foils and how they could be installed? -- Chef Ken ([chefken@chefken.com](mailto:chefken@chefken.com))

### **Responses...**

[2 Feb 02] See the website of Chef Kenneth Johnson, the Yachting Gourmet and winner of the Showboats "Concours des Chef's" Competition in Monaco year 2000: [www.chefken.com](http://www.chefken.com).

[27 May 02] It depends on what you want the foils to do! Do you want to make it fly? Are you looking just to add stability? Are you trying to improve its seaworthiness? What are the operating conditions where it will be sailed? You need to clearly identify what the deficiencies of the Stiletto are, and only then consider whether foils will cure those deficiencies. Foils do not automatically make the boat faster. In fact, they will make the boat slower over much of its operating range. For sure, the foils will add weight. Then there's the weight of the structure needed to take the concentrated loads of the foil attach points, especially considering the structure wasn't designed for them to begin with. When deployed, the foils add wetted area and the foil lift comes with a drag penalty, too. When retracted, they add windage. But, if the speed of the boat is limited by its stability, particularly its diagonal stability, then the foils may stabilize it enough that the extra power available is worth the added drag. This could be obtained with a canted dagger board mounted forward, or even a manually controlled T foil that wasn't intended to fly the boat. The maximum L/D (lift-to-drag ratio) for a flying craft occurs when the drag due to lift equals the other sources of drag. So as a rough idea of the breakeven point, the wetted area of the foils when flying would have to be well under half the wetted area of the hulls. Subtract off the wetted area of struts, divide by two, multiply by the cosine of the dihedral angle, and you have the planform area of the foils. Best L/D lift coefficient will probably be around 0.3 to 0.5, so this limits the minimum takeoff speed, plus the fact that you have to drag both hull and foils up to takeoff speed. So takeoff will only occur when you have enough wind to get boat + foils to around 12 kt or so. Say 15 - 20 kt of wind, minimum. You'd have to sail in a fairly windy area to make it worth dragging the foils around in the light winds. The Stiletto, being a catamaran, already has a problem compared to the tri's in the light stuff. I'm not saying it can't be done, or shouldn't be done - I've fallen for the allure of designing a sailing hydrofoil myself. Just be sure you know what the real requirements are. As you can see, my first attempt didn't come to closure on the performance requirements, either (<http://www.basiliscus.com/CSYSpaper.pdf>). If I hadn't analyzed the requirements first, I might not have found that out until the boat was built. As a must-have, get the AMV CD from IHS. It has a couple of handbooks on designing hydrofoils in it that will give you the relationships needed to engineer your foils. The big problem then is getting estimating the coefficients for your particular configuration. -- Tom Speer ([me@tspeer.com](mailto:me@tspeer.com)) website: <http://www.tspeer.com>

## Market For Sailing Hydrofoil?

[3 Dec 01] I'm interested in building a hydrofoil 33' long with a 12' beam based on a cat-style boat made out of aluminium. What do you think? Could it be sold to the general public? -- Tom Sundling ([CHGOJX@aol.com](mailto:CHGOJX@aol.com))

### Horiuchi's *TWIN DUCKS*...

[11 Nov 01] Here are photos of Mr. Kotaro Horiuchi's foil sailboat called *TWIN DUCKS*. Mr. Kotaro Horiuchi (email: [horouchi@ta2.so-net.ne.jp](mailto:horouchi@ta2.so-net.ne.jp)) has a long and amazing career of boat building, much of it with Horiuchi Labs of Yamaha Motor. He sent me his book called *A Locus of a Boat Designer*, [ISBN4-8072-4201-6], in which there is great detail on many of his projects. Unfortunately, the book hasn't been translated from Japanese yet, but the pictures and charts are still quite useful. I asked Mr. Horiuchi to contact you and peruse your site, and I believe he will do so soon. He's an amazing engineer and designer, and very well versed on all aspects of foil technology. He's still very busy building and writing, but I hope you get a chance to chat with him. Here is his description of *TWIN DUCKS*: "Dec.14. 2000, hydrofoil sail boat *TWIN DUCKS* made the first foilborne run in 3~4.5m/s breeze. I designed this boat; it was built by a student of Tokyo University as a graduate study project. Biggest feature of this boat is that the left and right hull have independent hydrofoil systems like human-powered hydrofoil boats and has independent stability. Both hulls are connected by an aluminum tube beam, but each hull is pitch free around that tube. By this system, individual hulls can keep their own altitude and longitudinal stability. And this combination supports the heel moment generated by the sail. Another feature is that the skipper can balance the heel moment when the boat takes off. Then the loading of hydrofoils was equalized and works 100%. This fact makes the boat takeoffs in breeze and runs fast by respectively small hydrofoils. I think the boat runs 30 knot by small foils. Length: 4.5m Beam:1.9m Weight: 70kg Sail Area:10.6m<sup>2</sup> & 6.5m<sup>2</sup>."

-- Ron Drynan ([info@humanpoweredboats.com](mailto:info@humanpoweredboats.com)) website: [www.HumanPoweredBoats.com](http://www.HumanPoweredBoats.com)



### **Response...**

[11 Nov 01] Lovely boat! Interesting concept to have independently articulated hulls in a catamaran. Much like a Trifoiler without the center hull. I'd like to see more details of her design and the analyses behind her. -- Tom Speer ([me@tspeer.com](mailto:me@tspeer.com)); website: [www.tspeer.com](http://www.tspeer.com); fax: +1 206 878 5269

[20 Jan 02] Mr. Horiuchi is now a member of IHS. He can be contacted by email at: [horiuchi@ta2.so-net.ne.jp](mailto:horiuchi@ta2.so-net.ne.jp) -- Barney C. Black (Please reply via the [BBS](#))

### **Calliope - Design and Development of a 4.9m Hydrofoil Catamaran**

[13 Aug 01] A couple of years ago my father and I wrote [an article about one of our sailing hydrofoil boats](#) for a conference in Hobart. The conference organisers never published it, but it appeared in AYRS Catalyst Vol 1 No 2 July 2000 and is now available via my web page at <http://homepages.rya-online.net/ejchapman/> . Sam Bradfield suggested it be made available to as wide an audience as possible, so perhaps it could be added to the list of members web sites? -- Joddy Chapman, South Brent, Devon, UK ([ejc.chapman@rya-online.net](mailto:ejc.chapman@rya-online.net))

### **Response...**

[2 Sep 01] Thanks to everybody involved for getting this interesting and enlightening article published here! My two person "bicycle" arrangement monohull foiler is almost complete, and I was particularly interested in the comments in the article on ventilation of the vertical foil (daggerboard), since my main foil is mounted there also. -- Doug Lord ([lorsail@webtv.net](mailto:lorsail@webtv.net))

### **Foil Kit Evolution...**

[24 Apr 01] Foiling Report #57, April Fools Day, 2001. Jacksonville, FL. Photos by Rob Lyman, owner of *DADDIO*, RC-27. After winning the River City Regatta ... (11211 with the *CATNIP* in conventional stock condition versus a variety of other cats (Nacra 6.0, Prindle 19, Hobie 18 and Hobie 16), I went out foiling. I have slightly modified my old wooden epoxy/plywood *CATNIP* to use the surface-piercing foil system, but using sturdier, simpler, different support arms compared to those Dave Keiper invented. This system works pretty well now, and the A-cat zooms along airborne nicely and stays up for minutes at a time. Nothing having to do with the boat or foils has broken yet- and



this foil set is 3 years old. A-class woodie with small foil set, both foils set about +5 degrees. Rudders +4 degrees with one lower fin only. Charlie Johnson, another old P19 racer and Rob Lyman went out with the JAX Rudder Club committee boat and Rob's camera and chased me. They got some good e-shots. I foiled pretty good, could stay up even tho the air was very puffy- estimated 12-15 knots in streaks, then 15-20 knots of air: It felt like I was doing 18-20 knots. I capsized once at slow speed off the foils just after a jibe when the mainsheet was at the wrong angle and I couldn't release it: No problem although one sticky H16 rudder cam stayed locked down which was a nuisance. I had to go back to shore to pop it up. The foils otherwise worked pretty good. After Rob and Charlie went off for a rescue (many cruisers motored in with torn sails, and one lost its rudder entirely which broke off at the shaft). I kept foiling until cold- for a good 2 hours. -- Dave Carlson ([dacarls@nersp.nerdc.ufl.edu](mailto:dacarls@nersp.nerdc.ufl.edu)) 731 NW 91st St; Gainesville, FL 32607, USA website: [www.fast sail.com/catcobbler/](http://www.fast sail.com/catcobbler/)

### **Hydrofoils for Trimarans...**

[2 Dec 00] I have recently rebuilt a James Brown Searunner (28'). The outboard hulls are each attached by four 2" aluminum box beams, each roughly 5' long. There are two wooden struts each about 10' long going out to each of the outboard hulls as well. As you know these connecting beams or struts are called akas and the outboard hulls are called amahs. The aluminum akas are used to create two vertically aligned right angled triangles. The vertical side is about 2' high and formed by the connection of the akas to the two main bulkheads of the main hull. The shorter of the akas is horizontal, both akas meet the amah at the inboard side of it's upper deck. The wooden akas provide rigidity fore and aft. It seems to me that retractable foils could be attached to the aluminum akas. The foils might be deployed when the boat reached 10 knots, and designed not to lift the boat entirely out of the water but only to provide enough lift to reduce the wetted surface, and increase the righting moment of the leeward hull. I'm not expecting such a project to be "cost effective". I look at the boat as a platform to experiment with (if only in my head.) I am not an engineer, but I am beginning to learn about how beams can be made light and strong, and shaped like hulls or foils. I have a nice shop at my home. I might undertake such a project next winter once I have finished fine tuning and tweaking the boat (the first shakedown cruise was in late Aug 00. -- Nip ([d\\_ensley@tpo.org](mailto:d_ensley@tpo.org)))

### **Composite Foil Sections Available...**

I am an enthusiast boat builder/sailor in Perth Western Australia. I have some info that maybe could be posted on your website. I have produced a moulded hydrofoil section for sailing dinghies or other which can be fitted in whatever configuration. It is a NACA 63412 120mm x 14mm x 1.8m. The section is hollow with a sandwich stringer. Manufactured from pre preg carbon, a 1.8m length weighs just 1kg. The laminate can be altered to suit if strength is a high priority. I am fitting the foils to an International Moth class dinghy in a unique configuration There was never any great intent to sell these as they were really just for this project. Since I have come this far I might as well test the water and see if there is any interest. They would cost \$360 Australian per 1.8m length plus freight, which I can arrange. If there is anyone interested in discussing my design, I would welcome this also. -- John Ilett ([fastacraft@hotmail.com](mailto:fastacraft@hotmail.com))

### **Foil Kits For Hobie 21...**

[19 Sep 00] : Do you know of any foils available for a Hobie 21? -- Greg ([cheryl.M.willocks@worldnet.att.net](mailto:cheryl.M.willocks@worldnet.att.net))

### **Response...**

[19 Sep 00] Greg, the most recent person to tackle the project of providing add-on hydrofoil kits commercially was Dave Keiper, but unfortunately he died before he could get his design into production. His website is still up at [www.wingo.com/dakh/](http://www.wingo.com/dakh/). His brother Frank answers [his email](#). Dave Carlson worked closely with Keiper to help debug the design and specify details suitable for production. I don't know if he intends to go the next step of producing kits for sale or not. In any case, his website URL is: [www.fast sail.com/catcobbler/](http://www.fast sail.com/catcobbler/) and I suggest you contact him to pursue the idea further. -- Barney C. Black (Please reply via the [BBS](#))

### **Please Share Your Experience...**

[3 Jun 00] I recently read your postings regarding sailing hydrofoil plans, and was wondering if anyone has had any success with building a reasonably priced hydrofoil sailboat? I am familiar with the [RAVE](#) and other models out there, but I am less than willing to pay the \$10K price tag. I am very interested in any successes anyone has had, or any info you might be able to provide. My family recently purchased a marina, and thus I have all of the resources available at my disposal to construct my boat. -- Kevin Knull ([KDKnull@aol.com](mailto:KDKnull@aol.com))

### **Response...**

[3 Jun 00] You may want to take a look at Dave Carlson's website at [www.fast sail.com/catcobbler/](http://www.fast sail.com/catcobbler/). He has continued to refine and test designs begun by Dave Keiper and appears to be having good success. If you are interested in becoming a member of IHS, [Click Here](#) for information on how and why to join.

### **Hydrofoils For Small Cat...**

[8 Aug 99] Can you send me any plans for hydrofoils for a 14 foot catamaran. design, materials etc. I am keen and willing to do this myself, but just need a bit of guidance in the right direction. -- Marcus ([bsltd@xtra.co.nz](mailto:bsltd@xtra.co.nz))

### Curious About TRIFOILER...

[8 Aug 99] I am very interested in the Hobie-Ketterman *TRIFOILER*. I would like to know if there is an off-the-shelf "J" style foil as used on the Trifoiler or are there plans available to construct them? The style of foil used in this craft is portrayed in some artist's renditions as a 90 degree foil, yet in some photos it appears to be at about 45 degrees. Multihull Jan/Feb 94 and Popular Mechanics June 96 are examples. Would you know if there is a racing version and a regular version? There are so many foil designs as with aircraft wings. Could you direct me to this specific foil for this specific craft, or is this a trade secret and thus the high (\$1 Million) cost of development and six year trial and error period? If this particular part is patented does this mean that it cannot be copied or just that it cannot be copied for the intent of resale or profit? My interest is only for personal use. -- Rob Dewar ([rdewar2@attglobal.net](mailto:rdewar2@attglobal.net))

### **Response...**

[8 Aug 99] Technical information, including copy of the patent application, is posted on Cliff Sojourner's website at [www.employees.org/~cls/trifoiler](http://www.employees.org/~cls/trifoiler). Unfortunately there is not much in the way of off-the-shelf foil extrusions available for hobbyists to experiment with. Presumably you could buy a foil only as a Trifoiler spare part, but I don't know this for certain. Several people have said they have bought spare foils from the Trampofoil and have used them for experimental purposes. -- Barney C. Black (Please reply via the [BBS](#))

### Hydrofoil Cat Project...

[8 Aug 99] I am looking into turning [my 18' long x 11' wide and 370 pound sailing catamaran](#) into a hydrofoil when the weather allows use (I would prefer detachable, maybe if they plug into the crossbeams). I have 18 sq meters of mainsail to play with, 193 sq feet. It is unrig (no headsail). I think it will be an ideal testing platform if I can get something. I was drawn towards David Keiper's design, but I found out that he had passed away last year. I was told by [his brother, Frank Keiper](#), that I could get information on his foils or others as well from the IHS. Anything you could email or send me by mail would be greatly appreciated. If it's under a small sailboat, I would like to get details. Can you help? If I had expertise with extrusions, I could get the die to cast the foil cross sections out of aluminum. I may make them out of high grade marine plywood (strong, stiff, lightweight) and coat that with a layer of fiberglass to make it more durable, stiff, and rot-proof. I need something I can build myself, carbon fiber and aluminum alloy are hard to work with. A wood base with a reinforced fiberglass skin will be quite heavy, but I can build it easily, quickly, and very strongly. My boat is plenty powerful to handle this weight, I can pull water-skiers behind my sailboat if the wind is good! I have a 6 hp Evinrude that can make my 9-foot inflatable hit ridiculous speeds and take my NACRA past 25 while slicing through the water for no-wind days... I read the descriptions to the articles; this wood construction appeared to be typical. I am kind of tinkering with the idea, but if I can do it for less than \$500.00 or so, I'm sold. I realize the potentials for damage to the boat and to self if I screw up somewhere, but this is too cool of a thing to pass up. -- Michael Coleman ([MECColeman@aol.com](mailto:MECColeman@aol.com)); Mike's NACRA Catamaran Pages: <http://meccoleman.freeyellow.com/index.HTM>

### Sailing Hydrofoil Design Data...

[19 Feb 99, updated 20 Jan 03] FYI, [Here's a new link](#) for your "Websites of IHS Members" section. I've put up some information on hydrofoil sections that might be of interest. -- Tom Speer ([tspeer@tspeer.com](mailto:tspeer@tspeer.com))

### **Joint Venture Request...**

[23 Aug 98] Anybody interested in a joint venture? I have developed what I believe will be the fastest sailing craft yet.... and, of course, it is a "foiler." It is pretty high tech, and designed to break records by wide margins. It's not your "regular" kind of boat!! The innovations that make this craft so unique have not been patented, yet (at least, not by me !!), and I have done some preliminary research on that front. I'm not sure if that is the direction I want to go in, but I'm open to suggestions. My love is for the concept... the vision of it flying across the water...( I've sailed it so many times, in my mind!!); I don't really want to get into the boat building business. But somebody might. If anybody has any thoughts about any of this, send me a note. I would love to be more descriptive, but I'm sure you understand my reluctance, at this point. In fact, if anybody has any thoughts about protecting "ideas" while still allowing discussion of them, I would really be interested. I would really like to share ideas with IHS folks.... it is such an incredible resource... and the potential for collaborative advances is so great... I look forward to your comments. -- Tyler Ahlgren ([tallgreen@earthlink.net](mailto:tallgreen@earthlink.net))

### **Who Has Added Foils To a Hobie?**

[8 Feb 98] I sail a Hobie 16 on Lake Ontario. I'd be interested to know if anyone has experience of fitting a hydrofoils to a Hobie, particularly hydrofoils from a kit, and what the results were. -- Peter Staadecker ([rps@sympatico.ca](mailto:rps@sympatico.ca))

### **Response...**

[updated 26 Aug 98] On page 2 of the Summer 1997 IHS newsletter you will find a photo and info on a [hydrofoil sailboat RAVE](#) produced jointly by Dr. Sam Bradfield of Hydrosail, Inc. and Rick Jones of Wilderness Systems, High Point NC. Mike McGarry of Hydrosail, Inc. has indicated willingness to work with individuals on hydrofoil projects (phone: (407)723-0733, ([hydrosail@aol.com](mailto:hydrosail@aol.com))). David Keiper of DAK hydrofoils was in the business of providing add-on hydrofoil kits for existing catamarans, but he died recently, and the kits are not available. Finally, [take a look at the Hobie Trifoiler](#) designed by Greg Ketterman. -- Barney C. Black (Please reply via the [BBS](#))

### **Where is Sam Bradfield?**

[10 Jul 97] Would you please tell me the address (postal/e-mail/fax) of Sam Bradfield whom I believe markets hydrofoil kits for catamarans? I wish to obtain a set for my 14 ft SeaSpray catamaran. -- Roger Napier ([rnap@islandnet.com](mailto:rnap@islandnet.com))

### **Response...**



[14 Jul 97] I got an address for Sam Bradfield: Prof. S. Bradfield; 3040 South AIA Highway # 154 F; Melbourne Beach FL 32951; email: [hydrosail@aol.com](mailto:hydrosail@aol.com). -- Roger Napier ([rnap@island.net](mailto:rnap@island.net))

[20 Oct 00] Current email address for Sam Bradfield is: [HYDROSAIL@AOL.com](mailto:HYDROSAIL@AOL.com)

### **Retractable Hydrofoils For 44 ft. Catamaran...**

[4 Oct 97] I am curious whether you know of any company or organization that has added hydrofoils to a sailing catamaran. the cat is a 44 ft, made of fiberglass. I've done a bit of searching, and thinking, and seems to me that foils can be housed, extended and retracted into the underside of the area between the hulls. Are there commercially available stock parts to do this? --Steven ([kao@aimnet.com](mailto:kao@aimnet.com))

### **Response...**

[4 Oct 97, updated 30 Oct 00] As far as I know, no one puts foils on any 44-foot fiberglass sailing catamarans. I assume that is an offshore, cruising catamaran. I see quite a few problems involved, partly the way you suggest doing it. Many catamarans have too little clearance between the underbelly and the water, and foils retracted to there would hook almost every wave coming through. The foils would also need some rather fancy folding mechanisms . I fear the sea would make short work of the foils, taking them apart quickly. (The water forces exerted on foils can be greater than one ton per square foot at times.) Further, if your boat is solid fiberglass, it won't lend itself well to foils and high speed sailing. Fiberglass can flex considerably, making secure foil attachment problematic. Also, as the fiberglass hulls flex, one can not keep the rigging tight enough for efficient high-speed sail rigs. I don't know of any commercially available stock hydrofoil parts: each company has to obtain its own extrusions, forgings, etc. A long time ago, we offered some stock aluminum foil extrusions, but soon discovered that experimenters were unable to utilize them effectively. -- [David A. Keiper \(dak.hydrofoils@home.com\)](mailto:dak.hydrofoils@home.com) [*Note: David A. Keiper died in June 1998 and his brother Frank passed away in 2002. Their DAK web site <http://www.wingo.com/dakh/> is still available as of Feb 2004.*] (Rev 040226wnw)

### **Sailing Rig Ideas Needed...**

[2 Aug 97] A friend and I are building a surface-sensing, 2-man sailing hydrofoil. We have been working on it for two years. It tows good (behind my power boat) but we haven't successfully sailed it yet. It requires 25 kg of force to get it over the hull/foil hump and then drops off to 16 kg. The speed at which it goes over the hump is about 8 MPH. We are having trouble getting a sufficiently powerful rig, are looking at about a 10 sq. metre rig unstayed! Any suggestions? -- Michael Robert Coote ([live@livewire.co.nz](mailto:live@livewire.co.nz)).

### **Response...**

[4 Aug 97] To possibly provide some help for you, I have posted your sailing inquiry in the IHS web site, and I will also publish it in the letters to the editor section of the IHS newsletter. Meanwhile, you could look through the postings here for names and email addresses of people with interests similar to yours who may be willing to correspond with you. For example, [Dave](#)

[Culp](#) and [Marc Schafer](#) are both technically knowledgeable, experienced, and usually helpful. You might want to invest US\$12.00 (\$4.00 each) in the [Amateur Yacht Research Society's \(AYRS's\)](#) publications #90 *Hydrofoil Options*, #97 *Sail Rigs and Hydrofoils*, and #101 *Windmills and Hydrofoils*. These are available in the USA from Multihull Books, 421 Hancock St., North Quincy MA 02171 USA, and there are other sources. Also, take a look at the [IHS web pages devoted to books and magazine articles](#) on hydrofoils. Finally, I have forwarded your email to various IHS members in case they might have some advice to provide. Hopefully some of this will bear some fruit. -- Barney C. Black (Please reply via the [BBS](#))

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This Page Prepared and Maintained By...

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