Catalyst

Journal of the Amateur Yacht Research Society

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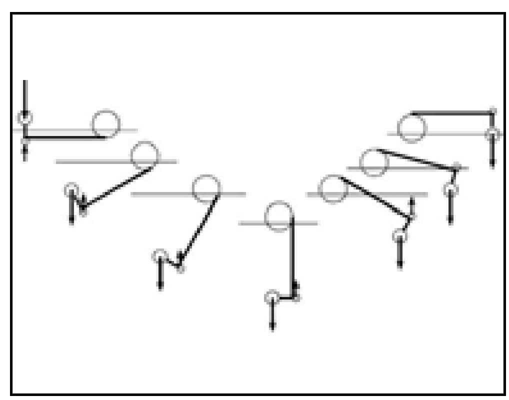
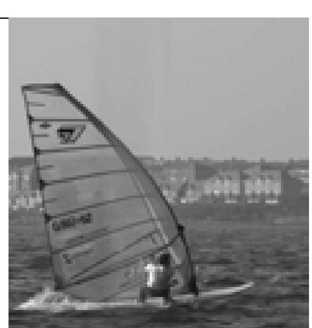
Features

Regulars



Cover picture:
Dan Ellis - fastest at Weymouth Speedweek.
photo: Nick Povey



Catalyst

Journal of the
Amateur Yacht Research Society

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AYRS Meetings

As I write this I've just come back from an AYRS meeting in London. It was very interesting – Tim Glover and Kim Fisher talking about their developments with wheeled sailing vehicles; but, unfortunately for those who were not there, there are patent applications in processing, and we all had to sign a non-disclosure agreement before the meeting started. So I can't tell you what went on.

It did however start me thinking about why there are not more of these meetings in other parts of the world.

The London meetings get organised by our Hon. Secretary, true; but it was not always so, and she only picked the job up when the previous organiser moved away. She organises the London meetings because they are on our doorstep as it were. She doesn't organise, for example, the Weymouth meeting that is held coincident with Speedweek.

Although there is an item in the AYRS budget for meeting room hire, the London meetings are more or less self-financing. We have a small collection each evening that nearly covers the cost of the room. AYRS accepts that as a donation, and pays the bill for the room.

Once upon a time there used to be meetings like that in other parts of the world. There are records of meetings in Bristol, East Anglia, Florida, USA West Coast and of course more recently there was a very active group in New England. That one died when Tom Blevins found he couldn't give it the time it needed; but there's no real reason why there shouldn't be AYRS meetings all over the world. It just needs someone local to organise them.

You could probably do it.

With this copy of Catalyst is a list of AYRS members arranged so that you can easily (I hope) contact other members in your part of the world. Why not arrange a get-together? It doesn't have to be formal; it could simply be a gathering in a bar somewhere over a drink. If you want to arrange something bigger than that, then there's a Meeting Organiser's pack available from the Hon. Sec that explains how she organises the London meetings, and how you could do something similar.

Go on, give it a try! If nothing else you'll meet interesting people and have a pleasant chat. But don't blame us if it turns into a lot more!

Weymouth Speedweek

Weymouth Speedweek, sponsored by the AYRS, took place as usual at the beginning of October (which is why this Catalyst is late). It attracted an entry of 14 boats, 4 kite boarders, and about 97 sailboards, not all of whom appeared for all the week.

Top left to right: Trifoiler (Charl;es Thomson); Ludo Brockway; bottom: Dan Ellis (fastest overall)
Photos: Nick Povey

For the most part the weather was kind: Day 1 (Saturday) produced winds between about 15-20kts, and Sunday & Monday were kind in wind strength (9 to 13 knots) and direction resulting in competitors using big kit & offshore boat courses; having said that there were some reasonable results turning into 20 + knots of speed. Tuesday again the winds were light; but having said that David Garrel in 9 to 13 knots of wind achieved an amazing 22.7 kts of speed.

Wednesday and Thursday (the only days your editor could be there) the winds went round to the North-East (onshore). On Wednesday, the offshore course was again used, although it was fairly choppy. Wednesday night, the wind really got up (damaging the boats on the pontoons) and it was clearly too rough for boats for most of Thursday. An inshore course was set, inside the moorings and across the front of the sailing centre, which provided good spectator sport, but was no good for either kites or boats. The offshore course was used later when the winds had died down.

The final day (Friday) of competition gave much more wind, 15 to 20 knots, but still from the wrong North Easterly direction. Competition was still tight with the three contenders for the week Dan Ellis, Frenchman David Garrel & John (Windy) Sanderson all fighting for the top spot.

The conditions suited Dan with his slalom kit and 8.2m sail; he posted the fastest time of the week.

From top left to bottom right: Demeter; M4; Int Moth; FlashBack; Catri 24; SeaCart 30; Emile Lautier launching his kite; close-up of Emile's boat; Torix Benett's cat.
Photos Nick Povey, Bob Downhill, S Fishwick

Equipment

For the most part the kiteboarders and sailboarders gear was nothing out of the ordinary for Speedweek. Their results are at the end of this report. The boats were a bit more varied and their results were as follows.

Charles Thomson *Trifoiler* 27.93kts

Charles recorded only a few runs on his standard Hobie Trifoiler, after which a gear failure caused his retirement, but amongst them was the fastest (boat) run of the week.

Non-entrant *Tornado cat #420* 19.43kts

This boat was not even an entrant! But they were out there training, and were invited to make a run down the course. This run at 19.43kts can be compared with the all-time Tornado record at Weymouth of 19.6kts (Tango Papa).

Joddy Chapman *Demeter* 18.97kts

Demeter is a lighter version of *Ceres* (see Catalyst No 10) – 4.9m long with T-foils under each hull and on the rudder.

SeaCart 30 Team 18.9kts

A standard SeaCart 30 trimaran came over from Sweden. On the day I was there, they were clearly worried about the shallow water of the course (see Catri), and also for some of the time sailed with two reefs in.

Torix Bennett 10m Catamaran 16.29kts

After a lot of problems with his hulls, ending with a legal battle with the constructor, Torix now has a "bimaran" with one long slim hull and one short fat one. She will sail (fast) only on one tack, although the tack can be changed by rebuilding her!

Alex Adams *Int. Moth #4062* 16.27kts

Alex brought a class-rule-compliant International Moth (there's no such thing as a "standard Moth"), fitted with T-foils on the daggerboard and rudder. Remember that this boat has only 8sqm of sail!

Stephen Walker *Catri 24* 16.08kts

The Catri 24 is a Latvian-designed trimaran which carries foils well forward under the floats. Unfortunately, Stephen ran aground early in the week and damaged the foils, so, after repairs, he took advantage of a lull in the weather mid-week to return to his base on the Solent.

Emile Lautier/Neils Haarbosch *Sandrak* 15.81kts

After last year's problems, Emile brought a easily-mended boat this time. He proved that by fixing a number of breakages in less than an hour! The hulls (it's a solid-deck catamaran) are of a hook-section designed to eliminate ventilation problems on the low-pressure side by getting all the lateral resistance from the high-pressure side! He uses a kite for power, but had problems with the whole hull lifting, with resultant loss of control followed by crashing.

They also brought a second hull, an older design that uses four foils for steering and lateral resistance. It is slower, but much more controllable. It is not recorded which hull was used for the speed runs.

John Fildes *Firebird* 15.41kts

John brought his (almost) standard Firebird catamaran, hoping to better Harvey Bowden's record of 24kts, and to show that yesterday's technology is still as good as ever. He's rebuilt the boat to bring it back to its designed weight, although he was running with anchor etc on board and for some of the time, water ballast in the sterns.

Simon Maguire *M4* 13.08kts

Due to the recent interest in hydrofoil-sailing dinghies, mainly due to the International Moth class, Simon was inspired to design an easy to sail dinghy foiler, with an emphasis on simplicity, reliability and fun.

The main brief was 'That the design could be given to a good club sailor for an afternoons foiling so more people can enjoy the thrills and spills of this new form of dinghy sailing', like experiencing the unnatural silences as you foil effortlessly, accelerating to high speeds, as the rigging starts to whistle and you don't even have to hike out!

Bob Date *FlashBack* 13.03kts

Flashback was back again, this year with the foils positioned a little lower, which is a slight improvement.

John Pepperel Foiled *Catapult* 11.8kts

As far as I know this is the same boat as previous years – a standard Catapult fitted with foils adapted from a Rave trifoiler.

Alan Blundell *Vari-Scari* 11.62kts

Vari-Scari has been described in previous years – a triscaph with twin sails.

Fred Ball *Red Baron* Kite Catamaran

Fred was there with his craft but made no runs on the course. He is still having trouble with his kite, and the weather conditions were not conducive to learning curves, so he concentrated on testing his hapa which has a low-aspect-ratio foil and is designed to act as a drogue (when stalled) and to transition cleanly to a hapa by adjusting line tensions. The drogue state is very stable, the transition to hapa is proving to be difficult however.

Paul Larsen/Malcolm Barnsley *SailRocket*

Sailrocket was there but did not run the course – too much chop.

Results

	Fastest Boat:	Fastest Kite:	Fastest Windsurfers:	Fastest Lady:	Fastest Junior:
Saturday 8th	Joddy Chapman, Demeter 18.97 kts	David Williams 23.56 kts	Dan Ellis 28.47kts	Amy Carter 24.46 kts	Dan Simpson 24.61 kts
Sunday 9th	Joddy Chapman Demeter 15.69 kts	Mike Pacey 13.95 kts	Nick Scott 21.11 kts		Dan Simpson 19.95 kts
Monday 10th	Joddy Chapman Demeter 16.43 kts	Ludo Brockway 18.47 kts	Dan Ellis 22.95kts	Amy Carter 19.03	
Tuesday 11th	Calle Hennix & team, Seacart 30, 17.7 kts	Ludo Brockway 22.26 kts	David Garrel 22.79kts		
Wednesday 12th	Charles Thompson - Trifoiler 27.93 kts	Ludo Brockway 23.95 kts	David Garrel 28.59kts		
Thursday 13th	Emile Burnaby Lautier 15.81 kts	On shore wind - no kites	Dan Ellis 28.76kts	Zara Davis 23.80 kts	
Friday 14th	Emile Burnaby Lautier 15.81 kts	On shore wind - no kites	Dan Ellis 29.07kts	Zara Davis 24.32 kts	

Overall Results & Prizes

Fastest sailor & winner overall Dan Ellis 29.07 kts
Thommen T1 Shield & Harness from Naish
2nd fastest John Sanderson 28.61 kts
3rd fastest David Garrel 28.59 kts

The Tushingham Youth Trophy for the fastest under 17's was awarded on Sunday night as the youths can only compete over the weekend. The youths were amazingly close with all achieving over 20 knots in light conditions with only 2 knots separating them.

Winner Youth Trophy: Dan Simpson 24.90kts (made all the more satisfying having pushed French Champion David Garrel into 3rd place on the Sunday)
2nd Richard Jones 24.61 kts
3rd Sam Gooch 23.47

Fastest Lady: Amy Carter 24.46 kts - Windtek "Fastest Lady" shield & Harness from Naish
2nd fastest Zara Davis 24.32 kts
3rd fastest Claire Newman 19.49 Kts

Fastest Novice Mark Newman 24.95 kts who won a Holiday for two from Club Vass
2nd fastest Eddie Murrell 24.21 kts - North sail from 604 Distribution
3rd Fastest Neil Hardwick 23.93 kts - Mast from Fiberspar

Fastest Master (Over 45) Robin Penna 25.30 kts
Windtek "Fastest Master" shield
2nd fastest Peter Davis 25.16 kts
3rd fastest Eddie Murrell 24.21 kts

Fastest boat Charles Thompson Tri-foiler 27.93 kts - Sports bag from Maui Sails
2nd fastest Joddy Chapman Demeter 18.97 kts
3rd fastest Calle Hennix and team - SeaCart 30 18.90 kts

Fastest Kite Ludo Brockway 23.95 kts
2nd fastest David Williams 23.56 kts
3rd fastest Michael Pacey 23.05 kts

In addition each day the fastest Boat, Windsurfer and Kite receive an engraved tankard provided by the Amateur Yacht Research Society. The prestigious Portland Pot, also donated by the Amateur Yacht Research Society for the competitor who in the opinion of the organising committee encompasses the spirit of Weymouth Speedweek was awarded to David Garrel from France.

Kangaroo Poo donated tops & wallets that were given to the support team & timers without whose help Weymouth Speed Week could not go ahead.

The organisers would also like to thank, in addition to all those that donated prizes, Weymouth & Portland National Sailing Academy, Weymouth & Portland Borough Council, AYRS, Windsurf Magazine and Red Bull.

The Concept Boat Competition

Concept Boat is an annual competition, now in its fifth year, intended to encourage interest in the design of future boats and to show the global small craft industry how they believe boating should develop. The Competition covers the full range of recreational and commercial/working boats, and each year has a different theme.

The organisers of the Competition, the British Marine Federation, supported by the Royal Institution of Naval Architects, wish to encourage everyone involved in the design, development, production and use of small craft to look to, and through the competition influence, the future. There are two categories of entry- Pure Concept' and Concept and Design' which take account of the past profiles of entrants who have ranged from professional naval architects and designers to school teams and those simply with a novel idea.

What is the 2006 theme?

The 2006 competition is open for entries that are of a new design of recreational or commercial craft of up to 24m length, designed to be towed behind a mid-sized 4x4 (SUV) or large family car, the theme being 'Tow a Boat'.

In all instances the maximum capacity of the towing vehicle engine is to be 2500cc and the maximum towing mass and linear dimensions of the towed element of the design are to be within the currently permitted limits of UK/EU or your own national towing regulations based on size of vehicle used as towing vehicle.

The judges will be looking for a design that makes the most innovative or conceptual use of the limited envelope available — there is a maximum length, width, height and mass to work with and how you use this is what will make your design stand out. The craft may fold out, modules may slot together, it may inflate — the choice is yours...

A selection of entries in each category will be on display at the Southampton Boat Show 2006 and on the Concept Boat website at the same time. This exhibition of entries will also be shown at the London Boat Show in January 2007, where the winners will be announced and prizes awarded.

Who can enter

Anyone! Whether you are a private owner, a yacht club member, a boatbuilder, naval architect, design studio employee, student, boat operator, surveyor, journalist, engineer or apprentice in the marine industry or just enjoy boating in general you can enter Concept Boat.

Such a broad mix will of course throw up many differing skills, but it's not your ability to produce beautifully crafted drawings that the panel of judges will be looking for. Instead, they want to see practicality of design and originality of thought in the creation of a safe, eminently usable vessel and, stylish boat for the future.

In the Concept and Design' category the judges will additionally be looking for an entry that has considered powering and performance, stability and construction of the boat: in essence a design that has moved beyond pure concept into a developed concept.

Entries can be from individuals or from groups and from any country: historically over 50% of entries are from outside the United Kingdom.

How to enter

Each entry must be in English and may be submitted in electronic format (preferable) or as hard copy.

Please read the Terms and Conditions and the Entry Form (on the website) for full details of how your submission should be presented. Additional guidance is also available in the form of Chairman's Notes which will be available on request by post or on the website www.conceptboat.com.

Entries should be submitted by 21st August 2006 to Concept Boat, Marine House, Thorpe Lea Road, Egham, Surrey, TW20 8BF. Tel: +44 (1784) 473377; Email: enquiries@conceptboat.com

The prizes

In each category there will be two prizes and in addition an overall winner of Concept Boat 2006 chosen from the winning entry of each of the two categories. In the 'Pure Concept' category the winning entry will receive £1000 and the runner up £500. In the 'Concept and Design' category the winning entry will receive £2500 and the runner up £1000. The overall winner of the competition will receive a further £2000. Commendations will be awarded at the discretion of the Judges.

The judges

Concept Boat 2006 will assemble a panel of experienced judges drawn from the Royal Institution of Naval Architects Small Craft Committee, British Marine Federation and appropriate user representatives.

What should the design be?

In this competition the focus is on 'tow a boat' small craft designs, not a necessarily a new method of construction or a new material although these elements might be part of the overall design.

It is very important that you study the 'WHAT IS CONCEPT BOAT 2006' document and detail the benefits and features of your design in the 1000 word description of the craft, possibly with a few words highlighting these in the 'intended purpose' box on the Entry Form.

How detailed should the entry be?

While the Terms place no limit on the additional drawings and explanatory notes that may be included with the entry the number of sheets and amount of text for the actual entry on which the final decisions are taken is limited.

If your entry is for the 'Concept and Design' category, they will require information about the technical aspects of your design, including specification of towing regulations, stability and powering. However, they do not require detailed explanations of all structure and stability calculations, full material schedules, individual weights etc. Summaries will be sufficient.

A statement or a short paragraph outlining your reasoning, concluding that your entry has adequate stability or will achieve your predicted speed with the specified power should be all that is necessary for most entries based on a conventional hull shape or configuration. The actual number of sheets will depend on the size and complexity of the entry, but the total space needed for all the written text and drawings should not exceed the equivalent of 15 x A4 (297 x 210mm) single-sided pages. In previous Concept Boat Competitions some very well presented large and complex award winning designs needed only 10 x A4 sheets and some of the smaller simple designs used only two or three sheets of A3 (297 x 420mm).

How should the entry be laid out?

The judges are given copies of every entry on A4 sheets. Therefore your entry will be best displayed if all sheets, both text and drawings, are A4 with a margin of no less than 10mm.

With complex drawings where it is not possible to show all necessary details on an A4 sheet it should be possible to use adjoining A4 sheets to give an A3 landscape format on facing pages of your entry.

It is useful if there is one profile or 3D image of your entry on a single A4 sheet; other sketches or images can often be put on the same sheet to save space.

What about coloured drawings and text? For paper entries, particularly those that are handwritten, please ensure that black and not blue ink is used and that the colours on drawings and illustrations will copy well. If you are sending your entry in an electronic format please do check that you are following the website instructions.

What Else?

If you have any other queries please contact Concept Boat by email, fax or phone.

Do look at www.conceptboat.com as you will see how the Concept Boat 2005 short listed entries have been displayed. The entrants provided some of these images, most were developed by the Competition Organisers.

Your Letters

Quatrefoil Update

I was lucky enough to win the John Hogg Prize for my design of Quatrefoil, which was covered in January 2004 number 15 issue of Catalyst. Winning this prize encouraged me to build another model with two metre length hulls. The main purpose was to be able to slew the hulls together so capsize tests could be carried out.

The first model had a conventional rudder linkage operated by a servo from the central cabin, but this allowed only about 45 degrees of slew before the linkage became snarled up. To overcome this problem, Mike Dunkley of the British Model Multihull Association suggested putting the rudder servos in each hull, and this subsequently allowed a fully slewed boat.

Earlier this year at the AYRS Weymouth meeting, we were able to use a swimming pool to test the righting possibilities. Quatrefoil was floated in a capsized position and sure enough, she floated like a trimaran, and as the hulls were winched together she just rolled on her side. From this position, one might have a chance of completing the righting manoeurvre with the aid of inflatable bags, or possible partial flooding of a hull, or even by assistance from a large kite!

Since that initial test, I have only been able to test one other possible righting aid which uses polystyrene balls at the ends of the two immersed booms, and these hold the boat at about a 45 degree angle, so by pushing the hulls apart, this completes the righting procedure. What is needed is a substantial buoyancy to lift the cabin, cross beams and rigs, so the boom buoyancies can take over the final righting procedure.

All in all, the new boat performs well and lessons learned from the first boat have dramatically improved sail handling and general performance. Our best speed to date is 10.4 knots as recorded with a Garmin GPS.

Winning the John Hogg prize encouraged me to persevere and the results are now most encouraging. All that is needed is a larger scale boat to continue development for ultimately an ocean going monster of 40 metres, with spectacular speed potential!

by Jon Montgomery
Jon.Montgomery@virgin.net
14th September 2005

New ROCAT Website

Just a note to draw your attention to the refurbished ROCAT website www.rocat.co.uk - amongst other things, it has an improved gallery and some video clips, including a good one of some rough sea trials.

The development of the ROCAT, from idea to market, has been a frustratingly long haul but, can you believe it, the end really is in sight! The course of R&D is extremely difficult to predict, but I reckon we should have a finished boat by the new year, and be able to demonstrate it in February/March.

I hope you enjoy the website, and feedback is always welcome.

with best wishes
Christopher & co
ROCAT Ltd

Soft Wing Sails - a criticism

I don't know if reactions to the contributions of others are appreciated *[They are - Ed.]*, but I would like to comment on Philip Eltringham's article 'The application of soft wing sails to large racing yachts to improve upwind performance'. The author's conclusions are based on the comparison of the thrust-heel ratio of a conventional genoa and that of a wing sail. I think that the author overlooked a basic factor that makes his comparison invalid, and it is quite easy to show where he went wrong.

The genoa has a thrust force vector of 245kgf and a heeling force vector of 800kgf. This results in an angle alpha between the heeling force vector and the total force vector of 17deg. The apparent wind angle beta is 21deg so the drag angle of the genoa is 21 - 17 = 4deg yielding a lift/drag ratio of 14.3 (by definition the angle beween the total force vector and the apparent wind is 90deg + the drag angle).

By the way, the total GBR Challenge rig has a drag angle of 5.8deg and a lift/drag ratio of 9.8 .

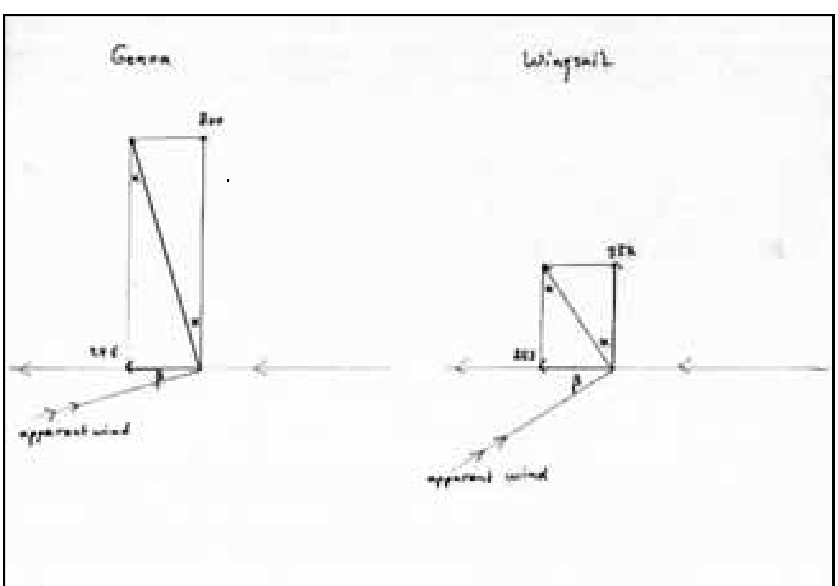
The wing sail has a thrust vector of 253kgf and a heeling force vector of 352kgf. The angle alpha between the heeling force vector and the total force vector is thus 36deg. That means that the apparent wind angle beta has to be at least 36deg how much over 36deg depends on the drag angle of the wing sail.

By comparing the thrust-heel ratio of (wing) sails at very different apparent wind angles the author is comparing apples and oranges and that makes his conclusions meaningless.

I have nothing against wing sails, but I do object to promoting them by giving misleading information. To make it more clear I have attached a sketch of the situation.

Regards,
Bernard Slotboom
B.J.Slotboom@hccnet.nl

p.s. I have to add that I didn't take the angle of heel into account to keep things simple. However, this has no effect on my reasoning and conclusion.



DWFTTW

Maybe the following analogy can help to understand how you can 'sail' straight downwind faster than the wind.

Suppose one has a very fast sailing yacht that can sail downwind at high speed with a Vmg downwind that exceeds the true wind speed. That is not an unrealistic supposition, land yachts and ice yachts do it on a regular basis.

Of course this yacht sails on a flat horizontal water surface. Now suppose we wrap the horizontal water surface into a cylinder that runs parallel to the true wind direction. Then the yacht will spiral down the cylinder, on the inside or the outside, whatever, it doesn't matter, but with the same Vmg downwind as it had on the horizontal surface. Let the spiraling trajectory of the sail of this yacht on the cylinder be similar to the spiraling trajectory of the blade of a rotor that moves downwind at a speed that equals the Vmg downwind of the yacht. The spiraling trajectory of the keel, or board or whatever the yacht uses to counter leeway, can be replaced by the spiraling trajectory of the blade of an impellor in the water. So, by replacing the sail of the yacht by a air rotor and replacing the anti-leeway device of the yacht by a water impellor and connecting the two by some sort of transmission (after all, sail and keel of a yacht are firmly connected), we have a yacht that can sail straight downwind FTTW.

The same analogy applies to land yachts with a transmission between the air rotor and the wheels. For ice yachts it is a bit more difficult but I'll leave that to the imagination of the readers.

Bernard Slotboom

Coastal rowing gains direction

Jake Frith

In October 2005, two members of Southampton Amateur Rowing Club travelled to Noli in Northern Italy to attend the FISA World Rowing Coastal Challenge, the first truly international coastal rowing regatta: an event operating under the auspices of FISA's new coastal rowing framework.

The trip was arranged at the last minute when we saw details about it on the internet four days before the event. I had never thought that coastal rowing took place in Europe and was immediately interested in this event that had the FISA (rowing's international governing body) stamp of approval. Further investigation soon revealed that the event was to be conducted in boats conforming to new and fairly open design parameters and with other events scheduled for the weekend, such as a discussion on the 'future of coastal rowing' with FISA's representatives it sounded very much like a showcase for what is set to become the new worldwide harmonised format for racing rowing boats on open water.

Coastal rowing currently takes place all over the world in a variety of boat types. The future has to be some kind of worldwide class. Although I don't welcome some of the parameters FISA have set, in particular the back-breaking minimum weight limits for the boats, I do think that the backing of FISA means that our trip to Italy was a glimpse into what will be the future of coastal rowing. I think these developments will mean a huge growth area for rowing as there finally will be boats that everyone can balance and feel safe in. More beginners will stick with the sport, and the media appeal of boats thrashing through open water for 12 kilometres has to be better than a flat water 2000 metre lane race. Most importantly, reminiscent of the Mini Transat in yacht racing, I think the rules have been left open enough to make this sport a fascinating development area for all with an interest in naval architecture.

A EuroDiffusions coxed quad:

The days leading up to the trip and the trip itself provided a steep learning curve in this new format. Here's a summary of what I found out:

- There have been four preceding iterations of this event. All have taken place in French territorial waters and attracted predominantly French competitors. The reason for this is that FISA chose to pick an existing format of rules and boat types for developing coastal rowing, and chose to base it around the already popular French format that uses beamy self bailing single, double and quad sculls mainly built by a company called EuroDiffusions: http://www.eurodiffusions.com/.
- With this latest event in Italy, and a proposed final 'World Challenge' in the British Isles for 2006 the format is steadily being opened up for what will be a worldwide class. FISA have no choice logistically for host countries for these early events other than France's neighbours, as they are having to rely on a pool of EuroDiffusions boats that are kindly donated by French coastal rowing clubs for the bulk of competitors. The 'Challenge' will be superseded for 2007 by the first official World Coastal Rowing Championships which will be a much more high profile event taking place first in France, then in Italy (probably San Remo) for 2008 and returning to the British Isles for 2009. Unlike the flat water rowing World Championships, the coastal variant will be contested between rowing clubs rather than countries. This does not necessarily mean lower standards of fitness though, as there were Olympic class river rowers competing at Noli and the building profile of the sport will only serve to increase their numbers.
- The new FISA rules are not a one design using the EuroDiffusions boats, as I initially feared. They simply state minimum weight, minimum beam and maximum length for singles, doubles and quads, and a few common sense rules such as that hulls be self bailing. In addition to this though, as I understand it, they also must conform to FISA's other definitions of what constitutes a rowing boat. The most important of these are:
    1. The only thing that is allowed to move independently of the boat during the rowing stroke is the sliding seat. Therefore, sliding rigger systems are not allowed, which is rather a shame particularly in the case of the single which with a maximum length of 6 metres and a sliding seat is likely to have hobby-horsing issues.
    2 The hull must be mono and not have any reverse curves (concave areas). So no multihulls, scooped bow sections etc.
    3 It can't use any developments that are not reasonably available to all competitors or manufacturers. So nothing patent-protected can be used.
- The racing is conducted over a triangular course of 6 km in exposed open water. Women, juniors and over 40s row one lap, senior men 2 laps – 12 km. Longer endurance races of over 20k and sprint races of 2k will be introduced, but the World Championship distances (and therefore the most frequently raced) will be the 6k and 12k distances.

This new format does not mean the end of the road for traditional localised coastal racing such as that carried out in pilot gigs, or the UK South

Coast sliding seat coastal rowing I compete in. In Noli, the Saturday consisted of a regatta for their local, almost coracle shaped fixed seat coxed fours; in which various international competitors rowed as guests, and this will be the format for future events worldwide, where the host club can showcase their own traditional brand of rowing.

I had intended to make the trip alone and race a single scull but a loan single was not available at short notice. I was saved in the nick of time by Roger Slaymaker, who took part in a row round the Isle of Wight I arranged earlier in the summer, and broke the two rower record time for round the Island. The fact that the organisers were trying to boost international attendance by offering free food, drink and accommodation for foreign crews soon persuaded Roger. A double was quickly booked, and considering our 6 months of long training rows (up to 5.5 hours at one sitting) for the island row, we felt fairly confident that we would be able to despatch the 12 km around Noli Bay quicker than some.

In the event, we committed the cardinal sin of drinking the tap water in the hotel, and Roger was too ill to row. At the 11th hour, I was saved by a generous gesture by the team from New Zealand who lent me their single scull for the race. This was a Reid Rowing Skiff, (http://www.customcarbon.co.nz/cam/about.htm) built somewhat under the 6m maximum allowed length with a transom stern to allow it to fit in a standard New Zealand garage.

It had no fin but relied on a dropped bow and stern for directional stability. This was fine when the bow or stern were in the water, but in the confused Mediterranean swell I found my technique, honed in narrow 22 foot long finned coastal singles was not appropriate for the equipment, and I frequently veered off course at up to 45 degrees to the correct direction of travel, particularly on the downwind legs. The subsequent corrections to course meant that my progress rendered the 12 km race a series of long sweeping s-bends probably nearer 15km. Nina Reid, who rowed the same boat in the women's race had no such trouble though, posting an excellent 2^{nd} place, only 4 minutes down on the leader.

In my race, a former Irish international sculler had similar problems to me as he was allocated a boat without a fin. Constant corrections to his course led to his forearms blowing up halfway through the race and his eventual retirement. In the end, I finished in 5^{th} place, but couldn't help wondering how I might have fared with the same equipment as some of the others. Italy and France dominated in most events, but the Irish women's quad managed a fantastic win.

I came away from the single sculls event thinking that directional stability, especially downwind is a real issue in the design of boats for these conditions. The winner in the single sculls category was Alain Moretto, the French National Champion. He raced in a prototype plumb stemmed design that looked like a cross between a planing skiff and an old windsurfing longboard. Of interest to me were the relatively wide aft

Roger and the double we were initially intending to row:

Jake Frith in the Reid Skiff in the sheltered water in the lee of Capo Noli:

FISA Parameters for coastal boats

Boat Type	Maximum Length	Minimum Width	Minimum Weight
Solo (One rower)	6.00 m	0.75 m	35 kg
Double (Two rowers)	7.50 m	1.00 m	60 kg
Four rowers With coxswain	10.70 m	1.30 m	150 kg

Weights do not include oars or electronics.

sections and a retractable daggerboard in the centre of the hull as well as a fin aft. It looked rather like it was supposed to surf downwind for a very long time, possibly the entire 3.5km duration of the downwind leg, with minimal rower input, although I was too busy fighting my own battles at the other end of the fleet to see how it went. The centre fin, I would imagine, would help prevent the boat skewing off one way or the other when the bow hit the trough, which is what I kept experiencing every time I had a tantalising couple of seconds of surfing downwind. I suspect he probably also helped matters by keeping weight out of the ends with a light layup and just enough ballast low down in the middle to make up the minimum weight.

So, fellow AYRS members, here it is, the first step forward by FISA and rowing since they took a step back and set an unfortunate precedent by banning the sliding rigger for competition in 1980. I, for one, am training with one eye on the inaugural Coastal World Championships in 2007, where I hope to place somewhat better than my 5th in the 12km single sculls. I truly believe that with this FISA backing this could be the birth of a successful new water sport. So take up your splines and pencils and start thinking about the challenge of designing something that could be the new de facto design for coastal racing boats. If anybody does have any ideas on this or wishes to discuss this further I am reachable on the AYRS forum.

Jake Frith
jake.frith@rya.org.uk


Read the full story at http://www.southamptonrowing.org/noli.htm. The FISA rules and regulations can be found at http://dps.twiihosting.net/fisa/doc/content/doc_7_273.pdf. The Noli event website at the time of writing was at http://noli2005.ficsf.it/nolienglish.htm#programme.

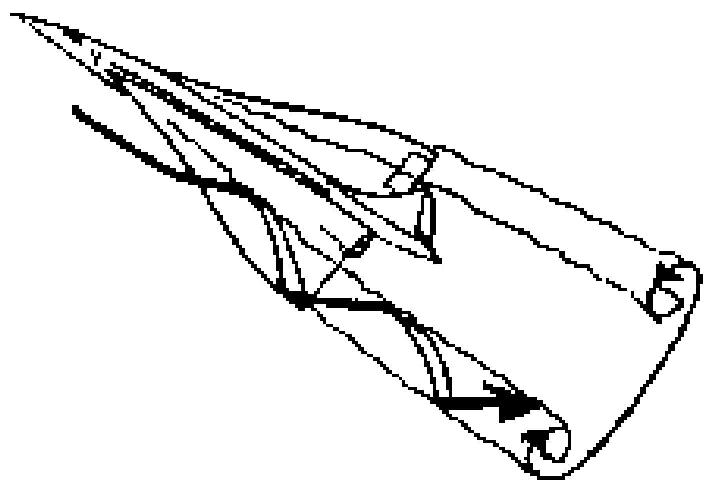
A New Analysis of the Pacific Crab Claw Rig

Bernard Slotboom

The impressive performance of the pacific crab claw sail was first brought to our attention by the publication of the results of wind tunnel tests performed by C A Marchaj (see AYRS 111 and Marchaj's book 'Sail Performance').

In 'Sail Performance' Marchaj sets out to explain that the crab claw generates lift by means of leading edge separation vortices (LEV's), just like a delta wing aircraft. In his view LEV's are responsible for the high Cl (lift coefficient) and Cx (driving force coefficient) of the crab claw at apparent wind angles from 80 – 120 degrees. According to Marchaj the sail ought to be sheeted as flat as possible to make most of the vortices.

I think that Marchaj's analysis is wrong and I will try to show you why.



Delta wing with leading edge vortices

Crab-Claw Sails

First of all, let me give a definition of a crab claw sail.

- A simple crab claw sail is an isosceles triangle with a yard and boom of equal length.
- It is the traditional sail of pacific proas and it is rigged in the following manner:
    - The apex where yard and boom meet is attached to the bow and the yard is at some point attached to the mast.
    - That means that the yard has a fixed position and only the boom is free to swing out.

A proa is a fore and aft symmetrical vessel that does not tack but it shunts. That means that when it changes tack it has to stop, and the apex of the sail has to be transferred from the bow to the stern, which then becomes the new bow as the proa moves off in the opposite direction.

The fact that the yard has a stationary position is crucial for the explanation of why Marchaj is wrong and for the alternative analysis that I am about to present.

Analysis

For lift producing LEV's to develop the leading edge has to be swept back at least some 50 – 60 degrees.

One only has to look at some pictures of crabclaw sails to see that the average sweep angle of the yard is a lot less than that. It often does not exceed the sweep angle of the luff of a headsail or a lateen, and that is at low apparent wind angles. At a high apparent wind angle, say 90 degrees, the sweep angle of the yard is zero, no matter how far it is inclined aft, because the yard now lies in a plane that is normal to the apparent wind direction (for the sake of argument disregarding the twist in the apparent wind).

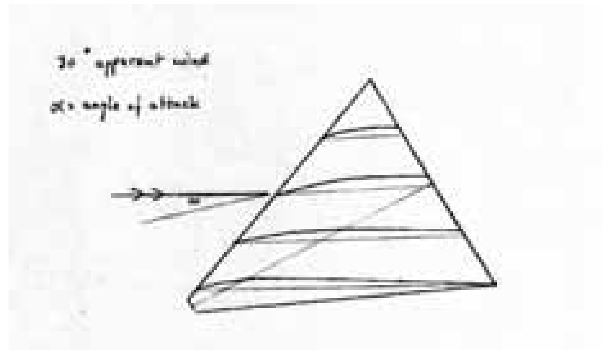
The boom is a side edge at best at low apparent wind angles and at high apparent wind angles it is a trailing edge.

To me it is obvious that LEV's are out of the question, in particular at the apparent wind angles where the crab claw delivers its best performance.

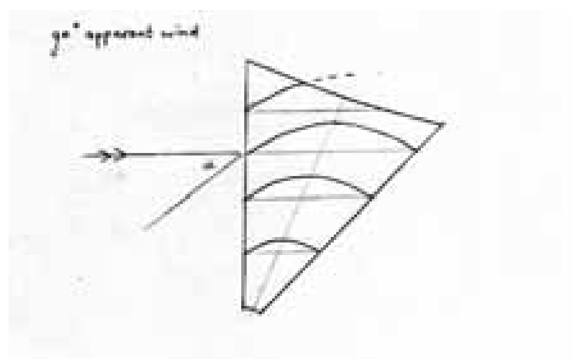
If LEV's don't make the crab claw tick then what does?

I think it can be best explained by showing some pictures.

This sketch shows the cambered sections, leading edge sweep angle, angle of attack and twist of the sail when close hauled.



This sketch shows the cambered sections, leading edge sweep angle, angle of attack and twist of the sail with the apparent wind on the beam.

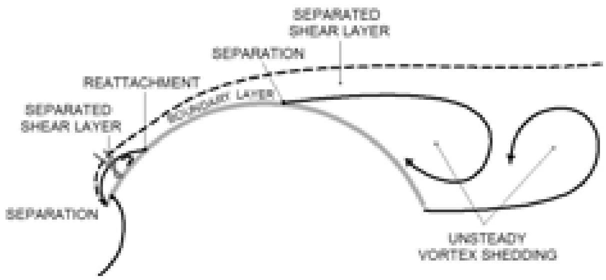


It is obvious what happens when the proa falls off from a close hauled heading and the sheet is eased – the leading edge sweep angle is reduced, camber is increased and there is less twist in the sail.

I think that is the key to the high performance of the crab claw at heading angles from 80 to 120 degrees.

This is a crab claw from close hauled to a close reach.

This is a crab claw on a deep reach at an apparent wind angle of around 90 degrees.



Effect of Camber

To show you what a lot of camber can do I only have to point you to a report about the CFD analysis of downwind sails : ‘http://syr.stanford.edu/RINA_Steve.pdf’.

The illustration above is taken from that report and depicts the flow over a highly cambered downwind sail section.

The report states that 2D section lift coefficients of about 2.2 can be expected, and that agrees quite well with the high Cl and Cx values that Marchaj measured in his tests.

Of course 2D sections don’t tell the whole story, there are also 3D effects and the lower the aspect ratio of the sail the stronger they are, but you need a powerful 2D section to begin with because 3D effects (vortices) alone are not sufficient to explain Marchaj’s high Cl and Cx values.

Wind Tunnel Tests

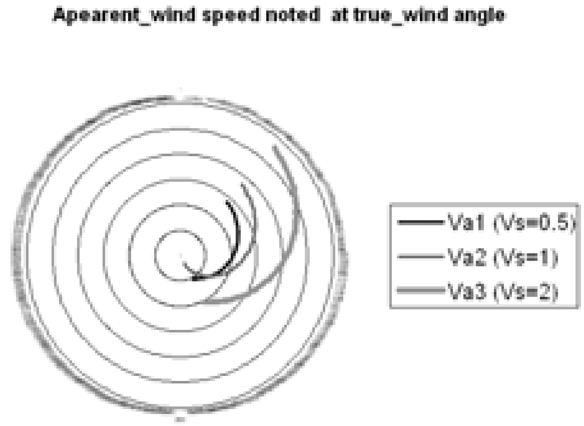
I can substantiate that with the results of wind tunnel tests that were initiated by Othmar Karschulin of ‘Multihull’ magazine in Germany. The test reports are available to members of the German language ‘deltasegel’ group of Yahoo.

Following Marchaj to the letter, flat models of crab claws were tested but the results came nowhere near those of Marchaj. Even for deltas that were rigged symmetrical like a delta wing aircraft the maximum Cl did not exceed 1.4 which goes to show that vortices alone cannot explain Marchaj’s high Cl values.

In fact, the best performance in these tests came from the one cambered delta that was also tested.

Why then the Clab Claw?

The next question is: why did the crab claw evolve as the sail for fast proas?



That is made clear in the above graph that was made by Janusz Ostrowski, like myself a member of the ‘proa_file’ group at Yahoo.

In this graph the apparent wind speed is plotted against the true wind angle for boatspeed = ½ * true wind speed, boatspeed = true wind speed, and boatspeed = 2 * true wind speed.

When one looks at how the apparent wind speed changes with the angle to the true wind it is evident that the apparent wind speed drops off fastest at high angles to the true wind for vessels whose speed is close to the true wind speed, like a pacific proa.

For a fast proa on a deep reach the sail needs to deliver the highest possible Cx to keep the driving force at an acceptable level, and that is exactly what the crab claw does.

To sum it all up:

The essence of the crab claw is not vortex lift but optimal camber + angle of attack at all heading angles.

It is like an automatic transmission: one only has to play the sheet.

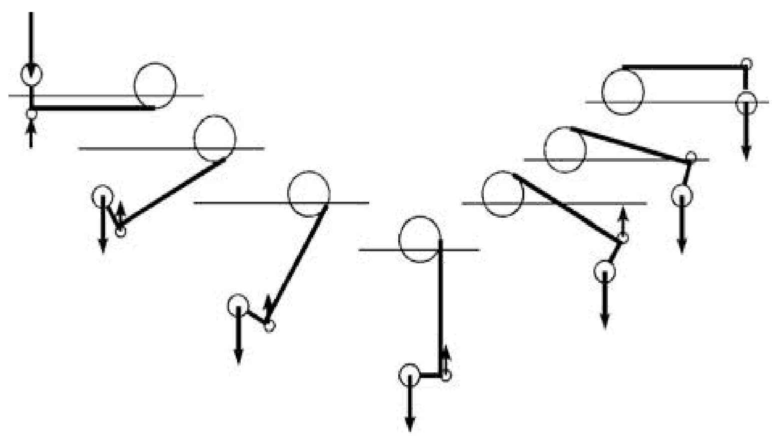
It is the utmost simplicity delivering the utmost efficiency.

Bernard Slotboom

Self-righting multihulls

Robert Biegler

Several methods have been developed to right a large capsized multihull at sea without outside assistance. Kelsall designed and built a catamaran that could be righted by flooding bow compartments, and demonstrated that this worked at least in flat water. Ian Gougeon's trimaran Splinter has 80% volume amas, and a wing mast buoyant enough to make the boat unstable upside down; and once it is on its side, tilting the mast can take the boat the rest of the way up. The racing cat Sebago had one floater hull built with a foam core sandwich, and a sinker hull built with a solid laminate. The theory was that the sinker hull could be flooded, but I do not remember seeing any explanation of how to get the boat all the way up.



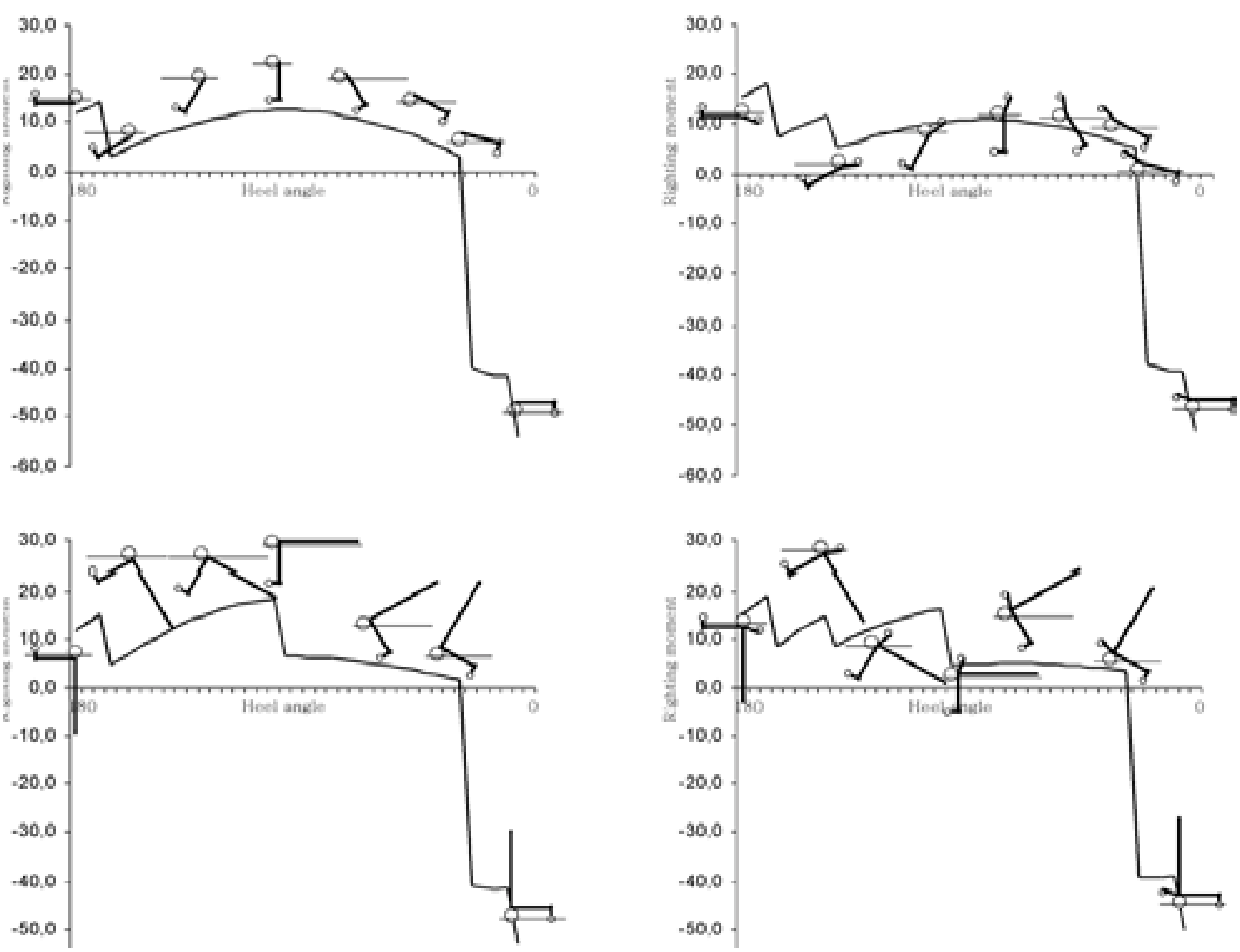
It occurred to me that this method could very nicely be adapted to proas and outrigger boats in such a way that it does not actually depend on the crew doing anything. As on Sebago, the ama should have a density high enough to sink when flooded. This could be achieved by building the hull from a sufficiently dense material, from adding ballast, or from carrying high-density equipment there, such as batteries and ground tackle. The two additional ideas, which could make such a boat self-righting instead of merely rightable, are some buoyancy high up in or above the ama, and a snorkel system for flooding the ama only when inverted.

The snorkel system is a straight adaptation of the classical floating ball valve snorkel. A floating ball is contained in a cage underneath a tube into which it barely fits. If water comes from below, the ball floats up and closes off a smaller diameter tube higher up. If inverted, the ball opens the tube and lets water in. Tubes leading from the bottom of the ama through the crossbeams and to the main hull can both let air escape after capsize and allow the crew to pump water out after righting.

Figure 1 shows a boat capsized on the left and upright again on the right. There is a smaller auxiliary float above (when upright) the ama. The buoyancy of this auxiliary float should be small enough that it cannot support the weight minus buoyancy of the crossbeams and ama. These forces are represented by the small arrows. When capsized, the float starts sinking. If then the ama is connected to snorkels above deck (one for each compartment), which let water in when inverted, flooding of the ama will let it sink all the way. Getting from 180° to about 90° by this method is quite straightforward. But at about 90° comes a critical point. If the weight is too large relative to the buoyancy, the boat will assume a stable position lying on its ear. That is rather less than what I have in mind for self-righting. However, buoyancy, weight and the distance between auxiliary float and ama can be fine tuned so that the turning moment from the buoyancy of the float and the weight of the ama still provide a turning moment which keeps the boat going until the float touches the surface and the ama is still below. So the righting itself would not require crew input, though pumping out the ama and getting going would.*

To be moderately certain this really would work, I set up a spreadsheet in which I could insert weights, buoyancies and the angular separation of float and ama, and calculate turning moments (currently available in the Files section of the recently-resurrected AYRS discussion group on Yahoo). I then tried this also with and without mast, and with and without a Newick-type sponson. The results are plotted in Figure 2, in which positive values mean a counter-clockwise turning moment. Both mast and sponson increase initial righting moment, but then lead to a decrease when lifted out of the water. I still managed to find a combination that would right the boat in any of the four cases. There are two crucial points here. One, the relationship between buoyancy, weight and angular separation of the float and ama is fairly critical, so trying to use things that are not fixed either as ballast (for example ground tackle) or as float (for example fenders) risks upsetting the balance if ground tackle or a fender is lost or added. Two, the greater the separation between float and ama, the less critical is the relationship between float buoyancy and ama weight. So if you were to design such a boat, put the float as high as is compatible with design criteria such as windage, and never mind the looks!

Note that most monohulls are stable when inverted over a range of anything from 60° to 150°, i.e. 30° to 75° either side from 180°. My spreadsheet claims that this self-righting proa is unstable at 180°. I have not done the additional calculations, but expect that for a Pacific proa without a sponson, the righting moment would vanish at about 70°; then if the mast is quite buoyant, the boat would become stable again



** The Editor is of the opinion that pumping will be essential to assure total self-righting in a seaway.*

when the mast hits the water at a little over 90°. At that point it would be stuck, like Cheers was when she capsized during early sea trials. The two possible solutions would then be either to make sure the mast's buoyancy does not prevent the boat from going all the way over and then righting itself by sinking the ama (hoping the water is deep enough to allow this), or to add a sponson.

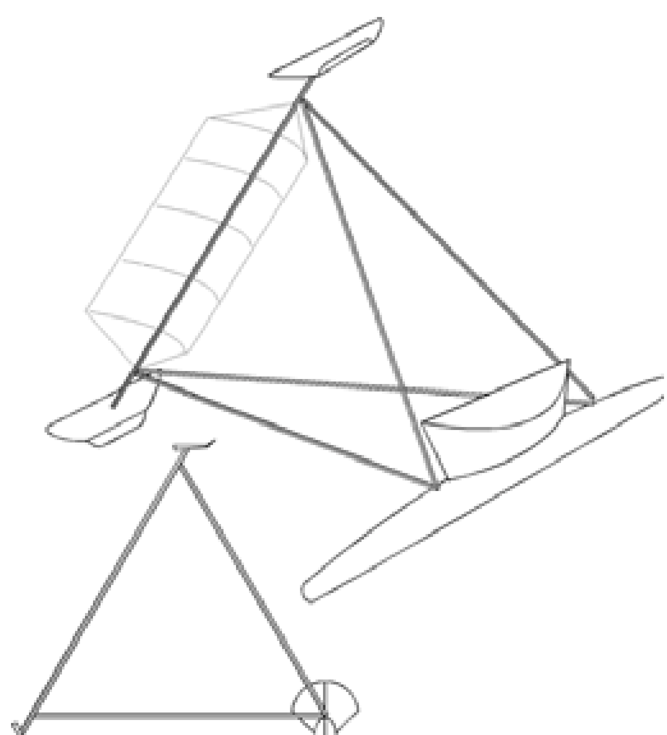
I have shown a boat in which the sinker ama is small, as on a pacific proa or an outrigger boat. The principle could also fairly easily be applied to Rob Denney's Harryproas or his Yasmin outrigger, though the greater buoyancy of the larger hull would require more ballast to sink it. I would avoid trying it with catamarans, not so much because flooding the accommodation is more of a nuisance, but rather because the much less predictable buoyancy and weight of stores could upset the balance.

I have worked on another project this year, so I have not tried even building a model, and there is not yet any practical proof of the concept.

A second possibility is a variable geometry proa as described in the other article. When the ama and the main hull are aligned fore and aft, the ama contributes nothing to stability, whether the boat is right side up or upside down. So if the boat is ballasted so as to be self-righting in that configuration, all that is needed is to make sure it gets into that configuration. As far as I can work out, that would need little force or could even happen on its own if the crossbeam is left free to swing. After a capsize, if the mast is buoyant enough to lift the ama up to a heeling angle of less than 180°, then the rotation axis is no longer vertical. There is the buoyancy of the rig below, the weight of the ama above, and the way the ama can fall further down is by swinging the crossbeam towards a fore and aft position. That increases the leverage, and the whole thing continues until the boat is upright. Those who want some serious performance would, of course, dislike the weight and the fat hulls required. Leaving the boat unballasted, but designing it with a fairly wide accommodation pod would leave it at a substantial heel angle, but it would be possible to design the pod so that the heel angle is small enough that moving the crossbeam to the side then rights the boat. The thing that worries me about this design is the prospect of two substantial objects, the main hull and the crossbeam, being left to move freely and being smashed into each other by waves.

Bernard Smith's fliptacker concept offers a more rigid self-righting structure. Figure 3 shows a proa with a tetrahedral frame of spars. There are identical amas both on the top and at the foot of the mast. If the boat does capsize, the other ama takes over. All that remains to be done is to flip the hull around. If that is a suitably shaped and ballasted hull, it could be left to do so on its own, but that would lead to things moving and banging about during normal sailing, so it is probably easier to use some coupling that can be released from inside the boat. The superstructure of the design shown here would make the hull unstable upside down, so it would flip over much of the way on its own. This design would have the quickest righting with the least user input, but offers some challenges of its own: the sail still needs reefing, despite the rig being nearly non-heeling. After all, when going into harbour it might be a good idea to go slowly rather than crashing into the nearest concrete wall or an expensive yacht owned by a lawyer, and it might be nice to have the sail down when beached or at anchor. Designing a sail so that it can be reefed in either direction should be interesting. Having to take it off and set it again the other way up, or else trying to capsize once more on purpose doesn't seem appealing when beating off a lee shore.

Robert Biegler
Trondheim



Design and construction of Hulls for Windriggercat (WRC) 6800

Ian Smith

From my experience, the major problem associated with amateur yacht research is the need to build a boat to provide a platform for researching and trialling ones ideas. I expended a lot of time and effort learning about hull design and construction - I started building the first hull of the catamaran shown in photo 1 in 1996, launched it as a proa in 1998, built a second hull in 2000 and launched the catamaran in 2002. My answer to this problem is described in the following and I hope others may benefit from my experiences.

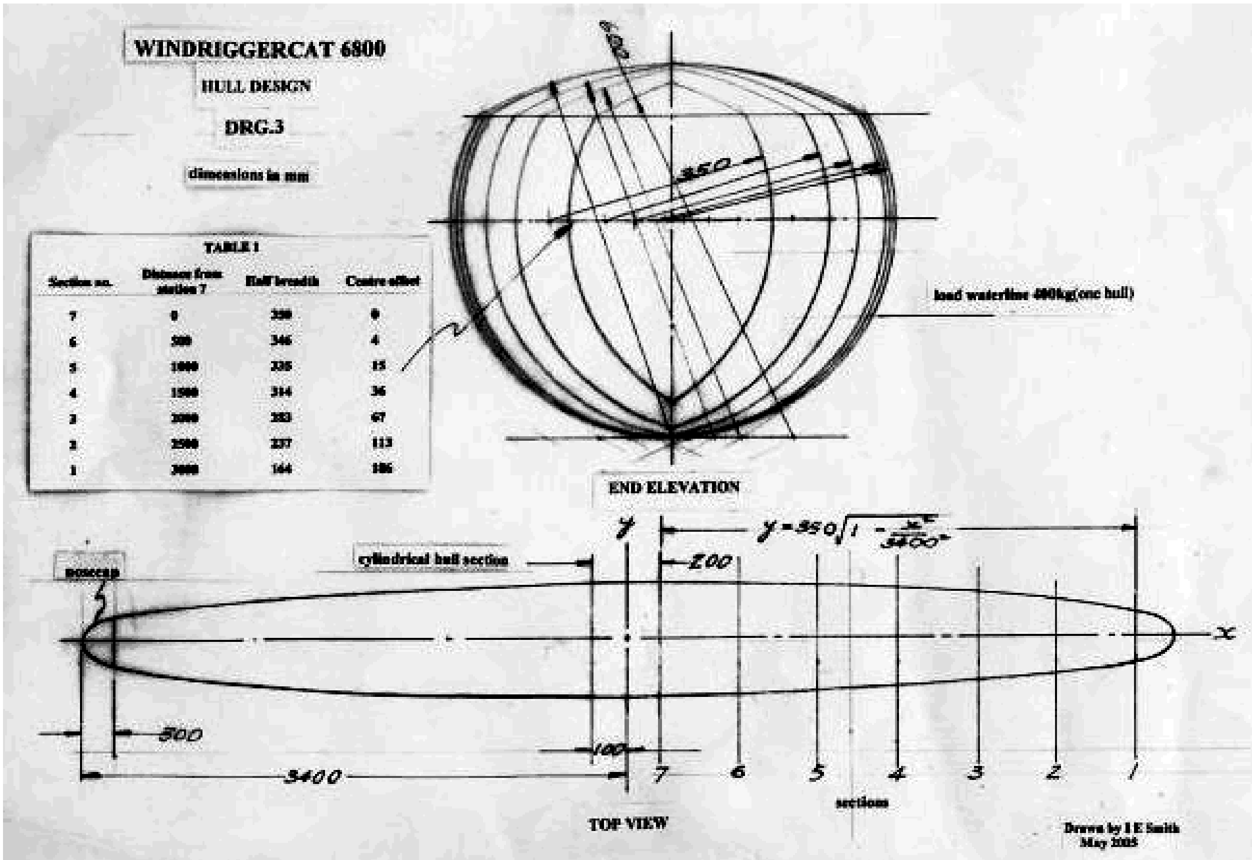
Photo 1 - WRC 6800 Oct 2005 with non-batten sails.

I designed my hulls by a process I refer to as Constant Cross Section Curvature (CCSC) hull design and describe below three examples of it.

I chose fibreglass as my boat-building method and have produced relatively lightweight and tough hulls using a wooden sub-structure to carry and distribute mechanical loads. After 7 years of a process of trialling, inspection and modification, I feel confident about the durability of this boat building method and consider it warrants publication.

I developed WRC6800 to suit my requirement for a sailing-boat which is safe, comfortable, easy to rig and capable of negotiating surf-beach shores. Its design is based mainly on my involvement in white-water canoeing, surfing and sailboarding - so its appearance may disturb traditional yachtsmen.

Some detail of this project were published in Catalyst no.10 of Oct 2002.



DRG 1 - Drawing and data for constructing the WRC 6800 hull

Method of Construction

During 1996 and after 5 years of building and experimenting with my plywood Dory multihulls, I decided to design and build a round-bottom-hull proa and considered cold-moulded veneer; strip-plank and fibreglass(FRG) as options for its construction. I concluded that the major worktime with these boat-building methods is finishing the exterior surface of the hull involving smoothing, sanding, filling, polishing and painting. I decided to use FRG because you only have to perform these tedious operations once, and that is on the plug that is used in making a female mould from which hulls are laminated.

To further minimise the plug and mould work, I designed a hull which is symmetrical fore-and-aft about its midship section, requiring a plug and mould only half the length of the hull. (having sailed my symmetrical-hulled multihulls during the last 10 years I have not found this feature to have any disadvantage.) A deciding factor was my previous experience building fibreglass canoes and particularly the fact with the mould, it takes only 3-4 hours to laminate a hull, and then it comes out of the mould with an exterior surface requiring no further treatment for many years.

Hull Design

I designed the hull using coordinate geometry covering the equation of a circle and ellipse and produced the design shown in DRG 1. This hull-shape is the surface generated by circular-curve setup as a midship cross-section of the hull, and moved forward whilst displacing it transversely following a predetermined curve resulting in elliptical waterlines. Referring to DRG 1, the 3400 value in the equation of the ellipse were determined by drawing a number hull-designs corresponding to various values, and selecting the one which provided the most buoyant bow without it appearing too blunt.

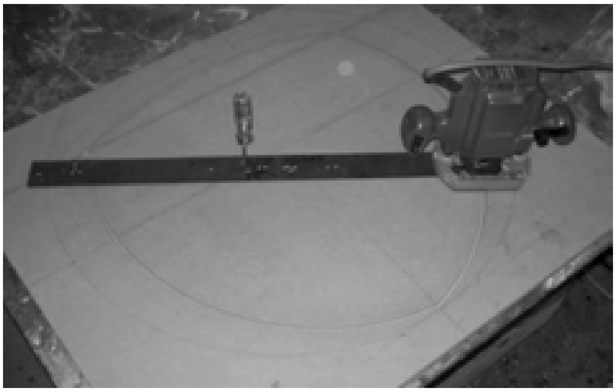


Photo 2 - cutting out a cross-section frame for the WR6800 hull plug

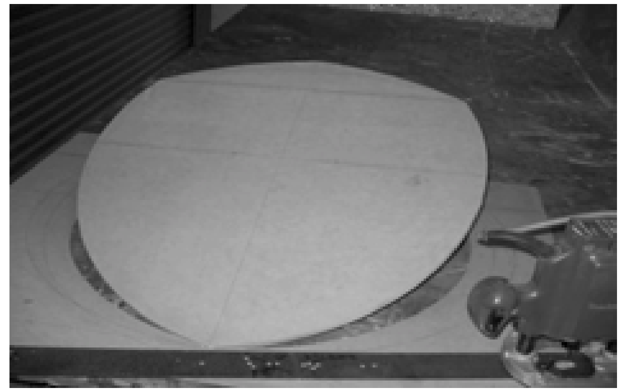


Photo 3 - Cross-section 3 used to construct the WRC6800 plug.

From these designs I calculated vertical and horizontal offsets which I keyed into Hullform software to determine hydrostatics data and particularly the Moment to Change Trim (MCT) parameter which I use as a measure of bow buoyancy and resistance to pitch-poling.

Manufacture of the plug

The plug was constructed from transverse sections cutout of 15mm fibreboard, using a radius-arm attached to a router and set to cut a 330mm radius (allowing 20mm for strip planking). A typical cutting operation is shown in Photos 2 and 3. The radius-arm pivot point for each section is listed as a the centre-offset figure in Table 1 of DRG 1.

The sections were mounted on a building frame and strip-planked with 20x20mm timber, to produce the plug similar to the one shown in photo 9.

The mould for the first hull

Photo 4 shows the moulds produced using the plug, and setup to make half-length hulls. A full-length hull (the first hull) was produced by joining two of these at the hull midship cross-section.

The first hull is shown in photo 5 - note that its deck panel is removable to facilitate installing various modifications and inspection of the durability of the hull laminate and its wood components. It was sailed as a proa and used to trial schemes such as capsize recovery, emptying water from the cockpit with a canvas bag fitted to it (not a success), various crossbeam structures, centrecase and dagger boards, reversible rudders and trailer options.

An unforeseen problem with this hull was difficulty in removing water from it due to its 8 water-tight bulkheads.

Overall I found this mould setup to be a difficult way to make a hull, so learning a lot from this exercise I tried another setup for the second hull.

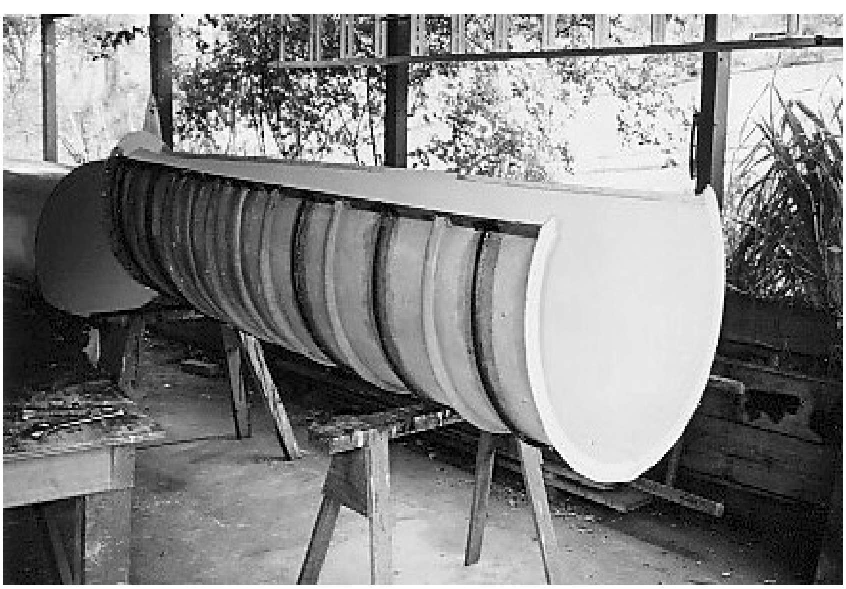


Photo 4 - mould for laminating a half-length the first WRC 6800 hull.

Photo 5a - first hull

Photo 5b - second hull

Photo 6 - mould setup for laminating a full length half-hull of WRC6800. The deck mould is on the right.

The mould for the second hull *(Photo 6)*

The big advantage of this mould setup is ease of working conditions for gel-coating, laminating, placing and attaching the stringers and frames. Each half of the mould is bolted together at amidships to facilitate transporting and storage. This feature provides the option to extend the hull by adding a cylindrical section. The nosecap moulds are detachable enabling attaching other ends to the hull - such as a transon stern.

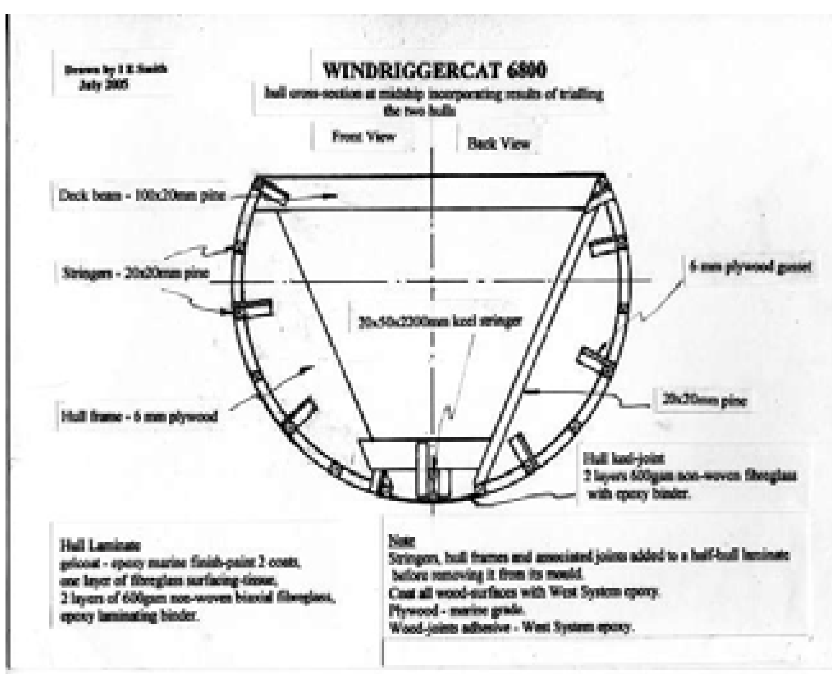
The hull structure

The hull laminate is about the same weight per sqm as 4.5mm marine plywood and according to my tests, has an impact strength equal to that of 9mm marine plywood. Mechanical-stiffness of these hulls is achieved using 14 wood-stringers 6000mm long fastened to transverse frames - as shown DRG 2. This structure is like the wooden frame of a Dacron/canvas-covered canoe and is used for attaching and spreading the load produced by beam-change fittings, mast supports, rudder posts, cockpit and decking.

The size and spacing of the stringers was determined by my feel and experience gained from white-water canoeing. I aimed at achieving a flexible hull surface capable of withstand dragging it over rocks on sea shore. It passed this test recently when the cat was left high and dry on a river bank, at low tide .

After a half-hull is laminated, its stringers are set in position by hand (requiring two workers) on the hull laminate using contact adhesive. (Functionally the hull structure does not require a permanent structural bond between the stringers and hull laminate, except for the gunwhale stringer which is fastened to the laminate with epoxy soon after the first stage of cure of the laminate). Then transverse frames are added and fastened to the stringers using joints such as shown in photo 7.

Two halves of the hull are fastened together as shown in DRG 2, to produce the second hull.



DRG 2 - WRC6800 hull structure derived from trialling the second hull

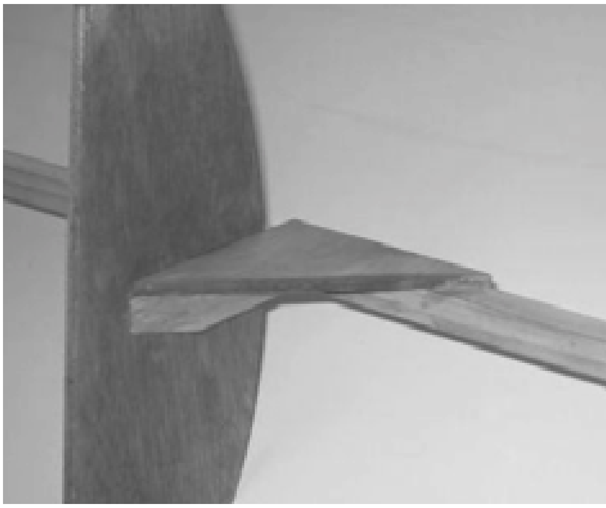


Photo 7 - sample of a joint for fastening a transverse frame to a stringer.

Photo 8 - Centrehull

The hull laminate

I used non-woven fibreglass with an epoxy binder for my FRG hulls. The traditional binder for FRG is polyester which I consider is much more toxic then epoxy because it is more volatile and its vapour is carcinogenic. Epoxy is more expensive but non-woven fibreglass requires less binder than woven and chopped-strand fibreglass, so binder cost is not a big concern. The outstanding advantage of epoxy is its superior water resistance - my first hull is 8 years old and has had rain water residing in it for most of this time and there is no evidence of deterioration and osmosis. I used polyester gelcoats for these hulls because epoxy was not available at that time. I am presently testing an epoxy marine-paint as a substitute gelcoat for the centrehull described below - I would appreciate information on epoxy gelcoats.

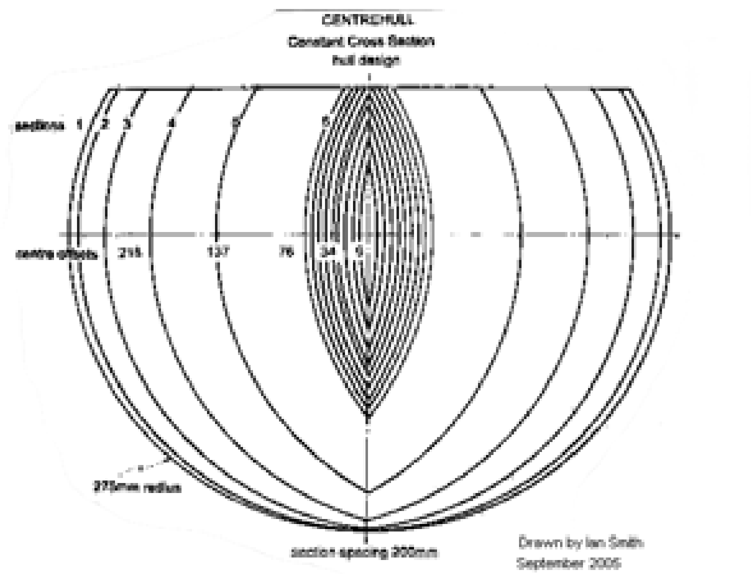
The centre-hull for Windriggercat 6800

I produced a hull designed to fit under the bridgedeck of WRC 6800, to provide comfortable sitting positions under the cabin top, but have delayed installing it until I have gained more experience sailing off a surfbeach with it. The centrehull shown in the photo 8 and comprises a FRG bow section 1100mm long and a plywood section made from a 1200 X 2400 X 4.5mm ply sheet rolled to form an open-pipe shape of 570mm outside-diameter. The design details of the FRG section is shown in DRG 3 and illustrated by its plug construction in Photo 9. The plug comprises six 275mm radius cross-sections spaced at 200mm intervals and displaced transversely to form circular-curve waterlines of 2400mm radius (instead of the elliptical waterlines of WRC 6800) - this value was determinded from drawings of a range of values. The plug was strip-planked with 10 x 20mm timber, nailed and glued

Photo 9 - Strip-planking the Centrehull plug with 10x20mm timber.

together with PVA wood glue. It was finished with a noseblock carved from a sandwich of 8 pieces of 12.5mm thick fibreboard and cut using a router with a radius arm centred according to offset centres of 51,45,39,33,27,21,14 & 8 mms. respectively. Photo 10 shows the centrehull plug and mould.

A surprising feature of the centrehull is its lightweight (20kgns) and stiffness such that it does not need stingers. In view of these features, I have been tempted to make a proa out of the centrehull by, for example adding another bow-section to make a hull of 4600mm loa weighing about 30kgs. Also I could make a 7000mm catamaran hull weighing no more than 50 kgs - about half the weight of a WRC 6800 hull. And the big attraction is, it would require only 2200mm of FRG construction.



DRG 3 - Centrehull design

A traditional catamaran hull

As another example of the CCSC hull design method and for comparison with WRC 6800, I designed a catamaran hull having an elliptical cross-section hull, relatively narrow beam, greater freeboard and knife-shape bow and the same elliptical waterline curve, number of stations and spacing as WRC6800, but an elliptical cross-section. This is shown in photo 13 and was selected from a number of ellipses drawn full size as shown in Photo 12 - which also covers an easy way to draw an ellipse which is explained as follows. The pertinent features of the ellipse are: it has a major and a minor axis with their centrepoints forming a right-angle cross at the centrepoint of the ellipse; two focus points which lie on the major axis equidistant from the centrepoint; the distance of a focus from the centrepoint is calculated as the square root of (the major axis squared minus the minor axis squared). The ellipse is drawn using a string of length equal to that of the major axis, with each end fastened to a foci point and stretched tight by a pencil at the apex formed by the string - as in Photo 12. (in the photo I used a length of fibreglass measuring tape because, unlike string it does not stretch). I selected the inner-

Photo 10 - plug and mould for Centrehull.

most ellipse of the three shown as the midship section for this cat design. It has a major axis of 700mm, minor axis of 300mm and focal points 632mm from the ellipse centrepoint.

I produced a template of this curve as shown on the left-hand side of Photo 13, which was used to draw the hull lines using the centre-offset numbers in Table 1of DRG 1.

The traditional catamaran hull is shown in photo 14. The notable difference is that it has a lower resistance to pitch-poling due to a MCT is 7.8 kg.m/cm compared with 13 kg. m/cm for WRC 6800. Also its relatively flat-topsides and high freeboard would make it more difficult to control in surf.

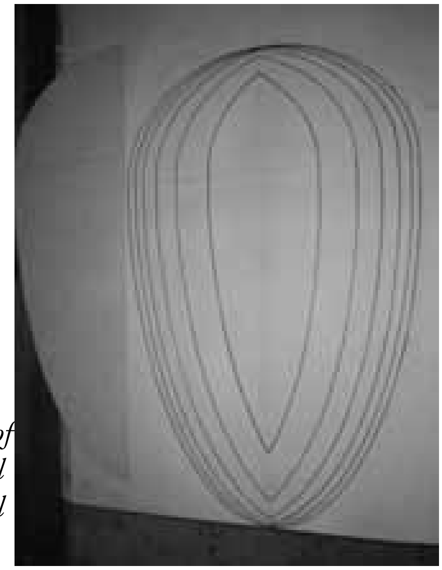


Photo 13 - Cross-sections of the traditional catmaran hull and template.

Comments

1. The CCSC hull design method described above uses circular and elliptical curves to define cross-section and waterline curves. In math-amatical terms these are known as continuous functions which define curves having no points of inflection - in boat building this means a perfect fair-curve. So this method should produce hull surfaces requiring less fairing than traditional hull design methods.

2. Cutting out cross-section frames using the router with the radius arm for circular sections and the template for ellipses, is more accurate and easier than the usual method of laying out hull-lines from a table of offsets and fairing them with splines.

3. FRG boat building is not a pleasant way to build a boat mainly because of its health hazards. When I fibreglass, I dress up in disposable overalls, wear a cartridge respirator and gloves. I work in a clean area so I can recover every bit of glass fibre waste. But for me the big plus for FRG is that it takes no more than 2 sessions of 3 hours each to laminate a hull such as WRC 6800. To make a wooden round-bottom hull takes much longer and wood dust is toxic requiring the same protective breathing equipment.

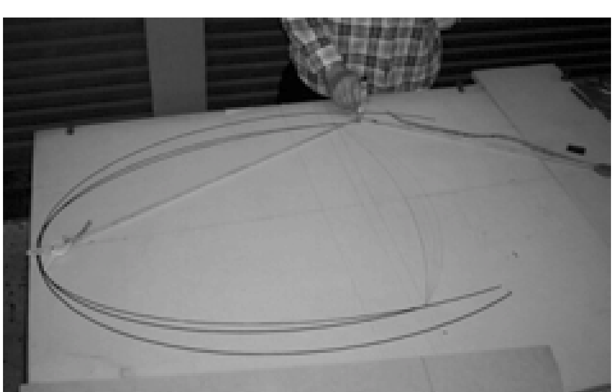


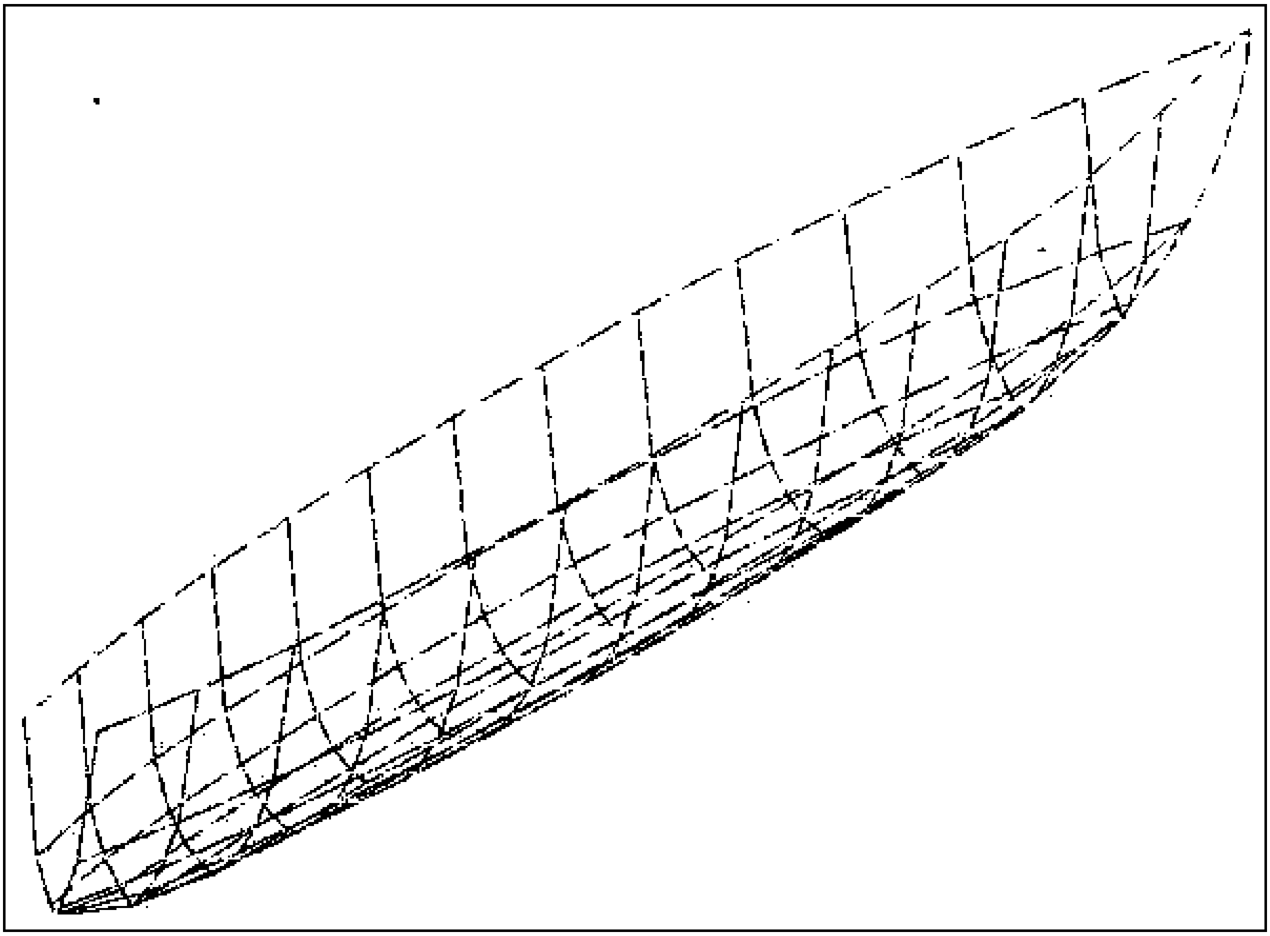
Photo 12 - A simple way to draw an ellipse

4. The drawback with FRG is making the plug and moulds. In my canoeing years I belonged to a club which made plugs and moulds as a club activity, and hired them from other clubs. In my sailing-skiff years moulds for boats such as the Flying Dutchman and 505s were also produced as a club activity. I am willing to lend the moulds featured in this article.

The last trial

Photo 1 shows WRC6800 following a trial of non-batten sails which allow sail-stowage by furling each sail around its mast. The winds for this trial were gusting to around 20 knts and sailing it by myself, I managed to beat back home without any dramas.The sail shown is a sailboard-stormsail which proved to be an excellent sail for the wild winds - I am searching for another sail like it as the other sail is cut too full for these winds. Although I cannot get excited about this cat, it sails these inland waters much better than the trailer-sailers. So its time to stop experimenting and go sailing.

Ian Smith
<smithvanaalst@ozemail.com.au>



Picture 14 - The Traditional catamaran drawn by Hullform from offsets scaled from the hull cross-sections as in photo 13

More on DWFTTW

Peter Jefferson

I would first like to apologise to John Wilson for my unintended implication that the "spool of thread" would not work the way he described it. (Catalyst #21, p 12) I have, in fact, observed this effect as a child when playing with a spool of thread. I have to agree with his final hypothesis that "there seems to be no theoretical limit to how fast <u>one might go</u> downwind in a wind powered vehicle."

Wilson's Spool of Thread

My problem is with the definition of the speed when the vehicle consists of parts which are moving relative to each other. In the spool-of-thread analogy, the speed is assumed to be that of the hub of the spool. If one chose instead the top of the rim, the speed is twice as fast as the hub. The speed of the rim in contact with the table is zero. If one can arbitrarily choose any point on the vehicle as the reference point, then there is no theoretical limit to the "speed" of the vehicle. Suppose that, under the racing rules, the reference point for the craft is the first part of the craft to cross the start or finish line. If the craft were fitted with a very long but retractable bowsprit, it could start the race with the bowsprit retracted and then finish with it fully extended. In this way it will be deemed to have gained some speed. It will have completed the course in less time than it otherwise would. This is clearly theoretically possible but probably not legally permitted. In the same way, a yacht finishing a race on a dead run can gain a few seconds by letting its spinnaker sheets fly ahead, but again, this may not be allowed under the rules.

I realise now that my assertion, that a wind-powered vehicle cannot sail DWFTTW, must be qualified to read: "On a wind-powered vehicle, the source of wind-power (i.e. the sail) cannot move DWFTTW". I think John Wilson would agree with this. However it raises the question, "What if the source of wind-power is a windmill?". Peter Sharp gives an excellent description of such a system. (Catalyst #21, p 18).

Sharp's Bauer String Yacht

One of the confusing things about analysing the performance of a sailing craft is that all the velocities are relative to each other. One can assume the table or water is stationary and define speeds relative to it, or one can consider the vehicle or the air to be the reference. As Sharp points out, it makes no difference what you choose to consider stationary provided you are consistent in defining all velocities relative to it. This is in accordance with the fundamental Principle of Relativity (not applicable when approaching the speed of light !). For simplicity, I choose to define the water or surface on which the vehicle runs as stationary and to define all other velocities relative to it.

This raises the question of what one means by "true wind". My assumption has always been that it meant the motion of the air relative to the water. I cannot accept Sharp's assertion that "Sailing craft do not require true wind". He refers to the case of a craft moving down a river when the air is "still", presumably relative to the land. However, in this case, for purposes to this discussion, the true wind, relative to the water, is equal and opposite to the speed of the river. If the true wind were zero, that is, if there were no relative motion between the air and the water, the craft would not move through the water. This argument hinges on the assumption that true wind is relative to the water which is considered stationary. In this context, the velocity of the land is irrelevant. Think of the craft in the middle of the ocean where the flow of the water relative to the land makes no difference to the craft's performance.

Definition of Terms

Sharp claims that wind is not necessary for sailing and invites comments from doubters. My view is that the question has nothing to do with mechanics. The confusion arises from using different definitions of words. Sharp defines sailing as “craft propulsion using energy derived from the relative motion between two material media…”. This is a good definition and I think most readers will agree with it. On this basis, one can then define other terms. It is convenient to regard one of the media as fixed and, for purposes of this discussion, I will choose to call this medium “water” even if in some cases it might in fact be dry land or even air. The other medium I choose to call “air”. As Sharp points out, it makes no difference to the result what you choose to consider fixed.

The motion of the moving medium (air) relative to the fixed medium (water) is, by my definition, the “true wind”. The velocity of the craft is, by my definition, its motion relative to the fixed medium (water). The “apparent wind” is, by my definition, the motion of the moving medium (air) relative to the craft. I believe these are the generally accepted definitions.

If the water is considered to be at rest it has no kinetic energy, therefore the craft cannot derive energy from it. If the craft is moving, it has kinetic energy, some of which may be transferred to the water due to its drag. If this energy loss is not replaced, the craft will lose kinetic energy by slowing down. If the craft is moving “downwind”, in the same direction but not as fast as the true wind, its sail will obstruct the true wind and therefore reduce its kinetic energy. This energy loss will be gained by the craft. If this energy gain is balanced by the energy loss to the water, the craft will maintain its speed. If, however, the craft is moving faster than the true wind, its sail will be “aback” and therefore cannot gain energy from the air. The energy to balance the drag loss must be supplied by the craft which means that the craft must lose kinetic energy and slow down. This does not necessarily mean that the craft cannot go DWFTTW.

A Mill-Prop Craft

As Sharp has illustrated, many types of craft have been designed and some built, which include a large air propeller/windmill connected to a water propeller or to a wheel. I would like to suggest another design which I think follows the Bauer principle. This would be a light land vehicle rolling on freely rotating wheels. Mounted on this would be a large freely rotating “rotor” which would have a mechanism for varying the pitch of the blades. By adjusting the pitch in relation to the apparent wind, the rotor could be set to act as a propeller or as a windmill. Starting at rest with a following wind, the pitch would be set so that the rotor acted as a windmill and would start rotating. With the craft held stationary, the pitch would be adjusted until the rotor was spinning at maximum speed. Then the craft would be released and the pitch adjusted so that the rotor became a propeller. The craft would accelerate to well over the true wind speed but the rotor would eventually slow down until it ran out of power, or until its speed dropped below the wind speed. I think all mill-prop type craft have the same limitation. The table (next page) illustrates the energy transfer features of some examples.

There is no doubt in my mind that this Mill / Prop vehicle could go DWFTTW but I question whether it is strictly wind-powered. While it is moving faster than the wind, it is powered by the kinetic energy stored in the rotor. Whether this disqualifies the vehicle for the DWFTTW prize is a moot point. As a purist, I would say it was not wind-powered while sailing faster than the wind, but as a sportsman I think it would be exciting to design, build and race this type of craft under a set of rules tailored for this purpose.

Peter Jefferson
pjjefferson@sympatico.ca
8 September 2005

Drive Type	Spinnaker Craft anchored	Spinnaker Max. speed	Rotor as Mill Craft anchored	Rotor as Prop. Max. speed
True Wind Speed	20 ft/sec	20 ft/sec	20 ft/sec	20 ft/sec
Craft Speed	0	15 ft/sec	0	25 ft/sec
Apparent Wind Speed	20 ft/sec	5 ft/sec	20 ft/sec	-5 ft/sec
Drive Force (assumed)	50 lb	50 lb	50 lb	50 lb
Water Drag on craft (assumed)	-50 lb	-50 lb	-50 lb	-50 lb
Energy Transfer Air to Craft	0	750 ft lb/sec	-	-
Energy Transfer Air to Rotor	-	-	1250 ft lb/sec	-750 ft lb/sec
Energy Transfer Rotor to Craft	-	-	0	1250 ft lb/sec
Energy Transfer Craft to Water	0	750 ft lb/sec	0	1250 ft lb/sec
Balance of Energy stored as Kinetic Energy in Rotor	-	-	1250 ft lb/sec	-2000 ft lb/sec

Peter Jefferson's table of the relative merits of DWFTTW craft

[Editor's Note: Insofar as Catalyst is concerned, this correspondence is closed until some one has some practical results to report. However, it may be continued on the AYRS email discussion group that can be found at http://groups.yahoo.com/groups/ayrs.]

Catalyst Calendar

This is a free listing of events organised by AYRS and others. Please send details of events for possible inclusion by post to Catalyst, BCM AYRS, London WC1N 3XX, UK, or email to **Catalyst@ayrs.org**

October

1st-7th Weymouth Speedweek
Portland Sailing Academy, Portland Harbour, Dorset UK. Contact: Bob Downhill; tel: +44 (1323) 644 879

5th AYRS Weymouth meeting
Speedsailing. 19.30 for 20.00hrs at the Royal Dorset Yacht Club, 11 Custom House Quay, Weymouth. Location Map: www.rdyc.freeuk.com. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX; tel: +44 (1727) 862 268; email: hon.sec@ayrs.org

22nd BMMA Meeting
Gosport: See above. Contact: Mike Dunkley on 01252 721439 for details

November

2nd AYRS London meeting
Sails on Wheels. 19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6 9TA. Location Map: www.linden-house.org. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX; tel: +44 (1727) 862 268; email: office@ayrs.org

December

7th AYRS London meeting
Subject to be confirmed.
19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6 9TA. Location Map: www.linden-house.org. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX; tel: +44 (1727) 862 268; email: office@ayrs.org

January 2006

6th - 15th London International Boat Show: Stand N1752
EXCEL Exhibition Centre, London Docklands. Those who can give a day or two, from 28th December onwards, to help build/staff the AYRS stand (reward - free entry!) should contact Sheila Fishwick tel: +44 (1727) 862 268; email: office@ayrs.org

22nd All-Day AYRS Meeting
9.30am-4pm, Thorpe Village Hall, Coldharbour Lane, Thorpe, Surrey (off A320 between Staines and Chertsey – follow signs to Thorpe Park, then to the village). Details from Fred Ball,
tel: +44 1344 843690; email frederick.ball@tesco.net

22nd AYRS Annual General Meeting
4pm, Thorpe Village Hall, Coldharbour Lane, Thorpe, Surrey (as above). Details from the AYRS Hon. Secretary tel: +44 (1727) 862 268; email: hon.sec@ayrs.org

February

1st AYRS London meeting
Subject to be confirmed.
19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6 9TA. Location Map: www.linden-house.org. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX, UK; tel: +44 (1727) 862 268; email: office@ayrs.org

March

1st AYRS London meeting
Subject to be confirmed.
19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6 9TA. Location Map: www.linden-house.org. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX, UK; tel: +44 (1727) 862 268; email: office@ayrs.org

Catalyst — *a person or thing acting as a stimulus in bringing about or hastening a result*

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Stabilising foils and variable geometry for proas — Robert Biegler

A different approach to Sail Design & Construction — Ken Coles

Tri-foiler project update — Peter Jefferson

John Hogg Competition report

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