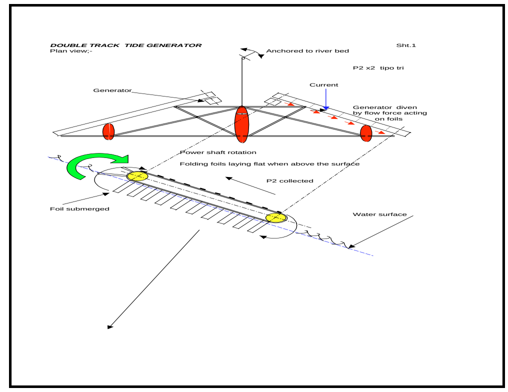
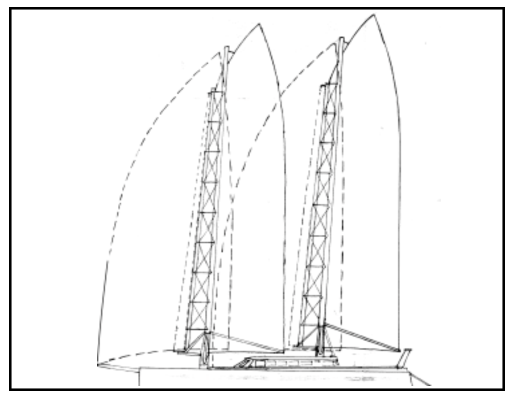
Catalyst

Journal of the Amateur Yacht Research Society

Number 9 July 2002

Features





Regulars

Cover photo -
The McGruer -built yacht
Al Malika
(see News & Views p 6)
Photo supplied by
Dudley Isaac

Catalyst

Journal of the
Amateur Yacht Research Society

Catalyst is a quarterly journal of yacht research, design, and technology published by the Amateur Yacht Research Society, BCM AYRS, London WC1N 3XX, UK. Opinions expressed are the author's, and not those of AYRS. AYRS also publishes related booklets.

Contributions are welcome from all. Email them to **Catalyst@fishwick.demon.co.uk**, or send (at your risk) disks or typed copy with illustrations to the Society's office. AYRS can take no responsibility for loss or damage.

AYRS subscribers receive both *Catalyst* and the booklets. Subscription is UK£20 or US$30 per annum for a Full Member, £10 or $15 for students and retired members. Subscription requests and all other queries to be sent to the AYRS Office, BCM AYRS, London WC1N 3XX UK, phone/fax +44 (1727) 862 268 or email: **ayrs@fishwick.demon.co.uk**

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Wanted – Assistant Editor for AYRS

Essential qualifications:

Own computer with email and FTP access to Internet;

Experience with DTP and/or advanced word processing software, (not necessarily professional experience, someone who has put together a college or club newsletter would fit);

Willing to put in the time and effort needed to guarantee that *Catalyst* appears on time, four times a year.

Rewards: sense of achievement, and the high regard of AYRS members. (This will have to do, because there's no pay!)

Useful attributes: GSOH, ability to read cramped handwriting, enough mathematics to proof-read and correct equations, etc.

Reason for vacancy: the Editor has not enough time to handle both *Catalyst* and write AYRS publications, and badly needs help.

What the job entails:

Most articles arrive by email or on disk, sometimes on paper. We reckon to accept any word-processor formats that MS Word can read (up to Word 2000). We get Excel tables, graphs and all sorts of drawings too.

Articles received as typescript get scanned and put through optical character reading software. This works fine sometimes; otherwise the OCR just gives up. Invariably, there is usually a bit of work to proof-read and correct the results. If manuscripts are really interesting they need to be typed up.

In general, however they are received, each article ends up as a Word document, and gets spell-checked, grammar-checked, and anything that might cause personal offence smoothed out.

Photographs need to be scanned (if not received by email or on disk), reduced to greyscale, and adjusted for brightness and contrast. Sometimes we will also fade or blur out backgrounds if they interfere with the subject of the picture.

Sketches get scanned if possible; otherwise they need to be redrawn into a standard vector-drawing program. Line drawings sent as JPEGs *always* have to be redrawn.

Once each article has been prepared, it is set up for the magazine using Adobe PageMaker. We have tried using Word, but PageMaker gives better layout control. Usually we have to adjust layouts, illustration sizes, sometimes even grammar, to fit it neatly onto the pages. The whole publication of course has to end up as a multiple of four pages, otherwise we will have loose or blank sheets.

The final magazine is then printed as an Acrobat PDF file, and sent to our printers across the Internet. The final file is typically 10 MB, so a good Internet connection is needed. Anyway, with the Editor spending most of his time in Belgium, and the AYRS office in England, the Internet is the way we keep in touch and work together. We also pass work around using private filing space on an Internet server.

AYRS has all this software of course, for a PC; but if you have it, or equivalents that you are used to, we can adapt!

Apply to Catalyst@fishwick.demon.co.uk, please!

THE AMERICA'S CUP OF COLLEGE CIVIL ENGINEERING

Emmanuel Roche

The ASCE/MBT Concrete Canoe Competition is often referred to as the America's Cup of college civil engineering. Many schools from around the country spend the entire academic year designing, building, and preparing their canoe for the regional and national competitions. The trick to making a successful canoe is to match a lighter-than-water concrete with a high-speed, manoeuvrable hull.

This is a challenging task. Standard concrete is nearly 3 times heavier than water, so special techniques and additives must be used to make the concrete lighter than water. The concrete used in the canoe must also be stronger and more flexible than standard concrete, calling for advanced materials in the concrete mix.

The design of the hull requires advanced knowledge of computer-aided-design and fluid dynamics. Because the canoe must be fast and manoeuvrable, hull designers are forced to compromise between these mutually exclusive attributes. Designers must strike a proper balance. On top of all of this, the canoe must support 4 students in an endurance race.

To think that all of this is done with the same type of material as a city sidewalk...

A Concrete Background

Concrete has been around for thousands of years. The Egyptians were the first humans to realise that certain rocks could be ground up and mixed with water to create a substance that, when it dried and hardened, gained strength. This basic concept has evolved from the simple "glue" used in the pyramids to a large industry that has built our cities.

Cement is any ground up compound, that, when mixed with water, will harden due to the chemical process of hydration. Once you actually begin mixing the cement with the water, it becomes cement paste. This cement paste is what provides the strength to any concrete. But cement is relatively expensive when you begin dealing with large quantities, so builders look for ways to reduce the costs. The easiest way is to mix in aggregates, generally sand or rocks, which are much cheaper. Concrete, therefore, is the result of mixing together cement, water, and sand or rocks. Past the basics, you find researchers that look to mix into the concrete all sorts of different chemicals and materials. Different characteristics that can be adjusted to meet one's needs include strength, flexibility, durability, workability, time it takes to harden, resistance to certain chemicals, and even its colour!

Getting Concrete to Float

A concrete canoe sitting at the bottom of Lake Ontario is pretty useless, except for the fish that might use it for a home. So the main task for the concrete design of the different teams will be to make the concrete float. This would be a simpler task if it weren't for the swamp test. You see, regular ships are made of steel (a dense material), but still float because they are displacing a large amount of water (i.e. they are buoyant). A concrete canoe would also normally float because the space inside the canoe is displacing water. But as soon as you begin swamping the canoe (i.e. filling it with water), you lose the buoyant nature of a canoe shape. What you are left with is just some concrete submerged in water. The only way for the submerged boat to float is for the concrete to be less dense than water. Thus arrives the true design problem: getting concrete to be less dense than water.

To create a concrete with a density below water, we recall that the main components of concrete are cement, water, and aggregate (or sand) mixed together in varying proportions. Cement paste is denser than water. To make the concrete float, we must use an aggregate less dense than water. Thus, when we mix the cement paste and aggregate together, the density will be somewhere in between. If we add enough of this aggregate, the overall density of the concrete will drop below the density of water. Imagine putting a lot of foam peanuts in a bucket of glue. If you have enough foam in there, the glob will float, even though the glue alone won't. In fact, foam is one of the materials that some teams use, choosing to grind it up instead of using it in peanut shape. Other teams use high-tech materials such as microscopic glass bubbles or rocks that have been heated to high temperatures (like lava rocks).

So next time someone tells you concrete can't float, tell them not to be such a cement-head.

Emmanuel Roche,
<salle.arobase@ville-rochefort.fr>

HYDROFOIL DISCUSSION

AYRS London meeting, 2nd April 2002

April's London AYRS meeting took as its topic hydrofoils - a subject that interests many AYRS members although few have had the opportunity to experience flight over water. Discussion concentrated on sailing hydrofoils, alhtough powerboats did get some mention.

1) Bob Downhill spoke of his experience with "Icarus II" and gave reasons for the failure of the project. These mainly concerned the control of foils, sails and crew. With amateur experimental craft there is rarely a chance to select a skilled and competent crew and train them to work together, the tasks and trim required being unknown. He also noted with regret that progress and development of hydrofoils has been almost non-existent over the last forty years. We were shown lift/drag graphs illustrating the reduction in drag as the hull lifts, which in the case of "Icarus II" resulted in very violent increase in speed usually leading to loss of control.

2) Slade Penoyre discussed the speed of "Yellow Pages" and wondered why this or similar craft could not sail at Portland, England. Michael Ellison and others pointed out that the craft was built with only three requirements 1) To be the fastest craft in the world under sail. 2) To be assembled and launched from a beach. 3) To store in a shipping container. There was no need to sail in two directions, to sail other than on flat water or be strong enough to be towed or moor up and these features were not included.

3) Slieve McGalliard brought an airfoil - actually a glider wing - made from foam covered with brown paper and glue. This part of the discussion diverted from hydrofoils to the construction of light, strong inexpensive hulls on which to mount the foils. Michael Ellison brought samples of foam sandwich from a 40ft (12m) catamaran building for the Round Britain race. Construction started in January 2002 to build a shed, plugs, moulds, hulls and cabin top aiming to launch ready to sail on 27th April. At the time of the meeting it was nearly a week ahead of schedule with engines installed, sheet tracks fitted and hatches going on. Using pre-impregnated glass cloth is claimed to save about 40% of weight and a displacement of 3½ tons is planned.

4) As neither David Chinery nor George Chapman were able to get to the meeting Michael made a few observations. David has produced a number of sailing hydrofoils all named "Mantis". Michael sailed "Mantis IV" in the 1974 Round Britain race, the first hydrofoil to enter an offshore race and he has joined with David to help with the design of "Mantis VII" which will be a joint entry for the Norwegian design competition. Michael has no knowledge of the lift/drag ratios of different foil sections at different speeds but stressed the need for a practical craft to have good light weather performance without foils. Rodney Garret's Mosquito class trimaran "Sulu" achieved this with a folding foil lowered through opening doors in the lee float at the stage when the wind became too strong for the crew to prevent heel. Ref: AYRS 68 Outriggers 1969 pages 54-59 for plans, photos and full details.

David Chinery and George Chapman are in favour of depth control. With Sulu, human control was too slow, and the foil tended to lift and plane on the surface heeling the craft to windward. David favours sloping surface piercing foils so that immersed area, and therefore drag, reduces steadily as speed increases and the hull lifts clear.

Some people at the meeting had not appreciated that, on a sailing hydrofoil, the big leeway-resisting force must always be produced and that as a result the windward foil is usually pulling downwards. On a folding foil pull down is impossible because "negative lift" folds the unit ready to retract.

There was brief discussion of the record holder "Longshot" and the production version "Trifoiler". These are very stable sideways but can pitchpole when gybing at speed in waves. Other than observing that the aft "T" foil fails to hold the stern down no cure was suggested. Bruce foilers can be deliberately capsized by bearing away hard — the leeway angle that was lifting the lee foil becomes negative in a tight turn and the foil pulls down. If the helm is kept hard over a capsize will result.

Michael noted that aircraft rudders are not usually connected to the tail plane and use of separate controls could be tried on boats.

Members present felt that much more attention should be given to control of foils; aircraft do not stop and adjust settings with a spanner. Foil angles have to change so quickly that humans are too slow to fly on the surface. Even if you go back to Noah you cannot find any creature that tries to go fast through the surface of the water. Otters, frogs, penguins and others swim under water. Ducks, swans and other displacement birds run or fly when in a hurry. Even flying fish do not travel along the surface. Must we lift out, submerge or be happy at slow speed?

Michael Ellison
92 Keat Street,
Devonport, PL2 1SB

Hydrofoil Control

*Response to Mark Tingley (*Catalyst *January 2002)*

In CATALYST No 7, page 23, You suggest a float inside the strut of an inverted-T foil to control the foil (or flap) incidence. This would require holes top and bottom so that the tube containing the float is 'free flooding'. A problem I see is to find somewhere at the bottom of the assembly for the lower hole that is not subject to either an increase or a reduction in pressure, which would vary with speed.

Please see the article on *Calliope*, *Catalyst* No 2, page 20, lower left, where we report the lowering of pressure under the foils.

Above 15 knots the reduction drew air down the free flood tube, which then exited as a plume, making a rumbling noise and for that reason ar least - we think - causing drag. So I had to seal the bottom end access hatches to the crank arms and block the holes, and fit shower-proof sleeves at the top end of the push-rods.

I do wonder whether the response of a float would be quick enough, and whether enough force would be available. Adjustment and experiment would be difficult. We and Dr Sam Bradfield in the US (designer of the RAVE) have found that our feelers and his wands, essentially similar rods tracking the surface and mechanically actuating the foils or flaps, work well. There is sufficient damping in both systems so that the rods skim over small waves smoothing out the minor variations, and we have total access to the linkages allowing easy afloat adjustment of gain and height setting. I have not measured the rod's drag, but calculation suggests it is very small and smaller than a TRIFOILER's sensor drag.

Even so, large waves can occasionally fool the mechanical systems, and we would dearly like to have some sort of sensor which tells the boat how high it is above the 'mean sea surface', each side and fore and aft. Maybe the solution is a GPS linked solid-state gyro.

What we have found on the 19ft CERES is that when sailing in winds below 10 knots, and to windward in any wind, it pays to keep the foils active but with the height control re-set to 'fly' the hulls just touching the water, rather than simply locking the foils in 'neutral'. Thus the boat is kept upright in roll, hull skin friction is minimised, and in fact the motion of the boat is reduced. We have the full area of the struts to carry leeway with their top ends fenced.

Our clutch mechanism allows up to change from 'flying' to 'flying displacement' at the pull of a string, so off the wind in a varying wind we can go progressively (as the wind increases) from flying displacement (at say 9 knots) to flying the weather hull (10 knots) and then the lee hull: 12 knots immediately accelerating to more if the wind continues to rise.

The captions in Figure 9 of the CALLIOPE article became displaced in transmission. Reading from the top, the diagrams in fact are d,c,a and b. The captions should be reassigned accordingly, when the very peaky leading edge reduction in pressure of the Bi-ogival strut can be identified for what it is, rather than erroneously blamed on the excellent NACA 0012-34 section.

George Chapman.
The Rock,
SOUTH BRENT, TQ10 9JL

Multihull Sheet releasers

In your May 97 newsletter on the web I saw mention of sheet releasers for multihulls. I “came up” with the idea for myself recently and, until I found your website, thought it was novel! In one way I’m disappointed but in another way I’m pleased because the idea must have some merit if others have also thought of it.

My interest springs from my experience with modern solid state gyro sensors which I believe could form the basis of a reliable and inexpensive method of triggering sheet releasers.

I am writing to ask if your society has anyone currently working on this problem with whom I could perhaps collaborate. If not, is there perhaps some source of information on the subject that you know of. Any help will be much appreciated.

I should perhaps mention that one of the UK’s leading commercial multihull designers told me to forget it on the grounds that “..there has always been a great reluctance by users to fit any sort of sheet release system on multihulls..”. If true I find this hard understand. In any case I am not discouraged!

Thanking you for your help.

Colin Mill
CSM_Ltd@compuserve.com

New Owner seeks advice on restoring teak Bermudan Sloop built 1933.

Al Malika

In 1933 King George V of Great Britain commissioned a Bermudan Sloop to be built as a gift from the British people to His Highness the Sultan of Zanzibar. This 32 foot, teak yacht was built by McGruer & Company Ltd. at Clynder on the Gareloch in Scotland and weighs 4,6 tons. The deck is teak and the hull is made from oak framing teak.

Since *Al Malika*'s delivery to the Sultan in 1933, she has had four owners and sailed from Zanzibar to Mombassa and then on down the East Coast of Africa to Durban - South Africa. In 1978 she was transported in land to the fresh water Vaal Dam in Gauteng where she spent approximately 15 years out of the water.

Dudley Isaac purchased *Al Malika* last year and is seeking advice on how best to restore this yacht.

Queries:

a.. Can anyone put me in touch with enthusiasts who may have info on this design?

b.. *Al Malika* is an antique yacht and as such, is there any historical significance?

c.. Originally Al Malika was a day sailer. Could anyone advise on the original design of the yacht?

d.. Could anyone supply advice on how this yacht should be restored?

If you can assist with any advice or information please contact

Dudley Isaac:
Email - dudley@sailafrica.co.za
Mobile: 27 - 11 - 82 564 8914

International Amateur Boat Building Society

AYRS members may remember this Society which flourished briefly around 1970. Well, the original founder, Jim Betts - himself an AYRS member - is bringing it back.

He is publishing a monthly magazine (Amateur Boat Building) offering new plans, new building methods and materials, as well as a technical advice service capitalising on his 40 years of boating and boat-building.

Subscriptions to the magazine are $30 for nine issues obtainable from IABBS, PO Box 1309, Point Pleasant Beach, NJ 08742-1309 USA; tel: +1 (732)295-8258, fax: +1 (732)295-8290, email: AmateurBoats@AOL.com

Do you still have your *American Sail Boat*?

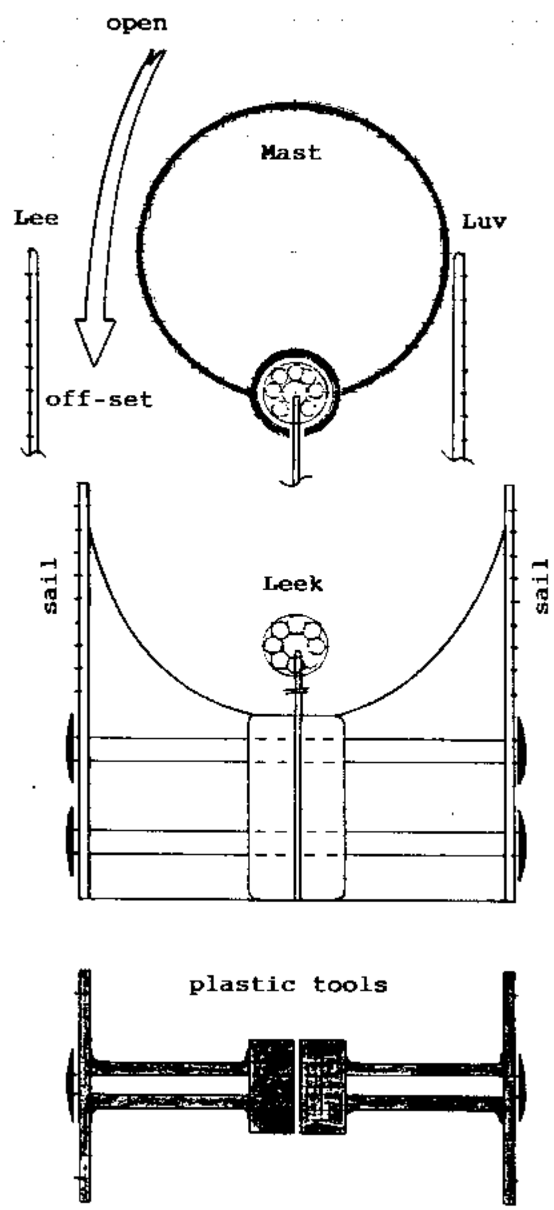
Where can I find the 1976 26' *American Sailboat* Owners Manual, Maintenance Manual, and Brochure?

I am looking for sources of information and owners who can share their experience.

Thank you

Jerry Watkins
2870 Leeward Lane
Naples FL 34103-4036 USA
Tel: +1-(239)-643-1292

Switzerland, 23. Mai 2002



Peter Bresch
techn. Kaufmann/HKG
Gartenstrasse 9
CH-8910 Affoltern a/A

Distance tools for main sails

Please find enclosed the drawing (above) according to *Catalyst* No 8 (Rigs from Robert Biegler, Trondheim, Norway) to be used on plastic toys for mains.

Peter Bresch
techn. Kaufmann/HKG
Gartenstrasse 9
CH-8910 Affoltern a/A

Conveyer belt foils.

Ken Upton

Most people do not understand the basic advantage you get from a foil or, as it's better known, a wing. When energy in water or air flows over the top and bottom surfaces, the molecules are separated from their neighbours, and you get a reaction and an effect; which can be used either way, if you know how.

Take, for example, a wing of a jet plane, which most people have seen while sitting in the plane. One side of the wing is curved (top) and the other is flat. The front (leading edge) is a wedge-like shape; this divides the airflow over the wing section. The airflow is made by the forward movement of the plane through the air.

The molecules on the bottom of the wing have less distance to flow along the straight surface and get to the back before those going the long way over the top . This makes a gap between the two flows, a gap in the energy stream created by the forward movement through the air, called a vortex. These you have also seen as a whirlwind or as the water going out of the drain plughole of your bathtub etc. This is a build up of energy created by different distances, pressures, etc.

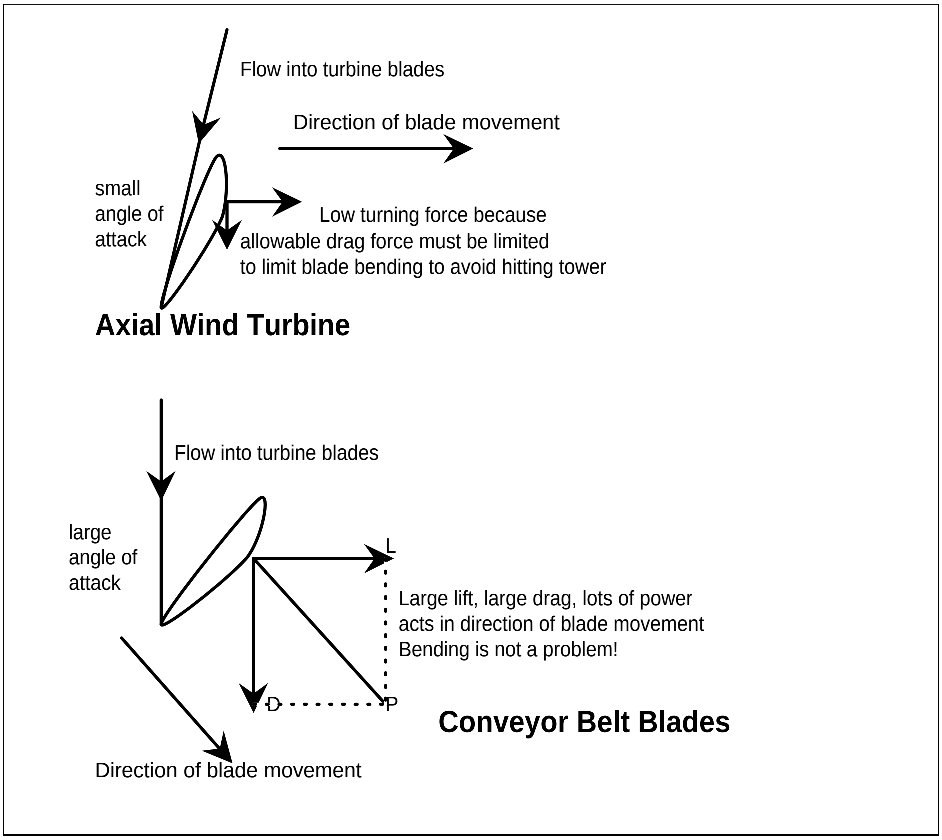
So what does all this do? The action of the dynamic lift pushes and sucks the wing towwards the low pressure side of the vortex, and this is what makes the plane fly. The force to move it forward through the air comes from the engine, and the dynamic lift comes from the wing section shape. Together you get the result — flight.

On boats with hydrofoils, the effect is basically the same. But like most energy conversions this can work either way. Put energy in and get lift out, or else take out passing energy from a stream by using the dynamic lift from the foil shape. This gives you energy that you can use elsewhere. Just the same as the oil energy you use in your boat, that came from elsewhere, too.

Now as you know, windmills have been around for thousands of years, as indeed have watermills. But consider — water has density of about eight hundred times more than air, so water has much more energy than wind. You are using the dynamic effect in a passive mode. This is similar to the lift balance factor of a sail and a keel, which is about 35/1. There are other considerations like friction, design, temperature, but they are for the engineers to find the best design for where you are going to site your green power machine.

If you look at the dynamics (drawing) you will see that a wind turbine is always working along the wrong path. If you give the blades a large angle of attack, which you want for power, the foils (blades) bend with the bigger drag load and hit the tower. Bonk!!! No windmill!! But if you have a foil that moves along the direction of the dynamic lift and drag combined, you then can take the maximum renewable amount of energy out, with the minimum of trouble.

Think about this when you get your bags off the airport luggage carousel. It is a conveyer belt. If all the suitcases were foils of the same size, and stood at regular intervals, you would get a linear fan, driven by an electric motor making it go around and around. Now if you turned it upside down and suspended the conveyer on a raft over the water, with the foils in the water, and all the machinery out of it, you could use it to stir up the water. Or you could turn the system around, replace the motor by a generator, and extract energy from the current. None of your pumps, generators etc have to work under water and make parasitic drag from their mass and pull your anchor out; they are all out of the way. So your hydrofoils can collect the passing energy as they move from the bow to the aft part of the conveyer track, and around and around.



That's OK, but if the foils had to go back up to the bow in the water, you would lose all the energy that you have collected pushing them to the stern. In fact, you would lose a bit more, from the drag of the returning foils. It would not work.

However, there is easy way to make it work. Take advantage of the difference of the densities of air and water. The conveyer is above the floatation line, with only the foils in the water. When it turns, make it lift the foils out of the water stream of free energy so they go back up to the bow in the air. Then you have the effect of going around and around to drive your generator, which is an electric motor being driven backwards.

The wind resistance may affect the foils. This can easily be overcome by turning the track 90 degrees so the foils are horizontal. Then if you want, you can put a cover over them. If you wish, you can make this cover into a good working surface for something else, or make it into a wildlife island. That way you would never have eyesores, like the inefficient wind turbines in use today.

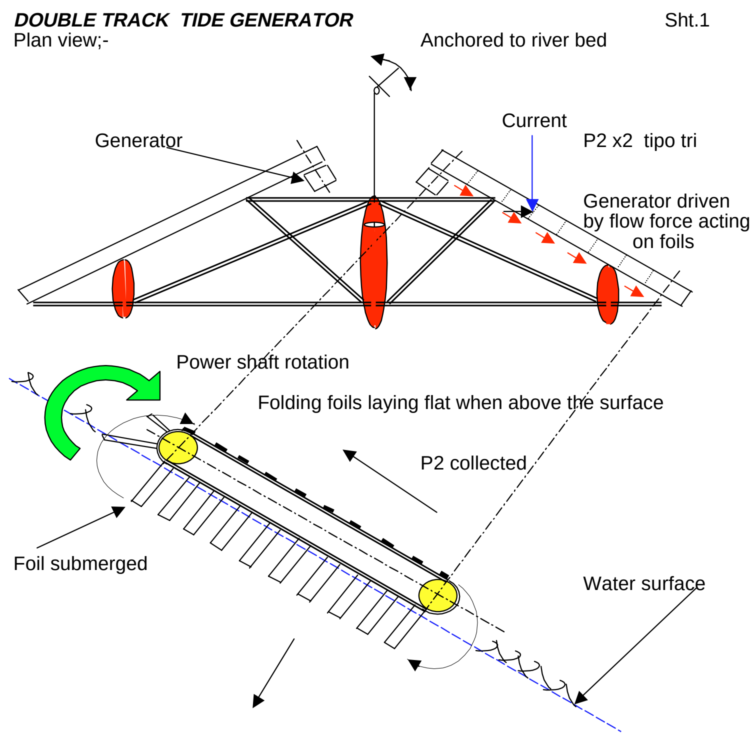
The power you take out from the system controls the speed of the conveyer, which would be slow, and most likely Dolphins would play games between the foils on the craft. By using two opposing tracks in vee, at the correct power-path angle, the craft then will find its own balance in the current and stay in proper alignment.. Using the right foil section the dynamic advantage can be made several times more (up to 4.6 approx.)

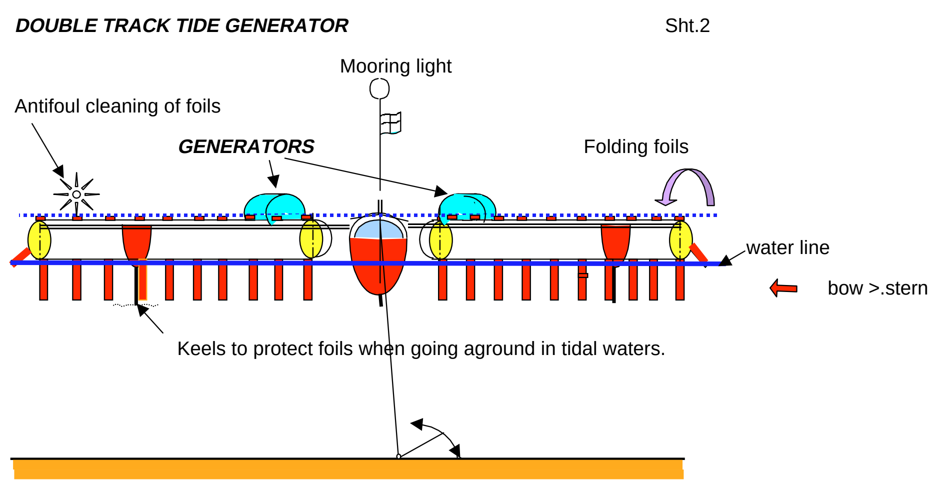
As like many things, even us,the system will look for the easy way out. If you only had one track the drag would take over and the track would line up with the flow, the foils going down it, with no dynamic lift effect. Like a sailboat going down wind or a water wheel. On smaller 4p foil conveyers, they can be hung on an arm over your flowing stream and the path angle made by a tension device.

The other advantage is that, since in all flowing streams there is weed and rubbish that tangles up and stops underwater rotating turbines, this Conveyer system is self-cleaning as the foil comes out the stream.

Weight on water is of no importance, so the craft can be made to mega sizes. A moored barge can be used in large rivers and tidal waters. It can be moved to anywhere you need RE or for servicing.

Maths: — Most rivers run for 24 hours a day, 7 days a week, all the year. Wind, at best is available for 30% of the time, and both are not constant.





patent pending 4p

Therefore dynamic advantage 35/1 = 35 x 3.33 =116.5 approx. Tidal generators will work for about 60 % of the time, but the tides are always there. A conveyor system like this has is a small loss from greater machine friction compared to a turbine, but as the conveyer will operate at maximum lift and drag angles, and can be made to catch a greater volume of a shallow river, there could be energy advantage over other turbines of over 100 times for the same immersion. Plus there are many other advantages, which good computer simulations will tell.

All the technology is well known and proven — this is just a new way to put it together that will give the cheapest kWh in the market today.

Note: 4p, the developers of this idea, are a small charity and looking for partners for the final R&D to exploit this new system to collect green energy. If you want to help, please contact:

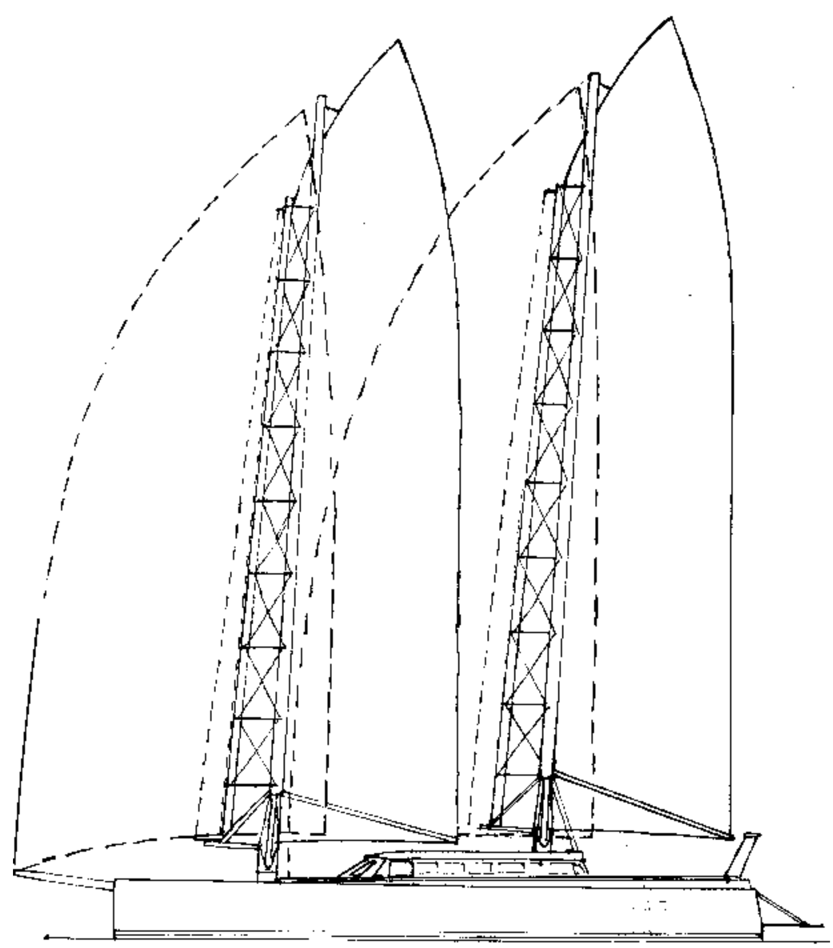
Ken Upton
25 Pedreguer
03750 ALICANTE
Spain

KCat70 - A High Performance Motor Sailer

Features

Graham Coombes

The KCat70 is a narrow-hulled sailing catamaran in the "form-factor" of a similarly sized monohull or a power cat. The intent is a versatile motor sailor capable of useful speed under power (estimated at 25 knots) and high performance under sail while utilizing largely conventional technology. Safety aspects such as no through-hulls, self-righting capability, and the ability to "yield" with moderate heeling were also part of the design brief. The "form-factor" in combination with the deep swing-down keel allows the righting moment characteristic to be a tailored combination of mono and multi-hull at the cost of the relatively light keel weight. The narrow hulls operate in the displacement mode, so the additional weight is not an excessive penalty. The design incorporates several novel features, most of which have been pioneered by others. What is possibly unique about this design is the combination of features - an example being the use of a Kitchen rudder with a synchronous belt drive obviating the need for a conventional reversing/ reduction gearbox.



The vessel construction is to be aluminum. The swing keel is to be high strength alloy steel with an encapsulated lead bulb. The "Y" component of the rotating mast is to be carbon fiber. The truss component of the mast is to be strip planked Douglas Fir with the exception of the forward vertical member which is an aluminum tube. Interior bulkheads to be either aluminum or foam/ fiberglass sandwich where appropriate, and all furniture to be veneer over foam or balsa.

Discussion of the features of the vessel is presented in sections:

1. Hull and appendages
2. Motoring power train
3. Masts and Sails
4. Exterior Layout
5. Interior Layout
6. Miscellaneous
7. Specifications
8. Summary

1 Hull and Appendages

Ragtime (ex Infidel) started the phenomena of the ULDB typified by the Santa Cruz 70 - relatively narrow low displacement easily driven vessels. These vessels excel in downwind conditions. Upwind, the narrow hull and light weight limit righting moment, and the shallow canoe body has a tendency to pound. Steve Dashew extended the concept into the cruising world through an evolutionary series of vessels culminating in Beowulf with a D/L ratio of approximately 55. The 77' WL of Beowulf allowed a more powerful hull form while maintaining a high L/B ratio (approx. 5.5) and low 1/2 angle at the stem (<11 degrees). This vessel has achieved excellent transit times with husband and wife crew (>340 miles/day).

The choice of a narrow hulled ULDB catamaran as advocated by Malcolm Tennant has some potential advantages over the monohull:

1. righting moment through form stability is maximized
2. the narrow hulls should be even more easily driven
3. pounding is eliminated (provided the bridge deck clearance is adequate)
4. shallow draft
5. deck space is increased
6. heeling is reduced

The concomitant disadvantages are:

a) ultimate stability is poor - righting moment goes negative around 90 degrees
b) maximum stability is developed at low heel angles. This means that the vessel has little ability to “yield” by heeling and spilling wind from the sails. If the point of maximum stability is passed without the sail force being substantially reduced then capsize is inevitable.

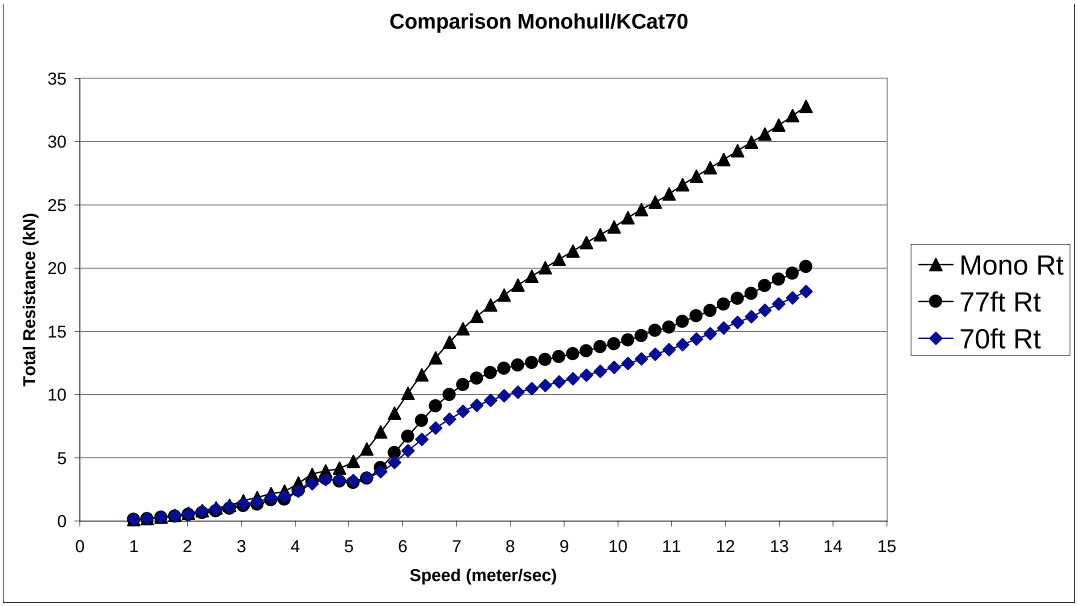
Limiting the overall beam so that the vessel “envelope” is similar to a monohull allows both of these deficiencies to be addressed. The overall beam of the KCat70 is 19' and the draft is about 30", so maximum stability (325K ft lbs @ 50K lb.) is developed at approx. 20 degrees, and falls off relatively slowly due to concentrating heavy storage/ equipment and tankage low in the hulls and the high freeboard. This gives the vessel an ability to yield to gusts by heeling and reducing sail efficiency. Normal operation is expected in the range of 10 - 12 degrees heel.

Water ballast tanks are provided under the cabin sole in the hulls - these can store up to 7500 lb. of salt water in 3 tanks on either side, providing an additional 105K ft lbs. of maximum righting moment. Unlike most monohulls with water ballast all tankage in this vessel is low in the hulls, contributing to stability even when completely knocked down. Pumping fuel or drinking water from one side to the other can also add to righting moment. Pumping fuel, water, or salt water between fore and aft tanks allows trim to be modified.

A swing keel similar to that used on “Route 66” can provide significant righting moment at high heel angles. This “keel” would only be deployed in extreme circumstances, it can therefore be very deep and the bulb weight can be correspondingly light. In this case the 6000 lb lead bulb can be placed >20' below the WL generating a significant righting moment for the ultimate condition. Deploying the keel to its normal 60 degree position causes a change in longitudinal trim bow down by a few inches. The keel position is controlled by a 8" hydraulic cylinder mounted on the bulkhead across the front of the pilothouse. Although the KCat70 has a significantly lighter keel than an equivalent monohull, it gives back some of the weight advantage due to the greater skin area/weight. If an equivalent monohull had a keel weight of 17,500 lb the advantage would be approx. 10,000 lb. Assuming a greater skin weight of 5000 lb, the net weight advantage of the KCat70 would be 5000 lb.

The length of the vessel is 70', with a 7' adjustable stern float giving an overall length of 77'. The transom at 70' is substantially submerged; the stern float can be adjusted to bring the float transom clear of the water for minimum drag at low speeds. At high speeds the floats can be lowered to act as trim tabs to counteract any tendency of the stern to settle. This increases the prismatic coefficient (cp) for better high speed performance.

The narrow hulls (L/B of 19) and the low 1/2 entry angle of 5.5 degrees provide an easily driven hull not limited by the conventional displacement vessel maximum speed of 1.34 square root(WL). Figure 1 compares the drag characteristics of a 77' WL monohull, WL beam 14' and displacement 55,000 lb with the KCat70 at 50,000 lb. This analysis was performed using the Michlet program developed by Leo Lasauskas of the University of Adelaide, Australia. Three curves are shown: the monohull, the 77' water-line KCat70, and the 70' water-line KCat70 (to emulate the vessel with the float lowered - ie. with high prismatic coefficient). Note that the 77' curve has generally lower resistance than the 70' curve below about 10 knots as would be expected from a lower cp. Above this speed however the higher prismatic vessel has a significant



advantage. Both KCat70 curves exhibit considerably less drag than the monohull curve. The monohull curve indicates that approximately 120 HP would be required to propel the vessel at 13 kts. This corresponds reasonably well with the 170 HP (assuming 70% efficiency) Beowulf, which has a top speed of about 13 kts. The KCat70 would require 70 HP at the same speed and 295 HP at 25 kt - the 550 HP available should be able to provide that assuming even 55% efficiency.

Fwd & aft rudders are used for leeway control in addition to steering the vessel under sail. This concept has been proven on the DynaFlyer 40 monohull and others. The swing keel is normally parked up out of the water under the bridge deck and so does not contribute to leeway control although its mass still provides righting moment. Twin rudders fore and aft provide sufficient surface to manage both tasks (2.5 - 3 % of sail area). The rudders are designed to kick up - and so do not have to deal with grounding loads. Steering and “collective” or leeway control is to be hydraulic.

2 Motoring Power Train

The vessel has been designed to utilize common truck diesel engines - either the International Harvester 7.3l turbocharged engine from the Ford F350, or the Cummins 5.9l turbocharged engine from the Dodge RamCharger. Both of these engines can develop 275 hp and weigh about the same. The engines will be keel cooled with dry exhaust and are mounted low in the hulls below the waterline.

The next unit in the power train is a Goodyear EaglePd synchronous belt and sprocket pair. These perform a reduction of 2.25:1 with high efficiency while translating the drive vertically and inboard. The driven sprocket axis is above the waterline on the inner side of the hull. The engine is connected to the driver sprocket via a clutch and driveshaft with a pair of universals. This allows flexibility in placement of the driver sprocket and allows relatively soft mounting of the engine.

The final drive unit is a fixed pitch propeller encompassed by a Kitchen rudder. The Kitchen rudder was invented by Lord Kitchen and has a reputation for extremely good maneuverability. This rudder is similar to the clamshell thrust reversers on DC9/MD80 jet engines, except that the two halves can also turn together for steering effect. The rudder therefore provides some benefit as a nozzle in addition to steering with forward thrust (open) or reverse thrust (closed). It can also be used as speed brake or drogue. Steering and forward/reverse control is to be hydraulic.

The final drive unit and Kitchen rudder assembly is designed to rotate out of the water when not in use. This is achieved by offsetting the propeller axis from the driven socket axis through a pair of opposed universal joints. This concept has been used by Malcolm Tennant to provide the final drive axis at an offset to the engine axis. The drive shaft from the driven sprocket to the propeller runs dry within a streamlined strut with support bearings as required. This strut has a rotary joint with the hull in line with the driven sprocket axis (ie. the through-hull is above the water line except when heeled).

3 Masts and Sails

Rotating masts are significantly more efficient. Smoother connected airflow over the low pressure side of the mast and sail in particular improves the lift and reduces the drag. A high aspect ratio gaff sail with a flexible gaff provides a more efficient elliptical planform a la Marchaj's "Lionheart" design and allows a greater sail area without additional height. I believe that the swept back "swallow" wing tip emulates that of many long range birds and serves to force the tip vortexes outward increasing the effective span and aspect ratio. Each sail is approximately 1500 square foot. Sail area to displacement is approximately 35 and sail area to wetted surface is about 3.5. Performance should be more than adequate.

Normal rotating masts have a wing shape, with the sail track running up the trailing edge. The righting moment stresses the wing in bending - accordingly for larger vessels carbon fiber construction is required to limit the weight with sufficient stiffness without excessive chord. Sponberg relates how these masts can flex and "average" the excess energy in gusts - a very nice attribute. The masts on this vessel are designed for 500K ft lb righting moment with a 2+X safety factor - this would require a lot of expensive carbon fiber. A diamond stay can be fitted for resistance to athwartships bending, however this adds failure prone fittings to the rig, makes the wing rigid/unable to flex and adds some drag. This type of mast normally requires over-rotation controls for correct shape on the low pressure side.

The design proposed for this vessel is a triangular truss, where the side members replace the shrouds in a conventional rig. The entire truss arrangement rides on a rotating "Y" member that transfers the stresses to the hull of the vessel. The "Y" member requires carbon fiber construction (high strength steel could be used at a significant weight penalty). The truss rig is loaded purely in tension and compression and can be of strip plank construction in Douglas fir or similar - light and stiff. The wide spacing of the truss vertical members and the relatively high number of spreaders reduces the loads so that slender wing sections can be used with light construction (1/4" thick planking). Selective use of carbon fiber reinforcement on the wing section would enable fewer spreaders with little or no weight impact. As an aerofoil section has 1/30 the drag of a wire shroud of the same thickness, the rotating truss mast will have less drag than a conventional mast, even upwind. It will also generate lift. The mast side spars are pin mounted to the "Y" member; releasing the connection of the forward vertical spar to the "Y" member allows the mast to be lowered. The side members and spreaders will be watertight, providing useful righting moment if the vessel is knocked down or inverted.

One of the drawings shows a B&R staying configuration - this eliminates the diagonal struts and the associated weight. These stays are Kevlar roving moulded into an aerofoil shape with epoxy, and faired into the vertical members so as to minimize sudden section change and associated stress concentration. This approach is similar to that of Monfort in his Geodesic boats. The durability in this application with respect to load cycling and working would require testing. Accordingly the proposed design at this time shows diagonal struts.

The forward vertical member is a 4" aluminum tube. Surrounding this is a headfoil which is free to turn on the tube +- 45 degrees so as to achieve an efficient angle of incidence to the apparent wind. This headfoil shape has been found by both Bethwaite and Marchaj to improve performance markedly, and also increases resistance to the loads imposed by the sail (along the axis/chord of the headfoil). The sail battens run in the sail track with small retaining wheels to reduce hoist loads. The battens are one piece into the headfoil as the alignment is common. Universal joints etc are not required. Sail retention between the battens is by rectangular slides.

The wishbone boom is loaded purely in compression, hence strip planking construction is adequate. The boom is connected to the rotating "Y" with a simple hinge joint - much simpler than the conventional gooseneck. A simple multipurchase vang to the end of the boom provides control of sail shape making a traveller unnecessary. The athwartships position of the boom controls the angle of the overall sail chord (and the entire assembly) and the outhaul directly controls the curvature of the sail/headfoil combination.

The gaff peak halliard depends from the peak of the "A" where the mast side spars connect. Unlike a conventional gaff rig this point is aft of the throat of the gaff and so can exert a centering or twist control force. The flexibility of the gaff also provides some "give" to absorb sudden gusts as per Bethwaite.

The mast is raked back, primarily to ensure weathercocking with no sail, even if the headfoil becomes backwinded. As all sail handling is performed on the mast, the unit is free to rotate 360 degrees without impediment. This raises the possibility of reaching directly downwind and also removes any concern regarding jibing. The rig is also completely self-tacking or jibing, and a downwind tack (sails crossing the centerline of the vessel ahead of the mast) is totally feasible. The rig is also partially balanced similar to the Aerorig, so jibing forces are reduced. In this case each mast supports a single sail so efficiency should be improved. A powered winch is provided on each mast primarily for sail hoisting. Outhaul, downhaul and vang controls are also on the mast in addition to reefing controls. The forward mast will be worked from the forward cockpit, the aft from the top of the pilothouse. A small platform complete with integral support struts (also functioning as sissy bars) attached to and rotating with the aft mast is shown (similar in concept but simpler than the mast cockpits on Pete Goss's Team Phillips).

A narrow sail can be hoisted ahead of each sail to function as a leading edge slat. This blade sail rides on a short boom at the base and functions to increase the useable angle of attack in a reaching situation similar to that used on large aircraft for landing/takeoff.

A telescoping prod can be extended forward of the vessel to support an asymmetrical spinnaker or light genoa. This prod can translate/rotate supported by a traveller under the forward crossbeam.

4 Exterior Layout

The vessel features three cockpits. The forward cockpit is adjacent to the forward mast and provides shelter while working the sails on the forward mast.

The aft cockpit provides an area separate from the working of the vessel with convenient access to the aft floats and has full length bench seats for sleeping. Note that the aft section of the port and starboard bench seats hinges down to allow step through access to the steps down to the floats.

The center cockpit is the primary sailing cockpit with the sail mainsheet, spinnaker, and prod controls, engine controls, and rudder and collective controls. The working area is at the aft end of the cockpit and is raised about 7 inches. This gives adequate visibility over the pilothouse and allows the helmsman to sit on the bridge deck between the center and aft cockpits. The area forward of the working section of the center cockpit features full length bench seats port, starboard, and athwartships along the pilothouse bulkhead.

The pilothouse structure continues aft over part of this center cockpit area. This provides shelter and also full standing room exterior to the pilothouse hatch. This area is used as a secondary nav station, with sheltered space for charts and instruments over the port hull outboard of the cockpit. The hatch to the pilothouse is of Dutch Door type to ensure that an errant wave can not flood the pilot house, without requiring the hatch to be completely shut.

5 Interior Layout

The concept behind the interior design of the vessel is to provide an effective single living level with seamless transition between interior and exterior space unlike a conventional sailing vessel. Activities where the concentration is focused elsewhere eg. Office work, TV watching, or sleeping are in the hulls, and a lounge area for cozy social interaction is part way between, 2 steps down from the pilothouse.

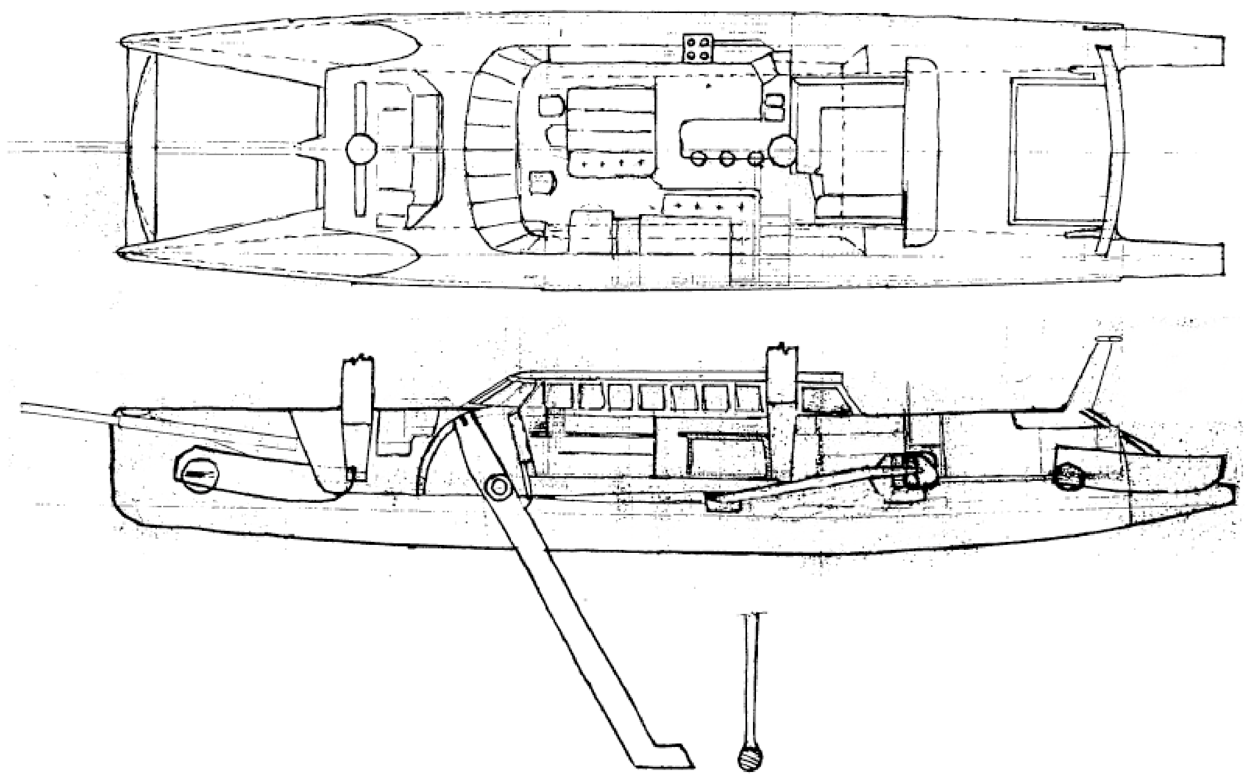
On entry through the pilothouse hatch/door the galley is to starboard with three bar seats providing seating at the central fridge/freezer counter. This provides informal eating/drinking or just chatting with the cook. Immediately to port are the steps down to the aft part of the port hull with a large foul weather locker three steps down. Note that a 6 inch sill surrounds the entry area to limit migration of water inevitably brought in from outside.

The galley is 'U' shaped. The starboard counter area runs out to the hull sides under the deck. The outboard section of this is locker space or a garage for appliances. The galley especially is intimately connected to the center cockpit living space with opening hatches providing a conversational link or a pass through for food.

Forward of the galley is a large dining area raised from the cabin sole to ensure good exterior visibility. Both bench seats are full length for sleeping. The table has folding leaves to improve seat access for other than dining. At the forward end of the table are two individual chairs that can rotate to face either aft for dining, or forward for monitoring progress.

To port at the forward end of the pilothouse is the helm station. To port and slightly aft of this is the nav station and instrumentation. Note that forward of the helm station is a large relatively flat area ideal for spreading out charts etc.

On the port side of the pilothouse aft of the nav station is the lounge area. This area is down two steps from the pilothouse and has full standing room only in the section under the pilothouse structure. Further outboard is seating headroom. A small stove against the hull side provides a cozy focus for this area. Again, full sleeping length is provided on the bench seats in this area.



Lifting the cabin sole in the lounge gives direct access to the engine and drive train just under. A section of the aft seat can also hinge upwards for access.

Each corner of the pilothouse has steps leading to the relevant section of the hull.

The forward staterooms in each hull are virtually identical. One has been shown with a fore/aft double, the other with an athwartships sleeping arrangement. The latter has the advantage of allowing egress without disturbing ones partner…… a definite advantage as one ages. The disadvantage relates to sleeping when the vessel is heeled, although this will be limited. When at sea the lounge seats would most likely be used as sea berths, so this may not be too bad of a problem. Forward of the berth access area is a small dressing space. Forward of that is the head, and shower area. Note that the shower space could be extended forward a couple of feet to give a full size bath/shower. If the extension forward was only the lower 30" of the bulkhead, external access to the forward space containing the forward rudder and some sail storage could still be maintained.

Aft of the forward hull access steps in the starboard hull is a multipurpose room - ships office, TV room, and single stateroom. Part of the space under the dining area is accessible from this office for storage of books or documents.

In the same position in the port hull there is a small single stateroom. The berth in this stateroom extends aft under the forward seat in the lounge area. The closet storage also extends under the seat. The outer door to the closet incorporates a hanging locker, opening this door reveals the rolling storage bin under the seat space.

Exiting the galley down the steps into the starboard hull places one in the pantry area. The washer/dryer unit is also mounted here up under the center cockpit starboard seat. A door back through the bulkhead provides access to the starboard engine room. This space provides full working headroom and reasonable access to the engine and drive train components.

Aft of the pantry area is the head and shower/bath for the aft double stateroom. The port and starboard staterooms are virtually identical with either fore/aft or athwartships double berths. A hatch may be fitted in the aft hull bulkhead of the stateroom which would give a nice view astern provided the floats were not in the raised position.

In the port hull forward of the aft stateroom are a shower and head. It is intended to fit a fold out urinal in the wall of this shower. On the inboard side of the space is a workbench running the full length under the port seat and working area of the center cockpit. Some storage is available under the workbench, but major items and tools are intended to be stored under the sole.

6 Miscellaneous

The primary nav station is forward in the pilothouse beside the inside helm station. If captive winches were used for the mainsheets the vessel could be largely operated from this position.

The forward cockpit may be fitted with an insulated fiberglass liner allowing use as a hot spa. The water would be heated by the small genset cooling system. Both the aft and center cockpits have storage under the sole. The center cockpit also has storage under the starboard seat and athwartships seat. Some of the under-sole storage is used by the raised propeller/rudder assembly and the raised keel.

The anchors are deployed from the center bow in an effort to keep the weight back from the bow. The anchor rode/chain is bridled to a relatively low point on each of the main hulls. Chain for two anchors will be stored low in each of the hulls under the head in the forward staterooms.

Major bulkheads are located:

1. Just aft of the forward mast
2. At the forward end of the pilothouse
3. At the aft end of the pilot house
4. The forward end of the aft staterooms

These bulkheads extend across the full width of the vessel and are good candidates for watertight doors.

Non full width bulkheads are located to further brace the forward mast, and also at the forward end of the engine spaces. Note that the engine spaces are constructed of aluminum, with a suitable fire retardant noise barrier.

7 Specifications

Displacement: Light ship: 42,000 lb.
Design: 50,000 lb.
Full load: 55,000 lb.
LOA: 70' (77')
DWL: 69.5' (76.5')
Beam: 19'
Hull Beam: 4'
Draft (Canoe): 2.5'
Draft (Power): 4'
Draft (Sail): 8.3'
Max Draft: 23'
Bridge Deck Clearance 2.5'
Ballast: 6500 lb. effective
RM Max: 325,000 lb ft @ 50,000 lb430,000 lb ft with water maximum ballast
360,000 lb ft @ 55,000 lb465,000 lb ft with water maximum ballast
RM (90 deg.): >140,000 lb ft
Sail Area: 3000 sq ft
WS Area: 840 sq ft (no appendages, 77')
D/L: 65 (49)
SA/WS: 3.57
SA/D: 35

8 Summary

The objective of the design was a fast motor sailor. The narrow hulls coupled with the length of the vessel ensure that the vessel will be easily driven. Adequate efficient sail area, a high righting moment and a good complement of horses along with a D/L around 50 will yield good performance in either regime.

Without the masts the vessel would be an attractive motor vessel. Of course under these conditions the four rudders would not be required, nor would there be any advantage to pivoting the props out of the water except draft.

The seamless interior/exterior living space and limited heel appeals to the spousal unit, and also has advantages when it comes to comfortable watch keeping. In the northwest the shelter can be particularly attractive. Shallow draft provides big advantages in access and anchoring.

The masts could be rigged to be lowered relatively easily which could be advantageous on inland waterways. Although the sail area is relatively large, the mast and boom design minimize the effort involved, given that each mast supports a powered winch for the halyards.

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Ergonomically-Correct Oars

Robert Fraser

Having developed and made many examples of an ergonomically correct kayak paddle; I was approached by the coach of a local rowing club about being able to apply the handle arrangement to a sculling oar. The apparent disadvantage was that it would be impossible to feather the blade on the return stroke. To remedy this shortfall I designed and built a self-feathering blade arrangement, which is my innovative contribution to the John Hogg Prize competition.

Most oar and paddle handles have a one-piece handle that is grasped by one or two hands so that when the handle is in front of the operators body the hands can be considered to be horizontally placed. When making a stroke with the oar/paddle it is necessary that the operator's wrists flex in a manner that is not entirely natural to the construction of the joints of the wrists. Many rowers/paddlers like to be able to rotate their blade as much as 90 degrees from the vertical position on the return portion of a paddling/rowing cycle so that the blade of the oar/paddle does not obstruct as much air. This feathering action becomes more necessary in competition where the speeds are greater. In order to rotate a handle to obtain the feathering action with a kayak paddle one of the operators hands has to release its' grip on the handle and the other hand has to rotate the paddle handle; with an oar both hands are used to twist the oar handle/s. These actions put further strain and fatigue on an operators wrists and do not allow a full embodiment of the operators physical resources to the pulling and pushing of the oar or paddle.

An improvement to an oar/paddle handle is to incorporate a split shaft handle that has individual handgrips placed between the upper and lower portions of the handle which allow the hands and wrists to operate in a more ergonomically correct manner than with a single shaft handle. With this split shaft handle arrangement it is not possible to rotate the handle of an oar/paddle in order to feather the blade on the return stroke. The use of a self-feathering blade on an oar/paddle eliminates this deficiency. The benefit of this innovation is that it allows the rower/paddler to use the more ergonomically correct hand arrangement while still maintaining the advantages of a feathered blade.

The Innovation: Reference figures

#1 – Oar to be used as part of a set by one operator

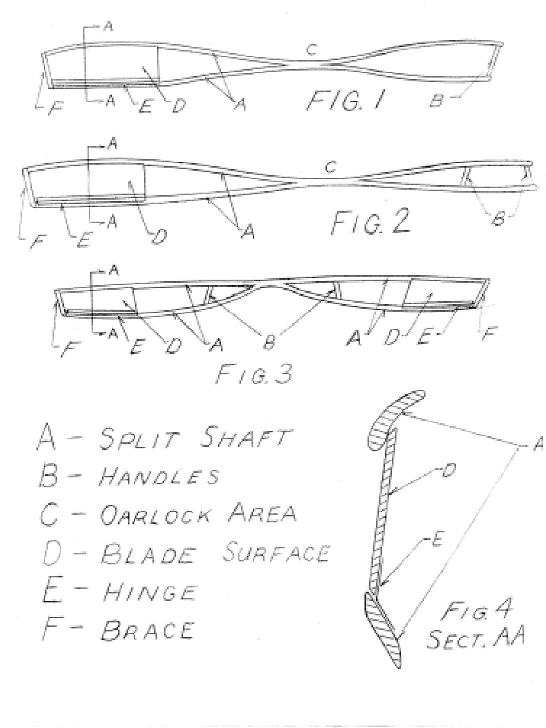
#2 – Oar to be used singly by an operator

#3 – Kayak paddle to be used by one operator

#4 – Cross section of the blade of the above

The hinged blade: the blade has upper and lower shaft portions (A) which have the rigid structure necessary to transmit forces back to an oar lock or paddler without bending or breaking. The ends of the split shaft portions are secured together in a rigid

SELF-FEATHERING OARS & PADDLE



alignment by a brace (F). The majority of the blade surface is made up of a flat piece of material (D) secured by a hinge (E) to the lower element of the framework. The arrangement, as seen in cross section in figure #4 allows the center blade section (D) to fall backward on the return portion in the cycle of a stroke and thus be less resistant to the passage of the blade through the air.

Sequence of the cycle of a paddle/ rowing stroke: as a blade is lowered into the water at the start of the power portion of a stroke the water pushes the center blade section (D) up and forward against the framework (A) of the blade. The blade is then a closed, cup shaped section which resists the movement of the blade structure through the water. The blade surface is held closed to the framework by water pressure during the power stroke. At the end of the power portion of the stroke cycle the blade is raised out of the water; at the start of the return portion of the stroke the action of the blade passing through the air will cause the blade surface (D) to fall backward (the feathered position) minimizing the resistance of the passage of the blade through air. This is repeated on each full cycle of a paddle or oar stroke without the operator having to twist or turn the handle of the oar or paddle as has traditionally been done to feather the blade.

The development of these oars and paddles proceeded quickly with prototypes being made out of laminated wood and plywood. One kayak paddle constructed for leisurely paddling proved to be rather noisy; two paddles constructed more on a racing style with a different hinge structure than outlined worked well but have been found to catch the water before closing on occassion.

The first hinges were of a poly vinyl chloride material which proved quite satisfactory and have not broken down. Later hinges have been made out of 1/4” stainless steel rod set into machined nylon sockets with the blades fastened to the rods using fiberglass and epoxy.

The first prototype oar made was 10’ long. This was shown to two rowing clubs and then a set of four 12’ oars were made in order to be tried on a boat. The major problem with them was that it was difficult to lift the blades clear of the water on the return stroke. The rowers like them in that they can obtain a more powerful stroke because of the handle arrangement.

The next set made was two oars to be used by a single operator. The split shaft handle was not used on these two because on a racing single a rower crosses their hands on the return stroke and the split shaft handles would be too high to accomplish this. The rowers found **it** more diffucult to maintain their balnce with these oars than with standard oars due to not being able to skim the water as easily on the return stroke.

As of the end of September (01) six oars were still being evaluated by the Halifax Rowing Club.

I have been granted a Canadian ‘Patent Applied For’ number (#2,337,299) for this invention.

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An Aphoristic Article

Or Miscellaneous Musings on Many Matters

Frank Bailey

The following is a selection of miscellaneous thought brought about mostly by rummaging through some old AYRS Journals and Newsletters. I am not sure what the intent is but perhaps it is to stimulate our readers to comment and perhaps write an article or two themselves on something. So without further ado as they say, let us start.

AYRS Publication No. 1, distributed in 1955, states the following objectives of the Society. (They have been shortened here and there.)

1. To make full sized and reduced size models of all types of outrigger craft to see if a cheap, fast, sailing craft could be produced for yachtsmen.
2. To make hydrofoil craft to achieve the greatest possible speed.
3. To produce a safe, comfortable, fast and cheap cruising boat.
4. To experiment with sails, rigs, and aerofoils.
5. To examine new developments in yachting.
6. To build up a pool of technical information.
7. To produce publications.

I would say that in general all of these objectives have been achieved with perhaps the exception of No. 3. Also, emphasis has been placed on speed and economy. I am not sure if economy can ever be attained with boats so we should dump that one. As they say in Hindustani "Shabash (Bravo) for the Society!"

In the May 1997 newsletter the following future projects were listed. (Again, objectives shortened here and there.)

1. Tilting rigs.
2. Hiking Aids.
3. Add-on planning surfaces under sterns.
4. Add-on anti-dive planes @ bow.
5. Multihull righting systems.
6. Multihull anti-capsize devices.
7. Automatic water-driven sail trim devices.
8. Triscaphs and quad-scaphs, hulls/boards/rigs at the corners of triangular or parallelogram frames.
9. Kite rigs.
10. Underwater kites.
11. Why do more men sail than women? (Skiing is split equally, say.)
12. Wave powered craft. Whale tails, etc. (How about the Batoidea?)
13. Rotors instead of foils in air or water.
14. Continual development of practical hydrofoil craft.

I would say that all of the above are alive and well except No. 11. No comment on that one. It might be politically incorrect. No. 13 infers that rotors, not wheels, in water are a possibility. I do not believe I have seen anything on this. However, the International Hydrofoil Society has shown on their website a vehicle with four horizontal rotors supporting and powering a hull (I think).

Here is something from the masthead of your Catalysts. It is a list of items that have specialist correspondents.

Aerodynamics.
Electronics.
Human and Solar Power.
Hydrofoils. Instrumentation.
Iceboats and Landyachts.
Kites.
Multihulls.
Speed Trials.
Steam Power.
Structures.
Windmills and Turbines.

What a broad and vast array of interesting subjects. Can you contribute to any of these items?

So, so far, what is the point of this? The point is we have loads of things to do so let's get cracking. Let's all start pitching in, for Pete's sake. There's something here for everybody.

And now for some miscellaneous ramblings.

Acceleration. We always seem to examine sailboats at some constant speed, that is, during some steady state condition. In small one design racing, the boat is continually accelerating and decelerating. Is there any point in examining the "mechanism" of accelerating and decelerating to see if something can be done to minimize the slow down periods and maximize the speed up periods? I have never seen this addressed. Is it because the acceleration is basically a mass problem which there is no way to alter? Why not take on water ballast at speed and dump it if a lull in windspeed is coming? Will the racing rules allow this? Is there an advantage here?

Viscosity. The viscosity of water changes with temperature. Between 50° and 80° F., it changes about 34%. Thus, there is a change in the Reynolds number. Thus, there may be a change in the drag coefficient. So, in comparing one design race against another, should we be recording the temperature also?

Angle of Attack. Let us assume that the following statement is correct: Depending on the leeway angle and the angle of heel of the sailboat, the angle of attack of the (non-jibing) centerboard will change. Is this change worth further study? Is it a significant change?

The International Moth. Catalyst No. 2 had a very interesting article on the Int. Moth on foils. I know very little about the Moth and will show some ignorance here. Every once in a while I get an urge to sail one of those things but due to applied palliatives, the urge passes. There are several web sites devoted to the Moth. The main thing I think you have to remember is that there is the classical Moth of ancient design and little change and then there is the development class where anything goes, almost, and now it has foils attached with some success (See Catalyst No. 2.) In regard to this group, it would be extremely interesting as a member of the AYRS if someone would write an article starting at the appropriate time period and reviewing the significant design changes that have resulted in the present developmental Moth. What changes were successful and what were not so successful and abandoned. Have these boats been able to increase their speed over the years due to these changes or are they still hobbled by the V root L thing. It appears the Int. Moth is "big" in Terra Novalis. How "big" is it in the U.S. or in your country?

Deceased One Designs. While browsing the stacks in a local library, I ran into a book: "A Field Guide to Sailboats" by Richard M. Sherwood. 1984, published by Houghton and Mifflin Co. There may be more up to date books on the subject. This one is 34 years old. Glancing through the pages, one is immediately struck by how many small one-design boats are no longer in production. On the other hand, one can also recognize some that are still around and thriving in various sailing organizations. Would it be worth while to make a study of these boats and see if there is some feature aside from luck, the economy, individuals, organizations, factor X, which makes a design long lived? Two designs in particular I am familiar with. The Butterfly and the Peanut (not included in the booked mentioned above). The Butterfly to the best of my knowledge is no longer in production. It was a 12 foot fiberglass scow with mainsail only and was an attempt to emulate the hull form and performance of the famous and larger M Scow needing a crew and the MC Scow which was singlehanded. The Butterfly was smaller than the MC. It was a great little boat and could be car topped. It gave one quite a thrill to heel it to about 40° and minimize the wetted surface. But it is gone. The Peanut was homebuilt of ¼" ply and nine foot long with mainsail only. It had quite a following at one time and there was an annual gathering and race for championship. It was designed by one Johnson as I recall. Being only nine feet long, it got up to hull speed quite quickly and was extremely hazardous for an amateur sailor to try and make a successful jibe. Sitting on the gunwale in a blow made one extremely tense. It was a great little boat to learn to sail in if you didn't mind getting wet and you didn't need to look around for a crew member. Why have these boats disappeared? Why do "new" ones keep appearing with similar characteristics of previous ones?

How to Design a Small Boat From Scratch. Let's say you are trying to put together a fast 12 foot singlehander or something similar, not a large cruising cat or tri or single hull type. Where do you start? After making some preliminary drawings and calculations, I would suggest you pull out if possible all of the old AYRS journals and yes, the newsletters and go through them, one by one, searching. In many of these old issues, both journals and newsletters, there are described many different aspects of design. If you have available an index to the journals, that is of course a great help. Unfortunately, the newsletters have not been indexed. I submit that, and perhaps it is self evident to say, attention to detail will contribute but not necessarily guarantee, a successful design.

The Vortex Generator. In Publication 95 (1982), page 18, was described a vortex generator by Paul J van Deenan. It was a plate-like device attached to shallow keels to make the boat point better. A description also appeared in Publication 83B and perhaps a June 1981 newsletter and perhaps in other places. "Vortices" also appears in the AYRS.Index. Has this device disappeared from use or has it re-appeared in the form of wing keels. Does it really work?

From an AYRS brochure circa 1984. A quotation: "From a letter in a recent copy of Nautical Quarterly, HRH, The Prince Philip Duke of Edinburgh, wrote, "The great value of the AYRS is that it provides an essential communication link between pioneers – between people who are never entirely satisfied with what is and always looking for what might be.""

Kites and Whirling Things. There have been many interesting articles in the newsletters and journals. This may appear to you as a tautology of the propositional calculus. On the late night television, one might see some 1930's motion pictures resurrected. One such abomination included in the plot an autogiro type aircraft, popular during that time period. Is it possible that that configuration, small wings, powered propeller, unpowered rotors similar to the present day helicopter, could be adapted without the powered propeller to kite type propulsion? In the gyro, what proportion of the lift was assigned to either the rotors or the wings? What was the advantage if any to the combination? Why not use just the rotors suitably stabilized or just the wings? Is the "wing" kite far superior to these other lift devices?

Amateur? In Publication No. 43, 1962, page 7, there is an interesting letter from one Lloyd Lamble on the use or misuse of the word "amateur" in the name of our Society plus a comment from the then editor, John Morwood. Dr. Morwood points out that most innovations and advances in yacht research come from "amateurs". For about $25 in the U.S., one can obtain a vanity motor vehicle license plate. Would not "AYRS" be a good one to have on the front or rear of your vehicle or both?

Urgent Yacht Research. In Publication 62, there is an article by John Morwood titled: "The Urgent Yacht Research – Hull and Sail Drag Angles". He says: "…the least possible drag angle (of the hull) should be known." I assume by now we know what this angle is in relation to hull form.

Progress Since 1967. In the year 1967, 35 years ago, Publication 64 stated that the following things had not yet been accomplished: The Flying Sailing Hydrofoil; The Foil Stabilized Narrow Hull; Bendy rig in ice yacht to take out twist. All of these things have been accomplished. Why does it take so long though? (Dr. Morwood was experimenting with his Kinnegoe Cruiser at a place called "Pluck's Gutter"!)

The 12 Pound Anchor. I cannot resist an anecdote from our illustrious Michael Ellison from a June 1983 newsletter. He abjures the owners of those boats with smaller than necessary anchors in an anchorage with gusts reaching 35 knots: "Would you sleep (in your yacht) if the yacht ahead of you had a 12 pound anchor?"

A Quote from Rad. AYRS member V Radhakrishnan wrote an interesting paper titled Locomotion: Dealing with Friction, published in "Current Science" Vol. 74 No. 10, 25 May 1998. I quote: "….catamaran. This is a strange corruption of the Tamil word *kattumaram* which literally means and refers to a craft made of a few tapered logs tied together and widely used by fishermen on the coast of South India." I recommend the paper to you if you have not come across it. I assume you all knew the derivation of the word "catamaran" or care. Yes, some advances in catamaran design have been made.

A Thank You. Thanks to member John Ponsonby for pointing out a decimal error in the square foot cost of a solar panel (Catalyst No. 6). Thanks to Rad (from the previous paragraph) for informing me that there is indeed rotary motion in the animal kingdom. He mentions G I Taylor and his work with minute flagellum and swimming bacterium published in a Journal of the Royal Society. Perhaps the papers of G I Taylor are worth investigating further.

Windsocks. Publication No. 64, 1967 has a picture of an AYRS. Windsock offered for sale. The sock is of tubular fabric. The length is about 2 ½ times the diameter. Is this the best design for a windsock? Should it be tapered a bit downwind? If it should be tapered, how much taper is best?

The Savaronius Rotor ??? Publication 87, 1977, discussed the "Savaronius" Rotor. Without going into much detail here (It is endless.), a plan view of this "windmill" type thing would be two semicircles attached on a circumference like an "S". The vertical dimension could be some multiple of the sum of the two diameters or the total width of the "S". It could be used to generate power from the wind or it could be used to drive through gearing a land yacht. (Dr. Morwood thought it impossible for boat use.) Dr. Morwood was also uncertain of the spelling. He was right. The above spelling is wrong. It should be "Savonius". One of the intents of this paper you are reading now was to describe a variation to the one shown in the publications mentioned above. However, plugging "Savaronius" into my web search engine turned up 1470 items on the Savonius rotor, SAVONIUS being the proper spelling. What I had in mind has sort of already been done. The moral of the story: Perhaps if you think you have a new idea, you had better check it out with a search engine on the World Wide Web. As mentioned above, the data on this item is almost endless. It apparently was invented as far back as 1949 or before by one O Y Savonius who in 1949 had a company in Helsinki. In this explosion of information we are all experiencing, I do not doubt that one individual could spend endless hours researching information available on the web of interest to AYRS members. It is mind-boggling. How do we cope with this? Are we re-inventing the wheel inadvertently?

With this last paragraph, a dark cloud of confusion has descended on my mind and I am suddenly greatly fatigued. I am sure we have not even seen yet the great impact that the World Wide Web will have on our search for information. How do we collect and archive the gold and discard the dross? I think I will seek refuge at the Toad Hill Boat Shop and finish up the new fuel filter whose internal element is wadded up cotton!

Frank Bailey
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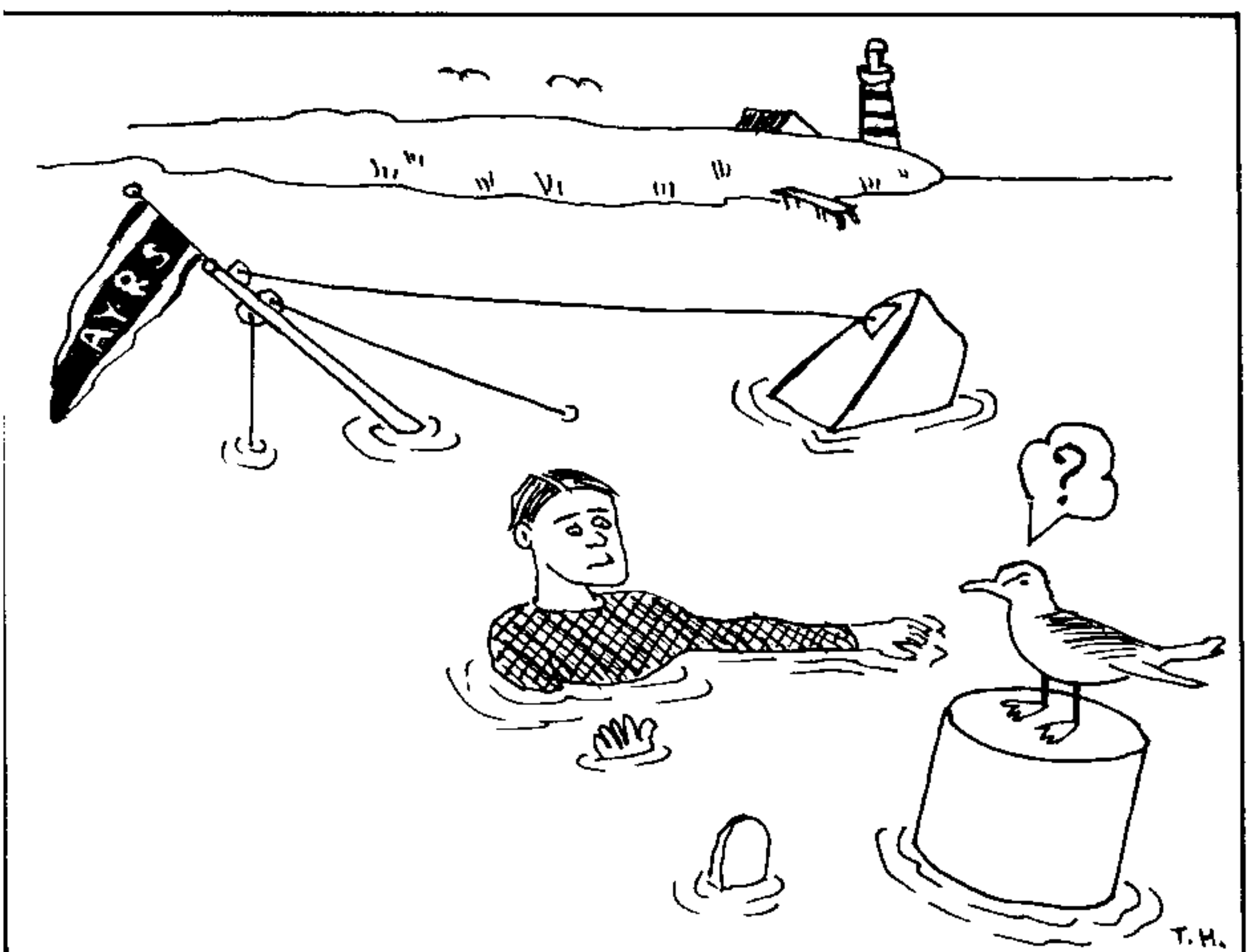

Well, It looked good on the drawing board.

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@fishwick.demon.co.uk**

August

Winds of Change is cancelled.

September

28th (to 4th October)
Weymouth Speed Week
Portland Harbour, UK. For entry details etc contact: Nick Povey tel:+44 (1342) 825292; email: nick@speedsailing.com

October

2nd **AYRS Weymouth meeting** ***Speedsailing***. 19.30 for 20.00hrs at the Royal Dorset Yacht Club, Upper Mall, Weymouth. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX; tel: +44 (1727) 862 268; email: ayrs@fishwick.demon.co.uk

November

5th **AYRS London meeting** on ***Windmills and Gyroboats*** 19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX, UK; tel: +44 (1727) 862 268; email: ayrs@fishwick.demon.co.uk

December

3rd **AYRS London meeting** on ***Landsailing*** 19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX, UK; tel: +44 (1727) 862 268; email: ayrs@fishwick.demon.co.uk

4th-6th **High Performance Yacht Design 2002** - Conference at the University of Auckland School of Engineering, Auckland, New Zealand. hosted by the University of Auckland, Massey University and the Royal Institution of Naval Architects. Details from RINA High Performance Yacht Design 2002, Private Bag 102904, NSMC Auckland, New Zealand; Tel: +64-9-4439799 ext: 9560; Fax: +64-9-414081; http://www.hpyacht.org.nz

January 2003

2nd - 12th **London International Boat Show (dates subject to change!)**
Earls Court Exhibition Hall. Those who can give a day or two, from 15th December onwards, to help build/staff the AYRS stand (**reward - free entry**!) should contact Sheila Fishwick
tel: +44 (1727) 862 268; email: ayrs@fishwick.demon.co.uk

11th **AYRS Annual General Meeting**
19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX; tel: +44 (1727) 862 268; email: ayrs@fishwick.demon.co.uk

Stop Press: Congratulations to Joddy Chapman who has been awarded his PhD by Exeter University. Joddy's thesis - "Sail Shape and Sailing Performance Measurement" was sponsored by the Junk Rig Association, and we believe CD copies are available from the JRA at 373 Hunts Pond Road, Titchfield Common, Fareham Hants PO14 4PB, UK.

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

On the Horizon . . .

Testing faster than the wind sailing
Notes on sailing hydrofoils
More sources and resources: reviews, publications and Internet sites

plus

What have *you* been doing this Summer?
Write and tell us!

Amateur Yacht Research Society
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