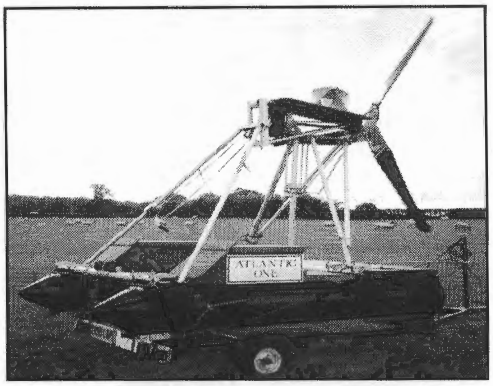
Catalyst

Journal of the Amateur Yacht Research Society

Number 27 April 2007

Features

Regulars



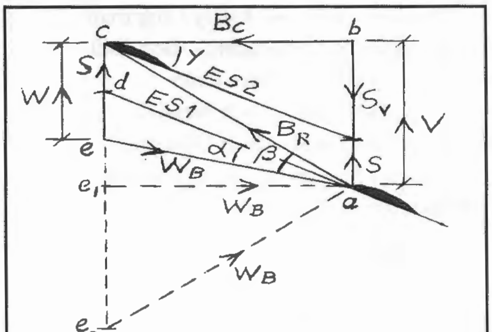
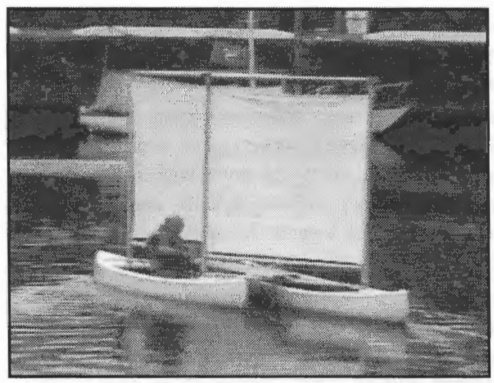
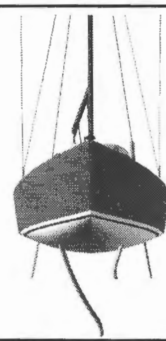
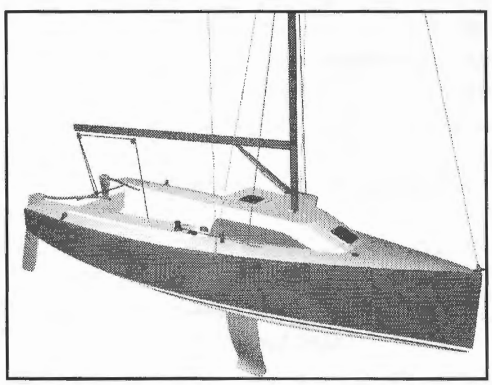


Figure 2



Cover shows a rendering of the SY-X24 novel lifting keel design. See page 19





Catalyst

Journal of the
Amateur Yacht Research Society

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Catalyst

Here we go again — apologies again for my delays, too much work (good in some ways, but bad in others!).

This issue will hopefully provoke, so feel free to respond.

You can delve again into the pros and cons of the DDWFTTW controversy, and consider the possibility of racing windward/leeward faster than the wind.

You can follow Slade's foray into national levels of wind generation of electricity; a well-thought-out plan that he has written up for us.

We have a novel square rig style of catamaran that has fascinating aspects of control and operation; a novel keel system for yachts, a novel righting system for multihulls.

Kites are looked at, and we have a summary of yachts with canting keels.

Because I had a couple of pages free, I've raised a few questions that I hope will generate some answers.

Please write for Catalyst with any projects under way or in response to thought from here. Good luck and good researching.

Percy Westwood, Catalyst Editor

From Mike Allison

A Radical New Hull Surface

I have an idea on a radical new hull surface.

I accept the risk of going public with an original idea and losing all patent rights. I am too humble to think I actually have a valid design, and something that hasn't been done. Simply put, I figure to dimple the hull of a boat, like a golf ball, to help it travel faster.

The physics behind the golf ball travelling faster than a smooth ball because of the turbulence the dimpled surface makes, seemed easy and logical to me. To perfect the ball in golf they tried to make it smoother. The same approach all boat designers have come to in hull shape. Basically if a dimpled golf ball travels better, why not a dimpled hull on a yacht?

With limited access and meagre budget I attempted to research my idea. The only solid information on validating my design was an advertisement for windsurfer boards with a dimpled bottom. The advertisement said 'it makes the board looser and has better *let go*'. This doesn't imply it goes faster, but is more sloppy in the water, and *let go* references it can release off the water easier, and might have less adhesion with the water.

This obviously has given me confidence in my design and motivated me to write this article.

My goal is simple, to see how this idea would be received by the sailing community. I want to hear judgements, tests, discussions, and/or positive feedback. Just as your magazine is named I want to be a catalyst.

Michael Allison
190325, P O Box 3300, Florance, AZ 85232, USA

From Ian Clarke

Slade's Plan

Ref: Slade's Plan — Could he be wasting his time? Or have I missed the point?

13 m pontoons would need to be spaced at least 2 lengths apart, for swinging room = 40 m per float.

20,000×40/1000 km = 800 km = 500 miles = a curtain of obstacles from Dover to Dundee.

Ian Clarke, Ivy Cottage, 53 Castle Street, Nether Stowey, Bridgewater TA5 1LW

From G M Whittaker

DDWFTTW

The concept of a rotorcraft being able to sail directly down wind faster than the true wind (DDWFTTW) is stunningly illustrated by Jack Goodman's video. It is an interesting, thought provoking and valuable educational exercise, being incredible to the layman, and is great for promoting AYRS via the internet. Web searches show comments about this on numerous blogs etc, and I am glad to see that AYRS website features it prominently. This would be worth following up e.g. with links to authoritative articles etc.

May I suggest that the AYRS website should publish a well thought out layman's summary, and a caution? I submit the following for consideration:

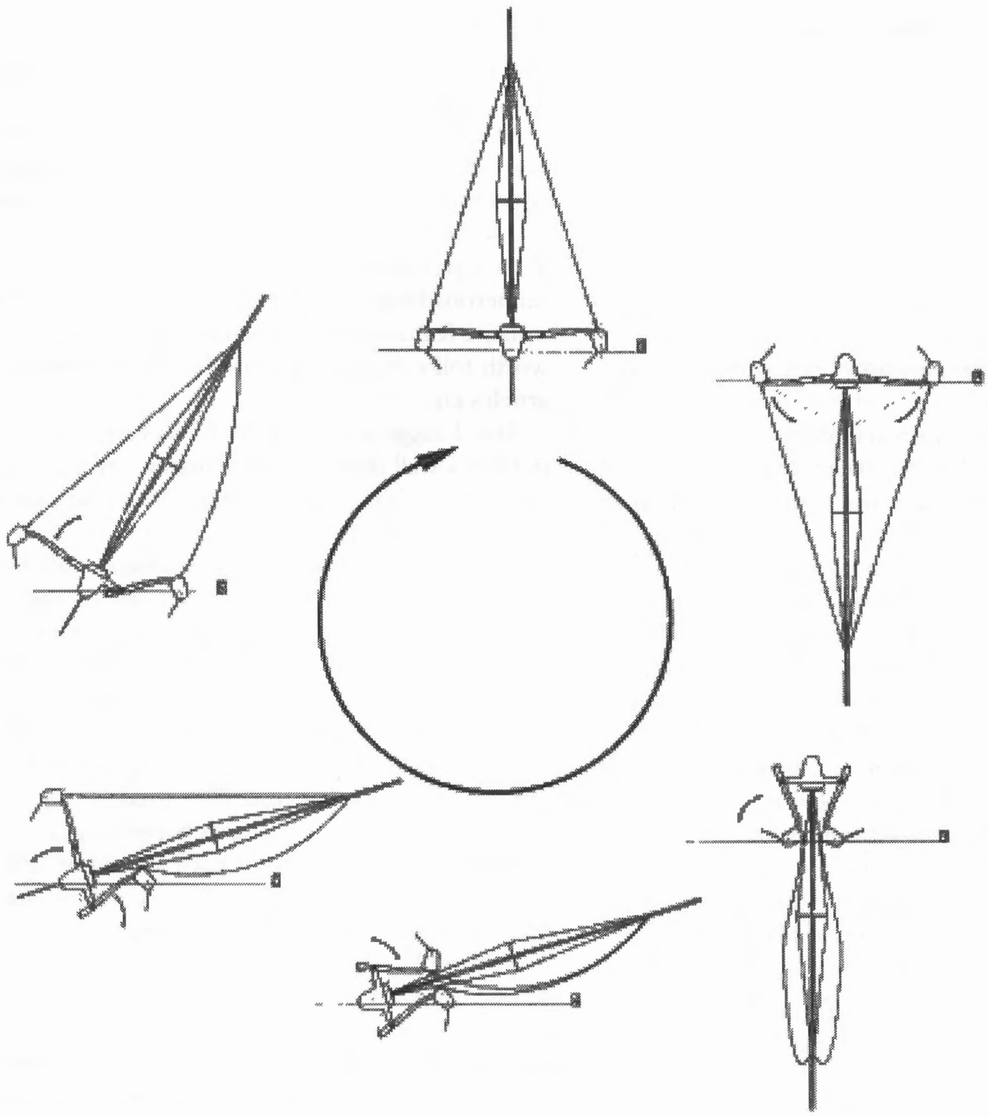
Layman's Summary

In suitable conditions, high performance sailcraft such as 18ft skiffs, land yachts , ice yachts and iceboats routinely tack downwind to reach the leeward mark significantly before the air they sailed through when leaving the windward mark. They have downwind V_{MG}s faster than the true wind. (The concepts of down wind V_{MG}, apparent wind etc, need to be explained & illustrated.)

Without understanding what is happening, it is counterintuitive that a rotor craft should be able to 'sail' DDWFTTW. However, since conventional craft (with fixed wings and fixed foils) can tack downwind FTTW without infringing the laws of physics by giving their sails, foils, and hulls an across-wind velocity component, it is therefore reasonable that a rotor craft (with its rotary wings and rotary foils that have an across wind velocity component) should also be able to sail DDWFTTW without giving its hull an across wind velocity component. The rotor craft's 'rotary wings' and 'rotary foils' have high air/water speeds as do the sails and foils of the skiff etc.

What really happens when a rotor craft sails directly down wind?

- When the craft is stationary and at low speeds, power is transmitted from the rotor (airscrew) to the water screw/wheels.
- When the craft approaches true wind speed, the apparent wind is close to zero. Small wind shifts result in big changes in the apparent wind as indicated by the pennant. Power is transmitted from the water screw/wheels to the rotor.



The 'Exploder' self-righting concept, from the website, as noted by Peter Lillywhite. Start from 'two o'clock' fully inverted, then clockwise shows the process to right the vessel.
See letter opposite

- There will therefore be an intermediate speed at which the no power is transmitted between the rotor and the water screw/wheels. All the power comes from aerodynamic drag of the rotor.
- This indicates the advantage of variable pitch air/water screws and/or variable speed transmissions, and the difficulty of making a rotor craft that is self starting.
- Rotor craft designed for DDWFTTW only operate within a very small range of true wind angles and wind speeds. Any significant deviation from DDW, or reduction in wind speed and it slows markedly or stops. A gust could crash it, as could the gyroscopic forces generated in a sharp turn.
- Conventional sailcraft tacking down wind have no such problems if sailed properly.

Caution

Whereas it is possible to demonstrate DDWFTTW using experimental land craft, it is important to realise that mathematical analysis shows that rotor craft will never be able to approach the performance of state-of-the-art conventional sailcraft around any practical course, in various wind speeds, and are always likely to be dangerous and impractical.

By all means have fun experimenting, but there are probably more useful topics to pursue.

G M Whittaker, gmwhittaker@iee.org

Exploder in trailable form, from the website, see letter from Peter Lillywhite, below

From Peter Lillywhite
Self-righting Multihull?

I seem to recall from a number of years ago a thread exploring a mini-multi capable of offshore racing on a budget. The concept appears to be alive with a new design from Poland. Details on:— http://www.exploder.info They have a novel (?) approach to self-righting that would be interesting to see demonstrated at sea *[diagram opposite, and photo above, Ed]*.

Peter Lillywhite, azuli1@nildram.co.uk

From D. Griffin
DDWFTTW

As a new member, I feel somewhat embarrassed at being critical of my first copy of Catalyst. However, I have to express some disappointment that a disproportionate amount of the newsletter was dedicated to wind-power's equivalent to the 'perpetual motion machine'. Regardless of whether the experiments (purporting to demonstrate so-called DDWFTTW phenomena) appear convincing or not, readers of non-scientific training will believe that it can be nothing more than an illusion. If the experimenters are convinced themselves that they are witnessing DDWFTTW then the mystery is simply where the necessary motive energy is coming from — because it cannot possibly be derived from the air stream. To unravel the mystery, all of the following must be independently checked/
demonstrated:-

1. The running surface is absolutely level

2. The wind direction is truly in the direction of vehicle travel, as evidenced by multiple stationary wind indicators

3. There is no traction cord that might be invisible to the camera

4. The air-screw and wheels are cannot be driven by anything other than the wind

5. The phenomenon can be sustained (i.e. it is not the transient result of kinetic energy)

I am confident that a closer examination would reveal contravention of at least one of the above, because, as wind-power engineers (and logisticians) will be aware, the energy extracted from the wind is derived from relative velocity between wind and generator.

With the first 4 of the above criteria met, the only way in which the apparently observed effect can legitimately (and briefly) be obtained, is if the vehicle is accelerated by a powerful gust, which then rapidly dies away, leaving the craft free-wheeling into an apparent head-wind. In such a case, because the rotor is necessarily connected to the drive wheels, the stored (kinetic) energy will be in the entire craft, and the rotor, although acting as a brake, will continue to turn without wind behind it. The power generated by a rotor of the type apparently shown, is proportional to the cube of the apparent wind. It will be obvious that when the apparent wind is zero, so is the power output. Although obvious, it is worth stating that, in travelling even at the same velocity as the wind, the velocity upstream of the rotor would be the same as the velocity downstream, so the rotor would experience zero apparent wind, and could therefore extract no further energy. This is also an explanation of why it is not even possible to travel at the exact wind velocity in this direction when friction forces are at work. Perhaps the acronym should stand for Dead Downhill, Faster Than The Wind?

I suppose it just goes to show that there is nothing like a controversy for attracting attention and motivating discussion. Maybe it also shows that innovations in other quarters are currently less than exciting?

D. Griffin
6 Little Orchard Way, Salford, Surrey GU4 BY

From Jack Goodman
DDWFTTW

To exceed windspeed in any direction, one only needs to make a vehicle that requires less energy to move it than is available. At 10 knots in 10 knots of wind, down wind, there is no apparent wind, however the wheels are rolling at 10 knots and supply the energy to turn the fan to blow the air backwards.

If I had known there was going to be this much interest, I would have made a better movie.

All that is required is for the system to have a lift to drag ratio of greater than 1 to 1. On land, the only wind drag on the vehicle is the fan, the rolling and mechanical losses are minimal. Going DDFTTW requires less energy than any other direction.

To help visualize the problem, remember: the wheels drive the fan, and the blades are not going dead down wind, they are on one long circular reach.

The car I made is geared for dead down wind and is fastest in that direction. Anyone who has seen it sailing will verify it is not a marginal sailor and that it goes well over wind speed in 10 knots.

If I had known there was going to be this much interest, I would have made a better movie.

Jack Goodman, imaginationltd@aol.com

To remind those new to this subject, and anyone who has not yet seen the video, it is on *adobe*, and can be found by searching for:—

sailing and DDFTTW.

or with the direct link:—

http://www.youtube.com/watch?v=aJpdWHFqHm0

A Proposed Offshore Wind Power System Using Small Floating Generators

Slade Penoyre

This project is not strictly yacht research, but it does involve extracting power from the wind using small seaworthy boats, so I feel the problems are similar. At present it is being done by Fred Ball and myself, and we would of course welcome advice and offers of practical help from other AYRS members. The aim is to develop an offshore wind power system which we think should be much cheaper to set up and maintain than the very expensive ones being installed now. Our idea is to use small windmill generators on moored catamarans rather than huge generators on columns driven into the seabed.

The Catamaran Concept

The catamarans would probably be about 12 metres long by 12 metres wide, and would be made easily demountable to fit into a standard shipping container for road or sea transport. Each would carry a fixed windmill generator with a diameter of about 9 or 10 metres, so the catamaran could lie alongside a dock wall or ship without damaging the rotor. The commercially available Proven WT 15000, 9 metre diameter wind turbine appears very suitable and is rated at 15 kW in a wind speed of 12 m/s (26 mph, 23 knot, Beaufort Force 6).

The Fleet of Catamarans

The eventual aim would be to have a huge number of these very simple floating catamaran/windmill units moored out at sea, built by an industry on the scale of the present car one, i.e. about 2 million new cars per year for UK and about 25 million vehicles on our roads. With an expected life of 10 years for each floating generator a build rate of 2 million per year would allow a fleet size of 20 million to be reached and maintained, with a rated generating capacity of 15 kW × 20 million = 300 million kW or 300 gigawatts (GW).

Providing UK Electrical Power

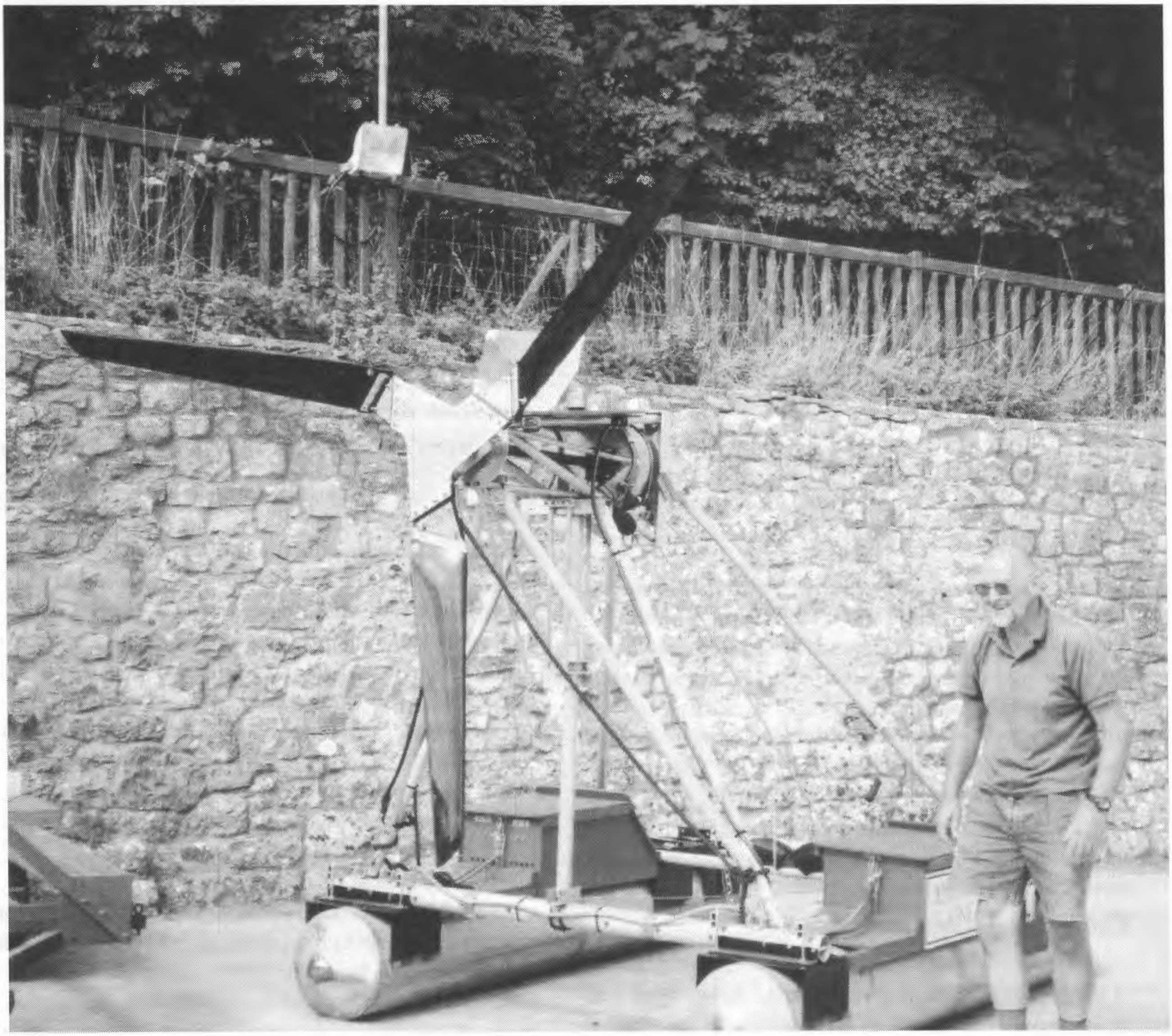
Proven's Specification Sheet gives an annual output range of 23,000 to 48,500 kWh for this machine, so a realistic figure may be about the middle of this range, 36,000 kWh/year. The fleet of 20 million would thus give 20 million × 36,000 = 720,000 million kWh/year, i.e. 720 terawatt-hours/year (TWh/yr). The current UK electricity requirement is about 350 TWh/yr, so this suggested fleet size would meet over twice our present needs, especially as some non-wind generating capacity must be retained to deal with calms. However our needs are steadily increasing, and any spare electricity could be exported by underwater cable to mainland Europe or used on shore to produce hydrogen and oxygen from water by electrolysis. These gases could then be liquified and stored for later use in calms to generate electricity in fuel cells. Alternatively the oxygen could be sold for industrial or medical use and the hydrogen could be added to (and eventually replace) natural gas in the UK's existing gas supply system, perhaps after conversion into methane by reacting it with CO_2 extracted from the atmosphere. This would allow our present gas-fuelled grid generators to be used to make up any shortfall from the wind turbine electrical output. It could also lead in the future to hydrogen made by electrolysis of water using electricity from a much larger fleet of floating wind generators gradually taking over the industrial and domestic heating loads now met by oil and natural gas, further greatly reducing the country's CO_2 emissions.

UK Transport Power

In the still longer term, the windmill generator fleet could be expanded to provide the energy needed for road and air transport also, though the cheapest way of doing this will depend on progress made in other engineering research areas. For road vehicles, there appear to be three promising approaches:—

a) develop better batteries so electric cars have long enough ranges to attract many users, and charge these from the grid overnight,

b) develop safe on-vehicle methods for storing liquid or gaseous hydrogen or methane, and use these



Fred Ball and the first version. The hulls leaked through pin-holes in the welds, and the generator weight was too far aft. It had a 2 metre beam.

in fuel cells or for burning as fuel in slightly modified normal vehicle engines,

c) synthesise petrol or alcohol using electricity, water and atmospheric CO_2 for use in normal engines. For aircraft, batteries will probably always be too heavy, but conventional jet engines could be used running on either synthetic kerosene or liquid hydrogen or methane carried in externally mounted tanks.

The Initial Fleet

The proposed initial fleet of 20 million catamarans would be moored in rows and columns at about 50 metre spacing, to prevent collisions, reduce interference with the wind reaching the windmills and make it easy to tow individual generators ashore for servicing. At this spacing each square kilometre of sea would hold 400 windmills, so the fleet would need 20 million/400 = 50,000 sq km. This could easily be provided along the UK's east coast, e.g. in a strip 1000 km long and 50 km wide from the north of Scotland to about Southend. Gaps would be left opposite ports and for shipping lanes, and the west side of the mooring area would be positioned just far enough offshore for the windmills to be out of sight from the coast, perhaps 15 km offshore.

The moorings could of course be moved easily and cheaply if this became desirable for any reason, unlike conventional seabed-mounted offshore wind farms.

It might be wise to locate some of the floating generators along the south and west coasts too, to

Welds repaired, hulls inflated to 5 psi, weight moved forwards (toward bows at left of picture).
In this Proven *generator arrangement the windmill is downwind of its supporting structure. This still has the 2 metre beam.*

reduce the chance of a calm affecting the whole fleet at once and to deliver the electricity ashore nearer where it will be used. There is clearly plenty of room in UK coastal waters for 20 million floating generators, and indeed for many times this number if the demand for pollution-free electricity increases to meet our heating and transport energy needs also, as suggested above.

The moored generator 'farm' would probably be divided into 'fields' perhaps one km square, with all 400 units in each field being connected by underwater cables to a central boat containing the electrical equipment to add their outputs and transform the electrical power (max 15 kW × 400 = 6 MW) to a suitable voltage for transmitting ashore, in exactly the same way as in a conventional offshore wind farm.

Costs

It is very difficult to predict costs at this stage, as it is necessary to extrapolate from the cost of one-off or very small production runs of catamarans and

The 3 metre beam version, starboard bow view, ready to launch

windmills to car industry numbers of perhaps 2 million identical units (each extremely simple by car standards) per year. In this quantity, reasonable price estimates might be £3,000 for a 15 kW wind turbine, £5,000 for a 12 m × 12 m steel or plastic catamaran, and £2,000 for moorings and electric cabling, giving a total per 15 kW floating generator unit of £10,000, equivalent to 10,000/15,000 = £0.67 per peak installed watt. For comparison, typical conventional offshore wind farms using large fixed turbines appear to cost at least £2million per 2 MW turbine, i.e. £1 per peak installed watt, or half as much again as the small floating system. If as suggested above each floating 15 kW generator produces 36,000 kWh/year, and if each kWh of this 'green' electricity is valued at £0.05, the economic return per year would be £0.05 × 36,000 = £1,800. The generator unit and its moorings and cables should last for 10 years, giving a depreciation cost of £1,000 per year and a net annual return of £1,800 minus £1,000 = £800, i.e. 8% on the capital of £10,000.

The enormous production rate of the small floating generators should not only allow low unit cost but also highly sophisticated design and engineering, so that desirable features like variable blade pitch which is automatically controlled to maximise electrical output in varying wind strength could be added to the present design. The figures suggested above for energy produced per year should therefore be easily achieved.

The cost of servicing the generator must of course be included, but should be small as minor work can be done on a calm day by putting a fitter onto the catamaran from a boat, while for major work the catamaran can easily be towed ashore.

Seaworthiness

The main question over this proposed system appears to be whether the moored 12 m × 12 m catamarans carrying 9 m diameter windmills could withstand storms, or whether they would:—

a) break adrift,

b) capsize,

c) pitch so violently that the gyroscopic forces would wreck the wind turbines.

Regarding point (a), mooring boats of this size in the open sea should not be difficult as Trinity House has been mooring navigational buoys and lightships successfully for decades, and the offshore oil industry clearly has enormous experience too. A grid of anchors and chains on the seabed with chains or modern synthetic ropes up to the catamarans should ensure they neither drag nor break away. The wind turbine will be fixed to the catamaran with its axis fore-and-aft and the plane of its blades across the boat, so it will of course be essential that the boat always swings around the mooring to point its bows into the wind, even when the tide is flowing under it in a different direction. This should be achievable by

(1) mounting the windmill at the stern of the boat so its wind resistance provides a weathercocking force,

(2) using a single mooring rope or chain from seabed to catamaran, fixed to the boat at a point about 4 or 5 m back from the bow, so there is considerable underwater keel area ahead of the mooring point (perhaps increased if necessary by using bow centreboards in the hulls).

Considering (b), capsize is a much more serious worry, especially in bad conditions when a strong wind, strong tide, and breaking waves are all in different directions. The windmill will be mounted as low down as possible with the blades just clearing the catamaran's deck, since reducing the risk of capsize by keeping its weight low is more important in this application than increasing output by raising the mill on a tower into the stronger wind higher up. Calculations seem unlikely to give reliable prediction of capsize risk in this case, and we therefore plan to use practical testing at sea, initially with a quarter-scale version of our proposed catamaran design fitted with a Proven WT600, 2.5 metre diameter generator rated at 0.6 kW. This will be moored offshore unmanned in an exposed position and will be video-recorded from the beach during gales.

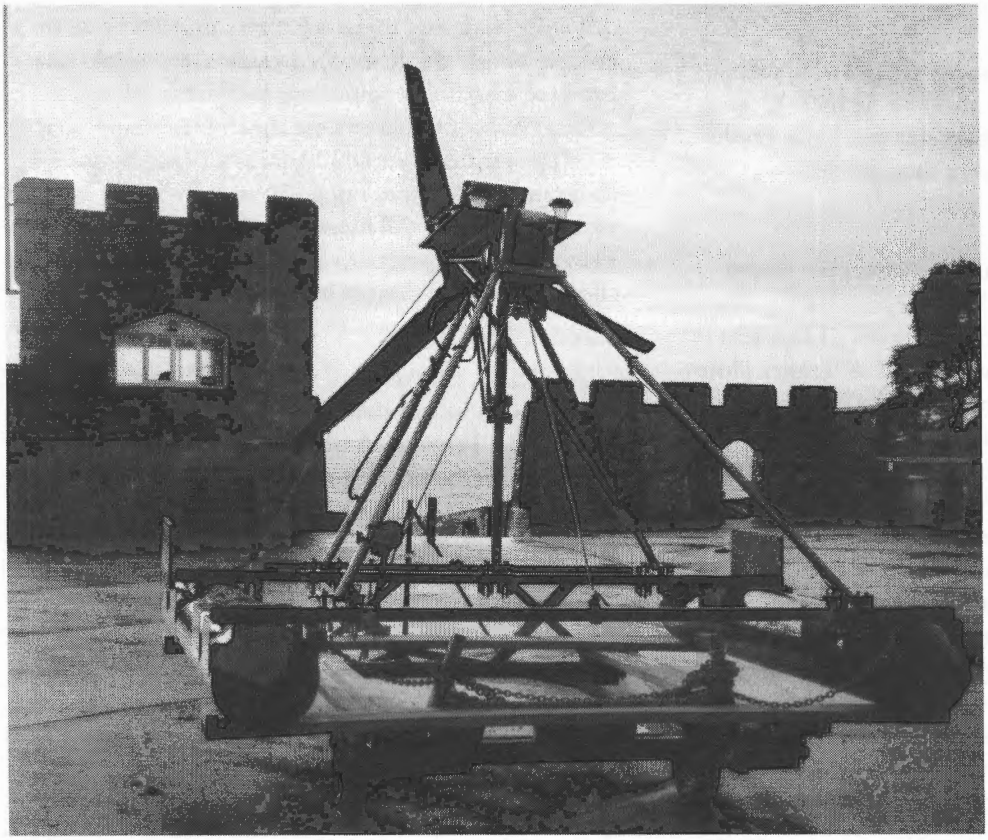
For c), gyroscopic force problems, small wind generators have of course been used for many years at sea on small and lively yachts with no apparent difficulty, so going up to a 9 metre diameter one on a comparatively stable moored catamaran should not produce insoluble engineering problems. Many military helicopter rotors are much bigger and turn much faster than our wind generator (handling thousands of kilowatts not 15!) and obviously survive violent pitch and roll manoeuvres. Sea trials with the Proven 0.6 kW generator on the quarter-scale version should settle any doubts in this area.

Lake Trials

As always, the practical work on this project is taking much longer than I'd hoped. We started by mounting a Proven 2.5 m diameter turbine on my Catapult catamaran, and showed this at the AYRS 2006 spring meeting at Thorpe before trying it on Bray Lake. This test was encouraging, a sunny and fairly warm day, light wind with some force 4 gusts, and the boat floating stable and level while the windmill whirred round. After lunching ashore, Fred and I were congratulating ourselves when we noticed the anchor was dragging and the mill was heading for the far bank, so we hurried into our inflatable kayak support boat and paddled after it. No damage done, but we had to lower the windmill to its 'road tow' deck level position to reduce windage before paddling it back towing the kayak.

Sea Trials

The next stage was to arrange sea trials, after changing the inflatable Catapult hulls for steel pontoon ones, 3 m long and still using the 2 m long Catapult crossbeams so it could be towed fully assembled, (though with the windmill lowered!). While considering possible sites for a sea trial it occurred to me that an ideal one would be Simon Fishwick's old school at Atlantic College, a sixth-form international boarding school on the north side of the Bristol Channel between Porthcawl and Barry. I therefore wrote to their Principal, without great hopes, fearing that even if he didn't just bin my letter there would be endless hassle over health and safety, liability insurance, police checks on me and Fred, etc, etc. I was therefore delighted to receive a phone call from him a few days later, saying he liked the idea and had discussed it with the staff involved who were keen to support it. He suggested we should bring the windmill down and talk to Gareth Reece, their Director of Studies, and Paul Dowling who runs all their numerous boating activities. This went very well, as they stressed the physical difficulties of keeping anything moored off their extremely exposed site but



Altantic College slipway visible under windmill.
Not launched, weather too bad (very fortunately), the students off 'til mid-January. 3 metre beam.

made light of my worries on the administrative side, and said we should bring the windmill and its ground tackle down when the students were back in August. They also offered to do all the work of laying the mooring and towing the mill out, using their RIBs or RNLI inshore lifeboat, as an interesting practical exercise for the students. *[As an aside, I should say how impressed I am with Atlantic College in all respects – bright, helpful, positive students; first rate staff; a superb campus; and altogether a very pleasant contrast to the usual gloom-and-doom newspaper reports about UK education and modern youth — Slade]*

We launched in August 2006 but had a problem when pinhole leaks in apparently sound hull welds caused the mill to capsize after a couple of days, though the College recovered it with only trivial damage. I fitted tyre valves to each pontoon hull and inflated them to 5 psi to find the leaks and have them rewelded. This use of gentle pressurisation seems a good way of getting early warning of hull cracks in service, using a large easily visible pressure gauge or an electronic pressure sensor, but it does need care: with our hull diameter of 15 inches each one psi on a cross-sectional area of $15 \times 15 \times 3.142 / 4$ sq inches gives a force of about 175 pounds trying to blow the ends off so don't connect up your electric tyre pump and go to lunch!

The modified and pressurised version was relaunched by the College just before the 2006 Weymouth Speed Week, so it had a fairly rough test. It survived two days of force 5 to 6, then capsized when the wind increased further. I am hoping this was caused by my use of 2 m beam for trailing convenience, instead of 3 m which would be correct for a quarter-scale version of our proposed final 12 m × 12 m design. I therefore changed to 3 m beam, but very luckily the College were unable to launch this version before the early December storms which wrecked their massive seawall and would certainly have made the windmill drag the light mooring we were using and end up totally destroyed on the beach.

I am now arranging to use a much more massive 'Trinity House buoy' mooring, with a 2 tonne sinker and heavy chain, but because the local mooring laying contractor does a lot of work for Trinity House we are having to go through the 'proper channels' by getting permission from a part of Defra called the Marine Consents and Environment Unit. Their forms and consultation requirements seem to be the same whether one wants to moor a dinghy-size craft or build a £200 million offshore wind farm, and they say I can't expect approval till May 2007. I'm hoping no one suggests that the seabed 500 m off the College is the only known habitat for some rare seaslug or starfish, and am using the delay to build another 3 m x 3 m generator unit with a different make of wind turbine and other minor changes. I have applied for permission for two moorings rather than one, to allow comparison of different designs in the same weather conditions. If the increased beam does not prevent capsizing we'll try either a ballasted pipe hinged down from the cat's front beam or some arrangement of extra floats etc (any suggestions welcomed !), but of course I'd like to keep the design as simple and cheap as possible.

Post Trial Planning

If we can make a quarter-scale version which proves able to survive storms, the next stage is presumably to build a full scale 12 m × 12 m steel catamaran with a 9 or 10 m diameter wind turbine. As a one-off; and if everything including the turbine and truck and crane hire has to be bought at full retail prices, we are probably looking at £40,000 for this, which is way beyond my means. I am therefore hoping either that the turbine manufacturer will give or lend us a used machine or that successful public demonstration of storm survival by the quarter-scale units (and consequent newspaper articles?) will persuade an offshore wind farm developer to take on the project. They may not be keen, since if my estimate of a one-third cost reduction is anything like correct their shareholders will moan about the money they have already wasted on huge seabed-mounted turbines. But I hope they will feel their priority must be to show that offshore wind is economically better than nuclear, and they will be attracted by the possibility that small floating turbines may offer a much cheaper way of achieving the well-known advantages of large scale wind power (no nuclear waste or terrorism threat, no reliance on imported fuel, no oil spills, explosions or radioactivity escapes, no pollution problems when recycling life-expired equipment, no greenhouse gases, no waste heat from power stations) while avoiding the many current problems of building new onshore wind farms.

. . . the problems of energy supply, climate change, unemployment and overfishing can all be solved together . . .

Our proposed use of floating rather than fixed wind turbines should allow much greater flexibility and much lower setup and maintenance costs than conventional seabed-mounted off-shore wind farms, especially if environmental considerations or shortage of suitable near-shore sites require these to be located in deeper water in the future. The scheme would also provide many worthwhile and satisfying jobs in building the catamarans and windmills – or rather supervising and maintaining the robots and automated production lines which are doing this – and in operating the offshore wind farms and servicing the equipment, ideal jobs for redundant fishermen and oil rig workers.

Another attraction of the proposal is that commercial fishing would be impossible in the catamaran mooring areas, so fish could breed there before swimming away into open areas where they could be caught without threatening the breeding stock. Once the floating wind generator farms are working well other types of renewable marine energy sources could be added to them, i.e. tidal power (similar catamarans but with water turbines below them rather than wind turbines above), and wave power (join two catamarans bow-to-stern with pivots which hinge as waves pass underneath, and use this mechanical movement to turn an alternator. (Steven Salter and Christopher Cockerell were working on this 30 years ago - whatever happened to it?). 'Hedges' of floating wave power generators round the 'fields' of windmills could share the sea-to-shore electric cables while usefully reducing the waves affecting the wind generators, lessening wear and tear and making servicing easier. The tidal generators would provide at least some guaranteed and totally predictable power in calm spells.

To Conclude

So, lots of people will benefit from the proposed scheme, no one will suffer from it or object to it, and the UK will again be leading the world into a new Industrial Revolution, this time demonstrating how the problems of energy supply, climate change, unemployment and overfishing can all be solved together.

Dream on? Perhaps–but it is proving to be a most interesting retirement project!

We would welcome comments, especially critical ones.

Please send these to:

Slade Penoyre, Little Pond, Kennel Lane, Windlesham, Surrey, GU20 6AA, tel 01276 472208 or 01497 831687, email slade@penoyre.freeserve.co.uk

[Slade is experiencing some electronic communication difficulties due to local road works, in the short term perhaps snail mail would be preferred, Ed]

Or,

Fred Ball, 1, Whitehall Farm Lane, Stroude Road, Virginia Water, Surrey, GU25 4DA, tel 01344 843690

The Effective Surface — an aid to understanding DDWFTTW

Paul Ashford

Picture a sail or foil aligned with and free to slide over an imaginary surface which can move in the wind direction. Call this the Effective Surface (ES). For a sail or foil to take power from the wind its effective surface must (1) retreat before the wind and, (2) retreat at less than wind speed. I believe this proposition can be applied to all forms of wind propulsion. It is not counter-intuitive and may therefore find ready acceptance as a starting point.

Symbols

W = true wind speed
W_A = apparent wind speed
V = speed of vessel or vehicle
S = speed of retreat of the effective surface straight down the line of wind
S_V = speed of ES relative to Bauer vehicle, in opposite direction to V

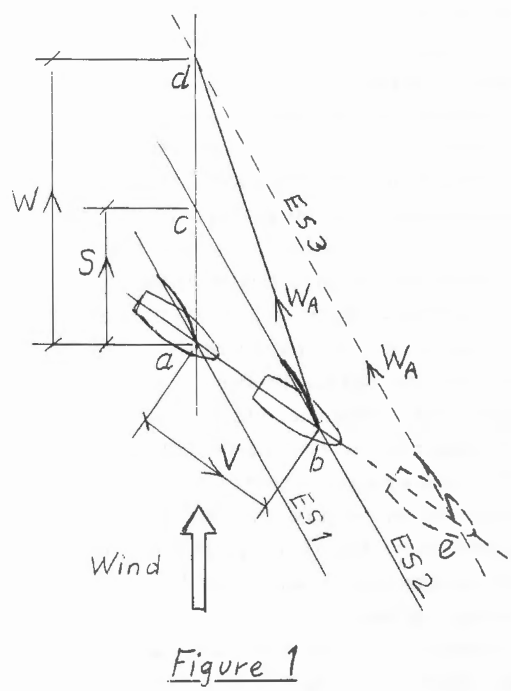


Figure 1

Figure 1 illustrates the concept for a boat sailing to windward. In unit time it moves from *a* to *b* and the ES moves downwind from *a* to *c*. The vector triangle *abc* gives the apparent wind W_A,. For the ES to retreat at wind speed the boat would have to speed up and reach *e*. The new vector triangle *aed* shows apparent wind in line with the ES, so angle of incidence is zero and there is no lift; this confirms rule (2). Staying on track *ab*, to get no retreat of ES we must pull the sail onto the centreline so the ES coincides with the track. There is then no forward component of sail force to keep the boat moving; this confirms rule (1). Similar diagrams can be drawn for other points of sailing.

Drag sails are easily understood and long associated with downwind sailing, and one school of thought has held that DDWFTTW must employ some variation of the reciprocating and opening and closing umbrella principle, whereby the driving open umbrella moves slower than the vehicle and so meets condition (2). Theoretically sound but hard to engineer.

More practical is a vehicle driven by a propeller geared to its wheels, as demonstrated by Andrew Bauer and others, most recently Jack Goodman. The Effective Surface is a helix generated by the propeller; for a two bladed propeller picture a twisted flat bar. The ES trails the vehicle at a relative speed S_V set by the propeller pitch and gearing. These can be selected so that the ES moves slower than the wind, while the vehicle exceeds windspeed. We can picture the wind overtaking this helical ES and transferring power to it.

This requires $0 < S < W$. We can expect wind force to run out as S approaches W. If $S = 0$, the ES does not move and no power is transferred. So we can expect best power from the wind when S is not too far from $W/2$ (but $S = W/2$ may not be exactly optimum).

To summarise, the Bauer vehicle can move DDWFTTW by taking power from the wind through its propeller to overcome friction and drag. It is able to do this because the propeller blade carves out and lies on an Effective Surface which travels slower than the wind. The propeller blade must keep up with the vehicle and makes good a speed DWFTTW but does not go dead down wind.

To design a vehicle to go directly against the wind, propeller pitch and gearing must be set so that $S_V > V$. The vehicle will then move upwind, while the ES retreats before the wind. As it gathers speed the apparent headwind will increase, but its speed will reach a limit as S must remain less than W.

The concept of Effective Surface provides a convenient tool for setting some basic design parameters for a propeller-driven land-yacht. I hope it may also help some of our Bauer vehicle sceptics to see the light. Carry on saying *It cannot possibly go DDWFTTW,* but realise *it* is the ES and not the vehicle.

A closer look at Bauer vehicle theory

Additional Symbols

For a section of propeller blade:

B_C = circumferential speed
B_R = speed relative to ground (resultant of V and B_C)
W_B = apparent wind (from W and B_R)
α = angle of attack
β = apparent wind angle
L = lift
D = drag
F = resultant of L and D
F_T = component of F resolved along track

For propeller:

p = pitch
d = diameter
ω = speed of rotation
γ = pitch angle

Now look at Figure 2, ignoring for the present the pecked lines below *ae*. It represents motion on a cylindrical surface, unrolled into a flat drawing. Essentially it is a velocity diagram for a section of propeller blade. It is best understood by noting that in unit time the blade moves from *a* on ES1 to *c* on ES2.

As long as the wheels do not skid, the movement of the blade section is constrained by the gearing as if it ran on spiral rails fixed in space. It can go forward or back on its track *ac*, but not sideways. The cart must move with it. We can move the whole system by pushing the cart forward, but not by pushing it sideways. Similarly the whole can be moved by pushing the blade along its track but not across it. Wind force acting on the on the blade can be resolved into a component at right angles to its track, which cannot

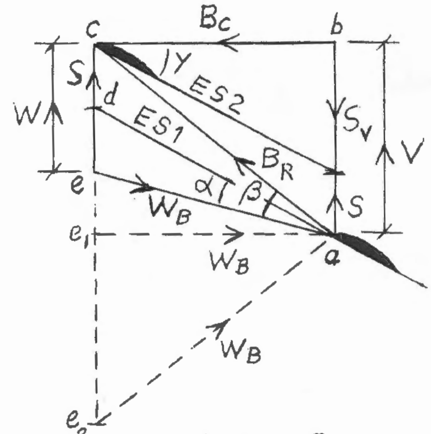


Figure 2

move the system, and F_T along the track which can. If F_T (summed over the whole propeller) is more than needed to overcome transmission friction and air drag of the car, the vehicle will accelerate. We can picture the foil as the sail of a conventional land yacht, and see how the direction of the apparent wind W_B allows it to sail course *ac*.

The shape of *abcd* is fixed by the propeller pitch and gearing, while *e* is drawn for V = 1.5×W. Moving *e* to *e₁* gives the diagram for V = W, when the cart feels no apparent wind at all, but the propeller blade still feels an apparent wind W_B to power the system. Now *e₂* corresponds with V = 0.5×W. Note that the scale of the diagram changes if W is constant.

To get S = 0.5×W when V = 1.5×W, S_V was set as 0.67×V giving S = 0.33×V. B_C was arbitrarily taken as 1.25×V. B_C will vary as we move from the propeller hub to the blade tip. Take the diagram to apply at 0.8 of total radius, as most of the work is likely to be done around this zone of the propeller. Then,

$S_V = p \times \omega$
$B_C = 0.8 \times \pi \times d \times \omega$

The pitch/diameter ratio

$p/d = 0.8 \times \pi \times S_V / B_C = 1.35$

Propeller size is not fixed by the diagram, which can apply to similar machines of different scale.

The following table is compiled by adjusting the diagram to different values of V/W and measuring α and β.

V/W	α°	β°
0.5	67	77
1.0	29	39
1.5	14	24
2.0	7	17
3.0	0	10

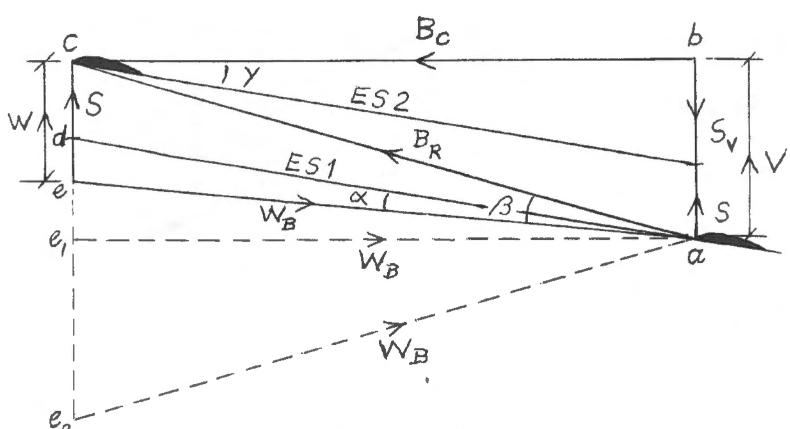


Figure 3

This table suggests that V = 1.5×W is not difficult, V = 2×W quite possible. With this design V = 3×W is clearly unattainable because W = S and $\alpha = 0$. Although B_C was chosen at random merely to produce a clear diagram, the vehicle seems to be turning out quite well for higher speeds. My only doubt is whether it would accelerate through the lower speed range where the propeller is heavily stalled. The answer may lie with the analogous land yacht sailing course *ac*, starting from rest with the wind over the quarter. For a quick getaway it would start with the sheet free (equivalent to lower propeller pitch), and sheet in as rising speed pulled the apparent wind ahead. Could it start and struggle up to top speed with the sail sheeted hard in throughout? Land yacht sailors, views please.

Comparison with Jack Goodman's Cart

It is interesting to compare my hypothetical design with Jack Goodman's cart as described in Catalyst Number 23. This gave:—

$p/d = 16.5/40 = 0.41$
$S_V/V = 10/17.5$, whence $S_V = 0.57\times V$
$S = 0.43\times V$
$B_C = 0.8\times\pi\times S_V\times d/p = 3.47\times V$

From Figure 3, again drawn with V = 1.5×W:

V/W	α°	β°
0.5	23	30
1.0	8	15
1.5	3	10
2.3	0	7

This accords with Jack's design target of V = 1.4×W. We do not know exactly how close to this his cart gets. I have no doubt it exceeds wind speed. It starts from rest, and the low pitch propeller may help here. In a 10 mph wind, when the cart reaches wind speed, and feels no apparent wind, the propeller blade gets apparent wind of 35 mph. This will rise to nearly 50 mph at V = 1.4×W. In the same breeze, at wind speed the Figure 2 cart has only 12 mph wind on the propeller, rising to 27 mph if it reaches 20 mph (V = 2×W). Does this imply that higher speeds call for a bigger propeller as well as increased pitch?

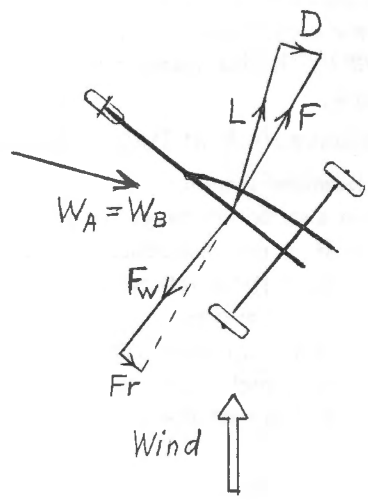


Figure 4

The land yacht analogy can be taken a step further. For the velocity diagram in Figure 2, Figure 4 shows the corresponding forces on the land yacht. F_r is friction and F_W the side force on the wheels. Combine the wheel forces of two land yachts on opposite tack (top and bottom of propeller) as Figure 5, and we get the tangential force on the cart's wheels, which turns the propeller. This from two land yachts, so tangential force is less than the side force on the wheels of a single equivalent land yacht.

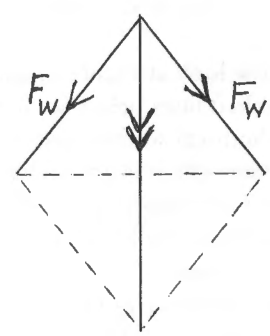


Figure 5

Analyses assume a clean wind, not yet slowed in giving up energy. The cart running at wind speed is trying to reuse the same chunk of wind, and must travel in a growing cloud of its own dirty wind! So perhaps there is a bit of a barrier to surmount after all.

Paul Ashford
Holly Lodge, Strumpshaw, Norwich, Norfolk, NR13 4NS

DDWFTTW — Whence the Energy?

Paul Ashford

To yield energy, air must be slowed. The rotor of a Bauer vehicle (or cart) is said to work as a propeller. Hold on, a propeller speeds air up, doesn't it? How can that work?

What follows sprang from the thought— *As a cart running at wind speed must reuse the same chunk of wind over and over, it must travel in an ever-expanding cloud of its own dirty wind.* On reflection, unlikely! To find out more and simulate

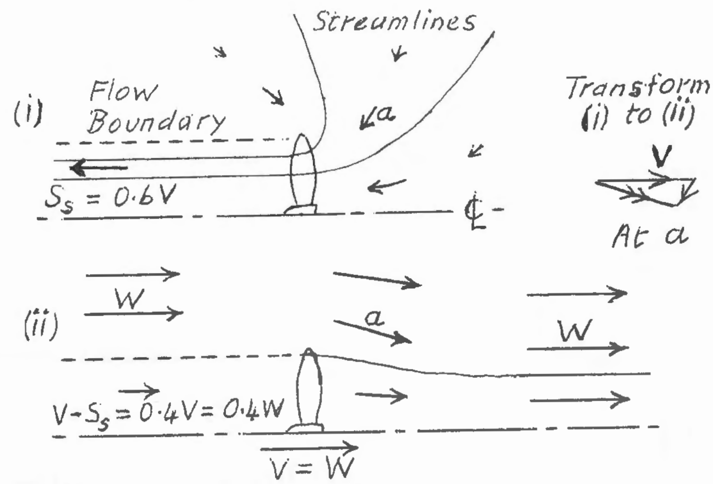


Figure 1

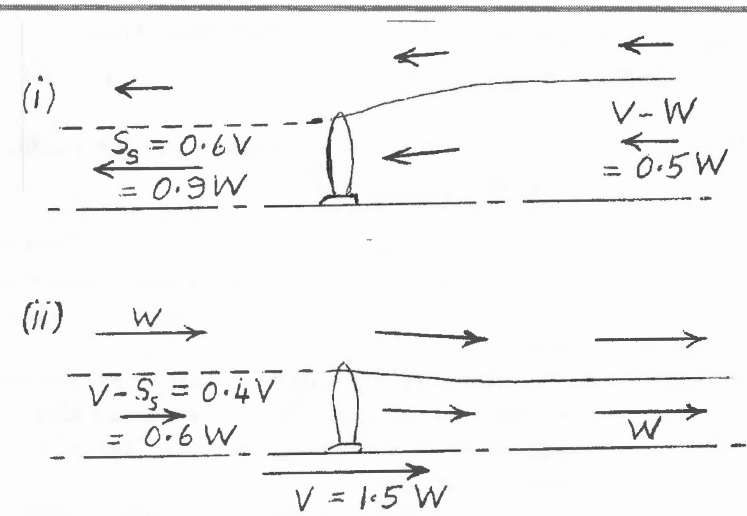


Figure 2

the propeller working in apparently still air, I used a fan and a wisp of paper on a thread to investigate the airflow round it. The pattern revealed by this experiment is sketched in Figure 1(I) for half the fan. At about two diameters from the fan, inflow appeared negligible.

Symbols

W = speed of true wind (over ground)

V = speed of cart

Ss = speed of slipstream relative to cart

Ss is set by propeller pitch and gearing, and is assumed 0.6×V. Changing the frame of reference from the cart to the ground by adding V (=W) throughout gives Figure 1(ii). Arrow lengths are proportional to speed. The triangle of velocities for a shows how the direction of convergence of the streamlines becomes reversed. For conservation of flow, as velocities increase streamlines must converge, or to be more precise the cross-sectional area of flow must contract. Both Figures (I) and (ii) conform.

Figure 2 shows similar diagrams for V = 1.5×W. This case is easier as the propeller is fed by the apparent head wind V–W. It is easy to misinterpret Figure 2(ii) as showing a flow through the propellor from rear to front. The propeller will overtake the air ahead, slow it and leave it in the slipstream. The pattern of flow lines moves with the propellor, and the length of the slipstream continually grows.

For V = 0.5×W, Figure 3(I) shows the slipstream fed by the annulus *x*. Air speed in the annulus is more than in the slipstream at *y*, so the area of the annulus is less than that of the slipstream. The next layer of air in annulus *v* continues forward to *w*. Assuming no loss of energy by turbulence there is no change in speed or cross-section of flow.

Whether the propellor accelerates air or slows it depends on the frame of reference. The cart, by its air propeller linked to a wheel on the ground, derives energy from the relative motion between air and ground, which is shown in Figures (ii). In each case the air behind it moves more slowly than the wind speed W, and has yielded energy to the propeller to move the cart.

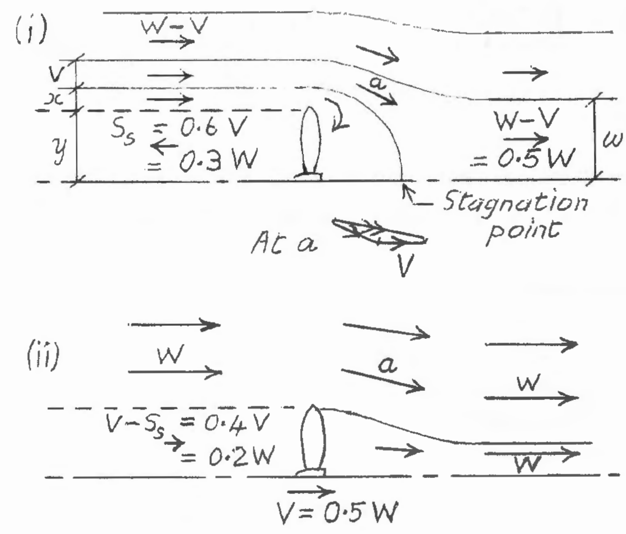


Figure 3

Paul Ashford
Holly Lodge, Strumpshaw, Norwich, Norfolk, NR13 4NS

Wave energy report

William Groombridge

The potential energy to be captured from ocean waves could surpass the other forms of renewable energy such as solar, wind, or hydropower, according to a recent study by the Electric Power Research Institute (EPRI), a research group funded by hundreds of utilities.

According to a report released in January, 2005, the total wave power along the coastlines of the US is approximately 2,100 terawatt hours per year, nearly as much as all of the electricity produced by coal and roughly ten times the total energy produced by all of the country's hydroelectric plants.

Wave energy systems can capture the same amount of energy using smaller and less expensive equipment than wind or solar systems, according to Roger Bedard of EPRI *[Electric Power Research Institute, Palo Alto, California]*, who authored the study.

Wave energy 'is among the most environmentally benign technologies,' and is less visible than offshore wind farms, according to Bedard. He says wave energy conversion devices have a smaller footprint than offshore wind farms and interfere less with marine life movements.

The think tank of 4 Paz went to work in 2004 and now you have in 2005 a built and proven wave-rocker that will work on any size wave from a small lake to an ocean.

However, we still believe the best source will be flowing river and tides. And we have a new idea on oscillating foils in a chaos flow chain. This last is being studied now.

William Groombridge, 4 Paz; ecofrogtec@terra.es

Champion

Denys Teare

This invention relates to a multi-hulled, non-rigid sailing ship, in which a person or persons and goods can be conveyed across water by utilising the natural wind force. A framework in box shaped formation, with hinged or pivoted joints, supports wind resistant surfaces, sails, and is mounted upon buoyancy units, hulls. To gain maximum wind advantage the angle of relationship between the hulls and their connecting beams may be adjusted and secured in a required position.

Light-weight pleasure craft will be controlled manually by a rope and pulley application. Larger vessels will utilise a more robust mechanical/ hydraulically-assisted means of adjustment, as in the power steering of road vehicles.

Claims

Stability — Traditional sailing ships have tall masts and need heavily weighted keels to maintain their equilibrium. The sail-base in this vessel is wide in relation to the mast height, giving greater stability in motion.

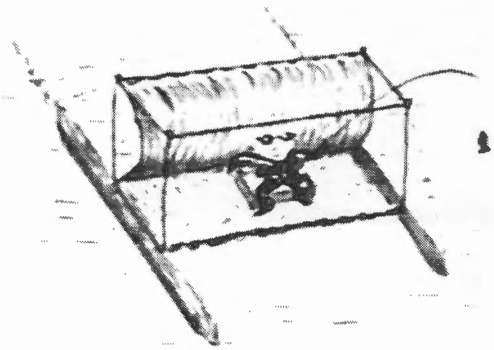
Manoeuvrability — The vessel is of shallow draft, well suited for operation in shallow coastal areas and inland waters.

Simplicity — The sails can be installed in an 'inverted roller-blind' system for the raising and lowering procedure to be carried out. This adjustment of sail area and the adjustment of the hull positions may be controlled from one focal point.

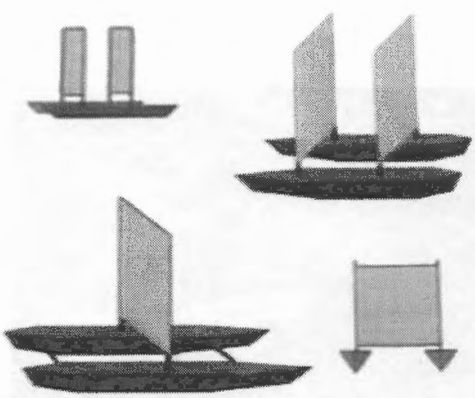
Ease of operation — The requirement of yachting personnel to transfer their body weight from side to side while 'tacking' against the wind, is replaced by a forward and reverse progression.

Safety — The movement of personnel and cargo to and from the harbour-side is facilitated by mooring the vessel with its hulls in the 'folded together' position.

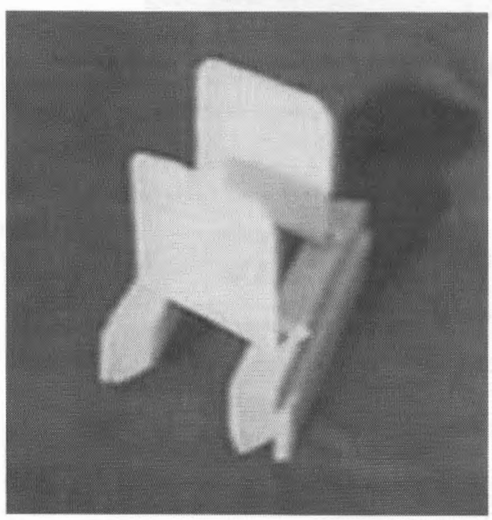
Adaptability — This invention may be applied throughout a range of marine requirements extending from a tiny manually operated craft for sport and recreational activities, up to a large commercial vessel wherein the controls are activated by powered winches and hydraulic rams. Rudders and inboard or outboard engines may also be incorporated.



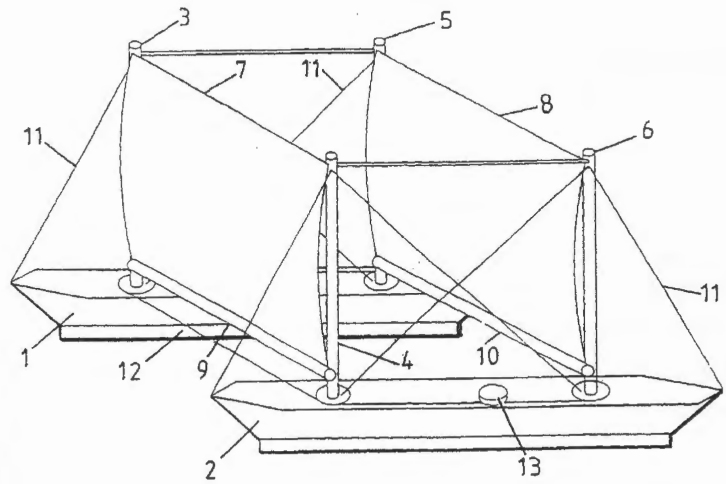
The first - half joke - half idea!



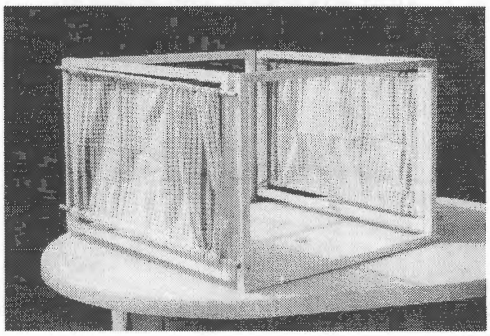
Sketches of early variants



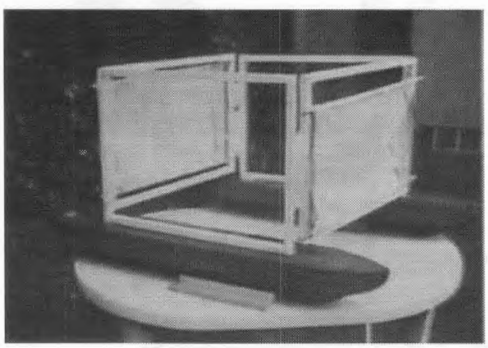
The 'Toaster' version



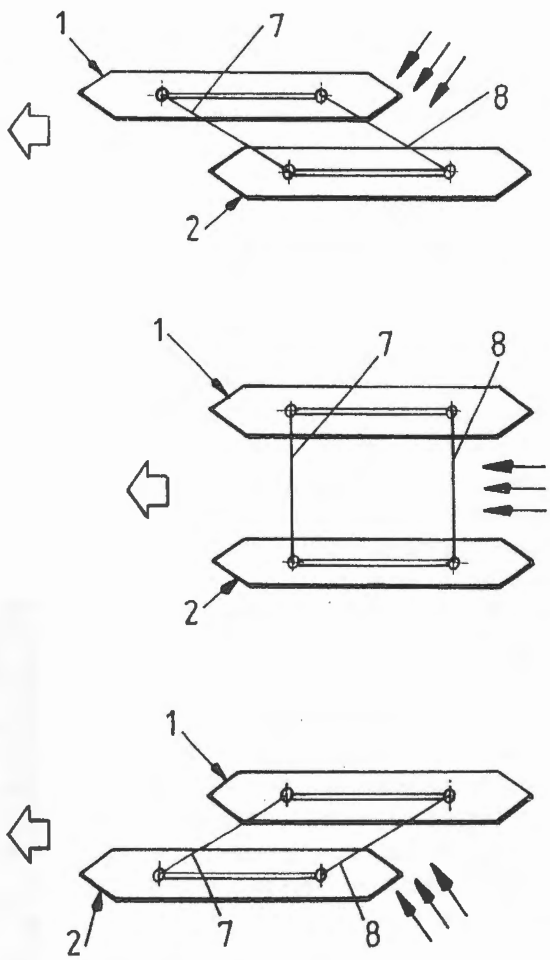
Sketch of generic version from Patent Application



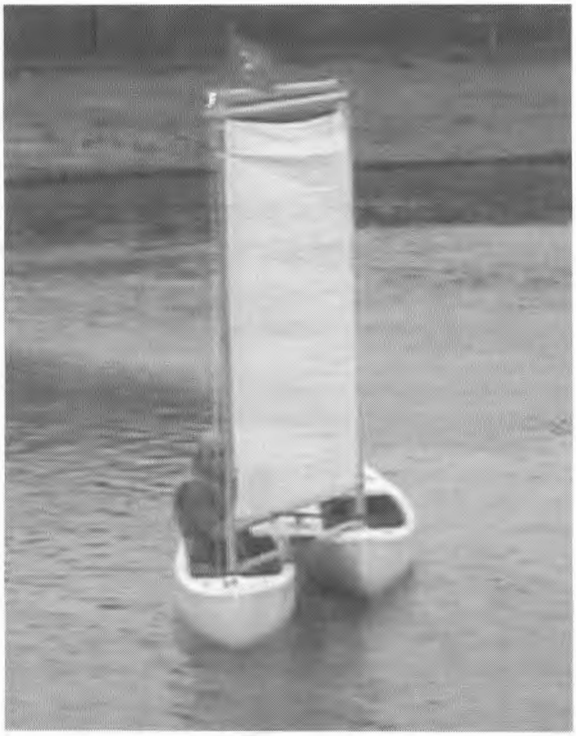
The 'Tea Towel' approach



'Tea-towel' model with hulls



Plan Views from Patent Application,
showing broad reach, run and broad reach gybing with no flying boom



Two canoe hulls sailing version.
On tack A

Shunted to new tack B

Fetching up

Full on new tack (B)

SY-X 24

News

Schickler Yacht Design and Engineering (SYDE) presents an original custom design. This 7.3 m yacht, commissioned by a German couple for use on the inland lakes and coastal waters has some exceptional features.

The design brief included the following highlights:

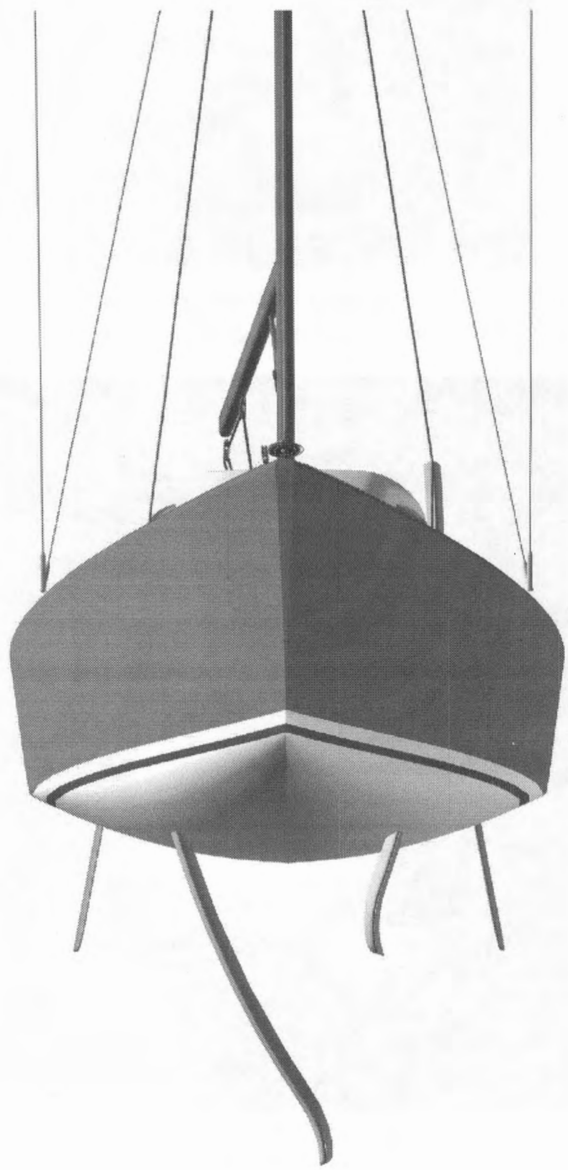
- Low draft underway under motor, 80 cm or less.
- Deck-stepped mast easily lowered for bridges
- Clear and functional interior space with a head
- Large cockpit for 4 sailors
- Best possible access to water for swimming
- Stable keelboat characteristics
- Easy sail handling
- Lively performance

This brief has been filled in a creative design utilizing two ballast keels raised and lowered in synchronization by a simple tackle system. The main motivation for this development is to create an unobstructed, though compact, interior in conjunction with the low draft. The keels themselves are arced inward to maximize stability. The radii of the keels create almost 5 degrees of static windward heel. As a permanently installed system, lifting the keels is not limited to the shore hoist or trailer, as with most sportboats. Shifting the asymmetrically shaped foils from side to side is simply done with tackle, as the weight of each balances the other.

Lifting them both requires only leading a line to one of the deck winches. In this condition, the vessel remains stable and is easily powered through shallow waters by an outboard.

The hull is shaped to take full advantage of crew weight for performance enhancing stability upwind and plane easily and smoothly off the wind. The deck and cockpit reflect the performance-based style of the yacht, with simple and effective sail controls based on the yacht's purpose. Included in this is an easy to access space aft with a ladder for getting in and out of the water. Twin rudders, raised and lowered by the helmsman as conditions warrant, provide positive control for a large range of heel angles, and make room for water access too.

Down below, the boat features standing room at the companionway, which can also be sheltered with canvas. The head itself is tucked beneath the cockpit



and vented separately aft. For use, it is pulled forward after the lowest step is removed. Comfortable seated headroom for the two owners is achieved by pull-out cushioned panels with canvas back rests. For weekending or to wait out a summer rainstorm, four can utilize the V-berth and quarter berths.

The keel trunks are positioned just outboard of the deck-house, and pass through handy stowage lockers to the hull. Light floods the interior through large windows on each side.

The rig is designed to be light, practical and powerful, with a wide staying base and a single swept-spreader carbon fibre mast. The sailplan features a large main, taking advantage of the lack of a backstay, and a roller furling jib. A deck-mounted sprit carries the asymmetrical spinnaker to add horsepower when broad reaching. In this configuration, the keels would each be positioned halfway between raised and lowered, balancing their lifting forces and minimizing drag. The boat remains just as stable as the upwind condition with no change in vertical centre of gravity.

Construction is planned in sandwich E-glass and vinylester for the hull and deck. Carbon fibre will be used selectively in the female moulded keels to provide the necessary stiffness. Practical construction details have been integrated into the foils and hull to make any necessary repairs as easy as possible. Bids are being tendered for the boats construction as a one-off. The owners are excited about creating this rather unique boat, tailored expressly to their ideas.

Further interested parties, who would make production female hull tooling practical, are considered a welcomed bonus.

Schickler yacht design - engineering
Leidsegracht 92 1016CS Amsterdam NL
T +31 (0)6 4438 1994 F +1 702 552 4213 E
yachts@syd-e.com

Windward-Leeward Faster than the Wind

Giles Whittaker

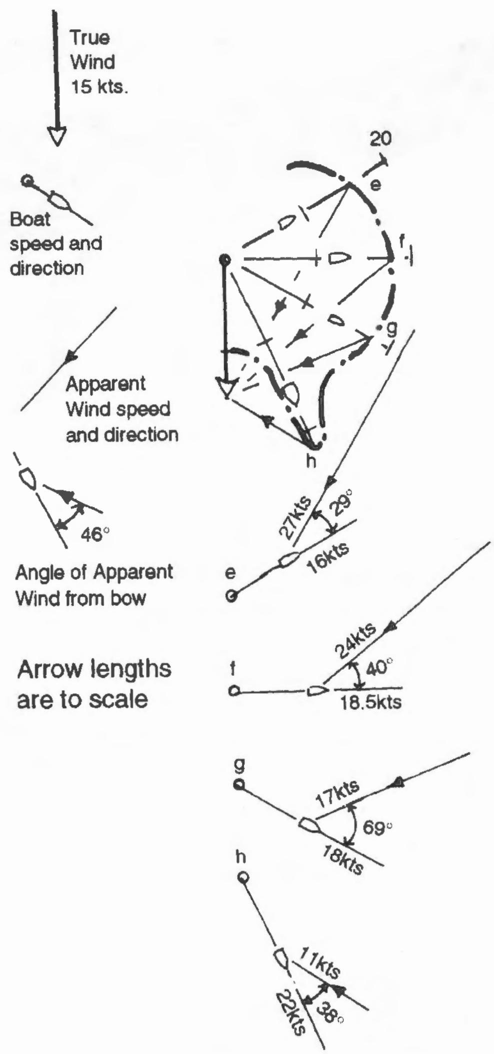
It is well known that high performance skiffs and iceboats can tack downwind with a dead downwind V_{MG} faster than the wind speed. This means that, on an accurately laid windward-leeward course, a truly fast boat can reach the leeward mark significantly before the air it had sailed through at the windward mark. Frank Bethwaite reported in the introduction to his classic book *High Performance Sailing* :—
"…The average speed which can be expected *[for 18 ft skiffs in 1996]* around a closed course in suitable conditions *[has increased]* from about two thirds of the wind speed *[with conventional spinnakers]* to something faster than the wind's speed – a near doubling of the speed in a mere 20 years".

Bethwaite's polar diagram for an eighteen foot skiff *(see right)* shows that, for a triangular course with a windward leg and two reaching legs the average speed through the water can easily be much faster than the wind (FTTW).

The polar diagram also shows that it is also possible for a skiff to sail a lap of a windward-leeward course with a V_{MG} faster than the wind. In 10 knot winds a skiff can achieve a maximum downwind V_{MG} on a course about 140 degrees off the true wind, at a boat speed of around 20 knots. This gives a downwind V_{MG} of around 15 knots, or 150% of wind speed. The polar diagram also shows an up-wind V_{MG} of 9 to 10 knots in 10 knot winds.

We can consider sailcraft that can sail routinely on all points of sailing on both tacks in a wide range of weather conditions to be at least 'reasonably practical'. We can thus say that many truly fast, reasonably practical sail craft can sail a windward-leeward course with an average windward-leeward-V_{MG} faster than the wind (WLFTTW??) under ideal conditions.

Let's look at some numbers. Consider an accurately laid windward-leeward course, with a



B Eighteen Footer dynamics

committee boat on the start-finish line at the leeward mark, with 1 nmile between marks, in a mythical steady 10 knot wind and no currents.

We arrange that, as our skiff crosses the start line, smoke, balloons etc. are released from the windward mark by remote control from the committee boat.

The polar diagram shows that we would have a close-hauled boat speed of around 13 knots, giving a windward V_{MG} of around 9 to 10 knots, reaching the windward mark in 6 to 7 minutes.

At 10 knots wind speed, the smoke etc. would reach the leeward mark in 6 minutes, having travelled 1 nmiles in around the same time as the skiff. We arrange that, as soon as first of the smoke etc. reaches the leeward mark, more smoke etc. is released from the windward mark.

Rounding the windward mark the skiff sets the 'kite' and accelerates to about twice wind speed, at about 140 degrees off the true wind. On that heading the apparent wind is ~15 knots, from well ahead of the beam.

We gybe half way down the run, when the leeward mark is almost abeam. Initially travelling faster than the true wind, we 'tack' through about 100 degrees roll-tacking both sails, accelerate and bear off for the mark.

In this way we cover about 1.3 nmiles through the water at 20 knots, reaching the leeward mark in about 4 minutes, a lap time of 10 to 11 minutes.

In that time the airmass travels around 1.7 nmiles. The second smoke etc. reaches the leeward mark 12 minutes after the start, well after us.

A similar skiff sailing the leeward leg directly down wind might make about 6-7 knot, with an apparent wind of around 4-3 knot from dead astern, taking about 10 minutes for the down-wind leg and 16 minutes for the lap.

Windward-leeward performance index.

The ratio of windward-leeward-V_{MG}-to-wind speed appears to be an excellent indicator of performance of practical sailcraft. A good way to measure that would be the ratio of the **lap distance made good** and the **distance travelled by the airmass** while the boat was sailing the lap

In the above case, this would be 2.0 / 1.7 = 117%, for a 10 knot wind.

This suggests a form of Windward-Leeward event for the AYRS to promote, in addition to the current absolute speed event, but more relevant to practical boat data and development.

Performance measurement would be easier. All measurement can be done from one committee boat.

A differential GPS set or laser rangefinder would measure the distance between the windward and leeward marks. This lap distance would be corrected to distance made good using the angle between the actual wind direction during the lap and the course axis. The wind direction data would be logged electronically.

A cup anemometer with modified electronics would measure the total distance travelled by the airmass during the timed run, by counting its revolutions, NOT its speed of rotation. This would allow for wind speed variations, and again would be logged electronically.

The ratio of those two distances gives the ratio **Windward-Leeward-V_{MG} : Wind Speed** (best expressed as a percentage), at that particular wind speed.

The usefulness of this scheme could be extended to suitable tidal waters, by adding compensation for current speed and direction.

This data could be captured in everyday yacht and dinghy racing where windward-leeward courses are used, and conditions are suitable.

References:

1) Figure 24-1 Bethwaite, F. High Performance Sailing. ISBN: 0713667044 — a reviews states — *This book has already become a classic, which no serious racing yachtsman* [or AYRS researcher] *should be without. The techniques explained and the theories expounded are original, and based on Bethwaite's many years of coaching the highly successful Australian Olympic sailing.*

This book also recounts Bethwaite's work on his High Speed Project, *that he based on Dr Smith's* The 40 Knot Sailboat, *which eventually resulted in his developing practical craft that contributed to 18ft Skiff technology, and thence to modern dinghy design.*

G M Whittaker, gmwhittaker@iee.org

Go Fly a Kite!

John Hornby

Is Kite Propulsion for boats an intriguing way forward or just an impossible dream? Most of us have had the inspiring sight of wet-suited figures skidding along the shoreline on a half-sized surfboard with a kite high in the air, pulling them along at a mesmerising speed. What then is this recent phenomenon which seems to be displacing the windsurfer?

Well, it's not new . . .

The kite itself was probably invented 3,000 years ago in China and the Han dynasty used them to frighten the enemy in battle. More recently there are 17th century drawings showing kites rigged to pull large sailing vessels from wind-shadowed harbours[1]; and Benjamin Franklin, best known for his experiments in 1752 with kites and lightning had been known to tie a kite to his own boat to get a free ride[2]!

Signalling by kite was commonplace in the early 19th century. Fishing by kite was common in China, and between the wars HMS Hood towed kites for gunnery target practice. Who can forget also the amazing sight in 1982, when at Weymouth, 'Jacob's Ladder' ran off with the world C-class speed sailing record[3] aboard a kite-propelled boat! —the pilot used in fact a stack of 10 flexible foil kites one above the other attached to a pair of extended Tornado catamaran hulls. So is there a practical future for kite propulsion for the more conventional type of boat?

. . . practical kite propulsion for ordinary folks with ordinary boats . . .

First, I suppose, we have to wonder what is the point of bothering with kites when we have perfectly good and proven sail systems already. The answer seems to fall into three areas — speed, saving the planet, and sheer fun. I think speed is largely beyond the scope of this article, but 'the environment' or 'saving the planet' is an extremely powerful and compelling reason at this very time of writing.

Both of these are good enough reasons, but 'fun' must clearly rank as number one. When it comes to speed, look to the kitesurfers for your inspiration, and to the record seekers at Weymouth and other similar events around the world. There are a number of books and magazines on kitesurfing and a good half-dozen fascinating booklets of the AYRS dealing in detail with fast sailing using kites and foils.

The environmental advantages speak for themselves. Harnessing the wind has got to be better than burning fossil fuels, and there's a lot more of it high in the sky than there is a sea level! However it remains the fun thing that really appeals to the majority of us. It is something different to try, and a real personal challenge; and I'm writing here about practical kite propulsion for ordinary folks with ordinary boats. Is it a goer or just a fancy idea? And how would one go about it?

What kind of kite?

Well, lets consider the various well-tried types of kites before we go any further. First there is the child's old-fashioned diamond shaped kite, always colourful and with a lively waving tail which you will see on just about any beach on any sparkling day in summer. For boat propulsion, rule them out — they don't fly well, and they don't pull well.

Then there are box kites, hexagons, deltas and rogallos, *[http://en.wikipedia.org/wiki/Rogallo_wing]* (famous as the hang-gliders of thirty years ago). None of these have any real pull or power[4]. Nevertheless, in 1910, the aerial for Marconi's 3,500 mile radio message across the Atlantic was carried aloft by a delta kite made incidentally by the Devon firm 'Brookite' which is still around today. *[http://www.brookite.com]*

I think we can go round the houses with kite types for as long as you like, but we will for sure return to the kitesurfers, noting that they all use kites of a very similar form — the inflatable mattress — an insult I know, but you get the idea. These things are far far more sophisticated than any mattress and are developing all the time, and because they have the greatest pull of all kites, they don't call them 'traction' kites for nothing! So the shape and type of kite for good propulsion seems now established.

Any kite, of course, for use on water has to have a water launch capability, otherwise your fun will stop for quite a long time as soon as your kite stalls or falls into the water through mishandling or through tricks of the wind. Recovery from the water is absolutely essential too, more later. In one short sentence therefore an 'on the water launch/retrieval system,' is a must[5].

If you take time to study these kitesurfing guys you will soon observe that they can sail upwind as well as down — and this may well surprise or even shock the average boating person. In fact, there is a clearly defined 'window' for kite positions relative to the wind where a pull can be obtained, and it gives a surprising field of wind-using ability. Obviously, if a surfer travels downwind only, the kite will fall from the sky as soon as it reaches the speed of the wind, although this is unlikely to happen with an ordinary boat. It is the 'window' that increases dramatically the achievable points of sailing; and it is encouraging to know that a moving kite is much superior — once in flight — to a static sail[6].

How then to get started on boat propulsion . . .

First learn to fly a kite on land. That way you will have a head start, have the 'feel', learn the sensitivity of control and know the peculiarities; like for example, that an impending luff is indicated by a drop in line-pull[7]; and know, for example, to take in the line only when the kite is flying properly and to pay it out when it isn't[8].

I would suggest you start with a two-line 'parafoil' of about one square metre, available from several suppliers, and buy a book on how to fly. This parafoil type of kite has what the technical type would call 'maximum MMR' (maximum/minimum pull ratio) [9]. They pull harder than deltas, and they don't backwind. So they are certainly heading for the sort of kite you'd want for a boat later on. They are simple and soft (no struts) made of strong rip-stop nylon, and have minimum complications. Try to fly in different positions in the sky, noting the change in pull as you do. When flying the kite is mastered you will understand well the enormous pull potential and will start thinking about how it could move your boat.

You might even have seen yourself lashed to the front of the mast, roaring off downwind, and having the time of your life! Well why not try just this very thing with the very kite that you learned to fly on land? It's not that easy, you'd have to find a way of getting the thing up! And there you have a big problem of sailing with kites in another short sentence. Parafoils are best flown well clear of water because once down, you can't get them up again!

What next then?

Look to the guys on the beach. They use kites which are similar to these flexible foils but which have inflatable ribs (the Legaignoux design) *[http://www.inflatablekite.com]*.

These ribs do two things; they keep the kite in shape and enable it to float when it hits the water out of control! Better than that, they allow the flyer to re-launch from the water. You will note that these kites have four control wires, sometimes five. This does make them superior in that they do not readily collapse[10]. So if you can launch and recover from the water you are well on the way to propelling your boat.

Now this does not mean that you should step out and buy the first inflatable kite you can so that you can charge off and head for Labrador! It still needs more thought. Do you think you have enough skill to fly it from a fixed position on your boat? If you do, then buy a second hand power or traction kite with inflatable ribs of no more than 2-3 square metres. This will be all you can handle, certainly in moderate winds, and give it a try — your outlay should be no more than £250 or so.

Don't try to do too much too soon, just sail down wind. Anchor by the stern, park the kite on the surface of the water ahead of the boat and run out the lines as far as you can, lean on the pulpit, pull sharply on the lines and up she goes. Haul in the anchor and don't forget to tell your helmsman what to steer for (a compass heading will be best). Once you are slowly underway, move to the mast and you could use it to support you.

Right, you're away. What now? Concentrate on keeping the kite in the air, here's where your land flying skills come in. Sooner or later it'll beat you, of course and crash into the water, right or wrong way up, depending on your luck. Again, luck depending, you may be able to re-launch quickly or not, or you could run down onto the kite. Don't do that. Anchor again over the stern, use a drogue, or even go astern on the engine. Above all try not to run the kite down. And try it all in shallow water.

One or two ditchings may well be enough for one day, but after that you'll be able to experiment. All sailing boat skippers like to play with the wind! You should also try your parafoil with the dinghy, experimenting in very shallow water to get the general feel of things. Kites have two huge advantages over sails, a) better pull for area, and b) a very very low heeling movement compared with ordinary sails[11]. To attach a kite a deck level near the front of the base of the mast has so much going for it.

Safety . . .

There are rules of course[12]. You can no more do silly things with kites and get away with it than you can anything else. It is crucial to make sure that there is nothing downwind of you that could be jeopardised or even inconvenienced by you and your boat or kite. It's all best done offshore or at least where there is plenty of open water between you and anything at all that you could mixed up with, so don't try it in any restricted or busy waters. Also make sure that your kite has a deadman feature (where necessary) so that it collapses if you fail to do something. Parafoils do not need such a feature[13].

You can no more do silly things with kites and get away with it than you can anything else.

Back to the future . . .

Back then to the future, as you might say — and the beginning of this article.

Is there any future for kite-propelled boats? I believe there is, but it's partly up to us. Kite technology has advanced quite dramatically in the past ten years. It has moved clearly from the realms of amateur yacht research to a growing and exciting sport.

It is very popular. There are claims that 35,000 people turned up to watch the Isle of Wight kite sailing festival at Yaverland in 2005, and it's on every year. *[http://www.whiteair.co.uk]* Remember too that windsurfing was quite undreamed of until the early 1970s — and now seems to have always been with us.

I think the 'holy grail' — the solution to the launch/retrieval problem, is not far from a fix, maybe by the use of compressed helium with a slow release valve on the kite itself, giving a 'neutral' or 'slightly lighter than air' flight beginning: and as the gas leaves the kite, normal flight takes over. Also one of the kite controlling lines could perhaps be a tiny helium-carrying tube inflating special extra ribs when the need arises.

This is stuff for the seriously clever, and is certainly not to be dismissed as just a laugh. Think of the advantages, kite stowage in no more than sailbag space, hardly any rigging that I can think of; no mast, no sails, no shrouds, no backstays and no halyards, I could go on. Maybe just a block at deck level and a cleat or two on the deck plus the control lines of the kite itself[14].

Perhaps the commercial world will show the way. It is tantalising indeed to imagine a supertanker being assisted by a massive (radio-controlled) kite in the right conditions. One visionary writes of manned airship type sky-tugs which would take a kite to the ship as and when the wind served well[15].

Computer-controlled high-tech kites for serious shipping purposes may well be seen in the not-too-distant future.

This is of course very seriously 'green'.

But for us, for now, let's give it a try: a new way to sail may be just around the corner!

And in the meantime it certainly looks like fun trying[16].

Notes & References

1 (AYRS 116.19);
2 (Currer p7);
3 (AYRS 116.19);
4 (Currer p7);
5 (AYRS 124.31, 124.6, 118.10);
6 (Currer p8);
7 (AYRS 116.59, Currer p22);
8 (AYRS 124.15);
9 (Currer p8, AYRS 122.24);
10 (AYRS 116.5, 118.13);
11 (AYRS 124.9, 116.21);
12 (Currer p119);
13 (AYRS 116.9);
14 (AYRS 124.30);
15 (AYRS 124.32);
16 (AYRS 124.44, 124.1, 124.6)
Currer, *(Kitesurfing: The Complete Guide, Ian Currer & David Barber, Lakes Paragliding, ISBN 0-9542896-0-9):* page,
and
AYRS publication (number.page)

John Hornby, 'Ashbrook', 17 Blind Lane, Southwick, Trowbridge, BA14 9PG

Editor's Musings . . . Number One

Percy Westwood

Any of you that have ever laid out a booklet knows that the number of inside pages must be a multiple of four. Woe betide anyone who ends up with blank pages. So you see the primary reason for this tailpiece. This is number one in a series of – well – one, at the moment.

At times while studying aero- and hydrodynamics (in my amateur fashion), I get puzzled. Perhaps someone out there can help:—

Puzzle the first (1) —

The lift/drag ratio of a sail increases as the aspect ratio (for a gaff sail of roughly luff to foot) gets larger. Traditional square rig, where sails are wider than they are high, bent to horizontal yards on a mast, have a gap between the foot of one sail and the yard below it, and each sail must be considered separately for lift and drag and has a very low aspect ratio.

If you look at the recently launched *Maltese Falcon*:—[http://en.wikipedia.org/wiki/The_Maltese_Falcon_(yacht)], you will see that the full sail stack on each mast has no gaps between the sails, so can be considered aerodynamically as a single sail and therefore a much higher aspect ratio and thus a better lift/drag ratio. How do the aerodynamic values vary between those two alternatives? How much vertical leakage between the sails is acceptable? Is a bit of leakage just enough to degrade the much improved lift/drag ratio of a high aspect sail?

Puzzle the second (2) —

For a 'normal' thin symmetrical foil with 'normal' flow, forces (particularly sideforce) is considered to act at about 35% of the waterline length from the bow. If we reverse the flow, presumably this moves to 65%? (35% from the other end). Of course with no flow it is about 50%? Again I am puzzled as to how the point of action moves, does it move instantaneously from 50% to 35% as soon as flow starts, at even the lowest positive value? Is not the definition of 'work done' the movement of a point of action of a force? *[I'll leave that one hanging in the air!]*. It seems to be not a simple concern, as if the sideforce is large, this will produce a significant torque on the vessel. This movement of the point of action affects sails and foils at both normal and reverse flows and when stationary in a fluid, and their respective balance. A well-balanced multi-mast, multi-sailed ship could be sailed with no significant helm. An understanding of all that is happening is crucial to the seamanship of the vessel.

Calculations of CE for sails and C_{LR} for underwater shapes are typically approximated by static area, when actually they all move forward – for each sail, and for the hull if it can be considered a foil, or each dagger board, fin keel, or rudder – as soon as positive flow exists, and vice versa.

Puzzle the third (3) —

If a 4 foot [1.3 m] diameter cylinder, 4 feet [1.3 m] long is placed horizontally, and immersed to 9 inches [0.22 m], it is a hull. The immersed length is about 3 feet [1 m]. The cylinder is rotatable. Let us imagine four such cylinders attached to the corners of a vehicle such as a quad bike. The displacement of the immersed volumes is about 22 ft^3 [0.62 m^3], or 1250 lb [560 kg] in water, surely able to support a vehicle? Now imagine rotating the cylinders. If they are smooth, the skin friction alone will mean that they will generate a small amount of thrust. If they have drag elements, they will perhaps begin to move the vehicle. If they have large paddle blades attached they will generate significant thrust. What happens to the hull shape? If we try to apply Froude's limit here the short fat hulls will behave as a displacement hull up to only about 2 knots! At this speed each hull should produce a bow and stern wave that coincide with the length of the hull. Given sufficient power, will the cylinder 'climb out of the hole in the water' and plane? Or will the confusion in the water surface 'foam' the location and sink the cylinder? All the vehicle's drag in the water is producing thrust. [I am deliberately avoiding air drag here!] The cylinders or hulls support the vehicle. Is this a case for laminar flow regime beneath the cylinders? Perhaps the cylinders should be limited in speed and the drag elements on the cylinders sized such that a Reynolds number applies that ensures laminar flow? I think this is a novel idea. What do other members think?

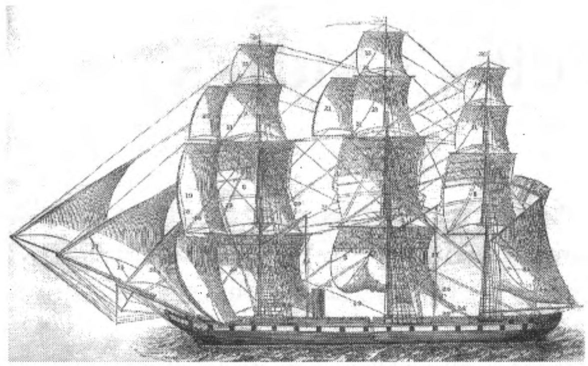
Practical applications of (1)

Philip Goode has done some interesting work on weatherly square riggers, see his website, [http://www.weatherlysquareriggers.com] and links, and the vessel *Pelican of London*, linked from above. By devising a method of attaining bracing angles of 18 degrees, it has thus been shown in model and full-scale form that a square rig vessel can point usefully as high as a fore-and-aft rig vessel. Philip Goode has shown recently that mast spacing has a major effect on 'thrust' from his trial brig model. It occurs to me that taking two aspects from *Maltese Falcon*, that of curved yards, and pulling the foot of a square sail toward the yard below to close the gap, (barring the minor problems of standing rigging) applying it to Philip Goode's work with bracing angles, could mean a significant increase in the sailing abilities, especially to windward, of a traditional square-rig vessel.

A vessel such as *Maltese Falcon* is a stunning example of modern engineering. Any problems would only arise after a major failure of electrical systems, hydraulics, generation, or propulsion. The vessel must rely on power to safely operate as a sailing vessel. Traditional square-rig sailing vessels only require a crew, and maybe less than the eighteen on the *Falcon*. Breaking the sail plan into small sections means each sail can be handled by a few crew, and the entire vessel can be kept in balance, sailed, or handled in even limiting conditions by the crew, whether any diesel engine is running or not.

Practical applications of (2)

The effect of (2) is shown by realising that the underwater shape of a commercial or naval sailing vessel 1750-1860 is a foil, albeit a short stubby one. This explains why the standing sail plan of a typical vessel is so significantly 'forward-heavy', as shown in accompanying figure.



a typical 1860ish ship

Colin Mudie has suggested *Sailing Ships, ISBN 0713653248* that it may be possible to 'fly' the hull upwind (negative leeway) as the hull foil has a trim tab at the after end (rudder) and can thus be made asymmetric — so long as the rig can be used to steer the vessel?

Practical applications of (3) —

Here is a rescue vehicle. It may sit on the beach until needed. It can be driven across the beach, into the water and possibly through surf to get out to sea. Operating at reasonable speed it can pick up a swimmer or casualty in the water and run them back up the beach to a place of safety.

I recognise many others for the ideas here. Colin Mudie introduced me to the idea that a ship's hull is a stub wing. The ideas of the 'cylinder' vehicle are primarily mine.

Comments welcome, and encouraged.

Percy Westwood
info@contextdesign.co.uk

Canting Keelers

Richard Boehmer

The first major and significant change in monohull design was to place the ballast outside of the hull in a keel. A refinement of this was to concentrate this external ballast at the end of a fin keel in a bulb.

We are now seeing this improvement taken one step further — a keel that is canted or swung to weather.

The accompanying table *(on the following pages, Ed)* which chronologically by year lists those boats with canting keels clearly shows that this improvement began about twenty years ago and has gained momentum in the past ten.

In addition to those boats listed, there are many smaller 6.5 Mini Transats (1st FOUESNANT- STATION VOILE in 1991) and Schock 40s with canting keels.

	launch year	type or location	boat	loa	designer	builder /comments	cant
	1946		L.F. Herreshoff, 1974, The Common Sense of Yacht Design, Volume II, pp. 120,121.				
1	1980	East Coast	RED HERRING	55	Hubbard, Dave		
2	<1987	East Coast	GREEN HORNET	33	modified Hobie 33		
3	1987	East Coast	RED HORNET	40	Brown & Burns		
4	1989	Open 60	ROXY † (FLEURY MICHON X, LA VIE AUCHAN, VOTRE NOM AUTOUR DU MONDE, UUNET FRANCE, UUNET, [TNT ITALIA TELECOM], AQUARELLE.COM, TIR GROUPE - MONTRES YPREMA, TIR GROUPE, GONNA GITCHA)	60	Briand & Lombard		30°
5	1991	MiniTA	FOUESNANT-STATION VOILE	21			
6	1991	East Coast	AMOCO PROCYON	65	Chance, Britton, also Olaf Harken et al		25°
7	1993	Open 60	ECUREUIL POITOU CHARENTES II	60	Berret, Jean		
8	1994	Open 60	VOILA.FR (SCETA CALBERSON, GEODIS, UUDS)	60	Groupe Finot/Conq	JMV-Mag-Amco	
9	1996	Open 50	VM MATERIAUX (AQUA QUORUM CHALLENGE, BMW PERFORMANCE, KINGFISHER)	50	Groupe Finot/Conq	JMV-Mag-Amco	
10	1996	Open 60	PRB	60	Groupe Finot/Conq		35°
11	1996	Open 60	AKENA VERANDAS (BUDAPEST, SOGAL EXTENSO)	60	Fa, Nandor		
11a	1996	Open 60	JUNOPLANO	60			55°
12	1997	Open 60	FILA (L'HEAUTONTIMOROUMENOS, LOIRE-ATLANTIQUE, WEL.NETWORK, GREY POWER, SAGA INSURANCE)	60	Groupe Finot/Conq		45°
12b	1997	Open 60	MARGARET ANNA (PETIT NAVIRE, LA RAGE DE VIVRE)	60	Joubert & Nivelt		
13	1997	West Coast	MERLIN	68	Lee, Bill		
14	1998	Open 50	GRYPHON SOLO (MAGELLAN ALPHA, MISSION AMERICA, SAILTHATDREAM.COM, TOMMY HILFIGER FREEDOM AMERICA)	50	Groupe Finot/Conq		
14a	1998	Med.	TIKETITAN	88	Frers, German		40°
15	1998	Open 60	HELLOMOTO [II] (ECOVER, TEAM GROUP 4, MOTOROLA)	60	Groupe Finot/Conq	JMV	
16	1998	Open 60	ARCELOR DUNKERQUE (SOMEWHERE [II], SOMEWHERE - BAUME & MERCIER, ACTIVE WEAR, SOLLAC ATLANTIQUE)	60	Groupe Finot/Conq	JMV	
17	1998	Open 60	PRO-FORM (WHIRLPOOL - EUROPE 2 (II), TISCALI [II], TISCALI GLOBAL CHALLENGE)	60	Lombard, Marc		40°
18	1999	Australia	AAPT 2 (NICORETTE [III])	79	Simonis & Voogd		
19	1999	Open 60	SOLIDAIRES (VM MATERIAUX [II])	60	Joubert & Nivelt		
20	1999	Open 60	HUGO BOSS [II] (SILL ENTREPRISES, SILL BEURRE LE GALL, SILL MATINES LA POTAGERE, SILL PLEIN FRUIT, SILL)	60	Lombard, Marc		
21	1999	Open 60	TEMENOS (UNION BANCAIRE PRIVEE)	60	Groupe Finot/Conq	Mag France	
23	2000	Open 50	LA LIBRE BELGIQUE (LIGHTNING, SAVING)	50	Berret & Racoupeau	FK Boats	
24	2000	Open 60	PBR [II] (VIRBAC)	60	Groupe Finot/Conq	Mag France	
25	2000	Open 60	SKANDIA [III] (KINGFISHER (III), CASTRO-DARTY-BUT, TEAM 888, TEAM COWES)	60	Owen & Humphreys, Giovanni Belgrano + Alain Gautie	Marten Yachts in Auckland	
26	2000	Australia	HEAVEN CAN WAIT	50	Welbourne, Hugh		
27	2000	Open 60	BOBST GROUP - ARMOR-LUX (SUPER BIGOU/ARMOR LUX, ARMOR LUX FOIES GRAS BIZAC)	60	Rolland, Pierre	Bernard Stamn	
27a	2001	Med.	TIKETITOO	88	Frers, German		40°
28	2001	W.C. & G..L.	VICTORIA 5	52	Andrews & Brown	TP50 modified keel by Matt Brown	

	launch year	type or location	boat	loa	designer	builder /comments	cant
28b	2002	Australia	KIWI MAXI	98	Elliot & Oliver		45°
29	2002	Australia	TARGE (WILD OATS [#], WILD JOE)	61	Reichel & Pugh		
30	2002	Australia	ALFA ROMEO (SHOCKWAVE [VI])	90	Reichel & Pugh		
31	2002	Med.	COMETA	65	Cossutti, Maurizio		
31a	2002	Med.	ONLY NOW	104	Frers, German		40°
32	2002	Open 60	FURTIF (FURTIF 60, LEASECOM - YMAG, CAEN LA MER, MAISONNEUVE REGION BASSE NORMANDIE)	60	Convenc, Dubois, Dejeanty, Leborgne, Leveel		
33	2002	Open 50	DEFI VENDEEN	50	Berret-Racoupeau		
34	2002	Open 50	CITY OF SOCHI	50	Owen & Clarke		
35	2003	Open 50	ARTFORMS	50	Owen & Clarke		
36	2003	MaxZ86	MORNING GLORY [IV]	87	Reichel & Pugh		
37	2003	MaxZ98	SKANDIA [II] (WILD THING [II], SKANDIA WILD THING)	98	Jones, Don		15°
38	2003	TransAt	MARI-CHA IV	140	Abgraal, Briand, Elliott, Oliver		40°
39	2003	Open 60	ECOVER [II]	60	Owen & Clarke		
40	2003	Open 60	VIRBAC-PAPREC (VIRBAC [II])	60	Farr, Bruce		35°
40a	2003	Med.	AORI	80	Farr, Bruce		40°
41	2004	W.C. & G.L.	GENUINE RISK	90	Dubois, Ed		50°
42	2004	MaxZ86	PYEWACKET [IV]	86	Reichel & Pugh		
43	2004	West Coast	MAGNITUDE 80	80	Andrews, Alan		
44	2004	Asia	MAIDEN HONG KONG	115	Kouyoumdjian, Juan		40°
45	2004	Open 60	SILL ET VEOLIA (SILL 2)	60	Lombard, Marc		
46	2004	Open 60	BONDUELLE II	60	Lombard, Marc		
46a	2004	Med.	DANGEROUS BUT FULL	80	Farr, Bruce		40°
	2004	Maxz90	NICORETTE [IV]	90	Simonis & Voogd		
47	2005	MaxZ98	MAXIMUS	98	Elliott & Oliver		50°
48	2005	Australia	CHIEFTAIN	50	Farr & Cookson		
49	2005	Australia	LIVING DOLL	50	Farr & Cookson		
50	2005	Australia	SPORTIVO	50	Elliott, Greg		
51	2005	MaxZ98	ALFA ROMEO [II]	98	Reichel & Pugh		
52	2005	MaxZ98	WILD OATS XI	98	Reichel & Pugh		
53	2005	Volvo 70	ABN AMRO ONE	71	Kouyoumdjian, Juan		
54	2005	Volvo 70	ABN AMRO TWO	71	Kouyoumdjian, Juan		
55	2005	Volvo 70	BRUNEL (PREMIER CHALLENGE, SUNERGY AND FRIENDS, ING REAL ESTATE BRUNEL)	71	Jones, Don		
56	2005	Volvo 70	MOVISTAR	71	Farr, Bruce		
57	2005	Volvo 70	BRASIL 1	71	Farr, Bruce		
58	2005	Volvo 70	PIRATES OF THE CARIBBEAN	71	Farr, Bruce		
59	2005	Volvo 70	ERICSSON RACING TEAM	71	Farr, Bruce		
59b	2005	Open 60	GALILEO	60	Lauranos, Angelo		
59c	2005	Open 60	PAKEA	60	Murray, Burns, Dovell		
60	2006	West Coast	STARK RAVING MAD III	66	Reichel & Pugh		
61	2006	Open 50	A SOUTHERN MAN - AGD	50	Elliott, Greg		
62	2006	Open 60	TEMENOS II	60	Owen & Clarke		
63	2006	Open 60	DELTA DORE	60	Owen & Clarke		

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**

April 2007

13-15th Broad Horizons (AYRS Sailing Meeting). Barton Turf Adventure Centre, Norfolk UK. Details on the AYRS website www.ayrs.org, or contact: AYRS Secretary, BCM AYRS, London WC1N 3XX email: office@ayrs.org.

May 2007

26-27th Junk Rig Association Summer Rally. Warsash Sailing Club, Contact: Peter Manning, 01204 849706, email: peter@perhygiene.clara.co.uk

14-18th Sailing Trials at Weymouth. Castle Cove, Portland Harbour, Dorset UK. No prizes, but the speed measuring equipment will be there. Contact: Norman Phillips, email: wnormal.phillips@ntlworld.com

October 2007

1-7th Weymouth Speed sailing. Weymouth and Portland National Sailing Academy. Contact: Nick Pogey, email: nick@speedsailing.com for details and entry forms

In October 2007, **RAINA** will be holding an international conference on **The Modern Yacht**, 11-12th October [note new dates], at Southampton Silent University, to provide a forum for the presentation and discussion of all aspects of modern yacht design, construction, operation and survey. The conference will address all aspects of yacht design including; performance, stability, sea keeping, construction and safety, as well as survey, operation and service experience; applying to sailing yachts, both high-performance and cruising and to motor yachts, in private or charter service. The conference is to present and discuss advances in technology; methods and concepts that have led to or are expected to lead to improvements in design, operation or survey; service experience, problems encountered and their solutions and how classification society requirements and flag Administration regulations are meeting industry needs. RAINA has invited papers on any of the following subjects:

- Performance, stability, sea keeping, hull motions
- Structural design, hull, keels, rudders
- Materials technology
- Fire safety and structural fire protection
- Windows, portlights, anchors and anchoring
- Masts and rigging
- Classification society rules, flag administration regulations
- Survey, NDT methods for FRP hulls
- Operation in general and helicopter operations
- Service experience

The conference will attract a large international audience and provide a forum and means of professional development for all parties interested in the design, construction, operation and survey of yachts.
http://www.rina.org.uk

May 2008

Innovation in High Performance Sailing Yachts
29-30 May 2008, Lorient, France. Organised by the Cité de la Voile Eric Tabarly (CVET), the Naval Academy Research Institute (IRENav) and the Royal Institution of Naval Architects (RAINA), INNOV'SAIL 2008 will provide an international forum for the presentation and discussion of the latest scientific and technologic research and its application in the complex field of high performance yachts and competitive sailing. INNOV'SAIL 2008 will provide an opportunity for scientists, architects, engineers, sailors, sail makers and others involved in this fascinating and challenging field to come together to share skills and know-how. The language of the conference is English for the publication and presentation of papers, but abstracts of papers and discussion will be translated into French
Content — Papers are invited on the following topics to be covered by the conference:

- Innovative design for performance
- Aerodynamics
- Design of sails, masts, rigging
- Hydrodynamics
- Design of hulls, appendages
- Structure and materials
- Fluid structure interaction
- CFD Validation
- New experimental techniques
- Performance enhancement in general
- Micro-meteorology and sites investigation
- Ecological ship, energy onboard...
http://www.rina.org.uk

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

On the Horizon . . .

More sources and resources: review, publications and Internet sites

Amateur Yacht Research Society
BCM AYRS, London WC1N 3XX UK

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