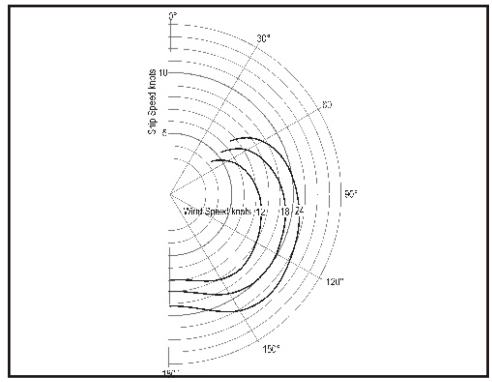
Catalyst

Journal of the Amateur Yacht Research Society

Number 28 July 2007

News & Views

Features



Cover shows an early impression of a floating foil conveyor [artist Florian Otto], see Page 12

Catalyst

Journal of the
Amateur Yacht Research Society

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

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

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Catalyst

Good-day again from your editor.

This edition, for which I again apologise for lateness, includes:—

PROFOIL, a hydrofoil assisted, two-way, flying, proa offered as a design concept to be built.

A note on speed downwind versus 'gear ratio' for a Bauer vehicle going DDWFTTW.

Several ideas from Ken Upton (to whom great thanks for providing significant material for this issue) on renewable energy, wingsails, and traction kites, shown at various stages of development.

A response on square rig to Editor's Musings in *Catalyst* 27, from Colin Mudie.

A request for information on a single-oared-sculling project and a prize.

A warning note from your chairman about the dangers of kite experimenting, and a plea for articles for publication.

Please check the Calendar section for AGM notice

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

How to supply information for publication in Catalyst:

The **Best** way to send us information:— An electronic [ascii] text file (*.txt created in Notepad, or Word, with *no formatting at all, we format in* Catalyst *style*). Images (logically-named please!) picture or graphic files (*.jpg, *.gif, *.tif).

Any scanned image should be scanned at a resolution of at least 300 ppi *at the final size* — assume most pictures in *Catalyst* are 100 by 150 mm [6 by 4 inches]. Digital photographs should be the file that was created by the camera. A file from a mobile phone camera *may* be useful. Leave them in colour, and save them as example *clear_and_complete_title_of_photo_or_graph.jpg* with just a bit of compression. If you are sending a CD, then you can be more generous with the file sizes (less compression), than if emailing, and you can then use *.tif uncompressed format.

For complex mathematical expressions send us hardcopy or scan of text with any mathematical characters handwritten (we can typeset them), but add copious notes in a different colour to make sure that we understand. Include notes or instructions, or anything you want us to note in a text file, preferably in angle brackets such as <new heading>, or <greek rho>, or <refers to 'image_of_jib_set_badly.jpg'>.

Otherwise:—If you write in longhand, and sketch or include photographic prints, and trust to snail mail (a copy, not the original) then all can and will be dealt with. If you have trouble understanding this section, email to ask.

As examples, the polar diagram on p16 of this issue was re-created from a second generation photocopy, photos of shunting in the *Champion* article in *Catalyst* 27 pp19-21 were screen grabs from a video supplied on DVD, the rest of the images in that article were scanned photographs, and the text was OCRed and keyboarded.

Send a **copy** of your work (copyshops can scan and email for you):
by email: catalyst@ayrs.org, by fax: +44 (0)1983 523324, or
by post:: Catalyst, BCM AYRS, London, WC1N 3XX

From Richard Eaton

'Rob Roy'

I am particularly interested in publications 77 and 80 as I understand that they have articles by, or referring to Reverend Stephen Pakenham.
I am currently the proud owner of *Rob Roy,* the boat in which he competed in the 1968 OSTAR and which is referred to in his book *Separate Horizons.*

I am currently in the process of restoring *Rob Roy* to her former glory. She has had some alterations over the years but I intend to rebuild her as near as I can to her original specification. I have some original photos dating back to the late 1950s but I would be very interested in any other material which may help.

I have tried to find out what became of her builders, G A Feltham and Sons of Portsmouth; I have found some reference to their location and that they closed in the mid 1970s but have yet to discover anything concrete.

Do you have any ideas? I would like to think that someone, somewhere, might have kept some documentation when they closed or even, dare I hope, some of the original plans?

I would be grateful to hear any advice your members may have to offer.

Richard Eaton,
Engelberg, Back lane, Pilsley,
Chesterfield, Derbyshire S45 8HJ

From William Groombridge

Some quick responses to *Catalyst* 27:

1) to Slade's pinholes: fill with two-part foam;

2) Slade's dynamics may be better sorted by putting a turbine under the catamaran — up to one hundred times more energy in a tidal or river stream for the same working surfaces collecting passing renewable energy. Needs a good lee shore with no waves but a good water stream.

3) Dimpled surfaces — there is a lot of work going on to make antifouling surfaces like shark skin or hammer paint. Maybe there is a reason?

William Groombridge
ecofrogtec@terra.es

From http://www.edie.net

Australia to study lawnmower and outboard pollution

A new initiative has been announced by the Australian government to fight pollution caused by **motorboats** and lawnmowers.

Lawnmower emissions make up a significant slice of pollution in urban Australia.

Malcolm Turnbull, minister for the environment and water resources said **outboard engines** and garden equipment were significant contributors to urban pollution.

Under the scheme, the Australian, state and territory governments will jointly fund a study into the viability of introducing regulations to control the emissions.

Mr Turnbull said: '**Outboard engines** and garden equipment, such as lawnmowers and line trimmers, *[petrol strimmers]* emit a variety of pollutants which can contribute significantly to urban smog and are potentially hazardous to our health.

'A brushcutter, for example, can produce the same pollution as ten cars, and small engines in general can produce up to 20% of total hydrocarbon emissions on a summer weekend day in Sydney.

'This is why governments are jointly funding a study to look at the viability of introducing regulations to control these emissions.'

The Australian government will provide half the funding for the study, which is expected to be published in the first half of 2008.

State and territory governments will provide the remainder of the funds.

The Australian government is already funding a project to test engine emissions from a range of lawnmower and handheld garden equipment engines.

Mr Turnbull said: 'The findings of this research will feed into the study announced today.

He added: 'We will also be working with the **outboard** industry to strengthen its **Voluntary Outboard Emission Labelling Scheme (VELS)**.

'This scheme is believed to be a world first industry agreement for labelling **outboard** products.'

Kate Martin
http://www.edie.net

From http://www.microtransat.org

The Microtransat project

Work at ENSICA

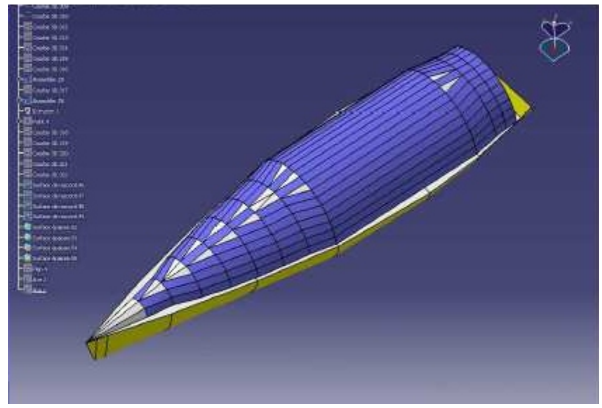
The final goal of the **Microtransat** challenge is to sail across the Atlantic ocean with a fully autonomous sailing boat. The boats are small (less than 4 m), fully autonomous, unmanned, have no other energy than sun and wind, and cheap (they are supposed to be developed in an academic context, as a support for research and/or teaching)

Before the 'big challenge' across the ocean (in 2008), a small challenge has been organized near Toulouse (France) in June 2006. A medium challenge took place at Aberystwyth (UK) in September 2007 *[see below]*.

Microtransat

Prototypes—Microtransat and Iboat

MICROTRANSAT is the first prototype. It is a 2.4 m length sailing boat with two classical sails mounted on a balestron. There are only two actuators: one for the rudders and one for the rotating mast. It is equipped with a GPS, a full attitude sensor (heading and angular rate are used for low level heading control and roll is used for high level wind direction estimation) and a wind sensor (speed and direction). Communication between the boat and the ground station is made by a 868 MHz modem serial protocol. Communication range is about 5 km. Amperage is about 700 mA under 12 V (including a constant half duplex communication at 4800 Baud). Energy comes from two classical lead batteries allowing for 15 hours of autonomy.



IBoat

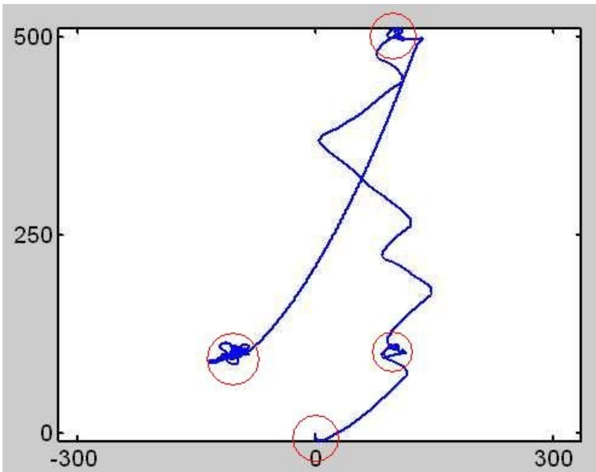
IBoat is under construction as the second prototype. The concept is the same with several small improvements: more robust sail system, more efficient actuators; and a major improvement: it will be actually fully autonomous. A set of 160 solar cells are mounted on the roof allowing for a day/night power average of 35 W (the calculation has been done at Toulouse's latitude of 44 °N). The battery charge is optimized via a MPPT (Maximum Power Point Tracking) dedicated system. The shape of the roof has been optimized in order to maximize the received solar energy.

All systems are organized on a common CAN 2.0b bus and a 12 V common voltage. This choice makes the integration of parts coming from different members of the team easier. The embedded computer is an Infineon C167.

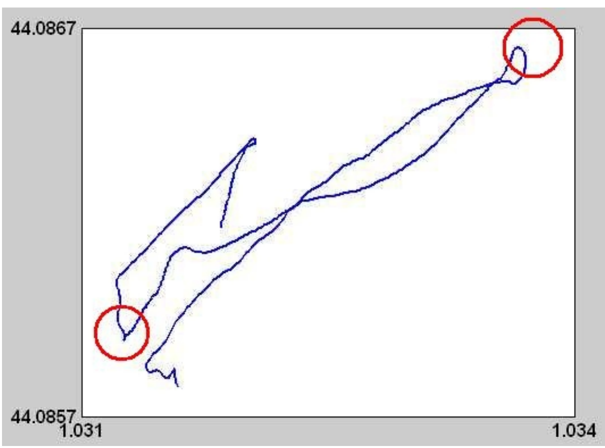
During 11 trials last year, the first prototype has shown a very sound behavior. It is relatively fast (3 kt with 15 kt of wind) and sound (tacking is easy).

Control

The control algorithm is based on a low-level strategy: the *traveller* calculates the heading of the next waypoint to reach and gives this desired heading to the *helmsman*. Helmsman adapts the actual heading to the apparent wind direction (avoiding to sail in the forbidden -45°/+45° range) and decides to tack if the desired heading is more than 20° across the wind direction. The *trimmer* constantly adapts the sail angle in order to maximize the boat's



Detail of the simulated navigation between 4 waypoints. (Wind is North 15 kt and current West 2 kt).



Datalog of a real test between two waypoints.

speed. A simulation model has been developed in order to test control strategy prior to each real test.

There is no tactician or strategy level implemented yet but a genetic-based optimization algorithm is under development for long range navigation associated with weather forecasts.

The academic side of the project

MICROTRANSAT is mostly an academic project. The goal is to give students an opportunity to work on a challenging and complex problem. Five universities have been involved to date.

- ENSICA[1] is the architect of the project. In charge of the systems, control and strategy algorithms. Between 2003 and 2006, 20 students have been involved in the project.
- IUT de Nantes[2] (Material science and engineering) is in charge of the boat itself. From 2003, 20 students have been involved in the project.
- IUT de Nantes[2] (Electrical Engineering) has developed the actuator low level control for the first prototype.
- BTS de Montauban[2] (Electrical Engineering) designed and developed the MPPT (Maximum Power Point Tracking) system for solar cells.
- INSA Toulouse[3] (System Engineering) takes the Microtransat concept as a starting point for a complete engineering system study.
- . . . and a kindergarten near Nantes will be in charge of the painting for the next prototype!

Microtransat Small Challenge June 2006

The *roboat* developed by Austria's InnoC has won first prize in the Microtransat June 2006 competition. To win, fully automatic sailboats no more than three meters long and controlled by computers had to navigate the course. French aeronautics university ENSICA organized the event. The ultimate goal is to construct sailboats that can cross the Atlantic without a pilot and without external intervention. The jury pay special attention to 'tacking,' i.e. sailing against the wind.

Five boats took part in the competition. However, the navigation system was not completely finished on one of them, and another had a technical defect and control problems. In addition to the Austrian *roboat,* an ENSICA boat and one from the University of Wales took part. InnoC says that its boat was the only competitor whose control and navigational system was completely on the boat and worked smoothly. On the two days of the competition (last Thursday and Friday), the wind was blowing at a full 20 knots (just over 10 m/s).

InnoC is a club of young people interested in technology; it also organizes the Robotchallenge. In March, 50 robots took part in that competition. After the Robotchallenge, the members began working on the 1.5 meter long *roboat* in their spare time. The HTL Spengergasse school of Vienna provided space for the workshop. A conventional model sailboat was equipped with a fanless computer (VIA mini-ITX 600 MHz and a 1 GB flash card running on Debian) and a number of PIC microprocessors.

After its success in France, the team now plans to take part in the second Microtransat in August of 2007. The goal of that competition will be to cross the Irish Sea. InnoC is now looking for sponsors.

2007 Microtransat, Medium Challenge, at Aberystwyth

We are very pleased to announce that the overall winners of this event were the *RoBoat* team from Austria. This team demonstrated true Autonomous sailing for the full 24 hour period of the challenge and a very robust control system. The physical craft, however, will need some serious modification before the Transatlantic challenge.

All the teams should be commended for their dedication and hard work. It was unfortunate that, due to software issues, the judges were unable to witness the full potential of the ENSICA boat from France.

The Aberystwyth boat was considered to have the greatest potential, in the context of the overall challenge, to cross the Atlantic autonomously. They achieved a respectable 19 hours autonomous sailing.

The MAST team from Canada are commended for both physical craft design and build quality. This craft sailed well in calmer conditions and a larger version could do work well in a Transatlantic challenge.

Congratulations to all the competitors, and good luck with your modifications, preparations and fundraising for the main event! *www.microtransat.org* for photos and links to other similar events

Melanie Landamore and Julian Eastwood

[1] ENSICA is a French *ecole d'ingénieur,* a high level engineering school delivering the French diploma of *Ingénieur* equivalent to a MEng degree.

[2] IUT, standing for *Institut Universitaires de Technology,* and BTS are delivering a French diploma of *Technicien supérieur* equivalent to a BSc.

[3] INSA stands for *Institut National des Sciences Appliquées* and delivers a degree of *Ingénieur INSA* equivalent to a MSc.

[material from http://www.microtransat.org]

ENSICA contact: Yves Briere, ENSICA, 1, Place Emile Blouin, 31056 Toulouse, France
yves.briere@ensica.fr

From DataTach LLC

Boat Performance System

Comprehensive, real-time boat performance data can be recorded and analyzed quickly with a test kit from DataTach LLC.

The DataTach Boat Performance Kit simultaneously records GPS boat speed, engine rpm (1, 2 eng.), propeller apparent slip, and heading. Also available, vessel acceleration, propeller blade speed, propeller angle of attack and more.

The recorded data are instantly saved to a portable memory card. The data is then uploaded to a web site *www.propslip.com,* where users can point and click to analyze it. Data display options include single or multiple parameter graphs and color charts. No special software or training is needed.

This kit enables the uniform collection and presentation of comprehensive data that's essential to evaluate boat performance for a wide variety of applications, including marine surveys, accident investigations, propeller selection and repair, insurance, and boater education, said Mark Wharton of DataTach.

Benefits include time and cost savings as well as new revenue opportunities for marine industry professionals. For boaters, a dashboard model, offers an opportunity to learn, compare, share and improve best-of-breed boat performance. Combined, the kit, and website bring knowledge and understanding of real-world boat performance to a much larger audience.

DataTach, LLC is an Affiliate Member of SAMS - The Society of Accredited Marine Surveyors. The DataTach Boat Performance Kit is distributed exclusively by Livorsi Marine, Inc.

For more information, visit www.livorsi.com or in the US call toll-free, 1+ 877-548-5900.

Errata to *Catalyst* 27, from **Paul Ashford**

In *The Effective Surface — an aid to understanding DDWFTTW,* on page 14 of *Catalyst* 27, 4th line of the first column '. . .the vector triangle *abc* . . .' should read '. . .the vector triangle *abd* . . .'

From Mike Bedwell

Prize Fund for **Single-oared Sculling**

Following a suggestion made at the AYRS meeting last November, I am considering offering prize(s) totalling £10 000 to encourage the technique of Single-oared Sculling, or *yullah,* on Britain's inland waterways. Before proceeding, I'd need advice on a number of matters, including legal considerations and administration, given that I'm in the UK only three months in the year.

As my main target audience is youth organizations in under-privileged city areas, I'd also appreciate advice on attracting matching funding from public authorities and other bodies.

Ideas from AYRS members are particularly welcome.

Mike Bedwell, michael_bedwell@hotmail.com

Update from Mike Bedwell:

I'll take the opportunity of updating AYRS on my limited progress with Single-oared-Sculling.

a) My offer of a prize remains on the table.

b) I have been assured that my oar with pear-shaped section will be ready for me when I return to the UK this summer.

c) I am also designing a raft that should enable the relative effectiveness of the two oars to be measured —and perhaps gain some publicity.

One reason for slow progress with (b) and (c) is that I limit my projects to doing the drawings, and rely on others to do the actual manufacture. You will recall from the Boat Show 2/3 years ago that I am pretty hopeless at practical engineering, and to get my model working had to fall back on the combined skills of the Fishwick family! So my greetings and best wishes to them, especially if they will be involved in the 2008 Boat Show.

Mike Bedwell

From Fred Ball

AYRS Chairman's Notes

First I have to apologize for not making you all contribute to *Catalyst.*

Catalyst is the AYRS journal and can only exist if YOU write it. The Editor puts what you write together, adds conformity and continuity to produce an interesting and useful contribution to our bookshelves.

What does *Catalyst* need?

- Details of your gadgets.
- Photographs and reports of your boat and its performance.
- Futuristic thoughts, we can discuss these and encourage the next leap in yachting progress.

Remember that AYRS members did much of the initial development of hydrofoils, multihulls, kite traction, sailboards, canting keels and many other now highly-commercialised topics.

What can you experiment on, without a huge R&D budget?

- Small boats and rigs, reduced costs and easy handling avoid the need for outside help and makes local lakes and rivers a suitable testing site, maybe even more frequent sailing!
- Models, not only small but some structural problems are reduced
- Human power
- Solar power

What else can you tell us?

- Boating facilities near you
- Suppliers of difficult-to-find materials
- Alternative construction materials
- Unexpected hazards, we need to learn from others mistakes: anonymity can be preserved!

Your suggestions for topics might encourage someone else to write an article as well. You can also help by enrolling more members—extra members mean more potential authors and ideas.

Chairman's Winter Projects

1) Backyard protection of mild steel from salt water–

Method: Construct small float to carry 0.3 m lengths of 50 2 mm mild steel strip prepared by wire brushing or angle grinder and then coated with various paint systems. Launch and fasten to my half-tide mooring and inspect the samples monthly.

Write up details of the experiment and initial results ready for the April issue of *Catalyst*

2) Write and illustrate hull cross-section talk given at the November All-Day Meeting.

3) Research local lake and river facilities and write report.

Fred Ball, 1 Whitehall Farm Lane, Virginia Water, Surrey GU25 4DA UK +44 (0) 1344 843690

Wave-power — the Wave-Rocker *[update]*

Ken Upton

A new device being developed to extract energy from wave power looks to be both simple, elegant and relatively low cost. It is derived from what happens naturally, if a boat is moored in a rough sea with something loose on deck. Sailors will be only too aware of the forces involved and the damage that can ensue. By adding an elastic mooring rope, the effect can be further enhanced. Our team of semi-retired engineers who specialise in developing green energy ideas are currently progressing an experimental generating system based on the idea from small scale sea trials to larger scale.

Living on an island, surrounded by the seas that can sometimes be very rough indeed, the United Kingdom is in a unique position to exploit wave power. According to the DTI renewables web site— http://www.dti.gov.uk/energy/sources/renewables/explained/wave-tidal/wave/page17058.html, wind-generated waves on the planetary ocean surface have an estimated power of 90 million GWatt. *[90 10^{15} Watt]*. Due to the direction of prevailing winds and the size of the Atlantic Ocean, the UK has wave power levels that are among the highest in the world. The Hydraulics and Maritime Research Centre in Cork estimates that the wave power resource around the UK is approximately 120 GW *[120 10^{9}]* or 2.5 times the total UK electricity demand.

Such a technology forms the basis of the 150 kW *Stingray* tidal stream generator installed in 2002, and its proposed 500 kW successor. At the 4Paz charity in Alicante in Spain, www.cyberlifeboat.org, we call the latest moored rocking boat with loose cargo technology, the *Wave Rocker*.

This latest version is to have a floating catamaran or similar shape, optimised to be stable laterally but to rock longitudinally. A mass is free to move up and down the length of the deck, acting on a piston as it reaches each end of its travel. Fluid displaced by the piston generates the power. Alternatively, the piston could be replaced by a magnet or armature running through coils. In addition, the mooring is deliberately made compliant, with an elastomeric section bridging the neck of a loop in an otherwise conventional mooring rope. This is so that the inertia of the moving hull, tensioning and being pulled by the rope, adds to that of the moving mass on deck.

Desktop model

As an oncoming wave lifts the front of the craft, the centre of gravity moves back and the mass on the deck moves towards the stern, delivering the first power stroke. The mooring rope loop opens out because of increased drag on the hull. The craft

Small model in pool . . .

. . . and at sea

is then lifted to the top of the wave and levels out. As the wave passes, the craft moves down the wave slope, tilting forwards. Its motion is increased by the tension on the mooring rope drawing it downwards. The moving mass moves towards the bows, delivering the second power stroke as the craft runs into the next wave and digs into it. The passage of the subsequent wave repeats the cycle. We believe that the effect could probably be further enhanced by adding vortex drag foils to the hull or adopting a special hull shape. The foils could be feathered when the elastomeric rope was contracting. It might be possible to extract additional energy by replacing the elastomeric rope with a fixed rope attached to a winch drum equipped with a *Tensator* type spring.

A scaled up, 4 m long car roof-rack portable version is currently being built from polycarbonate roofing sheets filled with construction foam and PET bottles, reinforced with an old car bumper, alloy door frames, and other disused items, but held together with modern materials. A patent has been applied for.

While most of the materials used are recycled in order to keep costs down, The resin and glass and carbon fibre cost hard cash, so the team is looking for investors, partnerships, or other input that can be used to help progress the idea further. I believe the construction techniques employed could also be used to build unsinkable work boats, or floating platforms for construction.

Summary

- New wave power generating system is based on what happens if loose cargo is left on deck, free to move under the action of a rough sea
- The effect is enhanced by the additional use of an elastomeric mooring cable.
- The development is still presently at the small scale experimental stage but is being trialed in the sea
- Wave energy contains about 1,000 times the kinetic energy of wind
- Unlike wind and solar, power from ocean waves is produced at all times of day
- Wave energy needs only 1/200 the land area of wind
- Wave energy devices are quieter and much less visually obtrusive than wind devices

Large Cat version

The oceans cover 70 percent of the Earth's surface. This makes them the world's largest solar energy collector and energy storage system. According to Dr Tom Thorpe of ETSU, the highest energy waves are concentrated off the western coasts in the 40°-60° latitude range both north and south. The power in the wave fronts varies in these areas between 30 and 70 kW/m with peaks to 100 kW/m in the Atlantic SW of Ireland, the Southern Ocean and off Cape Horn. The capability to supply electricity from this resource is such that, if harnessed appropriately, 10% of the present level of world consumption could be provided.

Ken Upton, ecofrogtec@terra.es

Circling kites gather more power

Ken Upton

These circling kites are a novel way of extracting energy from wind and water, that saves cost by bending with the flow instead of trying to stand up to it

Rotors constructed in the form of a series of tethered kites are able to extract energy from wind or water flow with high efficiency at low cost. Being light, such rotors work in light winds, are highly efficient and are inherently flexible enough to bend to conform to stresses exerted by more severe conditions.

The assemblages have been given the name *Kenape* rotor. Their ancestry is in kites and sailing yacht design, both extremely ancient technologies.

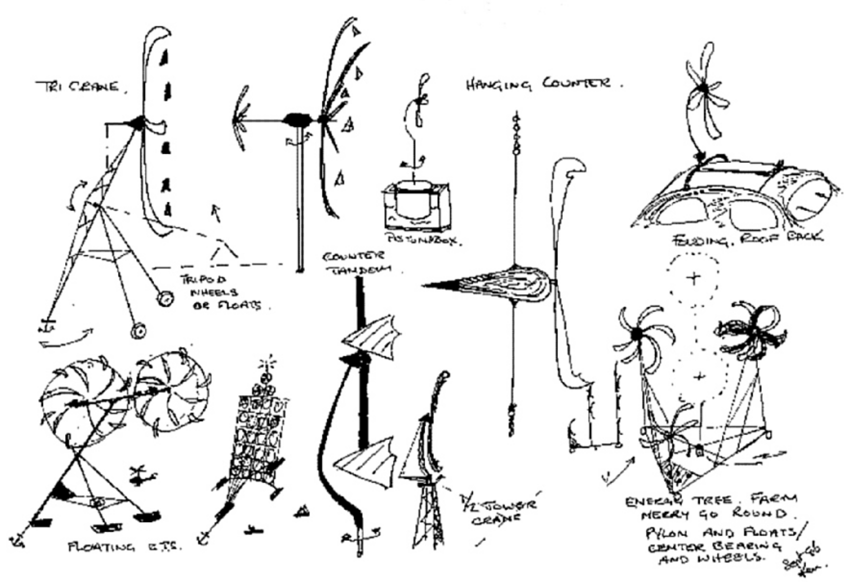
The rotors are based on flexible spoke wheels without rims. Over the spokes is a cobweb-like net to which the kites are fixed. The kite tethers allow just enough movement to allow the kites to find the correct flight angles. The rotors are supported on inclined tripod bases, which allow the rotors to weathercock and align themselves with wind direction. Because the rotors trail in the wind, rather than being forced to face it, construction can be exceptionally light and simple.

The driven areas are at maximum distance from the rotor hub, making best use of surface area, and increasing torque. Because they conform to airflow, the kites also cause less turbulence than conventional wind turbines, working more efficiently and producing less noise. In the event of higher wind speeds, the rotors are to a large extent self regulating. In such circumstances, the spokes bend inwards, reducing effective rotor radius and mechanical advantage.

A series of prototypes, made from scrap and re-used common materials have demonstrated the effectiveness of the principle of the idea over the past three years and the ability of the rotors to survive all weathers. We are currently assembling a *Kenape* rotor which will have a 12 m diameter, 40 sq metre rotor. We have plans to extend the idea to harnessing tidal and other sea currents. The idea is protected by patent application.

a Kenape rotor

Ken Upton, ecofrogtec@terra.es

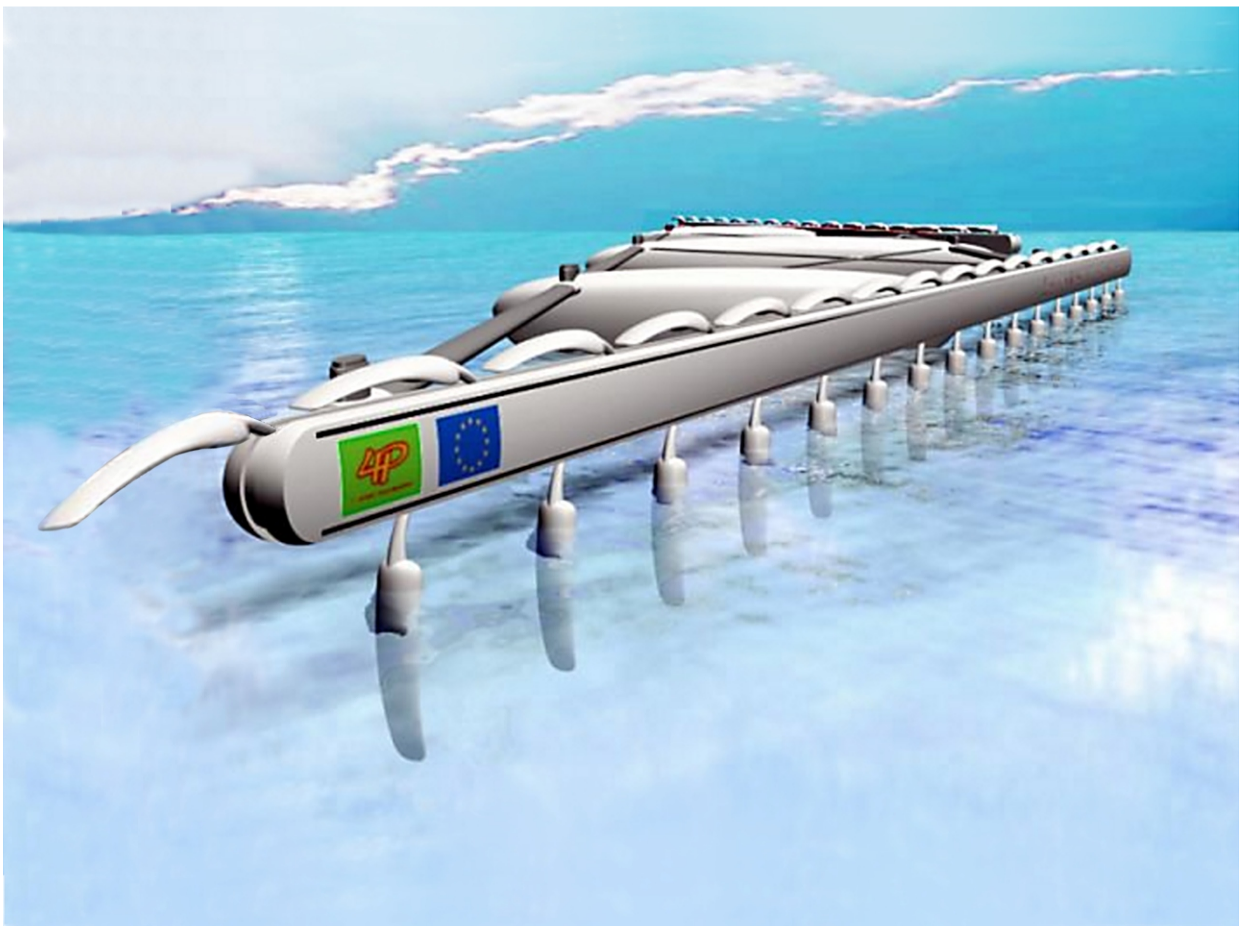


Various mounting methods for Kenape circling kites

Conveyor Foils—a high-density renewable-energy collector

Ken Upton

Most people do not understand the basic advantage you get from a foil. When energy in water or air flows over the two surfaces, the molecules are separated from their neighbours you get a reaction and a effect. This can be used either way if you know how.



An early impression of a floating foil conveyor generator - [Artist Florian Otto]

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

The molecules on the bottom have less distance to flow along the straight surface on the bottom of the wing and get to the back first. Going over the top is the long way in the energy stream.

This makes a gap between the two flows, which is called a vortex, which you have also seen as a whirlwind or the water going out of the drain plughole of your bathtub etc. This is a build up of energy created by different distances, pressures, etc. This hole then sucks the wing in.

So the action of the dynamic lift then moves and sucks the wing up into the low pressure side of the vortex. This dynamic action is what makes the plane fly. Force to move it forward through the air comes from the engine and a dynamic lift from the wing section shape. Together they get the result of flight. For hydrofoils the effect is basically the same when in water.

But like most energy it can work either way. Put energy in and get lift or take out passing energy from a stream by using dynamic lift in the foil shape. This gives you energy that you can use elsewhere. Just the same as the oil energy you use in your boat or car, it came from elsewhere. And vice versa.

Now windmills have been around for thousands of years, but water has density of about eight hundred times more than air. This is where real energy is, in the weight of water.

If you look at the dynamics you will see that a wind turbine is always working along the WRONG path. If you give a large angle of attack, which you want for power, the foils (blades) bend with the bigger drag factor and hit the tower. Bonk!!! No windmill. But if you have a Aureola foil moving along the correct path using the dynamic lift and drag together, you then can take the maximum renewable amount of energy out.

Think about this. When you get your bags of the airport luggage roundabout, which is a conveyer. So if all the suitcases were the same size at regular intervals at an angle you would get a dynamic fan, driven by a electric motor making it go around.

Now if you suspend the conveyer on a raft over the water with the foils in the water and all the machinery out of it. So your pumps, generators etc do not have to work under water and make parasitic drag from their mass and pull your anchor out. The hydrofoils will collect the passing energy as they move from the bow to the aft part of the conveyer track. Around and around.

Thats OK, but if the foils had to go back up to the bow in the water, you would loose all the energy that you have collected by pushing them back up. And a bit more, from the drag from the mass of the foils. It would not work. However, there is easy way to make it work, take advantage of the difference of the densities of air and water

The conveyer is above the flotation line, with only the foils in the water. Then as it turns, it lifts the foils out of the water stream of free energy. They go back up to the bow in the air. Then you have the effect of going around and around to drive your generator.

The wind resistance, which may affect the foils out of the water can easy be overcome by turning the track 90° so the foils are horizontal. They can be covered to futher reduce air resistance.

If you wish, you then have a good working surface for something else, a floating wildlife island, heliport, hotel etc. This way you would never have eyesores, like the inefficient wind turbines that kill our eagles and other birds. *[In Spain eagles are being killed by windturbines. This has led to a rise in the vole population, to such an extent that the voles are significantly threatening crops!]*

The power you want to take out controls the speed of the conveyer which would be slow and dolphins can play games between the foils on the craft.

Like humans, the unit will follow the path of least resistance . . .

Like humans, the unit will follow the path of least resistance. If you only had one track on the craft, the drag force would take over and the track would line up with the flow, with the foils going down it, without a dynamic lift effect, like a sailboat going downwind or a water wheel. Using a suitable foil section the dynamic advantage is several times more (up to 4.6 approximately), and by using two opposing tracks in a 'V', at the correct angle of attack, the craft then will find its own balance from a single-point mooring.

Smaller single row foil conveyers could be hung on an arm over a flowing stream and the path angle created by a tension device, or on piles like an oil rig.

In flowing streams there tends to be weed and rubbish. This can tangle up and stop underwater rotating turbines. This conveyer is self-cleaning as the foil is moved vertically out of the stream. To go back upstream, gravity would pull most things off in the air.

Weight on water is of little importance, so the craft could be made to a significant size. Moored and used in large rivers and tidal waters, they can be moved to anywhere you can recover renewable energy, or for servicing.

- Rivers are non stop.
- Wind at its best is 30%, and variable in direction.
- Tidal currents exist for about 60% working time each day.

'Power Factor'

Specific Gravity Air = 0.001225
Specific Gravity Water = 1
Ratio Water/Air = 816

That means there is 816 time more power on the working surface of the foil.

That's why you can float on water but you cannot fly in the air, the water is 816 times as dense. From many years of sail versus keel on sailing craft, the rule of thumb is a difference of about 35:1 for the dynamic advantage. As the parasitic drag from the hull is in this figure, the ratio of only the foil collecting renewable energy would be a lot higher.

The collected power output is estimated at about 50 times better than wind for the same size foil area plus the longer working time factor, giving a factor over 100 with tidal and 160 for river.

There is a small loss from greater machine friction, but the conveyer will operate at the maximum lift and drag angles. There could therefore be energy advantage compared to other turbines of over 100 times for the same inversion, plus many other advantages. It is portable and can go anywhere afloat.

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

We are a charity and looking for partners for the final R&D to exploit this new system to collect never ending green blue energy.

[Note to critics, this article is written in general terms for the layman to understand, so there are some finer points missed. Russian/English/ German Hydrofoil experts have said, Your calculations are very low.]

We can run the world on green-blue energy. Now, before its too late. We invented the cyberlifeboat and Greenpeace are now using our idea of virtual craft on their new web site. This new invention of 4paz is for the world to use for never-ending clean renewable energy. Help yourselves, give a gift of life to one you love. Go to www.4paz.org and buy eco block/s and become a member, partner or a sponsor.

Ken Upton, ecofrogtec@terra.es

[Update] The new static version HapCab

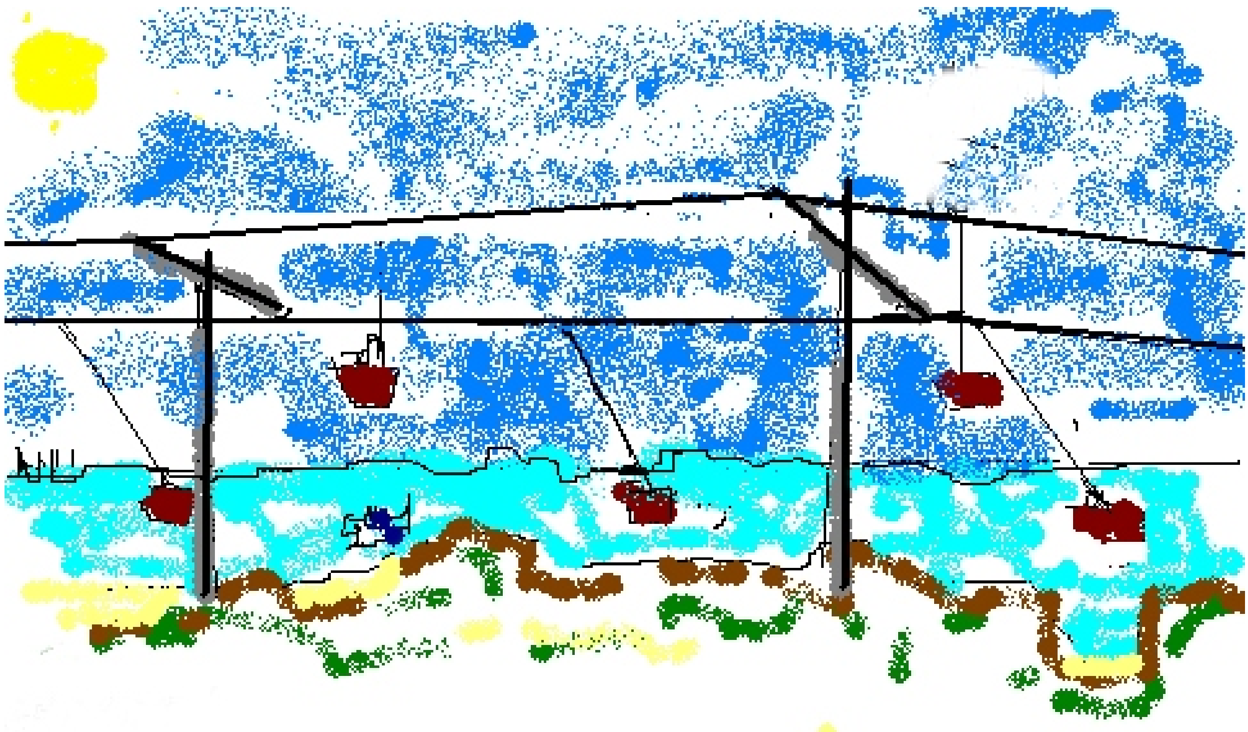
Ken Upton

'Little cable cars go half way to the stars' ['I left my heart in San Francisco', lyrics by Douglas Cross] says the song – Ski lifts, cable railways, and the biggest and most powerful machines in the world, draglines for mining—all work with this well-proven wire cable technology. We know a see-saw from our childhood and what a telephone pole looks like. A hapa is a vertical hydrofoil that can give lateral dynamic lift resistance for kite-sailing or it can be used on a sailing proa (outrigger boat) which has no keel. Or as in this case it can be used to collect passing renewable energy.

Most of these cable machines have a drive motor somewhere in the cable loop. This provides the power to move the load. But what if the cable was pulled along by some other force? In this case it is the collected dynamic renewable energy from the hapas in the moving fluid flow. The 'drive motor' then becomes a generator.

So how does the Upton Hapcab Renewable Energy invention principle work? Just think of a cable ski-lift, horizontally over water with water skiing instead of snow skiing. I think there are just two in Europe. One is in the world-famous holiday resort of Benidorm, Spain. Watching it one day, while at anchor nearby, helped me to invent the Hapcab.

Many places with a good flowing source of wet renewable energy are off headlands, river mouths, weirs, outpipes and other places. The T supports in the system could be mounted either near or on the shore. For easy servicing of the generating system, cables and foils and the minimum of electric power cable, conveyor cables run to where the power is needed. Water and electricity do not mix very well so



Sketch of HapCab centre section with immersed and airborne hapas

this is an advantage, and there is no need for expensive boat services to maintain the systems.

At this point the hapas would be out of the water, as it could be higher than the rest of the other cable masts.

Where tidal waters are used for this Renewable Energy machine the T support posts have a top arm that acts like a see-saw which lifts one side or the other to suit the direction of the tide. This can be a passive system using drag foil on the centre line of the system at the correct angle down across the flow to change the see-saw arms to the position for stop (level) or up and down either way for the flow direction. Some other device to move the T arms could be used.

The machine could be built almost any size, like other machine systems using continuous cable power trains. This is well-proven technology that has a long, reliable working life. The hapa foils are also passive and if damaged by floating debris (tree trunk or some other junk in the sea or coming down river), could be changed quickly, like a car wheel. Probably they would just push the rubbish along or out of their way, and carry on working.

Ski-lifts, cable railways, and . . . draglines for mining — all work with this well-proven wire cable technology.

To work around bends in rivers and rocky headlands, to find the best fluid flow, the cable line could cross over and the tilt angles of T support could be changed for each tack and depth. For the hapas to work in the available space and not interfere with river and sea traffic they could run in and around reefs, rocks, islands, dogleg piers, harbour walls for example.

Ken Upton, ecofrogtec@terra.es

Square Rig

Colin Mudie

[in response to Editors Musings, Catalyst 27—Colin Mudie RDI has designed many yachts of varying types, while also designing square-rigged Tall Ships: Royalist, Lord Nelson, Young Endeavour, Tarangini, Matthew, *and other replicas and re-creations - Ed]*

I can sympathise with the various views on the inefficiency of square rig expressed in your columns. In truth, I held them myself before becoming actually involved in square-riggers. I can appreciate the development of the modern Bermuda rig as a bright branch of wind propulsion but it has a long way to go to match the overall sophistication of square rig developed over some thousands of years by the top technical brains of their periods.

For a start notice that square rig had to develop the power to drive big heavy ships and notice how square rig uses a turbine-like wind flow to maximise that power development. Again notice that sails operate as efficiently sideways on as they do vertically and can be, and were commonly, kited to reduce heeling for the benefit of the hull hydrofoil. The horizontal slots between the sails of square rig are as important as the vertical slots between genoa and mainsail but there may be ten or twenty of them to get right.

Oddly enough to modern eyes, square rig was usually chosen over fore-and-aft for windward/ leeward trading and the fore-and-aft sails on square riggers were principally used for balance, manoeuvring or anti-rolling, rather than being an early attempt to improve windward ability. They were there to improve conditions for the principal wind power engines—the stacks of square sails.

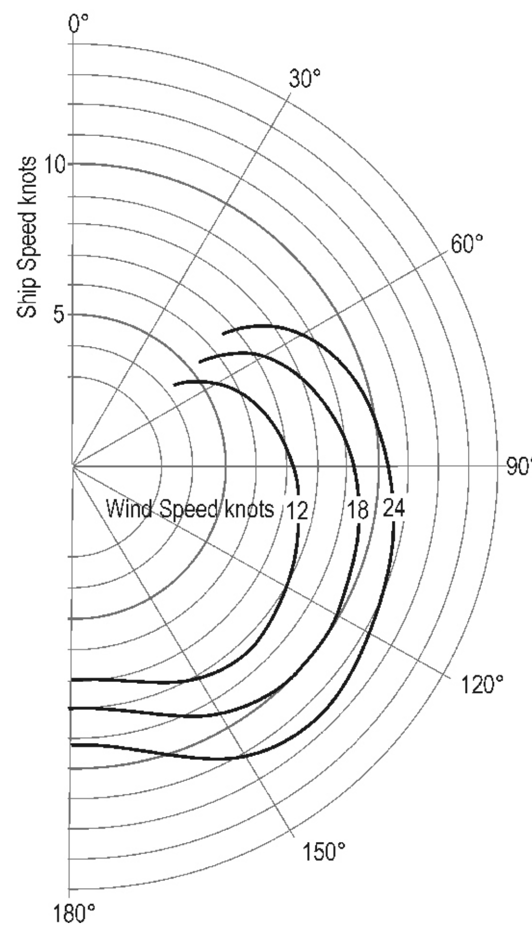
Windward work on square-riggers was of course of ultra importance. Even the weather-routed clipper ships had to get out of the Channel and the South China seas in highly competitive windward conditions. We are all aware of the national importance of the *weather gauge* in sea battles. The performance of the fore-and-afters, dhows, junks, Bermuda fishing boats was widely known and appreciated. The limitation, however, on windward ability was not the bracing angles but the sheer size of the ships which meant that the critical relative water flow speeds were tiny and the ships had to point away to maximise hull speed. After all the development of side force varies as the square of the relative water speed. It was more important, especially in light winds, to maximise the hull speed to minimise the necessary angle of attack or leeway. In big sailing vessels, whatever the rig, windward ability is restricted by the hull not the rig.

Of course, centreboards and leeboards were tried throughout history but it is possibly significant that they were generally disregarded. The relationship between their practical dimensions and the displacement of the ships meant that their contribution to side force was modest.

The ignorance of the use of wind power outside our rating rule yacht rigs is fairly universal and perhaps it needs to be explored which is why I am happy to write this short note on the subject.

To be helpful I attach the polar diagram for a 200 tonne brigantine which illustrates a modern use of square rig.

Colin Mudie, Lymington, Hants



STS Young Endeavour, 200 tonne Brigantine
Polar Diagram

Traction Kites

Ken Upton

I am working on a new traction kite system for motor boats, based on my Chinese hook kite which is reefable and either side can be the leading edge and will go to windward, if the craft has a hard chine. It is held up on a telescopic mast like a big surf casting fishing rod to get it flying and to recover it, without it falling into the water. As the batterns have a 7 to 1 curve it fits along most bow hand rails when not in use. The distance you can fly from the craft depends on the length of the four control lines (main halyard, lazy-jack line, and the twin multi-sheets). All four lines are on reels just like fishing reels. The sheets each side are fixed to the deck on the center of balance of the craft via a block and the others to blocks at the top of the mast, again just like heavy duty fishing lines.

The picture *[right]* is of my early junk kite. Now I have a better batten and lazy jack for self-reefing. So the kite can be several sizes for all weather conditions.

Ken Upton, ecofrogtec@terra.es

Eco-Reefs *(and an invitation)*

Ken Upton

I am just starting to build a 30 meters x 3 eco reef sculpture of a Carretta Carretta *[Loggerhead Turtle]*, if any AYRS members would like to come and learn for a few weeks with my 4Paz new technology.

We have two nice Spanish farmhouse-style flats here at our centre available. We also supply free lessons in boat building, reef, ecological sculpture in our reuse technology. Sailing, and other activities like diving with our team is possible. Also there are plenty of other things to do in this area of Spain, either local or expat. (read the Costa Blanca news on-line)

We will only charge the cheap rate for long term winter renting, the minimum time is one month. The flats have all you need, from log and gas fires, gas cooking, electricity etc. They are basic and practical and just outside of the local village. You would need to hire a car or drive down. Ideal for couples or three people. The only things you need to bring is your own sheets etc. (people are fussy) and the personal bits that make your life easy. There is a ADSL line free in the price.

Basic cost is 500 euro with light and water included. Plenty of wood can be collected locally or you can buy gas or logs.

We are 5 mins from beach, golf, Denia and ferry service to Ibiza, 10 mins from Javea. We are in the national park of Montgo, near the big La Sella urb but with no sea view. As that development faces North and we face South which is a lot warmer in the winter. The nearest motorway exit is in the next village of Ondara. We are thirty minutes from Benidorm and midway between Valencia and Alicante airports, each about seventy five minutes away.

Ken Upton, ecofrogtec@terra.es

Speed downwind vs Gear ratio in a Bauer vehicle

John C Wilson

A study of the ‘gear ratio’ between the speed of the propellor and the speed of the wheels for a Bauer vehicle.

The Bauer vehicle, shown schematically in figure 1, can be analysed by a speed argument. Let the gear ratio be such that the backward-moving air column through the propeller moves away from the vehicle at a speed **V** when the vehicle’s wheels are turning at a rate corresponding to a forward vehicle speed of **V**. Then, assuming the moving air shaft meets the wind (whose speed is **W**) head-on without any loss, we must have:

V = **W** + **V**

Solving for V/W, we get

V/**W** = 1/(1-)

Plotting this, we get figure 2.

This shows that, ideally, for all negative values of , V/W is between 0 and 1. In this range, the vehicle is going downwind *slower* than the wind.

For between 0 and 1, V/W is greater than 1 and the vehicle is going downwind *faster* than the wind.

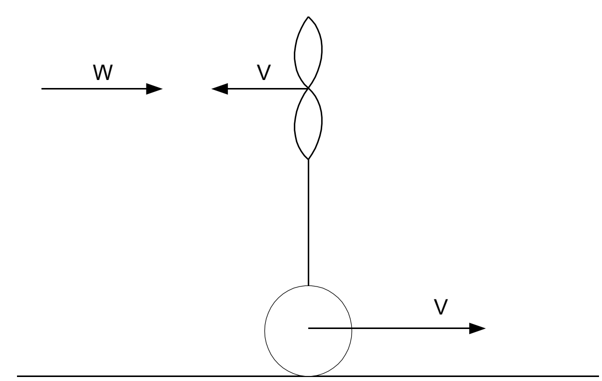


Figure 1 — The Bauer vehicle, schematic

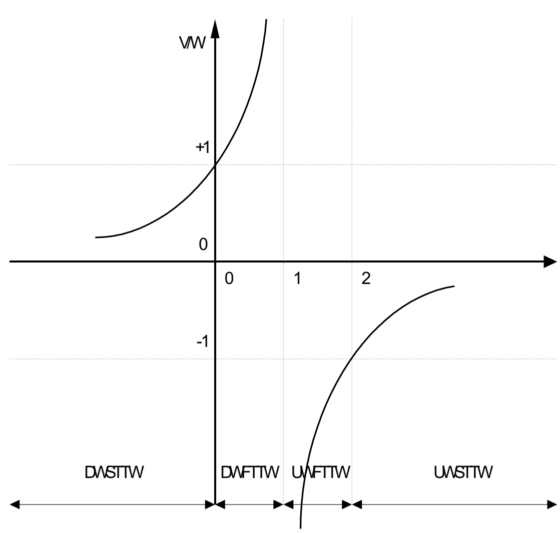


Figure 2 — Ideal Speed Ratio versus Gear Ratio

For values of above 1, the ratio V/W is negative: the direction of V is *opposite* to W (i.e. the opposite to the way it is shown in Fig. 1) and so the vehicle is going *up*wind.

For between 1 and 2 it is going upwind faster than the wind, and for values of above 2 it is going upwind slower than the wind. These ranges are shown on Fig. 2.

Are these speeds attainable? Certainly not, but they can be taken as an upper bound for the speed ratio attainable with a given gear ratio (see below for more on this). The practical difficulties of maintaining wheel grip and propeller function will obviously rise as approaches 1 from either side.

Jack Goodman (Catalyst 23, p. 5) reports that *For every 17.5 feet the wheels roll the propeller moves a theoretical distance of 10 feet*. This gives a = 10/17.5 = 0.57, and V/W = 2.33.

Comparison with Paul Ashford’s analysis

This analysis is similar to the one that Paul Ashford gives in his article *The Effective Surface — an aid to understanding DDWFTTW,* in *Catalyst* 27, pages 14-16, without the propeller details.

His S_V is my V, and his S is V – S_V, or V – V in my terms.

He suggests that rather than meeting without loss, the backward moving air shaft (his helical *effective surface*) would be likely to meet the wind in such a way that, approximately:—

$$\mathbf{V} - \quad \mathbf{V} = \mathbf{W}/2$$

This gives 1/2 the value for V/W that I show in figure 2.

In Jack Goodman's vehicle, this would be 1.17, although it appears that he exceeded this.

The table at the bottom of p15 in Paul's article is generated on the assumption that:—

$$\mathbf{S_V} = 2/3 * \mathbf{V}$$

This corresponds in my analysis to   = 2/3, which gives V/W = 3. His exposition is a little circular here, because he then computes propeller blade angles corresponding to a *range* of values of V/W, concluding on his page 16 that the upper bound is indeed 3.

A casual reader might conclude that this speed limit is an absolute one, but it is a consequence of the assumption that:—

$$\mathbf{S_V} = 2/3 * \mathbf{V}$$

I can't comment on the appropriateness or effectiveness of particular values of the propeller blade angles   and   in Paul's analysis but I should point out that the angles are sensitive to the value assumed for his B_C (the propeller tip speed); in his table he takes it to be fixed at 1.25 * V.

Upwind *and* down?

Several correspondents seem to have suggested that a Bauer vehicle would go upwind just by turning the vehicle around. This seems hard to understand, since the gear ratio isn't changed by turning the vehicle around. (The propeller would no doubt be inefficient).

Goodman (*Catalyst* 23, p. 5) says that *when the gear ratio is reversed … it goes up wind very well.* Presumably this must mean that he adjusted the gear wheels on the propeller shaft and the wheel axle to give   = 1.75 and so V/W = –1.33, i.e., *up*wind (theoretically faster than the wind).

If he had left the gear wheels in place and simply twisted the drive belt the other way, reversing the direction of the propeller, it would give   = –0.57 and in that case V/W = 0.64, still *down*wind (but slower than the wind).

It would be helpful if Goodman could confirm just how he *reversed* the gear ratio. *[I've asked, but as yet had no reply, Ed]*

DWFTTW principle

In *Catalyst* 19, I suggested the following unifying principle … *in order to get forward thrust in a wind-powered vehicle that is moving downwind faster than the wind, part or all of the propulsion mechanism must be going less than the speed of the wind, at least part of the time. Of course, it must not always be the same part, or else not all the time: otherwise that part will get left behind. Therefore, the mechanism has to be oscillatory in some way.*

At the time I wrote that I didn't see how the Bauer vehicle could satisfy this principle but I later changed my opinion. Imagine the air column coming out of the propeller to be solid, like a telephone pole. Then for appropriate values of , the end of the pole will be traveling downwind at less than the speed of the wind and can therefore interact with the wind to propel the vehicle.

Since the air shaft is constantly being replenished it doesn't matter that it gets left behind. (My conclusion about the necessity for oscillation was wrong.)

"Energy flow"

There have been many DWFTTW arguments based on *energy flow,* including arguments about whether the wheels drive the propeller or vice versa.

As Paul Ashford correctly points out (*Catalyst* 27, p18), the energy is supplied by the relative motion between the air and the ground: which way you consider it to *flow* depends on your frame of reference.

Outdoors, the Bauer vehicle 'obviously' derives energy from the movement of the wind (our frame of reference here is the ground) – and so the propeller drives the wheels.

But in the indoors experiment, where the vehicle rides on a treadmill, the energy 'obviously' comes from the motor driving the treadmill (our frame of reference is now the air in the room, i.e., the 'wind') – and so the wheels drive the propeller.

Yet these two experiments are mathematically indistinguishable.

John C Wilson, johnwilson@pocketmail.com

Extreme Danger from Kites (on boats)

Fred Ball

Launching a traction kite from directly downwind WILL lead to broken equipment and people. There have been fatalities.

The kite surfing equipment has multiple quick release systems to allow the kite to be jettisoned if things get out of control.

A kite flies in an area of sky which approximates to one quarter of a sphere; all of this except the edge of the vertical arc can be considered as a power zone where the kite can rapidly accelerate increasing the apparent wind and lift exponentially and uncontrollably until it reaches the edge of the power zone.

A downwind launch inevitably results in this happening; the kite blows downwind as a 100% drag unit, you coax it off the surface and air flows over it: drag instantly is reduced and it rockets skywards generating huge amounts of lift until it arrives overhead. The geometry of the lines does not allow the angle of attack to be significantly reduced, the sliding bar of the kite surfer is used to initiate a surge of power to permit stunts to be performed.

Fifth line systems do allow de-powering but not always easily and quickly.

Training by a qualified instructor is wise.

Practice is essential, flying the kite needs to be instinctive so that you can concentrate on where the boat is going and avoid potential obstructions. The lines are often 50–60 metres or more, which makes your boat potentially 100 metres wide/long.

General Hints and Observations

Kites have a wind speed range of use. A kite rated 7 to 15 mph; means an expert can fly it in 7 mph winds and cope with it in 15 mph winds but a beginner will only be able to use it at wind speeds of 9 to 12 mph. Newer designs have wider ranges, some are specially for beginners. If you can afford it, buy at least one new kite of suitable design.

They fly and respond more rapidly on short lines, loss of control will result in the kite crashing before it overpowers the operator.

Kite surfers launch their kites on the land and concentrate on not letting it fall in the water.

Water launching is easy when you don't want the kite to fly; not so easy otherwise, remember the wind speed at sea level is much less than at 10 metres. The aim is to coax the soggy heap to one corner of the flying zone (the 5th line comes into its own here) and then to coax the upper wing to lift off and gradually lift the whole kite from the water.

Kite lines love to tie knots in themselves and loop over any projections on a boat and cause havoc; they are most definitely not inanimate!

Fred Ball, frederick.ball@tesco.net

Fred in his Kite Boat

The PROFOIL — a hydrofoil-assisted, 2-way, flying proa

Roger G Napier

Designed many years ago, I had hoped to build it, but somehow it never happened. I pass the design on to the membership with my blessing — one of the members could build and race it!

Design Considerations:

1) The fastest boat will always be the one which has the least contact with the water and the least weight.

2) Multihulls are lighter than monohulls, and the proa is the lightest of the multihulls.

3) A 'flying proa' has only the single hull on the water.

4) 1 and 2 above imply that we must design a planing proa. These facts undoubtedly led to the production of Yellow Pages by Cunningham. Certainly, windsurfers or sailboards show that planing and light weight lead to remarkable speeds.

Problems:

1) Yellow Pages has several problems:

a) It can only go one way.

b) It has two planing surfaces instead of one. (Two hulls in line ahead)

c) It has to have 2 crew—one to control the flying ama (on which the crew cabin is mounted) and the other to steer.

2) Western designers thought that the single ama of a proa should be on the *lee* side. (See Newick's *Cheers* and pages 147/8 of Gougeon & Knoy's book: *Sailboat Design: Yesterday, Today and Tomorrow*, Macmillan, 1973, ISBN 978-0020014003)

3) Western designers also mistakenly ignored the native design of a solid, heavy narrow ama, replacing it with a light buoyant hull.

Conclusions:

1) My investigations in Hawaii showed that the natives deliberately passed up the plentiful palm tree trunks for their amas. Instead, they chose to use the *koa* tree. This wood I found to have a specific gravity of just less than 1.0, thus it only just floated in fresh water. (It will be remembered that it is relatively easy to lift a heavy submerged object because of its displacement, but it is much more difficult to lift it out of the water completely.) Consequently, the native *koa* **log amas** had the maximum righting moment when kept to windward. In addition, the narrow cross-section of a log has lower drag than does a larger, wider hollow hull when in the water.

2) The higher the wind pressure on the mast and sail, the more a sailboat tends to pitch forward in the longitudinal plane and bury its bow. Cunningham solved this problem by having two hulls in line ahead. My suggestion is that the bow could be held up by means of a submerged, triangular T-mounted hydrofoil with its angle of attack controllable by the helmsman.

It should be noted that Christopher Hook, back in 1946, was experimenting with aircraft propeller-driven hydrofoils. These used surface-sensing floats to control the angle of attack—a system which has been copied recently by Greg Ketterman in his *Trifoiler*.

In my discussions with Hook, he emphasized that the principal problem with foils is the entrainment of air down the struts which leads to a loss of lift over the top of the foil. He solved this by mounting the foil on the top of the short leg of **a J-shaped strut**, thus entrained air could only reach the lower, or pressure side of the foil where it caused no problem.

3) Because the original native flying proas had the ama fixed on one side only, they carried out what is known as a *shunt* when going about. This rather clumsy manoeuvre is well-illustrated on page 19 of *Multihull Sailboats* [E F Cotter. Crown Publishers, NY

1963 et seq]), *[or in the article* Champion *in Catalyst 27, Ed]*

My solution here is to have two identical amas connected by light-weight **sliding beams** across the boat. Thus, when sailing on the port tack for example, the port ama is fully winched out to port, while the other ama is close aboard under the gunwale on the starboard side, and vice-versa. In very rough seas, the boat could be sailed as a trimaran with the amas set equidistant on either side.

He solved this by mounting the foil on the top of the short leg of a J-shaped strut, thus entrained air could only reach the lower, or pressure, side of the foil where it caused no problem.

4) The hull shape I came up with has a very narrow but **high bow** that then widens aftward (somewhat akin to a paper dart) to a wide **flattish stern**, athwartship angles being about 8.5°. With the bow hydrofoil properly adjusted, the boat would ride at the correct planing angle of 7° above the horizontal. (It is interesting to note here that the *Tasar* planing dinghy came up with much the same hull shape.)

5) The craft is fitted with a **centre-board** in the usual way.

6) Because of the necessity of water clearance of the ama beams, it would seem that about **18 feet** would be the minimum practical waterline length for this boat.

Summary:

The *Profoil*—a proa with a *Tasar*-like hull, is therefore fitted with a fully-battened mainsail and carries no jib. It has a fully-retractable single foil mounted on a J–shaped strut, so that it can be swung up and back over the bow when not in use. The attack angle of the foil is controllable from the cockpit. There are streamlined, curved *koa* amas on both sides, mounted, native-fashion, on either end of a double, sliding beam. This beam may be winched from one side to the other by means of a crank system mounted in the cockpit. It is probable that winds of 10-12 knots would be needed to get the craft up to its proper planing angle. Top speeds will only be limited by wind strength and water conditions.

Whilst it seems likely that a bow foil would have less drag than a second planing hull forward, as per Yellow Pages, this probably will only be ascertained by actual experiment.

Roger G Napier,
gaunt@shaw.ca

My Sailing experience:

I started sailing first in 1931 on sand yachts at low tide on the wide beaches in Northern France. My next sailing was on ice boats on Lake Simcoe, north of Toronto, Canada. After surviving the 1939/46 war as an RCAF navigator then pilot, I owned a monohull in Trinidad, but soon graduated to a *Shearwater* catamaran, then later, to a B-class cruising catamaran.

In 1964, I built and raced a Unicorn, A-class catamaran in Victoria, British Columbia. It was at this time that I began to design the *Profoil* but unhappily, I never had the chance to build it. Next, I acquired a C&C 30 ft *Redwing* monohull for family reasons and more recently, I have been racing my *Enterprise* dinghy. Being outclassed in the latter by a friend in his *Tasar,* I have had to obtain an old *SeaSpray* catamaran to subdue him.

RGN

[I asked Roger by email if he had any sketches or drawings of this project, he said he did, but that they were re-ordered due to various house moves, however, he will try to locate them - Ed]

. . . I have been racing my Enterprise dinghy. Being outclassed in the latter by a friend in his Tasar, I have had to obtain an old SeaSpray catamaran to subdue him.

Eco-wings (Mk4)

Ken Upton

Following twenty-five years of work on this type of system, I present a new and simple idea for a wing sail which has good, controllable camber and position; easy reefing; set floating; on an unstayed mast. The thickness of the battens can be changed to suit the local sailing wind.

Mk3 Eco-wings shown here

As can be seen from these photographs of my Mk3 Eco-wings, the wing is slightly de-coupled from the mast, thus the vessel movement cannot disturb the airflow on the wing so easily.

The forward tether to the wing leading edge enables the center of effort of the wing to be moved. The wing has an internal lazyjack system and a multipoint sheeting system. Junk-style sheets provide easy reefing and an easy balance of load on the working sail area.

To operate the system normally you never need to leave the cockpit. If the main halyard is released it all drops down into a neat bundle automatically. If you want to stop, let the topping lift/lazy jacks off and just drop it to the deck. Alternatively leave it set, slack the sheets and the rig just finds the point of least resistance to the wind. The spinning crane on the top of the mast allows the ecowing to sail the boat backwards, forward, and luff up the sail in any position (very handy on a fore-and-aft mooring, low dockside or on land, etc).

As you see from the photos the masts are different diameter but the standard size wing is used. By adjusting the leading tether to the triangle, the fore-and-aft position of the sail can be adjusted to get the centre of effort where you want it. When the eco-wing is bent onto the mast it never needs to come off. If you use the same material as I use, it has as a minimum life of ten years in full UV with sail cover—effectively a lifetime. We use a plastic woven sandwich material made in Valencia in a small village by ex silk weavers. They will also weave and make other specifications (If you want any, I could act as agent). It is very much better and far cheaper than normal sail material. It is 100% water and air proof .

Mk4 Update: During the last month I have been sailing with my Mk4 ecowings on my old *Puff*. The idea really works well, but I have to use a different design on the battens. However the self-camber idea on the mast is perfect with the self-adjusting pressure sheeting from the junk sheets makes it a very simple and efficient rig. I have 7 battens on a 36 m^2 wing,

Mk3 Eco-wing

Three shots of the Mk4

the sail rectangle size is about 78 m^2. The centre of rotation is about 18% chord at the top and 20% chord at the deck and is fully adjustable with my floating system. In the Mk 4 there is a back cross-line, and the battens are not preformed but straight and bent around the mast with these back cross lines.

Yesterday we took *Puff* out of the water for a face lift ready for her/his (I never know what gender magic dragons are!) new life as the base boat for our eco-reef gardens project. That now has the full go-ahead from the Spanish government and Brussels but no funding yet. I had to sell up my little house in Tabarca to have the money to carry on with our project.

I hope to have a new knee joint before the new year, so that is my next big job. As soon as I sort my old leg out then I can do more running around . . .

Ken Upton, ecofrogtec@terra.es

Catalyst Calendar

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

October 2007

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

3rd Speedweek Evening Meeting at the Royal Dorset Yacht Club, Weymouth 7.30 for 8.00. Catch up with all the latest news and ideas.

November 2007

4th London Area All-day Meeting 9.30am to 4pm Sunday 4th November 2007, Thorpe Village Hall, Coldharbour Lane, Thorpe, near Staines & Chertsey. Location map via the AYRS website www.ayrs.org. Details from Fred Ball, tel: +44 (0)1344 843690; email frederick.ball@tesco.net

December 2007

No AYRS London meeting

January 2008

11th - 20th

London International Boat Show EXCEL Exhibition Centre, London Docklands. AYRS will be on Stand N058L, at the East end of the North Hall, next to the Start Boating feature. Helpers are wanted to staff the stand, selling publications and recruiting new members. If you would like to help (reward: free ticket!) please contact the Hon Secretary on +44 (0)1727 862 268 or email office@ayrs.org

January 2008 *(cont'd)*

27th All-Day AYRS Meeting 9.30am - 4pm, Thorpe Village Hall, Coldharbour Lane, Thorpe, Surrey (off A320 between Staines and Chertsey follow signs to Thorpe Park, then to the village). Details from Fred Ball, tel: +44 (0)1344 843690; email frederick.ball@tesco.net

27th AYRS Annual General Meeting 4pm, Thorpe Village Hall, Coldharbour Lane, Thorpe, Surrey (as above). Details from the AYRS Hon. Secretary tel: +44 (0)1727 862 268; email: secretary@ayrs.org

Note: Items to be considered by the AGM, including nominations for the Committee MUST be received by the AYRS Secretary before 22nd December 2007 (post to AYRS, BCM AYRS, London WC1N 3XX, UK, or email: secretary@ayrs.org)

This year, the Chairman and Treasurer posts are for election, Fred Ball and Slade Penoyre are willing to stand again, as are Committee Members John Perry, R Michael Ellison and Robert Downhill. There are also vacancies that can be filled and it would be nice to have some more new (and younger!) blood in the team.

Contact the AYRS Hon. Secretary tel: +44 (1727) 862 268; email: secretary@ayrs.org

March 2008

28th-30th

Broad Horizons AYRS Sailing Meeting Barton Turf Adventure Centre, Norfolk UK, NR12 8AZ. Contact AYRS Secretary AYRS Secretary, BCM AYRS, London WC1N 3XX, UK; email: office@ayrs.org Note: All boats limited to 1.2 metre max draft!

April 2008

27th Beaulieu Boat Jumble The National Motor Museum, BEAULIEU, Hampshire, UK. AYRS will be there!

June 2008

6th 8th Beale Park Boat Show Beale Park, Pangbourne near Reading, UK. Open-air boat show with a number of boats available to try on the water. AYRS will be there again selling publications. Contact: Fred Ball, tel: +44 (0)1344 843 690; email frederick.ball@tesco.net

October 2008

4th 12th Weymouth Speedweek Portland Sailing Academy, Portland Harbour, Dorset UK.

8th AYRS Weymouth meeting Speedsailing. 19.30 for 20.00hrs at the Royal Dorset Yacht Club, 11 Custom House Quay, Weymouth. Location Map: www.rdyc.freeuk.com Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX; email: office@ayrs.org

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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