Catalyst

Journal of the Amateur Yacht Research Society

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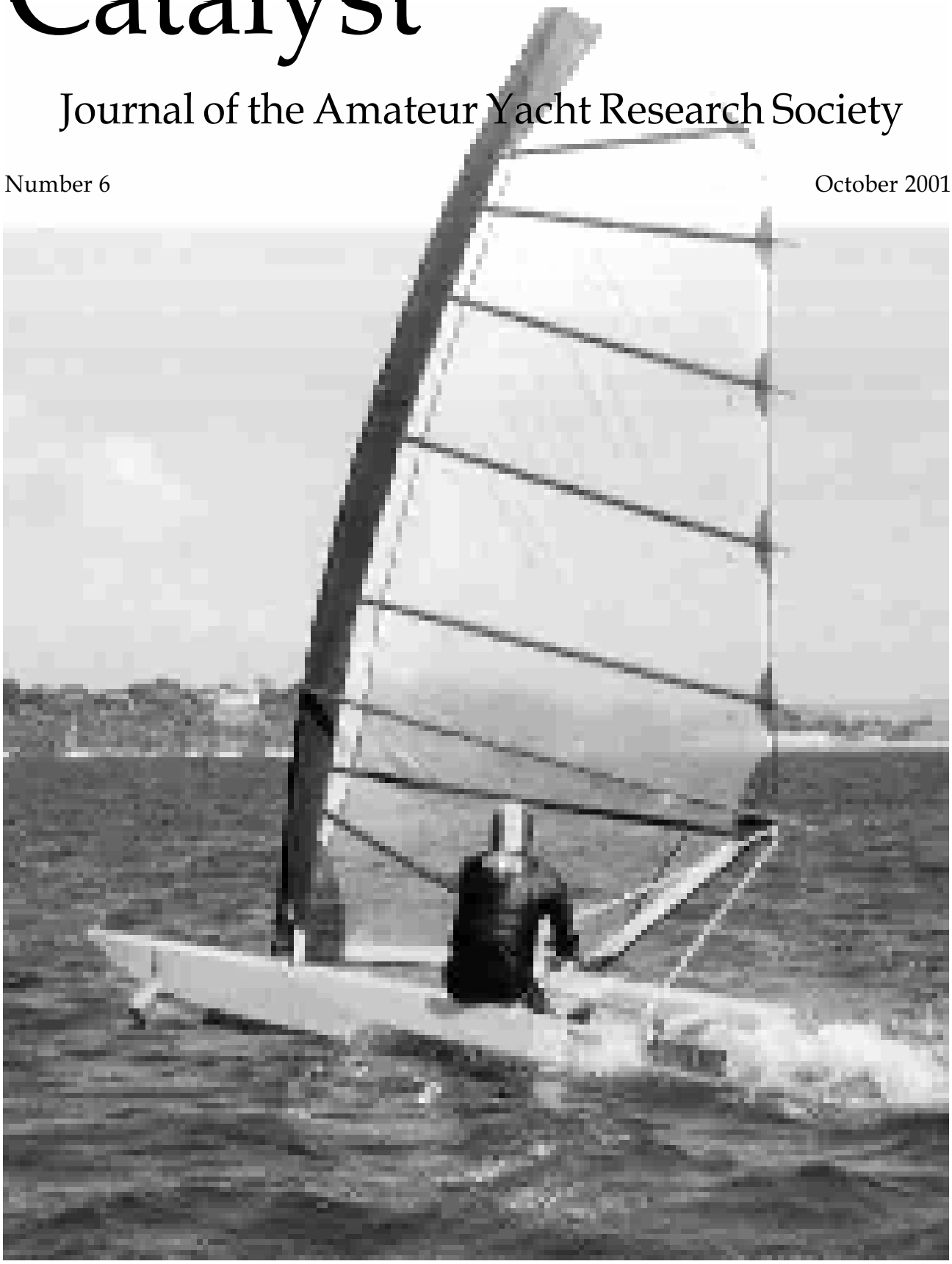

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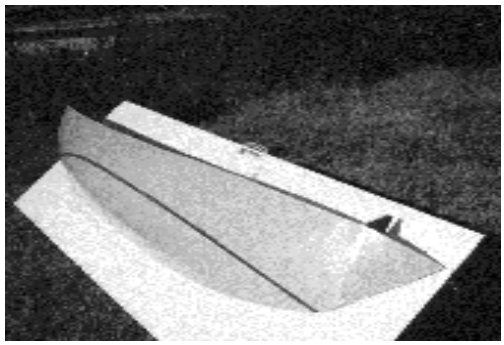


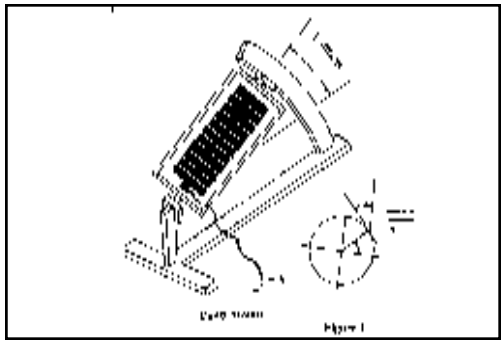
Speedsailing

Regulars

Cover Photo:

John Perry's hydrofoil close to lift-off at Weymouth Speed Week 2001. Wind about Beaufort F2 to F3.

Photo: Josephine Street



Catalyst

Journal of the
Amateur Yacht Research Society

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The end of the year

The equinoxes – time of mists and mellow fruitfulness in the northern hemisphere, but also the time of equinoctial gales. Time therefore for speedsailors to pack up the craft they have been building and head for the trials waters. Time to find out whether those carefully constructed ideas really do stand a chance of taking that elusive record.

In Europe, that means going to the Weymouth Speed Week, site of the first regular speed trials run by AYRS, a tradition continued by Bob Downhill and his team. This year's speed trials were blessed with wind, perhaps too much for some people whose boats were not up to the task. Crossbow's 1980 record still stands, but only just.

Time now then to think about next years developments, and maybe to write up this year's work for *Catalyst*. Tell us what you have done, and what you will do next.

In the southern hemisphere of course, summer is just beginning, and it's time to come out of the workshop and start some gentle testing. But maybe you people too could tear yourselves away from the Barbie of an evening and tell us about it. Catalyst has few southern hemisphere subscribers, but those few we know are active.

We would love to hear from you all.

Two forthcoming AYRS Events

Both of these are in the UK. — If there is anything being organised in the US in the near future, no-one has told *Catalyst*!!

The **AYRS Annual General Meeting** will be held on 12th January 2002 at 8pm at the London Corinthian Saling Club, Upper Mall, London W6. All are welcome, but only paid-up members are entitled to vote. Further details will be sent to members, or contact the AYRS Honorary Secretary.

A **Boat Building Day** will be held in the Thorpe Village Hall (between Staines and Chertsey, Surrey, UK) on 17th February 2002 from 9.30am to 5pm.. Bring your project along, or if you cannot bring it, bring some pictures (OHP or 35mm slides for preference) and be prepared to talk about it! (See page 28).

Weymouth Speed Week

Crossbow's record stands – but only just!

After a number of years of indifferent weather, WeymouthSpeed Week this year had wind!

The opening Saturday saw winds of about Force 4, but by Sunday, gusts of up to 35 knots were being observed, and this continued through the Monday and Tuesday, easing off somewhat towards the end of the week. Not surprisingly, the windsurfers had a great time. Nick Beaney recorded the highest speed of the week, 35.2 knots, on the Monday — just short of Crossbow's Portland record of 36 knots set in 1980. The most interesting challenge of the week came from the kiteboarders. Chris Calthrop set a speed of 33 knots in only six runs. Injury prevented him from doing more, but it is clear signal that the kites are a force to be reckoned with.

An innovation this year was the setting of a short, 200 metre, inshore course. This being close to the beach provided significantly smoother water than the 500 metre course in the middle of the harbour, so it is not surprising that speeds were higher. (Nick Beaney's best speed on the longer course was 30.6 knots). This was a controversial move — the shorter course length is not currently recognised by the World Speed Sailing Records Committee. It was felt that there was a high chance of an exceptional gust carrying a sailor at high speed all the way down such a short course, thereby setting a record by luck rather than by skill. Such help over a 500m course was felt to be less likely.

Nick Beaney, photo: R M Ellison

It has to be said though that when the WSSRC made that decision, likely records were of the order of 20 knots and a run would cover the course in 45 seconds or so. Nowadays, a record run over the long course would take less than half of that time, and the argument is less strong. A short meeting of the boardsailors, observed by Michael Ellison for WSSRC, suggested that short "sprint" courses should be used, to encourage speed sailing, but not recognised for the world record. There is a view however that such inshore courses need to be set to allow boats as well as boards to take part, and with a prescribed minimum depth of water to avoid shallow-water effects.

For many of the boat entrants though such considerations were merely academic. Breakages were endemic in such strong winds, of the 20 boats entered, only 12 managed to survive unharmed long enough to make timed runs. Torix Bennet's *Sea Spider* blew over in the boat park despite being held down by several blocks of cement. Guy Hawkin's big proa *Made in Dubai* (a very interesting design that we hope to describe in a future issue of *Catalyst*) was thrown onto the rock leaving the slipway and broke its rudders, Chris Evan's *Triton Chariot* achieved a spectacular capsize that fractured a float, and Patrick Mayne's Foiler 21 *Speedbird* also capsized, breaking the upper mast, apparently on impact with the bottom!

Michael Ellison

The Dutch Kiteboat at speed

Sheila Fishwick

Torix Bennett's SEA SPIDER *did not complete a run*

Results

Overall results were dominated by sail- and kite-boards. No less than 27 of them exceeded the fastest boat speed of 19.34 knots set by Alan Blundell's *Vari Scari* on the long course and the same was true for the inshore course. The top-ranking 'board results and all the boat results are given below.

500 Metre Course

	Knots	Entrant	
1	30.64	Nick Beaney	
2	29.19	Richard Ashenden	
3	28.91	James Paine	
4	28.60	Pete Martin	
5	28.47	Angus Hitchin	
Boats			
28	19.34	Alan Blundell	*Vari Scari* triscaph
29	16.79	John Peperell	Catapult
30	16.06	Alex Montgomery	Catapult
32	15.34	Neils Haarbosch	*Flaxcat*
34	14.34	Torix Bennett	*Sea Spider* triscaph
35	14.27	Chris Evans	Foiler 21 *Boomerang*
36	13.93	Patrick Mayne	Foiler 21 *Speedbird*
37	12.56	Fred Ball	*CopyCat*
38	12.22	Philip Middleton	*Triton Chariot*
39	11.86	Neils Haarbosch	Kiteboat
40	11.48	Slade Penoyre	Catapult + hapa
41	9.03	John Perry	2-foil trimaran

200 Metre Course

	Knots	Entrant	
1	35.22	Nick Beaney	
2	34.52	Stacey Vass	
3	33.54	James Paine	
4	33.38	Richard Ashenden	
5	33.38	Chris Calthrop	Kiteboard
Boats			
28	17.61	Alex Montgomery	Catapult
30	11.54	John Peperell	Catapult
31	9.45	Fred Ball	*CopyCat*
32	9.07	Neils Haarbosch	*Flaxcat*
33	6.68	John Perry	2-foil trimaran

Chris Evans

SPEEDBIRD under tow after breaking the mast

Ronde om Texel 2001

The Round Texel race this year was a test of concentration and endurance — concentration by the competitors as they searched for the next tiny puff of wind to waft them on their way, and endurance by competitors and spectators alike as they roasted in the unrelieved sunshine. Of the 700 or so competitors who started, only 20 finished the course, the rest having fallen by the wayside.

The island of Texel lies on the north edge of Holland. On one side is the North Sea; on the other the Waddenzee between a string of islands and the mainland. The Round Texel race starts on North Sea side, passes round the north end of Texel, down the Waddenzee and back out to the North Sea to finish. On a good day, the fleet of boats have the tidal current behind them all the way round, especially when passing through the narrow gaps between Texel and adjacent lands. This though was not to be a good day.

The Round Texel race comes at the end of a week-long festival of catamaran races. For most of the week, the westerly winds had been good, becoming quite strong as the sea breeze set in behind them. Out in the North Sea a swell had set in, producing some surf on the beaches of Texel, but nothing that the boats could not handle in the prevailing winds.

The morning of the big race dawned fine and clear, but the wind was light and had backed to the east. On the beach and on the start line the swell was still running, leaving competitors struggling to paddle and sail their way out through the surf. First of the casualties was AYRS' own Slade Penoyre in his Catapult – pushed backwards onto the beach by a wave, his rudders caught on the sands and his tiller broke. Others had similar problems. I saw one Formula 20 surfing sideways in, narrowly missing a navigation beacon.

Out at sea, the light winds made it difficult for boats to manoeuvre, and many were drifting over the start line. Still, it was the way they wanted to go, and with 700 boats lining up, there is no real prospect of a general recall, although individuals could be and were sent back. Eventually the fleet was started, helicopters flying down the length of the line firing flares to signal the start to those out of earshot of the shore, and the leaders stretched away north-eastwards towards the tip of the island.

Those of us on shore took to our bicycles, scooters and cars (Texel is an excellent spot for cycling being well provided with cycle tracks) and crossed the island expecting to see the leaders passing through the narrow gap into the Waddenzee. But across the hazy Waddenzee there was no wind, the sea was glassy-smooth, and of catamarans there was no sign.

Eventually, a small string of sails appeared in the distance, moving oh-so-slowly along the horizon towards the turning mark at the end of the sandbank. For an hour we sat and waited but only about 40 boats appeared struggling against the ebb through the channel between Texel and the next island. The rest had failed to make it.

With the ebb and the wind, such as there was, behind them, the leaders made better progress down the inside of Texel until by the time they reached the other end, the sea breeze had set in from the North Sea, and they beat up the coast, some even managing by careful control of weight and sheets to fly a hull for the photographers as they crossed the finish.

Ronde om Texel 2001 – the Start

First to finish were the Formula 20s of Peter van Deventer & Chris Ktijthe, Mitch Booth & Herbert Derksen and Jacco Salman & Marten Guyt. But the Ronde om Texel is a handicap race and the winners were not far behind them – the Formula 18 of Gavin Colby & Cori Camenisch. All in all it took the leading boats 7½ hours to get round – well short of the course record.

Handicap Results

Sail No	Class	Helm/Crew	Country	Corrected Time
729	Formula 18	Gavin Colby/Cori Camenisch	AU	7.38.04
3222	Formula 20	Hans Bouscholte/Peter Desmedt	BE	7.49.04
776	Formula 18	Sascha Larsen/Wouter Jongeneel	NL	7.49.24
269	Formula 20	Han Verdeijen/Ruud Faase	NL	7.54.27
59	Formula 20	Peter Vink/Sven de Laaf	NL	7.55.28
747	Formula 20	Maarten Mol/Peter Bloemsma	NL	7.55.44
227	Nacra Inter 20	Paul Hamers/Koen Spoorenberg	NL	7.58.22
252	Formula 20	Willem van der.Geest/Robert van Rijn	NL	7.58.45
101	Formula 20	Arien Hofman/John Zuijderwijk	NL	7.59.01
1561	tornado	Remco Kenbeek/Herwin van de Kamp	NL	8.00.07
17	M18	Hakan Frojd	SE	8.01.04
32	Formula 20	Vincent Huntelman/I.F. Harskamp	NL	8.01.42
2	Formula 20	Leen den Hollander/Sander Mulder	NL	8.02.19
159	Tornado	Xander Pols/Leonique Faas	NL	8.02.26
141	Formula 20	Bas van Loon/Runar Damoiseaux	NL	8.02.53
111	Tornado	Sven Karsenbarg/M. Heemskerk	NL	8.06.31
1281	Nacra Inter 20	Cor Salverius/Tom Hardeman	NL	8.12.33
208	Formula 20	Harry van Rhijn/Klaas van Duin	NL	8.36.03
22	Dominator	Piet Heemskerk/Antje Hoogendijk	DE	8.41.12

Report by AYRS

Texel Rating Rule 2002 (version 3)

You should know that the Texel Rating committee in Holland has decided to change the basic formula a bit and change some other elements in the Texel Rating Rule. The most complete information is to be found on the two websites mentioned in the text below.

The basic Texel Rating formula was developed in 1984. In 1993 the formula was updated to Version 2. After another nine years, the rating committee in Holland have decided to give the formula another update. This is done to lessen a slight disadvantage given to very lightweight multihulls by the existing formula. These very light boats now get higher TR numbers. As a consequence heavier craft get lower TR numbers. All numbers are relative. By this process, the total range of numbers given has been narrowed a bit.

The basic formula now becomes:

$$\text{TR number} = 100 / (0.99 * RL^{0.3} * RSA^{0.4} / RW^{0.3})$$

The power for RW has been lowered from 0.325 to 0.3. The constant factor from 1.15 to 0.99.

Another change in the rule is in the way to handle spinnakers for the beach catamarans with LOA <= 22 ft.

For these catamarans, if a spinnaker is to be used, 4 pts will be deducted from the calculated TR number.

For catamarans which use spinnakers larger than the stated limits, the spinnaker sail area will be rated as 11% effective, so that percentage will be added to the total sail area. This means that the deduction will always be more than for spinnakers which are within the limits. The deduction depends on the size of the spinnaker.

More details can be found on the website www.texelrating.knwv.nl about the beach catamarans and on the website www.ctcnederland.nl about all cabin multihulls, catamarans and trimarans

For any questions contact Geert Ruesink <*g.ruesink@hccnet.nl*> (the webmaster for the beachcatamarans and member of the Texel Rating committee) or me <*nboon@hetnet.nl*>, or, better, email both of us.

Nico Boon
nboon@hetnet.nl

WEYMOUTH SPEEDWEEK WEDNESDAY EVENING SEMINAR.

Report by John Perry
j_perry@btinternet.com

On the Wednesday of Weymouth Speed Week, AYRS usually holds a discussion meeting on speed sailing at which a number of entrants are invited to outline briefly their projects. My notes on this meeting are as follows.

SLADE PENOYRE

Slade continues to experiment with towing hapas alongside various types of sailing craft. A hapa is a wing, or hydrofoil, towed underwater to generate a force in the towing line which resists leeway and can also reduce or eliminate heeling under sail. There are various hapa designs utilising different methods for controlling the depth of immersion of the hydrofoil.

Last year Slade showed us a hook shaped hapa, as previously used by Didier Costes and others. This type of hapa has the main hydrofoil surface curved along the span so that as it rises out of the water the part remaining in the water becomes more horizontal to provide an increasing downwards corrective force. This year Slade showed us a prototype tee shaped hapa, the main hydrofoil being the cross arm of the tee which is connected to the tow line by a perpendicular strut which penetrates the surface at an angle inclined towards the towing craft. A tail plane mounted behind the strut is slightly angled to turn the strut to drive it deeper into the water. Stability is achieved by balancing this against the effect of a small canard which skims on the surface and is mounted on an arm above the surface and projecting forward from the strut. This has some similarity to the hapas constructed by Ashford and Biegler.

Slade's new hapa was tested by towing alongside a motor boat during this Speedweek. These early trials showed that it behaved in a stable manner, at least in calm water.

An obvious application for a hapa is to reduce or eliminate the heeling of a monohull sailing yacht but Slade also envisages hapas to be towed by a sailboard, perhaps with an attachment to the board sailor's harness. The hapa would take over from the skeg of the board in resisting leeway and because it could remain effective when the board is airborne perhaps some spectacular jumps clear of the water would be possible. Slade would be keen to hear from any board sailors who would like to work with him to develop this idea. (*slade@penoyre.freeserve.co.uk*)

John Perry at Weymouth demonstrating that it is possible to windsurf towing a hapa. The board is a Catapult cat steered by Slade. The rig is a genuine board rig, We completed a run over the course. It was not easy.

CHRIS EVANS

Sheila Fishwick

Chris again brought his 24 foot day-sailing trimaran, *Triton Chariot*, to Speedweek. This fast and elegant trimaran is fitted with retractable inclined surface piercing hydrofoils outboard of each float and a horizontal foil on the bottom of the rudder. The craft has not yet lifted entirely on the foils but no doubt the hydrofoils do provide useful lift and heeling resistance to supplement the effect of the fairly small floats even at speeds below the take off point.

Unfortunately the craft suffered a mishap during this Speedweek and will have to be transported back to Chris's workshop in Germany for quite extensive repairs. The author of these notes happened to be aboard at the critical moment. Chris had just completed a run across the speed course and was turning to gybe when I realised that I could see the seabed racing underneath, meaning that the water was getting a bit thin. I shouted a warning but then the lee hydrofoil caught the bottom causing the craft to pitch forward. The bow of the lee float then dived several feet into the water, crashing into the seabed and the bow of the main hull also hit the seabed a moment later. I think we were close to pitchpoling but recovered and sailed back to the slipway, settling deeper in the water since some of the watertight compartments were damaged.

The forward third of one float was broken away and the bows of the main hull were split and leaking. There was no damage at all to the hydrofoil which had hit the seabed, although the hydrofoil mounting was slightly twisted.

The hulls are round bilge 'tortured' ply construction with epoxy fillet joints. Inspection of the damage showed that the epoxy joints were not a weak point in the structure since all the fractures appeared to be in the timber itself, not at the joints. Chris was adamant that the craft will be rebuilt, possibly with slightly longer floats than before.

DIDIER COSTES

Didier's main interest these days is in airships and he is currently completing a two person 18m length helium filled airship as a commercial venture. But he also continues to work on his '*Exoplane*' series of experimental sailing craft the latest of which he brought to this Speedweek although unfortunately it was damaged before it was able to get sailing.

Didier gave us a history of his development of

Chris Evans

Didier Costes - Exoplane 5

this type of craft. The basic concept is a proa with an inclined sail mounted well to leeward of a main hull. There is a tiny lee hull under the sail but when the craft is sailing this will normally be lifted clear of the water. The main hull is fitted with inclined keels/ rudders which lift typically about half the total weight when sailing fast, the rest of the weight being lifted by the inclined rig. At least one of the keels are curved along the span. As for Didier's hapas, this curvature controls the flying height. Didier has in the past achieved 25 knots with this type of craft; for further details see Didier's article in the last edition of *Catalyst*, the AYRS Journal.

Didier also briefly mentioned his work on airships including successful trials towing a hapa with an airship, the engine of the airship being switched off and the body of the airship acting as a sail, the hapa as a keel. Apparently an airship has a lift to drag ratio of around 4:1 when inclined at a suitable angle of attack to a headwind – this is better than some sailing rigs and it also weighs nothing and does not necessarily impart any heeling moment onto a water craft which is in tow.

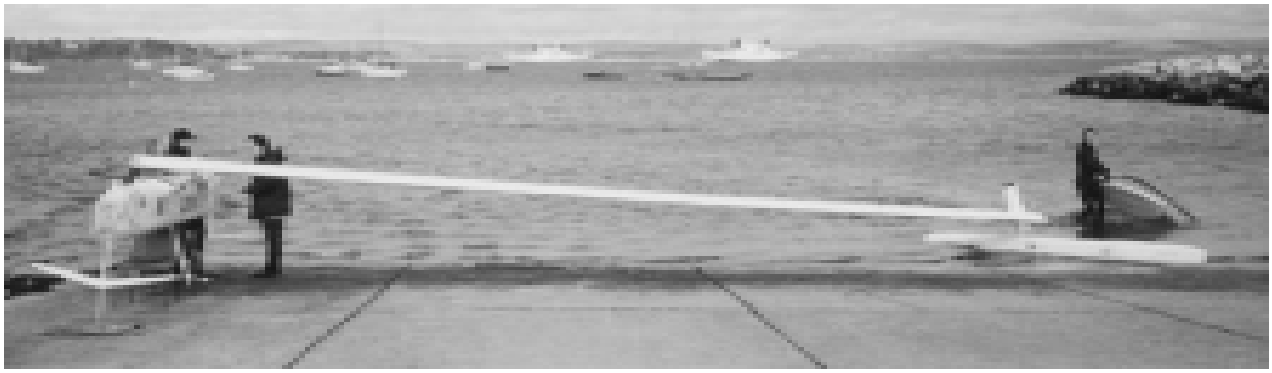
GUY HAWKINS

Guy and his team made a first appearance with an impressive new craft at this Speedweek. Guy was quick to say that much of the basic concept of his craft was shared with the previous speaker's '*Exoplane*' and other earlier projects. Like the *Exoplane*, Guy's craft is a two-way proa with inclined lifting rig set well to leeward of the main hull. The rig is a single wingsail with flexible membrane surfaces tensioned over transverse ribs mounted on a leading edge spar and a main spar. The connection between the rig and the main hull is a 12m long streamlined oval-section beam mounted horizontally between the main hull and the base of the rig. This spar swings freely about a vertical axis bearing at the mid-length of the main hull. This free rotation is intended to prevent the rig forces from overcoming the steering controls.

The craft is to lift clear of the water at speed by means of cruciform shaped lifting and steering hydrofoil units at each end of the main hull together with the lift-force component from the inclined rig. The hydrofoils can be rotated about 180 degrees for sailing on both tacks. The hydrofoils are expected to operate fully ventilated and it is hoped that this will avoid steering difficulties caused by transitions between ventilated and non-ventilated operation. At high speed the lifting surfaces of the hydrofoils may plane on the water surface.

The whole craft is well finished and the structure is almost entirely carbon fibre reinforced composite. Guy estimated that there was still three weeks full time work to do before it would be possible to start sailing trials so there was no possibility of seeing it in action on the Speedweek course. The hulls and cross beams were assembled and briefly launched and this did show up a weakness in the mountings for the hydrofoil units which were broken during this initial floatation test but I don't think it will be long before these are replaced with something a bit stronger.

The project benefits from industrial sponsorship in Dubai and the craft carries banners declaring '*Made in Dubai*'. Other sponsors include a finite element analysis software house and the whole structure has been the subject of a study by finite element analysis. The main site for sailing trials will be on a remote Scottish Loch. The team are confident that they are in contention for the world speed sailing record.



Chris Evans

Dr. Guy Hawkins and his team assembling his exotic craft for the first time. A very well built proa that had people guessing for days as it stood in the car park on its trailer waiting for calmer weather to begin the first assenbly. There is a rudder at each end which is designed to 'castor' when the craft is shunted. The cross beam is free to swing and the understanding is that it will find its own point of balance.

JEAN HURTADO

Sheila Fishwick

Jean again brought his tri-hulled craft from France, stowed neatly in sections on a custom-made roof rack. This craft assembles into a tetrahedral structure with large diameter but thin walled alloy tubes radiating from a central junction to the extremities. Steel cables link the outer ends of the tubes and hold the structure rigid. One of these cables is a stay for a triangular sail which has a steeply inclined luff so that when it is filled by the wind it generates a substantial lifting force on the whole craft as well as a forward drive force.

Unlike many speed sailing craft it is very robust and it is also not as heavy as you first imagine. All the aluminium work is to a good standard and neatly welded together.

The craft floats on three small aluminium drums attached to the lower corners of the tetrahedron structure, these drums being angled to provide planing surfaces. The planing surfaces are set at quite a steep angle of attack to the water and for a future modification Jean plans to reduce this angle of attack. Jean explained that the concept was inspired by a 15 foot sailing boat with a generous 36m^2 lifting rig which was built by Pilcher, an aviation pioneer, in 1894.

I was watching Jean's craft as it made its best run down the speed course and I saw that on two or three occasions the craft did start to lift off the water. At these moments the craft accelerated dramatically but the small low aspect ratio fins and forward mounted rudder then became ineffective causing the craft to veer off course and slow down again.

The audience were amused by Jean's comment " my boat is like a bus, not like a taxi – a taxi goes where you ask it to, my boat, well …."

JONATHON BARTON

This was Jonathan's first visit to Speedweek and he is already toying with ideas for building a speed sailing craft. He has experience of sailing Tornado catamarans and sail boards and he showed us a quickly made model to illustrate some preliminary concepts.

This model had a single narrow hull, based on the Tornado hull shape and a small float set on a long arm which could move fore and aft as well as somehow moving from one side of the hull to the other when tacking, perhaps it could slide across which would presumably require a small float at each end. The rig would also be movable fore and aft and cantable from side to side by means of variable length stays.

Obviously early stages, we hope to see him back with an interesting new craft.

JOHN THURSTON

John showed us a sailing model of a four hulled craft fitted with a cascade of five rigid wing sails, that is a set of wings mounted along side each other. A full size version might have as many as seven wings. The wings are mounted on a cross beam at the rear of the craft and two of the small hulls are at the extremities of this beam. The third hull is mounted from a cockpit structure which extends forward from the centre of the cross beam. All these three hulls carry hydrofoils which have an inverted vee shape, presumably they are surface piercing. The model also included a fourth hull aft which was needed to obtain some extra bouyancy at model scale but which would not be included in the full size version.

The aft cross beam rotates on a vertical axis pivot as well as the sails each rotating on a vertical axis from this beam. John explained that this allows the sails to extract maximum energy from the wind by covering the maximum area as seen in a projection from the direction of the apparent wind. The model will in due course be fitted with a radio control system for sailing trials.

MICHAEL ELLISON

Michael briefly updated us with his progress on fitting out his 38 foot ferro-cement monohull yacht based on a hull which he found abandoned in a quarry.

The three-cylinder air-cooled Lister diesel is now installed and Michael commented that he had not fitted a silencer since he so much liked the sound of the exhaust. The yacht will possibly be driven by a kite rig and the eventual aim is long distance cruising.

NIELS HAARBOSCH

Niels is the leader of the Dutch team which produced the *Aeroskimmer* catamaran a few years back and has also been responsible for a varied range of small experimental craft. Niels told us about their *Flaxcat* which is the most conventional boat I have seen from this team.

What makes the *Flaxcat* different is that it is an eco-friendly construction, the hulls being moulded using resin reinforced with flax, the natural fibre used to make linen. Niels considers that flax-reinforced resin can achieve a similar weight and overall strength to glass reinforced resin. Flax fibres are not as strong as glass but they have a lower specific weight at 600kg/m^3 compared with 2800kg/m^3 for glass and this allows a thicker laminate for a given weight which helps panel stiffness.

The flax fibres are supplied as a randomly oriented mat and Niels said that this is not very suitable for hand laminating. If you try to roll resin into it with a laminating roller the roller just gets larger and larger and the laminate gets thinner! Instead the *Flaxcat* was built using resin injection moulding.

This means that the mat of fibres was fitted into a female mould, a vacuum bag was applied over the fibres and a tube connection made between the vacuum bag and a bucket containing a carefully judged quantity of resin. When vacuum is applied the air is drawn out from the space between the fibres and replaced with resin. Resin to fibre ratio is good and there is little wastage of resin.

Only a single resin injection point was used for each half-hull moulding and a long coil spring was placed inside the vacuum bag to form a runner to help the resin spread the length of the hull. The infusion of resin into the reinforcement takes approximately one hour regardless of the size of the moulding.

The hull moulds for the *Flaxcat* were as used for the *Aeroskimmer* and are flatter bottomed than most cats, this being intended to promote planing. Other features of the *Flaxcat* are fairly conventional and it performed with better consistency than the more specialist speed sailing boats to win the prize for fastest boat of the day on more than one occasion.

EMILE LAUTIER

Emile is also from the Dutch team led by Niels Haarbosch. He first told us a bit about their group and pointed out the advantage of working as a team to pool ideas and resources. Their team originally had nine members. This is now down to four but the remaining members are true enthusiasts. In addition to meeting for sailing trials they meet on a weekly basis to discuss progress. The team generates some of its funding by doing commercial work such repairing fibreglass hulls.

Emile then told us about their kiteboat which made brief bursts of speed but in general was slower at this stage of development than the *Flaxcat*

Chris Evans

described above. This kiteboat is a lightweight craft with a comfortable seating position aft in the main hull and a cross beam forward which carries two small stabilising floats, and surface-piercing inclined hydrofoils made from aluminium extrusions. There is a horizontal lifting foil at the bottom of the main rudder, and this carries a large proportion of craft weight when full foil-borne.

The lines to the propulsion kite lead to controls just ahead of the helmsman. Various types of kite can be used. During this Speedweek the craft was tested foil-borne under tow from a motor boat and also briefly under tow from a kite.

Chris Evans

The Dutch kiteboat being assembled

For future development the team are considering developing an electrically actuated and computer controlled hydrofoil system, perhaps using movable flaps on fully immersed foils. The flaps might be hinged to the fixed part of the foils by rubber hinges which could allow a better cross section profile than conventional hinges.

They are working on the assumption that if such a system were used for record setting then the electric power would have to come from the wind, for example by use of a windmill powered generator. Michael Ellison said that the rules about this were still under consideration and that if the power were used only for control purposes then it is possible that battery power might be acceptable. This would need to be further discussed by the World Speed Sailing Records Committee.

BOB SPAGNOLETTI

Bob showed us the system he has built for tow testing small models. A heavy weight falls under gravity to unwind a line off a small drum which is mounted, together with a larger drum, on a free running spindle. A line leads from this larger drum to a model craft which is drawn across the water as the weight falls. An encoder on the spindle is connected to a computer to determine the velocity of the craft throughout each run and the towing force is determined from the weight and drum diameters together with corrections to allow for the acceleration of the model and other moving parts.

The system is suitable for models of around 400 mm length and Bob would be willing to test models provided by others.

Bob showed us two models he is currently testing, one representing the under surface of a conventional sailboard and the other representing a sailboard with a stepped planing hull.

Bob constructed such a sailboard a few years back and achieved a speed of 31 knots, so these experiments could provide some interesting results.

BOB DOWNHILL

Bob, as well as being the organiser for Speed Week, has been doing further experiments with the craft he refers to as his 'garage door'.

We have heard rumours about this for some time, but this year we had a first chance to see a large scale model of the real thing. Sure enough it does look very much like an 'up and over' garage door. It is a heavily constructed 2.4 metre square slab of timber fitted with four small surface piercing inclined hydrofoils, one at each corner. The hydrofoils are hollow, fabricated from mild steel sheet and with a kink about halfway along the length so that the upper part is at a shallower angle to the surface than the tip.

The first prototype door was a bit smaller at 1.2m square and was fitted with a sailboard rig. Bob told us that a skilled sailboarder did manage to get it going after a lot of practice. The larger version which appeared at this Speedweek is intended only for towing trials but the available motor boats were unable to tow it fast enough to get it foil borne. A 30hp motor boat would hardly move it but I assume that this was due to the drag of the heavy raft like structure, not the hydrofoils themselves.

But not to worry, the next version currently under construction will be larger but also very much lighter. It will be elliptical in plan, made from aluminium skins on a honeycomb core and measuring 25 feet long by 20 feet across. Eventually it is intended to sail it with twin side by side rigid wingsails adapted from glider wings.

Quarterline, easy build GRP Yacht hull shapes.

Tom Peat

At present a conventional GRP hull is rarely constructed by an amateur. The need to make a plug, and then a mould, makes one-offs uneconomic and time consuming. The alternatives, female mould or wood core are usually used, but these have their own problems – fairing and core problems among them. There may however be a way to produce a solid lay up GRP yacht hull without a plug.

The trick, if you can call it that, is to produce one-quarter mould and use this to make all four quarters of the hull. This may seem counter-intuitive as all four quarters of a conventional yacht hull are different, although mirror images of each other. There are however shapes that can be used to make a mould, from which all four quarters can be moulded. The making of a concave mould straight off is more difficult than shaping a plug. Only a quarter of the mould fairing is needed, so, with care, a reasonable mould can be produced. This will save money and materials. Alternatively, a quarter-hull plug could be produced to make the mould, if this was preferred.

There is then the business of joining these four shapes.

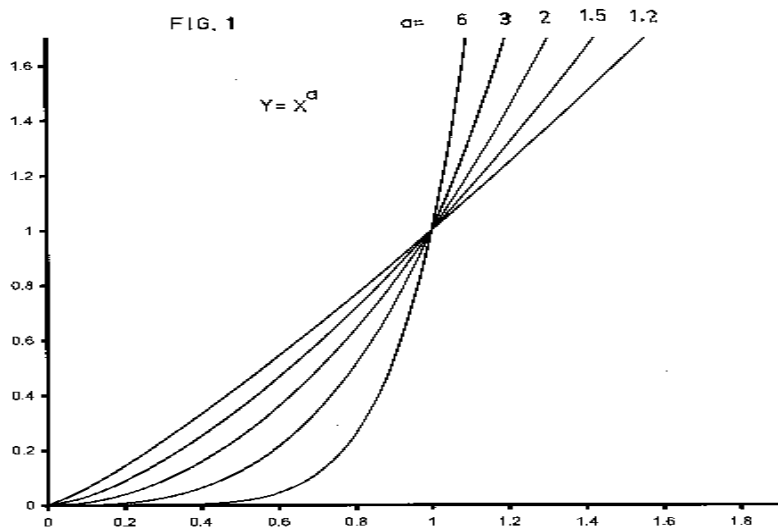
This is not the subject of this letter, but I am sure this can be done, as I have seen some repairs that virtually do this.

By now you may be saying, "Show me one of these shapes". First I must indulge in a little simple mathematics. This is for convenience and the method could be used without my kind of maths.

The Power Curves:

These are $Y = X^a$ (X to the power of a). and are shown in Fig 1 for $X^{1.2}$ to X^6

These are the curves used in the shapes because they are both easy to calculate and relatively easy to manipulate. The shapes can be easily reproduced, and problems of fairing and calculating offsets are also simplified.



Shape with some twist. (Axial moulds)

Firstly we might consider a mould shape that obtains a hull form purely by twisting the GRP laminates. In this first and simplest case the hull would be made of two longitudinal halves, either by joining the pieces at the ends while moulding, or by joining them when both quarters are out of the mould. These halves are then given a uniform twist so the bow and stern take on their differing shapes.

This twist should be done with laminates in a green condition so as not produce too much stress.

The form of such a mould is shown together with its equation in Fig 2.

The equation is for the positive quadrant; the other half of the mould (dotted lines) is just a mirror image. The approximate section lines for the hull this might produce are also shown in Fig 2.

I have made a half model of this to see how the scheme would work. The mould, Photo 1 (*below*), was constructed of strip planks on ply formers, following the curves described above. This model mould is about 1m long to make the finished model flex representatively.

The mould strips were covered with fibreglass, polished smooth and prepared for moulding.

The centre hull section curve was placed one frame from the end of the mould. The second curve from the centre was produced twice and the mould made one frame longer than needed. This makes the correct curve in the strip plank and gives alignment for "in-mould joining" of the sections. See Fig 3.

A half-model was produced from the mould; this is shown in Photos 2 and 3 (*opposite*). This half hull has been twisted through about 20 degrees from bow to amidships.

A tetrahedral section was added to make the point of the bow, this could be added at the time of moulding, as, in this case, it is almost a flat plane.

The transom shape has been changed with a little tensioning. If a more pronounced turn is needed at the transom the parts could be laid up with a thinner area on the turn. Fig 4.

This is a fairly narrow hull but could be made broader by altering the equation slightly, however this shape is not ideal for a modern type of yacht.

FIG 2.

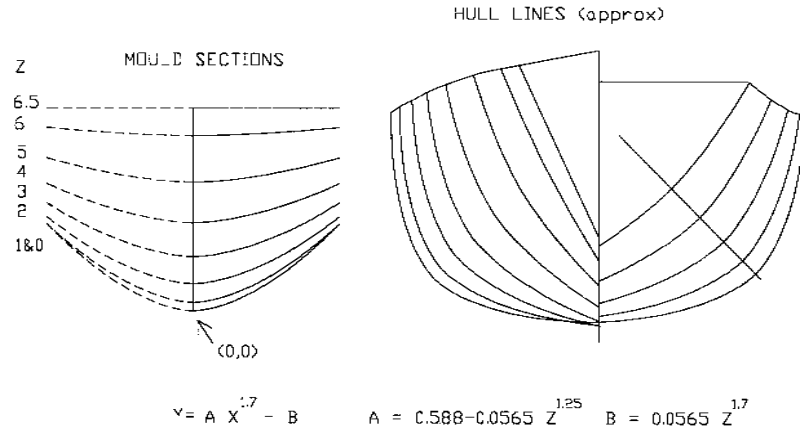
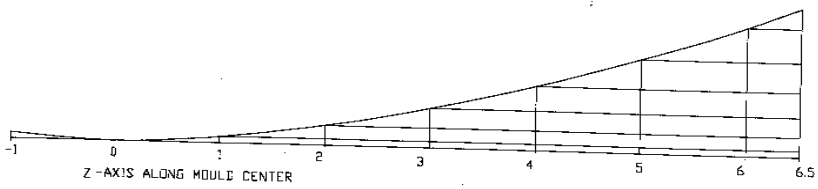
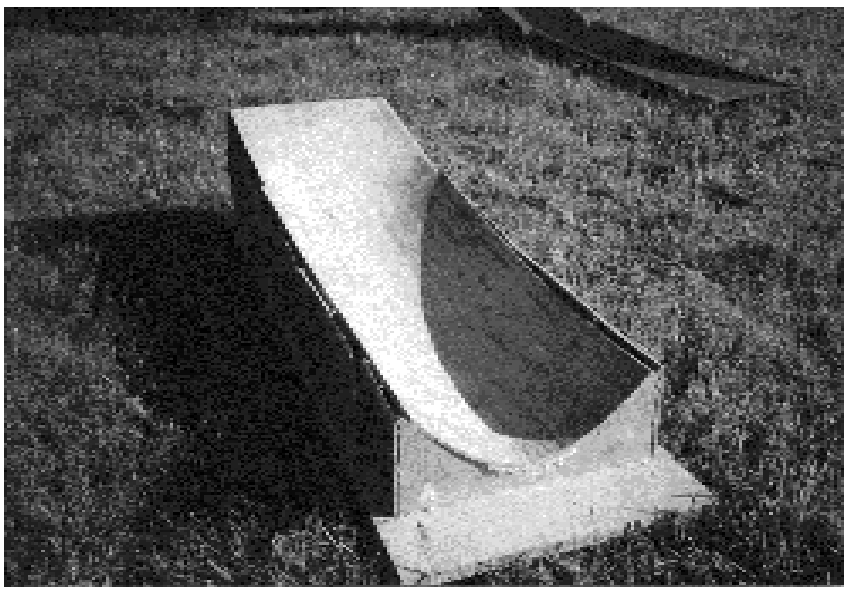


FIG. 3

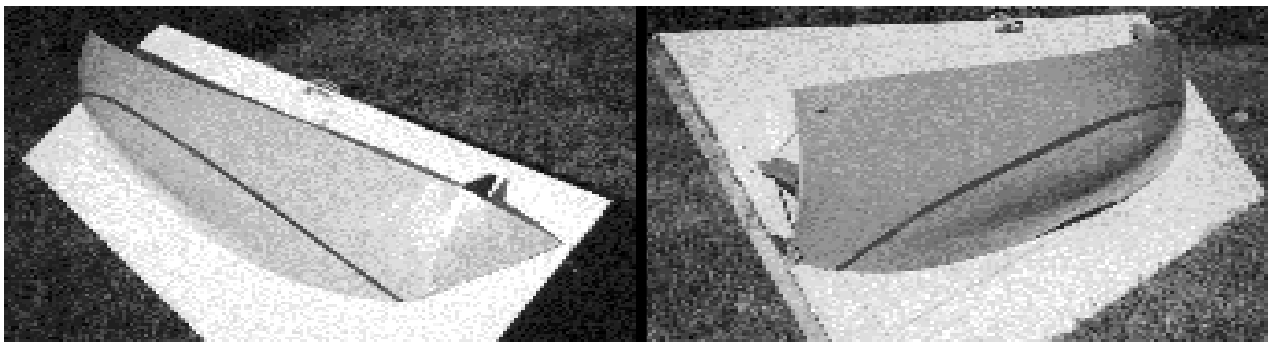




Non-axial moulding

A second approach is to produce a mould shape that will produce the quarters of a yacht hull without twisting.

Again we will describe this with the power curves. A possible mould shape and equation and the section lines of the resulting hull are shown in Fig 5. The bow



flare angle has been chosen here to make the deadrise close to zero at the transom. There are sections shown on the mould diagram; these are approximately the sections of the boat. Each of these sections has its centreline and a notional deck level waterline. Some tumblehome is shown. This is not a problem in this type of moulding, and could be used to make more efficient use of the mould area.

This hull does not need twisting, but makes much less use of the whole mould for the four individual quarters. This shape looks much more like a conventional yacht, and could be adjusted as desired for beam/length ratio and shear line.

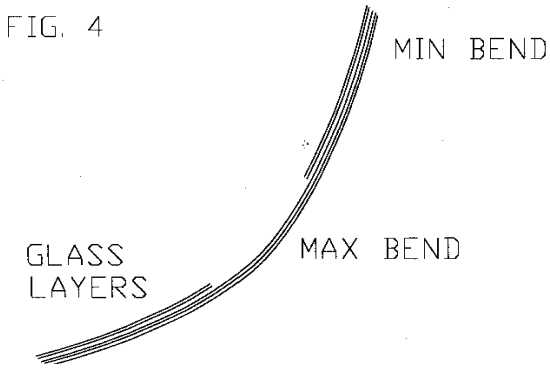
The advantage of using this shape is that the internal framing could be added while the hull quarter is still in the mould.

Further ideas

The methods described above can be combined. Using both asymmetric mould coverage and twist in the hull, a variety of different shapes can be made.

Computer solid modelling programmes might be configurable to generate such moulds for any shape of boat, but some of these moulds may be almost as big as a conventional mould, producing no economic advantage.

FIG. 4



It is a good idea to produce models of any proposed hulls as this is a good test of concept, and gives an indication of what may be encountered building a full size boat.

The method is not limited to the production of GRP hulls. Pressed steel hulls made from a single smaller component may be possible, and concrete hulls might be produced with a single flexible quarter-hull mould.

There may even be an application for making plugs for GRP moulds. I suspect that something like this already happens in some instances.

The methods described have a kind of square symmetry (90-degree rotation); but other schemes can be based on hexagonal symmetry.

I can envisage similar schemes that use from three to twelve identical curved sections; however most of these would involve too many joints to be manageable. I believe that my four-section "Quarterline" scheme is probably the right balance for GRP construction.

Tom Peat
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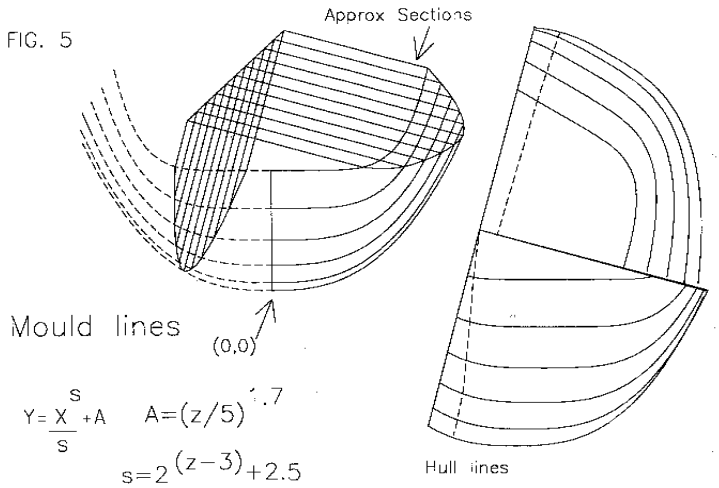
FIG. 5



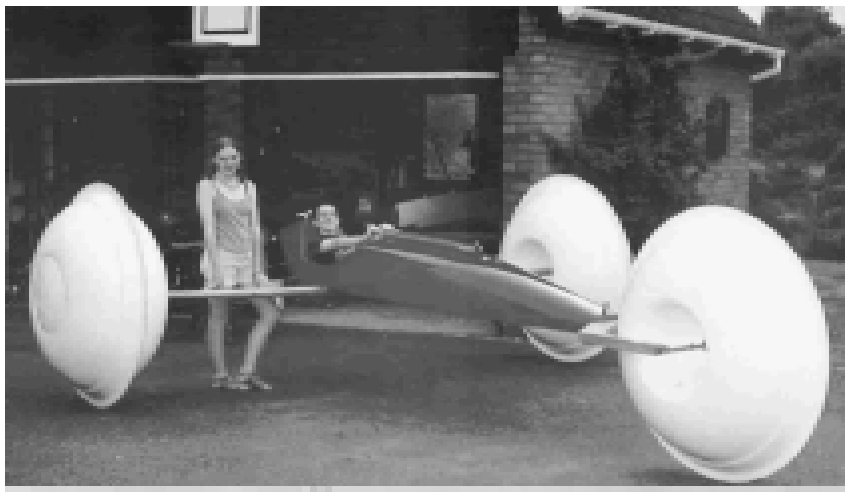
REVOL

This boat has already undergone preliminary tests on the River Deben, UK, and has proved to be an interesting concept. Bystanders watched in amazement as it sailed across the water them surmounted a low mud bank and proceeded to sail across that also. Not its main function in life, but it would make a great fun boat!

The wheeled yacht now lives at Alton Water, Ipswich and has sailed twice. 1st sailing was quite windy , Force 3-4, and it performed well. The 2nd sailing, at which these pictures were taken, was calm, Force 1-2.

UTION!

The wheels rotate, slowly, and it is incredibly stable. It is also very comfortable as you lie down inside it, out of the wind with a headrest and the tiller and mainsheet at chin level. The upwind performance is staggering as it has very good grip on the water and so stable. The pictures show it with its small sail: 7.24 sqm including the mast area. I have not used the bigger DN ice yacht sail yet as the centre of effort displacement it causes make it very hard to tack.



"Winds of Change... how it was for me."

Chris Evans
chris.evans@t-online.de

Having attended the inaugural Winds of Change last year I was delighted to learn that Bob and Genevieve (Bobgen) Quinton had made arrangements with The Royal Harwich Yacht Club to stage another event this year. A double booking of club facilities called for a slight change in dates but that was sorted out early in the year and caused no hardship. This is my story of the event.

Once into August my thoughts turned to preparing for this event that would be held from Friday August 17 through to Sunday the 19th August. I planned to take my newly acquired (purchased at last year's Weymouth Speedweek) Foiler 21 "*Boomerang*" which I had refitted over the winter months and my outboard powered inflatable. Up to this time I had not been able to sail *Boomerang* and was looking forward to doing so though I wished I had been able to check everything on the water and see that it really did work instead of the literally dry run in front of my garage/workshop, much to the interest of my neighbours. With this in mind I was careful to make sure that I packed every thing I could possibly need in case something was not quite right.

I live in the south of Germany, close to the birthplace of Einstein, Ulm. Which is about 700 miles from the Royal Harwich. My mode of transport is a large (by European standards) American camper which being 9 meters long and towing a trailer of 8 meters was only just inside legal limits. Not the most wieldy of vehicles but certainly comfortable and I believe it was Confucius who said "The only thing that mankind really needs is 'Luaus".

With so far to travel it was obvious that it would not be for just a weekend visit and so I planned for a two-week holiday accompanied by my wife Gabi. Departing on Thursday morning, we arrived at the Royal Harwich in time for lunch on Friday, followed by a well-earned snooze to recuperate from the weariness of travelling.

That evening we were joined by our friends and organizers, Bob and Genevieve to have supper in the yacht club. The club is set in a magnificent area on the river Orwell. On the landward side of the clubhouse there are tall mature trees which protect it from westerly winds and with it's long drive down through well kept grazing land from the small country road, it has an air of grandeur that befits a club that originated with royal patronage when Kings and Princes enjoyed racing huge yachts back in the 1800's. Hence the title the 'Royal' Harwich Yacht Club.

The present clubhouse looks as if it was built in the 70's and has been lovingly maintained. The floors are polished hardwood and walls are decorated with trophies in glass cases and various yacht flags of historical interest. There is a large bar and adjoining it is a smaller room used as a restaurant and 'function room' when required. Both rooms have large floor to ceiling windows that look out over the clubs neatly mowed lawn with outside seating and tables, onto the Orwell river and its many moorings that line the dredged channel. The river is tidal and

The River Orwell at low tide . . .

the difference between high water and low water is dramatic. At high water the water seems to stretch across for about a mile but this vast expanse rapidly dwindles when the tide goes out to leave a deep-water channel only 1/8th the size of the former.

As far as our activities were concerned this would be no hardship because high water would occur about midday for the duration of our stay. This would give us large expanses of water deep enough for the type of boats we would be sailing.

The following day Gabi and I assembled and prepared our two boats. One is an inflatable with a 15 h.p. outboard motor that pushes it along rather smartly. This I use to monitor test runs with our high-speed sailer "*Triton Chariot*" and to be close by in case assistance is needed. The second boat is "*Boomerang*", a boat I bought last year because it needed renovation and is a particularly interesting design that was too far advanced for its commercial good, consequently only half a dozen or so were ever made, and as far as I know this is one of the last two in existence. It is a striking design rather like a trimaran, but instead of hulls on extended outriggers, this boat has a pair of foils - one each side - canted at about 40° which provide all the stability required with minimal water resistance. Consequently they are quite speedy especially in light winds.

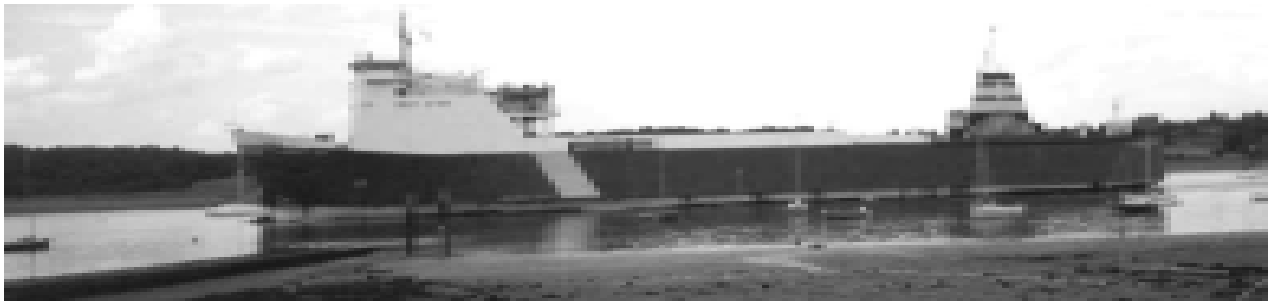
With both boats assembled it was time for a test sail with *Boomerang*. This was the first time I sailed this boat though I have seen it sailing at some of the Speed trials I have attended. I had made some modifications and was keen to put them to the test. One modification was to make it possible to steer with the feet via foot pedals. I have this feature on a couple of my boats and it is worth another crew member without the weight because it allows the helmsperson to operate lines with both hands yet still maintain steerage with the feet. This, of course, means that one sits IN the boat rather than the conventional style of sitting out or ON the boat. I was able to incorporate my conversion so that I retained the original tiller steering and would be able to choose whichever style I preferred.

The weather was fine and sunny with a perfect breeze for the occasion so Gabi accompanied me on this maiden voyage. The smile on Gabi's face said everything as we slipped effortlessly through the water. Crews on other boats beckoned to their companions who were below decks to come up and see this strange boat that was overtaking so effortlessly. Thumbs were raised in silent approval as we passed them by with hardly a ripple from our slim boat and it's even slimmer foils. There would be the inevitable slight increase of wind speed and Boomerang would immediately respond with a surge of increased speed that would create a small wave at the stern which gurgled as if *Boomerang* was chuckling with joy to be back in it's true element once more.

We sailed to the next village, Pinmill, and then turned back because it was clear that some adjustments to the lines that controlled the setting of the fore sail needed some adjustment. Back at the clubhouse our friends, Bob and Gen joked about the sheer joy shown on Gabi's face as we sailed away, and Gabi rejoined with the affirmation that 'This boat we will keep!'

The next couple of days just drifted by without anything spectacular. On Tuesday afternoon Philip Middleton arrived with *Triton Chariot* and we started to assemble it but needed most of the following day to have it ready for sailing. We set off together with Gabi and myself in *Boomerang* and Philip in *Triton*. The wind was stronger this day and by the time we reached the open banked region below Pinmill it was blowing a stiff breeze that demanded all my concentration and provided some exciting sailing.

As we sped along I heard a clunk on the port side and looked over to see what it was. It took me a couple of minutes to realise that the portside stay that holds the mast up was streaming uselessly astern. My first thoughts were that it had broken but it was later revealed that a securing pin had come undone and the stay had fallen down. My heart



. . . and its hazards!

stiffened with that awful realization that one stood before a precipice.... something like pressing on the brake pedal only to have it sink to the floor. OK, you haven't hit anything yet... but it's just a matter of time.

I quickly realized that as long as we stayed on this tack the wind would hold the mast up but if we allowed the boat to turn and the wind came behind the sail the whole rig would come crashing down. My initial gasp and cry of shock had startled Gabi into a state of extreme agitation. Now, I spoke my thoughts aloud for her to grasp the facts and how I intended to handle the situation. Getting the sail down was out of the question because the pressure of the wind would be too great; anyway, we needed that to keep the mast up. Gabi tried some suggestions but I cut her off sharply saying I had to think... bless her heart she did not take it badly. The river bank was mostly muddy and soft so it would not be a problem just to drive up onto the beach... This we decided to do and I swapped places with Gabi to allow her to steer so that I could jump into the water as we approached and take some of the speed off the boat to avoid hitting the bank too hard. As Gabi took over the helm I warned her not to allow the wind to back the sail which she immediately started to do but corrected it very quickly as my voice rose to a crescendo....

Photo: Gabi Koegel

Boomerang - a Foiler 21

I yanked up the centreboard just before leaping into the water and successfully slowed Boomerang and slewed it onto the thick ooze of mud. The wind promptly pushed the boat further onto the mud which made me worry that we might become high and dry because the tide was falling; however, a quick inspection showed that the problem was only a missing securing pin, and I was able to rig up a temporary solution using the foresail halyard. Once this was done we could adjust the mainsail to relieve the winds pressure and then turn the boat and slide it off the mud bank. Needless to say the mud was inky black and everything, including ourselves, looked quite a mess, but at least we were sailing again; albeit with a 'Jury Rig' whose strength was somewhat dubious. Consequently I sailed with great caution and sacrificed speed by spilling the wind as much as possible in order to arrive back in one piece, which I am relieved to say that we did. Back at the clubhouse it was straightforward to lower the mast and put matters to rights with some additional safety wires to avoid a recurrence.

Gabi was rather unnerved with all this and confided with me that she had always assumed sailing to be a serene pastime; clearly that was not so when sailing with me.... I understood what she meant but could not resist reminding her that at the end of the day we had arrived home safe and sound.

Later that evening, about 6 o'clock, Philip and I prepared for some sailing with *Triton*. Just as we set off from the slipway I remarked to Philip that there were some ominous black clouds on the horizon... shortly after that we were subjected to an almighty squall that had us sailing at full speed in a flurry of spray and rain that almost blinded me on the helm. Philip was working the trapeze and I shouted through the wind to him that I could see very little and he should warn me of any obstacles ahead as we blasted through the spray. He shouted back an acknowledgment.

We had fitted the foils but they were hoisted up above deck out of use. The wind, however, was so strong that it blew the leeward foil over the side and it then promptly deployed itself automatically. Bearing in mind that so far we have not had any real success getting the foils to work you can imagine our joy when this foil suddenly lifted the hull that was being submerged with the pressure of the wind clear of the water.... It was like magic. Suddenly, Philip, who was on the other hull that was previously being lifted from the water, was now getting his feet wet!

There were some moments for us to give a few whoops of delight and then I heard a strange clunking sound.... About the same instant I realized that we were too close to the shoreline and the sound was from the foil hitting the riverbed; the foil was ripped from its mounting with a resounding clunk! Philip hurriedly recovered the broken foil and lashed it down on the trampoline deck whilst I did my best to keep the boat under control and spill enough wind whilst retaining steerage.

Muttering words of consolation and regret we continued and then made a turn to come back to the clubhouse. We now deployed the other foil and adjusted the sails and were rewarded to see that foil also worked.... I fiddled with the rear foil attached to the rudder and was delighted to find that it responded exactly as planned. What a pity we were one foil less than required.

With mixed feelings of euphoria and dismay we made our way back to the slipway and brought the boat ashore for the night. After a hot shower in the excellent facilities we retired to the camper for a beer and some food and discussed the events. All in all the feeling of joy that the foils actually worked overcame the disappointment of breaking the foil. At least we had another set of different foils that we could try out over the next couple of days.

Speedbird

The next day was bright and sunny, with but little wind, which ruled out any testing of foils. We messed about with some sailing but nothing very special. Being the Friday some other participants began arriving. Some we knew and there was much chatter and passing on of news. That evening was a jolly time in the clubhouse where most of us also had a meal together. One of the arrivals was a chap called Patrick who owned the other Foiler 21 like mine. We had been in touch with email and I had challenged him to a series of races; the winner being the best of three. He heartily accepted and we arranged to have the first race on Saturday morning immediately after the days briefing which followed the excellent 'Full English Breakfast' that was all part of the entry fee.

The course was set from in front of the clubhouse and sailing up to a large road bridge and rounding a particular buoy named 'Pond Ooze' and finishing in front of the clubhouse. We started with the wind directly from behind which is about the slowest point of sailing and the last of the flood tide pushing us in the right direction. Patrick headed straight for the buoy and I took the more radical decision to tack across the wind in order to make more speed, the disadvantage though is that one has to travel a larger distance. I certainly was making more speed but after tacking again and then closing on Patrick there was hardly anything between us... Patrick then found more wind and edged ahead of me by about six boat lengths. I tried everything I knew but only managed to stop him getting any further ahead.

At the buoy Patrick turned before me and now had the wind on the 'nose'. This would make some interesting sailing being much faster and requiring many 'tacks' that need to be executed efficiently to minimize time lost with this manoeuvre. He sheeted in his sails and his craft leaned over with the increased pressure from the wind. The lee foil bit deeper into the water and his speed increased, rapidly enlarging the gap between us giving me the dejected feeling of being left way behind.

But my turn to round the buoy came and I too was soon speeding up and in hot pursuit of Patrick in "*Speedbird*". I quickly learned that I was able to point higher up into the wind than Patrick's *Speedbird*. This gave me a choice to travel a shorter distance, or cover him and travel the same distance but at a faster speed. For the first tack I decided to

point higher to keep clear of him and then, once ahead, I went for speed. I was amazed how much quicker *Boomerang* was than *Speedbird*. It was obvious that I had made some modifications like a rotating mast and a deeper centreboard and that these things undoubtedly give an advantage, but it was the degree of difference that surprised me. After crossing the line I noted the time and waited for *Speedbird* to cross some 18½ minutes later. Considering the race took me about 60 minutes you can see that *Boomerang* was significantly faster.

Needless to say I was delighted with my victory and showed little mercy towards Patrick when he later came ashore, especially because, when asked by an interested bystander which of the two boats was his, he replied "The fastest one!"

We agreed to make the second race the following morning, Sunday. The rest of that day was taken up with timed runs over a measured distance to establish the fastest boat of the day. With only six boats competing there was not a lot of competition but I thought it worth noting that *Boomerang* turned in a better speed than did *Speedbird*. I managed third fastest time against a very fast catamaran sporting a huge sail area, which came second. Philip took top honors with *Triton* and it being a boat of my design was like taking first for myself.

Also there – Gordon Stanger-Leathes's Trifoiler

That evening we had an official dinner and there were a couple of speakers afterwards explaining their designs and demonstrating models they had brought along.

Sunday dawned not so sunny but bright and with a lot of wind. Patrick and I soon had our boats in the water and hurriedly prepared them for the second race. Patrick sailed off the slipway before me and by the time I was ready and had sailed out into the main channel for the start he was way over on the mud flats which were at this state of high tide covered with water and perfect for sailing fast. Eager to commence the race I set off to join him and make the start together. On my way I had to make some adjustments to the steering and my seat and in the process ended up close to a large old sailing boat with a long bowsprit protruding from its bows, tied up to a mooring. I judged that I could sail past it but this turned out to be an error and the port stay - the same one that had come adrift earlier in the week - fouled the bowsprit and scraped along it. Unfortunately there was a tang of metal protruding from the side at the tip and this duly snagged the mast stay and held it fast which caused *Boomerang* to neatly pirouette around the front of the large boat whereupon the wind was now behind me and sent *Boomerang* promptly down the other side of the sailing boat with the bowsprit still poking between the mast stay and the mast resulting in "Checkmate" in one move. Or to put it another way — "Get out of that!"

For the first minute I just cursed my luck but as that did little to improve the situation I decided to clamber out on the crossbeams and try to wrestle the boat clear. It did not budge, which was not surprising with the tide still flooding and holding *Boomerang* against the sailing boat, and a fair stiff breeze against the mainsail. Which also made it impossible to get the mainsail down. Clearly I needed assistance, and looked around for Patrick to go and ask for a rescue boat. Patrick was way off playing at fast sailing, and came nowhere near me. I looked ashore but I was quite a way off and on the hidden side of the larger sailing boat so not very visible. Fortunately I had some emergency flares with me, and I then sent a white flare up. There did not appear to be any action at the club so I sent another and a minute later another. There was still no sign of action so I then popped off a red flare. This was getting serious because a red flare could set the whole emergency service in operation including helicopters.... Still nothing, so I

fired another red flare. Shortly after that I spied a rescue boat speeding in my direction.

The rescue boat was only crewed by one person and that made matters difficult but after two attempts we managed to extricate *Boomerang* without any damage. Getting the towline free again was difficult and by the time I had done so I was close to another boat on a mooring (There are many moorings on this stretch of river.) Fortunately it had no bowsprit and I was able to sail around the front of it but in doing so the large mooring buoy jammed between the tiller and the boat snagging firmly, stopping *Boomerang* in its tracks. I managed to wriggle it free with what appeared to be just a bent tiller for damage. Now I was in clear water and settled down to join up with Patrick and start the second race.

Sheeting in the sails the boat picked up speed and then suddenly slowed dramatically as if brakes had been applied. There was an accompanying whoosh of water and I looked behind to see a great sheet of water shooting up from the back of the boat. Examination showed that the top rudder pintle had been loosened by the snagging with the buoy and now parted completely, allowing the rudder to whip around at right angle to the boat and effectively apply the brake. I managed to wrestle the rudder free with some considerable effort and then used the paddle - normally used to get back ashore when the wind dies - to steer with. I did think I would be able to steer the boat back to the slipway; but with all the moorings around me and with defective steering, I decided to ask Patrick who was now close by, to ask for assistance. Whilst he was doing that, I managed to get the sails down in preparation for a tow back to shore.

This put the second race completely out of the picture which was really a shame, but that's sailing. I'm not too sure if Patrick was relieved or saddened.... All this excitement had its effect on me and I was happy to take it fairly easy for the rest of the day. Philip did manage to convince me to join him on *Triton* to test a couple of the other foils but with the stronger winds it made steering uncertain and with all the moored boats we decided to call it a day.

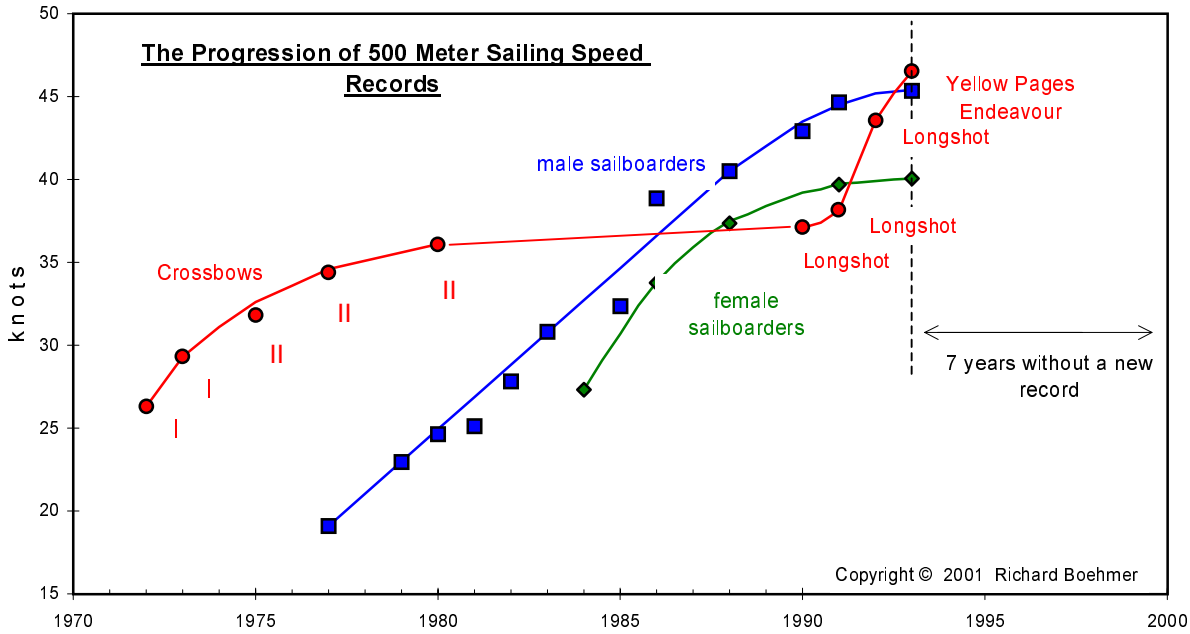
The Monday was bright and sunny and we made an early start packing up the boats and loading the trailers. This was done by midday and I was able to grill some steaks for a Brunch. We needed another couple of hours to get away but it all worked out well enough to avoid the London rush hour and arrive in Dover for the ferry with ample time. The rest of our journey was straightforward and we arrived home on Wednesday morning in time for breakfast.

All photos by the Author

Bob & Gen talking to John Thurston

From Hulls to Boards, Now Foils and Planing

Richard Boehmer



This diagram probably speaks for itself. It does though show that the sailboards seem to have hit a plateau - a matter that is explored in the article below. Maybe the time for planing craft is coming.

Hyperwind Sailing

= FOEHN NUMBER > 1

Barney Kenney

Before the ink dried on the patent, Windsurfers were impressing sailors with their speed. Shortly thereafter the entire yachting world was astounded when a sailboard became the fastest wind powered craft ever to sail on the water. Since speed under sail has been a quest since before recorded history, the significance of this event cannot be overstated. The question now is, how fast can a sailboard ultimately go on the water?

Perhaps the best way to answer this question is to examine what causes the drag that holds a sailboard back. A performance analysis of two idealized sailboards is described that may help to determine an upper limit to board speed on the water.

The simplest sailboard capable of yielding useful information is an iceboard (Fig. 1). With little structure and almost no friction on the frozen surface, iceboards have been clocked exceeding Foehn 3 in light winds. (The Foehn number is defined as the ratio of the board speed to the true speed of the wind - in analogy with the Mach number of supersonic flight.) But why can't an iceboard go faster?

In part, the answer is you! The performance analysis shows that the biggest drag preventing high speed is the drag produced by the sailor standing on the board - much larger than the drag of the board or the parasitic and induced drag of the sail itself. Even so, with no tipping or skidding constraints and no constraints other than drag, Foehn 4.7 is theoretically possible on an iceboard with a 20 knot wind (Fig. 2).

Photo by Blake Mills

Figure 1. Hyperwind sailing on ice and snow: Jibing at Foehn 2.

In practice, however, Foehn 4.7 has never been reached. If drag is not setting the upper limit for speed, it must be inadequate thrust. Although imparting many desirable handling characteristics to a sailboard, the analysis shows that the hand-held sail actually limits the maximum available thrust because the catapulting moment of the sail (lift times height of centre of effort) must be balanced by the hiking moment (sailor's weight times distance of their centre of gravity from board). Not surprising to speed sailors, who have taken to wearing 20 kilos of lead on their back, the hiking moment is a very serious constraint, effectively limiting the speed that a 80 kilo iceboarder can actually achieve to less than Foehn 2.3 in a 20 knot wind. Moreover, the situation deteriorates as the true wind increases. With a 40 knot wind, the maximum speed is limited to about Foehn 1.7.

The course sailed to reach maximum speed on ice is also changed by the hiking constraint. In high winds, maximum speed occurs on a very broad reach, 150 degrees off the wind. In contrast, with no hiking constraint, maximum speed occurs on a 105 degree course.

But what about the ultimate speed on water?

The iceboard is a useful model because it allows the performance of the sailor and the sail to be analyzed in isolation from water effects. This simple model establishes an upper limit to the maximum speed that can be reached with a hand-held sail. On water, a sailboard has to overcome additional drag from the fin as well as skin friction, pressure drag, wave drag and induced drag on the board.

Historically, the empirical approach to speed sailing has been towards smaller and smaller boards in an attempt to reduce skin friction drag. Although this approach has worked well in the past, the point of diminishing returns may have already been reached. As the board size decreases, the trim angle and the pressure drag increases. Once the pressure drag begins to dominate the total drag, there is no benefit to continued size reduction. In theory, minimum board drag occurs when the skin friction drag and the pressure drag are equal. Keeping the pressure drag as small as possible also has another advantage because the wave making drag is simultaneously minimized for fully planing boards.

Induced drag is the drag component due to the hydrodynamic lift. It may also be thought of as drag associated with three dimensional flow over the planing surface. To minimize the induced drag,

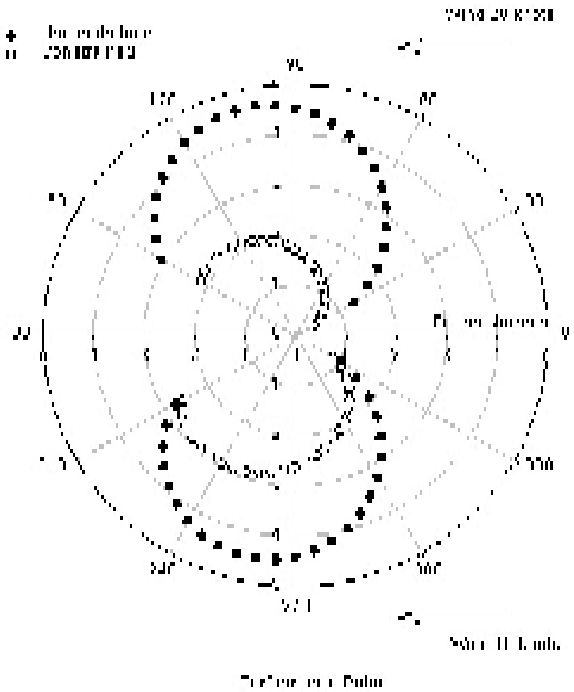


Figure 2. Performance polar calculated for an iceboard (oooo) with an 80 kilogram sailor at two different wind speeds. The wind is blowing from right to left. Because performance polars are symmetrical about the wind direction only half is shown for each wind speed. The top half of the graph shows results for 20 knot wind, the bottom half for 10 knots. The theoretical performance of the same iceboard, if unconstrained by the hiking moment (****), is substantially higher at both wind speeds. In this case, drag on the sailor is the main factor limiting speed.

the aspect ratio of the planing surface must be maximized to maintain as much two dimensional flow as possible. This criterion calls for a transom stern with a large beam and short planing length. Many of the new light wind planing boards meet this criterion.

Fin drag is the least important factor limiting high speeds on the water, partly because today's fins are so good. What is required is a fin with low profile drag and a high aspect ratio (length/chord) to minimize induced drag. Almost any high quality fin of the correct size will do.

A detailed performance analysis using data from a prototype speed board shows that drag on the water can be reduced from conventional designs. Results for two wind speeds are shown in Fig. 3. Foehn 1.5 is obtainable on the water in a 40 knot wind. Note, at higher speeds, the difference between the ice and water boards decreases because the single largest component of drag remains the sailor. While some drag reduction is possible using special clothing, only minor improvements can be expected without restricting movement required to sail the board.

To conclude, it is still possible for a sailboard to break the existing world speed sailing record of 46.52 knots, but it had better be done soon, before the record gets much higher. A well designed catamaran or proa variant will eventually prevail because the double constraints of high body drag and restricted hiking moment will be difficult to overcome for board speeds much over 60 knots. And then, there are the problems of stability and control, life and death, etc.

Barney Kenney, Ph.D.
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August 1999

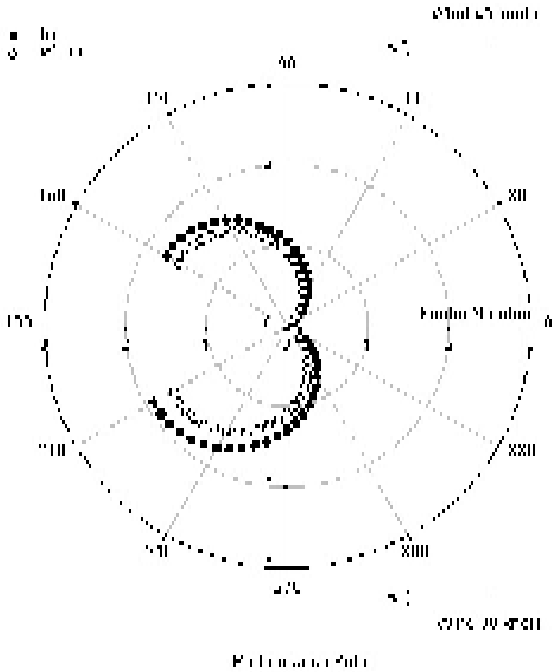


Figure 3. Comparison of the performance of an iceboard to that of a sailboard on water at two different wind speeds. The wind is blowing from right to left. The top half of the graph shows results for 40 knot wind, the bottom half for 30 knot wind.

Your Letters

Speedweek - Accomodation etc

I drove down on the Wednesday afternoon (three hours from work in Horsham W.Sussex). In the gathering dusk, as I drove over the causeway to Portland, the 7m para-glider surfers were a magnificent sight: though alas I had no camera.

When I got to the sailing centre I heard from John Perry that Chris Evan's yellow trimaran had a spectacular grounding. John was crewing sitting aft, and thought he was going to be falling a long way as she cartwheeled forward. Fortunately she fell backwards, having not quite reached vertical. Presumably Chris thought his boat was amphibious.

Stayed overnight in Portland Youth Hostel. New at the begining of 2001. Excellent beds, though too short for me being over six foot tall. Can sleep 32 people in the hostel. Being just outside the sailing centre I would have thought it would be the best place for people to stay during Speed Week. The warden 'Bonnie', local to the area,did not know anything about Speed Week or AYRS. Something for the PR officer to address in Weymouth perhaps?

I passed on the details of how to arrange a group booking next year with Bob Downhill (the organiser of Speedweek for the last ten years). One person makes the booking paying £13.00 and is given a booking number. Each person signs into the hostel giving the booking number and pays their bed-night fee. (Next year this will be £11.25 per night). The advantage of a group booking is that only the person making the group booking need be a member of the YHA, none of the others do.

Excellent breakfast on Thursday morning in the Breakwater hotel's big blue-glazed tile fronted building in Castletown, 5mins walk from both the Hostel and the Sailing Centre. A non-resident Full English breakfast cost £3.50 (fruit juice, cereal, tea/coffee, egg/bacon/sausage/fried.bread/mushroom/black pudding, and toast jam/marmalade) – too much for me.

I was a bit disappointed Thursday morning that no one was out sailing, as I had to be back at work on Thursday afternoon.

I eyed the shattered bows of the yellow small float trimaran during the morning. Apparently built of 3mm ply. I would love to know from Chris (a) How much the originally built tri weighed (without rig)? So I can compare for reasonableness with my Tri's estimate lightship weight. (b) When I finally move house I will get proper construction drawings drawn for my trimaran. Would Chris Evans be interested in building my trimaran for me? Alternatively some other club member might?

Watched Slade Penoyre tinkering with his hapa designs for a while. **Suggestion**: Rather than having the drag of a trailing rudder to steer it deeper in the water, perhaps Slade could try twisting one of the sailing board winglets up on one side relative to the other. Would it not then bank downwards to one side? To sail on the other tack replace it with another mirror image hapa.

Left Portland at 1115hr. Eight hours later got to Horsham. Never did do any work that day. I probably lost a good three hours driving the wrong way along A35 from Dorchester towards Exeter. Turned around at Bridport, though had by then sat in two traffic jams for road works. I had told myself the view was different because I was returning in daylight and besides 95% ot the things one worries about never happen, so why check the map.

My work colleagues say they might buy me a compass for Christmas. Sat Nav would be better as I've already proven I can drive around in circles with a compass.

Mark R. Tingley
<mark.tingley@uk.royalsun.com>

Alacrity Plans

Hello, I hope you can help me. I am looking for plans for a 19 foot Alacrity sailing boat. I have had no success in finding anything if any of your members can help it would be gratefully appreciated.

M Ranson
3a East Street
Isle of Wight
England PO33 1JB

ProSurf 3

New Wave Systems, Inc. announces the release of ProSurf 3, a major new version of its hull design and fairing program. After 15 years of development, ProSurf 3 has evolved into a general-purpose trimmed NURB surface modeling program. ProSurf 3 offers unique features, such as using edit points that lie on the NURB curves and surfaces, dynamic curvature feedback for fairing, fine tune shaping

commands, dynamic geometry constraints, editing and shelling of polysurfaces, plate development and expansion, hydrostatics, stability and resistance calculations and a database of airfoil shapes.

"Over the years, our boat and ship design program has evolved into one that can handle any 3-dimensional shape," says Stephen Hollister, President of New Wave Systems, Inc. "We wrote all of the code in ProSurf 3. It does not use any third party software or kernel and it contains unique capabilities that cannot easily be duplicated. We are also being very aggressive about lowering the price of ProSurf 3 to $795. No other surface modeling program provides the same capabilities at anywhere near that price. We also have a new ProBasic 3 program at $395 and a new ProChine 3 program at $195."

Two of the greatest strengths of ProSurf 3 are its detailed surface shaping and fairing tools and its dynamic geometric constraints. After generating surfaces using sweeping, extruding, shelling, lofting, and other techniques, the designer can perform detailed shaping and fairing using fine tune move commands and dynamic curvature feedback information. Combined with the use of edit points that lie on the NURB surface, these commands provide unmatched, detailed shape control required to develop fair surfaces. The designer can also dynamically display any plane-surface or surface-surface intersection while changing the shape of the surface.

ProSurf 3 also provides a number of optional geometric constraints that can be applied to the geometry. One of the most important is the ability to "bond" two surfaces together edge-to-edge. This allows designers to edit and shape connected polysurfaces without having them come apart. These constraints are optional and are defined independently from the geometric entities, which means that they can be added or deleted at any time without affecting the shape of the geometry. Another constraint allows the designer to attach a curve to a surface and use it to trim the shape of the surface. Once defined, the trim curve or the underlying surface can be edited, dynamically showing the changes to the trimmed surface. No untrimming and retrimming is required.

Full descriptions, articles, help files, examples, and a demonstration version of ProSurf 3 are now available at www.newavesys.com.

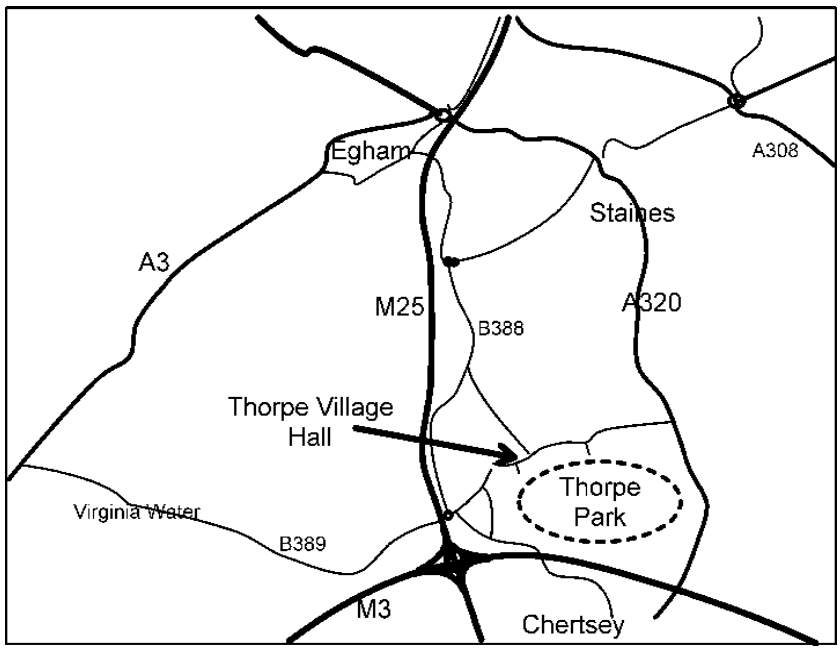
Stephen M. Hollister,
Jamestown, Rhode Island, USA
Tel: (401) 423-1852
email: shollist@newavesys.com

A Boat Building Day

A day of discussion on boat-building theory and poractice will be held in the Thorpe Village Hall (between Staines and Chertsey, Surrey, UK) on Sunday 17th February 2002 from 9.30am to 5pm. (Follow the signs towards Thorpe Park then enter the village.)

Bring your project along, or if you cannot bring it, bring some pictures (OHP or 35mm slides for preference) and be prepared to talk about it!

Details from Fred Ball, tel: +44 1344 843690; email fcb@globalnet.co.uk

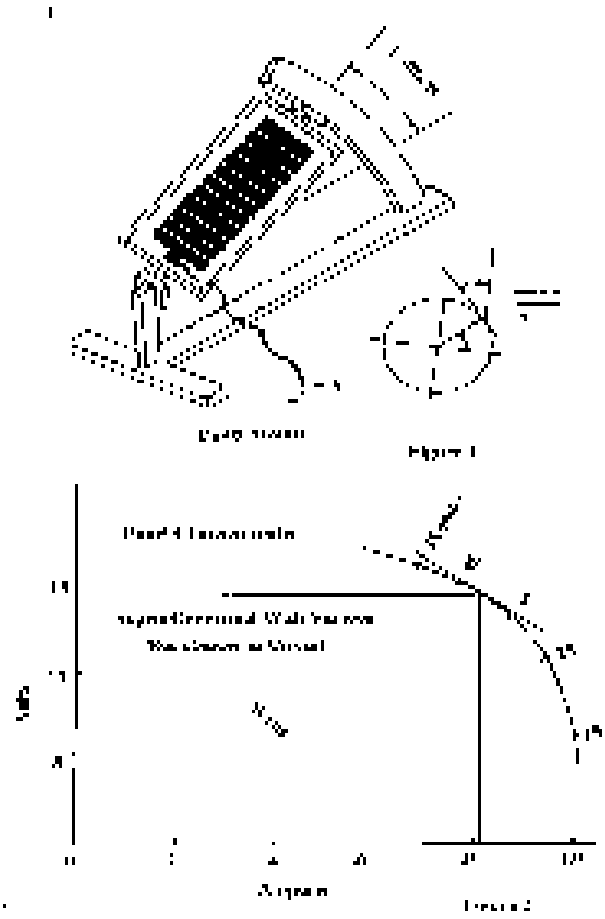


A Solar Panel Experiment

Frank Bailey

Solar panels are probably becoming more common as time goes on. The A.Y.R.S. has published articles on solar powered electric boats. The following material was assembled by me who up to this point knew very little about solar panel capabilities, their characteristics, limitations, and generally, their care and use. My electrical expertise is extremely limited but I can glue wood pretty well. After fiddling around with a panel as described below, I still feel I have a long way to go in understanding solar panels and how and why they work.

I had need of a solar panel for two reasons. First, the Toad Hill Boat Shop Annex has no electrical power and I wanted to install a radio for entertainment without continually purchasing small dry cells while I scrape and paint, etc., listening to Benjamin Britten's "Sea Interludes" perhaps. The second reason was I wanted to keep a battery charged so that I could maintain a 12 volt source for a weather station with instruments at the mast head of my small sailboat, the *Lulu Queen*, which only uses a 40 Plus Seagull outboard without a generator.

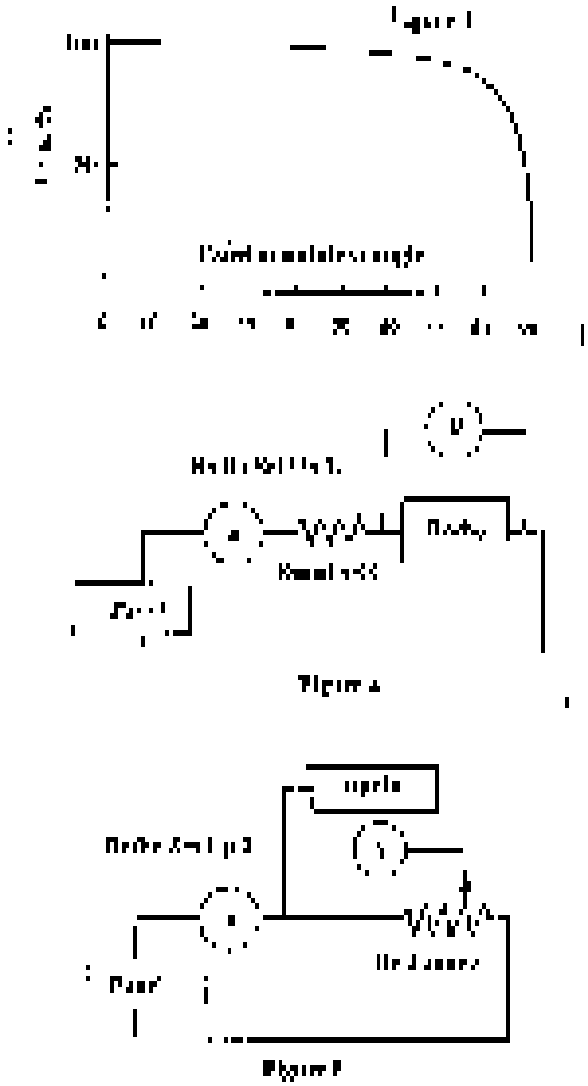


The panel I purchased was advertised as a solar battery charger for marine, RV and automotive batteries. The stated characteristics of the panel, which cost about £65, are as follows:

Rated Power	5.0 Watts
Voltage maximum power	16.5 volts
Current maximum power	0.3 amperes
Voltage open	23.8 volts
Current Short Circuit	0.37 amperes
Nominal area	0.8 Sq. Ft.
Weight	1.2 lbs
Cost per Sq. foot	£8.13

For convenience I built a simple wooden mount to hold the panel in a sundial type arrangement for my latitude. See Figure 1, including a small sketch of a sundial. I assume you are all familiar with horizontal sundials, and that the style of the gnomon is sloped to match the users latitude (What the heck is a gnomon?) Additionally, I allowed the panel to rotate to follow the sun as it passed from East to West. As it turned out, this additional mechanism probably was unnecessary. For the short duration of the tests, which only took several days time around noon, all of this may sound like overkill. Note there are eleven segments that make up the panel. Different experiments were gone through to see if I could determine what was in the "black box", or panel.

Experiment 1. No sketch is associated with this experiment as initially I was afraid of blowing up my ammeter and voltmeter and perhaps even overloading the panel but got up enough courage to attach the panel to two 12 volt automobile light bulbs in series. The readings were 4.5 volts and 1.0 amp across both bulbs, the amperes being about three times the rated. Since R=E/I, the ohms were 4.5. There was only a



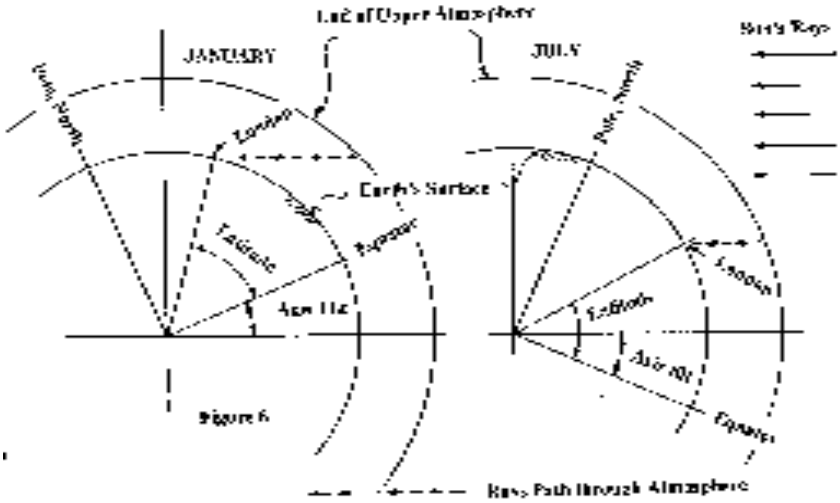
very dim glow to the bulb signifying not much current capacity was generated for the bulbs so I tried one bulb and got 2.5 volts and 1.05 amps, giving about 2.4 ohms and not much more brilliance. Nothing smoked so I proceeded to the next experiment.

Experiment 2. I thought it wise to find the curve of voltage versus current when various resistances were in the circuit. This curve is shown in Figure 2. The curve is similar to another panel curve I have seen, that is, as the current increases, the voltage drops. The various resistances I used are shown alongside the curve. Several things may be noted here. With the resistances I used, the current developed is well beyond the maximum power current listed in the original specs. Since D.C. watts is the product of amps x volts, where the horizontal and vertical lines meet on the curve, the area of the resulting rectangle represents the watts generated. The area shown represents about 12.6 Watts which is much more than the rated of 5 Watts (16.5 Volts x 0.3 Amps. = 5 Watts.) I was now worried about blowing out the panel. I did not understand why I could generate more Watts than the rated output other than the fact that I could have initially added more resistance to the circuit and thus reduced the current flow. I think the main thing to note at this point is that the relationship I=E/R does not work here. (There is a point on the curve that will give you maximum Watts. You calculus experts may wish to find this point on the curve in relation to the slope of the tangent to the curve, scale factors, squares and rectangles, etc — an interesting problem.) The variable resistance used was a length of nichrome resistance wire marked off on a board with feet and ohms. After looking at the results, I should have used more resistance in the circuit for more readings at lesser currents.

Experiment 3. All experiments were carried on under a clear sky, whatever that is. Northern Michigan skies are clearer than western Pennsylvania skies for instance. I was interested in how the volts generated related to the angle of orientation of the panel to the sun. Generally the experiments were conducted around about local noon so the panel would be sloped to the rays in a North/South direction because of latitude but otherwise the panel was in a more-or-less horizontal position in the East/West direction. Figure 3 shows the results. It appears there was very little change in voltage until the panel was almost edge on to the sun's rays. I don't understand this but it appears if the sun merely hits the panel, it works! This will give you some idea of how to mount your panel on your boat. This can depend on your course sometimes but on the other hand, why not just mount it on the deck (where you can walk on it)? Most mountings appear to hang from a rail.

Experiment 4. Courage up, I now put a 12 volt radio in the circuit using two setups, as shown in Figures 4 and 5. Setup 1 (Fig 4) has a resistance in series with the radio. Typical data for this Setup 1 is: 0.6 amps, 9.5 volts with 20 ohms in the resistance. If the resistance was too high, there was not enough voltage left for the radio to work. Note that the voltmeter is across the radio only. Typical data for Setup 2 data is: 0.85 amps, 8.0 volts, 0.50 ohms. The reason for the resistances in the circuits is I was afraid the voltage generated by the panel would be too much for the 12 volt radio. In each setup I changed the resistance until the radio worked. There were of course ranges of resistance where the radio still worked. I now had sound in the Toad Hill Boat Shop Annex without a battery, as long as the sun was out. I did not connect the radio to the solar panel without any resistance in the circuit. No guts - but see next experiment.

Experiment 5. No sketch. I now hitched up a 12V car battery to the car radio, watching carefully the polarities. The radio worked. (Why not?) The radio/battery combination drew 0.7 amps with 10 volts on the voltmeter. Why the voltmeter did not read 12 volts I don't understand. I then added the solar panel. With the solar panel connected, readings were about the same. This assembly was now most useful as I could have the radio on in the Annex after sundown.



Experiment 6. No sketch. I had on hand a 12 volt battery needing charging badly. It read on the meter only 5 volts. I hitched up the panel to the battery to see if I could recharge the battery. Some electronic items will keep a battery charged but will not re-charge a depleted one. To maintain some kind of standard sunshine, I only kept the solar panel connected to the battery between the hours of 10AM to 3PM. It took about nine hours to fully charge the battery.

Experiment 7. No sketch. You will note from the sketch of the panel mount that the panel itself consists of 11 sections. I covered each section with heavy cardboard held in place with tape. I then randomly uncovered one panel at a time to see how the open circuit voltage changed. It was no big surprise to see that the voltage increased in straight line proportion as each of the cardboards were removed. Is it possible to glean from this information that the panels are arranged in a parallel assembly? To further test this assumption, I took a piece of heavy cardboard sufficient to cover all panels at once and exposed the panels vertically one inch at a time until all 6½" of the panel width was uncovered. There was not much voltage difference from start to finish. With 1" uncovered, the voltmeter registered about 15 volts which rapidly increased to full voltage when the panels were fully uncovered. Did we learn anything here worthwhile?

The experiments are now done. I feel a bit more confident in the use of my panel. The panel itself is still a black box to me but I can use it now without destroying it or my radio or meters I think. It is still uncertain if I have damaged the panel by drawing about three times the rated current from it. I may have shortened its life perhaps. Is it possible some of you readers have additional worthwhile experiences, good or bad, with the care and feeding of solar panels?

Those not particularly interested in celestial navigation need not peruse the following material. But I assume many of you are true sailors who can navigate by the sun, stars, moon, and planets.

Please refer to the sketch showing a representation of the earth in January and July. You will note the axis of the earth is tilted either away or toward the sun's rays. The object of this exercise is to try and determine how much further the sun's rays have to go through our atmosphere and become more or less attenuated as the seasons change, compared to a place on the earth where the sun is directly overhead at noon. It is granted that very small particulate matter locally located is probably more important than the total distance the rays travel through our atmosphere. Nevertheless, it is an interesting exercise in geometry to try and figure this problem out. It is a bit more difficult I believe to solve this problem for a sunrise and sunset condition as you have to work in a three dimensional world.

If we assume the earth's radius is 4000 miles, and the atmosphere is 100 miles deep, to use round numbers, and it is noon, we can then solve a fairly simple geometric problem. The solution lies in finding the chords of a circle. Developing the formulas and running through the calculations, it appears the sun's rays have to traverse about three times the distance if the sun is not directly overhead at noon and you are in the latitude of London (51°N) in January. Obviously the best possible conditions for most sunlight is to sail in an area and time when the sun is directly overhead at noon to get the maximum power conversion from your panel. None of the above experiments have involved any kind of cloudy or hazy day or say a day in Los Angeles or Calcutta.

Two more experiments were undertaken: The solar panel has zero output in full moonlight. In full sunlight, the panel reached a temperature of 125° F.

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@fishwick.demon.co.uk

November

6th **AYRS London meeting**
Subject to be announced. 19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX, UK; tel: +44 (1727) 862 268; email: ayrs@fishwick.demon.co.uk

December

4th **Proas: a panel discussion**
(Participants include: Morris Arthur, Simon Fishwick, Iain Hutchinson, Richard Smith, Charles Sutherland, Keith Webster, etc)
19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX;
tel: +44 (1727) 862 268; email: ayrs@fishwick.demon.co.uk

January 2002

3rd - 13th **London International Boat Show**
Earls Court Exhibition Hall. Those who can, from 16th December onwards, give a day or two to help build/staff the AYRS stand (**reward - free entry**!) should contact Sheila Fishwick tel: +44 (1727) 862 268; email: ayrs@fishwick.demon.co.uk

January

12th **AYRS Annual General Meeting**
19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX; tel: +44 (1727) 862 268; email: ayrs@fishwick.demon.co.uk

February

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

17th **Boat Building Day**
9.30am to 5pm in the Thorpe Village Hall, Coldharbour Lane, Thorpe, Surrey (off the A320 between Staines and Chertsey – follow signs to Thorpe Park, then to the village). Bring your project along, or if you cannot bring it, bring some pictures (OHP or 35mm slides for preference) and be prepared to talk about it! Details from Fred Ball, tel: +44 1344 843690; email fcb@globalnet.co.uk

March

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

April

2nd **AYRS London meeting**
Subject to be announced. 19.30 for 20.00hrs at the London Corinthian Sailing Club, Upper Mall, London W6. Contact: AYRS Secretary, BCM AYRS, London WC1N 3XX, UK; tel: +44 (1727) 862 268; email: ayrs@fishwick.demon.co.uk

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

On the Horizon . . .

Electric Propulsion Design — Theo Schmidt
Proa Foil Sections — Tom Speer
The Maximum Speed of Yachts — Bob Dill
Alerion Electric Auxiliary Conversion — Charles Houghton
KCat70 —a High Performance Motor Sailer — G Coombs
More *Sunshine* — Chris Evans
More sources and resources: reviews, publications and Internet sites

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