Catalyst

Journal of the Amateur Yacht Research Society

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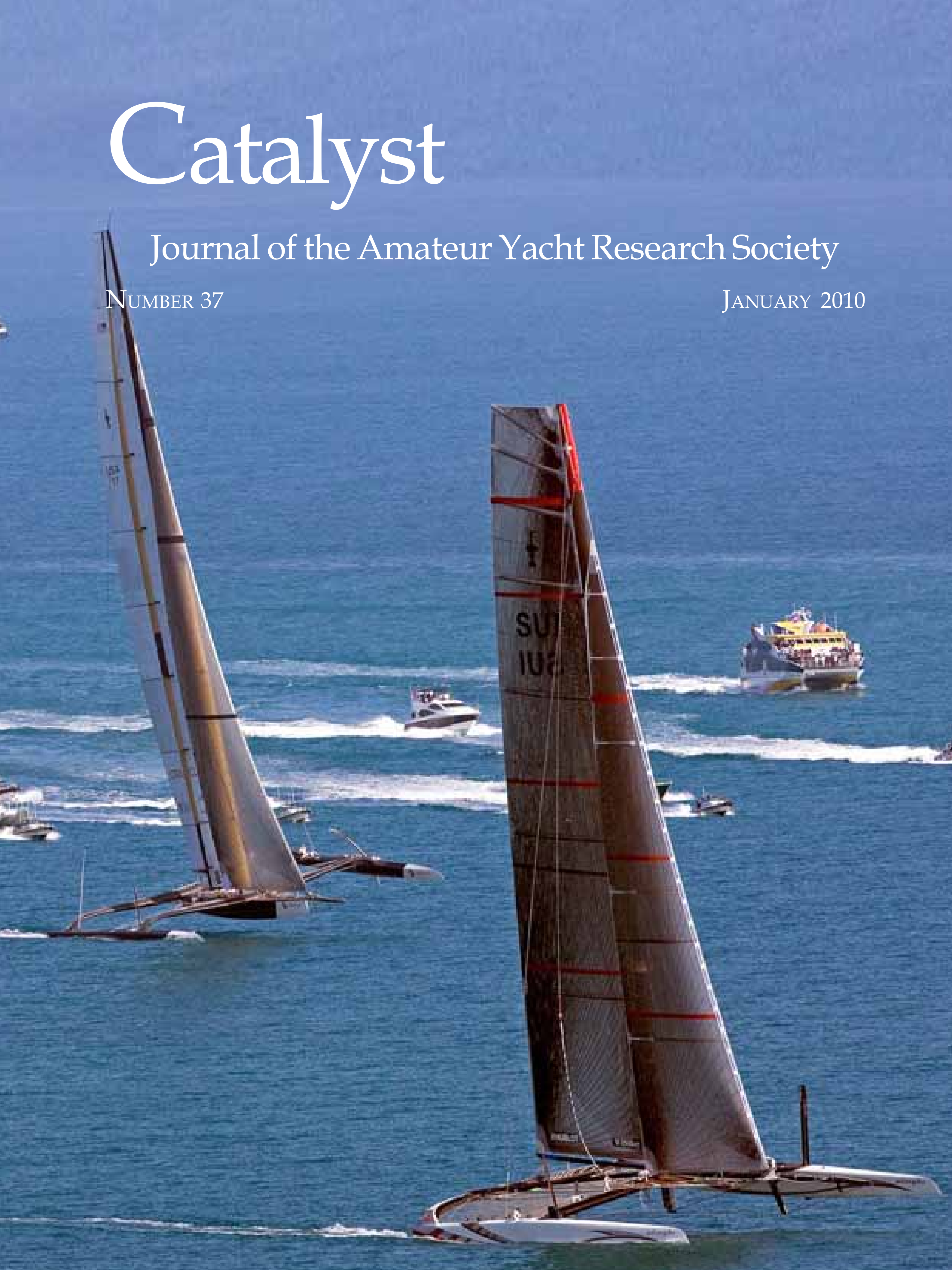

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As examples, the polar diagram p16 of *Catalyst 28* was re-created from a second generation photocopy, photos of shunting in the Champion article in *Catalyst 27* (pp 19-21) were screen grabs from a video supplied on DVD. The rest of the images in that article were scanned from photographs, and the text was OCRed (Optical Character Recognition software) or keyboarded.

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by fax: +44 (8700) 526657, or
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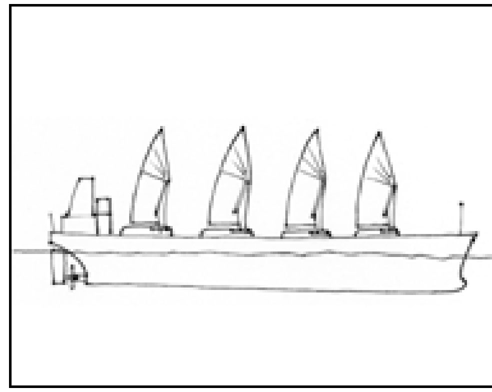
Features

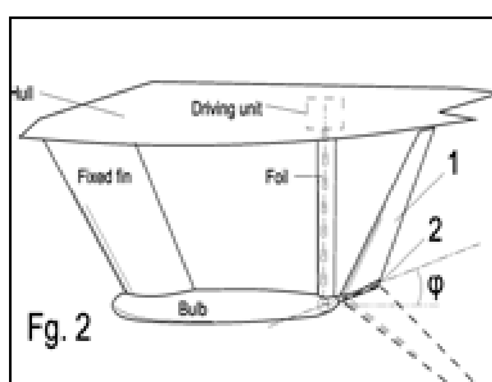


AYRS Matters

Cover Photo:

Race 1 of the 33rd America's Cup: BMW-Oracle's trimaran catching up with Alinghi's catamaran

Photo: Thierry Martinez; ©Thierry Martinez/33rd America's Cup



Catalyst

Journal of the
Amateur Yacht Research Society

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

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Wingsails = better lift/drag ratios = better performance

Catalyst having been delayed, it seemed silly not to use a picture of the America's Cup on the front cover. For those who have not followed it closely, the BMW Oracle trimaran with its 70m tall wingsail, proved faster than Alinghi's soft-sailed catamaran both upwind (but only just in Race 2) and down, to win the Cup by two races to nil (out of three).

The factors behind the win are many - superior handling & tactics, hull shape, platform stiffness, pitching response, etc - but the chief surprise, especially to the loser, seems to have been the performance of the wingsail which sometimes was used alone and sometimes with a jib or genniker. It allowed the winner to point higher and to achieve boat speeds that were pushing three times that of the wind.

It seems one or two AYRS members were involved in the development of the wing, and we hope to persuade them to write an article for Catalyst on their work. For the moment however they are still under contract to BMW Oracle and are obliged to keep things secret.

All of which is a sideways introduction to this issue with its two articles on rigs and one on stabilising foils for monohulls. The first two are Richard Dryden's proposal to use some of the Howard Fund money to develop sail assistance for commercial shipping, and Slieve MacGalliard's split junk rig on his *Poppy*. The last is new member Ilias Michalopolous' article proposing a foil to increase the righting moment on monohulls.

Which in turn are reminders to you that AYRS is open to more proposals for Howard Fund grants, and also that we are announcing another John Hogg £1000 Prize to be awarded in January 2011, for which we need entries by October. The former is for work yet to be done, the latter for work already done. Looking forward to hearing from you about your projects.

Simon Fishwick
AYRS Editor

Your Letters

Regional AYRS Meetings

Following on from Roger Glencross's plea (Catalyst 35) for "ordinary" members to get involved and to promote the Society, I have detailed below some ideas.

Tim Glover (Catalyst 30) flies an AYRS burgee and intends to have the AYRS website on his amphibian's "wheels". I suggest that the AYRS stock a range of promotional gifts similar to the RNLI - burgees, golf caps, sweatshirts, mugs, etc. Customised items such as these can be purchased in quite small quantities at very reasonable prices.

For a lot of members, including myself, the cost in time and money prohibits attendance of the winter meetings in London and the summer events in Thorpe, Norfolk and Weymouth. Whilst I don't want to get involved in a North/South divide, it does seem as if the "active" branch of the Society is southern based.

In order to create a broader base for the Society, individual members could volunteer to be "local points of contact". They would then organise meetings within their locality for members within a reasonable travelling distance of the venue. This is a "regionalisation" in a similar vein to the highly successful meetings held by the AYRS Southwest UK Area.

If there were not too many members attending each local meeting (I suspect only a handful of members will participate), perhaps a "house visit" might be arranged so that members meet at the house of a member who is actively engaged in his own project. Likewise, these small groups of people could arrange to attend local events to promote the Society and sell promotional gifts.

Regions can be arbitrarily designated - Scotland East and Scotland West, England North West and North East, Wales North and South, Midlands, East Anglia etc. Even if half a dozen members in each region meet up on a regular basis - this would be an eight-fold increase in attendances!

To start the ball rolling, I am organising a meeting in the North of England. [*20th March - see* Catalyst *Calendar*] I am sending out invitations within the next couple of weeks, once I have fixed a date and venue. I hope members in other regions will take the same bold step.

Mike Howard
ecotraction@aol.com

[Regional meetings – not only in UK but also in USA and Australia – used once to be a major feature of AYRS. Over time, only the London area meetings survived, probably because organisers dropped out and we were unable to find replacements. Thorpe, Norfolk Broads and the Plymouth meetings started because they are close to Committee Members homes/businesses. We would love to have more meetings and welcome anyone who volunteers to organise them. AYRS will underwrite any costs. If potential meeting organisers email me at office@ayrs.org, I can send them an information pack and lists of members in their locality. Sheila Fishwick, AYRS Hon Sec.]

Stuff to exchange or sell?

I am refitting my amphibious land yacht NEWT with a large rig so that it sails better at lower wind speeds. I already have a Hobie cat 14 main sail but no mast or boom. Has anyone got either an old Hobie Cat 14 mast and boom or a similar rig, to sell or exchange??

A Dart rig would do well.

The luff is 19' 6", and the foot is 8' 3", the distance from the boom to the foot of the mast is 2'6". Anything greater than these sizes will do, because I can always cut them down. (The track that the sail goes in is 6.5 to 7mm wide, and the mast is 4" front to back and 2 1/2" side to side)

I have a Merlin Rocket mast and a boom from my Westerly Pentland sloop that are not required. Any interest?

If there are lots of items of this type could we not start some type of wanted or exchange item in Catalyst, because I know lots of AYRS members who have lots of stuff that is no longer required BUT IS JUST TOO GOOD TO DITCH!!!

My I suggest some kind of AYRS-wide forum of Stuff for sale or simply reuse. This could be both in Catalyst and the website.

Thinking about this further, the whole concept and production of my amphibious land yacht would not have happened if I had not been talking to Kim Fisher: who was just about to throw away three 52" diameter wheels! I took them away and Newt was built using them.

Tim Glover
glovers@dircon.co.uk

[Small advertisements in Catalyst are free to members – just send them in! – Editor]

Help Offered

My name is Mike Howard and I have been a member of the AYRS for nine years. Like the majority of members, I have been one of the "silent majority", privately dreaming up ideas, sometimes committing them to paper in the form of scale drawings or cardboard models, but mainly sitting back, doing nothing, except to await the arrival of the next issue of Catalyst dropping through my letterbox.

However, over the past few days, I have been reading the 2008 and 2009 back issues of Catalyst and this experience has brought home to me just how desperate the Society is for "new blood". So I decided to get up off my backside and write to the Editor with my thoughts on how this "ordinary" member (and others like me) can contribute to the rebuilding of the AYRS.

I use the term "ordinary" because I am sure that the majority of members view the current contributors to Catalyst, together with those few members actually putting forward mathematical theories, building and testing ingenious maritime creations as somewhat "special" and in some cases verging on "genius" - I know I do!

I am setting out below my talents in the belief that other members might find them useful, and if a number of us combine our individual talents as a "team" - the total will be greater than the sum of the individuals. More importantly, some existing projects might well be brought to fruition by the injection of modest amounts of time, materials, finance and physical effort.

My current status is "semi retired" as, like most people these days, some part time work provides the luxuries in life. I am happy to offer the full scope of my knowledge FREE to any AYRS member who wishes to involve me in their personal pet project.

I am a member of the Royal Institute of Naval Architects and an Incorporated Engineer. For the last 15 years of my working life I have operated as a freelance Design Engineer, working in the waste recovery and remediation field. I consider myself to be a "nuts and bolts" engineer as most of my work involved turning projects from "back of the envelope" sketches into cost effective working equipment.

I spend a lot of my time sourcing components, equipment and services as well as developing simple, easy to operate bespoke items of equipment. I do not try to "re-invent the wheel", so I often adapt existing components and equipment to new roles. I have a lot of local contacts who can manufacture bespoke items at very competitive prices!

I own and operate Autodesk Inventor, a 3D modelling software package as well as Autodesk AutoCAD, a 2D software drawing package. Using this software, I am able to create a 3D image as simple or as complicated as you wish. Assemblies comprise a few basic shapes while other involve several thousand components. From these two programs I can produce accurate working drawings.

I have lots of experience of steel and aluminium fabrication and machining, including laser profiling and water jet cutting of components. I have modest woodworking skills as I have built a couple of plywood dinghies, one of which, I designed myself. I have also designed and project managed the construction of a wide beam canal cruiser. I also have a working knowledge of composite materials and mechanical hydraulic and electrical services.

I hope that, not only my offer of support to other AYRS members will be taken up, but that other members in a similar situation will feel inspired to offer their modest talents for the common good of the Society.

My contact details are:

Tel: 0151 531 6256
Mobile: 07740 919025
e-mail: ecotraction@aol.com
Mike Howard

Patents and Inventions

I am delighted to be in touch with you, this time due to your sending me two issues of *Catalyst* - excellent, as always, both of them.

I learned to "stern skull", when I was 12 years old, from a fisherman on the Danube, although it was unusual there only he was keen on it. His father was a miller on a floating watermill and that was their way, which died out together with the watermills. The one sided paddling with a steering movement with the paddle was the usual way of moving the boat. I learned that at the same time from the same man. Sometimes a piece of information on other people's ways is as valuable as the study of a physical feature of our hobby.

Catalyst always encourages independent thinking and invention, and may be that is what you are doing with Tim Glover's article on inventing and patenting. Very good and helpful. Please, though, tell me if you can why did you print on page 17, the paragraph "Paying for a Patent"? I suppose, because it was written in the article - *very* irresponsible of Mr Glover.

It creates the impression that an inventor was looked after in this country. If that were true, Trevor Bayliss would not have started a campaign to make the pirating of intellectual property a criminal offence. I called for that at the 10th Conference of the International Federation of Inventors Associations some 10 years ago. As it is, an inventor has to police his invention and sue at his own expense, very often, a thief who steals it, to protect his livelihood. £30,000 twenty years ago may be true, but it's not characteristic at all.

In the employment contract of an engineer, in all innovative industries, it is written that any invention of the employee is the property of the employer, whether it is in the business of the employer or outside of it. Now I have a story about the Nuclear Industry, but I do not want to brag about it; let me say only that nobody involved in my inventions had any reward from the company, except that when they extended the patent to eight foreign countries, they paid £1 0s 0p for each country to prove their acquisition of it. Another employer sent their in-house patent officer to my house, *after* I left the firm, with a document for me to sign, agreeing to them being the owners "absolutely, completely for all times to come". They came with the threat, that although I had left, they still had a hold on me as my future employers will ask them for reference and they do know my new employers personally. The implication is obvious, is it not?

My story is but one example of many. I have seen an invention being pirated, the employer made a trivial modification to it and applied for a patent in the name of the draughtsman who did it, behind the back of the inventor. I have translated the judgement of a foreign court against a British company who did the same in that country, not knowing that theft was illegal there. All inventors have a story of hardship to tell and only a few who succeeded in any way. Britain is still not a signatory of the international rules of the protection of intellectual property administered by the United Nations. Nor is a British subject free to apply for a European Patent (it's an offence)!

I know it is a fundamental rule of English life that "if one can not say something nice it's better to keep quiet". On this basis a lot of business is done and a lot of judgements are made; but it's a civilisation based on false impressions. I feel strongly about inventors. When he writes about infringements, Mr Glover does not say that the chance of winning is very slim and "no win no fee" is an unusual practice in this country. "Exploiting your patent" would be useful, if the possible manufacturers were at all willing to depart from the well-trodden path of their business. The fact is that 90+% of inventions are filed by large organisations using employed inventors and their names, whom they do not reward or reward only in a miserly manner. They have to stick to their own rules "If we gave you a big rise or a bonus, what would the others think?" is the phrase used.

Kind regards, yours
Ambrus Janko

Wind Powered Seaplane (re Catalyst 36 page 28)

To Fred Ball's report, I should add that the parascending kite would not lift off until the kite's brakes were tied down in the on position. The word "brake" is misleading. It is really pulling down the trailing flaps and thus increasing the angle of attack. In conventional para-gliding one applies the "brakes" counter-intuitively when the kite is about to deflate, thus injecting lift into it and maintaining the flight. Then one should immediately release the brakes otherwise you stall. This did not happen. It flew straight and steady, to my delight. My worry was that I would either have to go directly to manning the untested machine (too dangerous) or use remote control to release the brake (too complicated). This shows one should never cross one's bridges before you come to them!

Such was the ease with which the small canopy lifted the catamaran that we were enthused next day to use the correct canopy, a thirty foot (9m) span parafoil which lifts a man in a zephyr. The smaller kite would only lift a man in an apparent wind far too strong for safety. The chaps extended the A frame to 19 feet 5 inches (5.85m), equalling the length of the kite lines. We towed it the next day at the same speed in similar windless but wrinkled sea conditions. To my surprise, it did not take off even though Slade Penoyre bravely manned it to untangle lines, thus risking becoming one of the world's few aqua-aviators. Soon it capsized, due I suppose to a higher centre of effort than the day before.

The difficulty in recovering the heavy sodden canopy induced the team to fit a halyard for easy raising and recovery of the kite after capsize. This worked perfectly. We towed it the following windless day. It did not take off. This I believe was due to two factors: first, the sea surface was as flat as a millpond; and second, we did not apply the brakes. Seaplanes have difficulty in taking off on a flat sea but prefer a slightly rough surface. It is as though the floats "stick" to the flat surface. Maybe air gets in below the floats on a rippled surface and assists take-off. As for the brakes, the A-frame snapped before we could apply them, so take-off has been postponed to the May "Trials Week" at Weymouth.

Fred Ball, Slade Penoyre and Mark Tingley devoted most of Speedweek to the Hagedoorn craft. Was it blind faith in the genius of my idea? Or did the lack of wind leave them with nothing else to do? I will never know. But anyway thanks a million to them! My best Speedweek to date!

Roger Glencross

Captive Kite Sail Design

Dear Sir, I refer to the comments on the Captive Kite Sail Design made by Mr. Michael Collis in the July issue of Catalyst.

Mr. Collis makes two points: the aerodynamic tip losses of a rectangular sail, and the advantage of foregoing any lifting effect in favour of an angled keel. Aerodynamic tip losses depend on the aspect ratio of the sail - rectangular wings were normally used in early aircraft. A rectangular sail, incorporating a suitable internal mechanism, was suggested in the design so that the sail area (and its aspect ratio) could be varied at will. This is desirable in order to preserve a high lift to drag ratio (whilst keeping the lift at an acceptable level) when one is encountering a very wide range of apparent wind speeds. However, if this feature is not required it is clear that any shape of sail could be utilised.

The whole point of the lifting effect is to reduce the displacement of the boat and so reduce hull drag. Hull drag is the primary barrier to high speed sailing and is approximately proportional to the displacement of the boat. The suggested design would enable hull drag to be minimised whilst at the same time providing an automatic self-regulating system which would ensure that the boat could not become airborne as per *Sailrocket*.

Furthermore the variable geometry rig proposed would enable the boat to operate as normal in appropriate conditions.

Yours etc
J.G. Morley

The Howard Fund

What it is, how AYRS will use it, and how you can apply for a grant

AYRS Committee

In April 2005, Mr Donald Howard, a member of AYRS, died, and having no family, left his estate to be divided amongst a number of charities, one of which was, to our surprise, the Amateur Yacht Research Society. Of his residual estate, we were left 30%, some £42000, with the instruction that the Committee use the money to "provide funds as grants to members for further development of their practical ideas".

Having thought about it long and hard, the Committee have decided that we will do this in the following way.

How will we distribute the money?

In principle, we could give it all in one hit, but we think it would be more use if we made the money last over a number of years. Firstly, this will allow us to earn interest on the capital, which we can add to the fund; secondly, it will allow people time to think about what they need and when. So we have decided that we will distribute about £5000 each year, which means we can go on for about nine years. This will usually be a number of small awards.

We have also decided that the projects to which we give grants: a) have to be practical (as Mr Howard required); b) they have to further nautical science or knowledge of nautical science (to be in keeping with the objectives of AYRS); and c) that grants will be awarded on merit and according to need, after review by the Committee and any panel of experts they may appoint. Needless to say, neither the members of the Committee nor their family and close associates, nor anyone else involved with the decision process will be eligible to apply.

How to apply

Applications for grants should *preferably* be in writing (see next page for alternatives), and will need to be submitted by a given date each year. For 2010, this date is **1st April 2010**.

Applications need to include:

a) Name and address of the applicant, executive summary of the application, etc

b) Details of the project, (suitable for publication), containing

1. A description of the project as a whole
2. Its contribution to nautical science (this may be the most important bit)
3. Progress so far
4. What the money requested will achieve (probably the second most important bit).

As with the John Hogg Prize, clarity of thought, and an appreciation of the audience will probably help us, and technical details may be best reserved to an appendix (but they ought to be there if they are known, although we will be prepared keep these details confidential if requested).

c) Some kind of costed project plan/budget statement - which we will normally keep confidential - i.e. what is to be done in total; the total cost of the project (with some indication of the reliability of this estimate!); what has been/is to be done when (with some indication of the likelihood of success); spend so far; forecast spend to completion year by year; the amount requested, and when it is wanted (as the grant could be spread over a number of years), and where any other funding is coming from. Any commercial interests must be declared.

d) An indication of what might go wrong with the project, things that might cause it to be delayed for example, and what the applicants propose to do to minimise the risk, and to handle the consequences if things do not go according to plan.

Part (a) is obviously administration; (b) should tell us what the project is about, why it's worth supporting, how much has already been done, and what our grant will add. Parts (c) and (d) give us an idea of how well the project is being managed. Clearly if detail is lacking here, then we must question whether the applicants have thought enough about what they are doing for us to have the confidence that the money will achieve what they expect.

We think it will take us about three to six months to evaluate the proposals, so a successful application in September should receive a grant early in the following year. Applicants may choose to apply for grants to be spread over a number of years, and may (re-)apply in more than one year, but past performance will be taken into account! We should like to expose applications to the membership, by publishing them in Catalyst, or on the AYRS website, or both, so it would be helpful if applications were prepared with that in mind..

Remember that if you apply then you need to convince us that what you want to do with the money is sufficiently worth doing, that you stand a reasonable chance of doing it, that it's more worthwhile than other suggestions, and that the money will make a difference.

If we think your application is incomplete, we may come back and ask for extra information, or suggest you change your project plan, either as a pre-requisite to further consideration or to the eventual award of a grant.

Feedback after awards

We need to know, so we can tell others, that the money we grant has been well spent. We will require the successful applicants to come back to us, to report on the success (or otherwise) of their project, and to tell us what they managed to do with the money. Ideally too, they should do this in a form we can report to the membership, in Catalyst.

Clearly we do not expect 100% success with members' projects. Sometimes they may simply not achieve the contributions to nautical science that they expect to do. Sometimes they may find that their project management is inadequate, and they run out of money or time. Sometimes though they will achieve glorious success. Either way we need to know, both to avoid funding work that's going nowhere, and to ensure that we have greater success is sorting the good ideas from the bad in future.

So we are going to require regular progress reports, either in writing, or perhaps in the form of a project blog if we can work those onto the website (or you could use your own website).

What next?

Well, now that the Committee have decided what they are going to do, the rest is up to you! We need applications, and although the deadline is set, it would be helpful if we had them before then, if only so that we can begin the evaluation process, and feed back to you any points that we think need clarification before the cut-off date.

Send your application to:

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

to arrive as soon as possible.

You can also send it by email, to <office@ayrs.org>, preferably as a PDF file (with all the fonts embedded!), but Word documents, Powerpoint, Excel or HTML files are acceptable (but don't blame us if our browsers are not the same as yours, and make a total mess of what you send), as are videos. Don't assume we will be able to download material from the WWW when we read your application; as not all of us have permanently online Internet connections, and, anyway, we might be looking at it on a train!

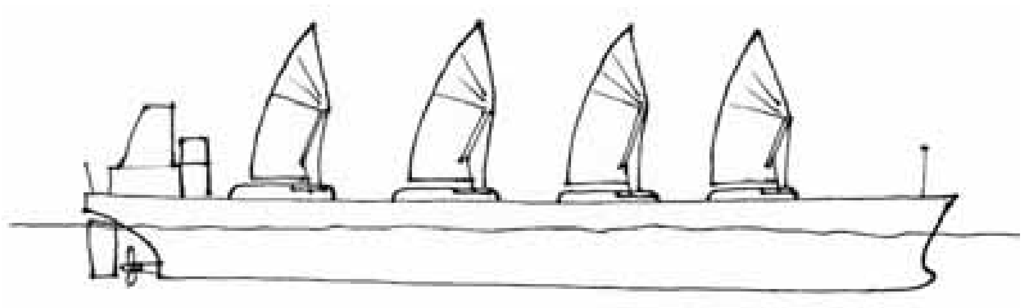
For further guidance see the notes on sending articles to Catalyst.

Footnote: Intellectual Property:
AYRS is willing to consider applications for grants under a non-disclosure agreement which will not prejudice applicants patent and other rights in the event that an application is unsuccessful. However, applicants must agree to place the nature and results of supported projects in the public domain, free for anyone to use, before any award is made.

Application to the AYRS Howard Fund

Sail modules for larger ships

Richard Dryden



Summary

There is growing concern about the impact that the marine transport sector is having on planetary systems, including climate. Fines for environmental damage combined with rising fuel costs are providing powerful incentives to ship owners and operators to look for alternative ways of propelling cargo ships. In the longer term, it is hoped that new technologies and cleaner, more efficient ships can be developed, but in the shorter term well-understood approaches such as wind assistance can help to make ships more fuel-efficient and less damaging.

Sails and kites are both viable options for wind assistance. They each have advantages and disadvantages. The proposal put forward here is for folding sailing rigs contained in streamlined pods that can be reversibly fitted to existing ships such as tankers and bulk carriers to reduce their fuel use on favourable routes by approximately 20%. When wind assistance is not required, as for example in adverse conditions or in port, the rigs can be stowed within the pods. The modules are removable for servicing or when not required for the next stage of the voyage. It is envisaged that the modules could be leased to the ship operators to make wind assistance financially attractive while a new generation of specialised wind ships is being developed.

The sail module concept has been patented and also modelled at table-top scale to work out the basic geometry and control issues. The next step will be to make a larger prototype that can be fitted to a craft so that it can be tested on the water.

An application is made here to the Howard Fund for the sum of £5,000 in year one towards building the prototype, and then a further £2,000 in year two for the testing phase, a total of £7,000. If the prototype is successful, it will then be possible to demonstrate the concept to interested parties in the marine sector and apply for further funding.

Although the ultimate aim is to develop sail modules for larger ships, the information gained from the prototype will also be of value for smaller-scale applications of folding modular rigs, for example emergency sails for powerboats with engine problems, in lifeboats, and for recreational sailing.

Introduction

The proposal is made here that sail modules could be developed to provide wind assistance to larger ships, and thereby reduce the amount of fuel they use and the amount of damage they cause to the environment. The idea has arisen out of the variable geometry Transition rigs that I have been developing – mainly as a hobby - for the last twenty years (summarised in Dryden, 2004a and at www.transitionrig.com).

The aim of this application to the AYRS Howard Fund for financial support is to enable the development of a working, reduced-scale version of a sail module in order to solve some of the associated engineering and control problems, to test its performance on the water, and then to demonstrate it to ship builders, ship owners, and funders.

At first sight, this proposal may not seem closely aligned with the aim of the AYRS to encourage curiosity-driven research by amateurs, and that it would be more appropriate for the marine industry itself to tackle the problem. However, the AYRS boasts a highly-talented membership with an unrivalled understanding of sails, wind, water, and engineering, so it would be highly appropriate for us to contribute to the development of wind assistance. We are all facing a critical time with regard to rapid depletion of fossil fuels and other resources, environmental damage, climate change, and the destruction of biodiversity, and we all share the responsibility to look for alternative, less harmful ways of meeting our needs and the needs of future generations. This proposal is seen as a first step towards finding ways to reduce fuel-use by the marine sector, and it is hoped that other AYRS members will feel encouraged to contribute their ideas and expertise to this process.

Historically, there have been several attempts to provide wind assistance to ships (reviewed in Appendix 1). In the past, steep rises in the cost of oil provided the incentive for experimentation, and then when oil prices dropped again the trials were abandoned. Today there is an even greater incentive to explore the options further. Not only are fuel prices fluctuating widely due to global uncertainties and expected to rise dramatically when demand outstrips supply, but also there is increasing awareness of the environmental effects of burning fossil fuels. Countries are beginning to introduce fines for the most polluting ships (for example the MARPOL Annexe VI legislation introduced by the EU), so even the traditionally conservative ship operators are now looking actively for ways of reducing oil use and pollution by their ships. One way is to reduce the speed of vessels by as little as 2 or 3 knots, and this is being implemented for cargoes for which delivery time is less critical. It has also been suggested that ships should switch to distillate fuels to reduce their sulphur dioxide emissions. Kite power is being tested, and sails, which provided a primary source of power for ships over many centuries, are also being considered again.

Criteria for practical wind assistance

Practical sailing rigs for the provision of wind assistance must meet the following criteria:

· they need to be operational without the need for more crew

· they must not endanger the crew

· they must not interfere with cargo handling

· they must not jeopardise the safety of the vessel

· they must be reliable with the minimum of maintenance

· they must work well when sailing upwind

· the mast height must not exceed 60m (a limit imposed by the Panama Canal and some harbours)

· they should not obscure visibility during manouvering

· ideally, it should be possible to fit them to existing ships.

Practical aspects of the sail module concept

From the experience gained while developing the Transition rig for dinghies, canoes, kayaks, and windsufers, I began to wonder whether folding rigs could be of value also on larger ships. Folding rigs have certain advantages over fixed rigs, for example they can be brought down to deck level when not required, or during storms, or when good visibility is required during manouvering. I began to look into the possibility of fitting 6 or 8 folding rigs to vessels with adequate deck space, for example tankers and some bulk carriers, so that the rigs could raised when required for wind assistance. At other times, the rigs could be folded and stowed away, and removed from the deck for servicing or when not required on a subsequent stage of the voyage. It would be possible to make the modules controllable from the ship's bridge, without the need for any other direct crew involvement. The purpose would be to provide wind assistance in order to reduce fuel consumption rather than to eliminate the need for engine power completely. The benefits of this approach would be both economic and environmental by reducing non-renewable fuel use and pollution. It became clear that the sail module approach would be able to meet most, if not all, the criteria for practical wind assistance.

Having several rig modules on the same ship provides redundancy, so that if one rig fails the remaining rigs can still be used. In potentially dangerous situations such as storms or equipment malfunction, the rigs can be folded to deck level to reduce windage. Similarly, the rigs can be lowered if the wind is coming from an unfavourable direction or is unsuitable as a source of assistance for some other reason.

It can be anticipated that there will be some significant engineering problems associated with the sail module approach. For example, it will be necessary to dissipate the sailing forces generated by the rig without having the benefit of masts that penetrate deep into the ship's structure – the modules have to disperse the forces into the deck. However, these problems should not be insurmountable. The ability of the rigs to fold means that they can be stowed in the protective pods during extreme conditions and only deployed in conditions that produce forces that the module has been designed to withstand. Existing ships will also need some modification before the proposed rigs could be attached. This might involve repositioning of some equipment to clear suitable areas of deck space, reinforcement of the deck beneath the modules, locking devices, and links with the ship's hydraulic and electrical systems.

There is the potential for the modular rig approach to be developed, provided, and serviced by companies other than the ship owners and operators. Presumably, funding for the research and development phase of such a project would need to come in part from governments firmly committed to the reduction of carbon emissions. A leasing approach would relieve the ship owners and operators from development costs, and this might encourage them to take up wind assistance at an earlier stage and benefit from reduced costs.

Arrangement of the sail module

Each module consists of a substantial base plate, a jointed rotating mast that can extend upwards and fold downwards, and a pivoted horizontal boom to support the lower edge of the sail. The base plate of the module is attached to the deck of the ship by a means that allows straightforward removal at a later time, for example by a through bolt or clamp at each corner.

The sail is made from a slightly extensible material that can accommodate the changes in mast geometry whilst at the same time being able to maintain an effective aerodynamic shape when tensioned in use. The upper segment of the mast fits into a sleeve at the leading edge of the sail. Radially-arranged battens support the upper part of the sail. The part of the sail below the battens is double-skinned, with the middle and lower mast segments located between the two skins. The mast and the operating equipment attached to it are thus protected from the elements by the sail. The double skins come together at the leading edge of the sail between the upper mast joints and the mast foot, and the sail is tensioned downwards and backwards by the boom outhaul to maintain a good aerodynamic shape.

The base of the mast is pivoted about the vertical axis to allow the rig to be turned in relation to the ship and trimmed according to the direction of the apparent wind. This is achieved by an actuator that drives the rim of the circular mast base. A braking system is applied to the rotating mast base to lock the rig in the desired working position. A link between the rotating mast base and boom ensures that the boom remains horizontal during elevation and folding of the mast.

Two hinged doors attached to the sides of the base plate form a streamlined cover for the sailing rig in its folded configuration, and open to allow the rig to be deployed. When the rig is fully extended, the doors close around the base of the rig to protect the control and operating systems around the mast foot. Before the rig is lowered, the doors open again and the rig folds, with the doors collecting the folds of sail material before closing over them.

The actuators that open and close the module doors, and produce extension, folding, and rotation of the mast can be hydraulic or electrically powered according to the requirements of the ship. An umbilical from the module connects to the ship's power and control systems to enable deployment and control of the rig by the ship's crew.

The concept was first published in The Naval Architect (Dryden, 2004b) and initiated a discussion about alternative energy sources for commercial shipping. Figures 1 to 5 below illustrate the mode of use of the sail modules.

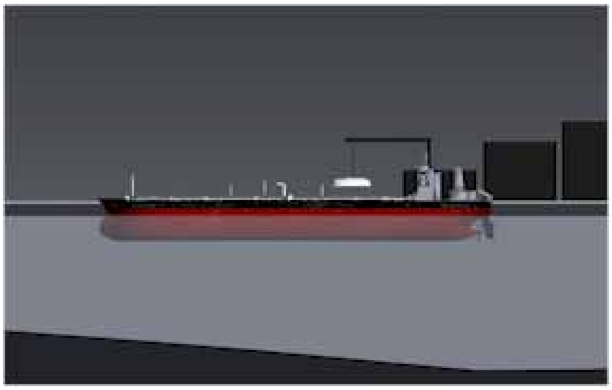


Figure 1: Each rig is contained in a module that can be lifted by crane onto the deck of a suitably-modified ship and fixed in place when required for a particular voyage. Each module is connected to the power and control systems of the ship.

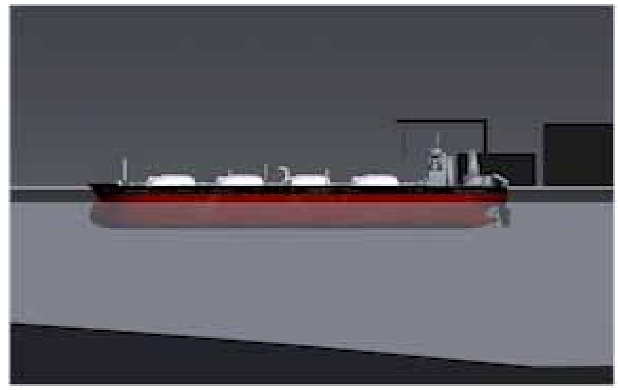


Figure 2: Leaving port, the modules remain closed.

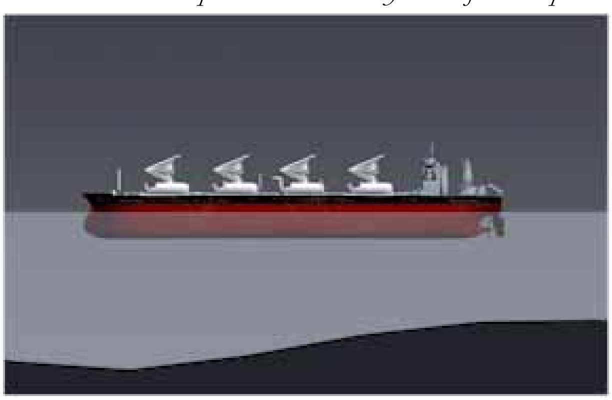


Figure 3: At sea in favourable conditions, the module doors open temporarily to allow the masts and sails to extend upwards, and the doors then close around the base of the extended rig.

Figure 4: The extended rigs provide sail assistance to the ship, allowing it to throttle back its engine.

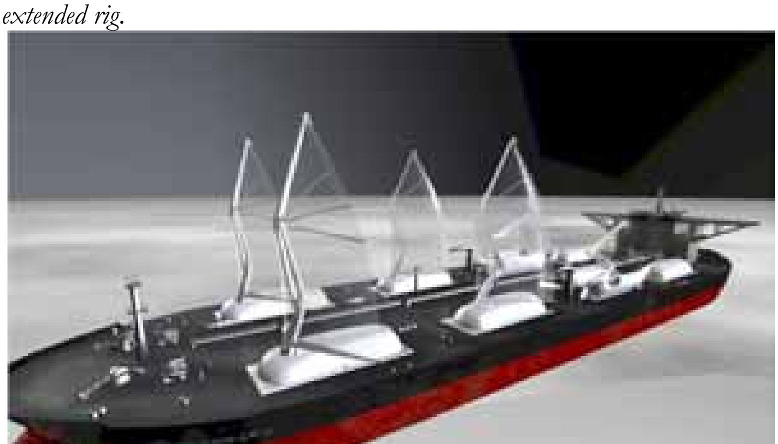


Figure 5: Illustration showing rigs at different stages of deployment.

Sail modules for wind assistance

Progress so far

I have gained valuable experience of folding, variable-geometry rigs by developing folding rigs for smaller craft such as dinghies, kayaks, and sailboards since 1987 (Dryden, 2004a), and the results have been sufficiently promising to encourage me to plan scaled-up versions for larger ships.

I made a pneumatically-powered model of a sail module to find out more about the geometry and control systems involved. The model is approximately 2 m high when extended, and is illustrated below (Figures 6 to 12).

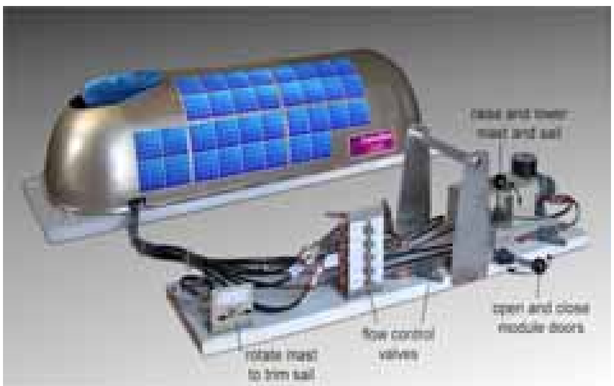


Figure 6: model of a sail module, together with the controls

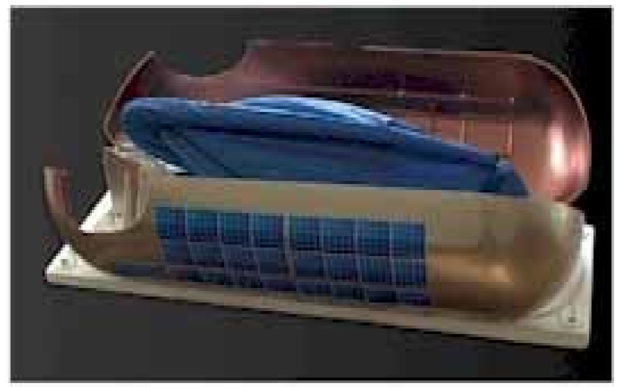


Figure 7: pod opens

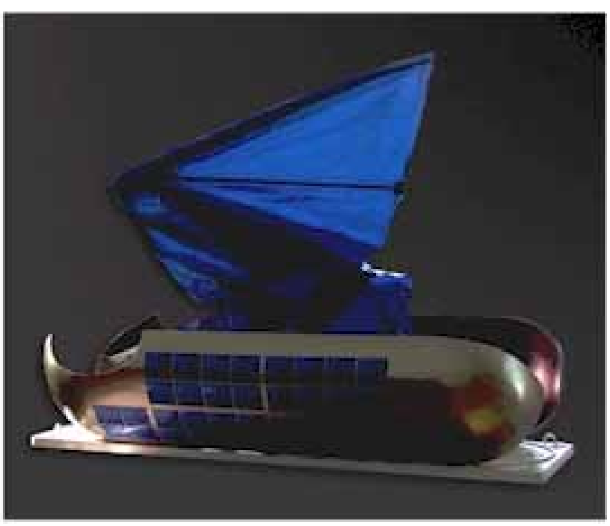


Figure 8: rig begins to deploy

Figure 9: rig extends further

Sequence of rig deployment

Figure 10: rig extended, pod still open

Figure 11: pod closes around extended rig, and the mast and boom rotate into the correct position for sailing

Figure 12: layout within the model sail module

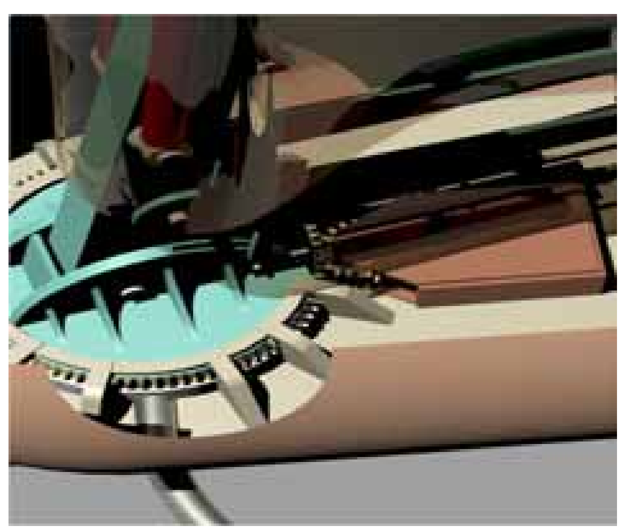


Figure 13: a computer-generated impression of the mast foot region of the proposed prototype

Control of multiple rigs

To develop a better understanding of the aerodynamics and control of multiple rigs in close proximity, a Mirror dinghy was modified to accept 3 transition rigs, each with a sail area of 2 sq m (Figure 14 below; a video is available at www.transitionrig.com/videos.htm).

Contribution of this proposal to nautical science

The sail module approach proposed here offers one possible approach to wind assistance. The design of the sail module is innovative, and has been granted GB Patent No. 2381515: "Engine powered vessel with removable sail modules" (2005). The overall concept has been developed to meet and overcome many of the objections commonly put forward by ship owners and operators when the suggestion is made to place sails on ships.

What the money requested will achieve

The money requested will enable the making of a functional one-eighth scale prototype of the sail module which can then be tested on the water. Highly stressed components such as the mast segments, boom, and the geared mast base will be made of aluminium and steel, aiming to gain experience that will be applied to larger scale prototypes in the future. The hydraulic cylinders, pump, hoses, and electronic control units will be as far as possible standard parts. In this prototype the pod doors will be made of renewable composites – epoxy resin derived from wood or sugar cane and reinforcing fibres of glass, flax or hemp. It is hoped that a resilient sail cloth made from recycled materials can be sourced.

In Phase 1 the money will be used to help purchase the necessary materials for the prototype and obtain advice about hydraulics and computer control systems. In Phase 2, the money will help to pay for the use of a suitable test vessel on which the protoype rig can be mounted.

The mechanical elements of the prototype rig will be tested first on land. When working satisfactorily, the prototype will be fitted to a suitable vessel (for example, a locally sourced motor-powered boat with sufficient deck space) and tested on the water under increasingly intense conditions. If necessary, modifications will be made as experience is gained. The performance of the sail in different wind strengths and at different points of sail will be analysed, and fuel saving will be measured. If the prototype performs adequately and it can be demonstrated that useful fuel savings can be achieved, funding will then be sought for the next stage of the project, which will be the preparation of a full-sized prototype. The performance of the prototype module will be published in journals read by the target audience, and the rig will be demonstrated to ship owners and operators, ship builders, companies reliant on marine transport, and sustainability organisations. The web site for the transition rig project (www.transitionrig.com) will be updated with information about the prototype as it becomes available.

Costed project plan/budget

What is to be done in total

The aim is to design, make, and test on the water a one-eighth scale working prototype of a sail module design for the wind assistance of larger ships such as tankers and bulk carriers. This will allow key variables, performance, and control issues to be identified and dealt with, and result in a demonstration prototype that can be used to show potential funders and users.

The total cost of the project

It is anticipated that the overall cost of the project will be in the region of £20,000, and the AYRS Howard Fund is being asked for £7,000 towards that sum.

The grant will be spent on materials, expertise, and testing as follows:

Phase 1: making the prototype (year 1)

- structural materials (metals and composites) £700
- specialist welding and metal-working assistance £500
- specialised sail cloth £300
- hydraulic components £1000
- electronic components £1000
- specialist hydraulic and electronic assistance £1500

SUB-TOTAL £5000

Phase 2: testing the prototype (year 2)

- lease of suitable test vessel £1000
- fuel, crew, insurance £1000

SUB-TOTAL £2000

TOTAL £7000

What has been done/what is to be done

Over the last 21 years, I have built numerous prototype folding rigs for windsurfers, kayaks, canoes, and dinghies (summarised on www.transitionrig.com). This has provided extensive experience with design, materials, and testing.

The prototype described in this application is a logical extension of this line of development. The creation of this prototype will help to demonstrate the viability of the sail module concept, and is a necessary stepping stone towards the development of a full-scale prototype. It will increase the chance of obtaining funding for further development.

The likelihood of success of the proposed project is high. As with all innovative research, there is some uncertainty about the effectiveness and efficiency of the prototype on the water, but all the findings will be of value when planning the next step of the project. Possible success in the longer-term goal of placing sails back on transport ships is difficult to evaluate at this stage. Clearly, however, the incentives to find alternatives to oil are increasing, and this will add to the chances of success.

When the funding is wanted

Phase 1 – the design and making of the working prototype - can commence as soon as possible. If funding is received early in 2009, then the prototype will be completed by Spring 2010.

Phase 2 – testing on the water will follow completion of the prototype, and take place during 2010.

Where any other funding is coming from

Personal savings will be drawn upon when required, and applications will be made to other funders if the outcome of this proposed study is promising.

What might go wrong with the project –

The success of the project will depend on significant input from the applicant. Having recently retired, I anticipate that I shall now have sufficient time to devote to the project. There is the possibility that other commitments may arise and compete for time, or that something unexpected such as ill-health might intervene, but there is no indication of this at the time of writing.

Apart from that, there may be occasional minor delays while waiting for materials or help from experts, but they should not have any lasting effect on the outcome. The processes involved in designing and making the prototype can all be carried out in my workshop, and our location near the Teign estuary and Devon coastline will facilitate testing of the prototype.

Email: rdryden@hotmail.co.uk
28th November 2008

Figure 14: three transition rigs mounted on a Mirror dinghy

APPENDIX 1 - **Wind assistance for larger ships**

"… it is often forgotten that the steamship did not oust the sailing ship overnight. Difficulties with its own development, the simultaneous rapid expansion of the world's economy and the requirement for low cost freighting, ensured the merchant sailing ship co-existed profitably alongside the steamship for a century before the disasters of war finally disposed of the last oceanic sailing traders." László and Woodman (1999).

"By the 1930s, most shipowners regarded the day of the big square-rigged sailing ship was over." Carter (2005).

"A proper combination of screw propulsion and sail power can propel ships more economically and cost effectively than is possible under either power alone." Bergson (1980).

"Aviation is in the firing line now but shipping needs to take responsibility. There will be increasing pressure to do something." Gregory (2007).

Marine transport plays a very significant part in world trade, carrying most of the raw materials and manufactured goods around the planet. Although it is a very efficient mode of transport, nonetheless it is using finite oil reserves at an increasing rate, and producing large quantities of carbon dioxide and other pollutants that are contributing to global warming and damaging the environment.

It has been predicted that oil production world-wide will peak during the present decade, and then decline (Deffeyes, 2001). We are using oil at an increasing rate (International Energy Agency, 2003). Twenty percent of it is used in the transport sector, including transport by sea. The annual growth rate of global marine bunker consumption from 1993 to 2010 is estimated to be 2.8%, the highest growth rate of all primary energy sectors. It is appropriate now, as a matter of urgency, to look for ways of conserving the oil that remains, and to develop alternative sources of energy.

Ships transport 90% of the world's trade, accounting for 30,000 billion tonne-miles per year. Carrying goods by sea is very efficient. However, the 70,000 vessels currently use 280 million tonnes of fuel a year, and that is expected to grow to 400 million tonnes by 2020. The residual fuels used in ships have a significant content of sulphur, nitrogen, hazardous components such as heavy metals, and polycyclic aromatic hydrocarbons that contribute to particulate emissions and sludge (The Naval Architect, 2007b). The carbon dioxide emissions from ships are double those from aircraft at 600 to 800 million tonnes per year, amounting to 5% of the global total. The fuel oil used in ships is rich in sulphur, and when it is burnt it produces 10 million tonnes of sulphur dioxide each year (7% of the world's total). Moving 1 tonne of goods 1 kilometre by sea releases 225 times as much sulphur as trucking the same load 1 kilometre on land. Sulphur emission control areas (SECAs) have been defined for the Baltic Sea and North Sea, and ships operating there must use fuel oil that has a sulphur content of no more than 1.5% (the global standard is currently 4.5%) unless they have an exhaust gas cleaning system.

Wind-driven transport vessels were in use up until the early decades of the 20th Century, but have been superceded by motor-driven ships that are better able to maintain tight delivery schedules. The issue of putting sails back on ships arises from time to time, particularly during times of rising fuel costs, but when fuel costs are at an acceptable level there is little incentive for the ship operators to invest in the development and running of specialised wind ships. More recently, however, there are growing concerns about the environmental damage being caused by the way we use oil, and this will provide an additional incentive to develop alternative energy sources.

The most favourable use of wind power can be made by ships travelling longer distances and carrying low density, relatively low value cargoes for which there is a steady demand. Dry bulk cargoes such as grain, sugar, soya beans, coal, ore, and minerals were the last to be carried by the old windjammers, and could well be the best ones to be carried by a new generation of wind assisted vessels. Other possible applications for the early re-introduction of wind power are tankers, cruise vessels and research vessels. Modern techniques of weather routing can help ships obtain the most benefit from wind assistance.

The comprehensive Danish study (Modern Windships Phases 1 and 2) concluded that modern windships with high-lift wing masts would cost approximately 10% more to operate than conventional ships. However, a rise in oil prices and the application of environmental taxes and fines would narrow this difference and potentially reverse it. It is proposed here that even in the present situation, it will be beneficial to develop wind assistance while we still have an opportunity to act rationally, rather than waiting for a crisis to unfold.

Approaches to wind assistance

In the 1920s, Anton Flettner experimented with vertical spinning cylinders on the vessel *Bachau*. The cylinders create a propulsive force perpendicular to the airstream. In August this year, the new *E-ship 1* was launched (The Naval Architect, 2008a). The ship is designed to transport windturbines worldwide, and its conventional motor is assisted by four spinning rotor sails.

Sixteen Japanese vessels were fitted with rigid rectangular sails between the 1980s and 1990s in response to soaring fuel prices. Fuel savings for *Shin Aitoku Maru*, *Aqua City, Usuki Pioneer* and other vessels were reported to be in the range 10 – 40%. When fuel prices fell in the 1990s, the experiments were discontinued.

A Walker Wingsail 13.5m high was attached above the superstructure of *MV Ashington* between 1986 and 1988. There was a usable wind for 30% of the passage time. In May 2008, Shadotec plc, Wilhelmsen Marine Consultants, and Petroleum Geo-Services announced that they were going to apply wingsails of a similar design to commercial vessels. The initial project will be to fit two wingsails to a seismic exploration vessel.

Kite assistance is being tested by the German company SkySails. Formed in 2001 and part-funded by the German Government, SkySails attached a 160 sq m kite to MV *Beluga SkySails* which then crossed the Atlantic in both directions (The Naval Architect, 2008b).

The figures for fuel-saving have not yet been published, but the test was considered to be successful. (There is a comparison between sail modules and kites for wind assistance in Appendix 2.)

An interesting concept ship called *Orcelle* has been proposed by the Scandinavian company Wallenius Wilhelmsen. It will have no combustion engines on board and will be powered by wingsails, photovoltaic panels, fuel cells, and wave power (The Naval Architect, 2005; Harrison, 2005). However, the ship is unlikely to be available until 2025. See www.2wglobal.com/www/pdf/Green_Flagship.pdf

Following their successful introduction of a ferry in Sydney Harbour powered by wind and solar energy, Solar Sailor Holdings are proposing to transport water from Tasmania to mainland Australia using Aquatankers with multiple rigid wings carrying solar panels (The Naval Architect, 2007a). The wingsails can be folded to deck level when not in use.

APPENDIX 2 - A comparison between sail modules and kites

In the following table, the benefits and disadvantages of sail modules and kites are compared.

	Proposed sail modules	Kites
Deployment	Each rig can be deployed safely and quickly from the bridge as required without additional involvement from the crew	The launch of a large kite from a ship will be a critical moment, probably requiring direct crew involvement and a special gantry. It will take several minutes to fully deploy and trim the kite
Control in use	With the rig raised, the main control movement will be trimming the angle of the sail around the vertical axis in relation to the apparent wind. When trimmed appropriately, the sails do not require further trimming unless conditions change.	Control of a kite has to occur in 3 dimensions - this is a more critical issue than the control of a sailing rig. Constant trimming will be required, presumably by automated computerised systems. Kites can develop oscillations that may result in nearby structures being put in danger or may result in ditching of the kite. The cable linking the kite to the ship will be of considerable length (200 to 500m) and under high tension, acting like a cutting wire if it comes into contact with other structures.
Retrieval/storage	The rig returns to its default position within the pod, assisted by gravity if there is a power failure. The folded rig is then protected against the elements within its closed pod.	The kite has to be brought back to the ship under control without touching the water. This will take time and direct crew involvement will probably be required. If the kite hits the water during this process, it can be dragged under the ship and the cable might foul the propeller(s).
Safety	The rig can be retracted quickly into the pod during storms at sea or when entering port. The default position for the rig is in its folded state where it will present minimal windage.	There could be entanglement incidents in busy shipping lanes. The kite and its cable can become a liability during storms, particularly electrical storms when electrical discharges might occur along the cable to the ship. Release of the kite in extreme conditions to protect the ship raises the possibility of damage being caused downwind by the free-flying kite and cable.
R&D Cost	There will be significant costs involved in developing modules and control systems, manufacture, and modifying ships to accept the modules. However, the behaviour of sails at sea is well-understood.	There will be significant costs in developing kites, deployment and retrieval systems, control systems, mounting systems on ships, and manufacture. Kites are a relatively new technology for marine use, and experience of their use in different conditions will have to be gained.
Equipment costs	Cost of modules and control systems - there are more structural elements in the rig module compared with the kite system, therefore a greater cost.	Cost of kite and associated fittings and control systems.

	Proposed sail modules	Kites
Running costs	Cost of power consumption for deployment and control, cost of maintenance, cost of leasing.	Cost of power consumption for deployment and control, cost of maintenance, cost of leasing or buying.
Complexity	More complex structurally, but simpler to control.	More simple structurally, but with additional control variables.
Attachment footprint	Requires horizontal surface for attachment - either free deck space or top surfaces of containers.	Small footprint - small attachment site and storage area on ship, but will need specialist launch/retrieval facilities on deck.
Power adjustment	For a ship with several modules, power can be adjusted by changing the number of rigs deployed at any given time and by the mode of trimming of each rig to the apparent wind.	By adjusting altitude of deployment, trimming, and size of kite.
Power availability	Sails attached directly to the ship will generate less power for a given area of sail compared with kites.	Kites can generate more power for a given area than sails when they are flown in the stronger, less turbulent airflow above the ship.
Benefits to ship operator	· reduction in fuel use · reduction in pollution levels and environmental damage · can be retrofitted · can be leased on those routes most suitable for wind assistance · can be serviced on land	· reduction in fuel use · reduction in pollution levels and environmental damage · can be retrofitted · have only a small 'footprint' on board · kites have low cost · can be serviced on land

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Poppy

Slieve MacGalliard

Back in 2002, I wrote down my thoughts on the modern junk rig, looking for a way to improve its one weak point, the windward performance. These notes were printed in JRA Newsletter 40 and AYRS *Catalyst* no. 11, and received some response from readers, but mostly advocating soft wingsails. The conclusion of my thoughts was that camber is needed right to the luff of the sail, a feature that is difficult to achieve with the standard rig, which is normally pulled aft. One possible idea was to build a cambered rig with a lot of sail balance forward of the mast and split the sail in way of the mast so that the camber would be the same on both tacks and not distorted by the mast.

The initial idea was to try the rig on a Mirror dinghy, but when a rather neglected 31ft Westerly Longbow with tired rig became available the project grew bigger. Needlespar made the basic mast and step, and Sunbird Marine provided the partners and completed the installation for me. I made all the rest of the rig after getting 50mm dia by 1.5mm wall tube welded to make 6 metre length for the battens. The split sail was home made in 3 sections of 6oz Terylene, and is 515 sq.ft (47.5 sq.m), the same area as the Bermudan rig mainsail and 135%

genoa. This, along with some other major work took more time than planned before we could try it out.

It would be nice to report that the boat, *Poppy,* was fully set up and running by now, but the truth is that I've enjoyed sailing her so much that I still have some modifications to make which should improve the appearance and possibly even the performance. When I modelled the rig I did not allow for the downward pull of the sheets when close-hauled so the result is there is some diagonal creasing in the upper panels when the sheets are pulled tight. This creasing affects the camber and seems to have a significant effect on the performance, but fortunately the sheets only have to be eased a little and the creases reduce a lot.

How to Test

As most experimenters find out, it is very difficult to evaluate the performance of a boat. With seemingly unlimited finances the Americas Cup boats simply build two identical boats to use one as a yardstick, but lesser mortals have to find another way.

With *Poppy* the decision was to enter *Poppy* into the 2008 Round the Island Race in the Island Sailing Club handicap fleet. The ISC provide a Rating for each boat involved. Armed with the list of ratings it is possible to sail alongside a wide variety of boats and by comparing their ratings make an assessment of how the boat is performing. The ISC initially placed *Poppy* in the 'too difficult to rate' category as there is no similar rig in existence, but they finally settled on rating her as a standard Longbow with a typical cruising rig with short battened mainsail and roller reefed headsail. As this is probably the most common cruising rig, then comparing the performance with other boats with known ratings should give an indication of performance compared with the standard cruising Longbow.

Apart from sailing in the 2008 and 2009 Round the Island Races, armed with the rating information on hundreds of boats has made it possible to form an opinion on the performance of the split junk rig over the last couple of year's general sailing.

Notes on Performance

Starting with **Close-hauled in smooth seas,** *Poppy* should sail at about the same speed as her Bermudan sister, or not more than 2% slower, but in practice we have not met smooth water when beating. In our local sailing area in the Solent passage making is always done with the tide, so that beating is always done in a wind over tide situation giving **Close-hauled in Choppy seas**. Under these conditions the unstayed mast has an effect that tends to reduce the pitching moment of the boat. Where a Bermudan boat with fore and back stays will dig its bows into the chop helped by the inertia of the mast, the unstayed mast will flex and let the bow rise and ease its way over the chop giving a smoother ride with less spray. In these conditions *Poppy* would appear to be 1 or 2% faster than her sister boat.

When **Tacking from Close-hauled to close-hauled** the split junk rig is very good. On a Bermudan boat the long leech of the headsail will flap as the boat heads above close-hauled and will slow the boat until the sails are filled on the other tack. With the split junk the short leeches of the 'jibs' do not have the same drag and do not significantly slow the boat as it heads up so that it is possible to take you time during the manoeuvre. As the rig is self-tacking there is no risk of being taken aback and forced onto either tack, and when the boat reaches the new close-hauled heading for the sheet setting the rig immediately develops full drive. There is no need to bear away to accelerate before luffing back up onto the new course. In practice this means that in a tacking dual the split junk will gain ground on each tack over the Bermudan sister, and all with no more effort than pushing the tiller over. Beating up a narrow river is practical and fun as it is only necessary to sail about one length after a tack before comfortably starting the next one, and it is possible to immediately tack back only a couple of metres after the completion of a tack.

The whole point of the 'Some Thoughts' article was to try and analyse the reasons for the poor windward performance of the westernised junk rig, and Poppy's performance, even in the early stage of development suggests that a solution has been found. It is quite common for skippers of other boats to go out of their way to comment on how good the windward performance is, probably because they were left behind when they thought they should have arrived first.

Looking at the **Close Reach to Beam Reach** performance, the split junk simply gets faster while the Bermudan performance deteriorates. As the headsail sheets of a Bermudan boat are eased the sail takes on a greater camber and although the flow can be maintained over the luff, the area towards the leech starts to stall and the drag increases, resulting in increased heeling force and reduced driving force. When the split rig is eased out the 'jib' and mainsail maintain their relative individual sheet settings with the 'jib' tell-tales streaming horizontally, and the total force vector simply rotates further forward, driving the boat faster. This continues until the rig is approaching right angles to the hull and the relative wind is about 110° from the bow. *Poppy* sails faster than her rating would suggest on these points of sail.

With the wind about **120 to 140° from the bow** the split junk has to be handled very carefully in certain conditions. The first time we became aware of this we had just left Cowes bound for Bembridge in company with a 38-41 foot Moody who wanted to see how the rig would perform. The wind was from the NW, Force 4-ish in gusty cold sector air, so we simply went "7-up" (all seven panels or full sail) as we turned on course while the Moody turned into wind and raised main and unrolled the genoa. After a few minutes we were well ahead while the Moody eventually dropped his main to let his big genoa set without being blanketed. We lost sight of him astern in very few minutes. Shortly after we were slowly overhauling a group of 36 to 40 foot sailing school boats, also under full sail, but we were aware that they were luffing a little on every gust suggesting that a strong gust might cause them to broach.

At this time the relative wind was 120 to 140° from the bow on the port side and our sail was squared of at 90° on the starboard side. We noticed that the Bermudan boats were all heeling about 10° to starboard, and with each little gust the heal would increase to about 15 °. *Poppy*, on the other hand was healing 10° to port, i.e. upwind, and on the gusts this would increase to about 15° to port. My wife was sitting in the cockpit with her back to the wind and steering with her hand on the tiller and not using the extension.

Then we received a fairly strong gust and the Bermudan boats heeled some 20° to starboard and started to swing up to port. *Poppy* increased to 20° heel to windward, to port, and started to swing to starboard. Because of the increased heel my wife was thrown back and was not able to push the helm up enough to straighten up the boat without my help from the other side of the cockpit. Despite having sailed most of my life I have never seen this happen to a displacement keelboat before. We promptly dropped two panels to 5-up, and sailed on with no further problem, nor any drop in speed.

My explanation for the windward heel is very straightforward. In the article 'Some Thoughts' I made the point that to get better windward performance we had to have a rig that had the total force vector as far forward as possible, with respect to the rig. This is another way of saying that we needed a good lift/drag ratio. The split junk rig seems to have achieved this to the extent that when the rig is at right angles to the hull the total force vector is towards the windward side and therefore makes the boat heel in that direction. The increase force from the gust then makes the boat heel more to windward. This is not a problem with Bermudan boats as they cannot ease their sail out far enough, and lose a lot of the rig efficiency as the sheets are eased and their lift/ drag ratio decreases. Having experienced it once, this is now not a problem as it is clear we must not over-press the boat when the wind is in this direction, or we must simply sheet in a few degrees to bring the total force direction to dead ahead. We have to be aware that the total force vector is so far forward with respect to the rig, and sheet accordingly.

When on a **Broad Reach** with the relative wind aft of 140° from the bow the rig begins to stall and the drag increase, however the boat does not slow significantly as the luff camber and the slot still seem to encourage some flow across the lee side of the sail. The sail area is fully spread by the battens when on this point of sail, whereas the Bermudan boats cannot spread their sail area and need to fly a chute to maintain speed. We do not have enough experience of sailing against similar performance spinnaker boats to be able to say with confidence how well *Poppy* performs, but it would appear that there is very little difference. In other words, by easing the sheet from the cockpit to square the rig across the boat we are getting performance similar to a boat where all the deck work has been done and the chute set and trimmed.

On the **Dead Run** the performance is similar to the broad reach. In light winds *Poppy* will run at half wind speed so 8 kts true will produce 4 kts boat speed and 4 kts relative wind over the deck. 10 kt wind gives 5 kts boat speed and as the LWL is 25 ft the maximum displacement speed is 1.34*LWL^0.5 = 6.7 kts. This then seems to be quite good performance, particularly as there is a large 3 bladed propeller being dragged through the water.

Most Bermudan sailors try to keep away from the dead run as they are worried about the accidental gybe. I am happy for my 4-year-old grandson to take the helm on a dead run. This is not a problem with the junk rig as the rig can be squared off and is stable across the boat. As the main sheet is attached to nearly all the battens the sail does not oscillate so rhythmic rolling is not such a major problem. *Poppy* can be sailed comfortably **by the lee**, and on one occasion when a smaller Bermudan boat overtook us I suddenly realised that our helmsman had followed the bend in the river and we were sailing 70° by the lee! I told him to turn 20° further and we all ducked to let the sheet fly across in a so-called crash gybe, but with the balanced junk the rig swings relatively slowly and ends up feathered before the sheets fully take the load. Then it only took a 20° turn back on track to quickly overtake the Bermudan boat again.

Conclusions

Poppy seems to support the points made in the 'Some Thoughts' article. The windward performance seems to be as good or better than the Bermudan equivalent, and on all other points of sail the performance seems to be superior. The rig is very powerful, and when the sails fill the instantaneous surge of power is very noticeable. Throwing into the equation the advantages of easier handling and a more comfortable ride suggests that the rig is well worth further development. Cost has not been looked at in detail, but it is essentially a very simple rig with no expensive hardware to buy or maintain so is significantly less expensive that the Bermudan equivalent.

Probably the only way to confirm my observations is to consider the comments of those who have sailed against *Poppy*. Virtually every time we sail, people who have seen our performance go out of their way to complement us on how fast *Poppy* sails. The day after the 2008 Round the Island Race, I met three of the hard men of sail in the sailing club car park pushing an empty trolley. You know the type – designer stubble, and dressed in the most expensive ocean breathable gear with their expensive sunglasses pushed up in their sun (?) bleached hair. Dressed in my 'too tatty for gardening clothes', I was looking for a trolley so approached them and asked if they had sailed the race the day before. They exploded that 'it had been blowing a gale', 'thrashing to windward', 'spray flying everywhere', 'soaked to the skin', 'absolutely exhausted' and waving their arms around to emphasise just how tough it had been. When they paused for breath I quietly commented –'I went round as well, (paused for effect) in a junk rigged boat'. All three stepped back together and in unison exclaimed 'POPPY!' I replied, 'Yes, do you know her?' One of them replied with a fast wave of his arm, 'You went past us as if were standing still!' Praise indeed, particularly as the average age on *Poppy* was probably twice the average age on their boat. I hope they didn't notice me smile as I walked away with their trolley.

So why did we not win the RTI race if *Poppy* is so fast? In the 2008 race with two crew members who had only one day's experience of sailing a junk rigged boat, we got three quarters of the way round overtaking boat after boat, all rated as faster and most having started before us. After passing the fort we suddenly discovered that the bilge water was up to the cabin sole, so we pulled out of the race into the foul tide to pump out and find the problem. We lost 40 minutes before deciding to rejoin the race. Even with this we were 236 out of 883 entered on corrected time, and if we subtract the conservative 40 minutes when out of the race we would have been about 60/ 883 and easily within the top 10%. In 2009 I was exhausted for my activities of the previous week and probably sailed the worst tactical race of my life. We watched slower boats overtake us in the distance while we sailed the wrong track on most legs, yet when we did sail near other boats we always had the speed advantage. I make no claims to be a good tactician as most of my racing has been in tideless waters and ended over 25 years ago.

After the 2008 Round the Island Race, I noted that –

1. An own design and homemade Junk rig can compete on equal or better terms with a Bermudan rig on a similar cruising hull.

2. The demands on the crew are relatively light as the combined age of the three of us was over 190 years, and we were not overly tired after 9hrs 30 min racing over 50 miles in boisterous conditions. All sailing was done from the cockpit.

3. No special skill is needed to get good performance out of the rig as the two crew members who actually sailed the boat had only about 4 hours Junk experience before the event.

4. The halyard, downhaul and yard hauling parrel were adjusted twice during the race when the reef was shaken out after the first beat and put in again for the second beat.

5. The main sheet (the only sheet) was adjusted only four times in the race and was cleated for the rest of the time. Set for close hauled before the start, it was eased to squared off when round the Needles, and further eased to squared off when the reef was shaken out. It was reset once when we rounded Bembridge unto the close reach and again as we came to close hauled and one reef down at the Fort for the last beat. Despite the apparently many pieces of string the rig is easy to sail.

6. We tacked 36 times and gybed twice all without touching the sheet.

7. Despite having the spray hood down and the typical Solent chop we had very little spray over the top due to the soft ride of the un-stayed mast. I did get my glasses wet with spray twice which I thought was very inconvenient. It is doubtful if any of the Bermudan boats could say the same thing.

Unfortunately winning the Round the Island Race takes more than boat speed; but it would make the public sit up and take notice! If only…

To summarise –

The list of advantages of the junk rig over the Bermudan rig is long, but this rig has the added advantage of equal or better performance to add to that list.

The disadvantages are that it is not fully developed yet, and cannot be bought 'off the peg'. There is still work to do.

Overall it is great fun to sail, but I do wish sailors on other boats would close their mouths as they stare at us when we sail past them.

Slieve McGalliard
January 2010

Notes on the Photos

The opening photo was taken by a friend on a Moody 31 on a trip from Hamble to Osborne Bay and shows *Poppy* with the relative wind just forward of the beam. My friend will not accept that the engine was not running as we steamed past him. The wind continued to free as we sailed away from him so that we arrived reefing panel by panel to slow down at a crowded Osborne bay on a dead run, and than sailed in among the boats to anchor. We kept the two panels up after the hook was down so that the Moody could find us, and through the binoculars watched him approach the anchorage to round up and drop the mainsail. There is no question that we would be quicker around a triangular course despite his 'faster' boat. Later that day we met a Freedom 30 with the latest Sunbird 90 ketch junk rig. When he was sailing close-hauled we literally sailed 360° round him and then sailed away 20° higher to windward.

The photo shows that the 'jib' panels are tightly stretched which would indicate that there is a significant pressure differential across the panel, and the 'main' panels are slightly creased showing the pressure differential in much across the material. This is what I expected in the 'Some Thoughts' article and I believe is what is needed for good close-hauled performance.

The photo below was taken by Jon Stone during the 2008 RTI Race. Jon sent me the photo and wrote – *" Normally I sail a junk rigged 28' Sunbird and find it an excellent rig. In this year's race however I was crewing on a Bermudan rigged Westerly Konsort. I was amazed at how tiring the sailing was. Every tack took three people's full effort (there were only 3 of us), and even when not tacking we had to post one crew member on lookout to peer out under the Genoa and call to the helmsman whether to stand on or give way. Quite terrifying under the windy and very busy circumstances.*

However my favourite memory of the day was when we were between Needles and St. Catherine's point - enjoying a fast beam reach. I looked behind and saw Poppy with her beautiful white Junk rig just coming around the Needles. She flew through the pack and within 20 minutes had overtaken us, and everyone else it seemed. 20 minutes later she had disappeared into the distance ahead. It seemed that no one could touch her for speed on that leg. We caught up with her much later in the day - and now I know why- (because we stopped to pump out and look for the problem) *but she still crossed the line well ahead of us."*

Jon also wrote "*As you can see Poppy is the only vessel's sail presenting any kind of useful profile to the wind."*

Jon's words left me worried that the Konsort was ahead of *Poppy* at the Needles, so I checked the details. For the race, their rating was based on them being a faster boat and using a spinnaker, and this placed them in an earlier start group, and started 10 minutes ahead of *Poppy*. It would appear that we matched them for speed during the first beat, and as mentioned overtook them quickly on the first reach, only for them to pass us when we pulled out with our bilge water problem. When we started racing again well into the last beat against the tide we again quickly overtook them and finished 17 minutes ahead in an elapsed time of 9:28:10 to their 9:45:50.

I also heard that the crew members on the Bermudan Konsort were so tired after the race that they motored the last leg to their overnight berth. We, on the other hand, sailed Poppy all the way back, including 3 miles up the river before going out for a meal and before the (60+ year old) boys drove 70 miles home. I know which boat I would rather be in - the one where a push on the tiller was all that was required to tack!

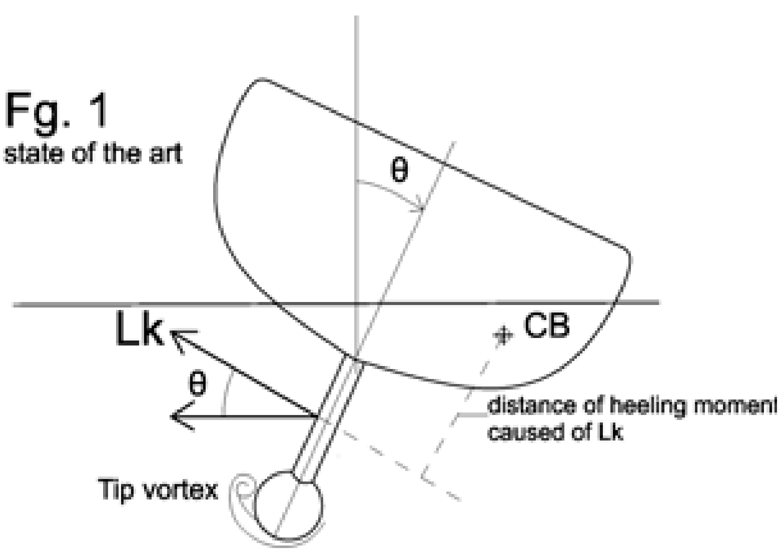
Automatically Deflecting Fin (or Fins) for Sailing Yachts

Ilias Michalopoulos

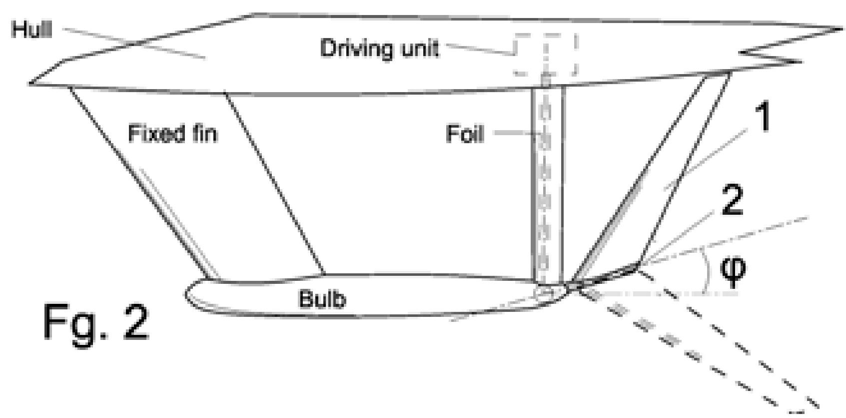
The underwater body of sailing boats has been a subject of continuous research and development and this is going to last for a long time, as things show. Whereas the well known main requirements for a keel are the same, from the old fashioned long keels to modern devices such as canting keels, each type of keel has its own characteristics, making it suitable for a specific type of boat. As for cruising yachts, their underwater layout must combine speed and upwind ability with safety, easy handling and commonly shallow draft.

This article attempts to a brief presentation of a proposal of mine, concerning sailing yachts, mainly cruising ones, through the use of one or more deflecting fins. The birth of this idea does not comprise parthenogenesis. Many inventions about rotatable fins, winglets, blades or hydrofoils may be found in published patents, which, regardless of their applications, have opened new ways in yachting research. Publication numbers of some of these patents are mentioned[1] for further examination.

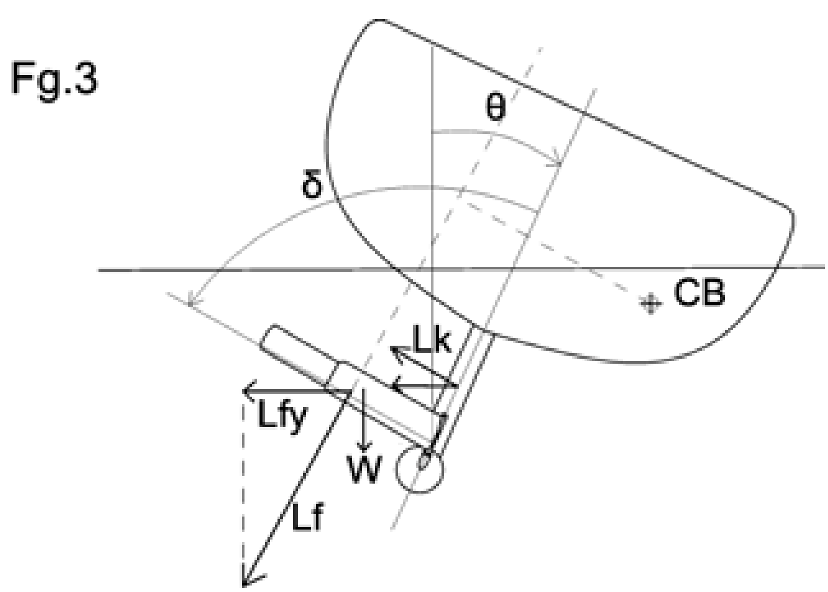
Fg. 1
state of the art



Firstly let us consider a typical fin keel (figure 1), with or without a bulb of ballast, and some of its disadvantages which my proposal intends to improve. As the boat heels to a heeling angle (θ), the efficiency of the keel on producing lift (Lk) is reduced, mainly due to two reasons. First, the actual draft of keel is reduced, resulting in reduced aspect ratio, with all its well known unfavourable consequences, and second, although (Lk) is developed perpendicularly to the lateral area of the fin, only its horizontal component is useful to counteract the lateral force of wind on the sails; while the entire (Lk) produces induced drag and increases heeling moment, due to the great distance of (Lk) from the Center of Buoyancy (CB), as we can see from this figure. Both effects increase as the heeling angle increases. Using tabs at the rear edge of the fin does not affect this added heeling moment. Besides as wind and heeling increase, the rudder undertakes to balance the yacht up to a point, but it induces drag, while when running downwind a broach may occur. A bulb of ballast is beneficial for lowering the center of gravity but reduces the effective draft of the keel due to the raised location of the tip vortex.



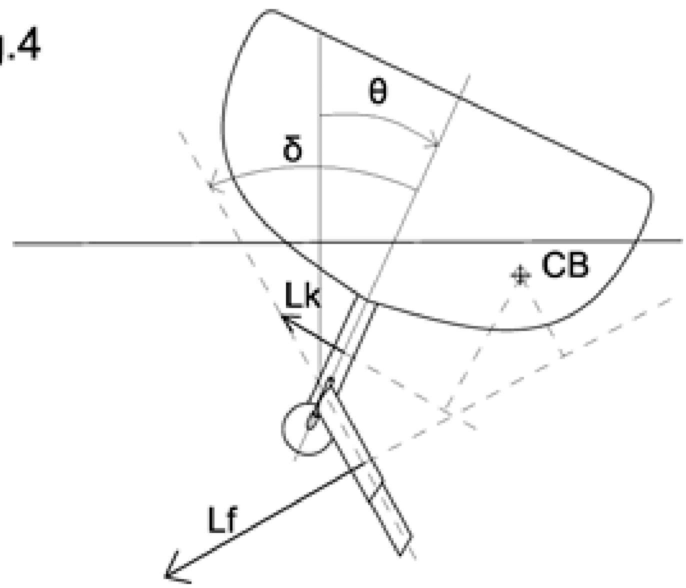
Now let us have a look at an embodiment of the present proposal in Figure 2. This keel configuration, compared to a conventional fin keel as considered above, combines much reduced draft with much reduced wetted area. As we can see in this figure, a fin (1) is added to the rear edge of the bulb of ballast, chocked on a shaft (2) – by its small side – and rotated by this shaft, which forms a small angle (φ) with the horizontal longitudinal axis of the yacht. In the figure, fin (1) appears in its rest position, while its lower position is indicated by dotted lines. In both positions the fin lies amidships and the lift produced on it, derives from the leeway angle only, which is also the angle of attack in this case, just like on the stable fin of the keel. However if fin (1) is deflected from amidships by shaft (2), an angle of incidence appears – caused by inclination angle (φ) – that produces an increased angle of attack, even in the case of zeroed lee angle[2]; thus much lift is produced on it, despite its small lateral area, while its high aspect ratio keeps induced drag low. The rotation of shaft (2) is automatically controlled by a driving unit, under the cabin sole – not much room is required – without requiring any human supervision in a sea way. This unit has a heeling sensor; thus the deflection angle (δ) comes only from heeling angle (θ), and the relation of these two angles is determined freely by the designer of this device, preferably after trials, so as to get the most advantage from this device for any individual yacht design. Generally the more the yacht heels, the bigger the deflection. The vertical foil in the figure covers the intermediate shaft, so no drag is created, and it supports the bulb of ballast as well. In other versions the intermediate shaft passes through a fixed fin and bulb.



Let us now approach the effects caused by lift on this fin

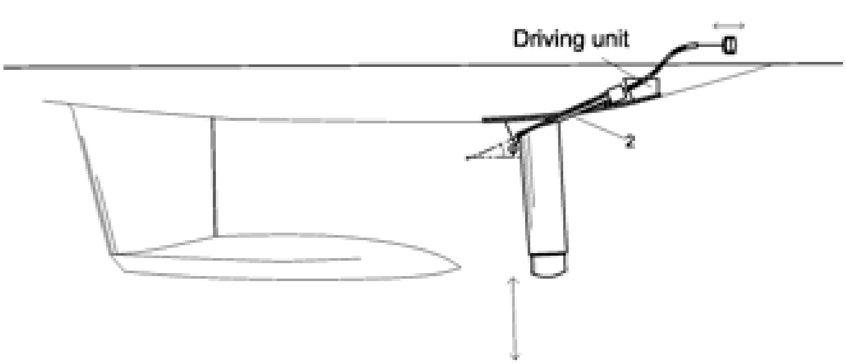
(Lf). In figure (3) we can see a first version of the fin's operation, when it remains always over shaft (2). When heeling is zero – or close to it – the fin remains amidships. Lift produced by the entire keel configuration has a center of effort slightly more forward than the replaced typical fin keel; thus in very light wind no lee helm is required to balance the yacht. That is the reason why the fixed fin is placed above the leading edge of the bulb. Now as wind and heeling increase, deflection increases, lift on the fin also increases for previously mentioned reasons. In the figure we can observe that Lf is much bigger than Lk. This fact moves the center of effort aft, balancing the yacht, under any condition, maintaining a slight, desirable, weather helm. Now, in the case of a gust or of a stiff wave when running, there is a lot of helm manoeuvrability available to avoid a broach. Besides, the whole lift required is split on three foils – on the fixed fin, on the fin (1) and on the rudder – causing less induced drag. Apart from these, (Lf) causes an additional righting moment – notice the large distance of (Lf) from (CB) - thus less heel is caused, or a bigger sail area can be exposed, both resulting in more speed. In this figure, we also notice that the fin consists of two parts, the exterior and the interior one, with the first one being able to insert telescopically into the second one. A spring inside the interior part pushes the exterior one when there is room, while the exterior one inserts in the second one when is pushed by the hull, via small elastic rollers at the free edge of it; thus despite the small draft of this configuration, a beneficial large aspect ratio for the fin is achieved.

Fg.4



That all sounds good, but in our hard world there are also disadvantages in everything. A first disadvantage of this configuration is that in very light wind conditions, with the yacht accelerating but not having enough speed, the keel may be stalled, - just like a typical fin keel, but this is not much of a problem, especially for a cruising yacht. A second disadvantage is that the tip vortexes on the fin are added to those of the stable keel. This effect can be avoided by getting this fin to function in another way, shown in figure (4). Here the fin lies always under the shaft (2) - when under sail. The vortex of the stable fin now is cancelled and only the vortex of the free edge of the fin remains at far lower strength. In this case the efficiency of the entire configuration increases as aspect ratio increases, but less heeling is achieved by decreasing heeling moment via the reduced distance of (Lf) from CB, not by producing hydrodynamic extra righting moment. Apart from calculations, trials on real yachts will demonstrate the best, for a given application of this device.

Fg.5

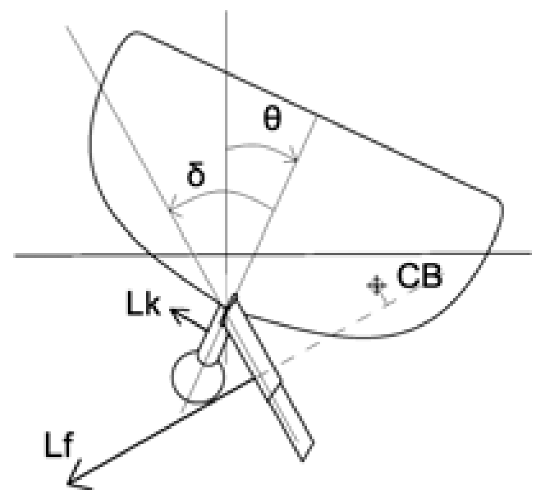


So far, we have had an overview of this new configuration, but what about the its cost? In my opinion what you receive is much more than what you pay.

Nevertheless let us consider another version, much more easily realized, having its own advantages and disadvantages. In figure (5) we can see this embodiment of this proposal, where shaft (2) comes out directly from the hull –just like the engine shaft does, but to the opposite direction. Here no intermediate mechanical parts or proper room in the keel is needed and this version can be installed on already-built yachts, without many alterations or much cost. Here the telescopic movement of the external part is caused by the weight of it and by a wire rope reaching the cockpit for manual operation. In figure (6) we can see that the moment of (Lf) – heeling or righting – is about zero, as the distance from (CB) is very small to zero. The disadvantage of this version is that the efficiency of the reduced draft fixed keel remains unaffected but this is not of much importance as lift comes mainly from deflecting the fin.

As far as the driving unit is concerned, a DC electric motor is used as a motor or – in the opposite direction – as a generator, taking advantage of (Lf), thus requiring little energy. In other versions a mechanical system can be used for this purpose. A wind generator can supply enough energy for this device, avoiding energy problems on a cruising yacht.

Fg.6



Apart from this description, there are more variations of this basic idea, using more than one fin, with more advantages, but they are beyond the purposes of this brief article. Detailed analysis has been avoided for the readers' convenience. Nevertheless I will be more than happy to answer any question, or to receive comments – positive or negative – or suggestions about this device that should lead to its utilisation, or to further research on this subject.

A remote controlled sailing yacht model has been built for testing this device at sea - since there is no test tank available, although some advantages, as the reduced draft, cannot be noticed on a model of this kind because of scaling. I hope a video of these trials will appear on the Internet soon.

Ilias Michalopoulos
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Footnotes

1. Relevant patents include:

- US 6453836 B1/(Ditmore Stephen[US] Sailboat keel with a rotatable secondary foil;
- DE 3713176 A1/(Victora Erich[GE]);
- WO 2005023632 A/(Levine Gerald [US] Shock limited hydrofoil system;
- US 5533462 A/(Parsons Bruce L [CA]) Keelboat arrangement for sailboat hull;
- WO 2008112513/ (Magnasail & Hofbauer) Apparatus & method to optimise sailing efficiency;
- GR1006319/(Michalopoulos Ilias [GR]).

The first patent listed is the closest to the present device.

2. Angle of incidence (γ_0) is given by the equation:

$$\gamma_0 = \arcsin(\sin(\varphi) \cdot \sin(\delta))$$

Where: φ is the inclination angle of shaft (2) and δ is the angle of deflection of fin.

Now angle of attack (γ) comes from the equation:

$$\gamma = \gamma_0 + \arctan(\tan(\mathbf{g}) \cdot \cos(d-\theta))$$

Where **g** is the leeway angle and θ is the heeling angle.

In the case that the fin always remains vertical, putting $\delta=\theta$, these equations give:

$$\gamma = \arcsin(\sin(\varphi) \cdot \sin(\theta)) + \mathbf{g},$$

thus the more the heeling angle, the more the angle of attack.

AYRS John Hogg Memorial Prize Award 2010

The AYRS announces another award of a £1000 Prize in memory of John Hogg, the distinguished amateur yachting researcher, who died in 2000.

The aim of this international award is to encourage and recognise important amateur contributions to the understanding and development of sailing performance, safety and endurance. Preference will be given to on-going work where the prize money is likely to benefit further development. Other than nominations for a "lifetime achievement" award, the work should have been performed within the last few years. Work that has previously been entered for the John Hogg Prize is not eligible, unless in the intervening period significant advances have been made.

Nominations, whether of oneself or another, should be submitted to the Honorary Secretary, Amateur Yacht Research Society, BCM AYRS, London WC1N 3XX, UK, to arrive by **30th October 2010.** Nominations may be made by or for anyone, whether or not they are a member of AYRS. Those nominating someone else must obtain the written agreement of the nominee and forward it with the entry.

'Amateur' in this context means primarily work done as a pastime and largely self-funded. Details should be given of any grants or other funding or assistance received. Work carried out as part of normal employment is not eligible, neither is paid-for research where the researcher does not own the results, but subsequent commercial exploitation of research need not debar work carried out originally as a pastime. Projects carried out as part of a course of education may also be admissible. A significant factor in determining the amateur status of such work is the ownership of the intellectual property rights in the results. Those with ongoing projects are as eligible to apply as those whose work is completed.

Whilst it is not essential that any innovations embodied in the work be demonstrated and "debugged", the work must have some practical application, which should be made clear in the entry.

The submission shall cover the following:-

- A summary, of not more than one page, identifying the nominee and the work submitted, and including a short statement of its merits to justify its submission.
- The description of the work itself, its novelty, its practical application, its degree of success to date, and (briefly) your hopes for the future.

The work will be judged on the results achieved to date. Please spare us a complete history of your researches except to the extent that they are truly relevant. The use of your already published material, whether or not peer reviewed, incorporated in an entry, is welcome.

- Submissions must be made in English, IN HARD COPY sent by post, to arrive by the due date. FOUR COPIES ARE REQUIRED – one for each of the three judges and one for the Secretary.

Electronic transmission, the use of website pages, and of direct extracts from patent applications (which are written by and for lawyers and can generally be shortened) have resulted in unsatisfactory presentation, hence the need for hard copy of a dedicated paper.

- Diagrams, graphs and photographs may be used, video material on VHS PAL videotapes or DVDs can be helpful supporting material. Programs and presentations on disk may be entered as part of a submission (accompanied by explanatory text etc). Appendices may be used, e.g. for mathematical workings. Direct reproduction of pages from an author's web site has generally proved unacceptable (due to formatting variations) and is not encouraged.

- Entries should be printed on A4/letter paper in a legible font. Successful short-listed entries to date have ranged from about 22 A4 sides of text with 6 of photos, to one winner with 5 sides, 3 of photos and one A3 drawing. Clarity, legibility and brevity pays!
- Separately, a brief biography of the nominee(s) should be included, and their amateur status and qualifications should be explained.
- Nominees may care to say how they will use the prize should they win.
- AYRS will wish to publish brief summary accounts of entries, and may also seek further articles from entrants. Grant of permission to publish such articles is a condition of entry. To this end it will be helpful if entries can (if necessary) readily be abridged for publication in *Catalyst,* and if a computer disk copy of the entry is included. However any information received as part of a submission will be treated 'In Confidence' if so marked.

The winner and runners-up will be announced at the London Boat Show in January 2011. All short-listed entrants will receive one year's free membership of AYRS and a certificate; the winner will receive a cheque for £1000 or equivalent.

The Judges, whose decision shall be final, will co-opt experts as required to assist their deliberations.

Submission of an entry will be taken as signifying the entrant's acceptance of these rules.

Queries concerning possible entries may be made by phone or e-mail to the AYRS Honorary Secretary on tel +44 (1727) 862 268; e-mail office@ayrs.org.

Tips for making your entry effective

1. Never forget that the winner of the John Hogg Prize is the entrant who can persuade the judges that his/her work is innovative, has merit, has practical application, and is the most deserving of the prize. Your idea may be the best, but unless you can bring the judges to realise that fact, it will not win.
2. Remember the judges have only a limited time to look at each entry. Don't expect them to wade through pages of dross to find the nugget that is hidden in them. Present your work clearly and concisely, and in such a way that they quickly understand it, its merits and its practical application.
3. Be sure your entry will stand alone. Don't expect the judges to come back to you for more information – they won't. By all means refer to books, articles etc, but make sure the judges can understand your idea without going and looking them up. If they are interested, they may do so, but first you have to get them interested!
4. The judges are all practical people. You don't need to "talk down" to them; but on the other hand don't force them to read pages of mathematics! (See 2.) Equations may be useful to demonstrate a particular point, but long mathematical derivations are best relegated to an appendix.
5. It helps, but is not essential, to have already demonstrated the practicality of your work. Theory is fine, but unless the judges can see the practical application, it will not get their attention.
6. Presentation ought not to win prizes, but it does help get a good entry noticed. Don't just send a collection of loose pages - put them in a binder and give them a pretty cover/front page.
7. Remember a picture can be worth a thousand words; and a picture in colour can be worth more.
8. Remember too that those pictures do not have to be static. One of the better entries to date sent a video, with an intelligent commentary on the sound-track.
9. You can add a sound-track to PowerPoint presentations as well, but if you send a PowerPoint file remember that not everybody has PowerPoint software, so use the "Pack & Go" feature so your presentation will run on any (Windows) system.
10. Don't expect the judges to go and read your webpage. They don't have the time. Use it as a supporting reference by all means, but if the information there is essential make sure it is packaged with your entry.
11. Remember to send enough copies of your entry – FOUR – one for each judge and one for the AYRS Office. The judges can view things like videotapes at their meetings, or they can pass them round; but they don't want to share paperwork, and the AYRS Office has neither time nor resources to do lots of photocopying.
12. Finally, don't forget to put in a disk (CDROM for preference) with all the printable material on it.

Catalyst Calendar

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

February 2010

8th, 10th and maybe 12th
America's Cup Races
IF they can get the protagonists out of court in time, you can watch the action on http://www.americascup.com/

27th AYRS Southwest UK Area Meeting
4pm 7 Cross Park Road, Wembury, PL9 0EU near Plymouth. As we did last year, we plan to hold a get-together of people interested in technical developments in sailing or boatbuilding. Wembury is a coastal village a few miles SE from Plymouth. We offer light refreshments at about 16:00, followed by presentations and discussions from about 17:00. We are reliant on at least one or two members coming prepared with some kind of presentation and maybe a few others bringing a few pictures to share, so do bring your pictures as prints or in a PC format such as CD, USB storage device etc. If you have a longer presentation in mind, it might be worth contacting me first so that we can fit it in.
As before, we propose an afternoon stroll for those who would like to join us prior to the evening meeting. This will start at 14:00 but we will try to think of a different route from last year and that may mean a different start point, so phone or email for details to John Perry, 01752 863730 j_perry@btinternet.com (note the underscore in that email address).

March 2010

10-11th Ship Design & Operation for Environmental Sustainability
RINA Conference, 10 Upper Belgrave St, London SW1X BBQ. Several papers on sail assistance. Details from conference@rina.org.uk.

20th AYRS North West England Group meeting
1400 hrs at 12 The Boleyn, Lydiate, Merseyside, L31 9PT. Contact Mike Howard for details: Tel: 0151 531 6256; e-mail: ecotraction@aol.com

April 2010

21st – 23rd Marine Renewable & Offshore Wind Energy
RINA Conference, 10 Upper Belgrave St, London SW1X BBQ. Details from conference@rina.org.uk.

25th Beaulieu Boat Jumble
The National Motor Museum, BEAULIEU, Hampshire, UK. AYRS will be there!

May 2010

10th—15th Boat trials, Weymouth
Location to be determined (not Castle Cove this time but somewhere else in Portland Harbour). We expect to have facilities for making drag measurements on boats if there is no wind. Contact: Norman Phillips email: wnorman.phillips@ntlworld.com; tel: 01737 212912.

28th – 31st *Broad Horizons* – AYRS Sailing Meeting
Barton Turf Adventure Centre, Norfolk UK, NR12 8AZ. Contact AYRS Secretary AYRS Secretary, BCM AYRS, London WC1N 3XX, UK; email: office@ayrs.org. Note: All boats limited to 1.5 metre max draft on launching!

28th –31st UK Home Boat Builders Rally – Norfolk Broads
Barton Turf Adventure Centre, Norfolk UK NR12 8AZ. Joint with *Broad Horizons*. For details see http://uk.groups.yahoo.com/group/uk-hbbr/

June 2010

4th – 6th Beale Park Boat Show
Beale Park, Pangbourne near Reading, UK. Open-air boat show with a number of boats available to try on the water. AYRS will be there again, selling publications. Contact: Fred Ball, tel: +44 1344 843690; email frederick.ball@mypostoffice.co.uk

30th - 1st July Innov'sail 2010
Second International Conference on Innovation in High Performance Sailing Yachts, Cité de la Voile Eric Tabarly in Lorient, Brittany, France. Organised by RINA, IRENAV and the Ecole Navale Francaise. See http://www.rina.org.uk/innovsail2010

October 2010

16th – 22nd Weymouth Speedweek
Portland Sailing Academy, Portland Harbour, Dorset UK. See www.speedsailing.com.

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

On the Horizon . . .

More Howard Fund applications
Experimental platforms
More sources and resources: reviews, publications and Internet sites

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

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