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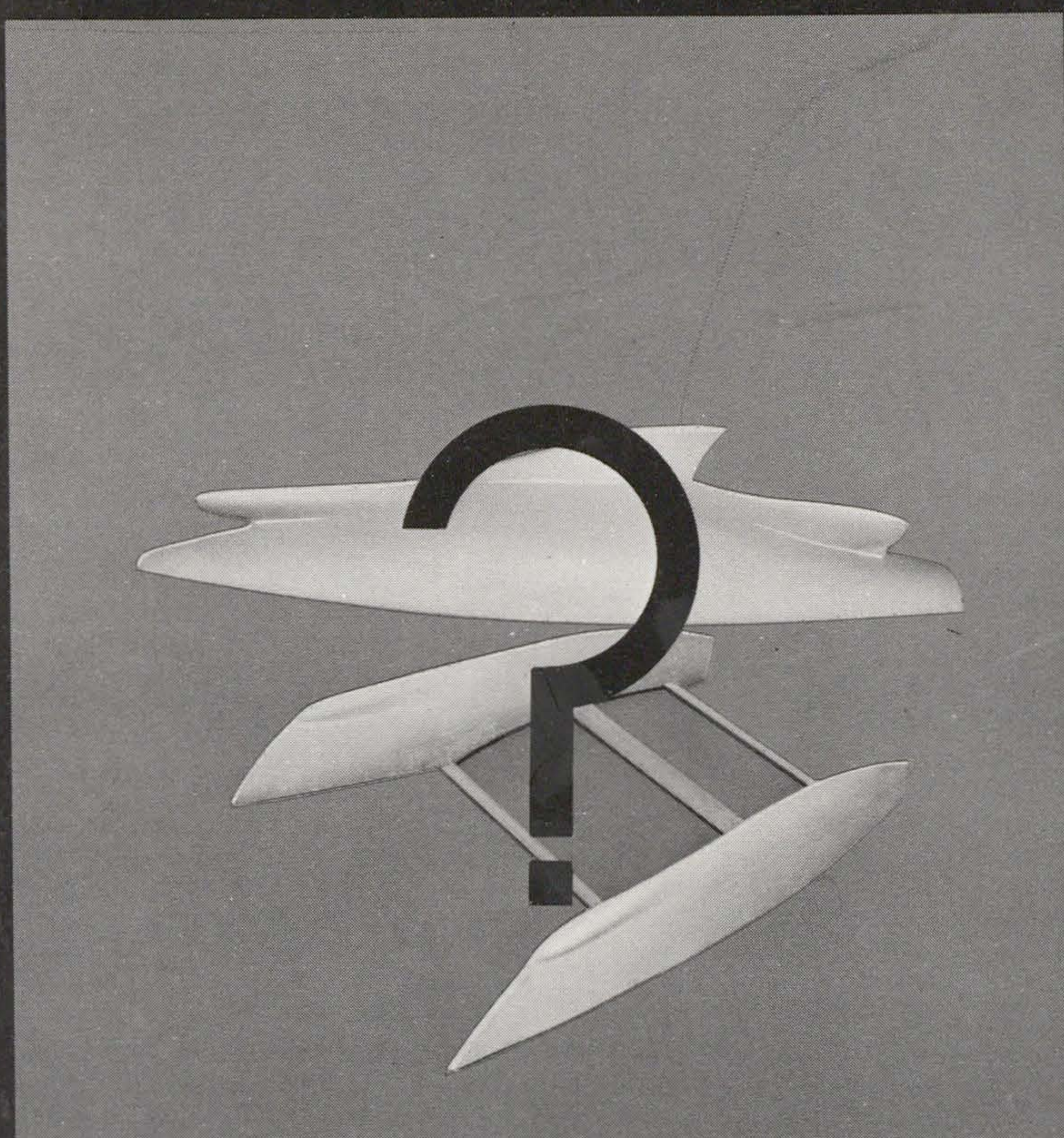
AYRS

Shallow Draft Craft



The shape of future yachts?

Joseph Dusek, Sydney Australia

The Amateur Yacht Research Society is a Limited Company, and a registered educational charity. Membership is open to anyone interested in the improvement of yachts and equipment by the use of research and development.

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EDITORS NOTES

by Michael Ellison

A great deal has been written about the 1979 Fastnet Race by those who are qualified and others who are not. Any proposal for modifications and alterations to rules or craft should be made after careful study of the official report. This document is available for £2.50 from the Royal Yachting Association, Victoria Way, Woking, Surrey. The article following, by John Morwood is intended by John to stimulate discussion and I include comments from three members who have seen the original.

Sailing the Fastnet Course but not an R.O.R.C. entrant was the trimaran "Bucks Fizz." She capsized and Richard Pendred her joint owner and three crew including John Dicks from U.S.A. were drowned. An enquiry into this and two other multihull capsizes has been held and copies of the report are available from Gp. Capt. Michael Thunder the Hon. Sec. of M.O.C.R.A. at White Oaks, 19 Belton Road, Camberley, Surrey, England, at a price of £1.00 each. I have many letters about multihull stability and will make this the subject of our next publication.

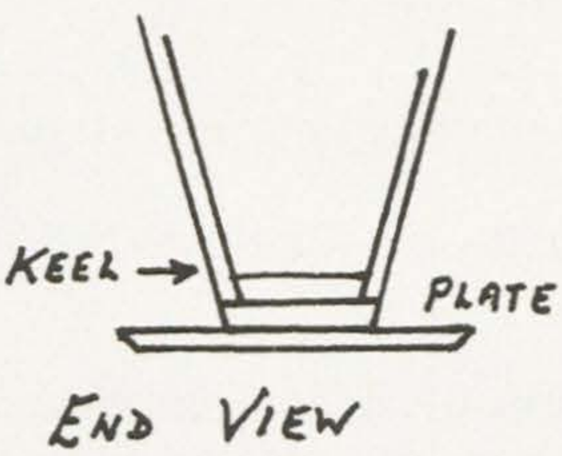
Amateur Status and 'amateurishness' aroused a lot of discussion and interest. Our Chairman announced at the A.G.M. that we shall continue to welcome professionals and that we will continue to be known as A.Y.R.S. We are certainly not receiving payment for our interest! One of our members in Australia wrote to say that the Queensland Multihull Yacht Club is to make every boat in the 1980 series carry advertising or be disqualified so that he would lose his amateur status if he competes. I spoke to Lock Crowther about this and the fact that a sponsor is funding a series of races and as long as the individual does not receive payment for an entry into a race, (no matter how much it costs to arrange) does not make him a professional!

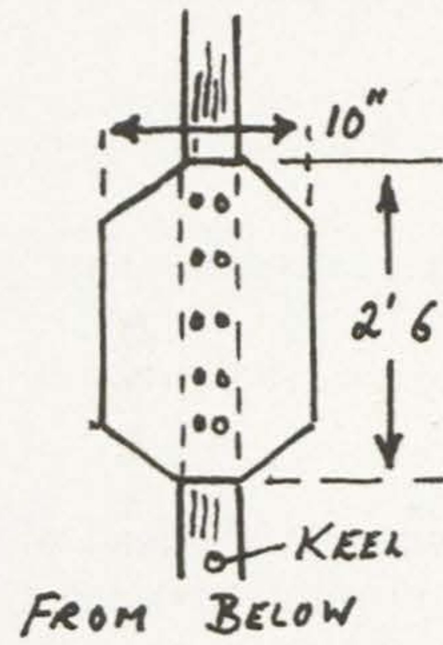
David Webb is a keen member. He also runs The Telford Press Ltd., who printed this number. He designed and produced our new brochure and we have great hopes that these will spread the word and encourage more people to join us. We must have more members to spread the cost if we are to continue. Please will you help by giving A.Y.R.S. a mention when discussing any new ideas or any ideas developed through the Society – for example, self-steering, multihull yachts, hydrofoils, kite rigs or inclined sails. Even sailboards are considered in our early publications (Jan. 1963 and Oct. 1966) in case you believe advertisements claiming invention in California in 1967! Our main interest must be the future but we have been publishing for 25 years and past success should be broadcast. Will members who own craft and equipment mentioned in past numbers please let me know about success and failures with as much detail and as few words as possible.

During the London Boat Show, we received an enquiry about preventing leeway with a vortex generator as described by Walter Castles in A.Y.R.S. 83B. The article published in Florida by Jack Shortall follows the description and photographs in 83A saying "Walter uses neither keels nor centreboards to achieve lateral resistance but rather has 11/2 inch vortex generators on the bottom and claims that these allow him to split 90 degree tacks. His equations and computer programmes are applicable equally to monohulls and catamarans." (page 41 and the equations are in 83B page 13 and 14).

Perhaps my mind went blank at the mention of a computer, I can think of no other excuse! In this number there is quite an interest in shallow draft so perhaps some further trials are indicated.

Joseph Dusek in Sydney ("Dalibor") sent us details of Wharram owners Peter Thwaites ("Tane") and J. E. Chitty ("Hina") who have fitted horizontal plates to the bottom of each hull and report that the yachts point higher and tack in a much more positive manner. The plates on the "Hina" are made of ¾" ply, 2' 6" long and only stick out 2" either side of the keel. This must be better than fitting boards.





THE FASTNET TRAGEDY AND SURVIVAL YACHTS

by John Morwood

The 1979 Fastnet Race must surely be about the worst yachting tragedy in history. In the area between the south west coast of Ireland and Lands End, 136 sailors were rescued, 23 yachts were abandoned and 15 lives were lost. Several yachts did 360 degree rolls sometimes more than once. Many yachts were abandoned too soon for life rafts which often failed while yachts were later found floating at their marks. Wide, shallow draft yachts have been alleged to have come off worse than deeper ones. The Australians who frequently meet such conditions in the Sidney-Hobart Race in the Bass Straight came out best and won the Race and Admirals Cup.

The cause of the havoc was a storm with winds of 60 knots occurring in water less than 300 feet deep, in places only 150 feet. This produced very steep seas often with near vertical faces which compare with those of the deep ocean which are surprisingly gentle in slope. These steep seas hit the yachts, washing the crews overboard, breaking the carbon fibre rudders, swamping the cabins where the washboards were not properly in place but only in the rarest of cases actually damaging the yacht hulls. This kind of damage is the concern of seamanship and yacht building whose lessons can be learned and, hopefully, corrected.

The 360 degree roll where the yacht turned through a complete circle on a knock-down is a matter of design. It will be the main concern of this article. It caused the majority of the broken masts which, in turn, damaged hulls.

The modern tendency of single hull design is to have a wide, shallow and light displacement hull which has a salient, ballasted and fixed keel. Yachts to this formula seemed to have been especially liable to the 360 degree roll. The six sketches show how the 360 degree roll may have occurred in a beam, steep sea.

Fig. 1. This shows such a yacht being approached by a beam sea. Most yachts seemed to have had some sail up and were moving forward, probably at some speed.

Fig. 2. When the sea hits the yacht, it is immediately thrown on its beam ends by the following:–

(a) The "Throwing force" which is the sudden blow above the centre of gravity heaving the yacht to leeward.

(b) The light displacement makes this sudden rotational movement quicker.

(c) The wide, shallow hull tends to conform to the almost vertical wave slope.

(d) The water just ahead of the wave face moves towards it and then vertically upwards, pulling the salient keel with it. This effect will be more severe if the yacht is moving forwards with the keel gripping the water, i.e. "unstalled."

Fig. 3. The same forces still apply as the yacht moves up the wave face to which are added two more:–

(a) Rotational momentum..

(b) The mast is now in the water and the yacht 'trips' over it.

Fig. 4. The yacht has now got to the top of the wave and upside down. It there meets both wind and water flows moving to LEEWARD while the mast is in deeper water. The forces on it are now:–

(a) Wind and water on the keel acting to leeward.

(b) Rotational momentum still applies.

(c) Water-flow on the hull acting to leeward.

(d) Mast in deeper water acting to weather.

Fig. 5. The forces of Fig. 4. may complete the 360 degree roll – or the wave may pass, leaving the yacht inverted, as in Fig. 6. The gravity-buoyancy couple may then right it.

CONCLUSION

Beamy, light displacement yachts with a ballasted fixed keel are especially liable to the 360 degree roll in storms on soundings when steep seas occur.

THE CIRCULAR SECTIONED YACHT IN STORMS

Though it is not a suitable shape for a yacht, it may increase our understanding of yachts in storms if we study a yacht with a circular hull section, inside ballast and neither keel nor centreboard projecting from the hull. The four sketches show what could occur.

Fig. 1. The yacht when the sea meets it. It will move slightly towards the wave.

Fig. 2. When the wave front hits this yacht, only the "Throwing force" will act on it. Neither keel nor buoyancy adds to this. The yacht will heel but the inside ballast will immediately counteract this to some extent.

Fig. 3. This yacht will rise up the wave face with the inside ballast still trying to right it. At the crest of the wave, it meets water moving to leeward which will right it momentarily. After this, the water moves once again to windward.

Fig. 4. This shows the yacht at the wave crest.

CONCLUSION

A circular sectioned yacht with inside ballast and no projecting keel should never do a 360 degree roll. Model tests in shore breaking waves might well show this.

TRADITIONAL SOLUTIONS

The problem of rough weather survival has been around as long as man has put to sea in boats. The best examples are likely to be found on the Atlantic shores of Britain and Brittany though China and Japan also have the same problems while even the Mediterranean is not so calm as we think of it.

In all cases, the traditional solution has been the same, though for a variety of reasons. The resultant boat has the following features:–

1. Shallow draft. There is never a fixed keel except for "deadwood" aft. Centreboards and leeboards are used by the Chinese, Dutch and Americans.

2. Narrowish beam usually less than one third of the waterline length.

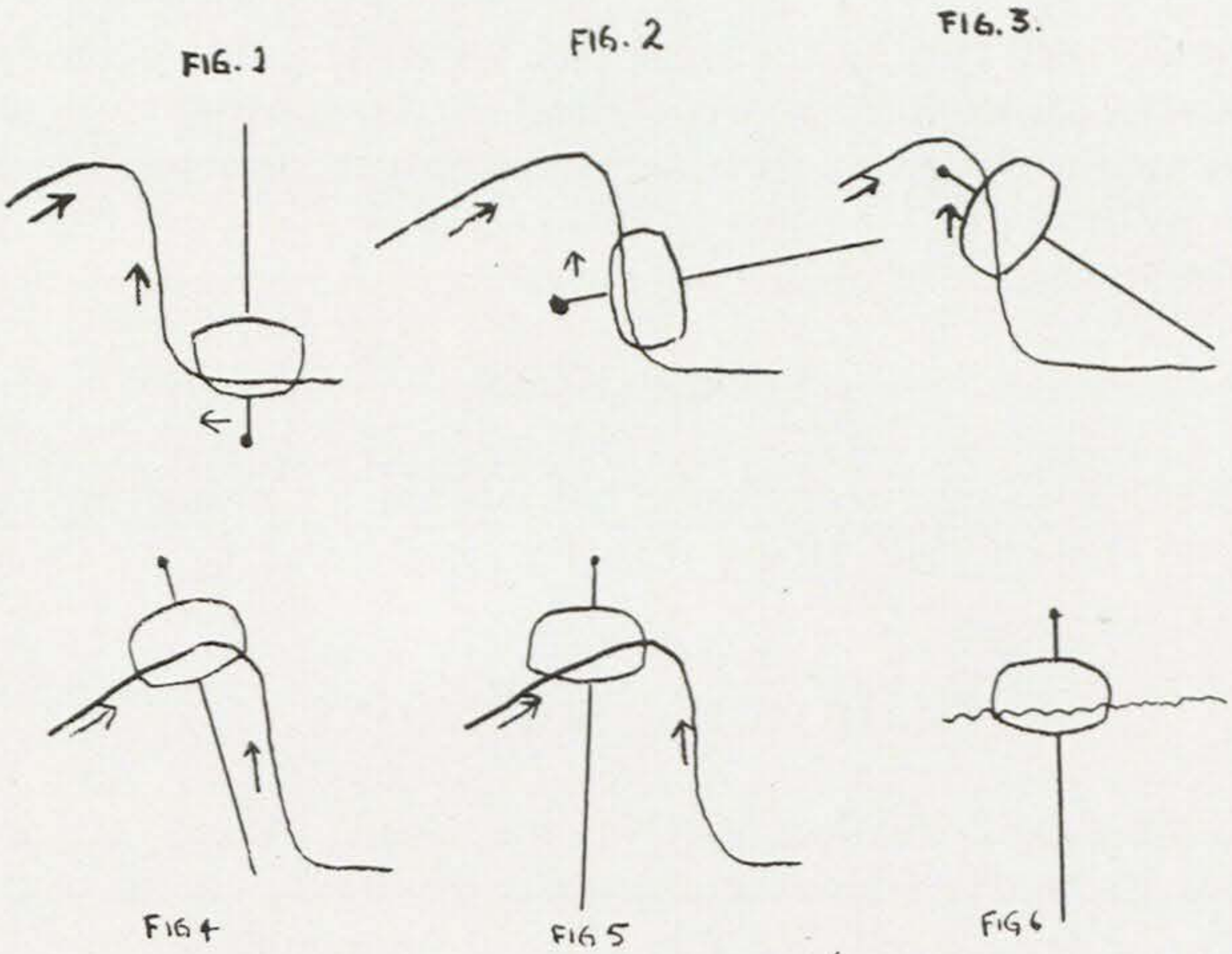
3. Inside ballast, generally of either stones or pig iron.

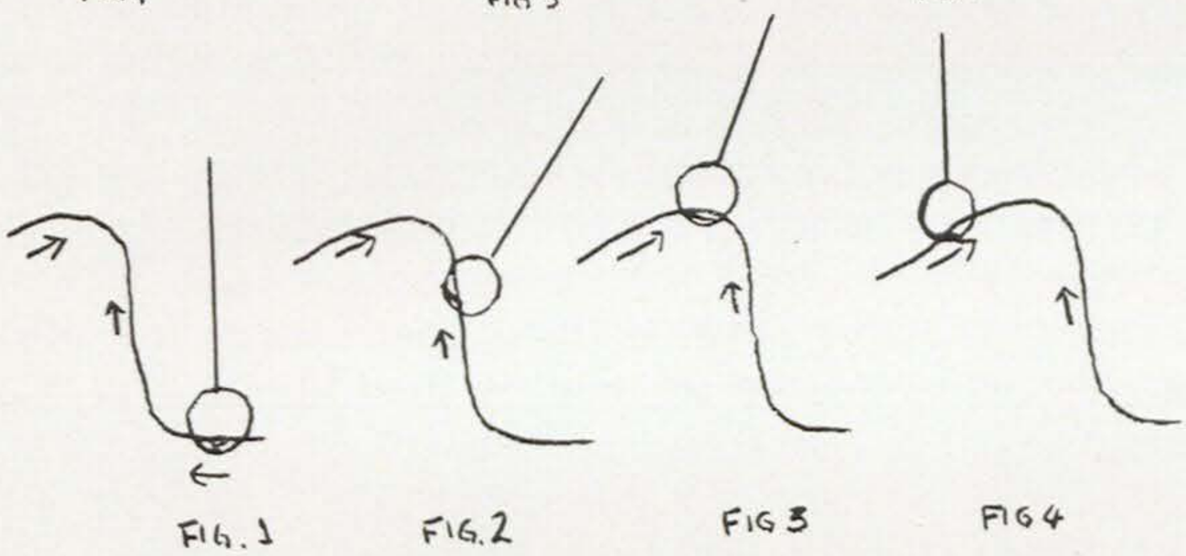
4. Usually of fairly light displacement to length ratio.

5. Almost all the pure sailing vessels have more than one mast.

Looking through Chapelle's AMERICAN SMALL SAILING CRAFT and Dixon Kemp's MANUAL OF YACHT AND BOAT SAILING (1880), there are but few exceptions to these rules in most of which iron on lead ballast is set into a deep keel as in the Bermuda Sloops. The supreme example of a rough water vessel is the Irish Curragh. Dixon Kemp says:–"I recommend anyone, wishing for a new sensation, to take a pull in one after a gale. They never ship a drop of water and literally dance over the tops of the waves."

More recently, Joshua Slocum built his Liberdade and Voss used an Indian Canoe for long ocean voyages. These two men whose empathy for the sea must far outstrip those of modern yachtsmen chose boats to the well worn formula. Joshua Slocum, of course, used a beamier boat. The "Spray" for his epic voyage around the world but her draft was only some four feet. He used inside ballast and did not build in the centreboard with which the original boat was most likely to have been fitted. Both Slocum and Voss used more than one mast. Slocum fitted a mizzen to his sloop rig while on his voyage, while Voss started out with three masts, each with a small jib-headed sail.





Finally, one can cite the "PRESTO" designs of Commodore Munroe as described in THE GOOD LITTLE SHIP (Livingstone Publishing Company, Narberth, Pennsylvania). The first of these was designed and built in 1885 with the following dimensions:–

L.O.A. – 41 ft. 0 ins., L.W.L. – 35 ft. 6 ins., Beam – 10 ft. 6 ins., Draft – 2 ft. 6 ins., Sail Area – 1054 sq. ft. (Ketch rig).

Munroe's designs all had inside ballast and centreboards, the ballast of the above boat being 4½ tons.

THE GOOD LITTLE SHIP more or less confirms all the arguments given in the first part of this article for the seaworthiness and safety of shallow draft and absence of keel in gales and storms. It claims that none of the PRESTO boats ever got a knock-down in the fifty years of their existence. They are most certainly built to the formula of seaworthiness which I worked out separately. Indeed, they are in most respects very similar to the Irish Curraugh in form. The hull section has a good deal of flare at the topsides and the waterline beam is only 9 ft. 1 in. to an overall beam of 10 ft. 6 ins. a ratio approaching 4 : 1 for length to beam.

No great speeds were claimed for the PRESTO boats, though they did win some races with free winds. The gaff ketch is not the best rig for windward work. They were held out as comfortable cruising yachts and seemed to have fulfilled this objective well. However, with straight and near vertical stems, transomes at the aft end of the L.W.L., the hull would be very fast indeed. The centreboards and their boxes could also be greatly improved by modern practice. If all this were to be allied to a modern sloop rig or possibly a wish-bone ketch, one would have not only a sea-kindly and safe yacht for storms but a fast and weatherly yacht for racing and cruising.

WAVES

from Reg Bratt

63 Old Castle Road, Weymouth, Dorset.

Waves travel in trains of a given wavelength. The waves travel twice the speed of the train. Thus each wave imparts its energy to the wave behind until it disappears at the front of the train. Viscosity causes the ultimate demise of the train.

Long waves travel faster than short waves. The waves of the sea are a mixture of waves of many lengths. Where two or more of different lengths momentarily coincide they cause a ridge or a trough. When trains cross, they cause peaks and holes. When a large number of trains cross as would be generated in a circular storm occasional very high peaks and very deep holes are to be expected. The peaks tend to be unstable, irrespective of the fact that they are exposed to the wind; once in a while a yacht must be lifted on a peak which forms under it. If the peak forms just to weather, the yacht may get caught in a tumbling white horse.

A recent newspaper article expressed puzzlement at holes in the sea. The same mechanism as produces transient peaks must occasionally produce some very deep holes.

SHIFTING BALLAST YACHTS

by John Morwood

Shifting ballast has been around ever since the first man to put a sail boat leaned out to counteract the force of the wind. Our Megalithic ancestors probably had the same type of boat described by Julius Caesar which was used by the Veneti of Brittany. This was a shallow draft boat with a sail and steering oar. This boat may well have survived unchanged into the present century as the Barco Rabelo which used to bring wine down the Douro River to Porto, Portugal. In the Megalithic voyages from Sweden to Morocco, the crew would have balanced out the sail force. It is assumed that this boat was the ancestor of the Irish 'Curraugh' or skin-covered boat.

By contrast, the use of weight other than human to balance the sail force is relatively modern, so far as we know. The sequence is as follows: –

THE 'SANDBAGGERS'. These were 19th Century large dinghy-shaped centreboarders. They carried nearly a ton of ballast in sandbags stowed on a shelf under the weather gunwale. On putting about, all this weight was shifted to the new weather side. This gave great stability and speed but quick tacking was impossible. If caught aback, they could capsize. For safety reasons, they were banned.

THE HERRESHOFF SUGGESTION. L. Francis Herreshoff, in his book "The Commonsense of Yacht Design" suggested putting a fin keel on "Piano Hinges" fore and aft. He suggested that the keel could be moved from side to side by a worm gear and bell crank, thus moving the ballast to windward on each tack. This involved sloping the keel. I know of no trials of this suggestion.

TABARLY'S "PEN DUICK VI". This yacht, like the "Sandbaggers", was a beamy, dinghy-shaped boat some 35 feet long with a fin and bulb keel of only enough weight to bring her upright from a knock-down. While sailing, however, water could be pumped into one or another tank placed at the extreme beam, thus giving extra stability and upright sailing. "Pen Duick VI" won the Trans-Pacific Race single handed and thus must have been some sort of success.

"IROQUOIS" AND THE ELLISONS. In a Round Britain Race, Michael and Peter Ellison shifted their anchor and chain into the weather hull on each tack, thus gaining some advantage from the weight penalty of their ground tackle.

A FRESH CONCEPT

This started modestly enough with a suggestion by Stephen Robbins for an asymmetrical proa hull with a ballasted fin keel. In order to get extra sailing stability, a sponson tank would be built onto the gunwale at the weather side. This would be filled with water in strong winds to prevent or reduce heeling. He also suggested that mercury could be used to replace water whose extra density would reduce the size of the sponson tank.

From Stephen Robbins suggestion, there immediately arose the concept of putting the ballasted fin keel as far as possible to weather so that the proa would be heeled to windward when not sailing. At moorings or in harbour, a sponson tank on the lee side could then be filled with water (or mercury) to keep the boat upright. This would have the advantage that the weight would be reduced in strong winds when it produces extra wave drag by allowing the water ballast to drain out. In light winds, the extra weight would be of minimal extra drag from additional wetted surface.

All these concepts were circulated to some six people to whom I regularly write. Dick Andrews next took up the principles. This was to be expected, as he has been concerned with concepts of righting a capsized trimaran by the use of weight at the end of a pole. Moreover, he had been writing that a ballasted fin only gave stability to a heeled boat and was only unnecessarily carried about in light winds.

Though excellent in concept, Dick Andrews' suggestion has three faults:–

1. The ballasted fin would be hard to haul up in its sloping box though this could be overcome by a roller.

2. All present day ballasted fins when raised leave the ballast in the centre-line below the boat. When aground, this puts great hogging stresses on the hull.

3. There is now a centreboard case in the centre of the hull.

All these faults can be simply avoided by the following:–

1. Use a hull which is symmetrical not only from side to side but also fore and aft. It would be of shallow draft and could even be hard chined with a single chine just below the L.W.L.

2. A ballasted fin keel-centreboard would be placed as far to one side of the boat as possible in the middle of the fore and aft length. Hard single chined construction would let it be farthest out, hence its value.

3. Water tanks would be placed far out either outside the boat as sponsons or possibly just inside the skin.

Such a boat would have great hull stability from its flat floor. The ballast placed to weather would greatly increase this when sailed as a proa. When sailed normally, water ballast would counteract the heeling of the laterally placed ballast. If there were a small ballast tank on the same side as the ballast and an oversized one on the opposite side, water could be pumped from side to side when putting about as was done with "Pen Duick VI."

With this suggested boat, the centreboard box would not interfere with the accommodation. On taking the ground or on a trailer, the ballast, though below the boat, would not unduly stress the hull.

CONCLUSION

A ballasted monohull has been devised by a group of us whose ballast might weigh no more than that of the floats of a trimaran. It would preferably be sailed as a proa but can equally well sail normally, though more slowly in strong winds. Its "centreboard" case does not interfere with the accommodation and its draft with the ballasted fin raised would only be a few inches. Its sailing speed might be greater than a comparable trimaran.

A MERCURY BALLASTED BOAT

Roughly speaking, about one quarter of the length of the boat described in the previous paragraphs is wasted as regards speed. The canoe stern could be chopped off and replaced by a transom without losing performance. Again, taking the suggestion from Stephen Robbins about using mercury as shifting ballast, a boat comes to mind.

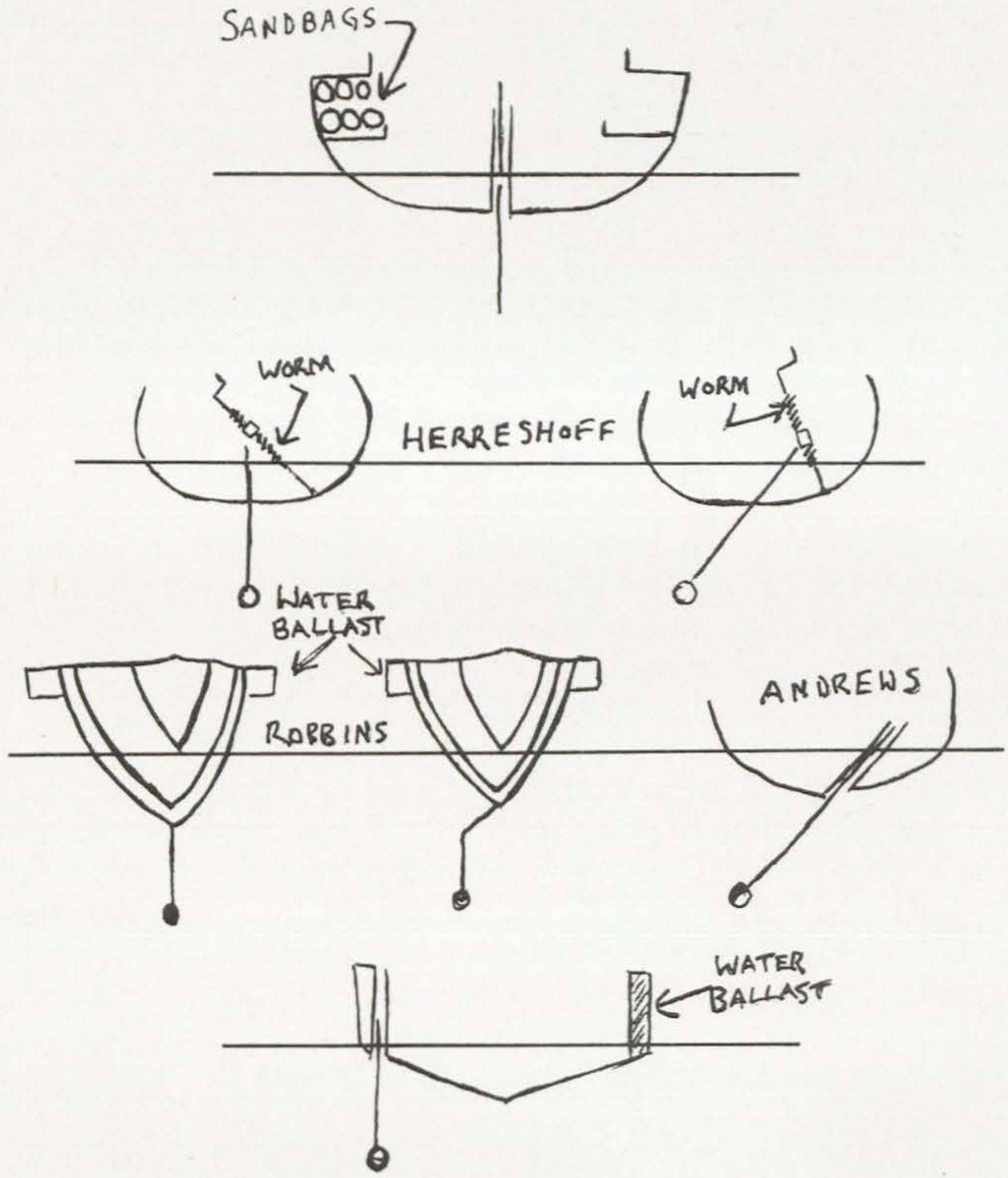
Using a single hard chined hull, two boxes are built for lifting keels, one on either side and as far out as possible. In accordance with modern twin bilge keel practice, they could be aligned parallel with the fore and aft line.

Each keel would be built from two steel plates placed about 4 millimetres apart. At their bottom would be a hollow torpedo-shaped structure connected to the hollows being sealed from the outside.

A single tube would run from the bottom of one bulb to the bottom of the other.

Mercury would be the ballast and would be put in the bulbs. When one keel is raised, hydraulically by preference, the mercury in its bulb would run by siphonage into the other bulb, thus again giving shifting ballast. However, even in a knock-down, the ballast would exert its righting moment.

With this idea, the maximum height of the siphonage tube above the bottom of the bulb can only be some 800 millimetres. That is about the minimum atmospheric pressure which will be met and is needed to make the siphonage work.



MOVEABLE BALLAST

by Ken Sully

I still believe water ballast, with the opportunity of ridding the craft of unwanted weight and easily adjusting mass to requirements, has some advantages. It can so easily be purged by compressed air, if all else fails! and there must be vast available expertise from submariners. You mentioned 'Liberdade' –Slocum used bamboo sponsons to increase stability, what about hollow sponsons on a monohull – a sort of enlarged bulwark flooding the weather side?

Still on air – this has the best energy-weight ratio of storage methods, perhaps the cylinder could be charged by a pump operated by the crafts motion in pitch, roll or by current or wind action plus the crews efforts of course.

From my experience of heavy plant machinery, an 'accumulator', a hydraulic chamber 'powered' by compressed air, would certainly be effective to RAPIDLY move a metal mass via hydraulic rams, providing the necessary clearance for this internal movement of a substantial metal ballast might need careful design of the craft?

Sincerely, Ken Sully.

* * *

Comments from Ken Sully

"I think ALL craft can and will be rolled by some sea conditions. Numbers of well known traditional design boats, without fin and bulb keels, have capsized, as you are aware, so much better than I, often when lying ahull under bare masts or with storm sail set. Moitessier with "Marie Therese 11" a typical case, dinghys with no board down or mast up will capsize in bad conditions.

I fully believe that any keel projection MUST increase the hazard of rolling, from the effects clearly enumerated in your article."

* * *

Comments from Harry B. Stover

"I cannot see anything wrong with your analysis. I have always liked centreboard boats for reasons other than those given by you, so I am probably biased anyhow.

Your proposal would end up, as I see it, narrower than today's conventional boat and with ballast inside. These two things, less beam and higher c.g. of ballast would require considerably more ballast and therefore more displacement to obtain the same sail carrying power under normal conditions. For this reason, I do not believe such a boat would win many races, except in extreme conditions. It, in my opinion, would make for a much more satisfactory yacht."

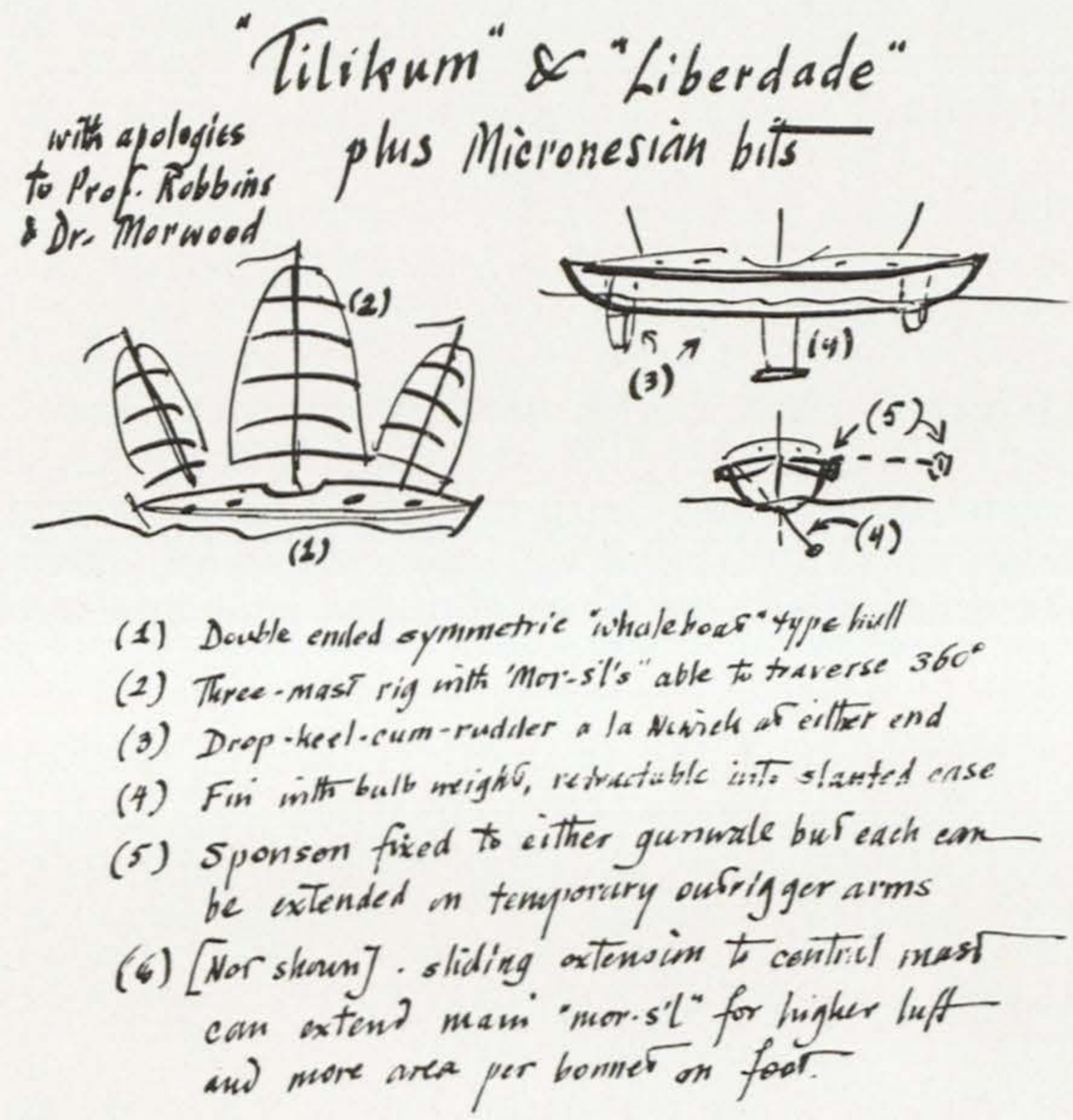
"One thing, all that inside ballast had better be fastened down to prevent shifting."

Letter from Dick Andrews, 25 Audubon Drive, Ossining, New York, 10562. 15th October, 1979.

Dear John,

Capt. Joshua Slocum was famous for his round-the-world voyage in the beamy little sloop "SPRAY", and Capr. Voss later made his famous long voyage in the Indian dugout canoe "TILIKUM" rigged as a three-mast schooner. Less well known perhaps is the fact that earlier on, Voss had made a considerable voyage in a beamy sloop of almost precisely the size of 'SPRAY' – the 'XORA' . . . while Slocum had earlier made a long voyage himself in a three-mast craft of his own make which was not much larger than 'TILIKUM' and might be called a hard-chine canoe form!

Taking elements of Voss' 'TILIKUM' and Slocum's three-mast dory 'LIBERDADE', plus an element of the delightful concept that Prof. Robbins had put forward – a keel proa – and giving the result a set of "Mor's'ls" to drive her I wind up with the craft sketched.



The purpose of this design is to provide a craft which can get along on a passage in good time, get through calms readily without resorting to internal combustion and hopefully ride out gales with reasonable safety.

However, another element in my mind is that of avoiding the rigidities that come in when one, for example, opts to shunt tack ONLY. My experience with two variations on the Micronesian type – both able to sail with the wind on one side only – is that when the wind gets round to the other side (and sooner or later it surely will – one is in Big Trouble. This is not the kind of situation in which a normally short-handed or single-handed yacht want to

Due to the increasing cost of labour and round bilge construction in steel, the design was converted to a single chine, and so became a modern version of a Chesapeake Bay "Skipjack" rather than a "Presto" boat.

The 620 sq. ft. of sail area seems more than enough in many of our Wellington winds; but on our shake down cruise to the Nelson district, their light winds encouraged the use of the small diesel and the V.P. propellor.

Reliable engines have so altered the cruising scene, that it is now difficult to accept that it was (and still is) possible to cruise with only wind power, helped out with oars and tides, plus an anchor; but few present day sailors have the time, the rig or the mental attitude to put aside the help of mechanical power.

On launching day, after a half mile ride from the fitting out site in our front garden, the boat was named "Mary of York". There was a short service and blessing, conducted by the local Minister. The crane gave a final "up and over," off slings, start motor, and once around the anchorage! A short break for lunch, then it was "up with the mast" helped by a timber "A" frame of 3 x 2 inch Spruce. The next step, "Up Main Sail!" Cast off moorings – we are sailing!

It is quite an experience – having a dream come to life! and finding that your five years of effort have produced the planned, worked and hoped for result.

Now after most of a seasons use, it is possible to say we have a yacht that is comfortable at sea and for living on board, easy to sail, and a better sailer to windward than the flat bottom might lead one to expect. The windows, they are not port holes, and they do not leak, are made from 5/16 inch toughened glass set in Butyl rubber in galvanized frames held in place by many ¼ inch counter sunk screws.

Crew or passengers, standing or sitting on the rather high set settee berths, are able to watch the waves go by, as well as admire the views of beach, hill or shore line. With the shallow draught and one inch thick steel bottom plate or keel, you can get really close in, and in many anchorages you can tie up to a tree or trees, and plan to sit on the bottom as the tide goes down.

The 13 h.p. Lister diesel, drives a 20 inch, variable pitch propellor, New Zealand made and of reasonable quality, this is fully feathered for sailing, and is driven at a 2.8 to 1 reduction ratio through two sets of triple vee belts.

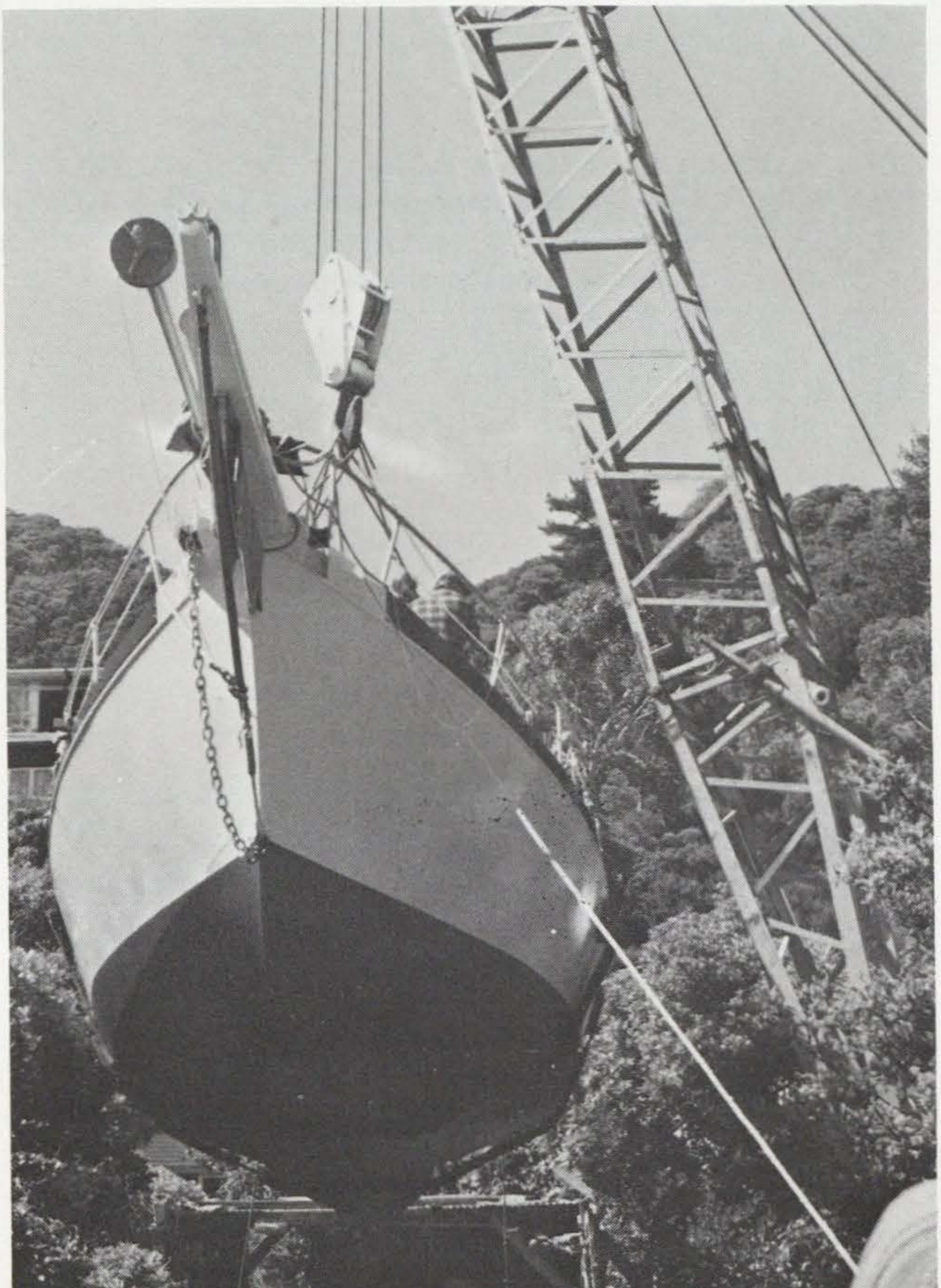
The fuel and water tanks are built into the ship, two fuel tanks hold 29 gallons each, and two 35 gallon water tanks give a reasonable capacity. The coach roof has been built so that it can be scrubbed down and then used as a catchment area for rain water, which can be led straight into one or other of the water tanks.

How often this will be used is anyones guess. Eric Hiscock in his book "Come Aboard" comments that they have carried a "rain catcher" for many years and had not used it.

To keep the weight low, the coach roof is ¾ inch plywood, covered with dynel in epoxy resin, and the cockpit shelter is built in aluminium.

Now I am working at five years put off maintenance around the house and garden, and looking forward to a summer full of sailing.

A. C. Atkinson, York Bay, Eastbourne, New Zealand, 26th Sept., 1979.



Launch day of "Mary of York," November 1978

"MARY OF YORK"

Comments on Construction and Sailing

The steel coamings and deck were sand blasted and immediately painted with a two part epoxy zinc rich paint. During the years while fitting out, the decks were covered with old carpet and sacks, they were then swept clean, vacuumed clean and wiped over with cloth soaked in thinners. A two-part, zinc chromate, priming paint was applied – two coats. This was followed by one coat of resin, which had ground up cork spread over the still wet resin. (just like spreading stone chips on hot tar for a road surface). The cork chips can be bought at the paint shop; we made our own chips; by putting the offcuts of the sheet cork, used for lining the cabins through an old hand mincer. It was hard work but made use of the otherwise scraps.

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Due to the increasing cost of labour and round bilge construction in steel, the design was converted to a single chine, and so became a modern version of a Chesapeake Bay "Skipjack" rather than a "Presto" boat.

The 620 sq. ft. of sail area seems more than enough in many of our Wellington winds; but on our shake down cruise to the Nelson district, their light winds encouraged the use of the small diesel and the V.P. propellor.

Reliable engines have so altered the cruising scene, that it is now difficult to accept that it was (and still is) possible to cruise with only wind power, helped out with oars and tides, plus an anchor; but few present day sailors have the time, the rig or the mental attitude to put aside the help of mechanical power.

On launching day, after a half mile ride from the fitting out site in our front garden, the boat was named "Mary of York". There was a short service and blessing, conducted by the local Minister. The crane gave a final "up and over," off slings, start motor, and once around the anchorage! A short break for lunch, then it was "up with the mast" helped by a timber "A" frame of 3 x 2 inch Spruce. The next step, "Up Main Sail!" Cast off moorings – we are sailing!

It is quite an experience – having a dream come to life! and finding that your five years of effort have produced the planned, worked and hoped for result.

Now after most of a seasons use, it is possible to say we have a yacht that is comfortable at sea and for living on board, easy to sail, and a better sailer to windward than the flat bottom might lead one to expect. The windows, they are not port holes, and they do not leak, are made from 5/16 inch toughened glass set in Butyl rubber in galvanized frames held in place by many ¼ inch counter sunk screws.

Crew or passengers, standing or sitting on the rather high set settee berths, are able to watch the waves go by, as well as admire the views of beach, hill or shore line. With the shallow draught and one inch thick steel bottom plate or keel, you can get really close in, and in many anchorages you can tie up to a tree or trees, and plan to sit on the bottom as the tide goes down.

The 13 h.p. Lister diesel, drives a 20 inch, variable pitch propellor, New Zealand made and of reasonable quality, this is fully feathered for sailing, and is driven at a 2.8 to 1 reduction ratio through two sets of triple vee belts.

The fuel and water tanks are built into the ship, two fuel tanks hold 29 gallons each, and two 35 gallon water tanks give a reasonable capacity. The coach roof has been built so that it can be scrubbed down and then used as a catchment area for rain water, which can be led straight into one or other of the water tanks.

How often this will be used is anyones guess. Eric Hiscock in his book "Come Aboard" comments that they have carried a "rain catcher" for many years and had not used it.

To keep the weight low, the coach roof is ¾ inch plywood, covered with dynel in epoxy resin, and the cockpit shelter is built in aluminium.

Now I am working at five years put off maintenance around the house and garden, and looking forward to a summer full of sailing.

A. C. Atkinson, York Bay, Eastbourne, New Zealand, 26th Sept., 1979.

Launch day of "Mary of York," November 1978

"MARY OF YORK"

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Under the floor boards in the 4 inch deep bilge, you find the internal ballast; this is in twenty pound lead bars, bolted down to the top face of the 1 inch thick, 3.5 feet wide steel keel plate: The keel plate itself is part of the ballast, from memory some ton and a half. The lower half of the centre board case is made from ½ inch steel; the hull plating from the keel to the chine bar is made of ¼ inch plate amidships with 3/16 inch at the ends. This is how the designer gave strength, weight and enough thickness to give security against corrosion, as well as bumps from whales or rocks or hard knobbly things. Topsides, deck and coamings are of 1/8 inch plate. This concentration of weight, low in the actual structure of the vessel has resulted in a self righting ability from a position where the mast has swung through 118 degrees or some 28 degrees past the 'mast horizontal.'

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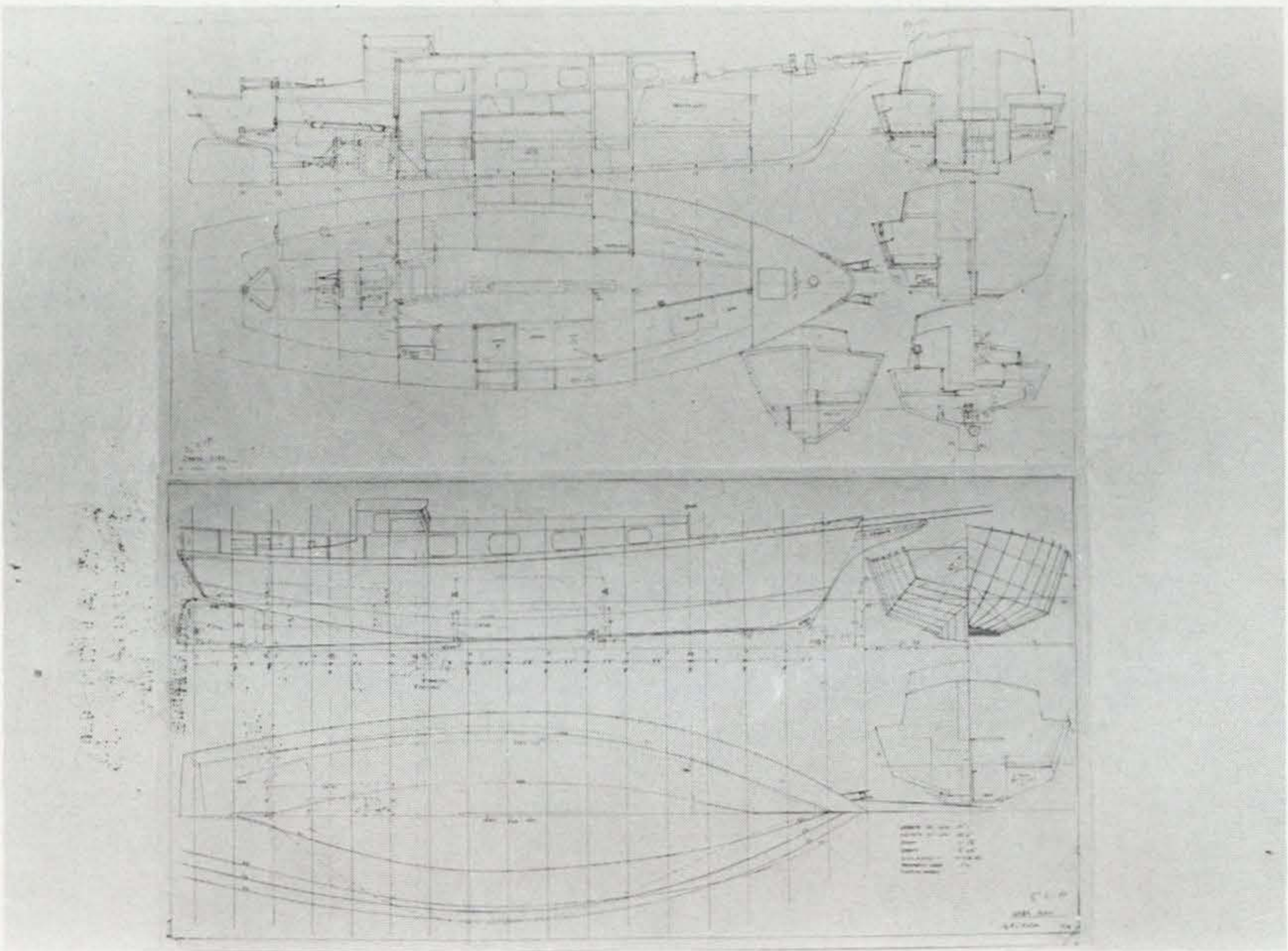

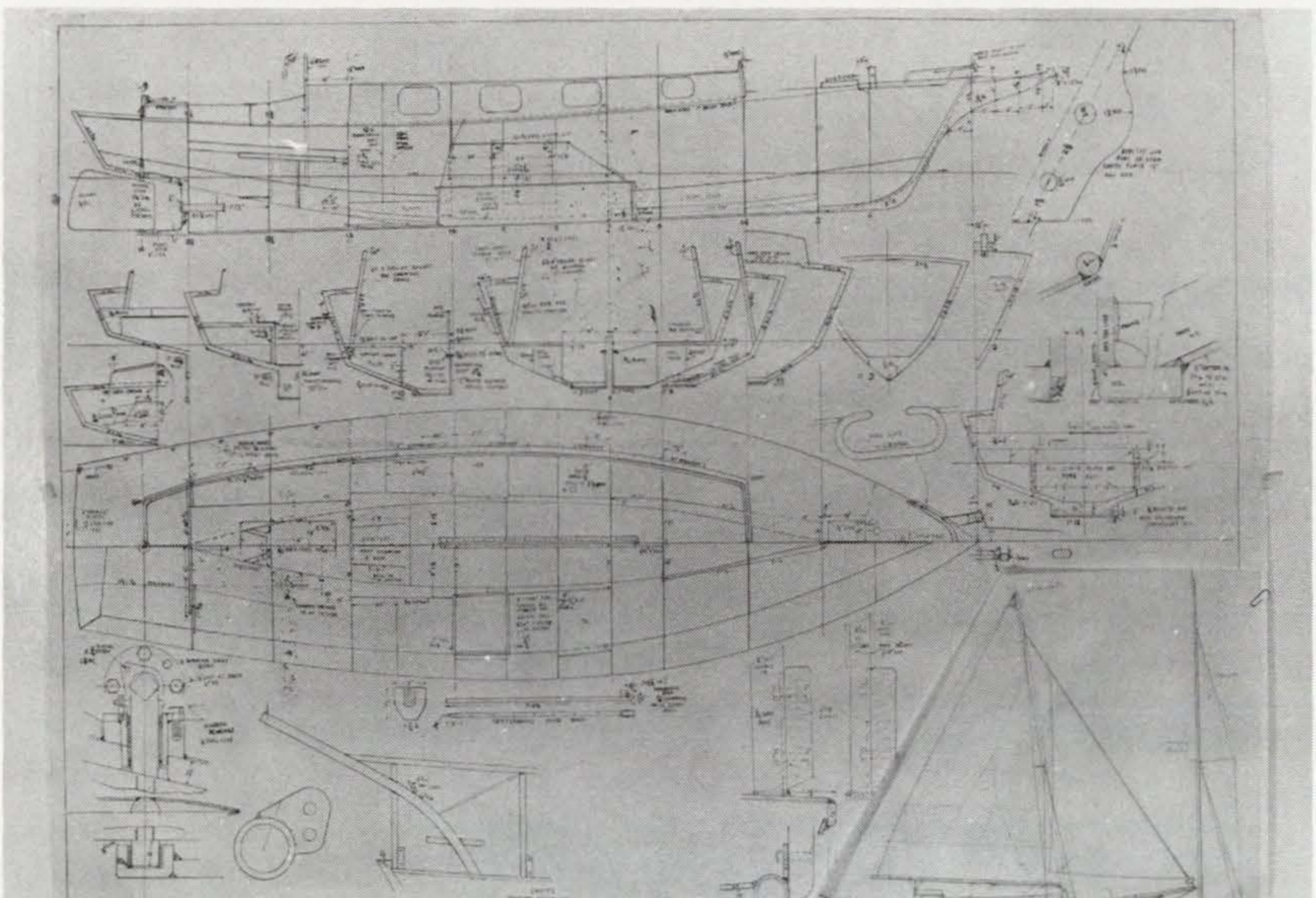

The sailing qualities of this hull are very good. It might be easier to list the bad points rather than the good, the good are so numerous. So the faults. The bow can be blown off very easily, so that coming up to the mooring to pick up the buoy is an opportunity to show your skill – if you have it. There is almost no control by the helmsman when going astern. On a still day with no wind or sea, it is possible to steer a chosen course in reverse; but only if there is plenty of sea room. Its not to be tried in a crowded anchorage, or in a close quarters situation; but reverse can be used to stop or slow down, or back out from a wharf. The bow can be stopped from blowing off so much, if the centre board is put down, or left down as you come up to the mooring buoy. I have not yet learned how to get control of the ship when in reverse. I think the answer may lie in having the centre board down and enough speed to let the rudder get a decent grip of the water. That sounds alright but nine tons of boat moving backwards NOT under full control needs judgement, cool nerves, lots of space, much practice and a good insurance policy – I have the insurance, I hope its good and am working on the others.

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It is not sensible to subject the rod bob stay, or its fittings to the bending strain when lying to the permanent moorings. The way this was overcome, was to fix the moorings to the stem at the base of the bob stays through a long hook on the end of a short piece of chain. The mooring chain is hauled up, the hook is put through the end link, then the mooring chain and long hook are lowered (by a rope to the eye of the hook) until the strain is taken by the short chain from the stem to the long hook, to the mooring chain. To cast off, the mooring chain is hauled on board with the buoy rope, the hook disconnected, (its then tied to the rail) and the mooring can be cast off and the buoy let go.

"Mary of York" will go about, jibe, tack, heave-to with the jib backed, or lie quietly in the water with all sail down. I have not tried to sail her with the jib alone; but she will sail very nicely under main alone. although there is a strong weather helm in a strong wind when no jib is used to balance the full main. She should be balanced with the double reefed main only.

When sailing to windward in a fresh breeze, if you look into the water at the fore foot, you can see quite a distinct vortex forming on the windward side, another vortex must form at the tip of the centre board, as a twisting line of bubbles can be seen through the water when you look over the stern. The trail of bubbles from the centre board is almost the same as the vortex you can see at the tip of the wings, as an airplane flies through moist air, or water vapour on the edge of a cloud.

The furling and reefing jib, that is set on a luff spar, which rotates on the fixed fore stay, makes setting or "dropping" the jib a pleasure; instead of having to go onto the fore deck and wrestle the flopping sail onto the deck, one has only to release the jib sheet and haul in on the furling line. Hey Presto, the sail is rolled up, out of harms way, and no sail bag to drag below. There is an "ultra violet ray stopper" sewn onto the exposed area of the jib, to save the terylene material from rotting, caused by sun light.

The designer suggested we have "lazy jacks" on the main sail, these are a very worthwhile addition; they allow you to let the main sail's halyard go, and the sail then falls into the lazy jacks, which hold the sail, in a bit of a mess, I'll admit, on top of the boom, where you can put a sail tie around it easily, rather than having to collect the sail off the coach roof, and while trying to hold the sail on the boom, get a tie around it, and stop the wind blowing the sail out of your arms. The rig allows one or two people, to get all sail off the ship and secured in a very short time, with little effort.

A.C. Atkinson, October, 1979

PORTSMOUTH NUMBERS AND BRUCE NO. X ROOT L.

by John Morwood

I was greatly impressed by Richard Boehmer's article in A.Y.R.S. No. 93, "SPEED SAILING" which showed that the best average daily sailing speed of any sailing vessels and yachts divided by the square root of the L.W.L. was linearly related to the Bruce Number (square root of the sail area divided by the cube root of the displacement).

It may be remembered that in A.Y.R.S. No. 89, "SAILING FACTS AND FIGURES" (October, 1977) I myself had analysed the speeds of miscellaneous dinghies and small yachts. For speed, I had used the inverse of the Portsmouth Numbers. Speed was then correlated with the square root of the L.W.L. and Bruce Numbers. The scatter of my points was wide but there was better correlation to Bruce Number than to the "Root L."

I therefore thought to multiply the Bruce Numbers of the same yachts and dinghies as before by the square roots of their "L's". I use "L" for sailing length because, where there are overhangs, the sailing length is between the L.W.L. and the L.O.A. The results would be graphed, as before, against the inverse of the Portsmouth Numbers.

THE METHOD

The book SAILING BOATS OF THE WORLD, edited by Rhoda Budd, was the source of information. Luckily, I had entered the Bruce Numbers and the square roots of "L" against each boat with a Portsmouth Number. This time, I tried a pocket calculator borrowed from my Grand-daughter, Lucy. I made as many errors with it as with old fashioned addition, but checked by both methods. I relied on it for multiplication and division.

RESULTS

The graph shows a much less spread of points than for simple Bruce Numbers. The flying Dutchman with its very large Bruce Number is way to the right while the 18 foot SKIFF is far off the page to the right.

All the conclusions of my previous article now seem to have become false, except for the fact that small boats are relatively slower than large ones.

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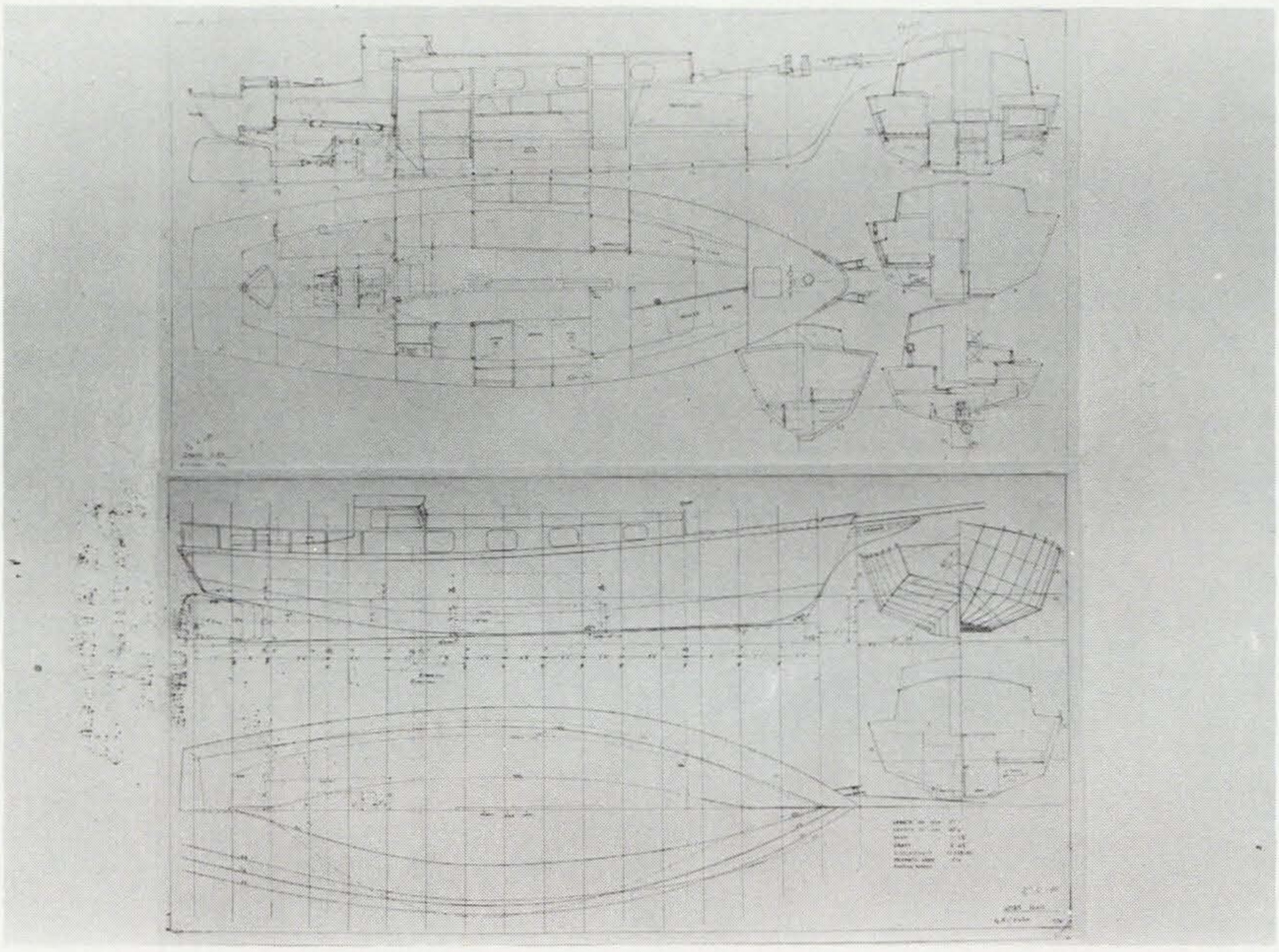

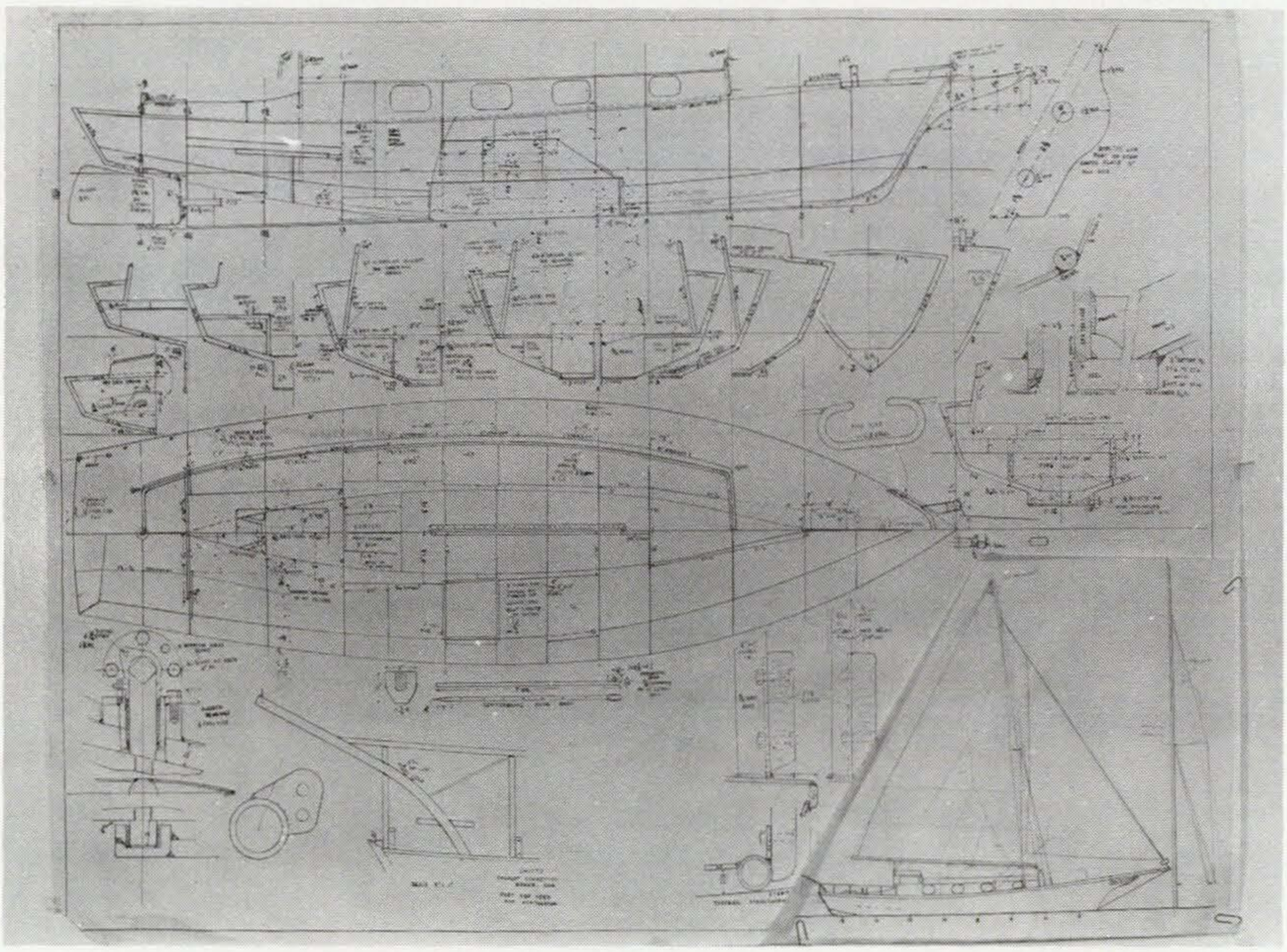

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"Mary of York" will go about, jibe, tack, heave-to with the jib backed, or lie quietly in the water with all sail down. I have not tried to sail her with the jib alone; but she will sail very nicely under main alone. although there is a strong weather helm in a strong wind when no jib is used to balance the full main. She should be balanced with the double reefed main only.

When sailing to windward in a fresh breeze, if you look into the water at the fore foot, you can see quite a distinct vortex forming on the windward side, another vortex must form at the tip of the centre board, as a twisting line of bubbles can be seen through the water when you look over the stern. The trail of bubbles from the centre board is almost the same as the vortex you can see at the tip of the wings, as an airplane flies through moist air, or water vapour on the edge of a cloud.

The furling and reefing jib, that is set on a luff spar, which rotates on the fixed fore stay, makes setting or "dropping" the jib a pleasure; instead of having to go onto the fore deck and wrestle the flopping sail onto the deck, one has only to release the jib sheet and haul in on the furling line. Hey Presto, the sail is rolled up, out of harms way, and no sail bag to drag below. There is an "ultra violet ray stopper" sewn onto the exposed area of the jib, to save the terylene material from rotting, caused by sun light.

The designer suggested we have "lazy jacks" on the main sail, these are a very worthwhile addition; they allow you to let the main sail's halyard go, and the sail then falls into the lazy jacks, which hold the sail, in a bit of a mess, I'll admit, on top of the boom, where you can put a sail tie around it easily, rather than having to collect the sail off the coach roof, and while trying to hold the sail on the boom, get a tie around it, and stop the wind blowing the sail out of your arms. The rig allows one or two people, to get all sail off the ship and secured in a very short time, with little effort.

A.C. Atkinson, October, 1979

PORTSMOUTH NUMBERS AND BRUCE NO. X ROOT L.

by John Morwood

I was greatly impressed by Richard Boehmer's article in A.Y.R.S. No. 93, "SPEED SAILING" which showed that the best average daily sailing speed of any sailing vessels and yachts divided by the square root of the L.W.L. was linearly related to the Bruce Number (square root of the sail area divided by the cube root of the displacement).

It may be remembered that in A.Y.R.S. No. 89, "SAILING FACTS AND FIGURES" (October, 1977) I myself had analysed the speeds of miscellaneous dinghies and small yachts. For speed, I had used the inverse of the Portsmouth Numbers. Speed was then correlated with the square root of the L.W.L. and Bruce Numbers. The scatter of my points was wide but there was better correlation to Bruce Number than to the "Root L."

I therefore thought to multiply the Bruce Numbers of the same yachts and dinghies as before by the square roots of their "L's". I use "L" for sailing length because, where there are overhangs, the sailing length is between the L.W.L. and the L.O.A. The results would be graphed, as before, against the inverse of the Portsmouth Numbers.

THE METHOD

The book SAILING BOATS OF THE WORLD, edited by Rhoda Budd, was the source of information. Luckily, I had entered the Bruce Numbers and the square roots of "L" against each boat with a Portsmouth Number. This time, I tried a pocket calculator borrowed from my Grand-daughter, Lucy. I made as many errors with it as with old fashioned addition, but checked by both methods. I relied on it for multiplication and division.

RESULTS

The graph shows a much less spread of points than for simple Bruce Numbers. The flying Dutchman with its very large Bruce Number is way to the right while the 18 foot SKIFF is far off the page to the right.

All the conclusions of my previous article now seem to have become false, except for the fact that small boats are relatively slower than large ones.

Either solving this equation where T is equal to 24 or by simply inspecting the accompanying plot, the extrapolated speed for 24 hours based on the other three runs is greater than that claimed by Keiper. Therefore, there should be no doubt that he sailed WILLIWAW 195 n. miles in one day.

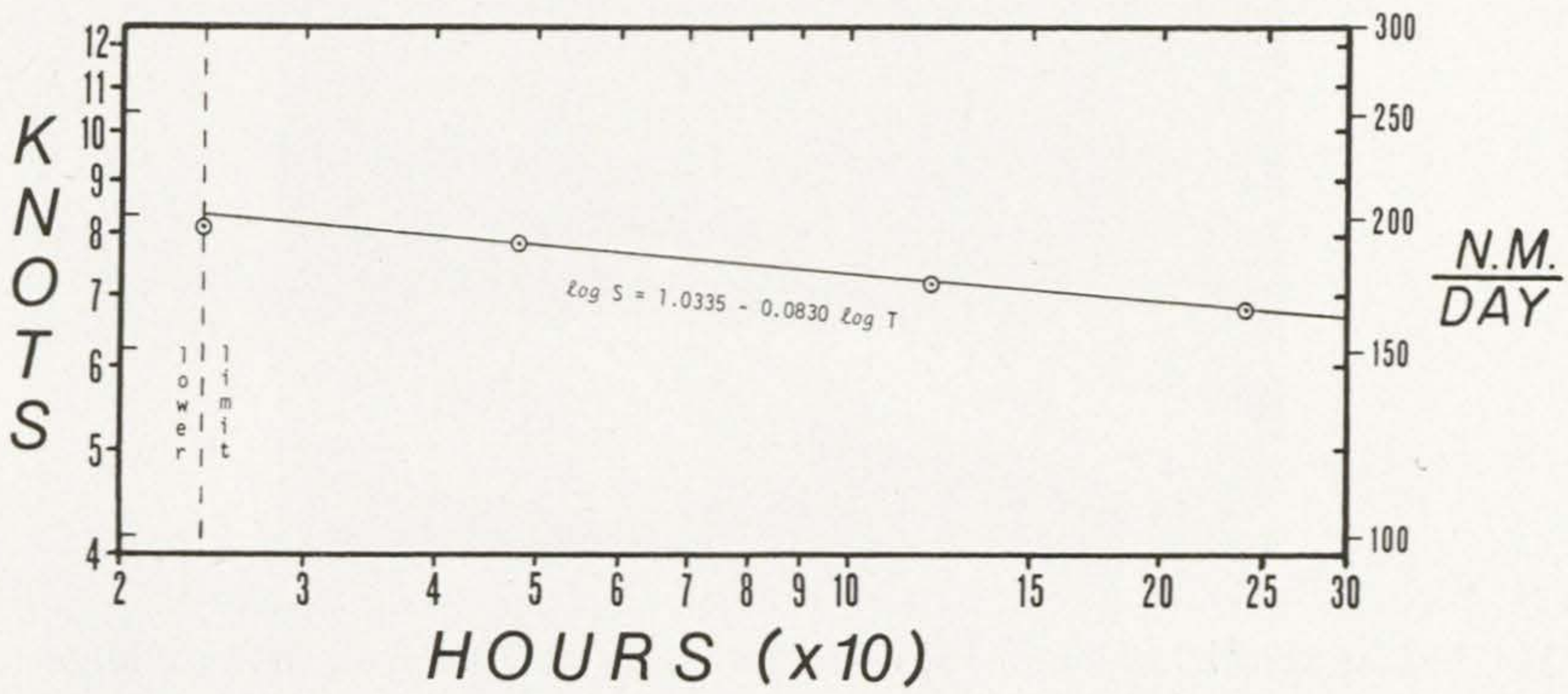
Considering WILLIWAW's length, sail area and weight and that she was sailed as described above, her performance (one day's run) is respectable. Knowing that WILLIWAW was David Keiper's first try at an ocean going, hydrofoiled sailing craft which was built with limited funds, I am looking forward to his next enterprise in hydrofoil sailing.

References:

1. "TREP analysis of CHAMPION OF THE SEAS' one day record run," Richard Boehmer, Sailing Facts and Figures, AYRS // 89, October, 1977, pp. 36 - 40; also in Nautical Research Jornal 24 : 2 June, 1978, pp. 69-71.

2. "Will a multihull ever break the clipper ship record?," Richard Boehmer, Multihulls, 3 : 4, Summer 1977, pp. 20 - 21.

3. "Analysis of sailing vessel performance ratios and their synthesis," Richard Boehmer, Speed Sailing, AYRS // 93, July 1979, pp. 31 - 41.



Letter from F. N. Potter,
The Willow, 116 Main Street, Burton Joyce, Nottingham. 12th Dec. 1978.

Dear Sirs,

AMPHIBIOUS SAILING

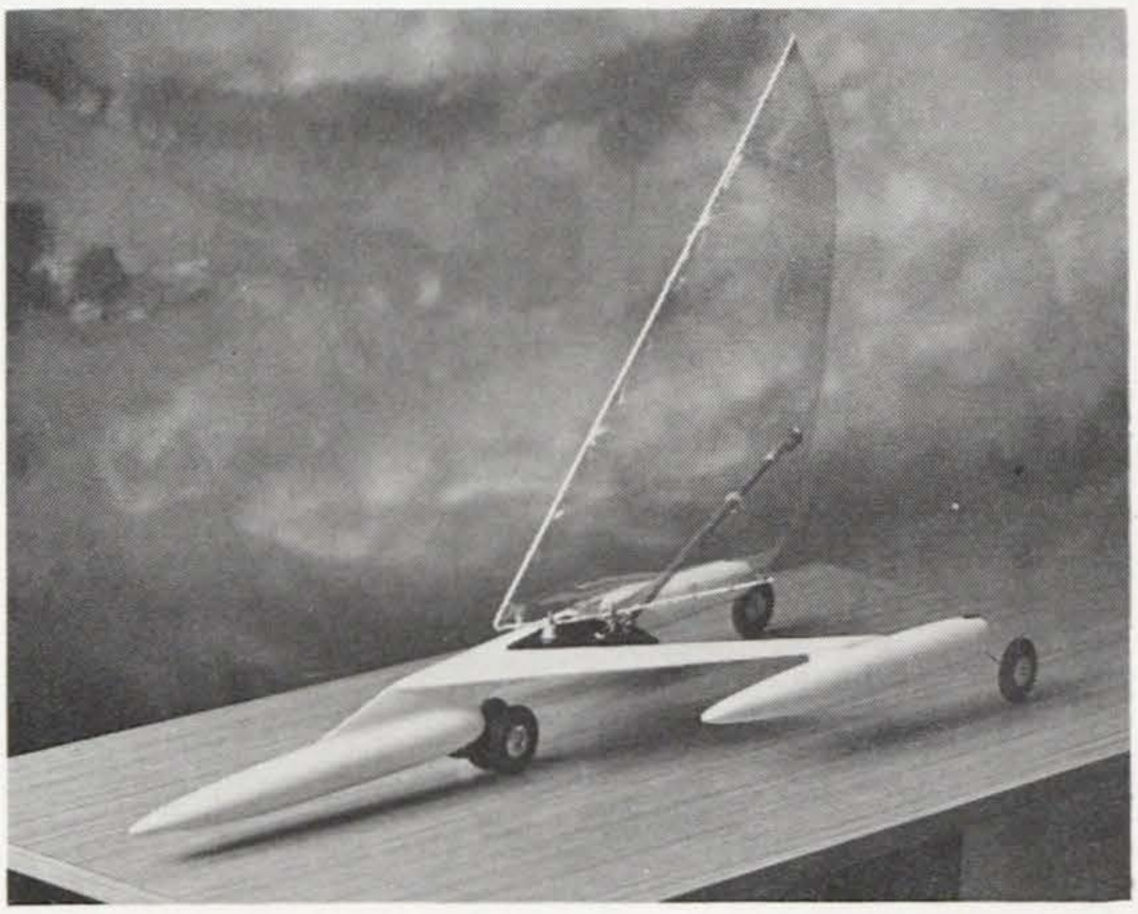
I have read the "Foiler" article with interest in November 'Yacht and Boat Owner' and I wonder if your Society would consider studying the exciting possibilities of amphibious sailing as a venture project.

Although the development work to date has been restricted to models, tests have proved most encouraging, i.e. approximately 20 mph on hard smooth sand and approximately 3 - 4 knots in water.

The models create a great deal of interest as water can be entered at very high speed from hard surfaces.

The amphibious yacht (Hotyot) is developed from the sailing machine, sharing the same trimaran hull; it has a self stabilising device and streamlined rubber wheels which also serve as efficient centreboards. A patent application has been made.

Yours faithfully, F. N. Potter.



Mr. Potter wrote again in February to report on trials of the amphibious craft using a windmill in place of the conventional sail.

During the course of the sailing machine development, it was realised that a lot of power was being lost at the airscrew with the catamaran layout. This was due to the hull pitching over the wave crests, as the main buoyancy area is situated approx. half way along the hulls.

The trimaran is much less effected by instability through waves due to nil buoyancy at the central longitudinal areas – the bow float cutting under the waves and the bow and stern floats straddling the crests.

SAVARONIUS ROTOR – SAIL COMPARISON

by Douglas Hannan
7 Lake Road, Huntington Station, N.Y. 11746 – 14th April, 1979

I was delighted to find on Page 6, titled EXPERIMENTS USING WINDMILLS TO PROPEL A MODEL CATAMARAN, a series of two photos, depicting my Savaronius Rotor sailing model as a follow up to Simon H. Sanderson's article (although not clearly noted as such). In any case, it was mentioned that the model had yet to be tested, infering that you might be interested in some further information and follow-up as to what were the results and conclusions.

Here it is (and if anyone is interested enough to enquire further, I will be glad to reply to their enquiries).

Firstly, the model shown in the A.Y.R.S. photos was an intermediate stage. It was built and tested in winter of '77 - '78 at a local marina until the ice closed the harbour. Hence the unusual white spotting shown in the photo is really snow falling as I took a photograph on the snow covered beach.

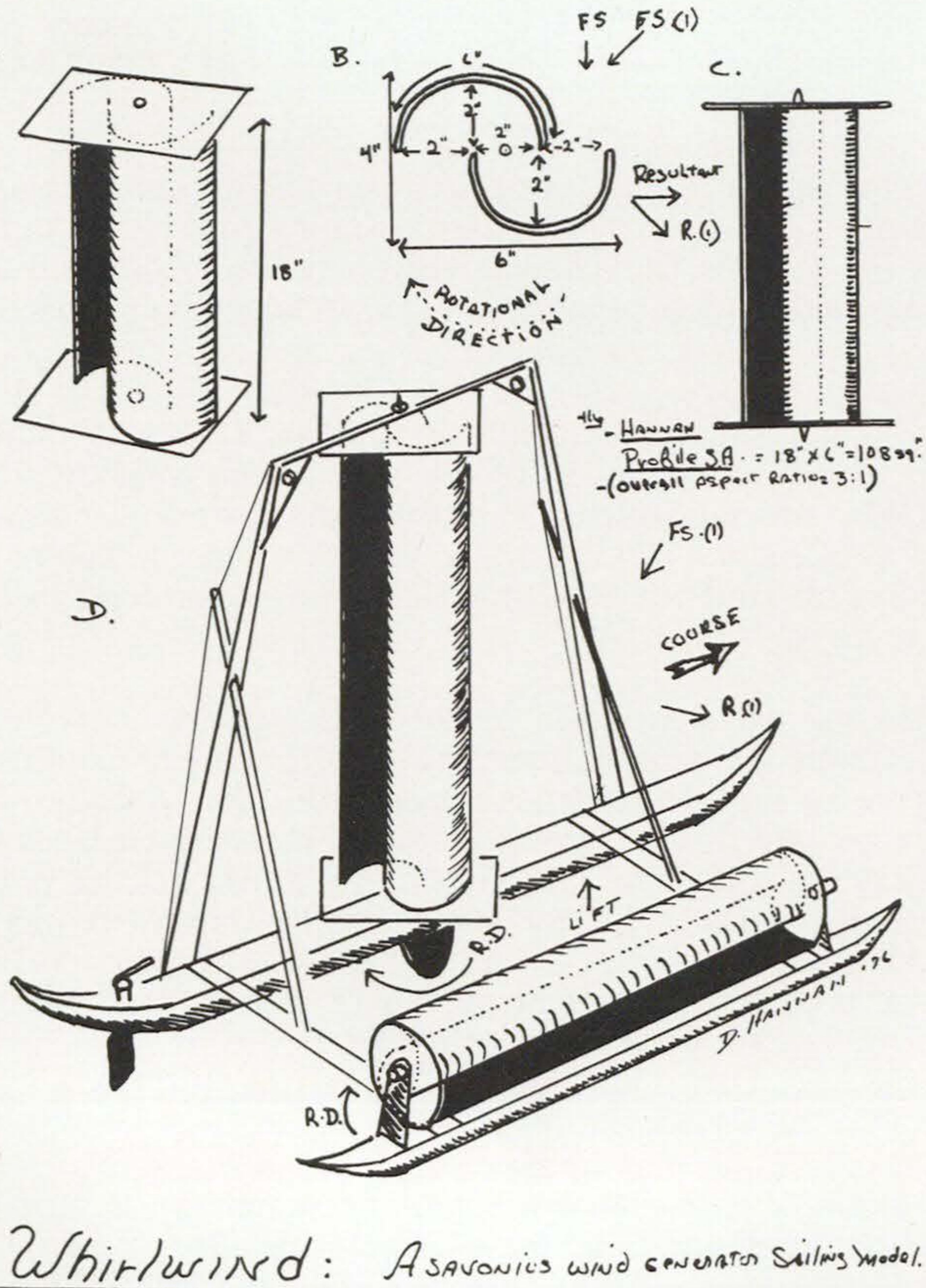
Specifications: Each individual curved section was 6 inches x 18 inches thin balsa wood (heated and formed under hot water, dried into shape and held in place with tacks. These were later removed after the shape had dried and glued to the end plate fences). The result was a semi-circle with a 2 inch radius (depth) and a 4 inch opening (diam.). The reason being that they had to overlap forming a 2 inch interconnecting passageway through which flowing air has to pass. The end plates and hulls were balsa, as were the rotor frame and Bruce foils (note: one had broken off when the photos were taken).

At this point you readers will note that I have not employed any elaborate calculations, but only the simplest basic maths. This is so that the reader may understand what the intent of the concept was and how it proved out when a model was constructed (following the proven A.Y.R.S. theory of design and construction . . .the K.I.S.S. method; better known as Keep It Simple, Stupid!). And the fact that I have no background in engineering, forces me to do so.

Aspect ratio and sail area would be the next question. How does one project and compile the various pressures and forces on to curved surfaces alternately swing into, through, and away from the wind, not to mention the interior passage of air. My first thought that it would cause my inexpensive pocket calculator to short out trying to unravel this mental hernia. Hence, I applied what is locally known as the Hannan Profile Technique (to find sail square area force on an inclined (heeled) surfaces) to this "S" curved surface. Each rotor vane presents a 18 inch x 4 inch profile. But they overlap so the overall project a Hannan Profile S.A. of 18 inches x 6 inches equalling 108 sq. inches. Individual aspect ratio per rotor is 4.5 : 1, but the overall ratio for the Hannan Profile is 3 : 1.

Sketch A shows the general configuration, Sketch B the internal vertical profile and Sketch C indicates the horizontal profile. Sketch D was a later test model (more advanced) that did away with the Bruce foiles on the leeward hull. It tried to utilise a horizontal rotor to create lift and counteract heel, as I have had difficulty with craft balance even with 2 Bruce foils as the pressures weren't always equal (not controllable, at least for me anyway). Hence the standard centreboard rudder. No fancy stuff this time. I was trying to not cure all my problems at once. I only wish to see if a Sav. Rotor was a viable means of wind propulsion; competitive with a standard sail.

To those of you not familiar with a Savaronius Rotor. It was invented in the early 20th Century. An advance over the Flettner Rotor in that it was self-starting. Perhaps the vessel built with multiple flettner rotors might have performed even better if half of their height were an incorporated Savaronius rotor. But I digress. The principle is the same as throwing a curve ball; be it a hard ball, or more controllable ping pong ball. The Spinning side into the direction of the wind encounters resistance and builds up pressure. The side spinning away helps the wind slip by more easily with diminished pressure. The result is a force at right angles to the wind from the high pressure side toward the low pressure side. Hence a ball curves when thrown (not counting the effects of gravity that can be made to even enhance a predetermined curve.



Whirlwind: A Savonius wind generator Sailing model.

This same effect can drive a land or water vehicle forward (providing there is lateral resistance be it a wheel or a centreboard).

My final conclusion from my one direction model were the following:–

It could point nearly as well as standard model. (Jib plus main on catamaran).

From dead in the water, it had a tendency to slip backward until the rotor spun fast enough to generate forward thrust.

It would go on a broad reach like a bat out of hell; but it always threatened to self disintegrate when the rotor approached apparent wind speed, and heavier materials defeat its purpose in competition with just a light mast and sail.

A major problem was that there is no way to reef and a brake has to be used to slow the rotor down . . . and it progresses backwards because one can't just let the "sail" out and flap about.

I had hoped for a major efficiency in light airs, but that is when its efficiency is at its lowest.

A scaled up, full blown boat would have problems transporting and mounting the rotor.

Conclusion: It is an interesting, eye catching alternative to the modern sail, but in no way is it as versatile. Just changing tacks and rotating the rotor would be a major job in itself, unless you just want to sail the boat across the lake and sell it to an unwary purchaser who, would have to wait until the wind swung around 180 degrees.

Yours sincerely, Douglas Oliver Hannan.

"AQUAIR 50" ALTERNATOR

Letter from Dr. Tim Dalay
6 Shears Court, West Mersea, Essex. – December, 1979.

Having just read your May '79 Newsletter, I noticed a request for information on electricity generators on boats. I now have some practical experience to pass on.

I acquired an "Aquair 50" alternator unit (from David Jolly, Little Russel, Lytchett Minster, Poole BH16 6JD, England) prior to setting off on the "North Atlantic Circular route" (a Caribbean cruise) having a typical unreliable boat engine and a single battery in "Coot of the North" a "Pioneer 9 metre."

The "Aquair 50" proved its worth. Many a time the battery was flattened attempting to start the engine – so all we had to do was go for a sail to charge the battery enough – then hey presto!

We found that we only had to use the unit about half the cruising time, as it produced an excess of electricity to our requirements (which consisted of v.h.f. radio-telephone, boat electrics, navigation lights every night, interior lights, soldering iron and engine starting). The alternator unit, well protected in its casing, was slung from the stern rail with a 20 metre warp and water turbine unit on the end. We found it started generating at 2½ knots or 12 volts, ½ amp at 3 knots, 2 amps at 4 knots and 3 amps plus at 5 knots. Its rated maximum is 50 watts.

To retrieve (every few days) one slowed the boat down until it was just turning then hauled it in. (If one tried at speed there was one hell of a tangle!) Re-launching was a simple matter in any conditions. We don't believe it slowed us down at all, from experiments we made. When surging at 8 plus knots down the trade wind swell it occasionally jumped out of the water spectacularly. We sailed 2,800 nautical miles trade wind crossing in just 21 days – not bad for 24 ft. waterline boat with 10 year old sails!

I also acquired the wind adaption to "Aquair 50", which we used when at anchor – attaching to the main halyard and slung from the backstay with a tripod rope base to stop it swinging as the boat moved. This didn't start working unless the wind was force 3 but with force 4 – 5 trade winds was averaging 3 amps at 12 volts removing the need to start noisy, smelly engines.

Unfortunately on the return in mid-Atlantic the warp fouled itself under the Aries self steering one dark night when the boat reversed while hove-to. This wasn't noticed, so unfortunately wore through Ugh! – then it was back to using the engine on alternate days. (The percentage of Aries self steering increases the further South one goes – confirming their reliability!).

We met a few other boats with "Aquair 50's" who all seemed equally pleased with it, although one stopped temporarily after water gained entry during a cold shower. After 8,000 miles sailing, before we lost the turbine, the bearings were just starting to become noisy – but showed no play, perhaps I should have greased them more often. It was suggested that sharks would attack it – but have heard of no such problems. I'm sure it would act like a giant mincer, actually.

A satisfactory solution to the problem of continuous wind powered electricity generation is used by the infamous Donald Street (Grenada waters) he uses a similar alternator to the "Ampair 50" permanently fixed to the mizzen of his ketch – thereby supplying all the electricity needs of the boat he lives on without the need for an engine.

I would conclude that the "Aquair 50" or similar device is an essential item for long distance cruising boats.

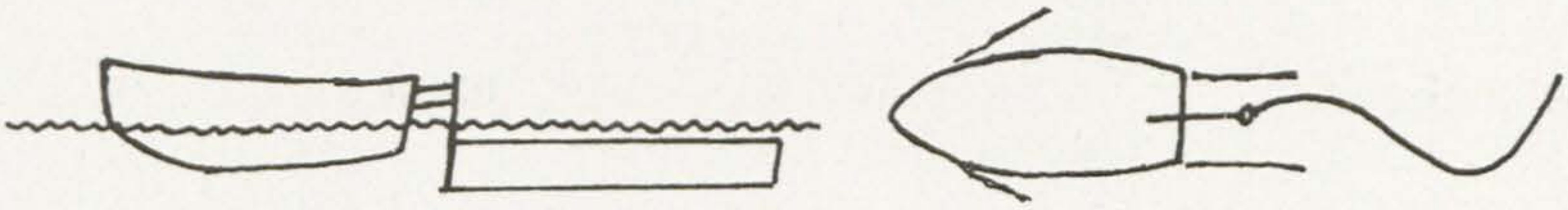
PROPULSIVE RUDDERS

Letter from Theodor Schmidt

Engelgasse 28, CH-4052 Basle, Switzerland, December, 1979.

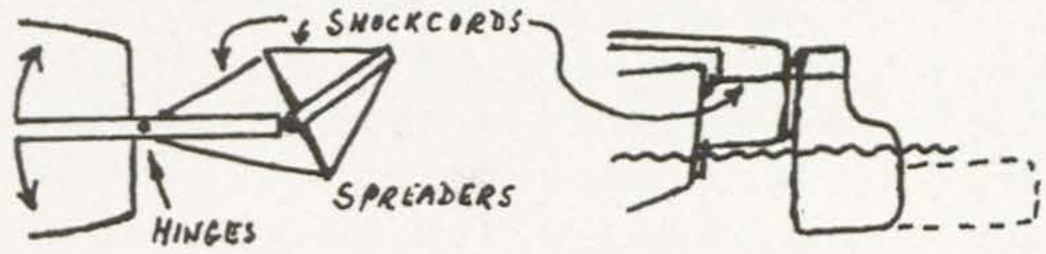
Theory suggests high efficiencies for flapping propulsion, birds and fish prove it. Slow fish have low aspect ratio fins which move in complete waves; fast fish have high aspect ratio fins which just beat back and forth (e.g. sharks, whales).

Boats, being slow unless vast power is available, would need a long bendy and "wavy" rudder for propulsion:



Model tests made in Berlin 10 years ago showed efficiencies up to 80% using spring steel, but this shape is difficult for seagoing boats; in contrast a sculling oar is more seaworthy, but is inefficient (unless you can scull at 10 knots!).

My rudder is a compromise:



It gives enough thrust to tack easily or about 1 - 2 knots in a dead calm, which is quite poor. With an extended flexible part thrust is greater but the boat unmanagable.

This seems to be an area which is difficult with technical materials but successful with living tissue, like flapping flight.

SELF-GYBING DAGGER BOARD

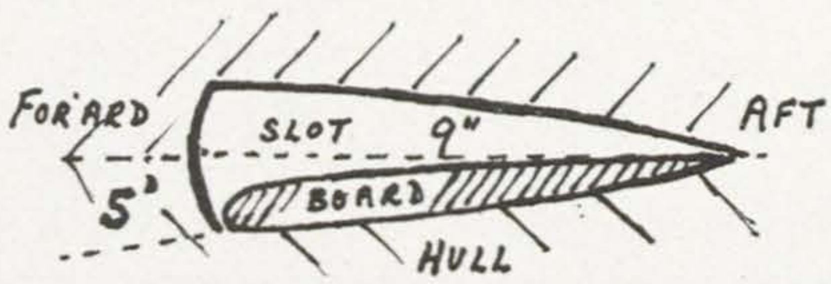
from Ken May
Brook House, Middle Street, Salisbury, November, 1979.

I have made a small self-gybing dagger board (i.e. a vertical foil) on "Kiki" this year. Gave 5 degrees offset on each tack and it certainly seemed to do away with leeway and made a most enjoyable boat to sail.

The gap in the slot has to be filled with a plug if going fast because of course, a fountain shoots up otherwise. (4 to 5 feet high at 17 knots).

Editors notes:
Ken is well known to members as the organiser of past meetings in Poole harbour, we hope that he will be able to do this for us again in 1981.

Edmond Bruce wrote about board shapes and sizes, refer to publication 82 (Design for Fast Sailing) page 65.



MULTIHULL UPSETS

from Slade Penoyre
Little Pond, Kennel Lane, Windelsham, Surrey.

Dear Michael,

I am writing to disagree with your implication (October news) that the blame for the continuing (capsize) tragedies lies only with the people who own and sail multihulls because for petty reasons they refuse to make inexpensive alterations. I'm sure the blame must be shared both by the commercial multihull builders and by the racing rule makers.

One searches in vain through the builders glossy brochures and so-called extra lists for any mention that escape hatches are either desirable or available for their designs, and I've never heard of a demonstration boat being fitted with one. Doubtless the builders reply would be that they can only offer what their customers want and are prepared to pay for, and that watertight escape hatches set low enough in the boat to be above the capsized waterline and which can be opened from inside or outside without tools will not be cheap.

I feel the solution must start with the racing rule makers. For years, M.O.C.R.A. and A.Y.R.S. have been recommending the use of escape hatches etc., but clearly this has not influenced owners much. The simple answer would be to insist that an escape hatch (or two for catamarans) MUST be fitted if the boat is to be rated or accepted as an entry in races.

This may be considered as too restrictive, and a more palatable alternative may be to give a large rating advantage to boats fitted with escape hatches, on the same lines as, but bigger than, the spinnaker allowance. The aim would be to persuade the owner that he would improve his racing results more by having a hatch than by getting a new sail or instrument of similar cost. Provided the rating calculations for all boats are published as they should be, this would put reluctant owners in a difficult position with their crews.

The requirements for carrying a sea anchor could easily be added to the existing ground tackle rule, although one would feel happier about this if there is evidence that lying to a sea anchor actually is the best way of dealing with storms in multihulls. Has A.Y.R.S. got this evidence or is it just being proposed because no-one has really tried it and the alternatives which have been tried (lying ahull, running before) do not work?

EXTENSION = IMPROVEMENT

Extracts from a letter from M. B. Scutt
8 Laverockhall, Lanark, Scotland, 8th May, 1979.

The extension to the stern of my 'Telstar' (26 foot), has been completed despite delays due to arctic conditions, she was re-launched last weekend.

We completed the first thirty mile race on Sunday, and are delighted with the improvement, we took line honours despite early problems.

The water flow has improved considerably, but the principal benefit so far seems to be a reduction in pitching, the Irish Sea particularly at our end (Solway Firth) is plagued by short seas. Our main rival, a very competitively sailed 'E' boat has always romped away from us to windward in these conditions. This time, we sailed the two fetches a total distance of 19 miles a half hour quicker than her, and pitching never lasted more than two cycles.

Regarding other points, we have carried a washboard since your '1,000 miles by Telstar' article (Airs 11), we have also raised the cockpit floor by nearly six inches, and incorporated a dinghy type drain flat as a panic measure (this has also improved stowage).

We are gallantly attempting to comply with the new M.O.C.R.A. guidelines. We hope to do the Clyde Cruising Club 'Blue Water Race' to Cork.

AVIS a MM les VOYAGEURs: How to Make a Fast Barque

by Stephen Robbins
Bodsbeck, Broughton, Biggar ML12 6HQ.

1) Give it plenty of canvas, in as few sailplaces as you can manage.

2) Make it easy to 'bend' the sail under way, i.e. to vary its camber with windspeed.

3) Make the sail tunable under way, either side of zero helm – this obviates the draggy, snappy rudder (you steer by varying the helm) plus self-steering gear.

4) Have retracting bilge keels – pump mercury ballast between them, so that on the wind the (light) ballast is all to weather – this obviates heel, if not roll.

5) Keep the skin continually unfouled, with an ultrasound antifouling device (they exist), powered by a windwheel (they too exist!).

6) Have a well-rounded hull, to lessen wetted area, plus for strength the asymmetric ballast will give stiffness, plus;

7) Make it easy to reef, easy to keep the sail no smaller than it need be. Also;

8) Co-sinusoidal waterlines like a fattened canoe, no draggy transom, no heavy quarters.

9) No draggy skin fittings (have an utterly chemical toilet, a cockpit shin-well only, drained through hoses over the gunwales), plus;

10) Fit no engine – with a craft this slippery in slow wind, you don't need one, plus a craft this light (say 9,000 LOA) you can ROW, already.

Yours, Stephen Robbins.

THE SUN, MOON, TIDES AND GRAVITY

by Ken May
Brook House, Middle Street, Salisbury, Wilts.

John Morwood has been doing some dowsing research. Basically, this is to see if he can find out the physical principles on which it is based (in which I wish him luck). He also believes that dowsing may have been used in pre-historic times not only as a compass but also as a navigational method. John became confused about the figures relating to the sun's and moon's influence on the earth, the moon having the greater influence on dowsing, apparently. As a result, I dug out the following figures which John has asked me to publish, because of their relevance to the tides. They may also be relevant to dowsing but that is another matter.

Firstly, the figures, using metres (m) and kilogrammes (kg) and treating the bodies as homogenous spheres which is good enough here:–

	Radius (m)	Density (water = 1)	Mass (kg.)	Mass rel. to earth	Distance to earth (m)
Sun	6.96×10^8	1.41	2×10^{30}	3.32×10^5	1.50×10^{11} ratio
Moon	1.74×10^6	3.33	7.3×10^{22}	1.23×10^{-2}	3.85×10^8 = 389/1
Earth	6.4×10^6	5.52	5.9×10^{24}	1	–

The ratio of the sun's mass to the moon's mass is 2.7×10^7.

Newton's Law:

The gravitational attraction between two bodies of mass M_1 and M_2 is: $G.M_1M_2/r^2$ where G is the universal gravitational constant (roughly 6.7×10^{-11} Newtons $m^2\ kg^{-2}$ or $m^3\ kg^{-1}\ sec^{-2}$) and r, the distance between them.

Applying this to the above, we find that the sun's gravitational pull on the earth is 178 times that of the moon.

The Tides:

Considering the relative tidal forces of the sun and the moon on the spinning earth, it is the RATE OF CHANGE of the gravitational force with distance that matters, as a fixed point on the earth's surface varies its distance from the heavenly body, due to rotation. Now, as stated above, at a distance from a mass M, intensity of its gravitational field $L_g = G.M/r^2$, and, using calculus notation, the rate of change of this with distance is $d(I_G)/dr$ which is equal to $-2GM/r^3$. Thus, the RATE OF CHANGE is proportional to the inverse cube of the distance.

Applying this to the figures from the table, we have:–

$$\text{The ratio} \quad \frac{\text{Moon's tidal effect}}{\text{Sun's tidal effect}} = \frac{389^3}{2.7 \times 10^7} = 2.2$$

So, the moon has more than twice the effect of the sun on the tides.

THE MOON'S AND THE EARTH'S SURFACE GRAVITY

A solid sphere's gravity acts as if the mass concentrated at its centre. Therefore, the gravitational pull is proportional to 1/ (distance from the centre)^2. The moon's surface is 1,74 x 10^6 metres from its centre while the earth's surface is 6.4 x 10^6 metres from the centre, i.e., 3.68 times further away from the c. of g. The moon's mass is 1/81 that of the earth and hence the ratio of the surface gravities is:

$$\frac{3.68^2}{81} = 1/6, \text{approximately.}$$

LIFERAFT – DINGHY

from Practical Boat Owner
West Quay Road, Poole, Dorset, June 1979.

Dear Mike,

My reason for writing is my interest in your proposed liferaft dinghy. This seems to me to be the right approach.

Some years ago, I made an abortive attempt to persuade the McClelan Rubber Company to produce inflatable fenders for rigid dinghies.

Do you know their Se-Este boat rollers? They are a wonderful aid for getting a dinghy up or down a beach. They also make excellent fenders or buoyancy bags. If desperate, you could even tie one round your chest! The rollers are only about three feet long, but they are actually available on the market, and can be stuffed into a canvass sausage skin to make something longer. That arrangement would not be rigid and if rigidity were essential, then the boat hook, spinnaker hook, spinnaker pole, mast or dinghy from sailing rig or the like, might be pressed into service. (Such things are possibilities, provided that the owner re-hearses the assembly beforehand and knows exactly what he is going to do when the time comes.

Going back to my discussion with McClelan some years ago, I still believe that an all-round inflatable cuff of five or six inches in diameter would be a valuable addition to the typical yacht's tender. Apart from providing desirable tendering, it would make a very large improvement to stability (much needed in some of these little boats) and would add a very great increment of reserve buoyancy in case of swamping.

The practical problems are not inconsiderable, they all centre upon a good means of attachment that is not so easy as it may look at first sight when you are dealing with a semi-rigid cylinder.

Nevertheless, I think that the general idea would be worth pursuing. After all, inflatable boat designers have gone over to rigid bottoms and that perhaps is a sign that rigid dinghies might benefit from inflatable top's

WIND VELOCITY GRADIENT AND SAIL TWIST

by

K. R. May

When wind blows across a surface, frictional drag slows down the air in the vicinity of the surface. The resulting increase in velocity with distance from the surface is known as the "Wind Velocity Gradient" (VG). The magnitude of the gradient in the lower 100 feet, say, depends on the roughness of the surface and the small-scale turbulence of the air. The latter depends largely on the variation of temperature with height. When there is an "inversion" with warm air overlying cool air which often occurs on quiet evenings, the atmosphere is very stable and the velocity gradient near the surface is at its greatest. This is especially so over water when it is cooler than the air. Conversely, if we have a relatively warm sea, there is a lot of turbulent air mixing and a small average velocity gradient.

If the wind at the masthead has a higher velocity than at boom height without any change in direction, it is obvious that the APPARENT wind direction on the sails of a moving boat will vary over the sail height. The upper wind will come from more aft. The question then is how great this difference in direction can be and how important it is in sail twist control for 'Una' rigs (Foresails have a profoundly modifying effect).

I have discussed all the above points with an expert meteorological colleague, Dr. Nigel Thompson. He pointed out that if one is given all the many relevant factors controlling the gradient in any particular case, actual values of the gradient can be calculated. However, as conditions in the near-surface air are constantly changing and all the necessary information is not normally available, it is futile to try to make precise calculations of gradient effects. We concluded that, for yachts with mast heights in the 15 feet to 50 foot range, the ratio of the true wind velocity at the masthead V_{Head} to that at boom level V_{Boom} would rarely be outside the range 1.2 to 1.5. The higher value would apply to a tall mast in large gradient conditions.

To examine the effect of this range of V_{Head}/V_{Boom} for fast and medium speed boats on various courses, we merely need to solve the well known vector triangles (via scientific calculator or graphically) for a few standardised conditions. I used Vb/Vt of 2.0, 1.0 and 0.5 and V_{head} to V_{Boom} velocity ratios of 1.2 and 1.5. The results are in the table, rounded off to the nearest degree.

"Speed Ratio" Vb/Vt	β	Angular difference between apparent wind direction at mast head and beam $V_{Head}/V_{Boom} = 1.2$	$V_{Head}/V_{Boom} = 1.5$
0.5	45^{o} (Approx. Vmg	2^{o}	4^{o}
1.0	,, maximum)	2^{o}	5^{o}

"Speed Ratio" Vb/Vt	β	Angular difference between apparent wind direction at mast head and beam: V_{Head}/V_{Boom} = 1.2	V_{Head}/V_{Boom} = 1.5
0.5	60° (Close reach)	2.5°	5°
1.0	,,	3°	7°
2.0	,,	3°	9°
0.5	90° (Beam reach)	4°	8°
1.0	,,	5°	11°
2.0	,,	4°	10°
1.0	120° (Approx. max. speed)	9°	19°
2.0	,,	7°	16°
1.0	150° (Tacking downoind)	12°	37°
1.5	,,	14°	37°
2.0	,,	8°	24°

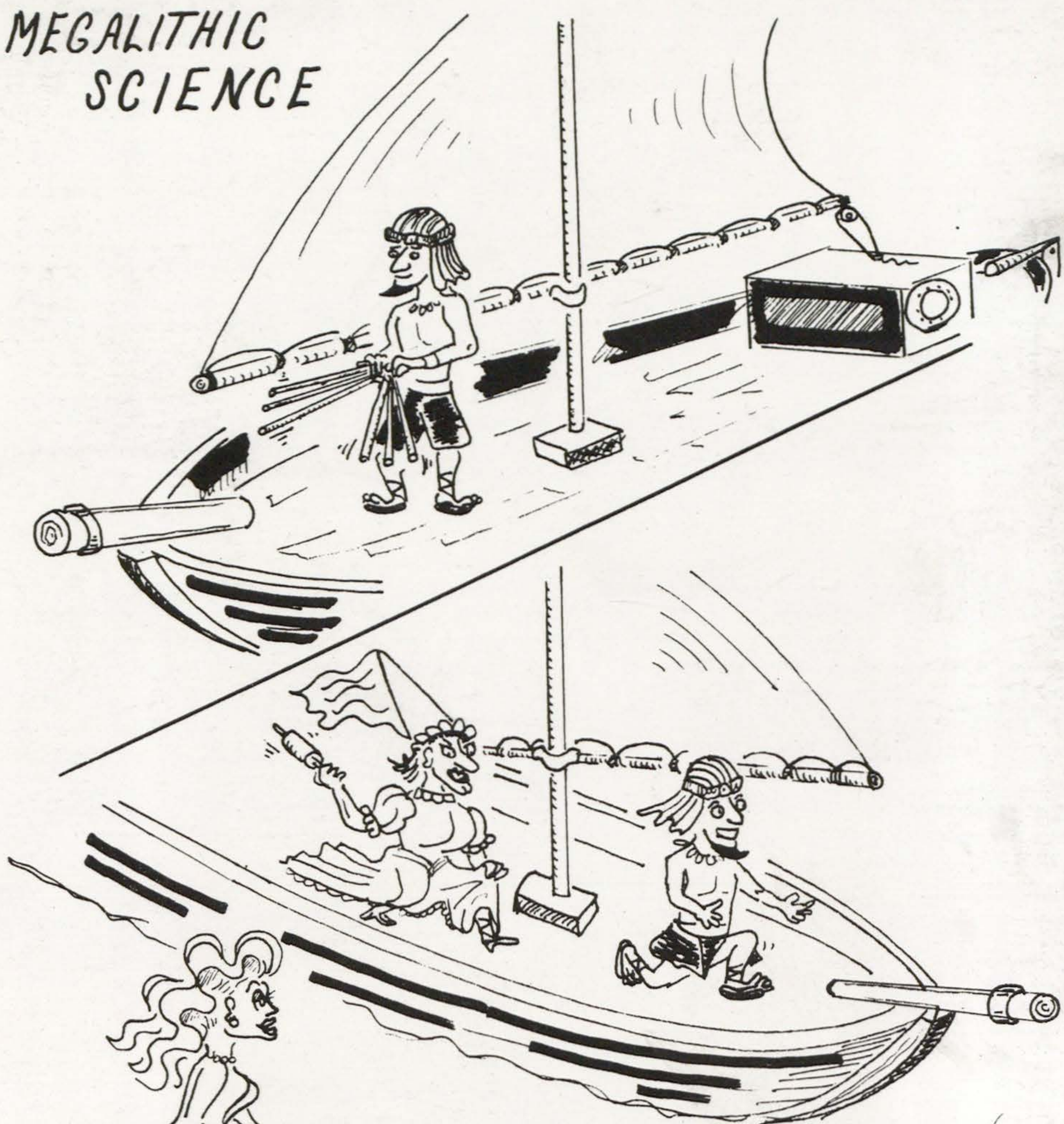
In the table, the boats are sheeted well in. In a very free or ordinary downwind course, the VG is of no concern. In interpreting the right hand columns, it should be remembered that, since the angle of the 'plane' of the sail roughly bisects the angle between the apparent wind and the fore-and-aft line of the boat, the sail twist required to accomodate the figures perfectly will be HALF the angles listed.

Soft sails have a twist well in excess of the values indicated here. That for a well tuned 6 metre yacht was measured at 15° when close hauled in 1955. Thus, the velocity gradient is really of little concern to your average 'slow' soft-sailed boat. Even if twist is reduced to the minimum possible, it will still be likely to be too much.

By contrast, a wingsail sailing machine, doing a "Speed ratio" (Vb/Vt) more than 2.0 on a course with beta of 90° or 120°, could have efficiency or stalling problems over parts of the sail. It might then pay to have built-in or controllable twist. The meterological conditions could be studied and wind vanes at the bow and masthead might be of value.

The high values of angular difference when tacking downwind are because of the huge shifts is apparent wind direction which arise. Ice yachts, however, never use twisted sails even in these conditions because of the dead smooth ice surface; the generally low rigs and the enormous "Speed ratios" (Vb/Vt's).

Ed. For rough estimates of the wind velocity gradient, some people have used the formula V X $\text{Height}^{1/7}$ which they think is a useful approximation. This does not give the same figure as V_{Head}/V_{Boom} because booms are usually well above water level, the datum for VG.



"NAVIGATIONAL ERROR"... my Foot!

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