SAILS 1960

A.Y.R.S. PUBLICATION No. 33

Biplane Rig—Manlio Guberti-Helfrich

CONTENTS

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EDITORIAL

October, 1960

The Annual Subscription to the A.Y.R.S. is now due. It is still £1 or 3.50. As opposed to last year when a heart-felt appeal was made for prompt action in this respect, this year we will content ourselves with merely urging early attention to this small matter.

So far, no one has been found to take over the Editing of the A.Y.R.S. publications or even help with this. I am prepared to carry on with all this work for some time but, as agreed at the last British A.G.M., the publications will be reduced to four in number but of about 60 or so pages, as compared to the 44 or so at present. This summer, I have been generally behind with the A.Y.R.S. correspondence as well as losing the perpetual battle with the luscious vegetable growth of my garden and woods. As I seem to do nothing but work, certain necessary planning for the A.Y.R.S. is becoming difficult, especially as we hope to introduce more technical matter in our publications from now on. Naturally, I don't mind the loss of leisure or the practical sailing as long as we are making such excellent progress. But there are about three medical research projects I want to get on with, which have been shelved for some years and also there is the wind tunnel to build and get working. The days just aren't long enough.

Again, as usual, it is requested that if anyone has had a misbound or faulty copy of a publication or has not had his full six, will he let me know.

It is hoped that all back publications of the A.Y.R.S. will be in print by the time this publication comes out or shortly afterwards.

Publications for this coming year will be *Ocean Trimarans*, *Multihulls*, 1960, *Sailing Aerodynamics* and another one which may be on sails or hulls. *Ocean Trimarans* will describe Arthur Piver's crossing of the Altantic and a Pacific cruise in a 24 foot *Nugget*. Other ocean-going craft may be described with perhaps a summary of our efforts so far in producing the " Perfect Yacht."

Sailing Aerodynamics. One of the faults of the A.Y.R.S. is that, while we can get any opinion we want on either the construction or the design of boats, whether conventional or multihulled, we have not built up the same number of people to whom we can turn for opinions of yachting theory. So far, I have articles by E. M. Dowlen and

Fin Utne on sailing theory of a more advanced type while I can write a more elementary article myself as an introduction. However, we need more contributors in this field as well as people who will give us accounts of previous work such as that of Crosseck, Barkla and others. Perhaps, anyone who is willing to help along these lines would be kind enough to send in his observations.

We should now begin to collect a list of published references for *Sailing Aerodynamics* and tank tests. The following list is taken from Hugh Barkla's list of his recent paper : (1) Davidson, K. S. M. : Trans. S.N.A.M.E., 1936, p. 288 ; (2) Curry, M., *Aerodynamics of Yacht Racing* (1930) ; (3) Experimental Towing Tank, Stevens Institute of Technology, Technical Memorandum No. 55 ; (4) Tanner, T.: J. R., *Aero. Soc.*, Vol. 34, 4 (1930); (5) Fairey, C. R., *Aeronautics*, Sept., 1939 ; (6) Warner, E. P. and Ober, S., Trans. S.N.A.M.E., 1925 ; (7) E.T.T., Stevens Inst., T.M. 17 ; (8) Crewe, P. R., Trans. I.N.A., 1958, p. 89 ; (9) Zimmerman, C. H., N.A.C.A., Report No. 431. ; (10) Barkla, H. M., Trans. I.N.A., 1951, p. 235 ; (11) Barkla, H. M., Paper No. 7 of the Association of Northern Universities Sailing Clubs ; (12) E.T.T., Stevens Institute, T.M. 16 ; (13) Allan, J. F., Doust, D. J. and Ware, B. E., Trans. I.N.A., 1957, p. 136 ; (14) E.T.T., T.M. 10 ; (15) Phillips-Birt, D., Trans. I.N.A., 1958, p. 79.

Other references will be published when received.

The 1961 *London Boat Show.* For the fifth successive year, a stand has been booked. The Boat Show runs from January 4th till the 14th, 1961. Our stand number has not been allocated, but we are on the first floor. The British A.G.M. will again be held on the first Saturday, the 7th and it will presumably start at 11 a.m. as in other years. The arrangements have not yet been made but, as the next publication may not be sent out before January, the announcement has to be made in this publication.

Mrs. Morwood will again be manning the stand on her own and offers of help will be much appreciated. I shall be present on the Tuesdays and Saturdays in the afternoons.

Dan Campau's Trimaran. The main hull is a 36 ft. Prout moulding and the floats are each 30 feet long by 2 foot 9 inches maximum beam, of right angled triangle sections from fore to aft, thus having a sharp point at each end. Having now sailed this craft, it is quite obvious that these floats will produce the minimum water resistance and be immune to heavy beam blows from seas. Arthur Piver prefers 60° angles along the keel to ease the sea motion but this trimaran of

Dan Campau appears in the early trials to have a good sea motion. Time will tell us which is to be preferred.

Return of Photographs. Will all the people who have so kindly sent me photographs for publication which they want back, please write for them. Otherwise, they will be filed for the reference of members.

INTRODUCTION

This year, we again present a remarkable collection of designs of sails many of which have actually been tried out ; along with many observations on sails, their handling and the devices which go to make sails safer or easier to manage. As usual with A.Y.R.S. articles, they come from all over the world.

One must be delighted with Captain Mellonie's squaresail which is as efficient as any sail ever made or conjectured in the way in which he uses it. One must like C. O. Walkers mast-aft rig as a method of the efficient use of canvas for a short handed sailor. The Micronesian sail and hull information will interest the people with traditional leanings. The " Over the-top " aerofoil sails are of unusual practical importance, while all the other sails and theorizing all add " body " to a very interesting publication.

The only new principle in this publication, however, is the use of a bi-plane rig by Manlio Guberti-Helfrich. This rig differs from the side by side rig of Donald Robertson, described in *Sail Rigs* (A.Y.R.S. No. 26) as the whole rig revolves to give an effective high aspect ratio with a low centre of effort and an efficient down wind canvas spread. A similar system, using semi-elliptical sails might give us the utmost in sail efficiency rather than having all the canvas in a single sail of semi-elliptical plan form with a mast-aft rig, as shown in *Sail Rigs.*

Having looked carefully through A.Y.R.S. publications, *Sail Evolution*, *Sails and Aerofoils*, *The Wishbone Rig*, *Wingsails*, *Commercial Sail*, *Sail Rigs* and this issue, it really begins to look as if all possible ways of spreading canvas more or less efficiently to the wind have been covered by us and we can only challenge our members and others to find yet other ways. It is true that some recent articles in *The Rudder* did show some other ways which were discovered in the files of the U.S. Patent Office but they can hardly be described as realistic in any sense.

Balanced Sails Set " Flying." Reports by Arthur Piver and David Jeffrey of balanced boomed sails set flying show that they tend to " flog " in winds over 12 m.p.h. They can be so unstable that it is impossible to sail with them. This would apply to the " perfect " sail shown on page 21 of *Sail Rigs*. However, the " back " sail of *Sail Rigs* and the fore-sail of Don Robertson are both set on luff wires and the complaint was not noted with either. Nor is it present in the traditional Chinese lugsail such as Col. Hasler used in the *Slocum* race across the Atlantic, single handed. It would appear, therefore, that this type of sail has to be stabilized against a taut stay or a mast.

In this publication, all the ideas and sail descriptions which have been received to date have been used.

EXPERIMENTS IN SAILS AND HULLS

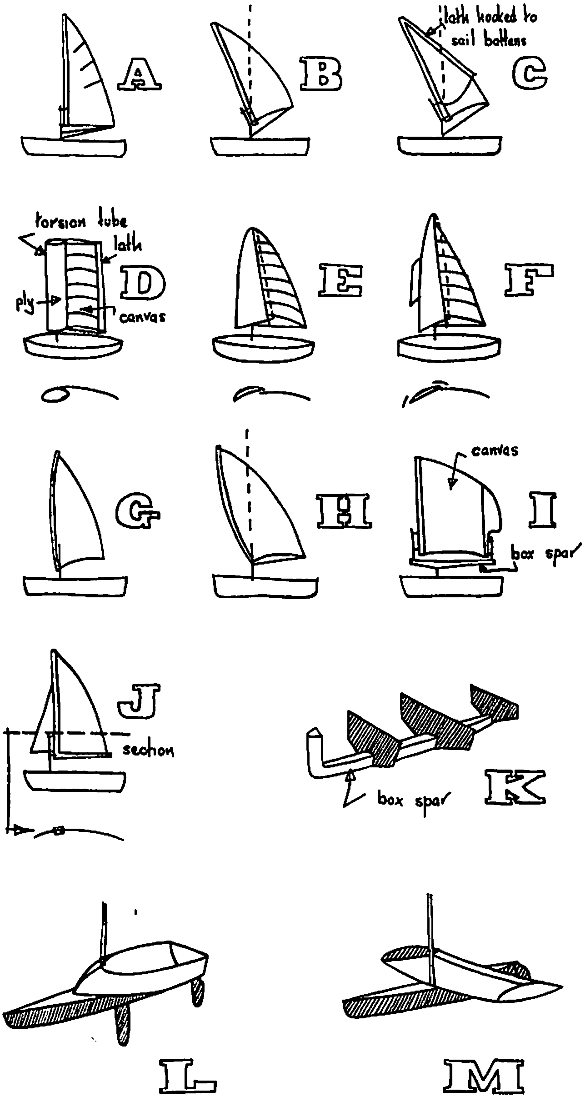
By Major-General H. J. Parham, C.B., D.S.O.
Hyntle Place, Hintlesham, Ipswich

I have been asked by the Editor briefly to summarize my experiments. But first of all I want to make clear my " philosophy " (if this is not too highbrow a word) regarding all this.

I believe one should have a hobby, or hobbies. Sailing is a good one. If one has an enquiring mind, then one can fool about relatively cheaply, trying out ideas. *Very* few of us have that spark of real genius which produces some major advance, but there is a place in the scheme of things for the amateur experimenter in that he may act as a stimulant to the thoughts of the (probably still unknown) young and particularly gifted person who will one day leave his mark on design. Even if the amateur has shown how *not* to do something, this may have been pigeon-holed away in the " up and coming " mind of someone and will therefore have been worthwhile.

I believe most firmly that once sailing ceases to be fun, it is worthless and I also believe that once you think you are going to make anything out of it, you have probably spoilt the fun.

I only started to sail in August, 1945. My main interest before that had been flying. I wanted to prove to myself that a sail was a wing stuck up on end, obeying similar laws. I believed that a twisted sail was wrong and that the mast interfering with the smooth airflow was wrong. I thought that boats should follow modern aircraft in having cantilever masts and no shrouds. I thought the conventional rig was horribly uncontrollable when running in a strong wind ; that reefing methods were laborious and poor and that " controls " in general were heavy and unattractive by aircraft (or horse riding)



A. Swivelling Cantilever plank mast

B. Same, Balanced

C. Same, with leech pole

D. Rigid wing sail

E. Wingsail with slot

F. Slotted and flapped wingsail

G. Gull's wing Sail (soft)

H. Same, balanced

I. Low A.R. *twistless Sail*

J. Rig with nose flap

K. Monospar Boat chassis

L. "Kippered" boat with long central float

M. Development of L

standards. Like many others, I failed to realize the importance of having a large sail area to deal with the normal light airs one sails in.

I built a dozen separate and distinct rigs and sailed them hard. Many were fairly unusual at that date but all worked. Some of these were of the hard " lobster claw " variety, the front 1/3rd being of this construction, the aft 2/3rds being of canvas. Nearly all had some aerodynamic balance to lighten the mainsheet's pull. Almost every one could be sailed unreefed in high winds.

It gradually dawned on me that, as one scaled up size, so the cantilever mast got more difficult, not because of air loads but because of strains induced by pitching *plus* air loads. It is, however, so good from the control aspect (particularly in catamarans which need good " throttle control " in crowded water) that I think it will come, some day.

The other discoveries were that rigid sails are hopeless unless the rigidity only extends as far back as, say, 1/3rd chord. The all-rigid glider type wingsail is " out " being far too flimsy. Every rig tried seemed to establish the importance of defeating twist and of reducing mast interference. It also seemed that, if one could do this, one had enough extra thrust to make the plain " monoplane " rig as good off the wind as was a conventional sloop rig with its " high lift " device of the jib. I do not, however, think that a purely symmetrical wing section will be as good. It must change camber on going about.

To help me make boats quickly, I developed a " monospar " system whereby a box spar from bow to stern provided stiffness and the sides and floors were merely wrapped around this on two or three bulkheads, the chines and keel joints being of flexible canvas/rubber fabric. Many such boats were made and were quite good.

Finally, a year or so was spent playing with hydrofoils, a fascinating and infuriating business! Towed flight on hydrofoils (with positive elevator control via the tiller) was easily achieved and gave one of the loveliest sensations I have ever had. Attempts to get up under sail failed — one could *just* get the front 2/3rds of the craft up in a gust—that was all. The conclusions were :—

1. It is a scientist's job and a costly one since hydrofoils must be very accurately made and of metal—wood ones are too bulky and so cause too much drag.

2. They *must* be retractable when sailing.

3. They are *highly* promising as anti-heel devices and this should be tackled first.

Finally, catamarans. I made a small one four years ago and have sailed her hard ever since. She suits us very well. Two points have emerged. The first is that a quickly retractable undercarriage is a perfect Godsend, need add little to the weight and reduces one's time to get in and out of the water almost unbelievably. The second is that more judgement (i.e. common sense) is needed in deciding whether water is too rough for safety when owning a cat than with a single hulled boat. There is a very definite limiting size to the waves which a cat of any given dimensions can tackle. There will be a series of serious accidents if this is not realised. I have a great affection for our little cat, which incidentally is an ideal vehicle on which to carry out sail experiments. She has been out on 317 days in 3½ seasons, and is as sound as a bell now.

Finally, I believe the conventional sloop rig is still the best provided we don't sit down and say it can't be improved or replaced. Apart from mast interference and twist, it is too slow to rig and reefing is still somewhat of a " nonsense," as now carried out.

My slogans still remains " Sail for fun." and be sympathetic to new ideas, however odd.

A SQUARESAIL

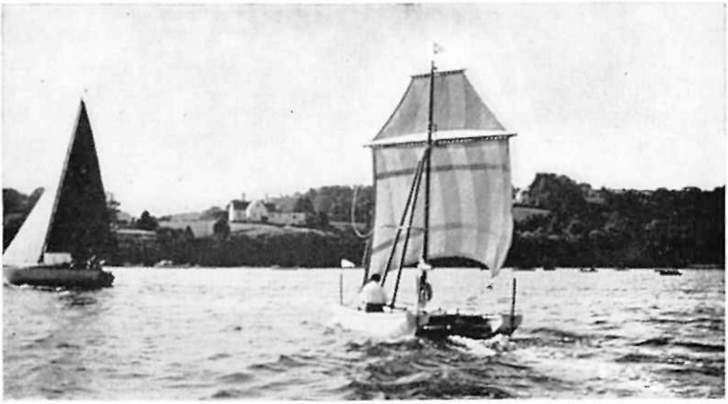
By Captain J. C. Mellonie

Trebah Lodge, Mawnan Smith, Falmouth, Cornwall

Editor - Janus *is a double hulled catamaran with identical ends capable of sailing equally well in either direction. Captain Mellonie is one of the diminishing band of sail trained seamen who, despite the hardships of life in deep sea sailing ships, retains a deep affection for sail. As a result of this, he has rigged* Janus *with a more or less traditional squaresail and topsail. The result is a craft which I, for one, would very much like to sail.*

Janus has been afloat and sailing about our local river estuary for as many days as possible in this very poor summer. I now feel that she is just about as good as I can make her and that the new rig is a definite success.

My whole desire from the very beginning was not to produce a thrilling new sailing craft, or even a twin-hulled vessel capable of sailing in either direction and, although this has come about, my first endeavour was to produce a type of rig and vessel to overcome (1) the dangers of a lee shore, (2) unexpected dangers on the lee bow, and (3) the inability of sailing vessels—especially a square rigger,



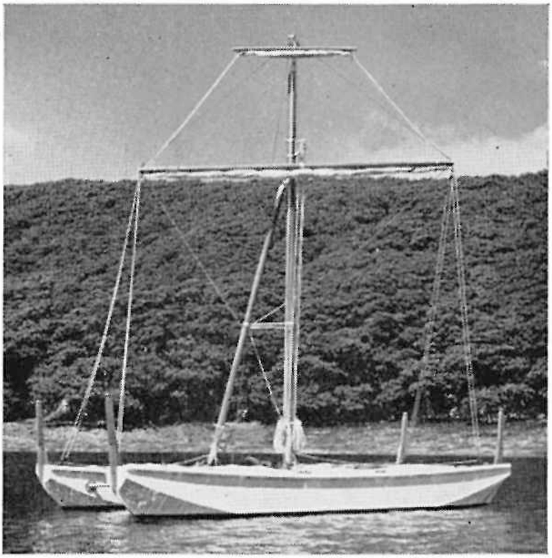
Captain Mellonie's Squaresail

to put about in bad weather. I wanted to avoid, if possible, the dangerous manoeuvre of having to bring a ship quickly up into the wind and seas in stormy weather with excessive way upon her. I must strive to find a way of taking the headway off a sailing ship before attempting to bring her to in high seas, whether to change tacks or avoid an immediate danger in thick weather.

Further, I wanted to " marry " the fore and aft rig with the square rig and retain the advantages of both, while obviating their drawbacks, such as the poor windward work of the square rigger and with the fore and aft rig, the danger of gybing—especially at night.

While there is nothing to it to put any sailing ship about in fine weather, I have been in a good many tight corners during violent winds and they have all been associated with the ship's inability to tack in the existing conditions where there was lack of sea room to leeward to wear ship, be it on account of a lee shore or the presence of ice. There is little doubt in my mind that just thousands of fatal strandings and total wrecks to fine ships occurred from this cause alone.

Bearing in mind these difficulties, it has always been my endeavour to produce a craft and especially the rig to make the coming about of a sailing ship whatever her tonnage more certain and easy in any state of weather. I wanted to avoid violent helm action in dangerous seas, so often the cause of shipping damaging water in violent motion. There must be means of checking the ship's way through the water, without having to place the ship in irons or head to seas. She must be so constructed and rigged as to be balanced both under sail and bare poles. Such a vessel could always " lie to " using a sea anchor and ride out the worst of any storm, without incident or too much leeway. The modern shape and rig of ocean racers which causes them to fall away and lie stern (and rudder) to the seas when sails have blown away is asking for trouble for I have learnt that there surely comes a time in every ship's life when it is no longer safe to run.



Janus at moorings

Gradually through the years, my ship grew in my mind and from time to time I made small models and from them new ideas came along until I felt I had at last fulfilled all my requirements. Had my rig been available say a hundred years ago or even fifty, sailing coasters would have saved days on their passages and countless misfortunes and loss of life, for I now have a vessel, so constructed and rigged, that she can be stopped in her own length and can be made to reverse direction at will and quickly, whatever the weather. Dangers ahead of her and on the lee bow have lost their meaning, for she does not have to tack or wear in going about. She does not even have to turn in azimuth to avoid trouble. Instead, she commences each new tack by sailing backwards, with the wind which was on the bow, now on the quarter. Under way, she is never in irons and her sails are always full and the ship under control. She lies as close to the wind as any yacht and runs with square-rigged efficiency without having to gybe.

Janus is steered from amidships on the weather side, by two interconnected rocker rudders, which automatically trip and take up position for headway in either direction. These rudders work in sympathy with each other and very little helm is ever needed. Except when running before it in either direction, she has a permanent weather side and all control ropes are handy to the helmsman without leaving his cockpit.

One may rightly ask why I have chosen a twin hulled craft for my new rig. It has no merits save that I got a larger craft for my toils, materials and expense. If you like, it is just a platform to try out the new rig.

Of the future, I had hoped that one day, a special sailing vessel, with double ends and single hull would perhaps be built to carry two of my tripod masts and rig, say about 60 feet on the water line and eventually be used as a training ship for some of our young fellows. I was a better sailorman for my training in sail with all apologies to modern seamen, but I fear, apart from local interest in my craft, there has been little impact on others.

I am wearing up a bit and have decided to sell *Janus* to an enthusiast or perhaps to a corporation for I cannot jump about quite like I used to and *Janus*, to do her full justice, is a young man's boat. I would like her to go to someone who had the means and desire to take her a step further and perhaps use her for experimental purposes. She is tremendously strong and more or less unsinkable with collision bulkheads and W/T compartments at her extremities. She is also far too heavily constructed to be a real flyer, but she is no snail and is a joy to sail once you have got used to her different behaviour under way.

One of the photographs used is by the kind permission of the Editor of *Yachting Monthly*.

THE MICRONESIAN SAIL

By A. E. Bierberg

Skovbrynet 23, *Lyngby*, *Denmark*

Nowadays, the outrigger and catamaran are quickly becoming accepted among yachtsman. By studying the native craft of the Pacific Ocean, yachtsmen and yacht builders, the world over, are successfully imitating the ingenious outrigger systems with modern materials. Very fine results have been attained but-mirabile dictu-the *Sails* of the original multihull craft have not been made the object of the same thorough going attention.

So far, nearly everybody has given his catamaran or outrigger a modern sloop rig with a jib and mainsail. Exceptions are (1) the use of a lateen rig with bipod mast some years ago by L. Francis Herreshoff, (2) the *Malibu* outrigger (A.Y.R.S. No. 29), (3) John Morwood's experiment (A.Y.R.S. No. 4), (4) my own craft *Aloha* (A.Y.R.S. No. 16), (5) *Pacific Atoll* (A.Y.R.S. No. 23) and (6) *Itata'e* (A.Y.R.S. No. 29). And, though the modern rig may be excellent, there are many advantages in the original " Oceanic Lateen " of the Pacific as I have found in my personal experiments.

The principles used in sailing the Pacific Ocean craft, which have neither keels nor centreboards, are quite different from the modern conception. From the first, the natives understood how to make the most of the spread bouyancy of the multihulled craft, The " crab claw " sail or the " Oceanic Lateen," the single triangular sprit sail (see A.Y.R.S. No. 3 *Sail Evolution*) is placed apex down, putting the greatest breadth of the sail high up where the wind blows more strongly. The native craft still does not heel, except under extreme provocation. Indeed, the natives, have shown *how to race* with a small keel-less craft with a very large sail. Since the earliest catamarans, they have gradually eliminated one hull and altered it into an outrigger log or float (ama) as a counter-weight, always to windward in the Micronesian craft at the extreme ends of long outrigger beams athwart the main hull (vaka).

Summarizing the characteristic points of the *Micronesian Canoe* (Marshall Islands type), the hull is asymmetrical with the leeward side less curved than the windward one to reduce leeway, the outrigger is always to windward, both ends are alike which enables the boat to sail with either end as the bow and, when " tacking " the tack of the sail, which is the apex of the isoceles triangle, is shifted from end to end of the canoe. The mast slanting towards the bow is set in a socket amidships upon or close to the weather gunwale. (It is as well to point out that on many groups of the Micronesian Islands (Palau, Yap, etc.), the odd symmetrical dugout with single outrigger is the common type of small fishing boat).

The Micronesian Sail. There are several types of these sails but undoubtedly the best is that of the admired " Flying Proa." This single sail (originally a mat sail) is an isoceles triangle with the apex as the tack. Nowadays, the sail is made of canvas attached to a yard and boom and the cloths are sewn in three or four small isoceles triangles which are joined to give the larger one.

Itata'e's Micronesian Sail

The yard fits into a socket in the deck at either end of the canoe and is kept raised by the halliard from the mast. Owing to the fact that the slope of the mast can be varied, the sail is moveable fore and aft to get sail balance and develops a nicely curved shape. As shown in A.Y.R.S. No. 26, the lateen of this shape holds a promise of nearly the greatest possible efficiency. The peak of the traditional sail is just vertically over a point 40% of the foot from the forward end, giving a vertical aerodynamic axis to the sail and the sail exerts a lifting force when eased for beam or following winds.

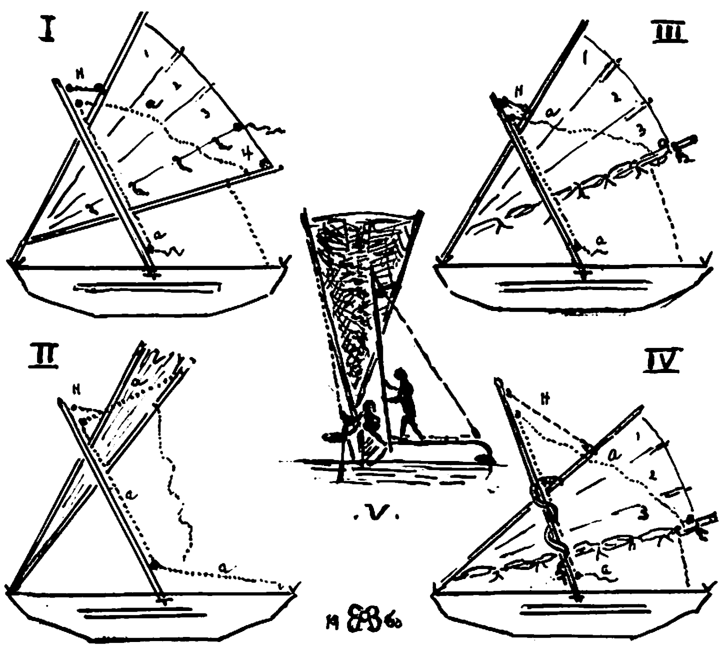
The *Single* triangular mainsail with its yard slightly convex, hanging free in the halliard's carabin-hook before the mast is not unlike the " mast-aft " rigs described in A.Y.R.S. No. 26. Furthermore, the mast can be trimmed athwartships by means of the stay to the " ama " (the outrigger stay). In light winds, it is let out to leeward so that the mast, yard and boom go to lee and this lessens the load on the float, decreasing the resistance. In a strong wind, by contrast, the mast is brought upright or even to windward to place extra weight on the float. The sail then takes the wind at a quite peculiar angle, which I have never tried to its maximum, myself.

In order to adjust the distance between the canoe (vaka) and the float (ama) in proportion to the wind and the sail area used, the cross beams are not always attached to the canoe permanently but are tied to thwarts by Spanish windlasses so that they may be pushed more or less to the windward (ama) side. This also allows the craft to be disassembled for transportation, but in sailing, variable amounts of weight are needed on the " ama " and when racing, the crew get out on the cross beams as human counterpoise weight. It is not thought to be good practice by the natives to drill holes in the cross beams and modern versions of the Spanish windlasses can be metal clamps or brackets with wing nuts, to avoid this.

The cradle shape of the hull in longitudinal section is useful as it allows the trimming of the craft by placing the crew in various positions fore and aft. When this is done skillfully, the sail and this trimming steer the boat.

Handling the Micronesian Sail. It is to be expected that such a sail as has been described needs its own method of handling especially in reefing and the 5 drawings shows the main way in which this is done. The stays are not shown for clearness sake.

Fig. 1 shows the full sail condition for a close hauled course. The " spiller line " is the name for the rope which one would, at first sight, call a topping lift. The reef points, reef thimble and sheet are shown.



N.B.—In all positions of the sail, there must always be a certain play in the halliard between the masthead and the yard to give mobility when shifting the sail from end to end of the canoe.

Fig. 2 shows how the sail can be instantaneously taken in by the "spiller line." Two spiller lines are often used, one on each side of the sail, passing through a double block aloft to provide a *partial* shortening of the sail for a sudden gust of wind ; the line to lee prevents the sail from bulging.

Fig. 3 shows the sail reefed and this raises the boom an equivalent amount.

Fig. 4 shows the state of the reefed sail in strong winds. The yard of the sail as shown in Fig. 3 is here lowered to bring the sail nearer to the deck. But this slackening of the halliard would let the yard blow away from the mast so an extra rope is fixed to the yard called a " Geol-tau " and wound around the mast as shown to hold it.

Fig. 5 shows the sail " as a fan " with the wind astern.

Comment. The small (5 to 6 metres) open outrigger canoes of the Lagoon type are designed for sailing on lakes, protected creeks and bays, though there are many reports about day long cruises along the coasts. With these boats, there is a risk in venturing out into the open sea where a sudden storm can raise, almost at once, short, crested and dramatic waves which are very dangerous to the open canoes with such low freeboard.

Summary. In getting to know how to sail the *original and native* type of Micronesian canoe with the corresponding *original* " *Oceanic Lateen* " the sailor has to apply his skill and knowledge in a different way and this presents a challenge to him which an original mind will find most stimulating.

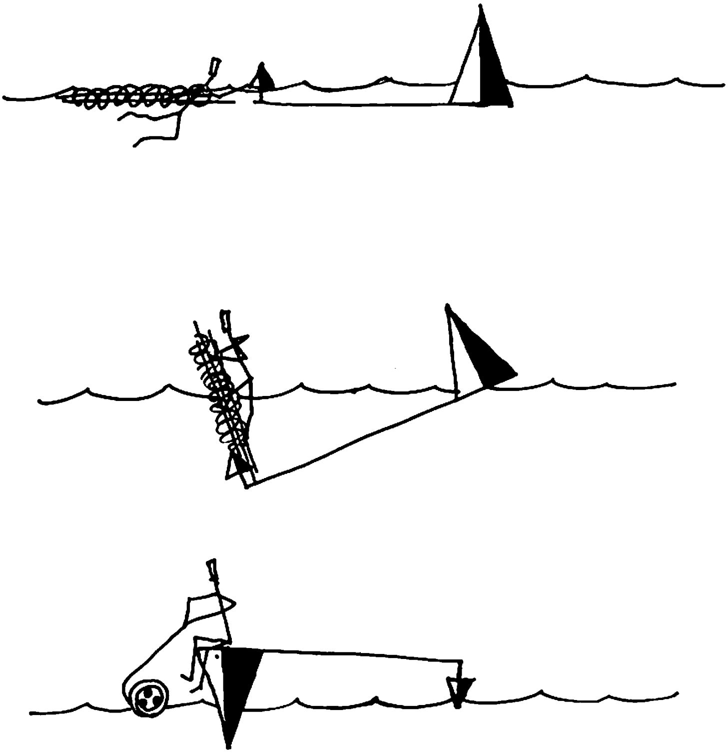
RIGHTING THE NATIVE OUTRIGGER

By T. O. Smallwood

U.S.O.M. Box 32, A.P.O. 143, San Francisco, California.

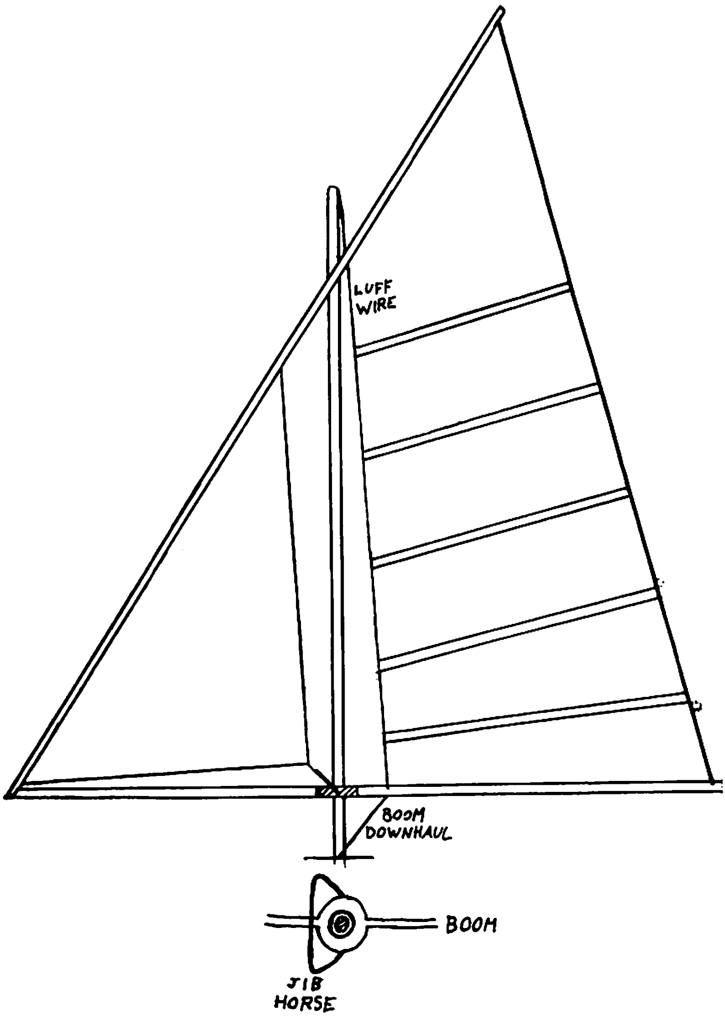
In my limited experience, a capsize in an outrigger is hardly ever due to carrying on too long or sailing too hard. The boats, as built by the Micronesians, arc very sensitive and handle very well indeed even in the chop kicked up by a 10 kt. tidal current running against a strong trade wind. So long as the helmsman's entire attention is given to sailing the boat there is no trouble but a moment's inattention will put the craft over and it happens instantaneously.

When an outrigger capsizes, no time is wasted. The sail and spars are gathered up and tied into as neat a bundle as may be. This bundle is then pulled around until one end is over the float with the rest of it pointing outboard. The canoeman then pushes the float



and the end of the sail-spar bundle under water and starts climbing up it. The float goes on down past bottom dead centre and the craft is right side up again. If it is done properly, the sails, spars and rigging are floating alongside the hull on the opposite side to the outrigger.

Outrigger Floats. I never saw a canoe used for offshore work in the Gilberts, Marshalls or Mariannas where the outrigger " float " had any bouyancy function other than to support itself and its share of the outrigger structure. They were big and of the heaviest wood available i.e. they were ballast. On the whole, they went through the water and through the waves rather than over them. A float skittering over the tops of the waves makes the whole canoe and particularly the sail shake, which is bad for speed.



John Thompson's Micronesian Canoe Rig

A MICRONESIAN CANOE RIG

By John Thomson
Lawlings, Danbury, Chelmsford, Essex.

The outline of the sail plan is based on the " Oceanic Lateen " used by A. E. Bierberg as illustrated in A.Y.R.S. No. 29 but the sail plan is designed to go about in the normal way in the manner suggested by Sandy Watson in A.Y.R.S. No. 7.

The suggested advantages of this rig are as follows :—

(1) The sails cannot twist.

(2) The sag to leeward of the mainsail luff will bring it into line with the lee side of the mast, as in the traditional Dutch rig. It can be prevented from sagging aft by means of full length battens (see R. A. Schroeders, A.Y.R.S. No. 26).

(3) Although the clew line of the jib should be eased off slightly when the wind is free to prevent stalling, there will, in general, be only one sheet to tend.

(4) The jib luff will be to windward of the mainsail luff on all points of sailing.

The windage of the yard can be reduced by fitting the jib luff and mainsail head round the yard to form pocket luffs.

It might be worth while to try the rig out first on an ordinary catamaran.

The only disadvantages I can see are :—

(1) There seems to be no easy method of reefing it.

(2) In a Micronesian canoe, the danger of the mainsail being caught aback against the backstay. However, racing dinghies and catamarans hardly ever do reef nowadays, and the danger of being caught aback applies equally to the lateen rig, and indeed, to any rig except one which, like Sandy Watson's, is fully revolving.

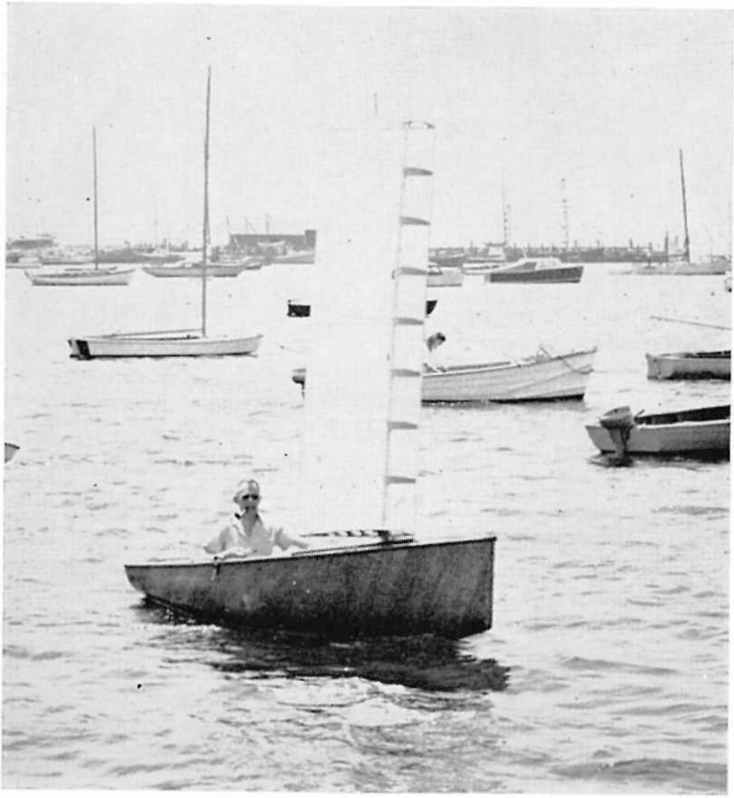
AN " OVER THE TOP " AEROFOIL

By John Ware Lincon

Lincoln, Massachusetts.

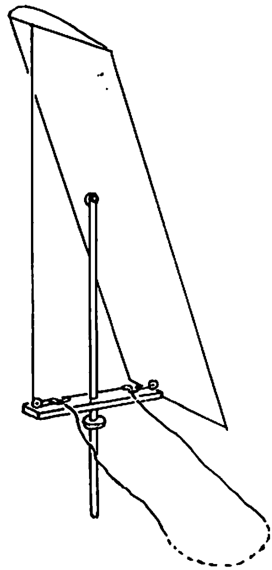
After seeing a picture of *Flaunder* several years ago, and evaluating Fin Utne's experiences, I decided to use true aerofoils on the deep-water schooner then taking shape on my drawing board. Mr. Utne's insistence on the symmetrical aerofoil was practical, but the greater efficiency of the high-lift asymmetrical sections for long cruises in light air presented a challenge. Hardware was the problem.

The rigid aerofoil shown here on a Firefly was built as a quarter-size model for the schooner's rig. It was to have been tested on an eight-foot " pram," which presented some difficulties and was superseded by the Firefly, although the foil has but a third of the regulation area of a Firefly's sail. The rotating mast mounting available suited the experiment perfectly. Confirming John Morwood's findings, we used the section of U.S.A.T.S. 10, and conventional wood glider construction, with a covering of 2-mil Mylar.



John Lincoln's Aerofoil

The rig shown in the sketch was finally adopted, and the purpose of the experiment was to test the hardware, and to feel out little problems that would become monstrous at larger scale when Neptune decided to mix up one of his special cocktails for engineers at sea. The pivot was a bolt and nut joining the masthead bearing plate to the wing-spar fitting. The spar was at 25% of chord, and the centre of pressure of this foil being somewhat aft of this point, the wing tends to head into the wind if unrestrained. This imbalance would not be desirable on a larger boat or with Utne's control fins, because the forces would be larger than humans care to exert for long periods, and by sheeting down the wing, or employing mechanical servos, one loses two advantages of the rigid sail : simplicity and safety. The



halliards, actually one strand of 1/8-in. cord. run from tip to tip of the wing, through sheaves and jamb cleats. The cord serves as " reins " to trim the sail, and, with cleats free, to come about by flipping the wing about 160 degrees to secure the opposite tip to the short boom. The tilt is for the practical reason that it avoids interference of aerofoil forces and mast turbulence.

Conservative critics of my rig for the schooner, seeing a model, shudder at the thought of this wing suspended horizontally, when coming about, from a flimsey point 20 feet above the rolling deck. Theoretically, the centre of gravity and the aerodynamic centre need not change, but that is small comfort for the anxious sailor. This manoeuvre in practice, in the Firefly, was cause for rejoicing, as it provided an unexpected stability at the transitional " anxious " moment of horizontality. The stronger the wind, the more vertical lift was noticed. Because the thin Mylar covering would rattle when the foil was allowed to stall or luff, we noticed that it remained taut during the coming-about cycle.

Another useful discovery was that the pivot pin, working in a single plane, took considerable strain, and at larger scale would transmit bending strains to the mast, which should remain unstayed for aerodynamic reasons. This problem will be met by a univeral or ball-joint at the masthead, with another pair of halliards, probably on common or paired winches, to maintain the foil's angle of attack throughout the manoeuvre. Of course, the most gratifying discovery was that this rig, which is basically the Glider stemming from L. Francis Herreschoff, could be practical and efficient.

It would be tempting to construct another aerofoil, of 75 sq. ft· instead of 25, to bring the Firefly up to competitive trim. But I leave this to the next experimenter, with the promise that he might sail faster in light airs, point up higher — most wings have their best Lift/Drag ratio at an angle of attack of two to four degrees, and are better than a sail at most angles — and generally gain time on all courses but running before the wind.

A WINGSAIL DESIGN

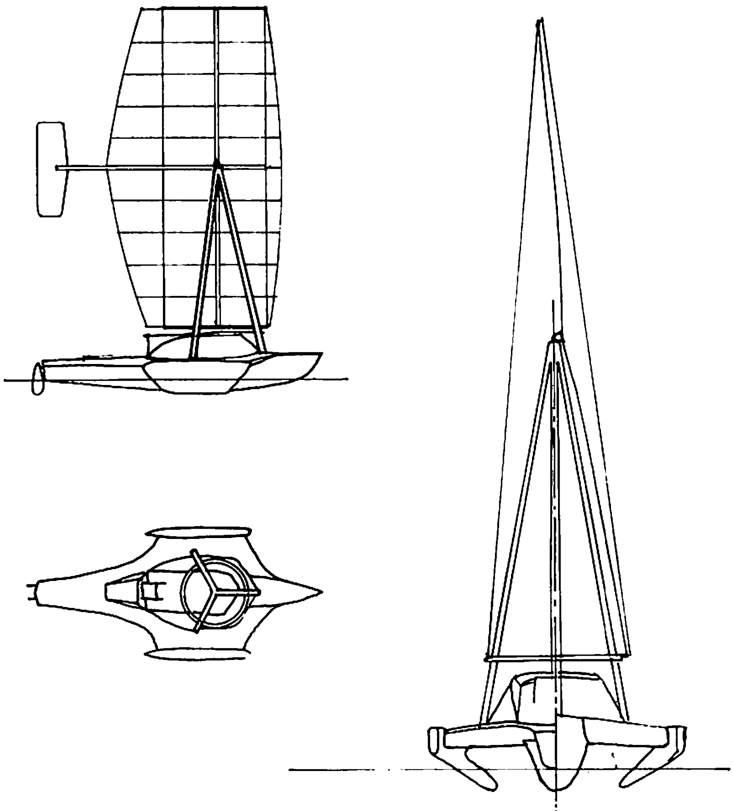
By William Baur

1684, Littlestone Rd., Grosse Pointe Woods 36, Michegan

The drawings show a new rig I am considering for ultimate use on my trimaran. It may not look very pretty but it has some absolutely beautiful potentials. The buoyant hydrofoils are also drawn and they provide about 700 lbs. each of buoyancy on a level keel.

The sail is the " oscillating airfoil " type described in Vol. 1 of Herreshoff's *Common Sense of Yacht Design*, i.e., it is an asymmetric airfoil, rotated in tacking around its horizontal (chordwise) axis from one side to the other. Also, since it will be suspended from the aerodynamic centre and therefore is fully balanced, the tailsail can be used. I am trying to work out a means of aileron control whereby the sail can be made to fly itself over from one tack to the next without resorting to winches to haul the upper wingtip down.

The mast consists of a tripod with legs spaced around the cabin, making more room inside and eliminating interior structure support problems. The sail is of fairly heavy weight dacron and is given its shape by full length battens which will remain permanently in the sail. The battens will travel on slides up and down the mainspar which is suspended at its centre from the peak of the tripod mast and there are extra spars which merely help to prevent twist and to keep the proper shape. The sail can be reefed symmetrically about the tailsail boom by hauling the battens in to it, or it may be reefed to deck level when tacking is not necessary. The lower wingtip will fasten to a ring spar around the tripod to take some strain off the suspension bearing and a windward runner may be set up to the upper wingtip, if needed.



The sail can be connected to the rudder to provide a windcourse steering system and the coupling thereto could conceivably be servo driven from a compass to provide a sailing autopilot.

Another little beauty of the set-up is the possibility of a crows nest with control station up below the peak of the tripod.

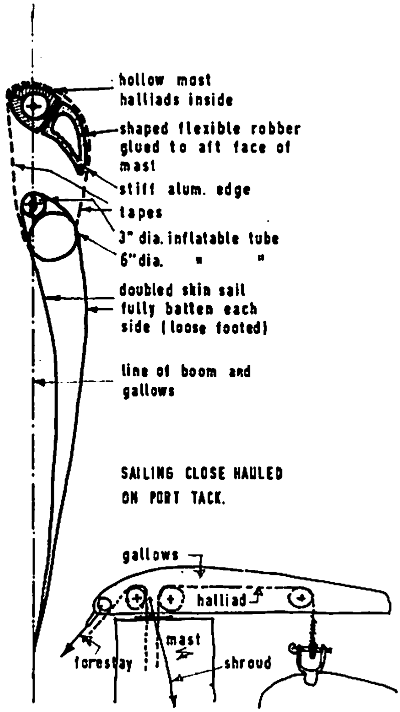
If the main spar suspension bearing can be made with three angular degrees of freedom, the sail can be rotated to a horizontal attitude to function as a squaresail for tradewind running.

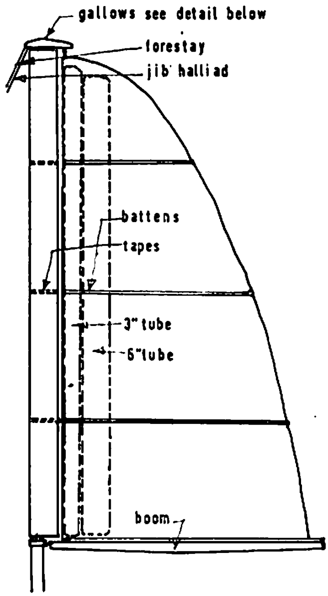
The only disadvantage I can see at present would be the weight of the rig — but then, I have additional available bouyancy from the bouyant foils.

AN AEROFOIL SAIL WITH SLAT

By G. .S Knight, A.R.I.B.A.
P.O. Box 28, Mona P.O. Kingston, Jamaica.

The sketches show a mast and mainsail with inflatable tubes, designed to produce a " slot effect " and aerofoil shape to the sail. The so-called " gallows " and gooseneck of collar type have a common centre and should permit the mast to be pivoted independently of the position of the boom and sail. It will also be necessary to have a means of twisting the mast and also of holding it in the desired position.





The " gallows " take the forestay and shrouds and contain the halliard sheaves.

The tapes I shew should have followers in a track on the fore edge of the mast to prevent them from slipping round it, when it is turned. The idea is that the pull induced by the tapes when the mast is turned, will in turn, produce the desired shape in the trailing edge of the mast and also twist the mainsail to produce an asymmetric aerofoil.

The flexible trailing edge to the mast could also be used with a flat sail running on a luff wire as used by Jack Fulton (A.Y.R.S. No. 26), if the " thick " mainsail has too much drag.

I think the scheme is a good deal simpler than the " solid " sails that have appeared.

A COLLAPSABLE WINGSAIL

Devised By R. Stirling Ferguson
1093 Chelsea Drive, Ottawa 2, Ontario, Canada

This very ingenious wingsail is the result of some 20 years experimenting by its inventor and is a very near answer to the " perfect sail." It is in many respects related generically to the lateen rig but is an improvement on that by virtue of having less twist.

Construction. The mast and stays are mounted in bearings in the hull and all revolve together. The sail is set flying from the bottom spreader to the masthead and is placed to leeward of the mast on each tack. Even though the luff is not taut, however, it sets in a convex curve, which improves its power, due to the full length battens.



R. Stirling Ferguson's Wingsail

Advantages. 1. The mast eddies do not interfere with the windflow over the sail, and being placed to windward, this windage may help the sail force as noted with other sails we have examined.

2. The sail is almost twistless, being held to shape by a compound sheet to the two middle battens attached to a barren mizzen mast.

3. The sail slopes up to windward which makes it more or less vertical when the boat heels, which is an advantage with the scow hull used which must be sailed heeled at all times.

4. The clew of a normal sail is not much use, being the worst part of the twist and thus too nearly fore and aft to give much drive. This sail is cut up at its after end and thus uses its area better.

5. The " wingtip eddies " at the lower end will be minimal, again owing to the absence of boom.

6. The convex luff is probably useful.

7. The aspect ratio appears to be about 3: 1, which is not far off the idea.

8. Sail control or incidence control. Mr. Ferguson describes this ability in a letter as follows : " One day, I was hit by a strong squall. I eased the sheet till I could sit in the centre of the cockpit and was still able to boil along to windward at a good clip. The sail was at zero or possibly a negative angle of attack. It held its shape well except for a small reverse dent near the luff."

Disadvantages. Aerodynamically, there are almost none. I cannot think that the loss of area in the clew is of importance except running before the wind and reaching. However, the revolving mast would be a bit more expensive than a normal mast, though its compression loading looks as if it were smaller and this might compensate. The forward placed mast might not suit the usual dinghy or catamaran as well as it does the more flexible scow. It looks as if there might be some difficulty in turning the mast when coming about but this will be fully automatic at most times and not need attention. The barren mast would be a nuisance and looks ugly. I feel that none of these disadvantages are at all serious or a real objection to the use of the rig.

Summary. A wingsail is described which is almost the " Perfect sail."

NOTES *by* R. STIRLING FERGUSON

This wingsail achieves it's shape in the following manner. There are both luff and leach wires and these run in pockets but are not sewed to the sail. They are made fast at the peak and at the bottom of the sail but otherwise run freely in it. They are secured to the ends of the battens. Both the luff and the leach of the sail are curved so that when the sail is raised the two wires are in tension and the battens in compression. The tension is inversely proportional to the curve so that the luff is highly tensioned and the leach hardly at all.

The warp of the sailcloth is parallel to the lines of vertical tension in the sail. The panels of sail between each batten are cut to introduce a slight belly. The sail is raised by the halyard till the wires are taut. Then it is hauled down with the downhaul and a fourfold purchase. This bends the battens till they take up the slack in the sail. When this happens the sail cloth begins to take tension and as hauling continues this tension balances the forces tending to make the battens bend. The sail is then rigid. Further hauling will make it more rigid without changing its shape materially.

The sail is made of four ounce duck, oak battens, and one-eighth flexible wire. Its area is one hundred square feet. It holds it's shape in winds up to 15 knots and might do so in higher winds if tensioned more than I have so far dared. Even so stronger material would probably be better. There is probably real advantage in using smooth material in this sail since it has a very clean luff. The gains in lift from reduced eddy making are large and could be taken advantage of here.

In my opinion the sail has great possibilities but the mast and turntable arrangement are less promising. It is a mistake to put a turntable at the point of highest stress. As for the sail it could be used as a jib or stay-sail or a storm sail, if heavily built on any boat.

I would be glad to receive comment and to answer questions.

TWIN WINGS RIG USING A MYLAR SAIL

By Bill Glenn

Indian Kill Road, Scotia 2, N.Y.

About twenty years ago the twin wings rig was rather popular for dinghies. This rig has a number of advantages but has not been used widely probably because the mast cannot be supported anywhere except at the foot and peak.

In the spring of 1959 I constructed a twenty four foot catamaran which uses this rig successfully. The rig uses a mylar sail which wraps double around the mast. The sail is loose-footed and is attached to two booms. On a reach or tack the sail is similar in behaviour to a " pocket " sail. Mast turbulance is reduced by the wrap-around sail. For running the main can be opened out and used as a spinaker. An aluminium cable is bonded up the centre of the main. The main can be rolled up on this with a crank on the end of the cable for reefing. This is similar to the roller reefing technique used on many jibs.

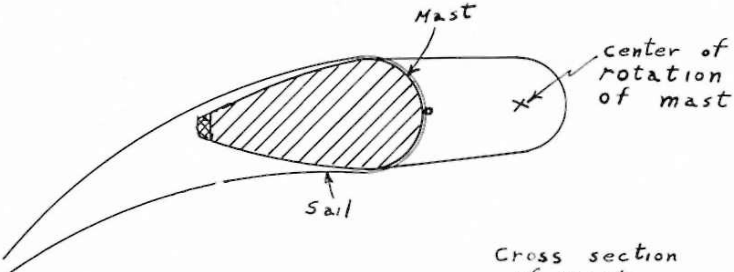
This sail handles beautifully. A rather large boat can be sailed single-handed with this rig even on spinaker runs.

Bill Glen's "Wrap Around" Sail

The successful use of this rig on this large size of a boat depended mostly on the design of a light mast (seventy five pounds) that would span twenty seven feet without intermediate support. A mast was constructed of 1/8″ birch plywood wrapped around airfoil shaped formers and covered with glass cloth and epoxy resin.

The shape of the mast is shown in the attached figure and photographs.

The mast swivels on bearings placed ahead of its leading edge so that it will "feather" with respect to the sail. This not only reduces the width of the leading edge of the sail but also allows one to have a large depth of the mast in the direction of the sail's force



Cross section of mast

for maximum strength. The sail is made of .0015″ mylar sheet glued together with DuPont 46971 adhesive. Canvas is sewn onto critical areas for attaching fittings to the sail.

S. D. Hamren in San Pedro, California has constructed a mylar sail in which he bonded heavy vinyl to the mylar for attaching fittings.

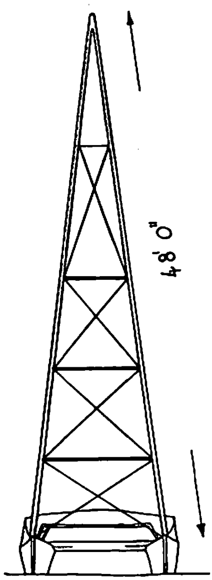
A mylar sail has the advantages of being cheap, light, strong, transparent and easy to fabricate. It only took a day to make a 400 square foot sail. The only disadvantage I have noticed in two years of use is the awful noise it makes when it luffs.

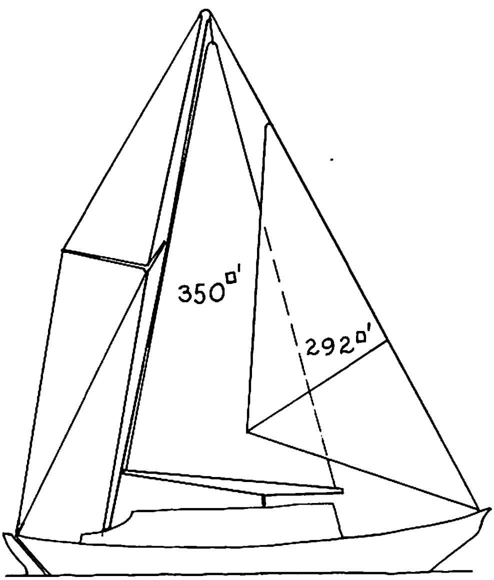
A MAST-AFT RIG

By C. O. Walker

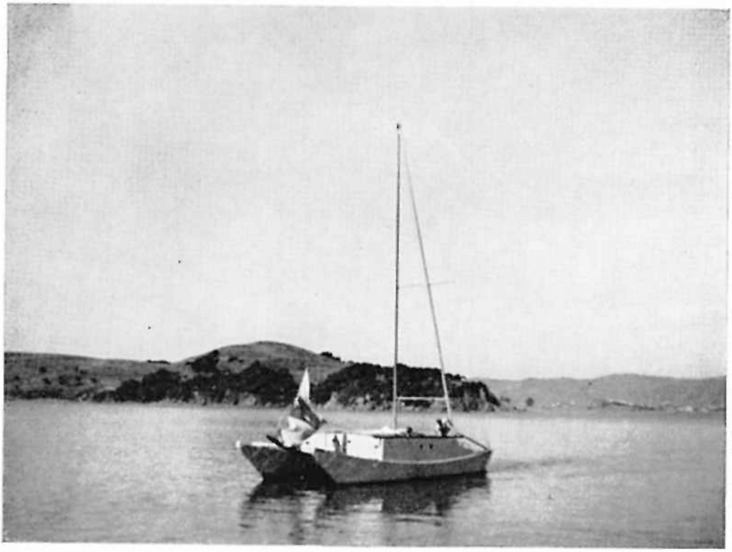
1909 Jonive Road, Sebastopol, California

The drawings show *Marara's* rig and sail plan. The bipod mast aft seems to be the answer for her type of deep box section hulls. She now can be handled single handed, which has been one of the main reasons for trying this rig.





As I see it, the main objections to the mast aft rig are stress problems. However, with a catamaran's wide beam and the use of a bipod instead of a single mast, I believe stress problems can be overcome without excess weight or loss of streamlining. The best ratio of height to base seems to be 3: 1. Because we could not use that ratio, our spreaders and X cables had to be made stronger than usual and, although our " A " frame, as we call it, weighs just a little over 300 lbs. it is only about 30% heavier than I figured a sloop rig or single mast would weigh. And the weight is aft, where we want it, so that doesn't seem to be any problem.



C. O. Walker's A-Mast

We have not got the new sails for *Marara* yet and we are very anxious to sail her with her proper plan.

Ed. *Marara* was described in A.Y.R.S. No. 27, *Cruising Catamarans.*

A BIPOD RIG

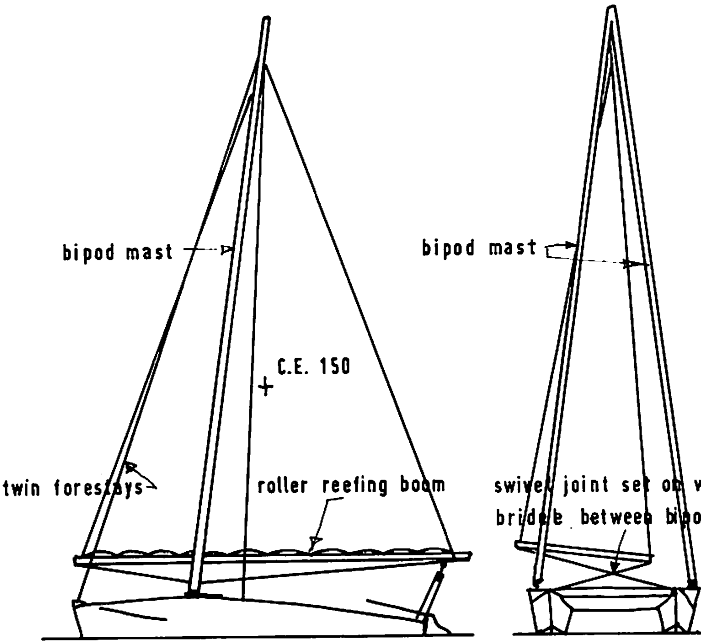
BY V. E. NEEDHAM

69, Gertrude Road, West Bridgeford, Nottingham

The sketch shows a bipod rig which seems to have points in common with several others but is not exactly similar to any shown in the A.Y.R.S. so far.

Advantages. (1) All major stresses are contained within the bipod triangle. Shroud and forestay strains are at the minimum.

(2). Roller reefing is possible.
(3). Absence of twist in the sail.
(4). Balanced sail with minimum pull on the sheet.
(5). Easier than sloop rig for single handed sailing.



Disadvantages. (1) Extra windage of bipod over single mast.

(2) Possible difficulty in stays owing to not being able to back the jib.

(3) Possible interference of airflow towards the peak of the sail where the bipod legs are in close proximity. This might be overcome by spacing the legs at the top somewhat.

Editor : So far, no bipod rig has been shown to be more efficient than the sloop rig. However, as time goes by and materials get stronger, the legs of the bipod can get slimmer and they will then produce less wind resistance. Sometime, therefore, a bipod rig will be good and this would be the form to use. Even at present, the extra handiness, of this rig might be preferred by some.

A SELF TRIMMING AFT-DIPPING LUGSAIL

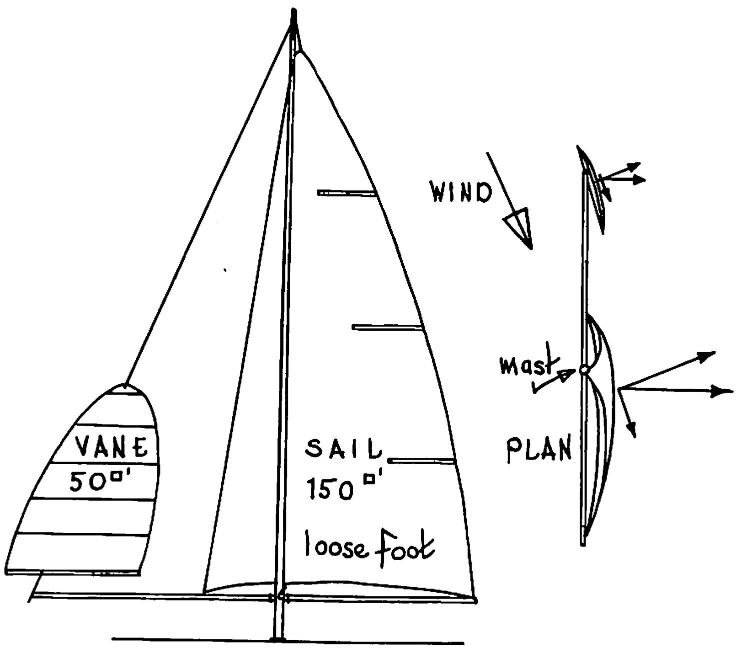
By Paul Germaine

176, South Kingsway, Toronto 3, Ontario, Canada

The drawing shows the sail which I am intending to put on a high performances sailing craft — an outrigger hydrofoil. In essence, it is a thin, twistless " reaching jib " type of sail with a control vane placed forward to increase the driving force. Vanes placed aft all produce forces holding the boat back.

The main points about the rig are as follows :—

(1) The boom is free to pivot through 360° on the mast, and see-saw vertically.



(2) The mast is cantilevered i.e., it has no stays.

(3) The vane sets the angle of incidence for the mainsail and the whole rig becomes self trimming to wind direction changes. The vane is controlled from the cockpit.

(4) The sail is put on the leeside of the mast on each tack but can be made to work without doing this, though it will be less efficient. When changing tack, the tack of the sail is brought back around the mast and tautened on the new tack. This is similar to handling a Genoa jib but backwards instead of forwards.

(5) The side force of vane × lever arm = side force of main × level arm.

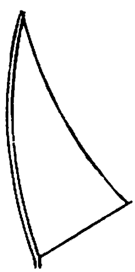
(6) Vane can control sail for reverse thrust for stopping, backing up etc.

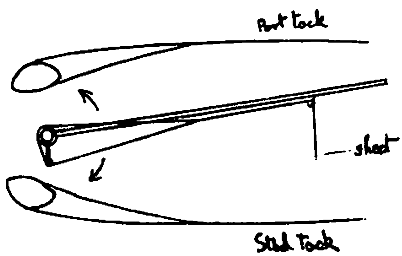
A BENT MAST WINGSAIL

By William Garnett

Hilton Hall, Hilton, Hunts.

As twist in a sail results from having the leech flexible and the luff stiff, the two easiest ways of getting rid of it are (1) to use a leech-pole and (2) to rig a balanced sail clear of the mast. The first is clumsy, and although the second may have advantages, there is the





third method of using a bent mast as described by General Parham in A.Y.R.S. No. 3, which has the advantage of a hard edge to the luff. The present suggestion also gives an asymmetrical aerofoil shape on either tack.

The mast is bent, fairly thick and quite stiff, in alloy or fibreglass' stayed to the top. It rotates through 180° when putting about with the concavity of the bend to windward. The sail is attached to the mast via a pocket luff to allow rotation.

In order to test this sail, I made two identical model pocket luff sails, one on a straight mast and the other on a curved mast, planted them clear of each other's windage and sheeted them together over pulleys placed to windward, both on the same tack. The result of this " tug-of-war " test was that the boom of the sail on the bent mast pulled the boom of the sail on the straight mast to a wide angle to the wind while setting at a fine angle itself, although both booms had kicking-straps. To express this result more precisely would be pointless in view of the crudeness of the models, but it was none the less obvious. The next stage will be to build a bent mast for testing on a land yacht against others of the same class.

THE CASE FOR THE BENT MAST

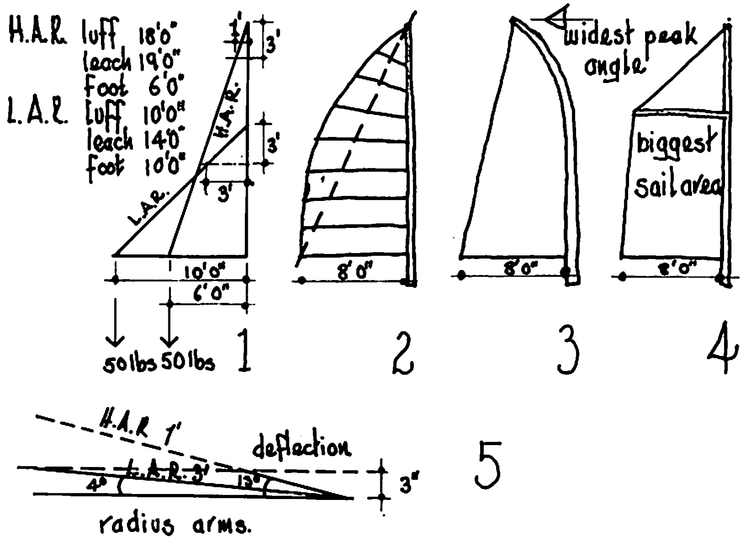
By Julian Allen A.M.I.C.E

3 Kenystyle, Penally, Tenby, Pembs.

The theoretical advantages of the bent mast seem so evident that it is strange that its use is so limited. I have no personal experience of them and my theorizing may not chime with those who have. But I am well aware of the sail twist with the conventional Bermuda rig ; and it is mainly to avoid twist that I look to the bent mast.

I want to make the point that, properly used, the wider the angle at the peak, the less the degree of twist. Or otherwise, the higher the aspect ratio (H.A.R.) the more the wind is spilled. To prove this, I compare the sails of an equal area but at extremes of aspect ratio. This comparison shows less twist for the low aspect ratio (L.A.R.). It also serves as a useful model to illustrate sail mechanics.

Let us review these mechanics in relation to twist. Firstly, twist increases as the aspect ratio rises. Secondly, it decreases as the leech tautness is increased. These two factors intermingle. The diagram, Fig. 1, shows two Bermuda sails of different aspect ratios with equal area. H.A.R. has a leach nearly 5 feet longer. Therefore, under the same tension, it will sag further sideways under wind pressure. If



(for the argument) a weight of 50 lbs. is hung on each of the boom tips, it will induce a tension of 70 lbs. in the leach of L.A.R. and of 53 lbs. in that of H.A.R. So L.A.R. scores for anti-twist.

Just as the load on a suspension bridge gathers at the towers, so the wind load in the sail divides between the leech line and the mast. By " leech line " I mean the direct line joining the mast tip to boom tip, disregarding the roach. The leech line, not being a rigid bar, also acts as a suspension bridge and receives and passes on its load to mast head and boom tip by sagging more or less according to its tautness. The less the sag, the less the scope for twisting.

All this started with the statement that the wider the angle at the peak, the less the twist. Here is the proof. Take two points 3 feet below the peaks of H.A.R., and L.A.R. From there, measure the horizontal distances to the leeches, H.A.R. — 1 foot, L.A.R. is 3 feet. These are radius arms, centered on the mast and ending on the leeches, which will register an angle when the leeches are both deflected by, say 3 inches. By reason of its short radius, H.A.R. will show a falling of 13°, while L.A.R. falls off only 4°. And that is not all. Because of the differences in length and tautness between the two leeches, the anti-twist factor of L.A.R. is actually much greater.

With the bent mast, Fig. 3, the peak angle is at its widest and the leech line runs true. The rounding out (for increased area) is handed over to the mast which deals with this matter, without the cost, weight and nuisance of battens and the leech is taut and happy. I feel that a mast with a preset bend should be better than a bendy one like the *Finn* dinghy. Its torque would resist the falling away to leeward and the whole situation would be more under control.

Fig. 4 is a rig I once used for two seasons. It also avoids the twist inherent in the multi-battened Bermuda sail. It has all the merits of L.A.R. where needed, combined with the merits of H.A.R. and a generous addition of sail area with a conventional mast. The thrust in the gaff batten is little more than that due to the " top-sail " and is met by a pair of oversize battens, clamped together on each side of the sail for added strength and butting on to the mast each side of the luff groove. The gaff batten is controlled by a separate or a combined sheet. I used to keep the top sheet in hand with the main sheet jammed when beating.

Editor : Austin Farrar has pointed out (private communication) that, though the sag of the line joining the peak and clew of the sail would produce twist in a sail without roach, the effect of full length battens and large roach is to produce a virtually twistless sail. Undoubtedly, this is true in very light winds but in any strength of wind, twist appears even in such a sail, though perhaps of lesser amount than in the usual high aspect ratio soft sail.

A SENSITIVE WIND INDICATOR

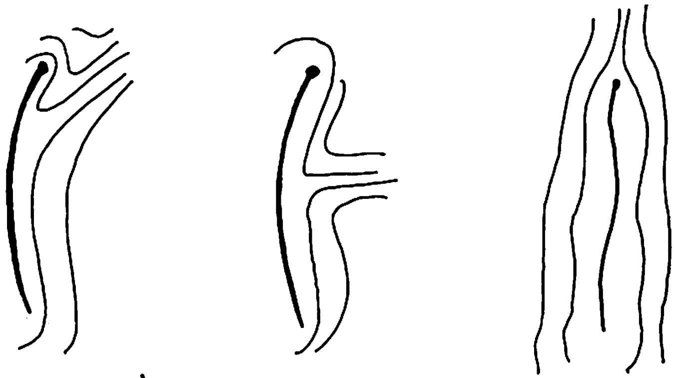
By R. A. Schroeders

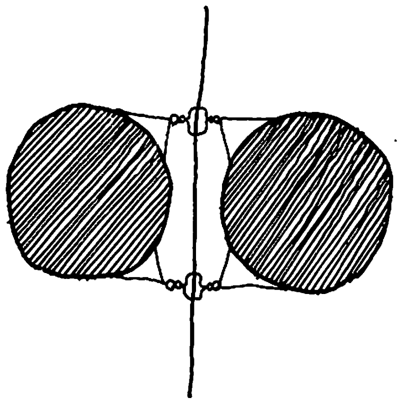
San Antonio 13, Texas

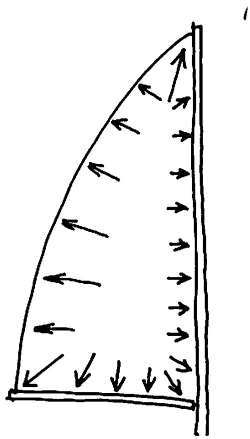
After reading several books on aerodynamics, I was puzzled over the diagrams of wind flow over a sail. The diagrams are an approximation of what was shown.

What puzzled me was the fact that when hard on the wind, the air divided 20 to 30 per cent of the chord back from the leading edge, up to that time I presumed that the wind would be divided in front of the mast, when head to wind.

In order to test these theories for my own satisfaction, I secured a piece of yarn on my Penguin sail (the Penguin is a cat rigged 11′ 4″ L.O.A. — the sail being 8′ 8″ on the foot, 16′ on the hoist). This yarn was fastened 8′ up from the tack, and 2′ back from the mast. The yarn was about 10′ long, it was passed through the sail, 5″ projecting on each side of the sail, it was secured by a knot on each side of the sail.







It was found that these theories were indeed correct. It was also found that this yarn could be used as an indicator, and a very delicate one at that. When the yarn flew forward and the sail did not luff the sail was on it's most efficient angle, when the yarn flew aft, it meant that the wind was too much aft, the slightest change (estimated 1 or 2 degrees) in angle of attack, would change the indicator from flying forward to flying aft.

One trouble experienced was that the yarn would stick to the sail. A frame of light steel wire was made, and covered with nylon material, two eyes were made in the frame, and the eyes were sewn to the sail, the thread was made into a small lashing to act as hinges.

This indicator worked to perfection on all points of sailing, with no defects, it is very valuable in light air, when it is more accurate than a wind pennant aloft, as often the wind pennant will be in a different wind than the main part of the sail.

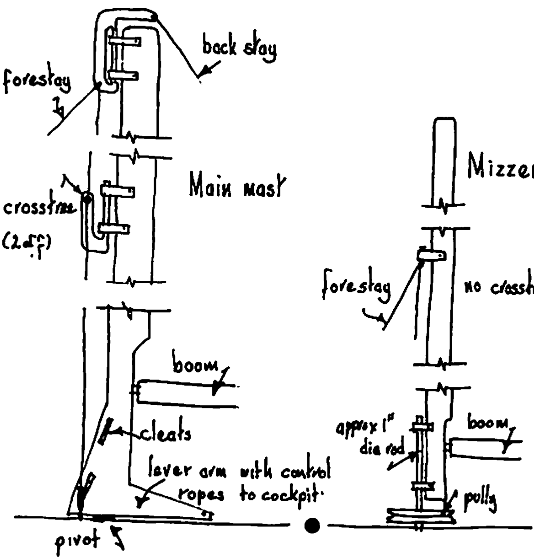
The only defect ever found was that it so utterly fascinated the helmsman, that he sometimes did not concentrate properly on the tactics of his opponents in the race, the boat being raced on a very small pond, where one small mistake would loose the race.

FEY LOONG'S ROTATING MAST

By Norman Pearce

9, Palmyra House, Palmyra Road, St. Helier, Jersey

The enclosed drawings show the method of mast rotation used by the yacht *Fey Loong*, seen in St. Helier harbour last summer. I believe she was Norwegian and looked like a conventional light displacement type at first with the top 6 inches or so of the hull raked



inboard giving a slight " *Atalanta* appearance." Although the standing rigging which was quite conventional was fixed, the masts rotated. It seemed a neat arrangement and, as the yacht had reached Jersey, it must work and be seaworthy. The mast section was approximately pear-shaped. I should judge the boat to be about 24 ft. L.W.L.

SAIL FLOW AND THE "WILSON" BATTEN

By B. P. Wilson, *New Zealand*

Introduction. My experience with yacht's sails has been for the purpose of obtaining the maximum amount of drive from a restricted sail area while keeping within the rules of class yachts. I have never had any time for sails other than those allowing full length battens. To me, a sail must be set as rigidly as possible so that the drive or shape will remain constant.

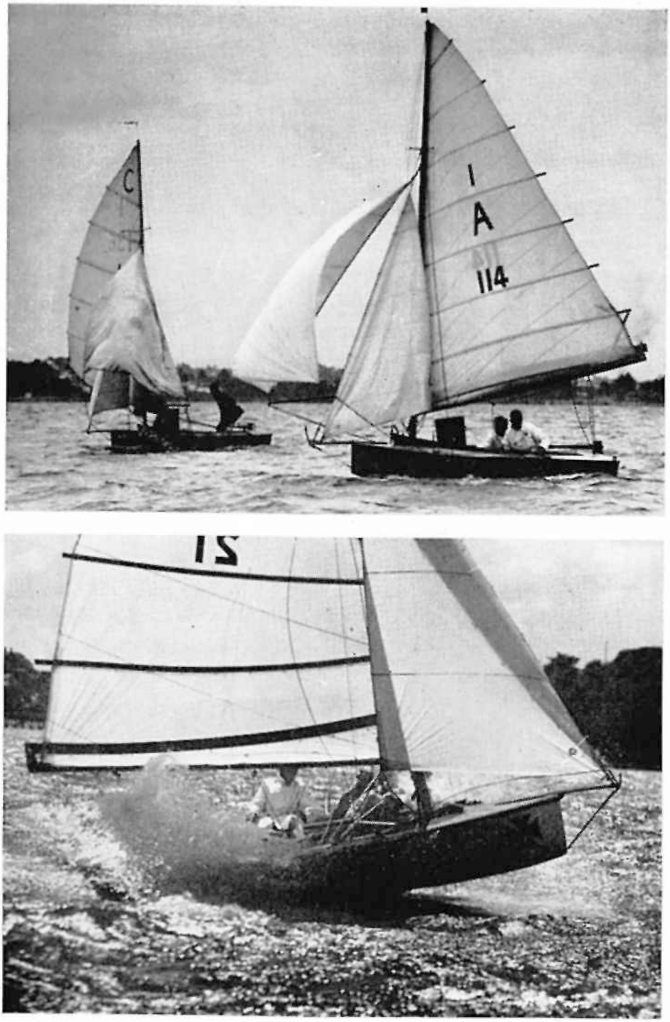
The experience I have gained during my racing career is based on common sense and trial and error. I could not, given a hull, design a sail plan for that boat as I do not know how to go about it, but in a one design boat, all measurements are given and on these I work to make the most efficient use of the restricted sail area.

Going back to 1950, I first realised the fact that full sails are faster, by the performances of yachts which had just received new sails and these were naturally cut full to allow for stretching over the years. In nearly every case, I found that the new sails improved the boat's performance by at least 2 minutes over a 2 hour course. Coupled with this, one big race day, I bent the top of my mast forward with jumper stays as my performances had not been satisfactory during the previous weeks. The bend in the mast was very pronounced and this naturally forced a lot of fullness in the sail at the top half. The race was in a 10 m.p.h. wind and we were first home by over 5 minutes and we also had 5% handicap. We won that race quite easily.

It is firmly established in my mind that the fullness in a sail must be about 1 in 10 for winds up to 20 m.p.h. For winds over that force, it is advisable to reduce the fullness accordingly. With such a sail as I now use, it is very easy to reduce the fullness by using heavier battens and lashing in the bottom so that it is laying along the boom. It is not necessary to take in all the fullness at the foot but only the amount deemed necessary for the wind conditions. As the mainsail has been cut with a large round at the foot, it does not need so much round up the luff. The fullness is placed in the sail with the big batten and reduced accordingly if so desired.

I have represented Auckland province in National contests 6 times during 12 years of yachting and won the events 3 times, once as crew member.

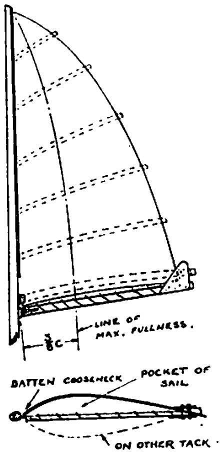
Development of the "Wilson" Batten. Firstly, the so-called "Wilson" batten, which I call "Bertha," can hardly be credited as my invention, although I was to be the first person to use this type of



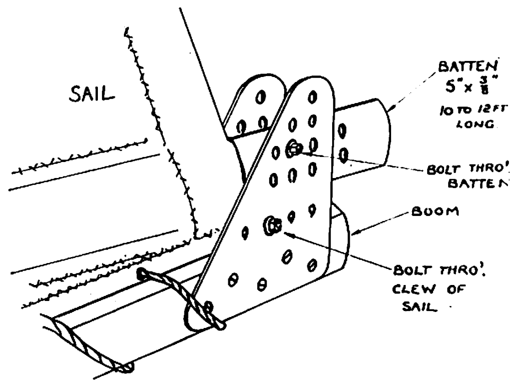
Yachts with the "Wilson Batten"

batten in its present form in New Zealand. Dr. Manfred Curry in his book " Yacht Racing " makes mention of this type of sail.

In 1950, Peter Simons and I built an *Idle Along* yacht *Outrage* and from this time on, the Bertha type sail slowly but surely developed



PLAN OF FOOT OF SAIL.



SKETCHES OF THE "WILSON" BATTEN

due to continued experiments. In 1952, we built *Outcry*, another *Idle Along* (1A 114) which was the first yacht to fly this sail with the Bertha batten with 100% success. Constructive thinking and Leo Bongaid brought the *Outcry* type about. Looking back to about 1950, this is roughly the process which occurred :—

(1) Sails, to be most efficient, must have full length battens.

(2) Once a sail is cut to shape, only a limited amount of forcing the battens into the sail is possible in an attempt to make the sail fuller for light winds. No sail will be satisfactory if battens are used to force it into shape. The sail is not designed for that purpose. Battens on the other hand, should be designed to lay in the sail and retain the built-in shape of that sail without undue tension.

(3) The best amount of fullness to have in a sail is in a ratio of 1 in 10 to 12, i.e., if a boom is, say, 12 feet long, then 1 foot of fullness is required at the boom to give the correct drive.

(4) Even with a sail very expertly made, it is not possible to obtain the correct aerodynamic shape to that sail in the lower 2 feet when the boom is straight, as the sail is changing from the correct flow to a straight line, which is a waste of good area.

(5) The obvious answer therefore is to have either (a) a " Park Avenue " boom or (b) a wide batten at the foot of the sail which can be

forced between the mast and leech end of the boom and, when compressed by a fitting on the boom, will bend the sail to the required amount of fullness.

(6) When the batten bends, it leaves a gap between the sail and the boom. This is then filled with sail cloth to form a sort of ledge. So, we now have a sail which is true to shape from the peak to the boom. As a result the drive we lost in our old sail in the lower 2 feet is now all efficient area.

(7) Due to having all this extra fullness in the foot of the sail, it is necessary to reduce the fullness up the luff.

(8) No strain is now placed on the sail as the Bertha batten at the foot is bent and held by the boom fitting.

(9) We now have an efficient sail for light to medium winds. But, for heavier winds, we have a row of eyelets under the Bertha Batten pocket and, by lashing these to the boom and removing the batten if required, we can get a sail of the same area but completely flat. By reversing the process, we can restore any degree of fullness we wish.

We therefore have the perfect sail for any conditions. Summarizing the advantages :—

(a) It is adjustable to any weather.
(b) It will not lose its shape.
(c) It costs no more than the other type.
(d) It is far more efficient.
(e) One sail of this type is cheaper than two of the old style (say, one flat and one full) which are necessary for competition racing.

As to why this type of sail was banned for the *Idle Along* class, I can only suggest it was due to " sour grapes " being foremost in the minds of those responsible. Throwing out an advancement in yachting which, at that time, conformed to class rules without first holding an inquest on all the facts is, to my mind, completely wrong.

The same principle as the *Outcry* type of sail has been applied to the new " X " class yachts. Firstly, I designed one for Tom Miller (X 10) and then for my new boat *Outvie* (X 21). The " X " class rules allow this, although not in quite the efficient form I developed for the *Idle Alongs.*

Without the help of Leo Bongaid, it is doubtful whether I could have reached the stage of the *Outcry* type of sail by 1952, as the amount of effort he put into helping getting the thing right would have cost a lot of money.

Reference : " SEA SPRAY," MARCH, 1955.

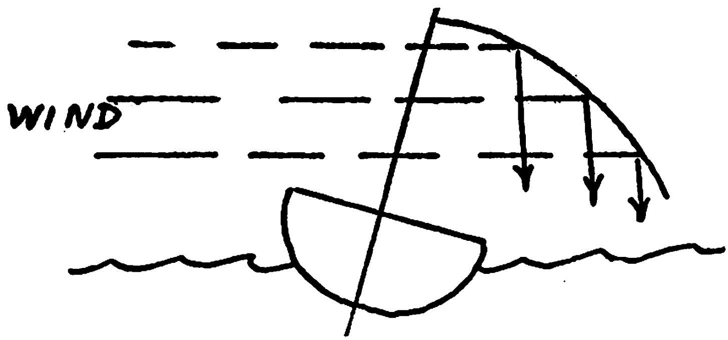
Photos by courtesy of the " AUCKLAND STAR."

THE UMBRELLA RIG

By John T. Roland

A letter to " Yacht and Yachting " to whose Editor we are grateful for the block used for the photographs.

I got the idea from a Polynesian craft and the extraordinary thing about it was that it *was actually* non-capsizable. My small model sailed bolt upright through squalls that would have thrown any toy boats on their beam ends.

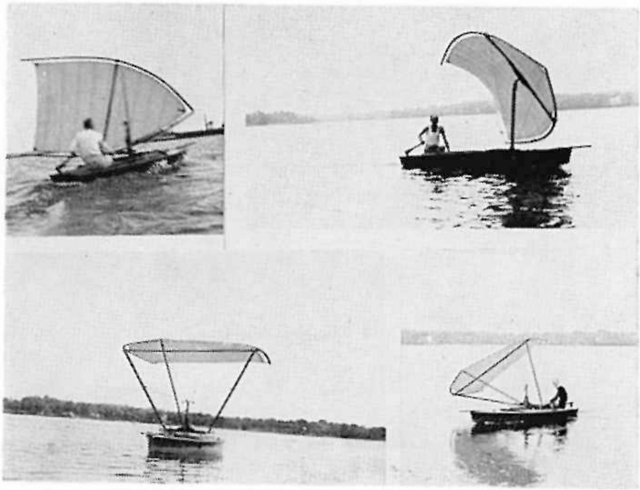


Then I put the rig on a 12 ft. *Snipe* hull and eventually gave that a real " breakdown " test by sailing it through a near hurricane that blew the whole rig away and landed it on the lawn of my place, a quarter of a mile away, without ever capsizing the boat. Before that happened, she nearly drowned me with spray and I got laughing so hard that I was weak.

The basic principle is very simple. It is just to have an inclined plane to leeward of the hull, so that the wind striking its under surface will force the mast *up* instead of *down.*

Experiments with an apparatus on shore proved that, no matter how hard the wind blew, a rig like this would never lie down. I had only to add a rotating element to the sail, so that it could be trimmed. Perhaps " trained," like a gun, would be a better word.

The first rig was by far the most efficient. It was also complicated to build and cumbersome to handle, so I tried to improve upon it. The second version sailed well but did not have the sure righting effect of the original. I took out basic patents on the thing, but they have long since lapsed. I still think it is an entertaining idea. Some ingenious character might do something with this yet.



AN ENGINEER'S SAIL

INVENTED BY BURNICE D. BEDFORD

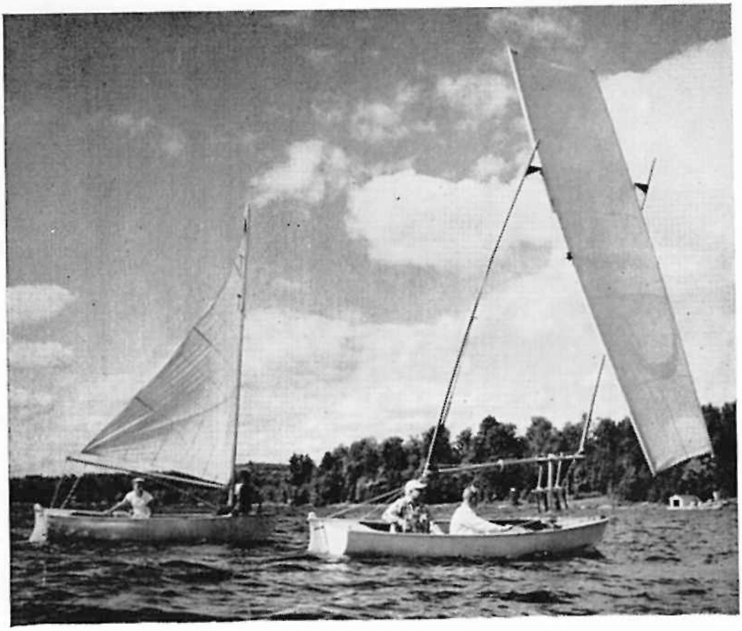
19 Washington Road, Scotia.

If a modern aerodynamacist were asked to design a sail for a boat, he would immediately think of erecting a rectangular sail of aspect ratio about 3: 1 and he would then try to figure out some way of keeping it in position. It would appear that this sail has been designed thus, though the aspect ratio is only 2: 1.

Here, the rectangle is held aloft by a U-shaped frame of light alloy tubes and the bottom of the U pivots on a horizontal axis on a 4 foot long stub mast which, in turn can rotate through 360°. The arms of the U are held aloft by 12 coil springs which presumably allow them to go to leewards under the wind pressure.

The sail rectangle is slung from luff and leech poles each 16 feet long and these are pivoted to the ends of the arms of the U, one quarter of their length from the top. The lower end of the sail rectangle is kept from flying upwards by two "vangs" to the "spreader" pole 8 feet long which keeps the luff and leech poles apart.

In Light Winds. The sail is twistless with a vertical aerodynamic axis. The luff pole will not produce any interference with the wind



Burnice D. Bedford's Sail

flow and the only inefficiency comes from the parasitic drag of the arms of the U which should be on the weather side of the sail and thus of little importance. The mainsheet is attached to the bottom aft corner of the U and sailing should be normal and conventional enough.

In Strong Winds. The arms of the U will be pulled off to leeward by an amount determined by the 12 springs and the bottom of the sail will be allowed to fly upwards, thus reducing the height of the point where the line of action of the sail comes over the boat. This will reduce the heeling moment of the sail and, at the same time produce some lift. As long as the angle between the sail rectangle and the vertical does not exceed 30°, the efficiency will not be greatly affected and, of course, it will even then be better than with a conventional rig heeled the same amount to leeward.

Practical Trials. As far as can be gathered, the only trials have been with a sail area of 120 sq. ft. on a *Tech* dinghy as compared with the usual 72 sq. ft. Bedford's rig was, of course, faster than the *Tech* and kept pace with boats as large as *Snipes.* No information is available about the relative speeds in very strong winds.

Ancestry. It is not known if this sail took origen from that of John T. Roland, itself taken from the Polynesian sail or whether it was completely original. Oddly enough, it has some features of what may have been the original mat sail of the Pacific and the Singalese sail.

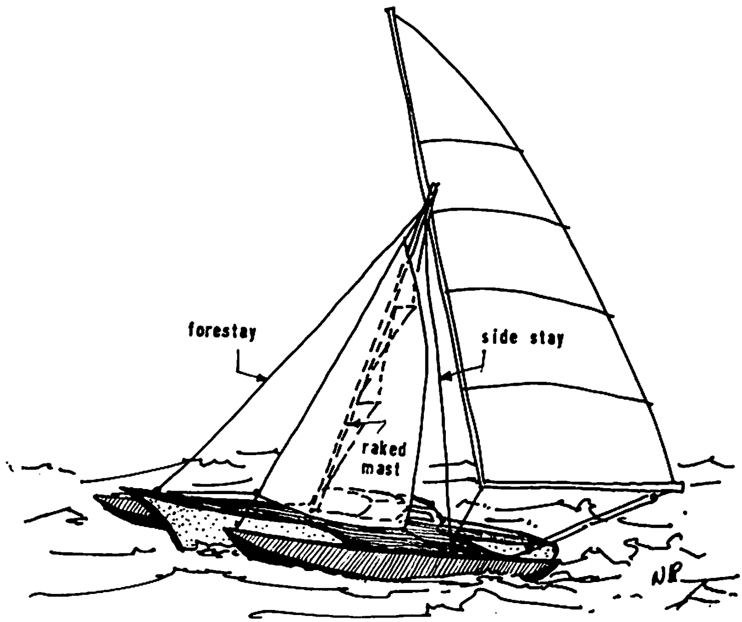
It is reported that the sail as shown was quite difficult to hoist but improvement would be possible.

A "KITE SAIL" DESIGN

DEVISED BY GEORGE BENELLO

1607 Milvia St., Berkeley 9, California.

The drawing shows the rig devised by George Benello for his *Nugget* trimaran. It will be seen that, when the mast and the luff spar are vertical, the sails become the normal gunter lug rig but, when the wind is strong, the mast can be allowed to heel to leeward and the boom can also swing out, sloping the luff spar to give a lifting force at the lee side of the craft. The jib may then be set on the forestay attached to the bow of the lee float.



This rig has all the theoretical advantages of such systems but, in practice, the mainsail luff spar would be very hard to control. At least, it was on a version I tried out some years ago. Both the weight of the boom and sail and the sail forces try to push the tack of the sail forward.

A "KITE" RIG

By W. Copley

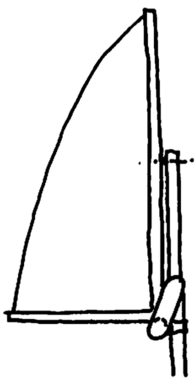
132 Onewa Rd., Birkenhead, New Zealand.

Readers may remember Walter Bloemhard's "Kite Rig" of A.Y.R.S. No. 26, *Sail Rigs*. This is a similar concept but tends more in its design to the "lateen" idea than to the Marconi mainsail.

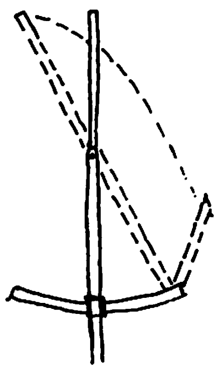
A short mast supports a yard by about its centre point and the lower end of the yard is fixed in a slide on a sprit, curved so that it is an arc of a circle whose centre is the halliard block. The sprit is, in turn, attached to the mast by a collar which allows it to revolve.

The centre of effort is, of course, below the top of the mast and thus the foot of the sail tends to be blown out to leeward on each tack. The sail has a boom which makes this more definite.

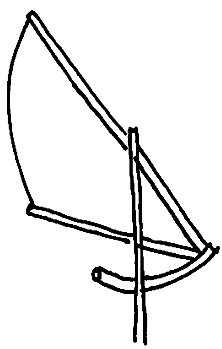
Close Hauled. The sprit at the tack is kept athwartships and, on each tack, the foot of the sail moves to leeward, turning a certain amount of the sail force into a lifting force. In strong winds, this



SIDE VIEW
close hauled
light wind



BOW VIEW
close hauled
strong wind



SIDE VIEW
free wind

may be a useful way of throwing away unwanted capsizing moment. In light winds, the yard would be kept vertical.

Reaching. On this course, the sprit at the tack is allowed to revolve, which takes the tack of the sail forward of the mast. This should also result in some lift but it will also give the sail aerodynamic " sweepback " as well and this will increase the sail forces.

Summary. In essence, this sail is a " controlled tack " lateen sail which can be used as a gunter lug in light head winds. In strong winds, it can efficiently throw away unwanted capsizing sail force by converting it into lift. In beam and following winds, it can be converted into a lateen sail.

A WHEELED WINDMILL MODEL

By William Garnett

Hilton Hall, Hilton, Hunts.

Wheelbase 30″ Front track 38″ Total Area 612″ sq.

This model is the result of numerous trials with different arrangements, aimed at simplicity as well as efficiency. I prefer eight sails to ten or more for the first reason. They are of right angle-clew shape

A Wheeled Windmill Model

and are placed to windward of the mast, in which position the centre of areas is to leeward. This effect is achieved by coning the spokes slightly and raking the whole fan considerably, as shown. The rake also affects the lateral balance, and a 30° rake will take care of masthead torque using a one-one ratio for simplicity. Chain and sprockets take the drive to the rear wheel. As a refinement each boom may be sheeted to the next spoke with elastic, to vary the angle of attack and absorb buffets.

Theory. With a normal rig, ignoring friction, there are two courses on which the " true wind barrier " takes effect : dead upwind and dead downwind. You cannot sail on the former and you cannot sail faster than the wind on the latter. The windmill is designed to overcome this barrier by having the sails move on a fore and aft axis. Thus, dead upwind, the sails move in a spiral at an acute angle to the wind and the yacht sails to windward as though on both tacks at once. Dead downwind, the sails take a spiral course at an obtuse angle to the wind and the yacht sails as if beating downwind on both tacks at once. The only limit to the speed attainable on any beating or reaching course is the " apparent wind barrier," and therefore, still ignoring friction, a windmill could exceed the wind speed in any direction whatever.

Another effect of the indirect drive is that the " apparent wind barrier " need not approach so soon, as a wider angle of attack can be used than is practicable with a normal rig on the same course.

Further, the sails may be asymmetrical aerofoils, which with proper gearing will always deliver the maximum thrust. This and the fact that it is never in stays make the rig highly manoeuvreable.

Disadvantages. Friction losses in the transmission.

The need for flexible gearing and variable pitch sails.

Danger and inconvenience.

Weight.

Performance. The model is at its best in moderate winds, and will flail away into the thick of the wind making quite a lot of ground. Actually the best ratio for a head wind only affords a maximum of two thirds the wind speed, and it never approaches this in practice, On other courses a normal rig goes better but blows over more easily, unless it is raked to give down thrust.

Prospects. I am not building a full-scale windmill as the cost is high and the engineering snags make the rig of little more than freak value. A modern bermudian land-yacht will sail within 20° of the true wind, which is running the windmill pretty close.

Note. Doubt has been cast on the possibility of exceeding the wind speed downwind. This is easily performed by an ice- or land-yacht sailing diagonally downwind, and is indicated by the apparent wind drawing more than 45° forward of the beam. A windmill sail would follow a similar course, but on the surface of a cylinder instead of a horizontal plane.

It is worth noting that the only other rig with a " free " sail, the kite rig described in previous publications, lacks the advantages of the windmill on head wind and running courses as the motion of the kite is not geared to that of the yacht.

CAT OR " UNA " RIG vs SLOOP

By Harold P. Wiggins

"Hans Cottage" Henley on Thames, Oxon.

Some of the helmsmen in the National 12 ft. Dinghy Class have recently been somewhat shaken by the efficiency of the Una-rig of the *Finn* Class, and have been agitating to have this rig prohibited for the National 12-footers, fearing that this will out-class the sloop rigged boats. The Una-rig, ever since this Class started, has been allowed by the Class Rules, and I do not think that is it likely to be prohibited.

In the early days of this Class, there were a few Una-rigged Nationals on the *Uffa-King* design, the plans for which allowed for this as an alternative rig. But they were apparently not a success. That did not surprise me because I predicted at the time that it would *not* be successful on an *Uffa-King* hull. For one thing, we found out when we were testing the proto-type of the Henley 12-footer, which was *Una-rigged* 90 sq. ft., that the relative position of the mast and the centre-plate was very critical. Consequently, if the position of the centre-plate as shown in Uffa's drawings were correct for the sloop-rig, as shown, it was very improbable that it would be correct for the *Una-rig* sail plan. Also, in my opinion, the bow sections of the *Uffa-King* were too fine to take the *Una-rig*. For the *Una-rig*, the boat has to be specially designed with a fairly full bow because the weight of the mast right forward, and the pressure of the sail when full of wind combine to press the bow down. It is no use anyone trying to fit the *Una-rig* successfully to a boat designed to take the sloop-rig. With most modern racing dinghies the bow would be too fine and the centre-board in the wrong place.

The *Una-rig* is apparently much more popular in the U.S.A. than it is over here. Not only are there large racing classes of *Una-rigged* dinghies out there, but it is also used for quite large cruising yachts. I think that there is scope for experiment in this country for the *Una-rig*.

In *Yachting* of May, 1959, Robert Bavier, who knows what he is talking about, had a very interesting article on the *One of a Kind* races in retrospect and he had something to say about the jib " slot " effect *á la Manfred Curry*, which recently has tended to become rather debunked as the results of experiments. In fact, I have even read that the effect of the jib on the mainsail is rather deleterious than otherwise ! Bavier says in his article " In 1952, the scows shone again, with the " E " scow winning elapsed time honours, and the " C " scow taking it on time allowance. Many were surprised that the cat-rig on the 20 ft. scow was so efficient. Inland water sailors had long since proved that the " C "'s cat-rig *was faster than the Sloop-Rig of the " D " scow*, which had the same hull. This rather upset all the theories about the slot effect of the jib and mainsail. It seems evident, from her outstanding performance, that *on small boats*, a cat-rig is at least as efficient, if not more so, than a sloop."

At the Henley S.C., a few years ago, we had a very nice Class of 12 ft. dinghies with a *Una-rig* of 90 sq. ft. in one Bermudian mainsail, the same Sail area as the National 12 footers. For several years, we raced these Henley 12 footers with the Nationals and, during that time, out of a dozen Club Challenge Cups, mostly for aggregate points, the Henley 12 footers won eleven of them. Now, sailing on the Thames at Henley, the *Una-rigged* dinghies went to windward just about as well as the sloop-rigged Nationals, partly because I think they changed tacks more quickly. But, when it came to reaching or running, they simply walked away, literally sailing three feet to the Nationals two, mainly I think because, having all their sail area in one sail, it was very much more efficient than the sail area being split up into two sails of jib and much smaller mainsail. This also started me wondering whether the jib was all it is cracked up to be.

Ed. : Mr. Wiggins observations have been adequately confirmed time and time again in many ways, as A.Y.R.S. members will know. The cat rig is much more sensitive to angle of attack when close hauled than the sloop and needs much more skill in altering course to wind shifts to get the best out of it. The point Mr. Wiggins makes about the fineness of bows for the two rigs is of interest but the cat rig can use fine bows (a) if the crew are prepared to sit farther aft and (b) if the centre-board and mast are placed farther aft.

A BIPLANE SAIL RIG EXPERIMENT

By Manlio Guberti-Helfrich

Grottarosa, Rome, Italy.

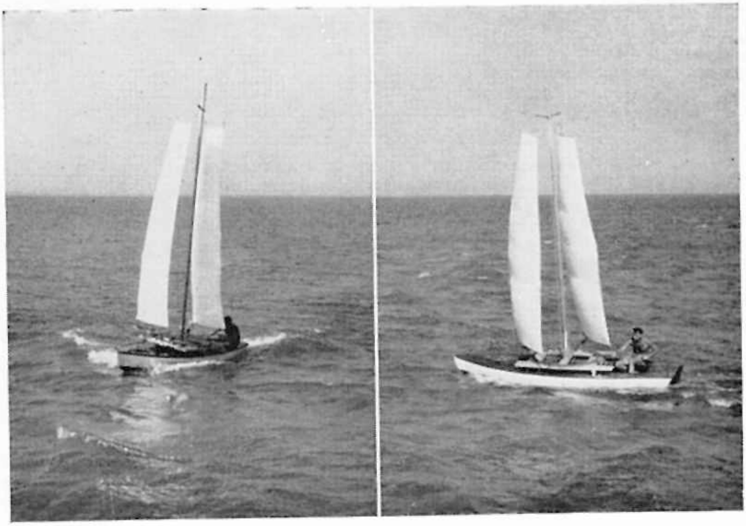
An experimental rig was built and tested by me at sea in the late summer of 1950. I had been (and still am) drawing rigs of every shape, yet by this experiment I did not propose to try nor to demonstrate anything new. I only wished to get my first physical feeling of how a non-twisting semi-rigid canvas sail would act.

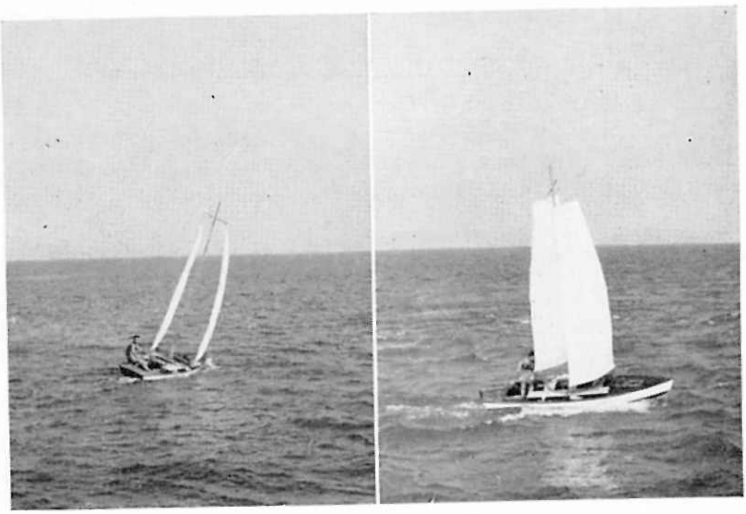
In order to avoid the use of expensive special materials I chose a biplane solution, although I knew it had some aerodynamical faults. The rig had one central mast supported by four stays along which the twin sails were hoisted. The lower ends of the two aft cables were fixed to two small slides which provided for a primitive hand control of the foils' concavity. The sails had elliptical edges and were fully battened. The whole system turned freely on bearings running along a circular rail temporarily fastened to the deck of a *Snipe*. The sail area was exactly the same as in normally rigged *Snipes*.

Being alone on board with that unusual wind machine was not frightening nor worrying. Since I left moorings the first time I felt quite at ease, and I could start to tack along a narrow port channel, 3/4 of a mile long, until I got off at sea. After some days of tests and of acquaintance with the rig I challenged the Snipes of the area and was able to beat them in most cases, although (due to the considerable weight of the rig) I sailed alone and was therefore slower in manouvering

Because of the negligible shift of the pressure centres there wasn't any uncomfortable strain on the helm, and I never had trouble in putting about nor in controlling the craft even in strong blows since the heeling moments seemed to be much lower than with a normal rig. The sails set nicely with no twist and their concavity's regulation had a surprisingly ready response on the boat's speed, particularly with light airs. The performance was remarkably good to windward and excellent with the wind a beam, the leeward sail seeming to ask for less concavity than the weather one.

The battened sails automatically changed their concavity on changing tack, and were handy to hoist and to lower, although I did not see any practical way of reefing but taking in one of them. I did appreciate the possibility to sail backwards when, going for mooring in crowded waters, I could manoeuvre the craft as if she were a car even at very low speeds.





2 Views of the Biplane Rig

LETTER

Sir,

In A.Y.R.S. No. 26 Mr. Christopher Mattingly writes of a method of testing rigs on land by means of balanced brakes. He suggests doing this on an airfield runway near to the sea. Although Gransden Lodge airfield, Great Gransden, Hunts., is nowhere near the sea it is fairly bleak and unsheltered and H.Q. of the Gransden L.Y.C. (one of the only two land-yacht clubs in the country) who, I am authorised to state, would welcome any such experiments by Mr. Mattingly or other A.Y.R.S. members at Gransden. They might even be able to give some useful advice to the experimenters.

If you wish for any further information on this, please contact me or the G.L.Y.C. secretary, Mrs. Irene Taylor, Greenbanks, Caldecote, Cambs.

Yours sincerely,

WILLIAM GARNETT

Hilton Hall, Hilton, Huntingdon.

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Key to Abbreviations :—SC. Sailing Catamaran ; AB. Specially suitable for amateur building ; MP. Can be built in marine ply ; A 1-2 Normally accommodates Max/mm. persons 1 or 2 etc. ; GF. Hulls available in reinforced glass fibre ; K. Supplied as kit ; MM. Moulded mahogany shell hulls ; C. Supplied complete ; B. Sleeps 1 to 2 persons etc. ; D. With detachable hulls ; S. Safe.

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