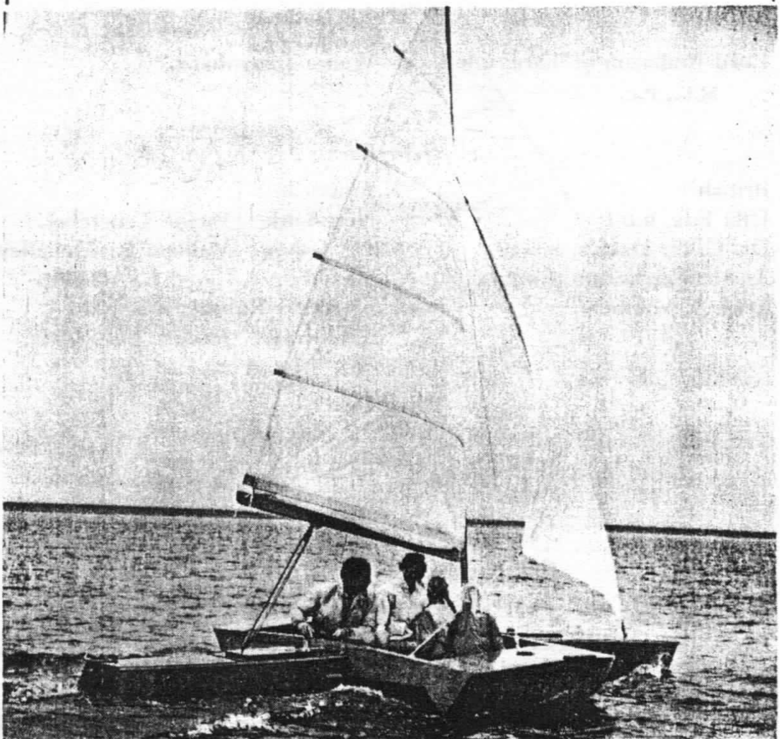
# OUTRIGGERS 1959

## A.Y.R.S. PUBLICATION No. 29



"AVOCET"

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## EDITORIAL

February, 1960.

We now welcome a French " Secretariat " of the A.Y.R.S. This will no doubt in future branch off into an autonymous Society which is more appropriate to a group which has its own language but, for the present, it will be organized so as to use our publications. Perhaps it is not very well known to English speaking readers but it was in France and the French Pacific Islands that much early work on both catamarans and outriggers was done, using modern materials.

Pierre Gutelle is hoping to organize some towing tests from the banks of a canal to get some hull resistance figures and this should be most interesting.

## A SOCIAL AFTERNOON IN LONDON

R. Gresham Cooke, C.B.E., M.P. has most kindly invited A.Y.R.S. members to a meeting at his house, 4 Ranelagh Grove, London, S.W.1 on Saturday, 12th March at 4 p.m. (Ranelagh Grove, off Pimlico Road, S.W.1, is near Ebury Bridge Road about 150 yards from the B.O.A.C. Terminal Building, Victoria). There will be short film by Erick Manners on Catamarans, followed by general discussion.

## THE A.Y.R.S. BURGEE

A.Y.R.S. Burgees may be got from Captain O. M. Watts, 49, Albemarle Street, London, W.1. Prices vary from 11/6 for 9 inch to 39/6 for 54 inches.

## INTRODUCTION

I think by now that we, in the A.Y.R.S., have made an almost complete study of catamarans of the double hulled type. The information we have collected has now spread all over the world and elegant and efficient catamarans are appearing everywhere both as light racing craft and cruisers. We would be foolish if we said that everything about catamarans is known but at least there is no longer any excuse for badly shaped catamarans to appear.

Now, in this publication, there is every hope that an equally satisfactory job has been made of the trimaran and outrigger. There is this difference between the two studies, however, in that our study of the catamaran was only keeping up with the vanguard of development while with the trimaran and outrigger, we have tended to lead the advance. It is much easier to be wise *after* an event than *before* it.

*Outrigger Hull Design.* There is no reason to suspect that the main hull of an outrigger craft should have a different shape from that which we know is best for a catamaran. Our conclusions in this matter can be summed up by saying that the *Shearwater* hull is the fastest shape for the moderate speed range for a given weight while *Freedom*-like hulls with a greater concentration of buoyancy at the middle, fine bows and flat broad sterns have a higher top speed and are also faster in light airs.

*Floats and Cross Beams.* The shape of these are examined in this publication and it is quite likely that our conclusions are correct. Certain dimensions may still have to be found but I believe that the main features of the configuration are now settled.

*The Polynesian Craft.* This is a very fast configuration which pure human slowness and convention has neglected in favour of the double hulled catamaran. To my knowledge, the *Malibu Outrigger* and the *Islander*, described in A.Y.R.S. No. 23, have been the only ones to appear. We are lucky in this publication to have an account of the *Malibu Outrigger*, designed by Warren Seaman, which I know will interest everyone greatly. It is the largest multihulled class in the world, except for the *Shearwaters*, over 500 sets of plans having been sold. This surely should make some of our professional designers and boatbuilding members take some interest.

*The Micronesian Canoe.* A. E. Bierberg again shows plans and a photograph of his latest canoe of this "backwards and forwards" type. *Itata'e* is 6 metres long, pleasantly shaped and asymmetrically hulled with lateen rig. If yachting is a sport undertaken solely for pleasure and recreation, surely some individualist would like to make one of these most interesting craft which are really great fun to sail and no sluggards by any means.

*The Indonesian Craft.* This boat or "Trimaran" has now been taken almost to finality by Arthur Piver and Louis Macouillard on the practical level, helped, I believe, by the theoretical studies of the A.Y.R.S. Starting from Victor Tchetchet's craft, Arthur Piver has designed and built trimarans in an apparently never ending stream, always improving them till his 30 foot cruising trimaran will, I feel sure, be the perfection of the configuration. The floats of the 30 foot craft and the 24 foot cruiser, described in A.Y.R.S. No. 27, should, Arthur thinks, have a little deeper V than a right angle to avoid pounding on waves and this has made some future experiments in floats desirable.

Ivan Psaila shows a very nice trimaran design for rough water while Dr. Anthony Ryle's craft, though made as a stable mate for his brother's foil trimaran is itself of excellent conception.

*The Float-Foil Configuration.* This is an exciting and entirely new concept which has come directly out of the A.Y.R.S. work. Professor Martin Ryle's *Avocet* is described by him and opens up still another field of experiment to us of fascinating possibilities. Peter Cotterhill describes his experiments with the *Parang* design of A.Y.R.S. No. 18 with the same principle and while neither he nor Professor Ryle got the answer with perfection, both did, in fact, again prove that angled leeboards will lift, though the settings appear to be rather critical. We, with *Jehu,* appear to have been very lucky. Julian Allen and A. R. Gibbons discuss possibilities with foils, while Dr. D. B. James suggests a useful single outrigger.

We conclude with a sketch of Arthur Piver's idea for a hydrofoil cruising trimaran with ladder foils as a concept for us to aim at.

## THE FLOAT SHAPE FOR OUTRIGGERS

*by* John Morwood

Outrigger and trimaran floats of many different types have been tried and described in the A.Y.R.S. publications from the traditional circular pole to the wide flat surf board. To try and sort out the results of all these experiments is a difficult problem but I think the following facts emerge :

1. Surf boards and water skis will plane or can be made to plane at high speeds, probably around 10 to 15 knots. However, at low speeds, they have more resistance than displacement floats and may have more resistance even when planing.

2. Floats have to function at varying degrees of immersion and therefore have to have a section which will have the least resistance at different amounts of immersion. A right angle below and a keel line sweeping up to the top of the stem and stern achieve this best, giving a longer waterline at increased immersion and therefore increased speed.

3. Arthur Piver, Louis Macouillard and Anthony Ryle and my *Parang* design all use floats with a square or rectangular section and this partially achieves the object but, when the immersion is such that the side angles of the float go under the water, eddying flow occurs. My *Parang* floats were not wholly successful but the other three have produced craft which are extremely fast.

4. From all these facts, the logic of the position is unassailable. The sections of floats should be triangles with a flat deck and right angles below from the greatest section to the bow. From analogy to all boats, the lower angles of the aft sections should flatten out till the lower edge of the transom slopes up some 8° to 10° on each side. The transom should be very shallow so as not to constitute a source of drag.

5. Length to beam should be about in the ratio of 8 to 1. The keel line can be an arc of a circle which, with the flatter angles aft will give extra buoyancy aft and prevent the bow lifting too much at speed (see accounts of *Tamahine*, A.Y.R.S. No. 28).

6. It is noteworthy that a triangular section will be stronger and lighter than a square or rectangle (it has one less chine piece). The flat deck makes for easier attachment of the connectives to the cross beams.

7. My *Tamahine* or *Tuahine* hull below the chine would do for a trimaran float as it is but the after sections should, I believe, be flattened for higher speeds.

8. It is just possible that, for utmost efficiency, the angle of the float in the horizontal plane should be adjustable.

*Outrigger Cross Beams*

It is now quite settled that outrigger cross beams should be hollow or solid rectangular or streamlined beams. Decking may be added as required for comfort.

*Connectives*

Connectives between the float and outrigger beam are best of the type used in the *Malibu Outrigger*, a metal strap with four angles in it screwed to the top of the float and screwed or bolted to the outrigger beam.

## THE MALIBU OUTRIGGER

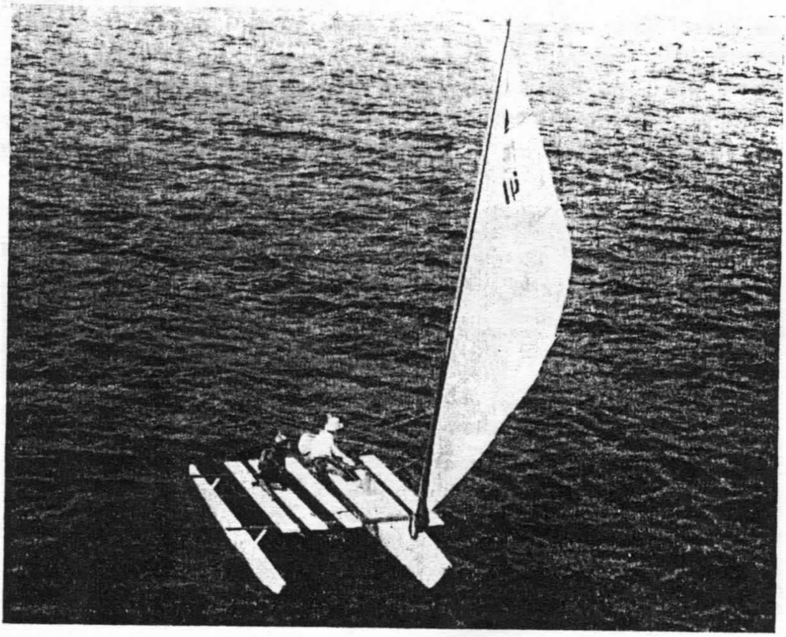
L.O.A. 18 ft. 4 ins. Sail area 200 sq. ft.
Float 16 ft. Weight 400 lbs. (rigged)

Designer : Warren Seaman.

Class secretary : Ethel Buck, 8004, Fordham Road, Los Angeles, 45, California.

Price of plans : $10.00. Cost of materials: $150.00 to $350.00 (ex sail).

The *Malibu Outrigger* is one of those rare phenomena which sometimes appear in order to amaze us. It was devised by Warren Seaman, if we can really believe the accounts published, simply by knocking together some odd bits of plywood without benefit of plans and rigged with odd poles which were lying about and a bit of cloth for a sail. This may literally be true but most of the traditional work boats of the world are made the same way and simply reveal the fact that some people, by tradition and training, can attain to such a degree of " feel " for the wind, the sea and for materials that they can produce boats almost subconsciously which perfectly suit the wind and sea.



*The Malibu Outrigger*

The *Malibu Outrigger* is a craft which all the A.Y.R.S. studies indicate is the fastest possible configuration of a sailing boat and moreover, it has the theoretically most desirable sail shape.

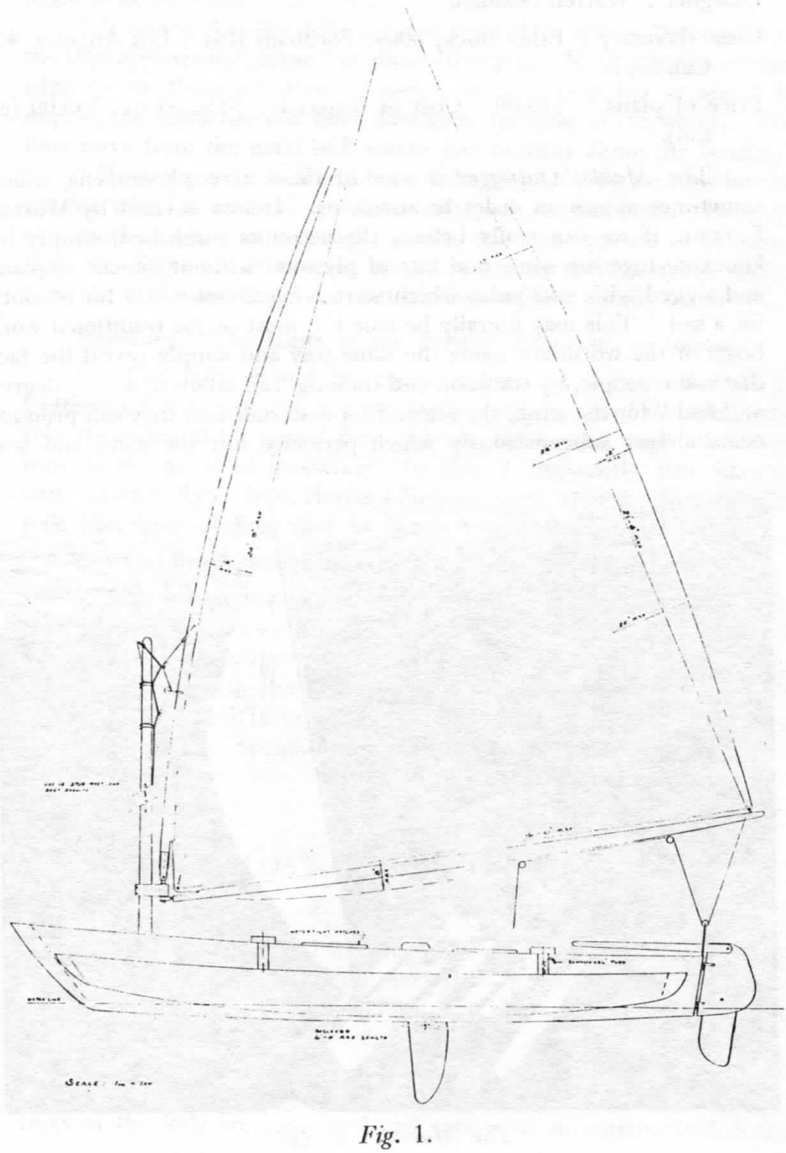


*Fig.* 1.

*The Configuration.* This is orthodox Polynesian, even to having the float on the starboard side.

*The Sail.* This is traditional in the Philippine Islands and in the "*Kolek*" of Malaya. However, the *Malibu Outrigger* sail has the theoretically desirable points as follows : 1. Aspect ratio of approximately 4 : 1. 2. A convex luff to the sail. 3. The peak of the sail vertically above a point 40% of the foot from the forward end, giving a vertical "Aerodynamic axis."

*Construction.* This is of the "deep chine" type with the least wetted surface possible with this section. Construction is $\frac{1}{4}$in. plywood with chine pieces. The float is similarly made. The cross beams are wooden spars bolted to deck beams on the main hull and to metal U-shaped connective pieces above the outrigger float.

*Performance.* In the first Pacific Coast *One of a Kind* race, the *Malibu Outrigger*, magnificently sailed by Robert Fortier, won both boat for boat and on handicap against Walt Hall's *Shearwater* and boats from 15 other classes. In the second Pacific Coast *One of a Kind*, she won on handicap, though *Wildcat* (A.Y.R.S. No. 28) won boat for boat.

In general, the *Malibu* appears to shine best in lightish winds but tends to be more easily overpowered in strong ones than heavier catamarans according to the reports I have received and this is rather confirmed by the *Yachting One of a Kind* races at Miami where the outrigger failed to finish any race in the strong winds.

*Summary.* The *Malibu Outrigger* is a unique craft which has made yachting history only comparable to *Shearwater I* in its far reaching effects on the sport. Considering that she first appeared in 1952, it surely is amazing that apparently no other outriggers have appeared except for the *Islander* (A.Y.R.S. No. 23). Either yachtsmen don't want to have fast boats or commercial firms don't want to produce them.

The drawings for this article have been most kindly done by J. L. Cole. The photograph is from H. W. McFarland.

## THE MALIBU OUTRIGGER

*by* ROBERT FORTIER

The outrigger has become an exciting new racing class in Southern California ; and like many one design boats, it fulfills a particular need in its area.

West Coast sail enthusiasts suffer a lack of natural harbours and launching sites. Proposed man made marinas should help to alleviate

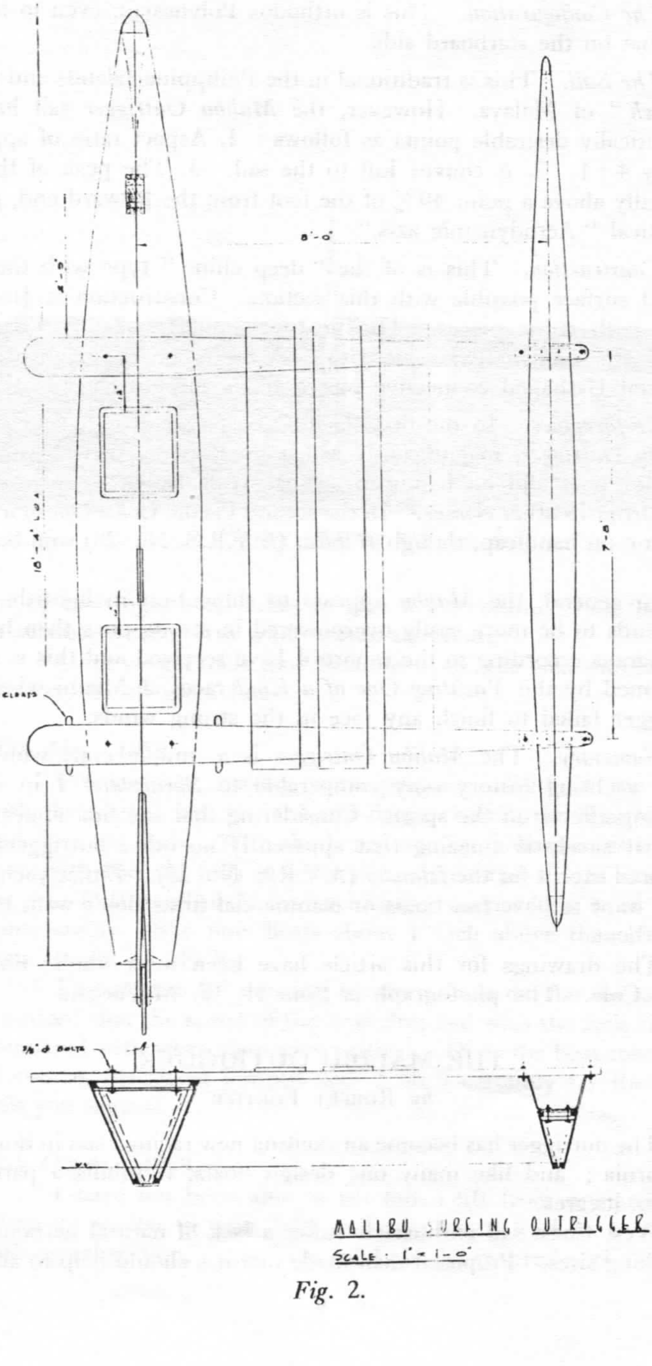

8'-0"
10'-4" L.O.A.
CLEATS
3/8" ϕ BOLTS
MALIBU SURFING OUTRIGGER
Scale : 1" = 1'-0"

*Fig. 2.*

this problem in the future ; but in the meantime, miles of wonderful sailing areas remain relatively inaccessible to eager boatsmen. Moreover, the Pacific surf exhibits an insatiable appetite for boat wreckage. Attempts to conquer it have been made with catamarans, trimarans, rafts, dinks, dorys, and various " idea " boats. Proponents of these crafts are numerous, but their success has not been consistent.

The outrigger meets the challenge of Pacific coastal sailing. She is light, fast, easy to handle in the surf, and can be beached anywhere. She accelerates quickly, a characteristic which is the key to navigating hazardous surf. The rig is a modified lateen type which is quite flexible and thus excellent in gusty airs. A daggerboard extends the draft from five inches to a maximum of four feet ; making possible an extremely good performance to windward. The flexible rig and " arms " enable her to span swells and stiff chop with ease. She is wet, but exhilarating to sail in a rough sea.

The home of the outrigger is the Malibu Yacht Club, in Malibu, Calif. There are no moorings, no slips ; just a large private beach facing the ever present surf. We are often dubbed " The Malibu ' Lot ' Club." Most of the boats are kept high on the beach at the club or on residential beaches in the area. We have no bottom paint worries or a teredo threat, but we do have gophers.* Our gophers are evidently delighted with manila ; it is not uncommon to lose several feet of a mainsheet over night. Here is a unique problem for a unique boat.

About five hundred sets of plans have been sold. Many Malibu Outriggers have been launched and many more are near completion. Practically all are owner built. The hull is eighteen feet four inches overall and the ama (outrigger float) is sixteen feet. The racing sail has an area of around two hundred square feet and can be cotton or synthetic. The design of the boat utilizes standard wood sizes. Both hull and float are constructed of quarter-inch plywood with fibreglassing optional. Cost of construction is under two hundred dollars (excluding sail) and the amateur need have only the most basic of hand tools.

The total beam of the hull and float is twice that of the conventional eighteen footer. Tacking therefore becomes a slower process for the outrigger than for her counter-part.

She can be capsized but is non-sinkable and is easily righted by one man. She is light (400-450 lbs. fully rigged) which makes for easy portability on the beach as well as on a trailer or cartop.

The Malibu Outrigger is a fun boat. She is fun to race and fun to day sail. She is particularly ideal for enthusiasts who live in a locale where shoal water or surf dominate an otherwise good sailing area.

* *Gophers — Prairie dog.*

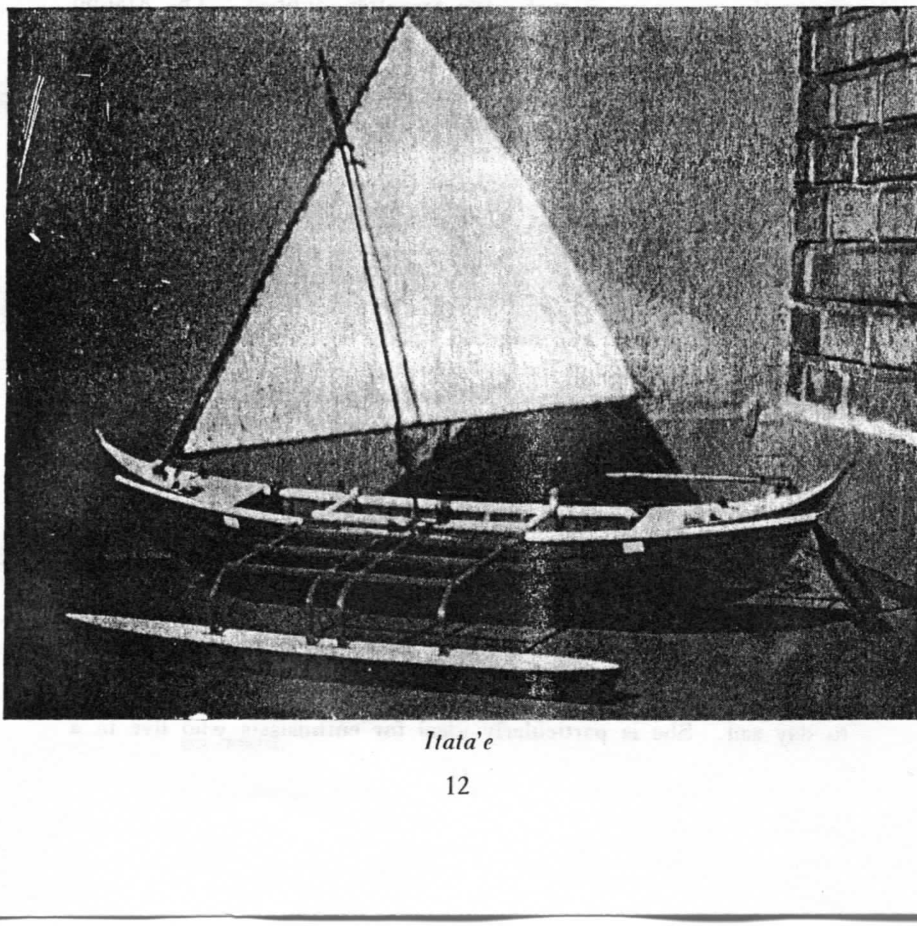
## ITATA'E

### A Micronesian Outrigger

| | |
|---|---|
| L.O.A. 6 m. | Float L.O.A. 3.00 m. |
| Beam O.A. 2.50 m. | Beam 0.26 m. |
| Beam, hull 0.85 m. | Depth 0.24 m. |
| Depth 0.75 m. | Total weight 200 kg. (440 lbs.) |
| Draught 0.35 m. | Sail area: 10 sq. m. (100 sq. ft.) |

Designers : Jörgen Andersson and A. E. Bierberg, Skovbrynet 23, Lyngby, Denmark.

This summer (1959) A. E. Bierberg launched another Micronesian canoe larger than his *Aloha*, described in A.Y.R.S. No. 16. This boat, however, is a copy of the traditional craft of the Pacific



*Itata'e*

rather than a demonstration of the principles of the craft as was the former boat. For example, the Micronesian asymmetrical single outrigger canoe was taken for a model and, apart from the modern materials and a stronger construction, nothing was changed in the shape or sail of the boat.

*The Main Hull.* In the traditional manner, the hull is composed of strong cross frames closely spaced above a long straight keelson. However, 6 mm. plywood is used for planking but even so, the weight at 200 kgm. (440 lbs.) is fairly large, though she has been built for sailing in the open sea. The hull shape looks very easy and of excellent lines. The slightly curved lee side of the long and very slender hull, combined with the more curved weather side, act fully as a lee board to reduce leeway and compensating for the pull of the single outrigger float on the weather side. When the relative proportions of the curvature of the sides of the main hull are correctly adjusted to the pull of the outrigger, the craft will travel in a perfectly straight line, if given a push when afloat.

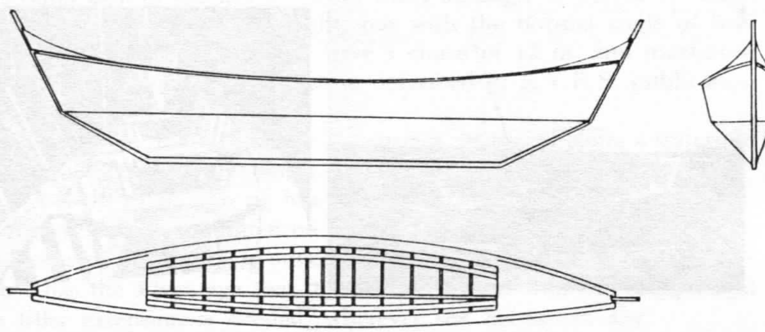


*Fig.* 3.

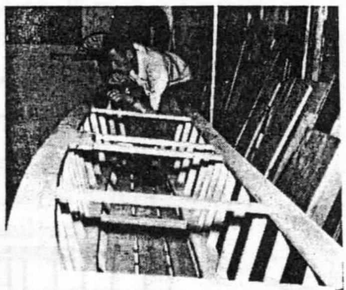
The cradle shape of the hull (in longitudinal section) is useful as it allows the trimming of the craft by placing the crew in various positions fore and aft and this trimming is used to help steer the boat.

Both ends of the boat are decked with hatches for storing things during long sails and to the solid gunwales are fixed the four cross-ships outrigger beams which are, in turn, fastened to the float by four arched pieces of iron.

*The Float.* This is made of planks of 1 in. first rate " Kalmar-pine " which is strong, supple and easily worked. A 6 mm. plywood deck has two small hatches, not only to bail out any water which may get in but also to allow ballasting the float, if desired.

*The Rig.* This is traditional Micronesian consisting of an isosceles triangle with a yard and boom and two full length battens running from the apex of the triangle to the leech, making a sail which looks like a fan. The apex of the triangle is placed at the end which is the bow on a tack. This is the usual type of " Oceanic Lateen," though other types exist.

The mast should be supported by three stays passing around blocks on the outrigger and also a continuous stay which runs from the masthead through two blocks, one at either end of the boat. This stay prevents the mast falling towards the float should the wind ever come on what should always be the lee side of the craft. The mast step is exactly in the middle of the boat but, of course, the mast can lean towards the end where the tack is placed, being held by stopknots in the running stay. The running rigging is machine-made Manila rope which is somewhat cheaper than the hand made sort but considerably stronger. Mast, yard and boom are Oregon pine but bamboo may be used later for lightness for the yard and boom.



*Putting About.* The float must always be to windward so putting about with this type of boat differs from the ordinary procedure. In order to change tack, the boat is stopped, the tack of the sail is carried from one end to the other. The helsmman changes ends. The sheet is pulled in and the craft sails off in the opposite direction.

*Summary.* The tests so far carried out with the boat have been absolutely satisfying and fully came up to expectations. Thus, there is no doubt that a new type of boat to us, satisfying even the most fastidious sailor, is being created.

## A POLYNESIAN CRUISER

It is an arguable point whether a catamaran should ever be used for offshore work. I have never seen a catamaran design in which I would feel really happy about crossing any ocean. This is because of the exceptional wave and the very sudden wind squall which can (and does) capsize even a catamaran with its enormous stability, and an upside down catamaran is just as stable as it is the other way up.

The only way to deal with this, as I see it, is to have high up buoyancy, either in a structure at the top of the mast as in Michael Henderson's design (A.Y.R.S. No. 27) or in a raised bridge deck with unstable sections when upside down, combined with one or two ballast keels. When carrying enough ballast to make a catamaran self righting, however, the increased weight reduces the performance almost to that of single hulled boats.

*The Polynesian Cruiser.* The main hull would be of a shape such as was shown in A.Y.R.S. No. 28 with a length to beam ratio of about 8 to 1. A ballasted and retractable fin keel would produce self righting in case of a knock down and an outrigger with float, possibly of light alloy for lightness, would give stability when to lee to produce upright sailing and comfort.

This only leaves us with the problem of stability when the outrigger is to windward. I suggest that an ex-aeroplane wing tank filled with water be used, which can be made to slide out along the outrigger beams. This tank could be jettisoned in case of emergency by some means or other such as having it attached by a pin which can be pulled out from *inside* the cabin, as well as from outside.

*The Upside Down Capsize.* Let us assume that the wind has suddenly come from the opposite side to the outrigger with the water ballast tank at the outrigger end. The outrigger has been driven under and, by some freak, the craft has turned completely upside down. The outrigger is to windward but is held down by the water ballast, even though the fin keel is trying to right the craft. Release of the water ballast tank would immediately allow the outrigger to rise enough for the wind to get under it and blow the craft upright again.

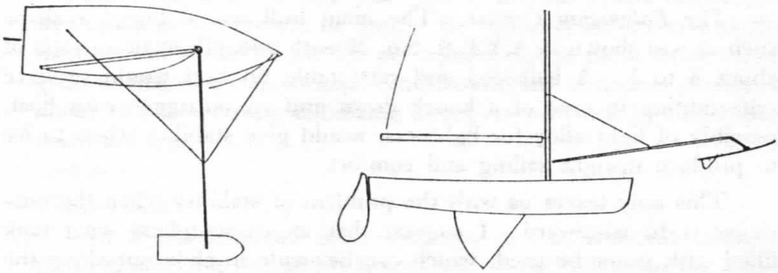
Should the capsize occur in the opposite way, with a sudden squall lifting the unweighted float, it would surely be impossible for an upside capsize to be completed with the ballast keel horizontal and the sails in the water. But, if this occurred, the craft would turn around till the float came to weather and the craft would again right itself. It is true that there would be some delay before this happened but it *would* occur.

*Summary.* A Polynesian cruiser is suggested which would have a high top speed and be capable of self righting.

## A SINGLE OUTRIGGER STABILIZER

*by* Dr. D. B. James

This suggestion is a method of converting an ordinary dinghy to an outrigger craft. Instead of two outriggers, only one of which really works at once, let us have a single outrigger on a boom which swivels out to leeward on each tack. At its outer end is suspended either a water ski or a float on a vertical axle which is pressed down onto the water by the wind pressure. The axle would be attached about the centre of lift or a little forward of it. A fin at the aft end of the water ski or float would keep it aligned with the water flow.



On the dinghy, the outrigger boom would be articulated directly to the mast so that no force would be transmitted through the hull. Thus, a *Finn*, having no rigging would be an ideal boat to use. When not in use, the outrigger would poke out ahead of the dinghy.

The main danger would be that the water ski or float could get buried by a wave. It could then get negative incidence and capsize the craft. However, it might be possible to make the device safe.

## THE MACOUILLARD TRIMARAN

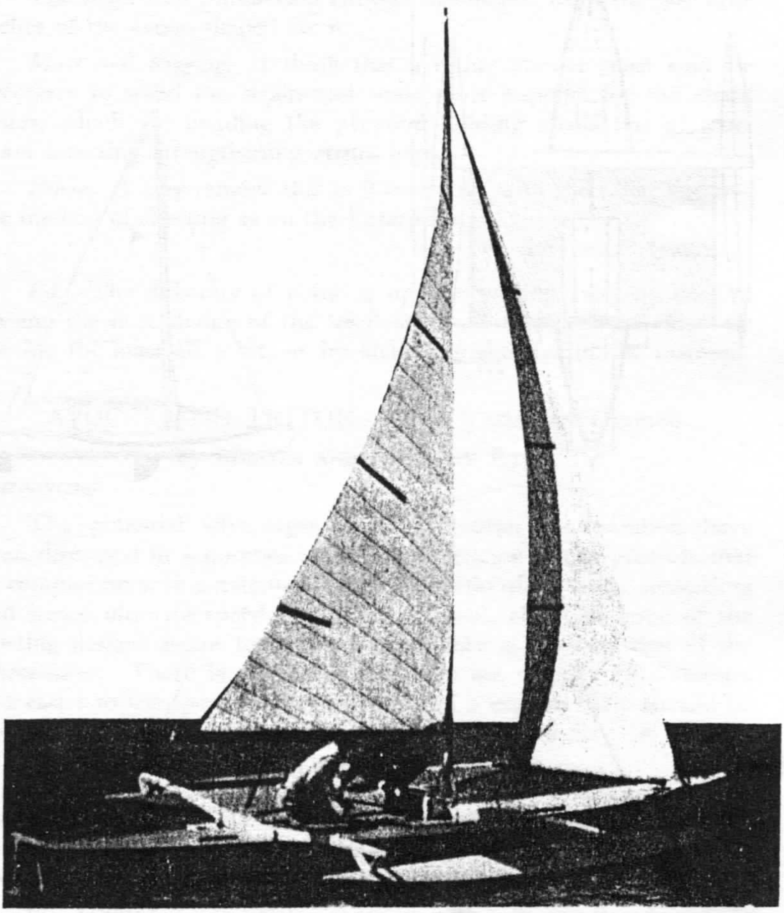
| | |
|---|---|
| L.O.A. 24 ft. | Freeboard 1 ft. 6 ins. |
| L.W.L. 23 ft. | Draught 6 ins. |
| Beam O.A. 15½ ft. | Float L.O.A. 16 ft. |
| Beam hull 1 ft. 6 ins. | Sail area 200 sq. ft. |
| Hull depth 2 ft. | |
| Designer : Louis Macouillard. | |

We publish the information in this article by kind permission of the Editor of *The Rudder*.

Louis Macouillard in this trimaran has come as near to the perfection of the configuration as we are likely to see for some time.

The craft owes its origin, apparently, to the South Pacific pirogues or double outrigger craft developed by the French from the native single outriggers. But the main hull and floats have so many parts reminiscent of Victor Tchetchet, Arthur Piver and the A.Y.R.S. that it seems to me that a study was made of the preceding craft before the design was completed. However that may be, or if the development was entirely independent, the floats are distinctive and, I think, a distinct improvement.

*Construction.* This is of $\frac{1}{4}$ inch plywood throughout with chine pieces of conventional type.



*The Macouillard Trimaran*

*The Main Hull.* This is of the " immersed chine " type but very shallow which doubtless explains the ease of putting about which apparently is present. The entry is very fine, giving a dry boat.

*The Cross Beams.* The fore beam is hollow and thick. The aft one is solid and thin. Both extend right across the hull from float to float.

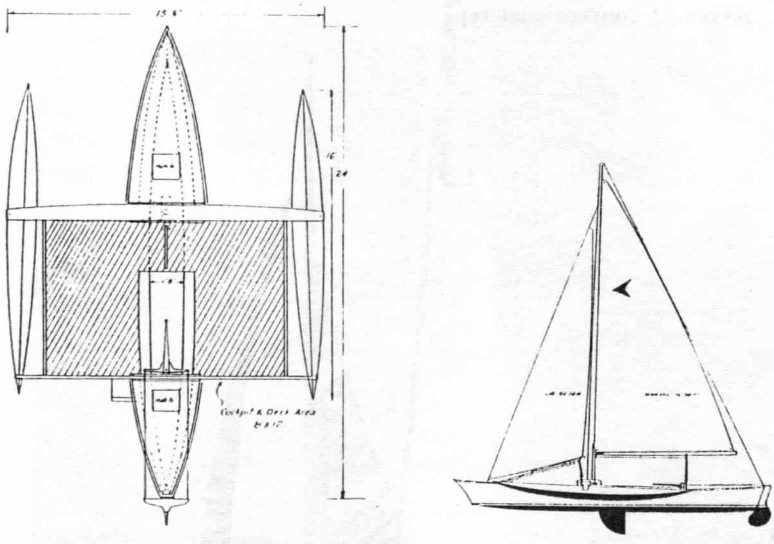


*Fig.* 4.

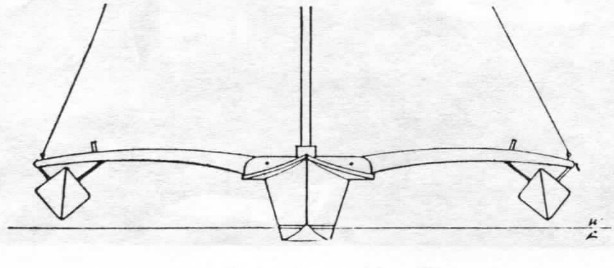


*Fig.* 5.

*The Connectives.* These are two flat rods which appear to be metal and are similar in use to those of both the *Malibu Outrigger* and some of Arthur Piver's designs.

*The Floats.* These are most distinctive, though a similar type has been used by Arthur Piver. Of square section and sweeping up to a point both fore and aft, there can be no dragging of water behind them no matter what the immersion. In light winds, the craft can be trimmed so that only the lower edge of the lee float is touching the water ; again giving minimum resistance. As regards their displacement, this seems adequate as it is claimed that they have never been driven under.

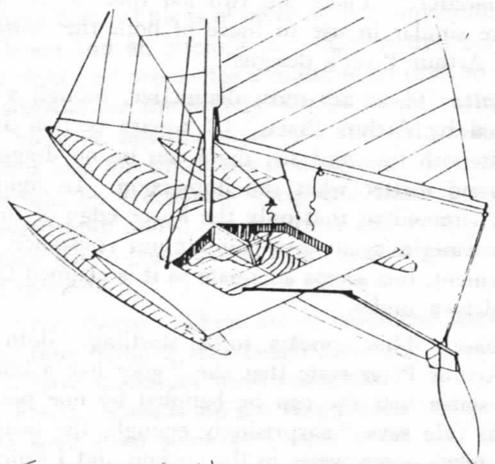
*Performance.* This appears to be startling. Both the *Rudder* article and Arthur Piver state that she " goes like a bomb." Louis Macouillard states that she can be handled by one person, even in strong winds. He says " surprisingly enough, the boat is not wet. We've never taken green water in the cockpit and I sailed her on the Lightship race, unofficially of course. We beat to windward 12 miles off shore in the worst conditions possible for us, short of a gale—a lumpy and confused cross sea. All we took was a splash from the lee float and I'm working on a device to eliminate that. We passed 38 foot Farallon Clippers and fast 33 foot Windward class sloops. In fact, we went through 90% of the fleet with a light wind and we prefer a 15-20 mile breeze."

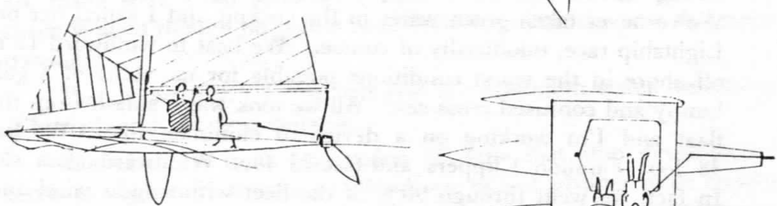
*Summary.* This craft is well nigh perfect. Though the underside of the floats cannot be much improved in my opinion, when the side chines of the box sections immerse due to wind pressure, I feel that eddying flow will occur. It might be better to have a flat deck to the float and have a triangular section with a right angled V below.

## A TRIMARAN DESIGN

For the last 2 years, I have looked longingly at the trimaran design shown here, wishing it could be published but it had become separated from the letter with it and the designer's name is unknown to me. Nor is the handwriting any guide as the writing of most A.Y.R.S. members is so similar. However, I now feel that it should be shown and I hope the designer will forgive me.

*The Configuration.* Essentially, the design is the first fully engineered trimaran design which has come to my notice. Torsion strains are taken by cross beams in a plywood centre section which itself forms a box girder. Thus, one has a tremendously strong cross structure which could be very light.





The connectives are thin planks with little water resistance, should they be submerged. The floats are elegantly shaped and boat-like.

*Summary*. A most elegant and fully engineered trimaran is shown which, if made, would be very fast. I hope the designer will contact me so that, if anyone wants this craft, he may design it for them.

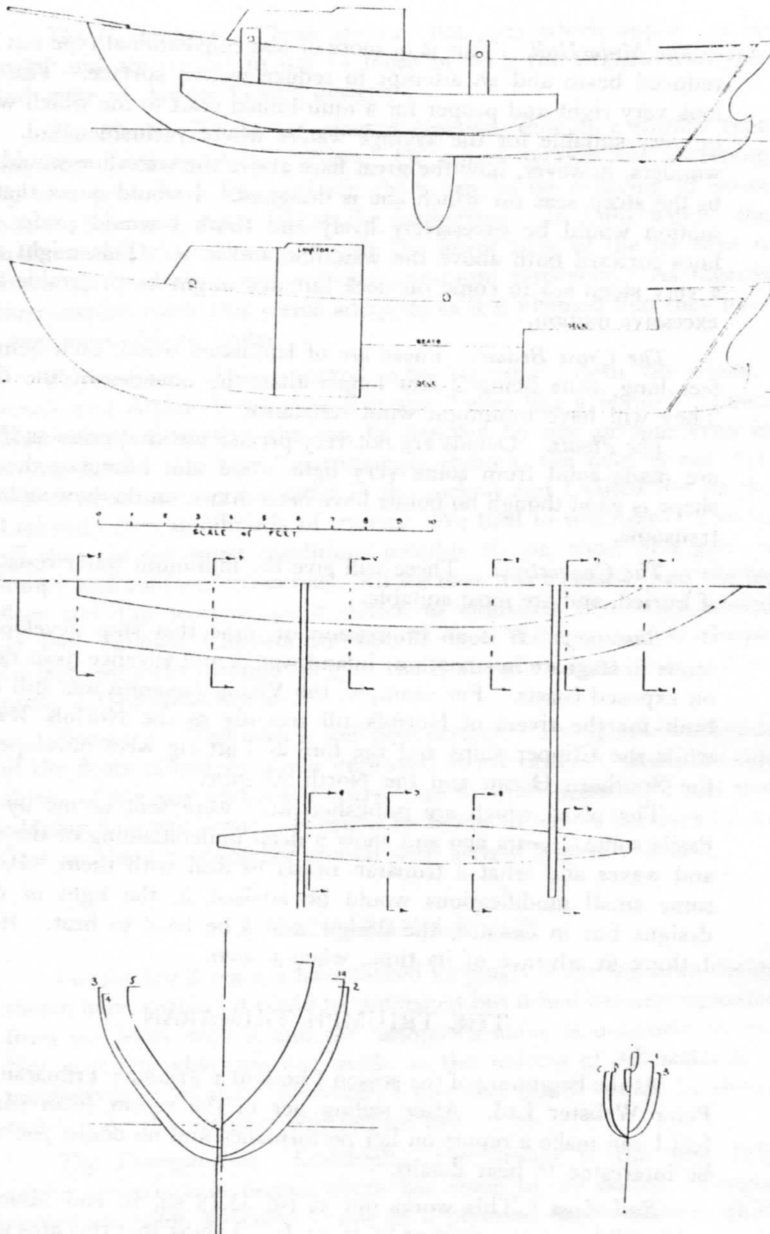
## 29 FOOT TRIMARAN DESIGN

L.O.A. 28 ft. 0 ins.
L.W.L. 24 ft. 0 ins.
Beam, hull 6 ft. 0 ins.
Beam O.A. 22 ft. 0 ins.

Floats 16 ft. by 1½ ft. by 1½ ft.
Sail area 450/500 sq. ft.

Designer : Ivan Psaila, 41 Main Street, Georgetown, British Guiana.

This design has been produced to contend with the 10 feet high waves which can be met on the coasts around British Guiana and still keep going. It is a daysailer with toilet and seats.


SCALE OF FEET

*The Main Hull.* This is of more or less conventional type but with reduced beam and an attempt to reduce wetted surface. The lines look very right and proper for a multihulled craft to me which would be very suitable for the average waters where yachtsmen sail. One wonders, however, how the great flare above the waterline would take to the steep seas for which she is designed. I would guess that her motion would be excessively lively and think I would prefer finer lines forward both above the waterline and at it. This might allow a very steep sea to come on deck but this might be preferable to an excessive motion.

*The Cross Beams.* These are of laminated wood, each being 24 feet long, thus being 2 feet longer than the outsides of the floats. They will have minimum wind resistance.

*The Floats.* Details are not very precise but it appears as if they are made solid from some very light wood and fibreglassed. The shape is good though no points have been drawn on the bow and stern transoms.

*The Connectives.* These will give the minimum water resistance, if buried, and are most suitable.

*Summary.* It is an impression of mine that ship development tends to stagnate in smooth or inland waters and advance most rapidly on exposed coasts. For example, the Viking *Longship* was still being built for the rivers of Norfolk till recently as the Norfolk *Wherry*, while the Clipper ships and the fore and aft rig were developed for the Southern Ocean and the North Atlantic.

The plans which are published here were sent to me by Ivan Psaila some 2 years ago and show a deep understanding of the ocean and waves and what a trimaran needs to deal with them. Perhaps some small modifications would be advised in the light of recent designs but in essence, the design would be hard to beat. It was, I think in advance of its time, when drawn.

## THE TRIUMPH TRIMARAN

Dear Sir,

At the beginning of the season I bought a *Triumph* Trimaran from Peter Webster Ltd. After sailing her in the recent fresh winds I feel I can make a report on her performance and no doubt you would be interested to hear details.

*Sail Area.* This works out at Jib 33.15 sq. ft. and Main 52.3 sq. ft. This gives a total of 85.45 sq. ft. I think that this area should be increased by enlarging the size of the Main, though this would mean increasing the mast height by 1 foot.

*Performance.* Close hauled, as you would expect from the hull shape, it is not possible to point up with National 12 fts. The big jib also helps to make the boat crab away in the puffs instead of heading up.

The Trimaran is fastest on a reach, where some good speeds have been experienced in planing winds. The speed if chiefly limited by the lee float nose diving. It would appear that the bows of these floats might be better " water ski " shape in order to produce some lift, as the size of the bridge prevents the helmsman sitting aft to alter the trim of the boat.

The main hull produces a curious turbulence from the last nine inches of the canoe shaped stern.

*Mast and Rigging.* I think that a rather stouter mast may be necessary to stand the strain and some more support for the chain plates, which are bending the plywood holding struts out of true. I am inserting strengthening struts here.

*Horse.* I may remove this as it interferes with the tiller, and use the method of sheeting as on the Enterprise.

W. JEFFERSON SMITH.

*Ed.*—The difficulty of pointing up, the pulling away by the big jib and the nose diving of the lee float can, I think, all be cured by moving the mast aft a bit, or by increasing the size of the mainsail.

## AVOCET AND TRITON — TWO TRIMARAN DESIGNS

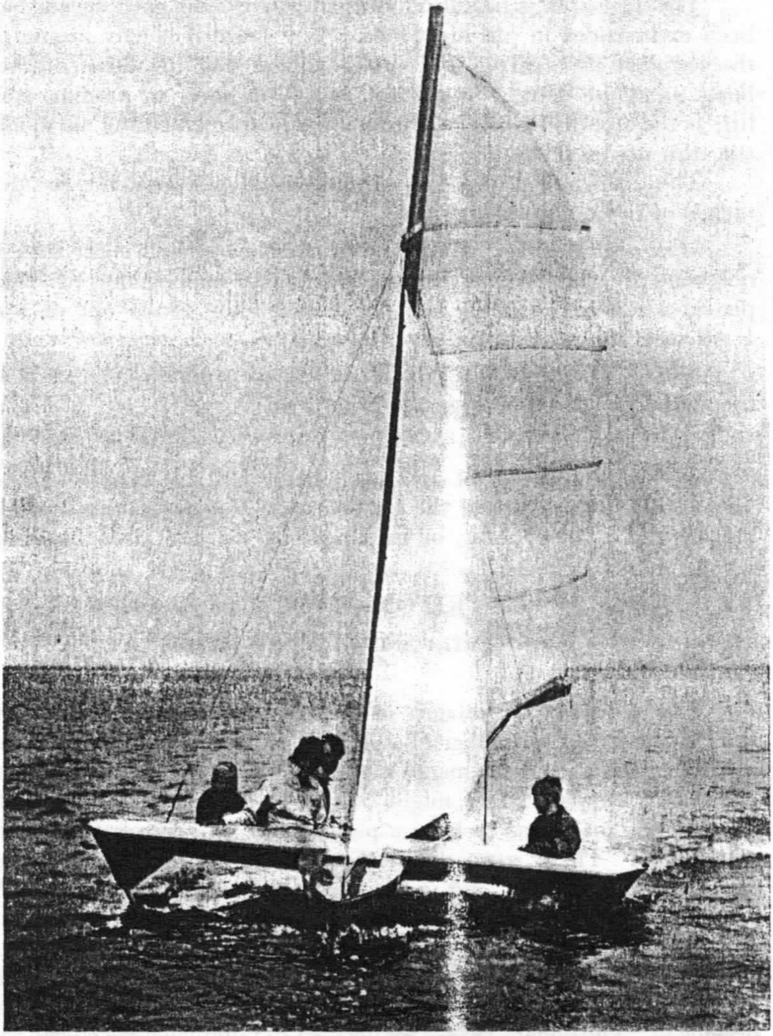
*by* MARTIN AND ANTHONY RYLE

*Introduction*

The potential advantages of the trimaran configuration have been discussed in a number of A.Y.R.S. articles. It is possible that in comparison with a catamaran a greater ratio of restoring force/drag and hence ultimate speed might be achieved, although none of the existing designs seems to have a performance as good as that of the *Shearwater*. There is no doubt that they are cheaper to construct and easier to transport, and in the event of a capsize there should be no tendency for the angle of heel to increase beyond 90°. A cruising trimaran might indeed be made to be self-righting.

With these advantages in mind, and with the examples of Arthur Piver's *Triumph* and *Frolic* and John Morwood's *Parang* and other designs of " Outriggers 1958," we decided to build what we considered the two most promising trimaran arrangements :—

(a) Hydrofoil stabilization at speed, with sufficient float buoyancy for low-speed stability (*Avocet*—M.R.).



*Avocet, showing foil*

(b) Long slim V-section floats intended to provide displacement lift at all speeds (*Triton*—A.R.).

Neither craft has been designed as an all-out racing machine, as they were intended to be used for family sailing as well. This has resulted in the usual compromise between crew comfort and weight, and in a somewhat modest sail area.

Both boats were completed in time for some experience to be gained this summer, and although the trials were incomplete it is clear that both are fast and stable craft, having good manoeuvrability.

## AVOCET

| | |
|---|---|
| Length 18 ft. | Sail area 120 sq. ft. |
| Overall beam 12 ft. | Weight (less rig) 210 lbs. |
| | Weight of rig 50 lbs. |

*Basic design*

In this design both heeling forces and lateral resistance are provided by a float-hydrofoil combination at either end of a wing which also provides accommodation for the crew. Crew weight can thus be used to full advantage. Of the various lift-producing hydrofoil systems, surface-piercing foils inclined inwards seemed to provide the simplest self-stabilizing arrangement, as well as eliminating the need for a centreboard. The most serious difficulty in their use, however, is to prevent air being sucked down the upper surface. This may be demonstrated in a striking manner by holding a paddle over the side at a speed of about 10 knots. With the paddle vertical very

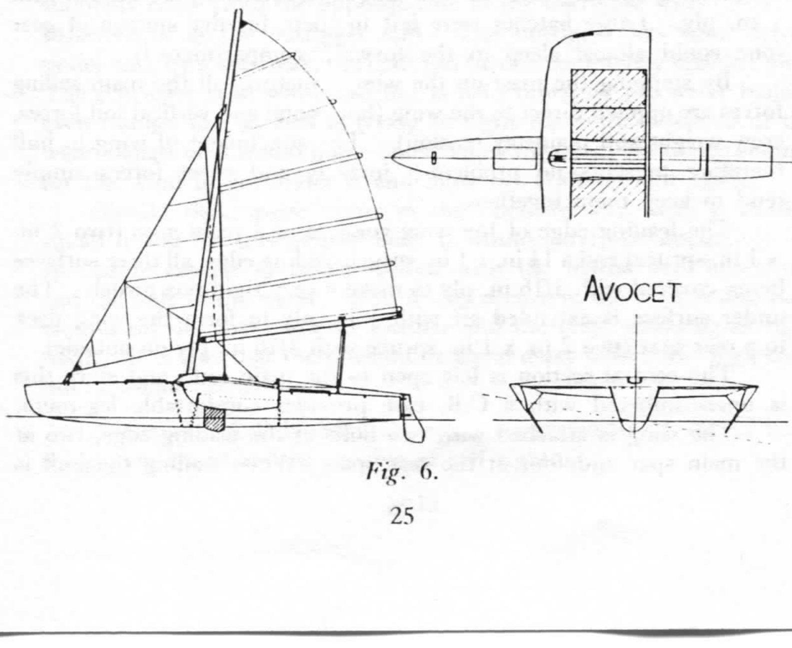



*Fig. 6.*

considerable side forces can be produced as the angle of incidence is increased (and of course free vertical centreboards are used in the *Shearwater* and other catamarans). If, however, the paddle is held outboard at about 45° to the vertical, then as the angle of incidence is increased to obtain a comparable lift, the water flow suddenly breaks away from the leading edge and the lift practically vanishes.

To avoid this difficulty the foils in *Avocet* emerge through the centreline at the front of the floats, where the water-flow should prevent a low pressure area developing.

By sailing the boat with an angle of heel of about 10°, so that the lee float is immersed about 4 in., air entrainment is prevented, while the wave-drag from the immersed float is still small ; with a crew of two the weather foil is then just clear of the water, and asymmetrical hydrofoils may therefore be used. By adopting an effective angle of incidence of about 9°, the lift per square foot is about three times as great as that of a conventional centreboard, and at speeds greater than about 10 knots, strong stabilizing forces are provided by the relatively small foil area.

*Construction*

In a trimaran the main hull operates at constant immersion (until appreciable overall lift is provided by the foils), but the requirements otherwise differ little from those of a catamaran. Because of its continued success a *Shearwater* hull was adopted, and an 18 ft. one was specially moulded by Prouts with 3 in. greater depth than normal. Bulkheads and strengthening frames were built at either end of the wing opening, and the bow and stern sections were decked with ¼ in. ply. Large hatches were left in these for dry storage of gear (one could almost sleep in the forward compartment !).

By stepping the mast on the wing structure, all the main sailing forces are applied direct to the wing (horizontal and vertical foil forces, crew weight and mainstay tension). The attachment of wing to hull therefore presents no problem ; forestay and sheet forces simply tend to keep them together.

The leading edge of the wing consists of a main spar (two 2 in. x 1 in. spruce) and a 1½ in. x 1 in. spruce leading edge, all three surfaces being covered with 3/16 in. ply to make a very rigid box girder. The under surface is extended aft with ¼ in. ply to form the wing deck to a rear spar (two 2 in. x 1 in. spruce with 3/16 in. ply on outside).

The central section is left open to the main hull, and since this is unencumbered with a C.B. case provides comfortable leg-room.

The wing is attached with two bolts at the leading edge, two at the main spar and four at the rear spar. When trailing the hull is carried upside down with the mast and boom on a roof-rack, the wing on a small (12 ft. dinghy) trailer.

*Floats*

The floats are triangular in section, the angle increasing from 75° at the bow to 90° at the stern. When deeply immersed the underwater section is slightly asymmetrical, the outer surface being flatter than the inner, so that the bow is inclined outwards by 3 in.

The ¼ in. ply is screwed and glued to a laminated stem and keel stringer ; the deck, also of ¼ in. ply, continues the upper surface of the leading edge.

The float and outer half of the leading edge provide a sealed buoyancy of about 400 lbs. each side. The inboard half of the leading edge is used for stowage.

*Foils*

These are retractable through " C.B. cases " mounted against the outer skin of the floats. They make an angle of 55° to the horizontal when the boat is upright, but with the normal angle of heel this is reduced to 45°. They have a chord of 12 in. and maximum thickness of ¾ in. with the section described in A.Y.R.S. publication No. 19.

The angle of attack of the flat surface measured along a waterline is 7°, giving an effective angle of incidence of about 9°.

A Swift catamaran rig has been used, with sail area of 120 sq. ft. A transverse tiller mounted on the rear spar of the wing operates the rudder with wires passing outside the mainsheet track. This arrangement has the advantage that it does not project into the cockpit and no tiller extension is needed, wherever the helmsman sits.

*Performance*

When first launched *Avocet* had strong weather helm, which almost prevented her from sailing to windward, but by reducing the rake of the mast, to bring the sail plan forward by about 8 in., her performance was completely transformed. She is obviously fast, exeedingly stable and goes about easily ; even at speed she can be steered with one finger. No extensive speed trials have been possible this season and the only tests with *Triton* were before the rig of either boat was moved forward. A few days were however spent in comparison with Peter Ward's *Shearwater III ;* during most of this time winds were light, and *Avocet* was definitely slower on all points of sailing. In stronger winds the difference did not appear to be so great but unfortunately on the two days when there was as much wind as *Avocet* needed the *Shearwater* was not available for trials. On these two days the value of foil stabilizers really became apparent ; as long as the lee float was allowed to remain deeply immersed (for example with insufficient sitting-out when on a beat) its bow made a lot of fuss at speed, but as soon as one turned on to a reach the speed suddenly shot up and the wave noises would disappear to be replaced by a hiss as the foils kept the boat strongly stabilized with the lee float just touching the water.

At lower speeds, especially to windward a finer entry on the floats would probably have been an advantage, although this is difficult to achieve if the floats are not to extend beyond the width of the wing. Alternatively, the solution may lie simply in increasing the foil area, so that they become effective at lower speeds.

The stability is so good that a greater sail area could be carried, and it is hoped to extend this by using a large Genoa.

The photographs show *Avocet* with two grown-ups and three children on board ; though obviously deeper in the water, with slightly more wave-making from the lee float, her performance does not seem to be greatly affected, although some weather helm is produced.

## TRITON

*(Built by Anthony Ryle and Jose Cisneros)*

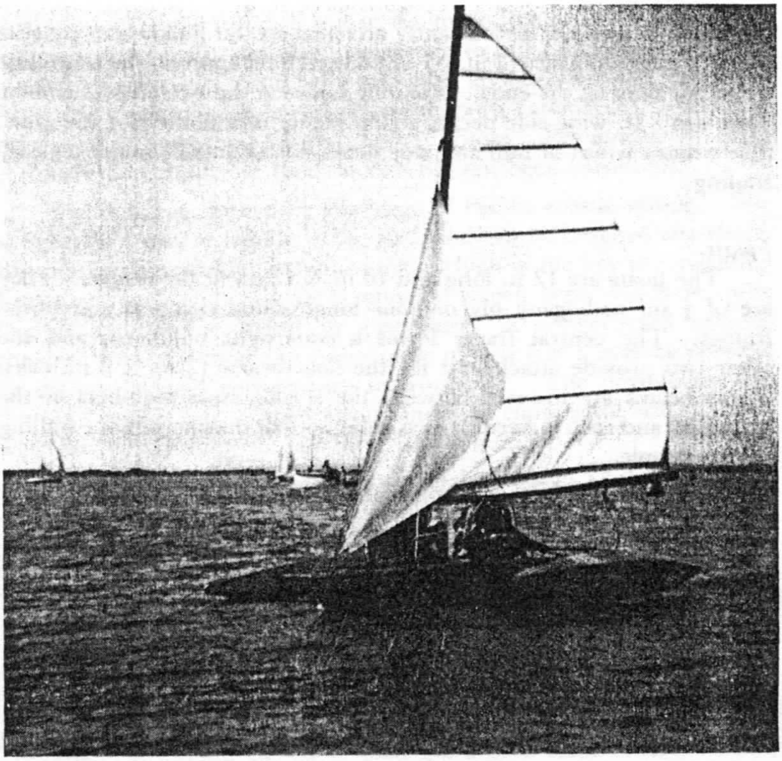
| | |
|---|---|
| Length 16 ft. 6 ins. | Overall beam 11 ft. 6 ins. |
| Float length 12 ft. 0 ins. | Sail area 120 sq. ft. |

*Basic design*

In this design stability is achieved solely by the use of floats and the lateral resistance in these is supplemented by a centreboard in the main hull. In the design of the floats the need for length to reduce wavedrag and the desire for constructional simplicity lead to the adoption of symmetrical floats of rectangular cross-section, tapering to a point either end, and fixed at an angle so that the underwater section is a right-angled Vee. When sailing level neither float touches the water, except with a crew of three or more.

*Construction*

The main hull was built from a *Shearwater III* shell moulded with increased depth. This has bulkheads separating off the fore and aft compartments from a central well. The forward end of the well is decked over 6 in. below the gunwale, and is supported by the C.B. case aft and the forward cross member. Each of the two 6 ft. cross-



*Triton*

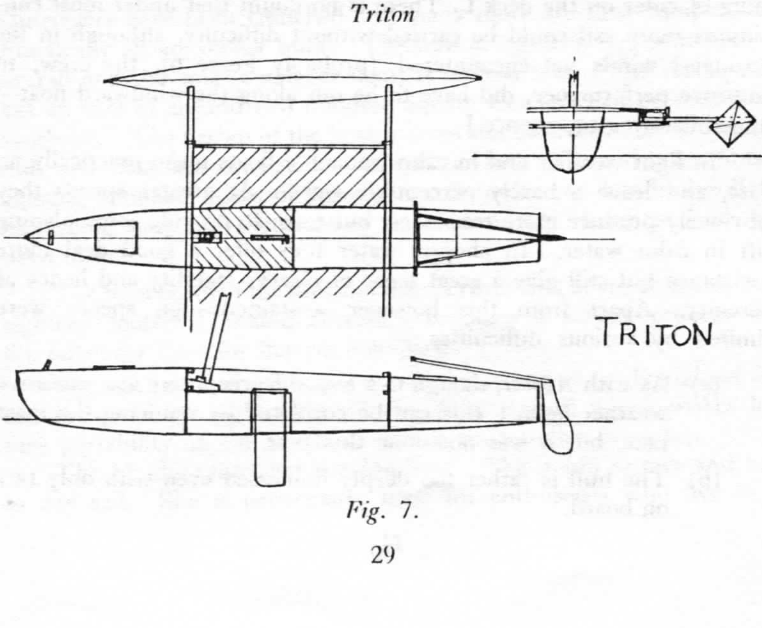



*Fig. 7.*

members, which are permanently attached to the bulkheads, consists of two pieces of spruce (2 in. x 1 in.) bowed 6 in. apart on the centreline and 3 in. apart at the ends. Running between the two cross-members there are 2 ft. wide side decks, giving plenty of mobility for the crew. The overall width of hull and side decks is still small enough for easy trailing.

*Floats*

The floats are 12 ft. long and 10 in. x 12 in. at the centre. They are of $\frac{1}{4}$ in. mahogany ply on four longitudinal stringers and three frames. The central frame forms a watertight bulkhead, and the other two provide attachment for the float beams (2 in. x 2 in. oak). These beams are inserted between the spruce cross members of the main hull and each is fixed by two bolts, so that dismantling for trailing is very simple.

The floats have no angle of attack, but they are " toed-in " about 2°.

The rig is that of the *Swift* catamaran, the rotating mast being stepped behind the forward cross-beam on the cockpit deck. A vee-shaped tiller is used to allow the helmsman to sit well out.

*Performance*

Stability is excellent, with an impression of pneumatic motion. The maiden voyage through Itchenor was accomplished with a full mug of cider on the deck ! There is no doubt that under most conditions more sail could be carried without difficulty, although in the strongest winds yet encountered, (probably Force 6), the crew, to improve performance, did have to lie out along the windward float—an exhilarating experience !

In light weather and in calm water the floats make practically no fuss, and leave a barely perceptible wake. At greater speeds they obviously produce more resistance, but seem to provide some planing lift in calm water. In choppy water they offer a good deal more resistance but still give a great sense of reserve stability and hence of serenity. Apart from this however, sustained high speeds were limited by various difficulties :—

(a) As with *Avocet*, though to a lesser degree, there was excessive weather helm ; this can be corrected by reducing the mast rake, but it was not done this year.

(b) The hull is rather too deeply immersed even with only two on board.

(c) Both the forward edge of the side decks and the undersurface of the deck at the rear cross-member need to be faired-off ; at certain speeds the bow-wave of the main hull built up most impressive water-spouts at these places, with a dramatic loss of speed.

It is hoped that with improvements in the sail balance, and perhaps with increased sail area, speeds similar to those of the *Shearwater* may be obtained. In any case *Triton* promises to be a stable, fast and manoeuvrable boat in the water, and a reasonable proposition for trailing and launching.

The overall cost of materials including the moulded hull, mast and terylene sails was about £150. Construction occupied ten days holiday and most weekends for two people for a little under four months.

## PARANG

L.O.A. 16 ft. 6 in. Beam 2 ft. 0 ins.
L.W.L. 15 ft. 9 in. Displacement 632 lbs.
Beam O.A. 11 ft. 6 in. Sail area 160 sq. ft.
Designer : John Morwood. Builder : Peter Cotterill, Box 124, Selukwe, S. Rhodesia.

Members may remember the *Parang* design of A.Y.R.S. No. 18. This has been built to the design by Peter Cotterill and his report is as follows :

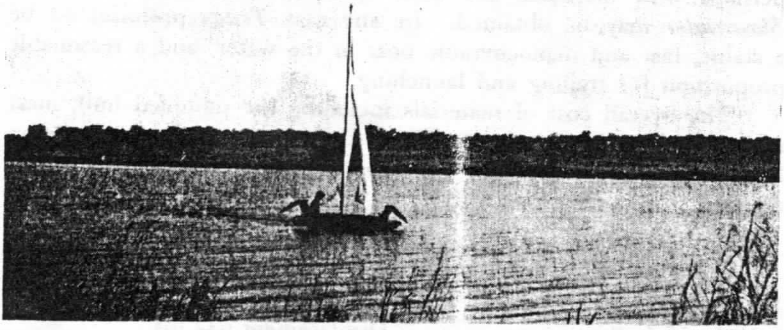
20*th April*, 1959

" The foils work well in a reasonable wind and we have had her up with the floats well clear on a broad reach. There is then a noticeable increase in speed, with two up. Unfortunately, she is much too heavy at 400 lbs. for light breezes which, with two up, brings the waterline well above the chine. She then sails about half the speed of a G.P. 14, does not point at all well and does not always come about.

" In a stronger wind, she seems quite as fast as a 505 and points and tacks quite well, though at present, she tends to weathercock—presumably the result of too large a mainsail.

" At present, I am fitting a dagger board and we hope to try her soon with the mast further forward.

" The short floats are obviously causing drag as a foot high spout appears behind each at quite moderate speeds. Therefore, as indicated by A.Y.R.S. No. 23, I am constructing two double tapering floats 12 feet long, 6 inches wide and 8 inches deep which we plan to mount



*Parang showing original foils*

on 1½ inch light steel tubes to give 8 feet beam. The foils will be attachable when worth while winds are about.

" Once we get these modifications made, the boat should be fine—anyway, its all great fun."

*10th May*, 1959

" We are now making some progress. Without the foils and with the mast 2 feet forward and dagger board, the boat tacks easily and does not crab. With the board up, her behaviour is little worse than with the old foils in vertically. Then the weight saving of 40 lbs. (the foils weighed 24 lbs. each) improves her light wind behaviour considerably. She now floats about 1 inch above the chine with a crew weight of 340 lbs.

" I agree that 40° dihedral for the foils is too flat for low speeds. I noticed that the speed of the boat dropped with the foils right down compared with when they were vertical. Once the boat rose on them, of course, the speed jumped up. I shall certainly try the long, 60° foils you suggest.

*18th October*, 1959

" I have not been able to get much lift from my present foils. They are similar to your *Jehu* configuration, 4 ft. 4 in. by 1 ft. 1 in. with ogival section, made from solid obeche covered with one layer of fibreglass cloth. At neither 45° nor 60° have the floats been lifted and the lift has not even stopped the float being submerged. The boat tacks as easily with the foil at 60° as it does at 85° and goes to windward quite well but in neither case as well as with the centreboard.

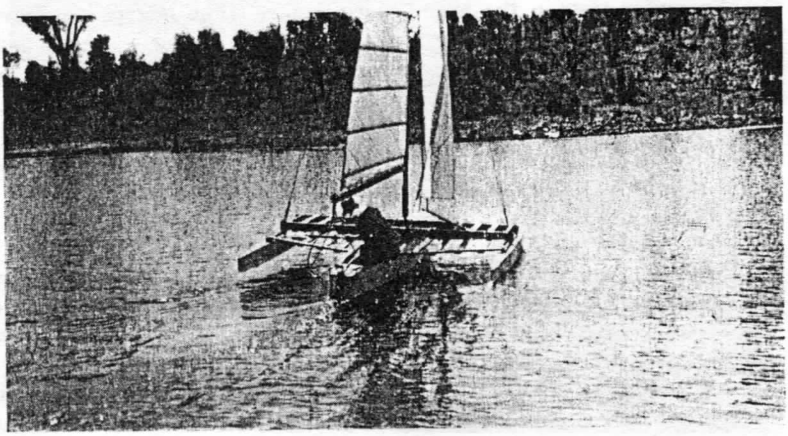
" The foils are set at about 2°-3° incidence and this may well be too low but even so, their drag is considerable. The speedometer only crept to 6 m.p.h. with the foil in but apparently similar strengths of wind gave easy 8 to 10 m.p.h. with the foils out. I am modifying one of the *Parang* foils to fit one side and increasing the incidence on the foil on the other side.

" Your hull is easily driven to 10 m.p.h. in quite light winds. 12 m.p.h. requires considerably more wind and 14 m.p.h., considerable gusts. Above 10 m.p.h., there is a considerable bow wave and when this hits the cross beam, spray starts to fly. Bringing the crew back helps to reduce the wave but the speed remains the same."

*November*, 1959

" You will see from the pictures that the new floats are in operation. There is considerable improvement in entry and exit—there is no fuss at the bow and only a slight wake, the wake of the main hull being the major feature visible.

" We tried light metal tubes as cross beam but they looked so revolting that I have reverted to 2 inch by 4 inch beams. She points and tacks easily—about as well as a *Flying Dutchman*. The floats weigh 28 lbs. apiece and are reinforced (to the chine) with fibreglass cloth.



*Parang new floats*

" The foils work quite well at 60° but slow her in the light winds we usually have here. We tried her in a " gale " the other week but blew the mast out before we could try them. The boat is quite stable in 30 m.p.h. winds and it seems that the inherent stability is more than in a cat.

" It seems that the foils are not needed in strong breezes since the boat appears to " plane " at about 10 m.p.h. Normally, the trailing edge of the floats are about 3 inches in the water but at about 10 m.p.h., the bows rise and both float ends are clear of the water. The bow wave from the main hull comes just midway along the floats.

" Having got the hull and floats behaving well, we are now having trouble with the mainsail which scarcely pulls on the sheet. Even so, at a recent regatta in very light winds, the boat appears to be faster than the *Snipe* on all courses, about as fast as the *Finns* but slower than the 505's and *Dutchmen* and we were sailing mainly on the jib."

*Summary*. The faults in the *Parang* design are as follows :

1. The foils should be much lighter. I believe that Peter Cotterill's failure was due at least partly to the angle of incidence and that they should be placed fore and aft, letting the angle of leeway provide the angle of incidence. In this, I apparently also disagree with Martin Ryle, Bob Harris (*Tigercat*) and others. Symmetrical foils like those of *Jehu* may be better than asymmetrical foils.

2. The floats should have been long and narrow.

3. Cross beams are still a slightly difficult subject. Dural tubes, solid spruce and plywood box spars have all been used successfully.

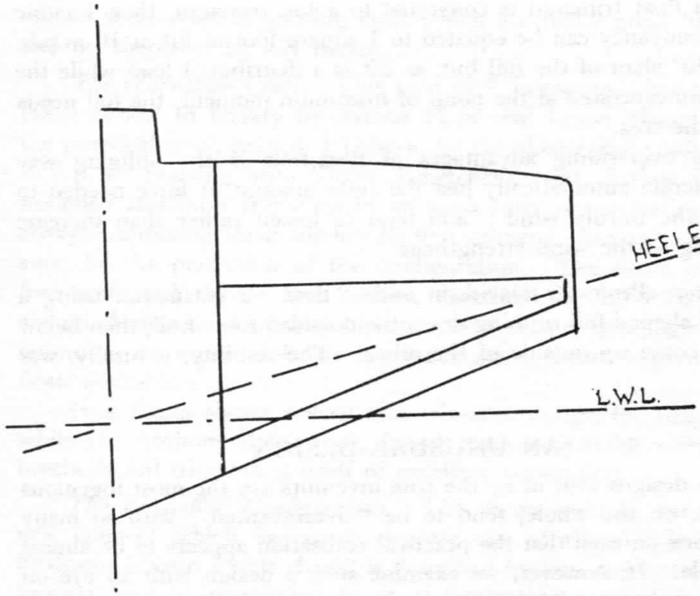
The *Parang* hull shape as in *Tamahine* (A.Y.R.S. No. 28) seems to be satisfactory in the lower speed range. The hog is too heavy in the design and 3/16 inch plywood could be used instead of ¼ inch for the planking. Weight is of paramount importance to all multi-hulled boats.

## FLOAT-FOIL STABILIZERS

*by* JULIAN ALLEN

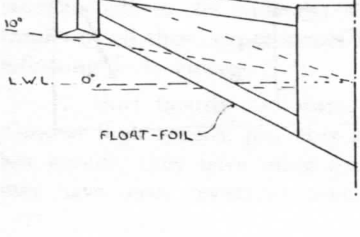
As an engineer, I find the loose limbed attachment of stabilizers too vulnerable and would rather make them part of the main structure by triangulating them to the chine and the outrigger. This gives mutual support to themselves and the hull.

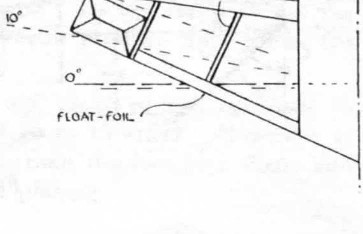
The system is shown in the drawing and, if we follow the foil action through a wind range, we see that at rest, little more than the roots of the foils are immersed and compared to outstretched floats,




the stability is tender. Yet, they have a rapid build up both in buoyancy and foil lift. A light wind will make quite a heel since only the buoyancy of the foil is in action. This heel will relieve nearly all the water resistance of the windward foil. When the wind rises enough to drive the boat at 5 knots, the lift on the lee foil will be felt and the heel will be *reduced.* As the wind strengthens so that the speed and the lift both increase, the heel may be reduced still further, together with some foil drag. The limit is reached only when increasing wind pressure is unable to cause increase of speed.

Going about in a strong wind requires full buoyancy until the vessel gathers enough speed for the foil to function. The simplest plan would be to supplement the foil buoyancy with extra floatation as shown.



If a float trimaran is converted to a foil trimaran, then 1 cubic foot of buoyancy can be equated to 1 square foot of lift at 10 m.p.h. with a 30° slant of the foil but, as lift is a distributed load while the float is concentrated at the point of maximum moment, the foil needs double the area.

The over-riding advantages of float-foils is the obliging way they generate automatically just the right amount of force needed to counter the unruly wind ; and tend to lessen rather than increase their drag as the wind strengthens.

*Editor*—Professor Davidson once " flew " a catamaran using a broad-U shaped foil running down the outside of one hull, then below both to come up outside of the other. The stability, naturally, was good.

## AN UNUSUAL DESIGN

The designs sent in by the true inventors are the most ingenious seen but, on the whole, tend to be " overinvented " with so many innovations on each that the practical realisation appears to be almost impossible. If, however, we examine such a design with an eye on each feature separately, we often see some very ingenious things which could be very useful.

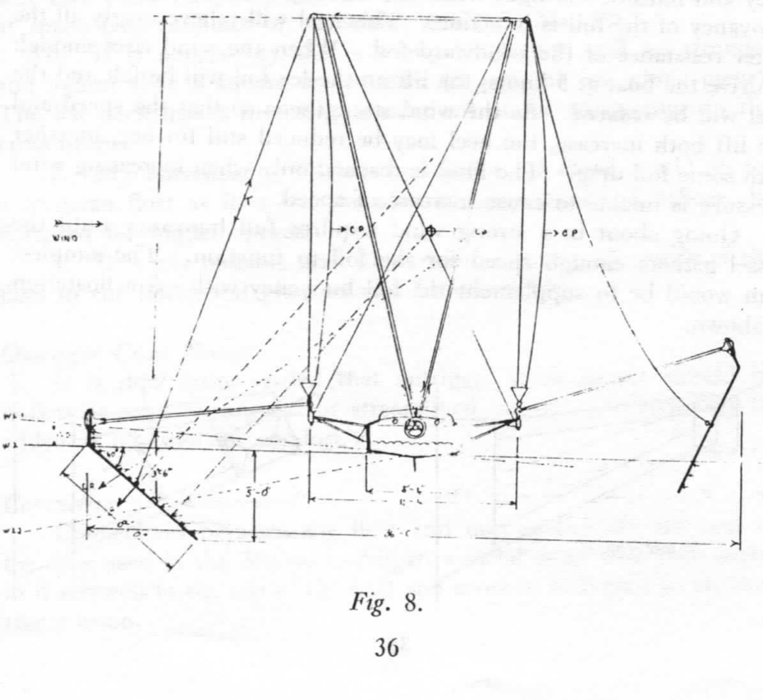



*Fig.* 8.

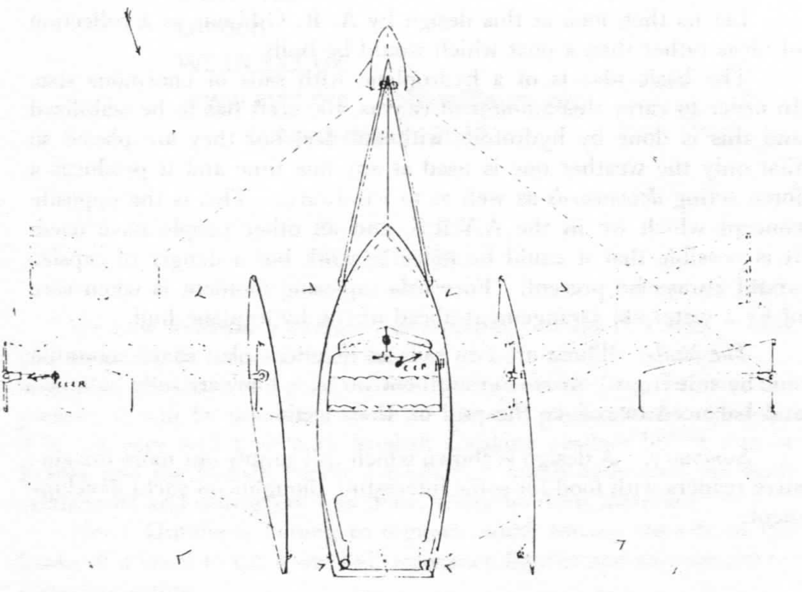


*Fig.* 9.

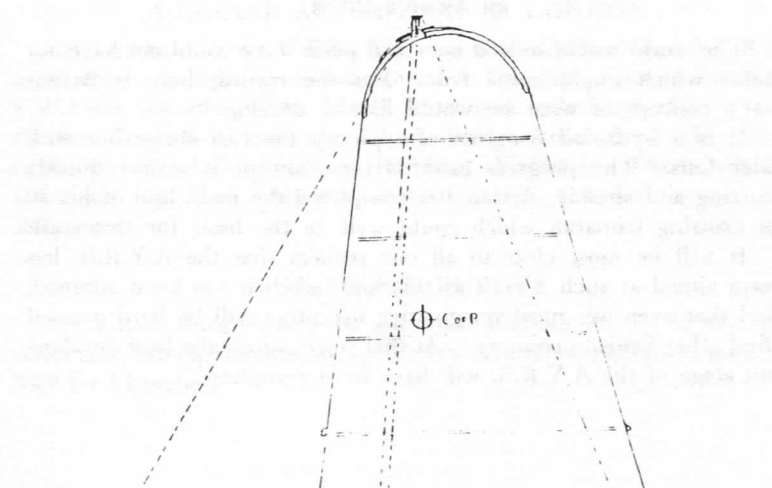


*Fig.* 10.

Let us then look at this design by A. R. Gibbons as a collection of ideas rather than a boat which would be built.

The basic idea is of a hydroplane with sails of enormous size. In order to carry this amount of canvas, the craft has to be stabilized and this is done by hydrofoils with dihedral but they are placed so that only the weather one is used at any one time and it produces a force acting *downwards* as well as to windward. This is the opposite concept which we in the A.Y.R.S. and all other people have used. It is possible that it could be made to work but a danger of capsize would always be present. Forwards capsizing moment is taken care of by a water ski arrangement ahead of the hydroplane hull.

*The Sails.* These are two sails of excellent plan shape mounted side by side from V masts to their bent yards. They are fully battened and balanced to reduce the pull on the sheets.

*Summary.* A design is shown which will supply our more imaginative readers with food for some interesting thoughts on yacht development.

## A CRUISING HYDROFOIL TRIMARAN

*by* Arthur Piver

The world would indeed be a dull place if we could not have our dreams which might come true. For the record, here is Arthur Piver's concept of what he would like to develop.

It is a hydrofoil trimaran of typically Piverish shape but with ladder foils. The progress towards this concept is almost quickly occurring and already, Arthur has completed the main hull of his 30 foot cruising trimaran which could well be the basis for this craft.

It will be most clear to all our readers that the A.Y.R.S. has always aimed at such a craft as this and when it has been attained, I feel that even our most imaginative inventors will be hard pressed to find other fields to conquer. At that stage, surely the boat development stage of the A.Y.R.S. will have been completed.

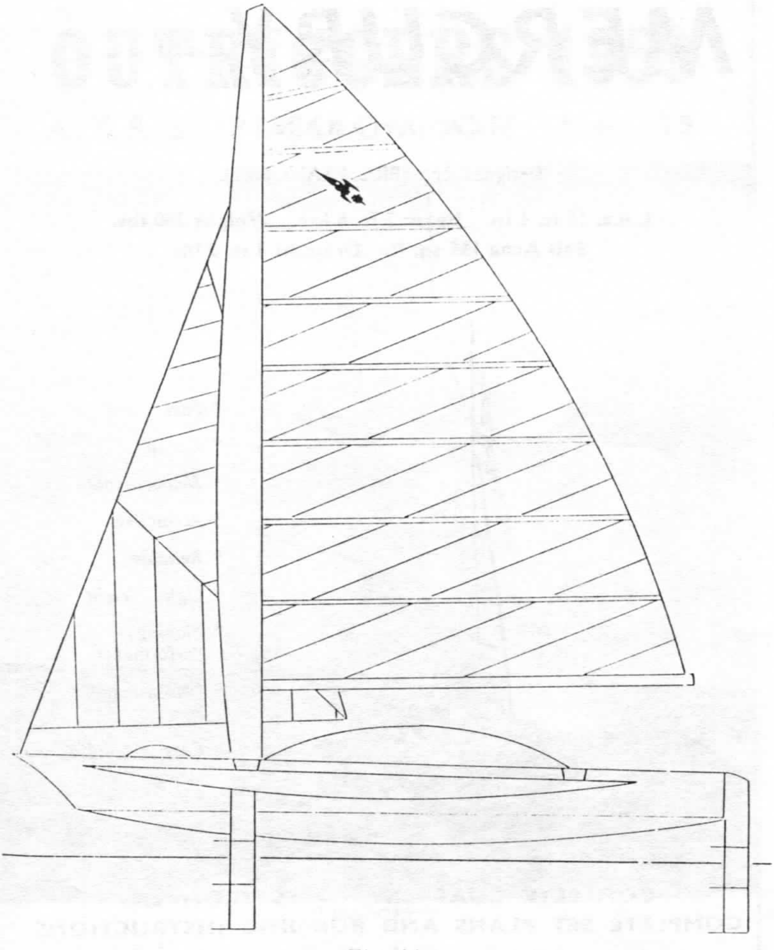


*Fig.* 11.

# MERCURY—

## CATAMARAN

*Designed by :* BILL PRANGNELL

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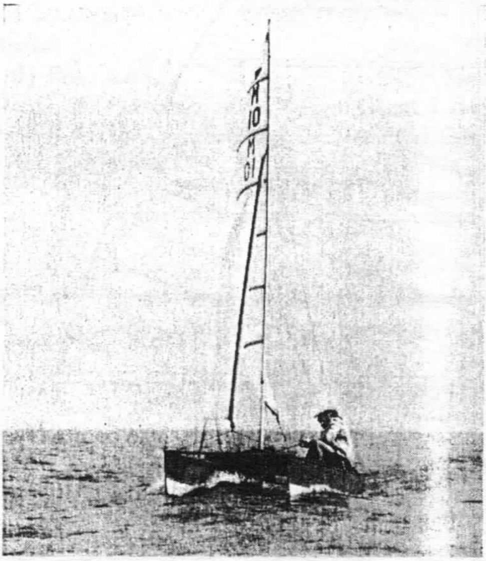
**Sail Area 155 sq. ft. Draught 3 ft. 3 in.**



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