MULTIHULL SEAMANSHIP & TRIMARANS 1966

A.Y.R.S. PUBLICATION No. 66

Dick Newick's Trice

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THE AMATEUR YACHT RESEARCH SOCIETY

(Founded June, 1955)

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EDITORIAL

April, 1967.

Extraordinary A.Y.R.S. Meeting. We have the honour to announce that H.R.H. Prince Philip will take the Chair at a special Meeting of the A.Y.R.S. to be held on July 18th, 1967 at the Naval & Military Club 94, Piccadilly, London, W.1. at 7 p.m. for 7.30 p.m. Admission will be by ticket only and will be limited to 400. Each member can apply for two tickets only at a cost of £1 each from Woodacres but he can state that he would like to have further tickets should all places not be taken. A buffet supper will be served with coffee and a bar will be opened after the talks. All members must be in their seats at 7.15 p.m. precisely and any latecomers will only be admitted in the intervals between speakers. Both the Ladies' and Gentlemen's Cloakrooms are in different places than usual but their sites and the passages to the room where the talks will be held will be well sign-posted and there will be Stewards in attendance. The subject for the meeting will be :

" Yachts for the 1968 Single-handed Trans-Atlantic Race."

We hope to have six speakers from all over the world speaking about the yachts which they will be sailing or hope to sail.

Prince Philip will be interested to know who is coming and it would help the organisers if people applying for tickets would state in their letters what yachts they have designed or what yachting research they have done, for example on hydrofoils or yachting figures. Or, what oceans they have crossed.

American Members. Please note Dorwin Teague's change of address.

Increasing the Membership. We wish to thank all our members who have so loyally got new members for us. As we wanted (but frankly did not expect to get) we have had an amazing surge of new members so that our membership for this year may be nearly double that of last year. This is indeed encouraging and, if the process continues, our present size of publications can continue unchecked, or even expanded.

The Publications. The " Business Sub-Committee " of the A.Y.R.S. has given me instructions to publish *anything I think of interest*, irrespective of the cost. This Sub-Committee will then advise the main Committee of its recommendations to meet these, either by putting up the membership dues or in any other way.

Members' Letters. We always answer any letter which contains a request for information—even if we don't know the answer. Sometimes, of course, there is a delay if a publication is being prepared or some other work is in hand but we always reply. It is this two-way communication which gets us material for the publications. We like to have descriptions of boats of all kinds, particularly if they have some unusual features. I guess that the majority of members own single hulled boats and we are just as anxious to improve them as to study multihulls. Indeed, more so.

The A.Y.R.S. Officers and the Committee also wish to thank all the kind members who have written to us appreciating the publications. Speaking for Hetty and myself, we are pretty fully extended when the subscriptions come in from October till March because, of course, the A.Y.R.S. is our "spare-time hobby." When, therefore, we get a bit depressed because we are behindhand, we think of all those nice letters you write and it cheers us up a lot.

WILLS VENTURER II. Messers W. D. & H. O. Wills, have kindly given us *WILLS VENTURER II* "on permanent loan." Rod MacAlpine-Downie, John Fisk and I think that this is the fastest C Class hull design yet produced and, if properly rigged could be a champion. The A.Y.R.S. Committee wants to put the boat in the hands of someone for the 1967 season to rig and sail as and how he pleases. If she becomes as fast as we hope, she will be kept as a racing boat but, when her racing days have ended, she will be passed over to be instrumented and used to improve the sailing of C Class catamarans or to take figures of yachts.

A British D Class Catamaran. One of these can be built for £2,000. One member has offered £500 towards such a boat. If three other members would do likewise, one could be built and sailing this year. People willing to sponsor this "Fastest Sailing Boat in the World," please write to the Editor.

Self Steering. This publication has been brought up to date by the inclusion of all the latest self steering ideas. It is now available as a 'hard-backed' book at a price of $4.00 or 22/6d. A limited edition has also been made in more or less the usual A.Y.R.S. style (for sale to members only) at 5/- or $1.00. This publication is easily our best selling issue and it would help us enormously if members would talk about it in their yacht clubs.

Lists of Members. Members who joined at the Boat Show and others may not have received lists of members for last year. If anyone would like a copy, please write to Woodacres, Hythe, Kent.

Change of Address. Would all members please advise us when they change their address. Otherwise publications go astray and cannot be replaced at the cost of the Society.

Low Aspect Ratio Keels. Pat Patterson has written questioning my figure of 60% for the after end of low aspect ratio keels. I thank him for his letter and now feel that, though the figure of 60% *may* be correct, it might also be correct or even better to bring the aft end of the keel to the maximum section, which will usually be at about 70% of the L.W.L. We are still studying the matter and will let you all know when further information comes to light.

* * *

THE FUTURE OF YACHTING

Now that trimarans have been brought to the peak of their design in *TORIA*, and catamarans, in my opinion, in *WILLS VENTURER II*, there are only two craft left to develop. These are :

1. The flying sailing hydrofoil and
2. The ballast and foil stabilised " trimaran," not using floats.

The flying sailing hydrofoil is well on its way to " hardware " at present with many people interested and (we think) building these craft.

The ballasted and foil stabilised " trimaran "—see *RYSA* in A.Y.R.S. No. 44 for the general idea is well under way to development. Indeed, such a boat could be made at present for a relatively small sum of money, though the best arrangement of hydrofoils might need some re-thinking. However, we have formed a small consortium of inventors and hope to be able to publish our ideas soon.

When this craft has been developed, the cyclical process which I described some years ago will have come to full circle.

Sail Development. Now that we have Clarence Farrar's *LADY HELMSMAN* rig, we have removed all the inefficiencies of a sail, except for the boom eddy. However, General Parham's " Bent mast rig " might be just as good in practice and much lighter. Or, a thoroughly " cleaned up " Wishbone rig, without jib or mizzen and a rotating streamlined mizzen mast might be the answer in practical terms. Semi-elliptical lugsails or squaresails might be made practical and would be excellent.

We leave all these ideas with our members for mulling over and, if possible putting into practice.

* * *

S/Ldr. D. H. Clarke, D.F.C., A.F.C.(Ret.), who holds the sole European, African and United Kingdom franchise for Arthur Piver's trimarans, and the sole European and United Kingdom franchise for Hedley Nicol's trimarans, has resigned his directorship of Cox Marine Limited of Ipswich. Enquiries concerning Piver and Nicol designed trimarans should, in future, be addressed to him at: "Gables," Woolverstone, nr. Ipswich, Suffolk.

In order to prevent inaccurate rumours, S/Ldr. Clarke states that his resignation is purely the result of the present credit squeeze. All the directors of Cox Marine Limited, including himself, were quite unanimous in their decision to close the Company rather than waste hard-earned money waiting to see what the immediate future offers. However, trimaran postal enquiries, which have increased considerably over the past few months, will continue to be answered promptly if sent to S/Ldr. Clarke's private address.

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BRISTOL GROUP—AMATEUR YACHT RESEARCH SOCIETY

FIRST ANNUAL REPORT November, 1966

The past year has seen the inauguration and steady consolidation of the Bristol Group from almost a daydream into a progressive informal body. During the summer of 1965 a circular letter to the dozen or so local members showed that two-thirds were in favour of forming a group. By courtesy of the Cabot Cruising Club a tentative meeting was held on board the John Sebastian and attended by eight members who were unanimous in proposing the formation of a group. M. Garnett was elected chairman-secretary and actioned to get things going.

The first meeting of the new group was held in December 1965 also on board the John Sebastian, and J. Poslett gave the first talk on methods of small boat construction. He showed that simple jigging combined with glass-fibre taping techniques could enormously simplify building methods and would result in very rapid construction times. Following this meeting the Cabot Club proposed that the group should become part of their organisation so as to regularise the use of

the John Sebastian for meetings. This proposal was not accepted, and with mixed feelings the group severed the connection with the Cabot Club and looked for a new meeting place.

The next meeting was held at the Bay Horse Hotel when R. M. McDougall described his ideas for a fast sailing collapsible fishing boat. He visualised a surfboard type hull built up with inflatable bulwarks and driven either by a centrally positioned motor, or by a lateen rig hung from a bipod mast.

A second meeting was held at the Bay Horse in April 1966 when the purpose of future meetings was discussed as it was evident that there was only a limited talent on which we could draw for formal lectures. Experimental work involving the whole group either as participants or spectators was agreed to be the most sensible subject, and for the first trials it was decided to try to calibrate a full-sized sloop rig owned by a group member. This did not of course preclude any additional experiments involving hulls and foils when any ideas were put before the group.

No meetings were held during the summer months but starting in September regular monthly meetings were arranged at 4 Portland Street, Clifton at which actions were placed on individual members to produce the equipment necessary for sail calibration. The emphasis was placed on simplicity nearly to the point of crudeness in the experiments, as the working together of the group was felt to be as important as the experiment itself. Further discussions took place at the meetings in October and November and showed that the main difficulty was going to be in the limited time members can actually work on the project. It was also agreed that as a much longer term project the instrumentation needed to calibrate a boat during actual sailing should be designed and built. As an individual effort R. M. McDougall at the October meeting described some very promising experiments he had made in using a modified golfing umbrella to move a swimmer through the water. He had found that there was no serious rolling moment from the umbrella during reaching, and also that the lift produced was sufficient to move the swimmer directly into the wind. He was busy developing the system which certainly seemed to have interesting possibilities.

Membership of the group has changed in the year, and whilst some of the original members who had no definite interests have disappeared, new members have joined and the current strength is fourteen. It is noteworthy that these are all practical sailors and that

there are no purely theoretical boffins in the group. Provided that members can make the time needed to prepare experiments, the group seems assured of an interesting and useful long life.

M. GARNETT, *Hon. Chairman.*

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THE 1967 CRUISING YACHT DESIGN COMPETITION

This year, we managed to have the races on the Sunday after the Boat Show. The day was warmish and the winds perfect at about 7 m.p.h. but the light was too bad to get photographs.

PRIZES : *First:* Donald Maclachlan. *Second:* Graham Singleton. *Third:* The Ryles (father and son). *Fourth:* Tony Marrison.

FIRST RACE : Windward course (best Vmg).
(1) Maclachlan. (2) Singleton. (3) Ryle.
(4) Marrison. (5) Beer. Miller and Lear did not finish.

SECOND RACE : Downwind.
(1) Maclachlan. (2) Singleton. (3) Marrison.
Beer, Ryle and Miller did not finish.

THIRD RACE : Windward
(1) Maclachlan. (2) Singleton. (3) Marrison.
(4) Ryle.

FOURTH RACE : Downwind
(1) Singleton. (2) Ryle. (3) Maclachlan.
(4) Marrison.

FIFTH RACE : Windward
(1) Ryle. (2) Maclachlan. (3) Marrison.

Donald Maclachlan produced another very nice trimaran for these races, a fuller description of which is given later. Graham Singleton's trimaran was also very nice and with much more accomodation than Donald's and again is described later. The Ryle trimaran; designed by the father and built by the son was a box sectioned craft with sheet to tiller self steering and did very well in spite of its leaks. Tony Marrison's trimaran was the foil-trimaran which Graham

Singleton raced last year and it would look as if the light winds did not suit it so well as our scale gale conditions of 1966.

David Mole raced Ken Beer's boat which was a variety of catamaran with the hulls joined at the bow.

Mr. Miller raced a windmill-propeller boat but couldn't make it go to windward at all well and its downwind performance was modest.

Mr. Lear's " Tri-catamaran " had never been in the water before the races and could not be got to sail in the time available.

* * *

TRIMARAN DESIGN

BY

DONALD MACLACHLAN

The Lodge, Edinbane, Skye.

My own special requirements have led me to develop a type of trimaran design which is very suitable to use on the Scottish west coast, with its multitude of natural harbours, each bristling with rocks, reefs and wrecks.

A 17 ft. L.O.A. version has sailed under winds up to force 8 in the Minch and surrounding areas for a couple of seasons now, being taken out by friends and acquaintances almost every day in all weathers.

The aim of the design was to optimise rough weather performance on a boat with minimum draft and no centreboard. A 'Quickcat' main hull section was the starting point in the development of the lines. The result, constructed of 4 mm ply with fibreglass seams and without longitudinal frames is an immensely rugged cruising boat for two, capable of carrying camping gear and food for a fortnight.

Equipped with International 10 sq. metre canoe sails it goes to windward in force 5 winds or above better than anything of its size I have seen. Members who saw and sailed it at the '65 Weir Wood meeting were very impressed by its ease of handling in the strong gusty winds. One steers by canoe type foot pedals and Jam cleats are provided for the sheets; tame at Weir Wood perhaps, but fine for a 50 mile offshore trip.

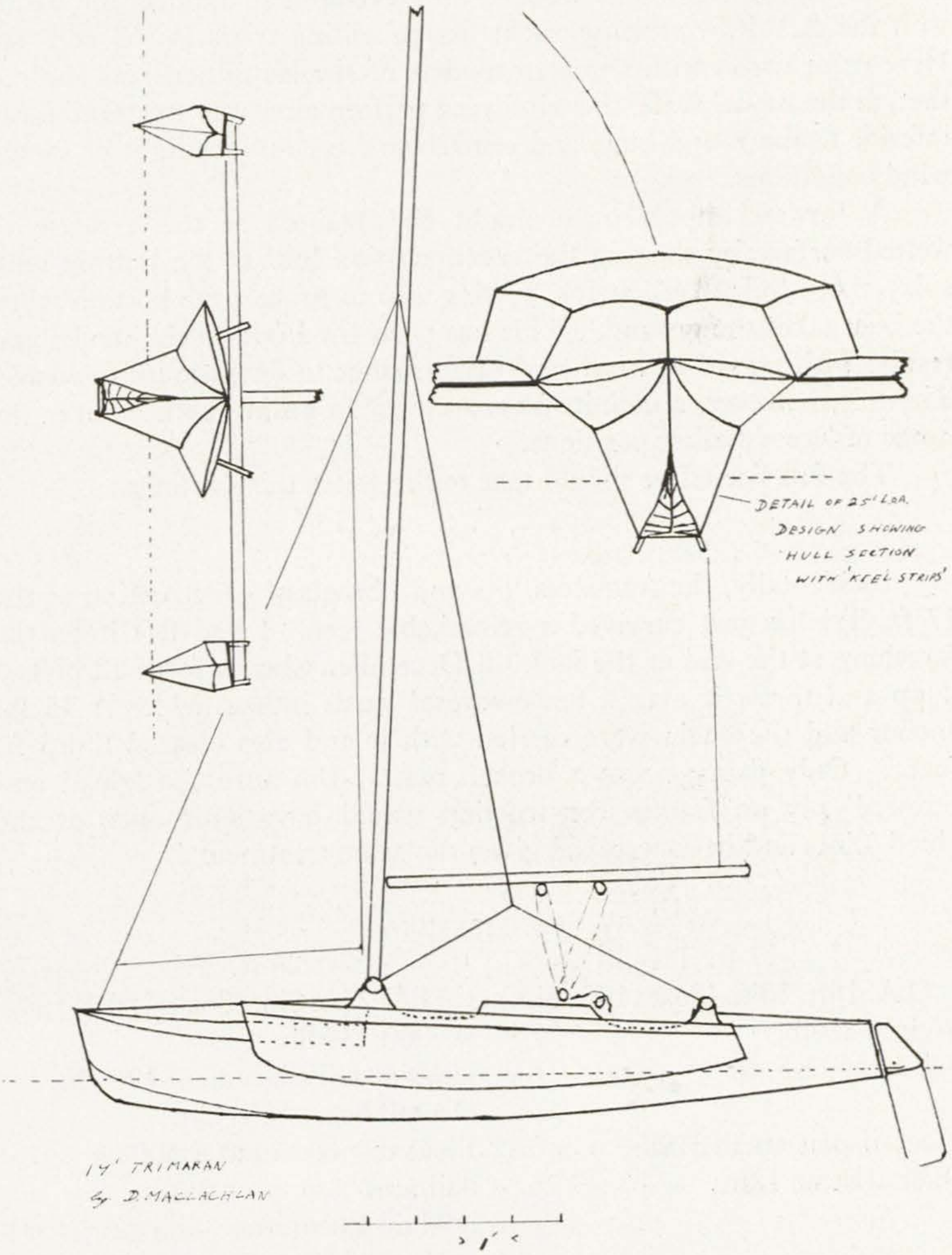
A disadvantage is that it is very wet to windward in steep seas. The volume of water entering the boat via my wife's neck when she is sitting in the forward cockpit is considerable, although the cockpit is equipped with spray covers to prevent more copious entry. In light wind conditions the hull appears to stall and develop a large angle of leeway when boat speed drops below about one knot. Comparison with a reefed SHEERWATER cat with round bilge and centreboard

Donald MacLachlan's model.

showed that the 'stalling' point of the latter was a little later, but that this could be easily be due to slight differences in sail handling.

John Morwood pointed out in the discussion following Lord Riverdale's talk on bilge keels that these should be hopelessly inefficient as hydrofoils because of the enormous tip losses associated with their

low aspect ratio, and that they probably act rather by impeding the water flow around the bottom of the hull, and hence improving the efficiency of the hull. As a surface piercing hydrofoil of very low A.R. the hull's resistance to leeway may be due almost entirely to the excess hydrostatic pressure on the lee side, and I have designed my hull to give a maximum impedance to loss of this pressure by water



Donald MacLachlan's model—note bilge keels.

flow round the bottom, whilst retaining a minimum draft and surface area. The chine at the Bows smooths the ride to windward in rough water without noticeable loss in efficiency. The underwater lines are quite critical, and it is most important that the maximum width of the hull at the waterline should not appreciably exceed the draft.

The same basic hull design and method of construction are being used in my 25 ft. L.O.A. design, the development models for which won the A.Y.R.S. cruising yacht design sailing trials in '65 and '66. Here comparison with trimaran models of similar dimensions showed that, at the model scale, the windward performance was not noticeably inferior to the round bilge and centreboard type under light or strong wind conditions.

A further improvement might be obtained at the expense of wetted surface by shaping the centre section hull at the bottom with splayed out 'bilge keel' strips, serving also to protect the bottom when the boat takes the ground. This has been tried out on the model and results with regard to windward performance to date are inconclusive. There is, however, a definite improvement in sailing balance over the range of 'crew' ballast positions.

The full size effort should take to the water this summer.

* * *

Incidentally, the frameless 'ply and fibreglass' construction of the 17 ft. Tri has just survived a remarkable test. I had left it on the foreshore at the end of the loch till December when a force 12 picked it up and threw it over a fence several yards into a field. A 15 lb. anchor and the chain were carried with it and also cleared the 3 ft. fence. Only damage was a broken mast. I'm sure the 'glued and screwed' ply on frames construction would have split open at the glued joints and been wrecked given the same treatment !

Specifications

17 ft. Tri	25 ft. Tri
L.O.A. 16ft. 10in. (floats 10ft. 6in.)	L.O.A. 25ft. 2in. (floats 18ft.)
Weight 220lb.	Weight 1300lb.
Sail area107sq. ft.	Designed displacement 1900lb.
	Overall beam 18ft. 2in.
Float displacement 370lb.	Float displacement 1,600lbs.
Overall beam 12ft.	Sail area :
	Main 140sq. ft.
	Genoa 140sq. ft.
	Working jib 50sq. ft.

Sir,

The model trials were interesting but I feel they would be more useful if spread over a number of separate meetings throughout the season (or winter), so that comparison over a range of conditions would be possible.

Also, may I add a plea for more models. If the Society sponsors such a design competition in future, surely it is reasonable for, say, 10% of our members to produce some sort of contraption embodying their ideas and bring it along so we all can learn from it. Many of us are busy building at full size, yet how much better the result might be if we did a little model development first ? Those also, who haven't the time or money to try out their designs at full size could show them to the Society as models. It's a very cheap way of testing that ridiculous idea which might just prove a winner.

Who'll produce the flying hydrofoil to beat the tris ? Get a model to work carrying a cruising load and somebody will have a go at engineering for full size.

A last word. Congratulations on the splendid magazine !

DONALD MACLACHLAN.

* * *

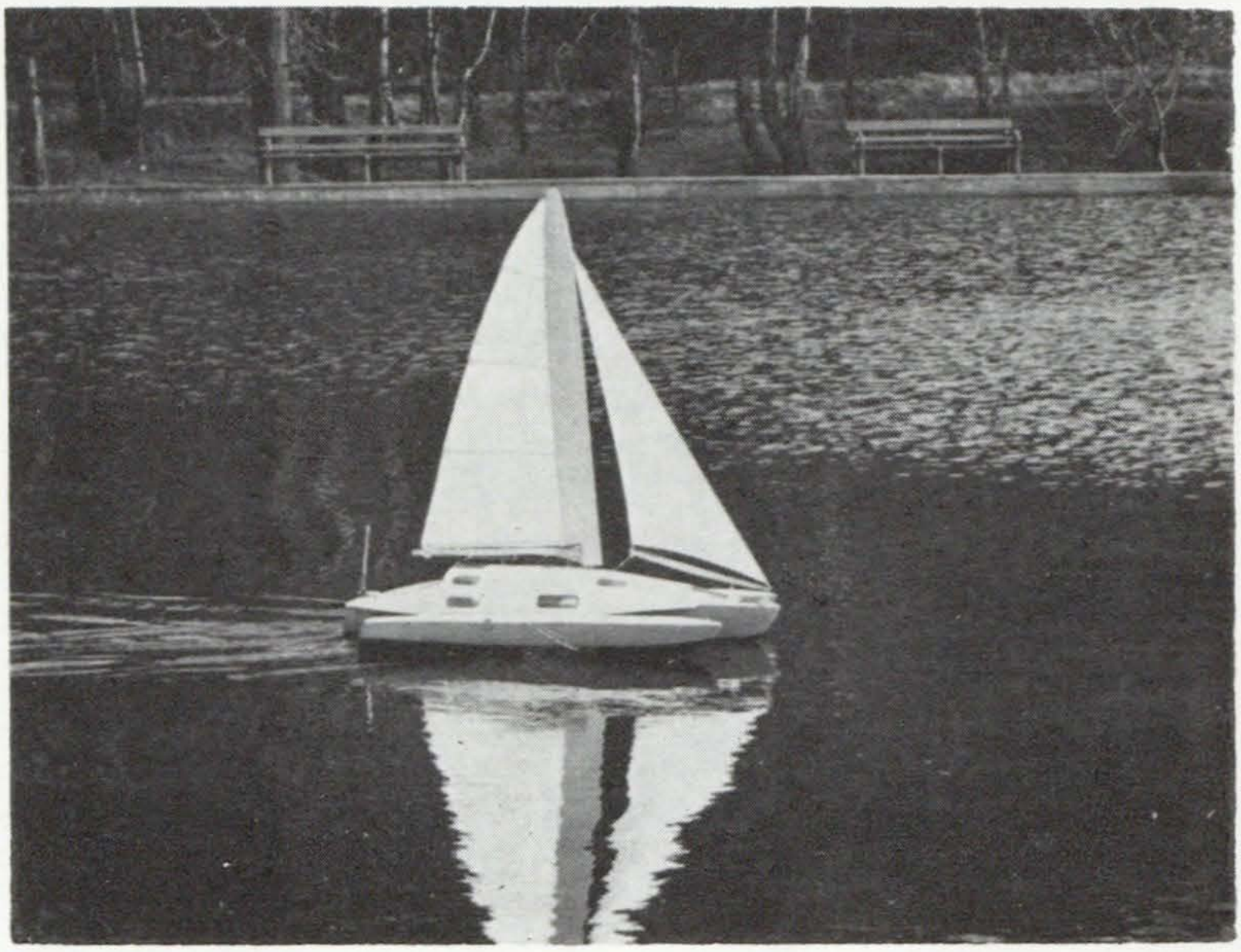
Sir,

Some thought since the model yacht races has underlined a few ideas about design parameters in trimarans.

Firstly, as expected, the hydrofoil model which so nearly won last year and sailed by Tony Marrison this time was outclassed because of its small area and high hull windage.

Considering only Donald Maclachlans' trimaran and my own, they represent two distinct types. Donald's is a very light weight, large sail area type with a hull design to resist leeway, i.e. very low aspect ratio hydrofoil. Mine is a somewhat heavy, moderate sail area type with hull design to minimise drag and windage with a high aspect ratio centreboard (2 : 1 or 4 : 1, assuming that the hull acts as an " end plate.")

Comparison of performance in the races showed that in very light winds, Donald's boat was distinctly superior, I believe because of its low wetted area, large sail area and the low A.R. foil seems to resist leeway better at low speeds. However, in winds of about 7 knots (22 knots at full scale) performance was pretty well equal. It appears that the low drag of my heavier boat was beginning to pay off, particularly to windward. In the odd gust, the heavier boat was faster, and just lifting the weather float. The light weight showed signs of being overpowered.



Graham Singleton's model.

It seems to me that racing model trimarans can teach us quite a lot about design. I doubt if any of the above would have been noticed in any other way. I thought my boat was pretty good until I saw the way Donald's showed its heels in zero wind. Perhaps he thought his was good in high winds until mine went faster with less sail.

I would like to see more space in the journal given to the discussion of these races. Up to now, we seem to have fumbled in the dark but I think design points are beginning to emerge which could show us the way to vast improvements in overall performance. In other words, there doesn't seem to be anything to stop the races achieving the object of finding the best cruiser. Provided, of course, that everyone accepts the philosophy that a good racing boat will make a good cruiser. If one disallows techniques like hand-held sheets and spinnakers in force 6, I subscribe to this.

GRAHAM SINGLETON.

2, Everard Avenue, Bradway, Sheffield, Yorkshire.

MULTIHULL CAPSIZING

BY

JOHN MORWOOD

Every week, I get a letter expressed somewhat as follows : " I am rather worried about the possibility of capsize with this catamaran." My reply has always been that " No multihull is absolutely immune from capsize and, given the correct circumstances, will go over." The conditions are as follows :

(1) The 50 m.p.h. squall with full sail up and sheets tied, especially at anchor.

(2) The steep breaking waves at a harbour bar or in shallow water.

(3) The " freak " ocean wave which is quite as capable of tipping a yacht stern over bows as merely capsizing it even with ropes trailing astern in the surface water.

The matter boils down to simple seamanship.

(1) Reef early and don't leave the sails up at moorings. Our model yacht trials showed that trimarans can beat off a lee shore with greatly reduced sail in a windspead of about 60 m.p.h.

* * *

(2) Harbour bars and shallows should be given the same respect in multihulls as with deep keeled boats.

(3) Multihulls should not lie ahull in storms but should be kept stern-on to the seas by sea anchors (preferably two) ballasted to lie at half the height of the largest conceivable wave. Captain Voss gives this depth as 25 ft. The top water in a wave will be coming at the yacht at a greater speed than the wave itself so ropes in the surface water will be useless to prevent a stern over bows capsize, unless they are ballasted by a length of chain in the centre of a bight. However, it must also surely be wrong to have the chain or sea anchor too deep when it will be in water which is moving in a direction away from the yacht i.e., in the bottom half of a wave.

If we consider the number of trimarans putting to sea on long voyages manned by comparative novices, they have so far been relatively immune from accidents. Indeed, these light-heated ocean voyagers seem to be far more accident-free than those in conventional deep keeled yachts. A re-reading of the causes of yachting accidents as given by Peter Tangvald in YACHT ELECTRICS will quickly show the reason for this. The multihull scores on nearly every heading but it seems a shame that the one multihull fault of potential capsize should

not be " designed out " if that is possible. Righting methods for capsized catamarans have already been adequately studied by the A.Y.R.S.

To my knowledge, no trimarans and only three catamarans have been designed with relative immunity to capsize (or self-righting when capsized) in mind. These three are the James Wharram series of designs, those by " Monty " Montgomery (owner of C.A.T.I.N.) and Michael Henderson's *GOLDEN MILLER.*

The Wharram Designs. All of Jim Wharram's designs are similar to *TANGAROA*, A.Y.R.S. No. 59 with no bridge deck cabin and triangular hull sections with, as a result the greatest hull beam at the deck. If such a design goes over, she will not capsize until she has turned more than 90 degrees. Even then, the minimum of mast-head or lower buoyancy will not allow the centre of gravity to get so far away from the buoyancy of the downward hull that the normal heave of the ocean in such circumstances will not bring her upright again. An overstrong lower mast and inflatable buoyancy at the stay attachment are tempting ideas here but no seamanlike way of rigging the buoyancy is seen by me at the moment.

The Montgomery " Catacruisers." The caatmaran design is normal enough here, except that the hulls are filled with polyurethane foam and all the accomodation is in the bridge deck house which, as a result, is rather high above the centre of gravity of the whole boat. The roof of the deckhouse can now have a thick layer of polystyrene foam in it which not only keeps it cool in the tropics and warm in cold climates but can provide enough buoyancy to float the whole boat upside down. The positioning of centres may then be expected to right the craft in a seaway. Or, if this doesn't happen, the boat will be habitable upside down.

The Principles Involved. Reserve buoyancy high up and far out delays the " going over " point and reserve buoyancy either on the mast or cabin top will throw an upside down multihull on its side.

Curves of Righting Moments. Before starting to write this article, I had been thinking of working out curves of righting moments, comparing single hulled boats with multihulls. I had also thought in terms of making models of multihulls which would be self righting. However, I neither have the information nor the time to work out stability curves and my interest in model making at the moment centres around hydrofoil boats—one cannot do everything.

Summary. Many people are put off multihulls by the possibility of capsize. Ordinary seamanship will prevent capsizes and render the

multihull more safe than a comparable monohull. Methods of reducing the liability to capsize are examined and self righting methods studied.

Those multihull enthusiasts who will cross the oceans with impunity will accuse me of being " old womanish " by writing this article. Arthur Piver will no doubt say that " If one wants to be *that* safe, one should stay at home, preferably in a deep cellar." However, the A.Y.R.S. must examine every proposition and get every aspect of yachts examined carefully, if only to refute arguments on the opposing side.

* * *

NOTES ON SEAMANSHIP IN CATAMARANS

BY
JAMES WHARRAM
Catamaran Rongo, Poste Restante, Deganwy, N. Wales.

Captain Cook was the first European to notice the incredible seaworthiness in breaking shoal waters of the type of boat we now call a catamaran.

John Morwood is correct in advising people to avoid shoal water and harbour bars during strong onshore winds. It's good advice on any ship.

People, unfortunately, don't listen to good advice. Two enthusiastic builders of one of my 22 ft. *HINA* designs sailed it out to sea over Conway Bar, in a force 6 gusting 7 onshore wind. From the shore I watched them through the binoculars. The little boat disappeared into the walls of breaking surf. She emerged, (thank God), on the seaward side of the shoal going well.

Later, they told me of the sheets of spray on the deck, but, most important, no solid water. They were lucky. A normal mono-hull yacht of this size would have broached and capsized in such a confused sea.

The ability of a catamaran to live and live comfortably in all sorts of seas, constantly amazes me. I remember being caught in a gale in the Irish Sea and running before the gale over the Arklow Banks. It looked to us as if the Lightship was going to capsize, but my son was playing with soldiers upright on his bunk in his cabin—such is the steadiness of a catamaran, and from what I hear, trimarans.

What happens if you get in a monster breaking sea, is a question I am frequently asked. Well, it depends on what you mean by " a

monster breaking sea." The worst seas in my experience were in the Gulf of Cadiz.

A " Levanta " blew up. I did not want to be blown out to Madeira, for a " Levanta " can blow up to 70 knots for days. So I headed into the Portugese Coast with approximately a 40 knot wind on the beam, under staysail and mizzen. The seas shoaled to about 6 fathoms, creating a terrifically steep beam sea. The thought did go through my head, " If she is ever going to go over, it's now." The two hulls seemed to " stick " to the surface of the sea, and gave me once I was used to the motion, no concern. I was afraid of the masts being pitched overboard.

* * *

Early in my catamaran sailing life, I found that the conventional sea anchor was of no use. With it, the cat lay beam on to the sea. Now, my practise in bad weather in the open sea is: If the gale is on the beam or forward of the beam to the direction I want to go, I heave to under jib and lash over the helm.

Proceeding approximately on course, the boat will look after itself, until the gale increases to such an extent (a good force 8 and upwards), that the noise of the wavecrests hammering on the side of the ship is unbearable. Then I turn the stern into the sea, take in the jib, and put out my " drogues," a motor tyre tied on to the end of a 30 ft. warp. One for each hull. Then, in the cabins, apart from the rigging howl, it's quiet from the battering of the waves.

If the gale is in my direction, I keep running under jib or bare poles up to 6-8 knots.

I have seen the phenomena of the surface of a large wave cascading down in a gale. It's a bit frightening at first. I am convinced that the shallow draft of a multihull enables it to slide forward in the moving part of the wave, and remain upright, where a deep draft keel yacht tips over because the keel is held in the slower part of the wave.

What happens to the tyres and warps ? They do slacken as the fast water comes, as the editor has previously pointed out, but they hold when the catamaran gathers speed in the momentum of the moving water, then drag, holding the ship steady, preventing possible broaching and tipping.

The average offshore multihull design for cruising as distinct from the over-canvased multihull ocean racer, can suffer and care for the novice better than any mono-hull due to its ease of motion. I personally, am prepared to and will take a well designed multihull through the worst ocean seas in the world.

THE MULTIHULL " LEAP "

BY

JOHN MORWOOD

The " Giant Sea " in the deep ocean is well understood. We think that a multihull, if lying to a sea anchor over the stern will be safe enough because, as Jim Wharram says, the boat can yield to the sea, possibly surfing before it enough to diminish its force. The sea anchor may also hold the sterns down enough to prevent stern over bows capsize. But, it will be remembered that Joshua Slocum met such a sea in only a moderate gale while he was probably sailing under reduced canvas. He had, however, enough time to lower all sail and climb the mast to watch *SPRAY* disappear under a cascade of water—slowly rising to the surface afterwards. We would like to know how a multihull would behave under the same conditions and the answer must be that she would suffer the same fate as *SPRAY*, *if she were travelling at the same speed.*

Unfortunately, people try to sail multihulls on the ocean much faster than *SPRAY* and this can produce an entirely new problem to the sailor, if not to the power boat ocean racing man. This is the " Air Leap " in a head sea. Our cover photograph shows Dick Newick's *TRICE* almost doing one and there is a photograph of Derek Kelsall in *TORIA* in the same attitude. Arthur Piver describes the process very well in this publication while Jock Burrough—also a pilot of aeroplanes like Piver—describes it as " taking off like an aeroplane and then, either falling flat onto the surface again—or burying to the gunwales and stop dead, or falling onto the lee float, presumably tipped by the wind pressure in the sails."

The only way in which the " Multihull Leap " and that of the Offshore Power Boats can occur is from going too fast into a short, steep sea. By the time the boat has ascended the hill of water, the hill has disappeared, having passed beneath the boat leaving it suspended in mid air, partially or wholly, in the bows-up position.

For a sailing multihull, the situation is dangerous. The boat may leave the water altogether while actively lifting its bows and may continue to do so, while the wind pressure on the sails may capsize it sideways and the possibility very strong wind under the fore part of the bridge deck could capsize it bow over stern.

The design cure for this condition is to have a long boat, fine bows and full sterns and little bridge deck to catch the wind. The seamanship

cure for the problem is to slow down to a safe speed in a heavy head sea. A rig which is easy and quick to reef should therefore be developed for multihulls and the semi-elliptical squaresail or fore-dipping lug would be suitable.

* * *

A *NUGGET* CAPSIZE IN TABLE BAY, CAPE TOWN

BY

ROGER MOSSELMANS

Ed.—The Piver-designed trimarans have the greatest buoyancy of float of any and this is placed " high up and far out " which delays the " going-over " point. NUGGET *is therefore as stable a trimaran as there is and this account of a capsize allows us to estimate the chances of a capsize in any trimaran allowing for the weight and " scale effect "—not taking into account the " giant wave " of the Deep Sea.*

The position of the capsize was 100 ft. east of the bell buoy roughly one mile from the end of the Breakwater. The date was the 15th September, 1966.

In September, we have a peculiar dominant wind, the " south-easter." And, when this develops quickly, it is called the " Black South-Easter." It is a strong and vicious wind with savage gusts and starts mostly in the afternoon.

Another fact to note is that, because of the interference of Table Mountain, some part of the Bay can be in a dead flat calm while 100 ft. further on, it can be blowing 40-50 miles per hour.

Around 2 p.m., I was coming back to the harbour with an inexperienced crew and a young boy, 12 years old. I had my full standard sails of main and clubbed jib. I realised that I would soon be getting into the windy part of the Bay but did not reef, as I saw no reason for this.

When we got the wind the sea was " choppy " with breaking waves about three feet high. It was blowing 30-40 miles per hour, gusting to 50. My boat took on an angle of heel of 40-45 degrees. Obviously, I was grossly overcanvassed and would normally have reefed. I didn't because I didn't trust my crew and I thought I would be able to make it.

When I was in line with the breakwater, I came about and got the wind on the beam. My boat heeled to 50-55 degrees, may be more. The port float completely submerged. I tried to reach the mainsheet

cleat to let it go when I slipped on the floor, my deck being almost vertical. Then came a gust of wind and I felt that I was " in for a dive." It was thus sheer stupidity on my part to let my float dig in so much—and I should have reefed.

TAA ROA after being towed in.

★ ★ ★

My boat overturned completely, with the mast and sails still set. It was when I was towed in that the strain of the sails ripped the mast out of its socket and chipped the foot of it. Actually, that was all the damage done to the boat—apart from the loss of tools and a nice sextant.

To give you an idea of the strength of the wind several of the class boats of the R.C.Y.C. (*BLACK SOO*, a Van der Stadt design) dipped their masts 2 feet deep in the water that very afternoon.

You must agree with me that I asked too much from the boat and behaved stupidly—" Mea Culpa." I did a dis-service to the trimarans'

TAA ROA, six weeks later.

reputation and I regret it. What more can I say ?

It was a good lesson and in a certain way, I don't regret it. I have still confidence in my *NUGGET* which is a joy to sail and unbeatable in speed. At Christmas, I am going for the third time to Saldauna Bay, 70 miles up the coast. The last time I went there, we had to beat all the way against a 30 m.p.h. wind, and we made it comfortably, still sleeping in the bunk and not on the side as with a single huller. With the constant tacking the distance actually covered was around 170 miles.

I am definitely very pleased with the boat which I built myself. Structurally, it proved to be unbreakable, thanks to Aerolite glue. Even after my capsize, I take off my hat to Mr. A. Piver. He is a great man.

Ed.—In my opinion, by this frank article, Roger Mosselmans has enhanced the reputation of the trimaran, rather than detracting from it and by his admission of his mistakes, he teaches us all seamanship.

NINIKI

THE BUILDING AND CAPSIZE OF A TRIMARAN

BY

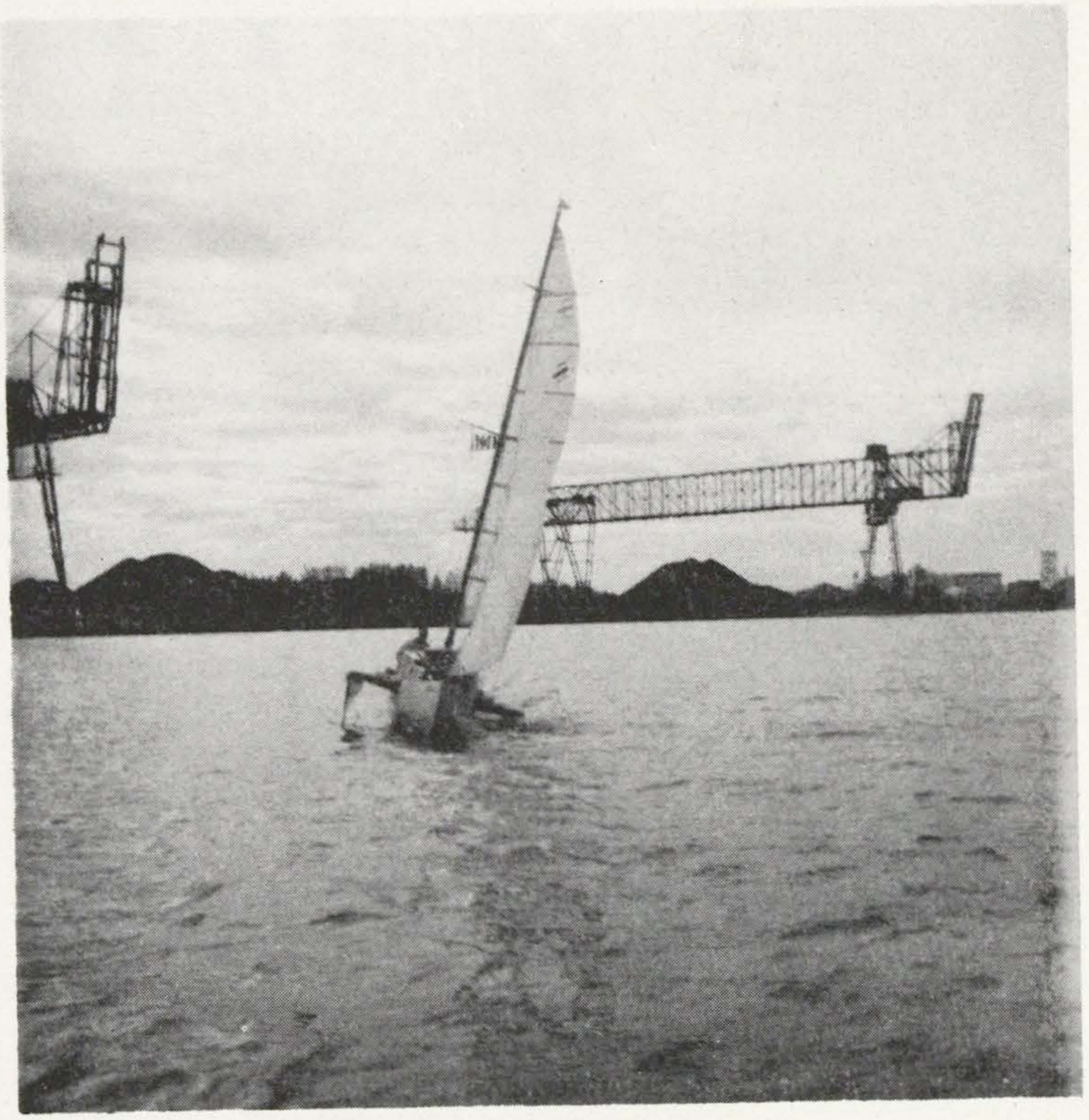
G. R. LAWRANCE

34 South Hill Street, Port Arthur, Ontario, Canada

L.O.A. 27 ft. 6in.
Beam O.A. 10ft.
Beam, Main Hull 5 ft.
Beam, Outriggers 1 ft.

About 4 years ago in Montreal I started building my first boat, a trimaran designed by Dean Kennedy of California.

The floats were constructed of $\frac{1}{4}$ in. plywood frames and sitka spruce stringers. The skin consisted of one layer of $\frac{1}{16}$in. birch planks 4 in. wide, glued and nailed to the stringers using Aerolite 300.



NINIKI sailing.

The second layer of 1/16 in. birch and the third layer of 1/28 in. mahogany were fixed with contact cement.

The beam of the floats being of very narrow section—12 in. at the widest point, I could see that it was going to be impossible to do any maintenance inside the hulls once the deck was glued and screwed. I was of course thinking in terms of dry rot, therefore I filled the fore and after sections with a poured foaming plastic. The hulls were finally fibre glassed.

Access to the centre section was by means of a small hatch and was used mainly for stowing of fuel for the outboard engine.

No changes were made to the design of the floats apart from the addition of the plastic and the result was two elegantly shaped hulls which Dean Kennedy is noted for.

Construction of the floats took close to a year to complete and I began to shudder at the thought of how long it was going to take me to finish the main hull. It was also at this time that I realized that possibly

NINIKI

one or two changes could be made to the main hull to suit local conditions of a lowering water level.

The design called for a canoe stern with the rudder sliding up and down a trunk situated in the middle of the cockpit. This changed the draft from 9 in. with the rudder up to 3 ft. 3 in. with the rudder down. This in itself was not a drawback but it does tend to get away from one of the attractions of trimarans, namely shallow draft. However, what really gave me concern was if the rudder became damaged there was always the possibility that I would not be able to withdraw it into the trunk.

Another factor was that I could see no way of mounting an outboard motor, other than fixing it to either the Port or Starboard outrigger arm or spar and this I did not want to do if for no other reason than it does not " look right."

In order to speed up construction of the main hull, the round bilge was changed to a double hard chine and I was thus able to use $\frac{1}{4}$ in. plywood for the skin.

The next step was to widen out the stern and fit a reverse transom. A kick up rudder was placed on this transom.

A well just forward of the transom accomodated a small outboard engine, although in actual practice the engine was placed on a bracket in the cabin when not in use.

The boat was finished in June 1964 and was sailed out of the Pointe Claire Y.C. in Lake St. Louis (part of the St. Lawrence River) for a few weeks.

I entered for a number of races against conventional boats but the sideways drift nearly drove me up the wall and I seldom finished a race.

A short time later in August 1964, I was transferred to Port Arthur at the head of Lake Superior, this is a large body of water often treacherous but nonetheless offers some of the finest sailing in Canada.

During the winter it was " back to the drawing board " for an answer to the drifting problem. I finally fitted fins to the outriggers, 8 in. x 8 in. x 1 in. plywood, glued and screwed and glassed over.

On the main hull I fitted a piece of aluminium 2 ft. long 8 in. deep and $\frac{1}{4}$ in. thick.

I sailed the boat all during the summer of 1965 and she handled beautifully, she was fast and quick to respond to the helm also the sideways drift was gone. She could point as well as the next boat and in the Thunder Bay Club races she performed well and was second in overall points gained throughout the season.

At 11 a.m. on 11th October, 1965, my wife and I sailed out of Port Arthur en route to Sawyers Bay, a distance of 16 miles.

It was a good day for sailing, with the wind at approx. 10.m.p.h. and we were running before it under Jib and Mainsail (the only sail she possessed). At about 12 o'clock, a cloud appeared on Mount McKay on our stern and we donned our wet weather gear. We had hardly done this when the wind struck us. The boat literally jumped forward. Within seconds the wind was howling and I learned later that gusts of 38 m.p.h. were recorded at the local airport. Out in Thunder Bay, where we were sailing, the wind speed was well in excess of 40 m.p.h. We were by this time tearing through the water and the force of the wind appeared to keep the waves down. There was a long gentle swell with white streaks running parallel with us. The speed at which the storm struck us gave us no time to turn into the wind and

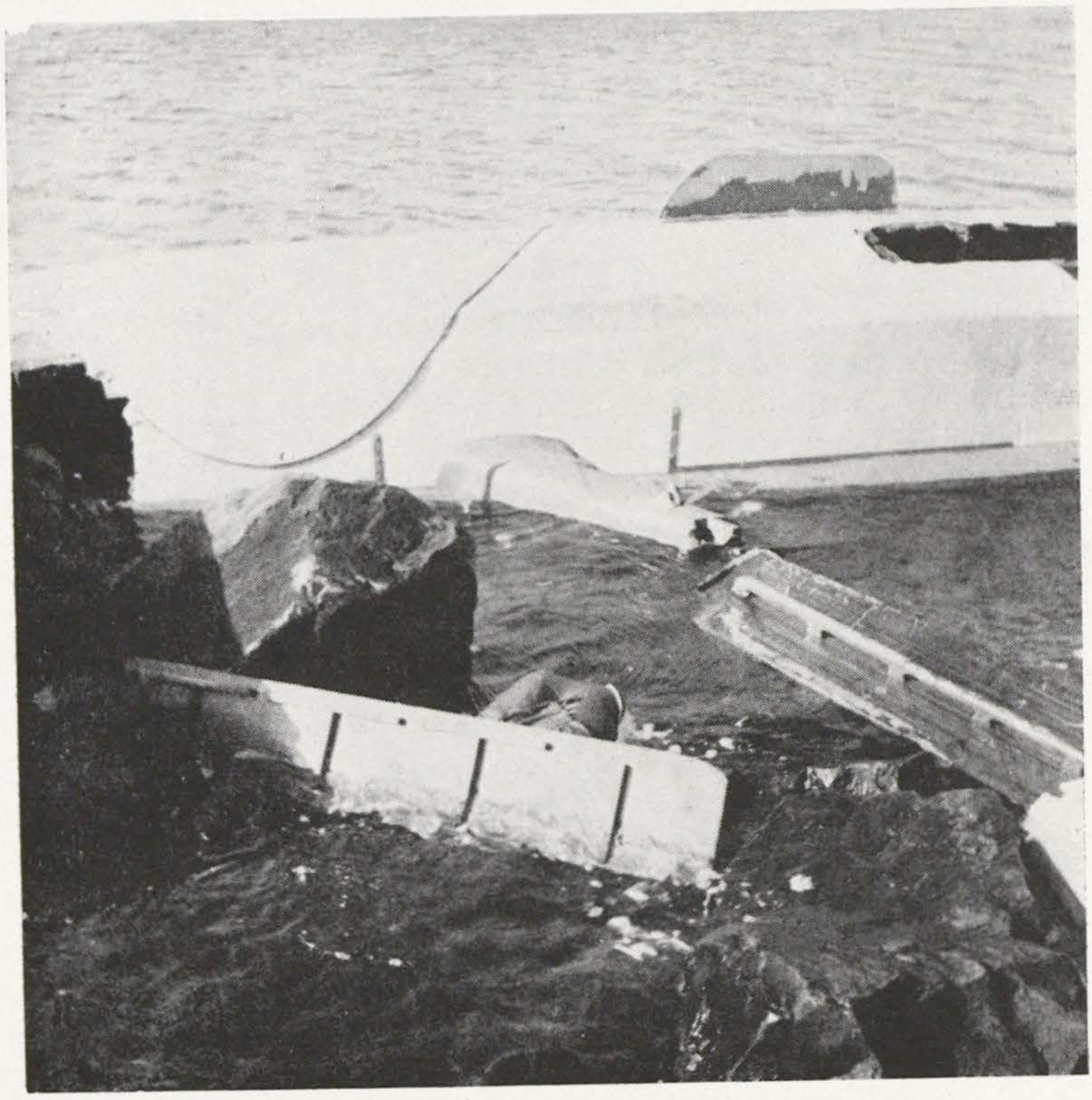
* * *

all we could do by this time was keep running. I have read many accounts of boats going fast and I have even thought of myself going fast but this was almost like a nightmare. As the speed increased it became almost impoosible for me to steer her and the fear of broaching became very real. It took all my strength to control the tiller and it creaked ominously. The boom started to climb up until it was at an angle of about 15 degrees to the mast, the mainsail was folded into a thin vee stretching out to the bow of the boat. I could not see at what angle the mast was at, but I recall the forestay flapping about in the wind.

The stern of the boat began to get deeper in the water until there was only 2 or 3 in. of freeboard. I don't think I frighten easily nor do I want to exaggerate but I don't mind admitting I was terrified. I would not like to guess at what speed we were travelling but it was obvious that we were planeing.

After what seemed a lifetime, but was probably only 15 minutes the storm passed and the wind dropped to some 15 to 20 m.p.h. we were able to turn her around, drop the sails and proceed under engine power. The only damage that I could see was that the bronze snap-hook attached to the topping lift, at the end of the boom, had become elongated and the topping lift wire was flying about. With the dropping of the wind the waves started to built up, and in this part of the country they are very short and steep.

We were not making much headway and after some refreshment the sails were hoisted and we started back for Port Arthur under sail and power. I had enough for one day ! By this time, the waves were some 10 ft. high and it was obvious that we were in for a very rough



NINIKI's broken bones.

passage. We were on the Port tack and sailing as close to the wind as possible when at 3 o'clock in the afternoon the second storm struck us, again with no warning. One minute we were poised on the crest of a wave, the stern out of the water and the tiller limp in my hand and as the boat started to plunge down the wave the wind shifted and the wave action became confused, the boat twisted and suddenly the wind was on our Starboard. The mainsail swung over and the boom came tight against the Port running back stay. The boat started to heel and at such a speed that we could not even keep our balance, let alone do anything else. We were flung backwards into the water and I watched horrified as the mast hit the water and disappeared below the surface until the boat was upside down.

The seas were running high and we had the greatest difficulty in climbing on to the boat and in staying there. The little aluminium

fin keel came in handy for holding onto, although it was never intended for that purpose.

We were cold and wet and our position was quite serious, we were about 9 miles from Port Arthur and 7 miles from Sawyers Bay. The water temperature was around 40 degrees and the air temperature 42 degrees.

At about 4.30 p.m. the mast broke off and came floating up, complete with boom and sail. We had one rope between us—my wife's lifeline and with this around my waist I went back into the water and after a struggle we were able to get the whole rig on the boat. The boom was used as a seat, balanced on the keel of one outrigger and the main hull. The sail was used as a sort of tent and it did a lot in helping us to last out the night.

Sometime after midnight we started hitting the rocks off Sawyers Bay. Getting off the boat proved to be a tough job, the waves were pounding her on the rocks and it wasn't until the cabin top was smashed away that we were close enough to crawl ashore. I say crawl because after 9 hours in the one position we were a little stiff. We made our way through the bush to a deserted fishing cabin where we spent the remainder of the night. Our children had raised the alarm the night before and we were picked up by the R.C.M.P. Patrol boat in the morning.

Conclusion: I realize that having changed the designers plans I may be open to criticism, however, I cannot honestly believe that these changes I made altered the stability or safety of the vessel. Having studied the designs in the A.Y.R.S. and other publications I believe that the floats were too close to the main hull and did not have enough bouyancy. However, the contributing factors to the capsize were undoubtedly the running backstays coupled with the speed at which events took place.

I have the plans of a 37 ft. double ended ketch and will probably start building this spring. This does not mean that I have lost all faith in trimarans but I believe that a self-righting monohull takes a lot of beating for safety. There is also the question of accommodation or I should say living space, for in a trimaran you can accommodate people sleeping on shelves or wings but very little actual living space. Mind you this is probably alright in the tropics, where you spend most of your time on deck. However, in this neck of the woods, a cosy cabin and a wood stove where you can invite your friends in, is the order of the day.

Hello, John, Bermuda.

Thanks for the nice remarks concerning our work you made in No. 55. As far as criticism of trimarans is concerned, the statement that these boats are unproven in heavy weather is so much rot. We would like to have some of these critics with us in hurricane-force winds we and other of our trimaran sailors have encountered.

Concerning John Chapple's letter in No. 55—there is no such thing as a fool-proof boat—nor automobile—nor much else.

You are correct in your advice concerning trimaran motion to windward. If conditions are particularly rough—slow down until they ease. Sometimes when driving hard to windward we have apparently flown clear into space over wave-tops—to land with a shuddering crash beyond. This is scarcely recommended for family cruising.

It is interesting to note the emergence of the semi-circular hull for racing. When we began designing multi-hulls in 1954 we used this shape, but could not convince amateur builders that either strip-planking or molded ply (including double-diagonal) was easy to do. Both methods are indeed tedious. We think sheet ply over simple framing is much the best for amateur builders—who are usually interested in cruising rather than all-out racing. Sheet ply is also the cheapest, and one of the early challenges was in producing designs which would make better boats most available. This also resulted in our revolt against lofting and other traditional boatbuilding skills.

Most of the designs for the past several years have acknowledged the effectiveness of the semi-circular shape—achieved by the use of the double-chine bottom section. Thus you have the essential shape but with the simplicity of V-construction.

★ ★ ★

Fins for hulls are an interesting item. When we discovered in 1960 we could design shallow-draft sailboats which did not need centre boards we were delighted—for we had long considered boards obnoxious if necessary appendages. With rounded shapes some lateral plane is needed—otherwise such boats lack directional stability—going sideways almost as readily as going ahead. As used by Nicol the fins make sense; whereas as shown by Cross and Macouillard they destroy beachability—surely one of the greatest assets of the multihull. On our cruising designs the deep-V float provides sufficient lateral plane—as well as the most comforatble motion at sea.

There is something of vital significance in the trimaran movement which is not generally understood—and indeed—something which those conditioned by the limitations of conventional craft seemingly cannot understand. It has little to do with boat design; but is instead concerned with *attitude* toward the sea.

We who sail these boats are first surf-riders and next sailors. The surf-rider considers the sea as just a great big playground and a huge wave a thrill and a challenge. This is the attitude of the Polynesian; who believes man always has a chance with the sea. On the other hand, the conventional sailor has learned—and rightly so—to respect his ponderous yet vulnerable boat to the point of apprehension. The sight of a huge wave can strike terror to his very marrow.

It was this understanding of the principles of surf-riding which enabled us to handle *NIMBLE* as we did on the 1960 Atlantic crossing. The boat proved to be merely an extension of our surf-boards—with similar characteristics in huge waves but with the added bonus of unprecedented cruising comfort and performance under sail.

It is obvious we have opened an entirely new approach to sailing—both in technique in heavy weather when technique becomes most important; and in the possibility of regarding the sea as an ally instead of an enemy to be feared and battled. This latter factor becomes feasible because of our development of sailing craft which are vastly superior to ballasted types.

A good sailor needs henceforth to be a surfer; or at least should understand the basic principles. He must also be a brother to the sea—accepting its impersonal vagaries without a fundamental fear of them. Respect of its often awesome power is indeed indicated—but with proper multihull equipment he can be far safer than any of the billions of his predecessors. There are now available to the enlightened thrills and satisfaction far beyond anything which has gone before.

ARTHUR PIVER.

* * *

STILETTO TEST-SAILING

BY

ARTHUR PIVER

We have just completed a 9,000-mile testing programme with our new 33 ft. ocean-racing trimaran *STILETTO*, and having left the boat in New York to be sold, are at present enduring a mixture of the unalloyed delight we found in the craft—together with the feeling we have irrecoverably lost an immediate member of the family.

We had for years been involved with the development of the cruising trimaran, and when the basic principles had seemed well ironed out, decided to build a prototype ocean racer. She was to be of a somewhat different configuration. The central hull would be narrower for less wave-making, and the floats would be larger—both to carry some of the load, and to furnish even more stability for harder driving. She would also be round-bottomed, and as we had not had a round-bottomed trimaran since 1957, looked forward to renewing our acquaintance with this shape.

All our early multihulls had been round-bilged; which we considered the most efficient shape—at least from a theoretical point of view. Principal drawback was the fact that amateurs considered such shapes too difficult to build—either in the American method of strip-planking or the moulded ply used elsewhere. For four years we did not sell a single set of plans. In 1958 we noticed the right-angle V-section shown in the Amateur Yacht Research publications, and upon adapting that things began to boom—with amateur builders almost fighting to obtain a set of plans. We had also evolved a simplified building system, featuring non-lofting and requiring far less money than hitherto. The fact these boats also possess features of safety, comfort, and performance which a millionaire cannot buy in a conventional boat was just an added bonus. Thousands of our trimaran designs have since been built.

In 1964 we added a new line of boats—with double chine construction which gives the advantages of the round shape but still were almost as easy to build as the usual V. They were also efficient on the wind without the need for either centreboards or draft-increasing fins; for we have been proud to develop the extreme shallow-draft, boardless sailboat. The first of these was the 35 ft. *LODESTAR* in 1961.

We have mentioned the round-bilge as theoretically the most efficient shape, but because of both poor directional stability and excessive leeway, various boards and/or fins must be added—thus restoring wetted surface which was originally saved. It is also much more tedious to build than the V, and double planking can double plywood costs—to say nothing of the copious quantities of glue which must be used.

Thus we believe that those who want a fast cruising multihull would be well advised to utilize the simpler V-bottom, while the speed demons will use whatever shape makes the fastest boat—and the round can be fast indeed. For those who must have this shape we have developed a line of ocean racers which are simpler to build than

any others we have seen—requiring far less strip planking or ply moulding.

One round-bilge characteristic which impressed us with *STILETTO* was the manner in which she would rise in the water when at speed—sometimes rising so high the upper half of the rudder would be exposed. It seemed incredible she could be managed with so little effective rudder area, but she proved docile in such conditions —although she did feel as though she were blanced on a needle-point.

Our actual voyage in *STILETTO* furnished the usual contrast of heavenly bliss mixed with moments of dread—for we encountered a situation we considered more dangerous to our persons than ever before; and there was an episode in which it was nip and tuck as to whether we would make unwelcome contact with some menacing rocks.

We had ten halcyon days between San Diego in Southern California and Acapulco in Mexico. Although the wind was light to non-existent it was always aft, the skies were completely cloudless, the sea smooth, and the temperature balmy. We sailed for days with only the spinnaker set—on two occasions we had moderate winds for some hours; racking up 200-mile days. It took ten days to do the 1,400 miles.

* * *

With such light craft, the spinnaker acceleration to sudden gusts is so great the boat seems to leap from underneath the crew—the last night out of Acapulco the wind became gusty and short steep waves developed. We seemed to occasionally fly clear out into space off wave-tops—landing with a shuddering crash beyond. After a while (in the black night) this became hard on the nerves—so down came the spinnaker.

The next leg to Panama—also 1,400 miles—also took ten days. There was a good deal of calm as well as many hours of head winds. Upon rounding Cape Mala we endured a wild night of head winds and steep seas—abetted by a current which held us just off the light house for many hours. We were to learn later that some boats with powerful auxiliaries did no better than our motorless craft. We did borrow an outboard engine with which to transit the Panama Canal—one of the high points in any cruising sailor's career.

We were happy to discover more than one-third (5 out of 13) of the Balboa Yacht Club's cruising boats were our *NIMBLE* design.

The Caribbean proved delightful—with the only steady fair winds of the voyage to date—although they were on the light side—ranging from practically nothing to force 4. It took four days to travel 800 miles —with the best day's run 230 miles.

We navigated to miss the west end of unfriendly Cuba by a wide margin. Imagine our consternation when we found ourselves some 60 miles too far east ! The currents shown on the pilot chart proved far more powerful than indicated. We spent an agonizing night drifting so close to land we could hear motor traffic, and were actually in the breaker line for a while. We expected any minute to feel the searchlight of a Cuban gunboat upon us—or be confronted with a fishing boat full of pitchfork-armed peasants. Luckily it was a nasty night—and although calm a series of thunderstorms about us apparently kept the inhabitants indoors. We picked up a friendly breeze at dawn, and fled into the Gulf of Florida. This body of water provided only severe head winds—although at least we were in no fear of having our throats cut. It was so rough we would pull down the sails at meal times; missing three hours of sailing each day, but being able to eat in comfort. It took another ten days to travel the 1,700 miles shown on our log.

Upon leaving Miami for Bermuda we had some bad moments. The ebb tide was racing out the narrow breakwater, and a force 6-7 wind was directly opposing the current. We contemplated the narrow, rock-bordered channel with some trepidation, deciding if a steamer should come in from the sea while we were going out, we would simply turn back and try again later.

The opposition of wind and tide produced waves three and four feet high with perfectly vertical faces—to meet one of these simply stopped the boat dead—and if she fell off on the wrong tack we would immediately be on the rocks—for to make any headway we had to tack clear across the narrow channel. This meant we had carefully to choose the moment to turn.

It was a fierce battle but at last we were approaching the open sea—when in came a steamer—seemingly filling the narrow water-way. We refused to turn and retrace our hard won advantage, and as the steamer approached stayed close to the bordering rocks; head to wind with mainsail sheeted hard and jib flogging. The steamer seemed to take forever to pass, and the several men on the bridge stared steadfastly at us as they went slowly by, apparently convinced they were about to witness a shipwreck. The rate at which our boats can sail in reverse can be astonishing.

Putting the helm over so the bow fell on the proper course, we made the last agonizing tack past the breakwater end—to find the waves on the bar outside larger and fiercer than those we had already endured. Several times we heeled so far the mast appeared horizontal.

Our next stop was Bermuda, a rough trip but with the wind off the quarter. We usually had only a portion of the genoa set; averaging some 200 miles per day.

We next sailed North to Newport, Rhode Island, 630 miles and the start of the Bermuda Race, the most important feature of East Coast American yachting. Two years previously, we had been unofficial entrants with our 38 ft. trimaran *BIRD*. On that occasion we had the company of Dick Newick of the Virgin Islands and his 36 ft. ocean-racer *TRICE*. The race began in a spectacular manner, with *BIRD* passing some 100 of the finest ocean-racing fleet ever assembled the first afternoon—with *TRICE* doing even better. The course was hard on the wind, with moderate breezes. It was on this occasion we resolved to never again be caught in a short-rigged cruising boat while our competition had a racing version.

The genoa halliard block on our boat failed the second day, with the wire being cut by the axle after it had sheared through the fabric sheave. This finished our serious participation. We did beat more than 100 of the 143 boats. *TRICE* passed all but *STORM-VOGEL* and *NINA*. We were proud of her.

This year's Bermuda Race proved a heartbreaker—for we thought we had profited by the mishap of the previous one. This time we did not have a genoa halliard block—but rather a large mast-head sheave. The Race again began hard on the wind—but with only light breezes. The first afternoon we passed some 60 boats. This was followed by a dead calm from nightfall until next mid-morning. During the second afternoon we had the only decent sailing of the entire race—two hours of fair winds which furnished 12-14 knot speeds. Crossing the Gulf Stream proved a nightmare. Fog restricted visibility to a boat-length, there was unbelievably turbulent water, screaming squalls from ahead—all covered with ceaseless rain which fell with the volume of a Niagara.

In the final squall just before leaving the Gulf Stream, the entire clew pulled out of the genoa—and there we were again—over 400 miles to go up-wind in a genoa-less boat which goes but slowly without a genoa. By this time we were among the largest boats, and were forced to watch in frustrated anguish while our erstwhile victims sailed away and left us. Two-thirds of the fleet of 196 racers beat us to Bermuda.

Three other trimarans made the trip to Bermuda at the same time—although they were not actively racing. They were : a 24 ft. *NUGGET;* a 25 ft. *MARINER;* and a 30 ft. *NIMBLE.* With our boat and those already in Bermuda (mostly still building) we counted eleven trimarans. It should be easy to form a multihull division for the next Bermuda Race—or have pure multihull races such as are now being held between California and Hawaii.

We next visited the North American Multihull Championships held in Connecticut—near New York City. It was a delight to dash about in the light airs with an ocean-going boat and pass the racing catamarans—all except the C Class. There were four of these; although one was not strictly legal, being the 25 ft. trimaran of Meade Gougeon —who had astonished observers at an earlier one-of-a-kind regatta in Florida by sailing very fast in apparently non-existent airs.

Mead Gudgeon's Trimaran.

The three C Class catamarans all had wing masts and una rigs. The new *ALLIANCE* of the Hubbard Brothers had an interesting double-sail arrangement—with a slot on either after corner of the mast with the sails being joined at the leech. There was another with identical hulls but the usual single sail on its wing mast. Winner of the championship was George Patterson in *GAMECOCK*, with second place going to Gougeon's trimaran. The Hubbard Brothers were third. In the previous regatta—at Sea Cliff, N.Y., Gougeon had beaten all the Class C catamarans.

Trimaran fanciers will be interested in Gougeon's boat. The central hull is of the classic round-bottomed shape, and the outriggers are mounted on a hinge just aft of the center of buoyancy, so the float in the water articulates over the waves. The central hull weighs 200 lbs; cross-arms are 21 lbs. each; floats 16 lbs. each; mast 55 lbs. Sail area is 256. Gougeon reports that the wing-masted, una-rigged catamarans are becoming much faster on the wind—he is usually beaten to the windward mark but as an ice-boat sailor has developed tacking down-wind to such an extent he frequently makes great strides. He does best in light airs—we cannot imagine his doing much driving with his tiny floats—which are extremely sharp forward, with semi-round bottoms aft.

We left *STILETTO* in New York to be sold—with the proviso we could sail her in the forthcoming International Multihull Regatta, to be held September 22-24 at King's Point, Long Island, N.Y. Already some dozen cruising trimarans are expected to compete, including one designed by Paul Elvstrom of Denmark.

* * *

TRI STABILITY

JOHN WESTELL

compares the stability characteristics of the trimaran form with that of the conventional multi-hull. The author bases his calculations on those originally produced for his 30 ft. *OCEAN BIRD* design. *By courtesy of Yachts & Yachting.*

How is it that a light, unballasted yacht can have so much more sail-carrying power than a heavy mono-hull with a large lump of lead on her keel? The answer lies in the great beam of the multi-hull. *SWING WING*, one of the 30 ft. long Ocean Bird class, has an extreme beam of 22 ft. 7 in. and this is perfectly practical and convenient because it can be reduced by 10 ft. in a matter of minutes for docking or mooring in restricted places.

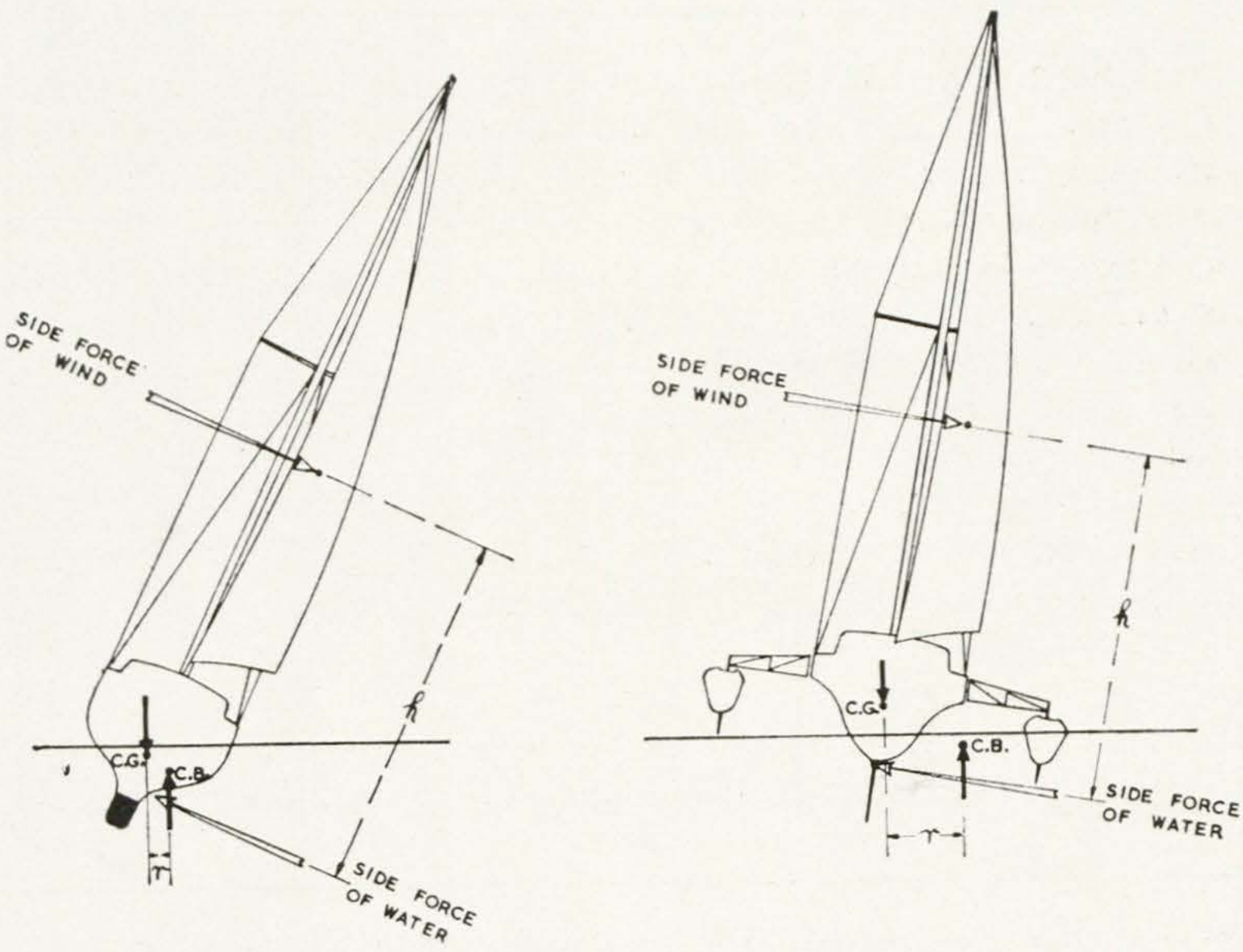
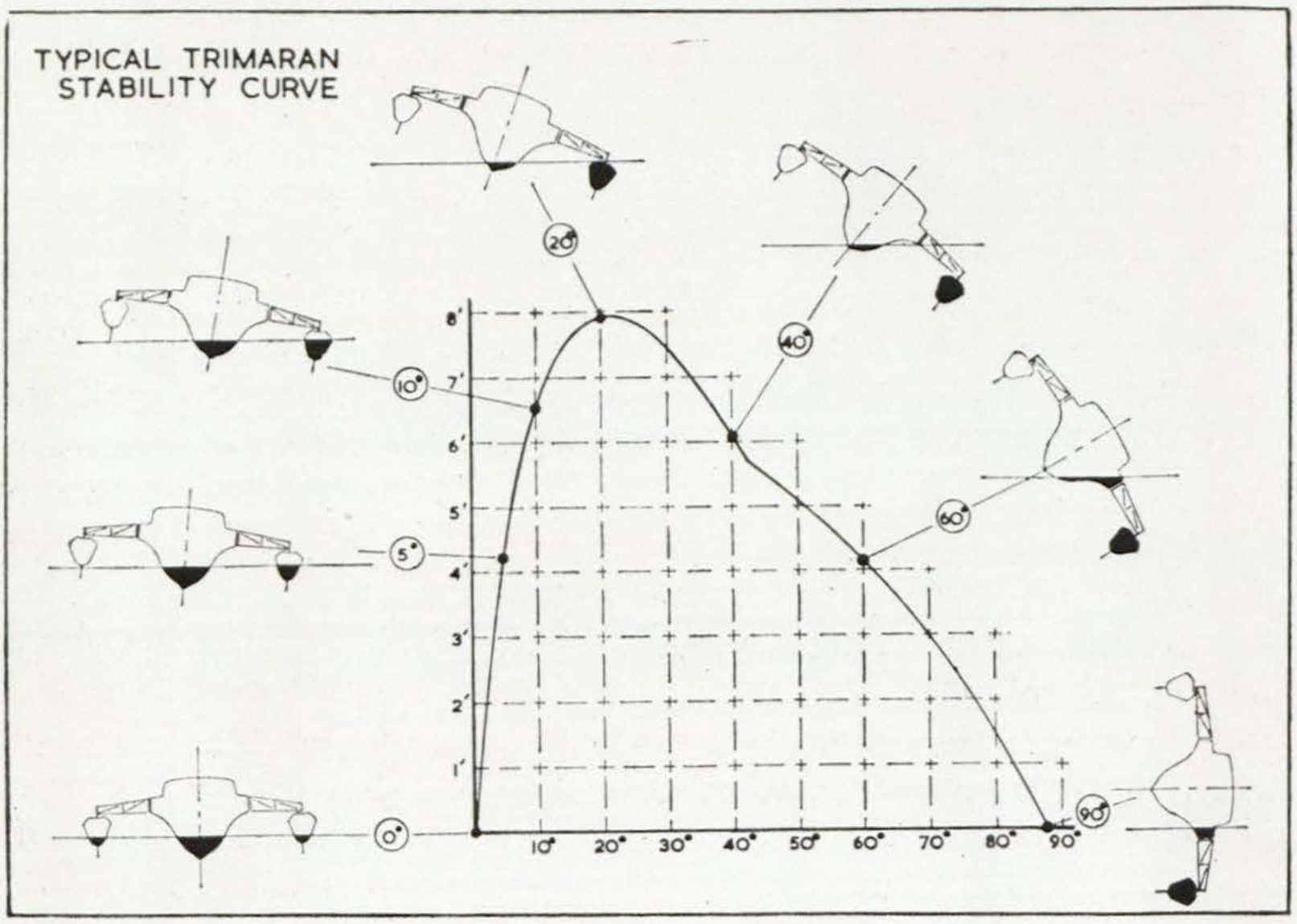


Fig. 1 shows how the side thrust of the wind on the sails combines with the equal and opposite side thrust of the water on the fins and hulls to produce a couple tending to heel the vessel. This side-force from the water is generated by the fact that the craft makes leeway and it has to be equal to the side thrust of the wind to keep her in steady motion. The larger the wind's force and the greater the distance between the centre of effort of the sails and the centre of lateral plane below the waterline, the greater the heeling tendency.

This heeling tendency has to be resisted by the stability—or righting couple—which is found by multiplying the total weight of the yacht by the horizontal distance between the centre of gravity and the centre of buoyancy. This is indicated by " r " in the diagram. The distance " r " is known as the *righting arm* or *righting. lever* As the weight does not vary at any particular time, it is the change in the length of the righting arm which determines the righting couple and which has to be equal to the heeling couple. Mathematically, if " A " is the side force of the wind and " W " is the weight of the craft, then :—

$$A \times h = W \times r$$

In Fig. 1, the trimaran, heeled to 10 degrees, is compared with a conventional yacht of similar size heeled to 25 degrees and it can be seen that " r " in the case of the multi-hull is about three times as



great as that of the mono-hull. It is probably fair to assume that the mono-hull will be nearly twice the displacement since about 40 per cent of her total weight is in the form of a metal casting on the keel. Even so, her righting couple at 25 degrees is only some two-thirds that of the multi-hull at 10 degrees.

That is as it may be, but will not the mono-hull go on getting more and more stable the further she heels, while the multi-hull will reach her maximum and then suddenly flip right over ? The sail-carrying power of the mono-hull will not, infact, increase very much as she heels further, although the power of the wind to heel her will diminish as the sails approach the horizontal. However, even when she is pressed flat she is likely to have a useful righting couple and may have the ability to right herself after turning completely upside down—if she does not fill with water and sink first.

The unballasted multi-hull cannot have this self-righting ability but she can have a very considerable range of stability, as the diagrams in Fig. 2 show. Here the length of the righting arm is plotted against angle of heel and the little sketches are added just to show what this really means. The curve summarises a series of calculations to determine the centre of buoyancy at varying angles of heel. When the yacht is plumb upright most of the displacement is concentrated in the main hull and each wing hull bears a small amount equally. The centre of buoyancy is then directly beneath the centre of gravity,

which might on first thoughts seem to indicate a state of instability. However, this is not so because if the yacht heels only a very small amount the centre of buoyancy moves out sideways much faster than does the centre of gravity and so there is always a couple operating to push her back to the upright position.

At an angle of heel of only 5 degrees the weather hull comes clear of the surface and the lee hull doubles its displacement. The centre of buoyancy lies between the main hull and the lee hull and is in the particular boat under discussion just over 4 ft. to leeward of the centre of gravity. This is a great deal further than the centre of buoyancy ever moves in a conventional mono-hull yacht of similar size, even when the latter is heeled right over.

At 10 degrees, the lee hull is carrying about as much weight as the central hull and the centre of buoyancy is about halfway between them, giving a righting arm of 6.5 feet. Doubling the heel angle again to 20 degrees, brings the lee hull just about to the point of immersion, with only a small proportion of the total being borne by the central hull. This is the point of maximum stability and as the yacht heels still further the horizontal distance between the centre of buoyancy and the c.g. gradually gets smaller. Just beyond 40 degrees there is a slight unfairness in the curve as the flared topsides begin to become waterborne.

The significant thing about this part of the curve is the fact that even at the extreme angle of 60 degrees the righting couple is still very considerable—about the same, in fact, as at 5 degrees—whereas the heeling power of the sails has become very much less. Just before the mast is horizontal the c.b. passes directly under the c.g. and at this point the craft is balanced and can either right herself or go completely over.

In practice the static stability at these extremes is of academic interest only because before she heels anything like as far as even 40 degrees there has to be a strong wind and the sea is likely to be rough also, while the yacht will probably be travelling fast. Changing wave slopes and the inertial forces on the hull will play important parts in the picture, while hull windage must not be forgotten also.

After a season's sailing of the prototype *OCEAN BIRD*, during which she was pressed hard in a variety of condition and often carried sail when a prudent mariner would have reefed, it is very difficult to imagine the circumstances in which she would heel more than 20 degrees. Because of the relatively large and stable platform afforded by the multi-hull, reefing and sail changing are far more easily carried out in rough weather than aboard a mono-hull, so there is no excuse

for carrying excessive sail when it is obviously stupid to do so. The sudden, very heavy squall can always be dealt with by freeing the sheets.

Catamarans and trimarans differ from each other just as much as ordinary single-hulled craft and what is true of one may be far from true of another. It seems fair to say, however, that the chances of a well-designed cruising multi-hull yacht being capsized are no greater than those of a ballasted yacht being sunk.

★ ★ ★

OCEAN BIRD CLASS 30 FT. GLASSFIBRE TRIMARAN

DESIGNED BY

JOHN WESTELL

DATA

LOA	30.0*ft*
LWL	25.7*ft*
Beam, max	22.6*ft*
wings folded	12.6*ft*
Draught CB up	2.2*ft*
CB down	4.7*ft*
Designed displacement	7,200*lb*
Weight for trailing, about	7,800*lb*
Sail area	520 *sq ft*
Engine	1,200*cc petrol or diesel*
Price ready for sea	£4,660

Builders: Honnor Marine Ltd., Seymour Wharf, Totnes, Devon.

This yacht is aimed at being as close as possible to the ideal family cruising yacht, with a strong appeal to the experienced sailing man. It has a powerful inboard auxiliary, ample fuel and water tanks, gas cooker, electric lighting, self-contained w.c., a large self-draining cockpit and berths for five adults and a child. Construction is all of glassfibre except for bulkheads and interior joinery, while the spars are aluminium, rigging stainless steel and things such as two-speed jib sheet winches and stainless steel pulpits and stanchions are standard equipment.

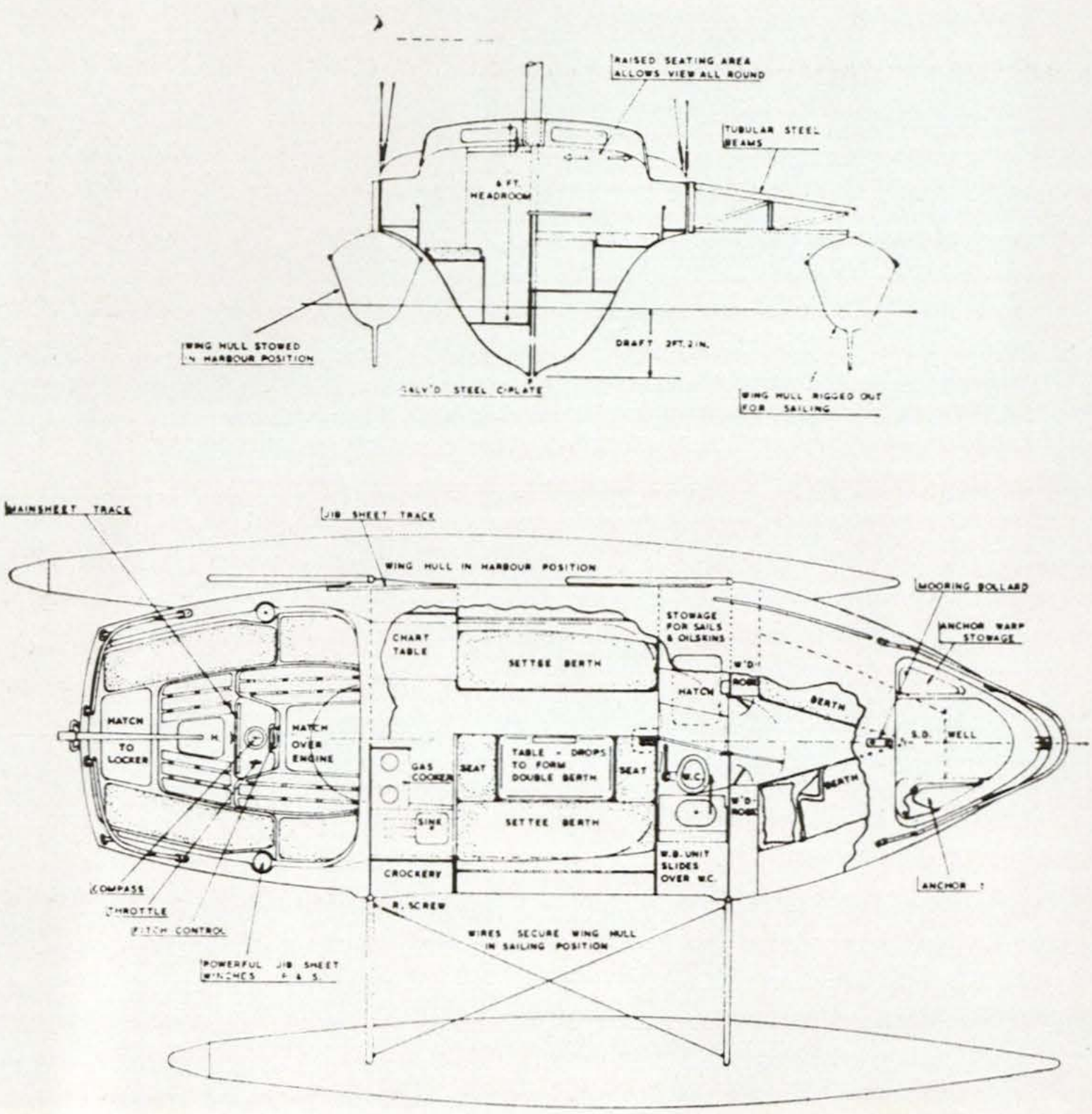
The round-bilge hull is of a form which is not sensitive to changes of trim or variations in weight but the slim underwater form gives an excellent performance under sail or power. She is delightful to handle, with a finger-light helm, and never fails to tack under any conditions.

A simple form of vane steering gear works very effectively. A centre-board is fitted in the central hull and the wing hulls have small fixed fins which keep her upright when aground. Well tried conventional practice is followed in the masthead sloop rig, all gear being extra strong

OCEAN BIRD

on account of the tremendous stability given by the extreme bean of 22 ft. 7 in.

Wing hulls are carried on welded tubular steel beams which pivot at their inboard ends to allow the hulls to be swung in alongside the main hull and half beneath its flared topsides. Thus in a few minutes the beam can be reduced to a manageable 12 ft. 7 in. and the yacht is welcomed at any marina ! She can be motored with the wing hulls inboard and they can be swung in or out under way. Wing hulls are completely foam filled and more than suffiiciently buoyant to support the main hull even if it was completely swamped. The lee hull is designed to submerge just before the main hull leaves the surface, giving a large range of stability and ample warning of when it is time to reduce sail.



OCEAN BIRD—accommodation plan and retractable floats.

Dear John,

Your letter of the 24th on leeway is a subject very close to me at the moment, due to the designing of the *TANE*, *RAKA*, *ARIKI* and *TEHINI*.

The original *TANGAROA*, *EBB AND FLOW*, *SHAMROCK*, *MISTY MILLER* and *IROQUOIS*, all with different cross-sections, and keel rocker dragged displacement waves. They all have one thing in common; the beam-length ratio of about 7-9 of each individual hull.

RONGO has a beam-length ratio of 12-1. She does not pull any appreciable wave on the outside of the hulls, but there is a *fall* on the inside of the hulls.

HINA, *AY-AY*, and Choy Designs are between 15-18 beam-length ratio. They do not have a fall on the inside of the hulls.

Conclusions: For a sea-going catamaran working in a rough sea, minimum wave making is of more importance to design than minimum wetted surface.

On board *RONGO* going to windward in open sea, we allow for safety in navigation calculations, 10 degree leeway. It is obvious that our leeway is less than this. We have been looking for a slick of leeway on the *HINA* design. It is not visible to the eye. We intend to tow a line on a marked board to get a precise degree.

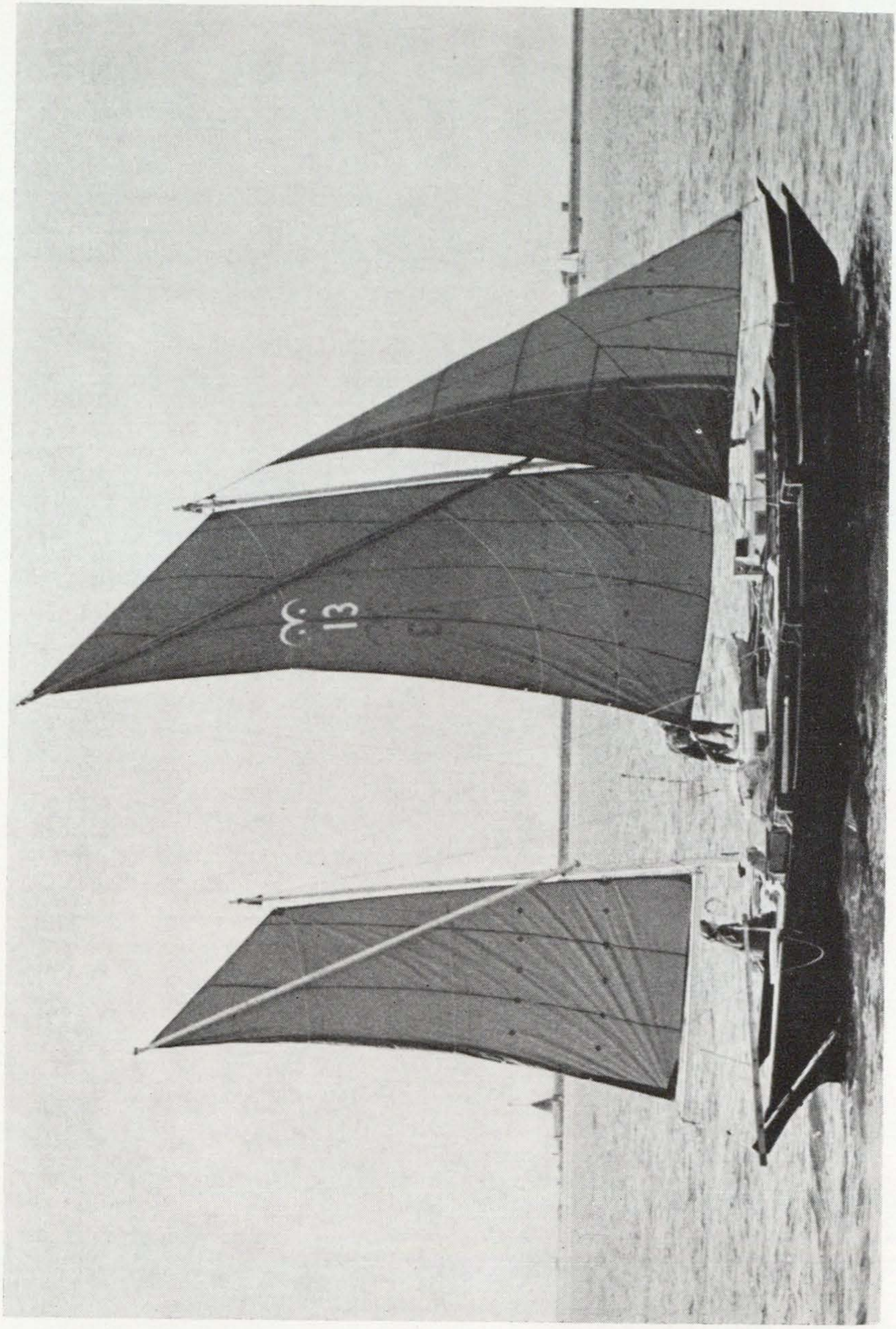
Some owners of a *RONGO* design were very enthusiastic about the *RONGO's* ability to move straight forward on hoisting sail, for it saved them from drifting on a wreck. They claimed from their experience that a single-hulled boat would have made leeway onto the wreck, before it got moving enough to draw forward.

Thank you for telling me about the meeting on July 18th. Actually the designers should be explaining why they think their designs are ocean racing worthy. I am one of the few designers who actually designs and sails offshore multihulls. Most designers leave other people to take the risks.

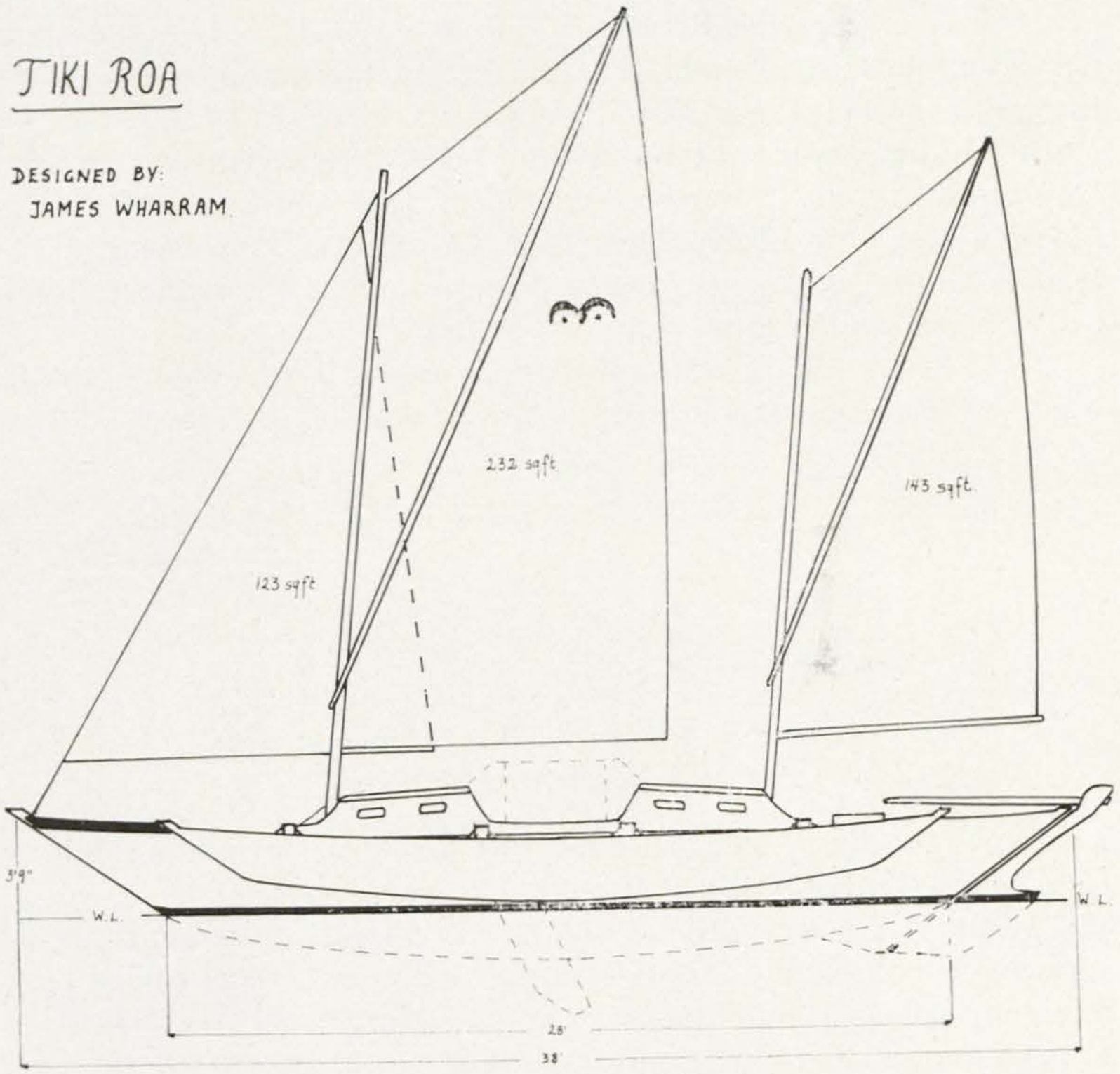
Best wishes from the *RONGO*,

JIM WHARRAM.

Catamaran Rongo, Poste Restante, Deganwy, N. Wales,



TIKI ROA



TIKI ROA sail plan.

TIKI-ROA

BY

JAMES WHARRAM

Poste Restante, Deganwy, N. Wales

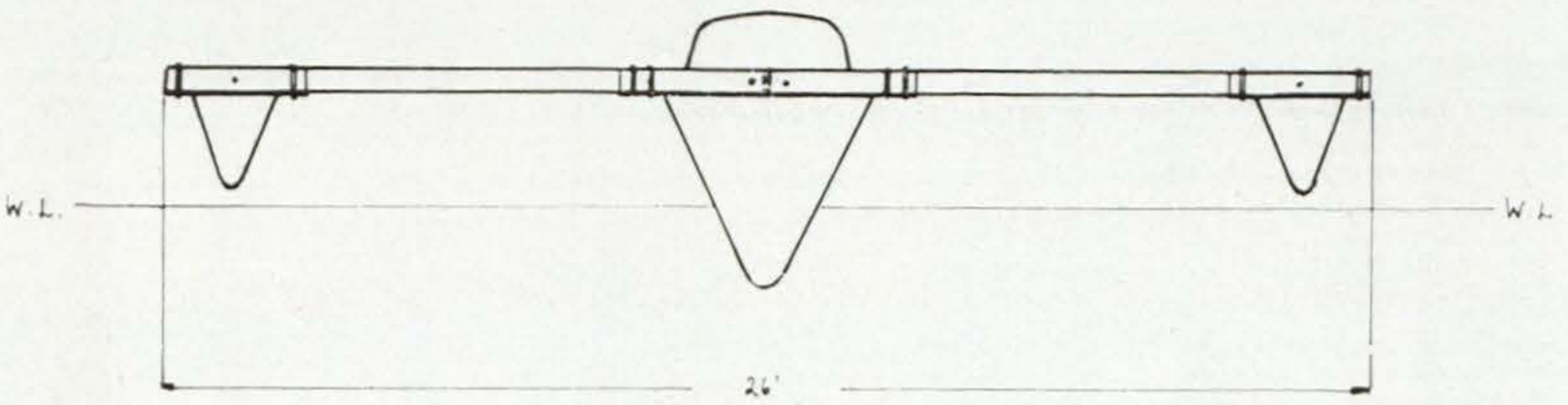
L.O.A.	38 ft.	Beam (hull)	4 ft. 9 in.
L.W.L.	28 ft.	Weight	3,000 lb.
Beam O.A.	26 ft.	Sail area	500 sq. ft.

It's a pity that the *TIKI-ROA* dagger-board sheered off so early in the Round Britain Race, for I entered the Race primarily to prove that a multihull is the only ship design which offers speed and sea-worthiness at a price that any man can afford and a simple shape that he is able to build.

Had I entered the Race with one of my *TANGAROA* designs with a Bermudan rig, I could have demonstrated this far more effectively than with the Polynesian Double-Outrigger, *TIKI-ROA*.

"Ah Jim," you will be saying, "The Polynesians never used Double-Outriggers." Sorry, Gentlemen, they did! Read: "The Maori Canoe," by Elsden Best, Page 17. In fact, the name of the Double-Outrigger voyaging canoe, which brought a migratory group to New Zealand, is preserved: "Takitumu."

Had I have had £1,000 in the kitty, I would have designed a 40 ft. waterline length catamaran. But, when I decided to enter the Race,



TIKI ROA cross section.

I had not even the £10 entrance fee, so I had to sit down and think—a fast low cost boat.

What makes a multihull sail fast is simple: minimum wetted surface, (in a sea-kindly shape, otherwise one would use a hemisphere); minimum windage; minimum weight to maximum sail area in relation to maximum stability, (it's no use sticking too much sail on, the boat turns over !).

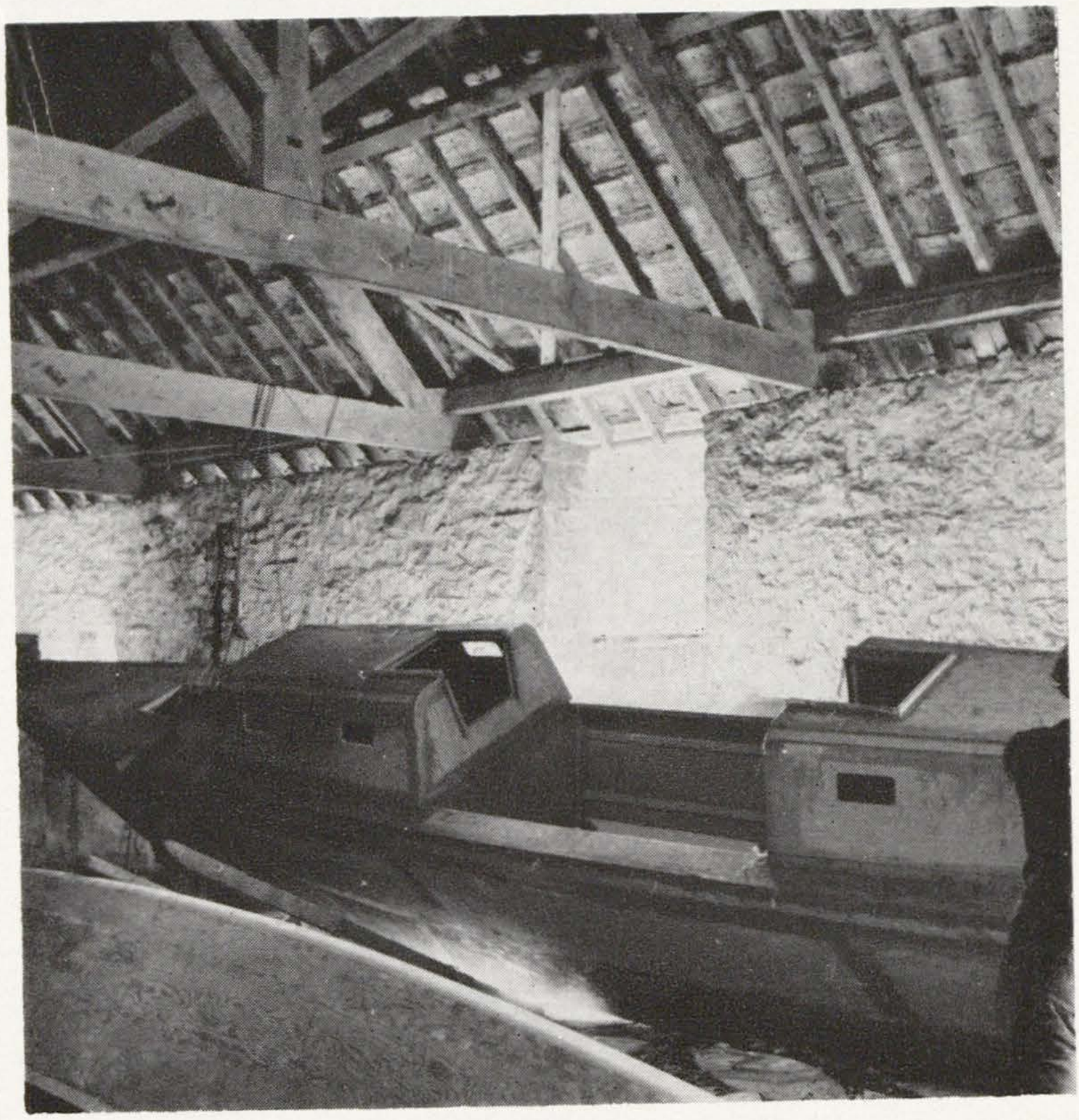
None of these facts cost money (apart from the sails); in fact they make a boat cheaper.

Every man is entitled to his opinion. I think that the average commercial trimaran is but a three-hulled catamaran, which to my mind is a waste of time: three hulls to build instead of two, only one of which carries a load.

The genuine outrigger canoe is a different matter. The Polynesian and Micronesian outrigger canoes, by reason of their minimum wetted surface and minimum windage, are potentially the fastest sea-going craft (ignoring hydrofoil craft and wing sails). They are also the cheapest boat to build, one hull, one small float.

The outrigger canoe is seaworthy, as a classic account published in READERS DIGEST some years ago shows, but it does need a large highly skilled crew.

The floats on *TIKI-ROA* are set, so that in a stationary position, one float is just kissing the sea, the other about 6 in. in the air. Thus



TIKI ROA in her building shed.

I solved the problem of how to make a faster, cheaper sea-going boat than the equivalent waterline length catamaran.

Of course, Derek Kelsall was thinking along the same lines, and I write here and now, Keldsll'd design was better than mine. His previous experience in trimarans had led him to a very clever float design.

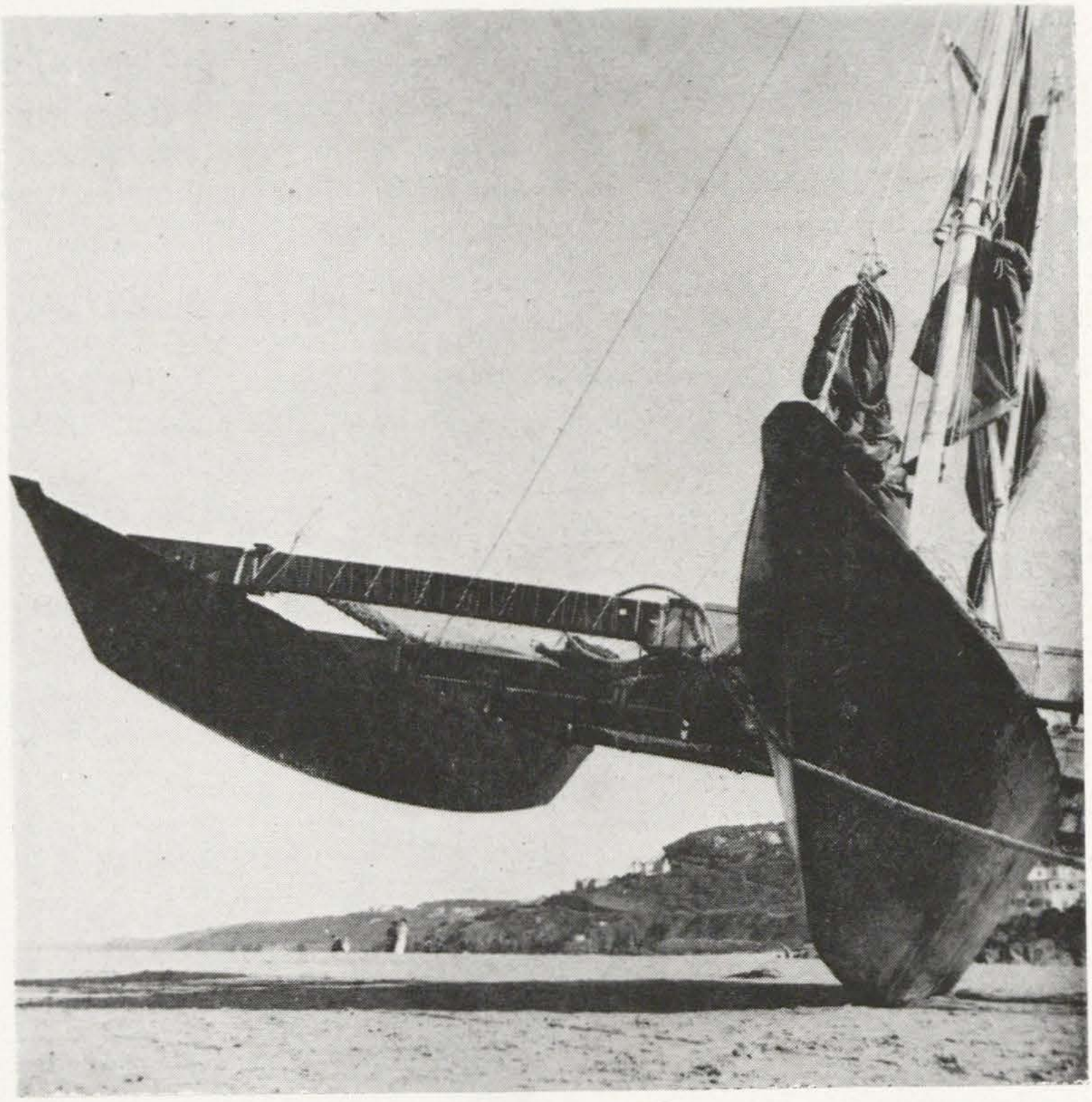
The main hull of *TIKI-ROA* is one of my *TANGAROA* catamaran hulls with increased overhangs for racing in very heavy seas. Catamaran *TANGAROA* is designed for 4; therefore one hull had accommodation for 2.

In the float design I had first to think of safety, so I designed them not as slim floats in the true Pacific style, but as " hulls " as others in the west have done.

TIKI ROA's float and cross beams.

The floats were basically the underwater section of the *TANGAROA* hull, given more shape and deepened. The theory being that in a force 7-8, with all sail up and a beam wind, the lee float would be nearly submerged. The *TIKI-ROA* would then be a catamaran again. In light to moderate winds, the lee float would just skim the surface of the sea. The *TIKI-ROA* would then have a very good sail area to wetted surface and stability factor. In fact, on paper, she had the best in the fleet.

The rig chosen was unfortunate, not because it was a sprit. Polynesian outriggers using normal sprit sails race to this day in the Pacific, at timed speeds of 20 knots. The sprit is a fast sail, but undoubtedly, there is no sail rig to equal the lateen, or its Western equivalent, the mast-head Genoa rig going to windward in light winds.



TIKI ROA's float.

I gambled on having a fair amount of reaching in rough seas. I thought that a low, less capsizing, easily handled rig would pay.

Right at the beginning of the Race, against the very light head wind, I was at a disadvantage. When the dagger-board sheered off, *TIKI-ROA* was beginning to move at 10 knots.

In Falmouth I got a new dagger board and my wife joined me. as crew and I was prepared to push on unofficially.

Leaving Falmouth in a force 3-4-5 on a close reach, *TIKI-ROA* by her log began to move at 15-20 knots.

Hitting the race off the Lizard, at this speed was unnerving to say the least. There was spray everywhere. We could not slow the boat down to find our way through the seas; the reason was the cut of the sails.

That was the end of the *TIKI-ROA* in the Round Britain Race. I have missed out the strain of building the boat alone in a freezing barn in the winter; the weeks of dawn to dusk labour to get her finished for the Race. Once I realised I could never catch up even unofficially with the fleet, the reaction set in. For a week I just slept.

Since then, we have sailed even with the wildly flogging sails, enough to draw these conclusions :

(2) Theoretically, the Double-Outrigger of the *TIKI-ROA*, *TORIA* type, is the cheapest and fastest multihull there is. (*TIKI-ROA* cost £425 with the sails).

TIKI ROA—stern view.

(2) Compared to a catamaran, built on the same logical principles, such as my Polynesian Designs, there is much less space and less confort, due to whipping from float to float.

It remains to be seen which will become the fastest, most popular multihull, the *TIKI-ROA*, *TORIA* type or the *MIRROR CAT*, *WILD WIND* and Polynesian Catamaran Designs.

* * *

TRIMARANS
by
LOUIS MACOUILLARD

By courtesy of the Australian Catamaran Association from its magazine CATAMARAN, 28 *Dally Street, Clifton Hill, Victoria, Australia.*

Unfortunately, Trimarans have little appeal to the sailing masochist who insists he enjoys having the rail buried, the cockpit awash, and the galley a hopeless mess. But, in all fairness to traditionally-minded sailors, there are some shortcomings and obvious disadvantages to trimarans that must be mentioned. Avoidance of these issues does not create enthusiastic favourable response. The questions and doubts voiced most frequently are :

1. How can you be sure it won't capsize ?
2. Will it break up in a seaway ?
3. Will it really go thirty knots ?
4. Where can I find a berth wide enough ?
5. Why don't they perform better against conventional ocean racers ?

One hesitates to give definite answers ; perhaps there are no answers. But one has to come up with something, so here goes.

1. Of course an over-burdened multi-hull, badly sailed, will capsize. Rank beginners will get into much more difficulty than an experienced sailor.

2. A badly-engineered and poorly-constructed craft will certainly tend to fall apart. It takes more than just glue and a prayer.

3. There have been a number of exaggerated claims of hull speeds. These published accounts rarely give figures for a day's run or average speed. Most cruising trimarans with any ability at all should do at least 15 knots under favourable conditions—which are rarely found at sea.

4. Berthing **is** a problem. Whenever possible, mooring is preferable.

5. I believe that trimarans haven't shaped up too well in competitive ocean racing because there has not been a comparative investment of money. We are competing against dollars with pennies.

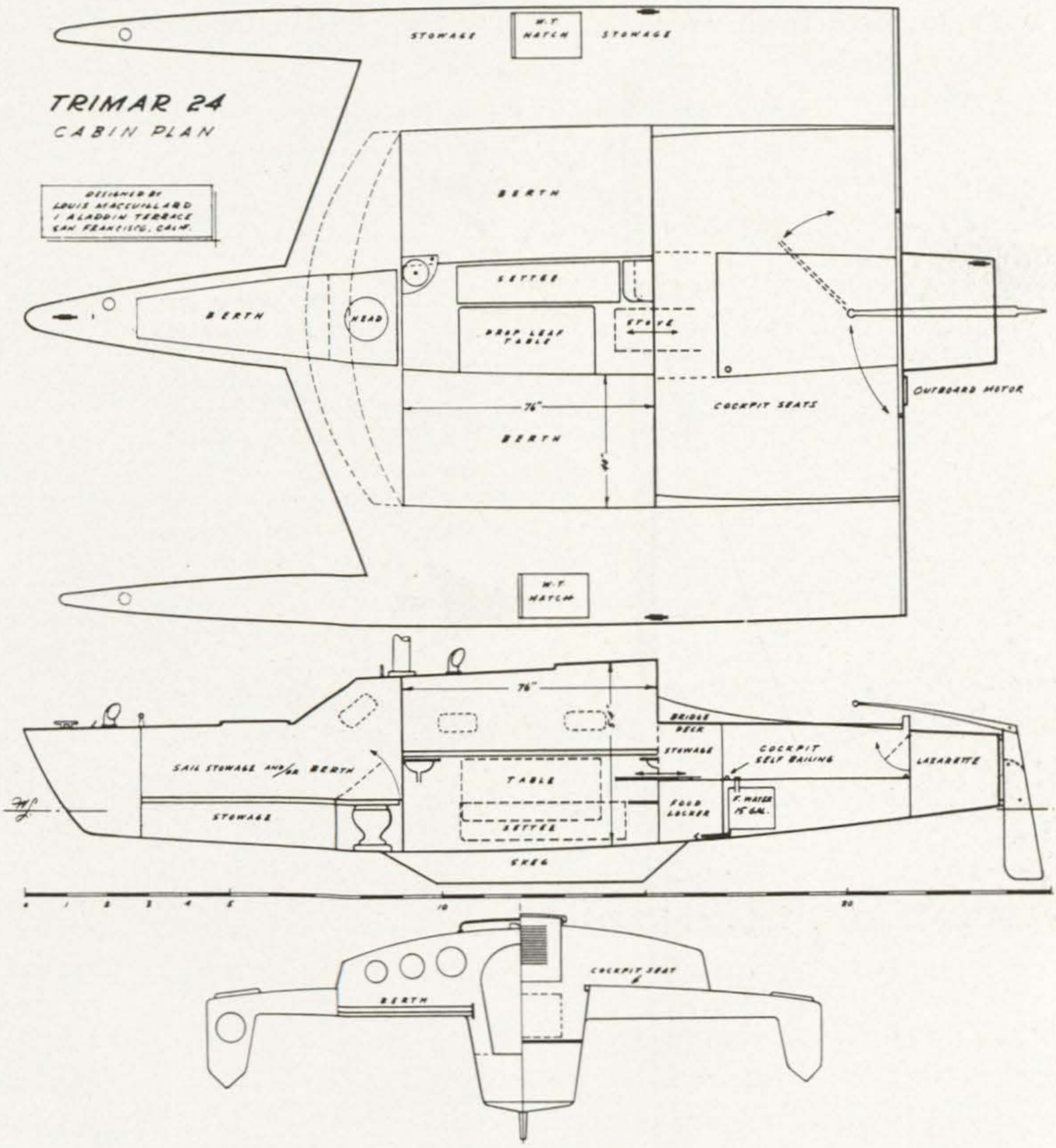
To go back for a moment to the third question. I have been somewhat annoyed from time to time reading the wild claims of some

TRIMAR 33 main cabin and galley.

trimaran enthusiasts about the glories of surfing in a gale while running from a storm. These events necessarily must take place far from a lee shore and not too much attention can be made to the desired course. Any sail boat must be able to hove to, or at least ride to a sea anchor. Granted, making a course good at perhaps one-third of a knot does not make exciting reading—but it does make a lot of sense.

The basic difference between a trimaran and a catamaran tend to be minimised when the former attains a slight angle of heel and the weather float is clear of the water. A submerged float to weather creates drag and does nothing to support the thrust of the sail. I

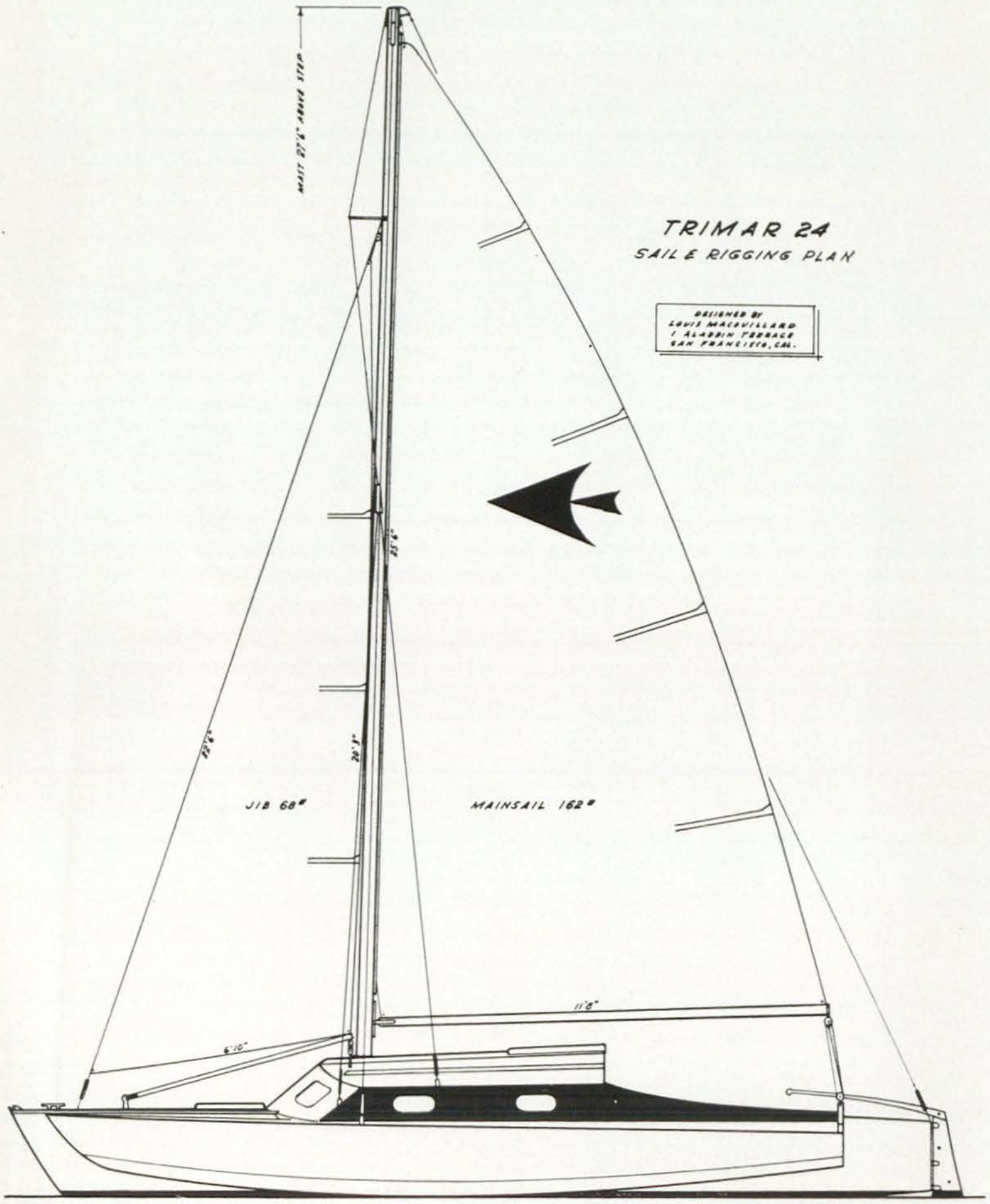
prefer to think of the trimaran as a single-hulled vessel supported by outriggers, rather than a three-hulled vessel. A trimaran should have some roll, but an easy motion, not the quick action produced when both floats are submerged. A " snap " roll can prove very uncomfortable and tiring on extended cruising, besides being dangerous for sail handling, galley work, and so forth.



TRIMAR 24

The Floats. The shape, placement and proportion of the floats is the most critical part of trimaran design. Besides providing necessary displacement, the floats should produce a dynamic lift (lee side) and be so shaped to give a slight lift to windward when sailing close hauled. Floats are more effective when placed well forward, relative to the main hull. All three bows can be almost on the same

line. Rocker in underwater sections ought to be kept to a minimum. A long, flat run is desirable but, with varying load conditions (due to angle of heel and wave conditions) it is best to introduce at least 12 in. rocker. Also, a long, straight, submerged float will tend to prevent the boat from coming about smartly. The Polynesian outriggers and the Philippine trimarans of native design are brutes to bring through the eye of the wind and a paddler is usually placed in the bows to force them over.



INCOME AND EXPENDITURE ACCOUNT FO

1965					
£	£				
		Cost of Publications:			
1,965		Opening Stock		1,953 6 0	
1,025		Printing Costs and Blocks		1,463 5 2	
2,990				3,416 11 2	
1,953		*Less:* Closing Stock		1,076 12 7	
1,037					2,399 18 7
52		Rent of Office			52 0 0
1		*Repairs and Renewals*			
52		Salaries			52 11 11
16		Travelling Expenses			21 18 9
55		Printing, Stationery and Telephone			75 4 6
177		Postage and Carriage			348 10 10
219		Secretarial			112 15 11
21		Advertising			101 17 4
67		Hire of Rooms etc. for meetings			58 9 6
259		Expenses of Stand at Boat Show			348 14 9
15		Subscriptions			12 0 0
10		*Rent of Reservoir*			
—		Insurances			4 1 6
2		Sundry Expenses			12 13 6
75		Audit and Accountancy (including Audit Fee £42)			43 7 2
1		Bank Charges			4 4 5
4		Model Yacht Competition Expenses			92 0 0
14		*Wind Tunnel Expenses*			
—		Loss on Sale of Test Tank			20 10 6
		Depreciation:			
—		Wind Tunnel	50 0 0		
7		Office Equipment	7 6 8		
—		Fixtures and Fittings	7 1 0		
605		*Excess of Income over Expenditure, carried down*			64 7 8
£2,689					£3,765 6 10

ACCUMULATED FUND FOR THE Y

—	Balance brought down	803 2 2
120	*Formation Expenses*	
3,437	Balance carried forward	2,634 1 9
£3,557		£3,437 3 11

BALANCE SHEET AS AT

£	£		£ s. d.	£ s. d.
3,437		ACCUMULATED FUND		2,634 1 9
287		AMERICAN SECTION FUND		286 13 4
		CURRENT LIABILITIES		
	747	Creditors	982 14 9	
	27	Subscriptions in Advance	123 4 10	
774				1,105 19 7
£4,498				£4,026 14 8

Notes:

1. In the even of the Winding up of the Company every member undertakes to contribute such amounts as may be required not excedding £1 each.
2. No Depreciation has been provided in respect of the Building.

REPORT OF THE AUDITORS TO THE MEMBERS OF T

We have examined the above Balance Sheet of The Amateur Yacht Research Society Limited as date, and have obtained all the information and explanations which, to the best of our knowledge and b amination thereof, proper books of account have been kept by the Company and the above Balance She

Further, in our opinion and to the best of our inforamtion and according to the explanations give thereby required, and the Balance Sheet and Income and Expenditure Account give, respectively, a tru the year ended on that date.

54 Old Broad Street, London, E.C.2
1966.

SEARCH SOCIETY LIMITED

R THE YEAR ENDED 30th SEPTEMBER, 1966

1965 £	£	£ s. d.	£ s. d.
1,360	Subscriptions received		1,605 15 5
1,228	Proceeds of Outside Sales of Publications		1,203 14 4
10	Surplus on Sale of Ties and Burgees		7 15 7
91	Income from Advertisements		117 17 10
—	Interest Receivable		27 1 6
—	Excess of Expenditure over Income carried down		803 2 2
£2,689			£3,765 6 10

EAR ENDED 30th SEPTEMBER, 1966

605	*Balance brought down*		— — —
1,837	Balance brought forward		3,437 3 11
1,000	*Transfer from Reserve for reprinting publications*		— — —
115	*Transfer from Reserve Account*		— — —
£3,557			£3,437 3 11

30th SEPTEMBER, 1966

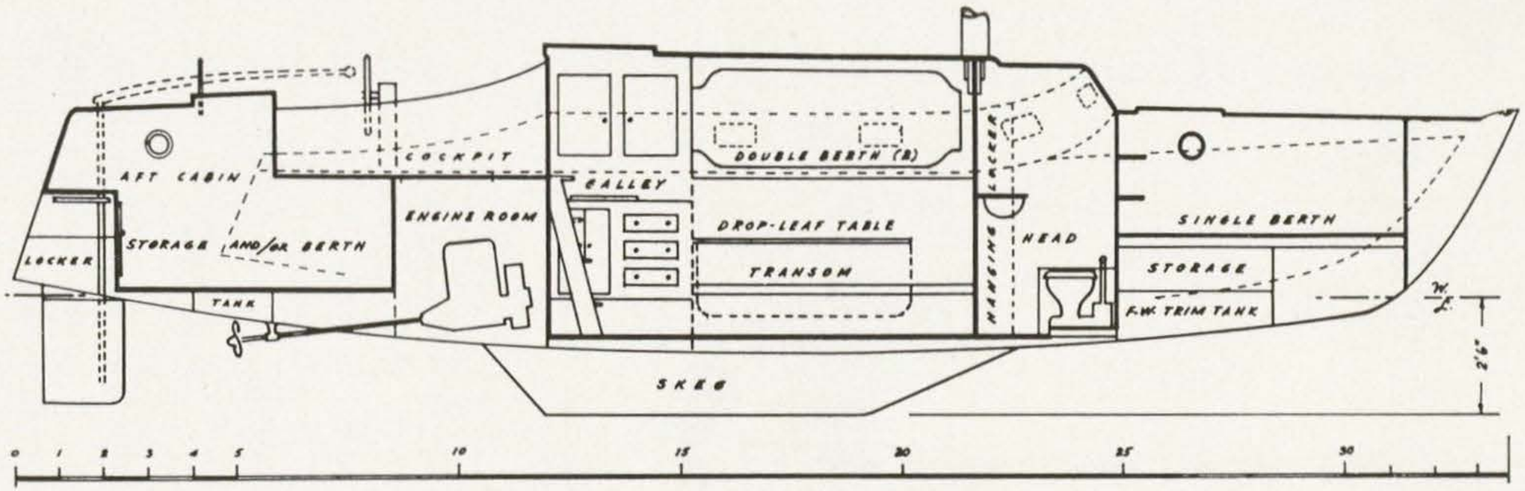
1965 £	£			£ s. d.	£ s. d.
		FIXED ASSETS			
—		Building, at cost		164 17 6	
290		Wind Tunnel and Test Equipment at cost	250 0 0		
		Less: Depreciation to date	50 0 0		
				200 0 0	
	59	Office Equipment at cost	50 13 3		
	21	*Less:* Depreciation to date	28 6 7		
38				30 6 8	
		Fixtures and Fittings at cost	56 1 0		
—		*Less:* Depreciation to date	7 1 0		
				49 0 0	
328					444 4 2
		CURRENT ASSETS			
		Stock of Publications and Ties, as valued by Company Officials		1,264 8 11	
1,953					
	170	Debtors and Prepayments		371 4 7	
	1,931	Cash at Bank		1,821 0 5	
	115	Post Office Savings Bank Account		115 6 9	
	1	Cash in Hand		10 9 10	
4,170					3,582 10 6
£4,498					£4,026 14 8

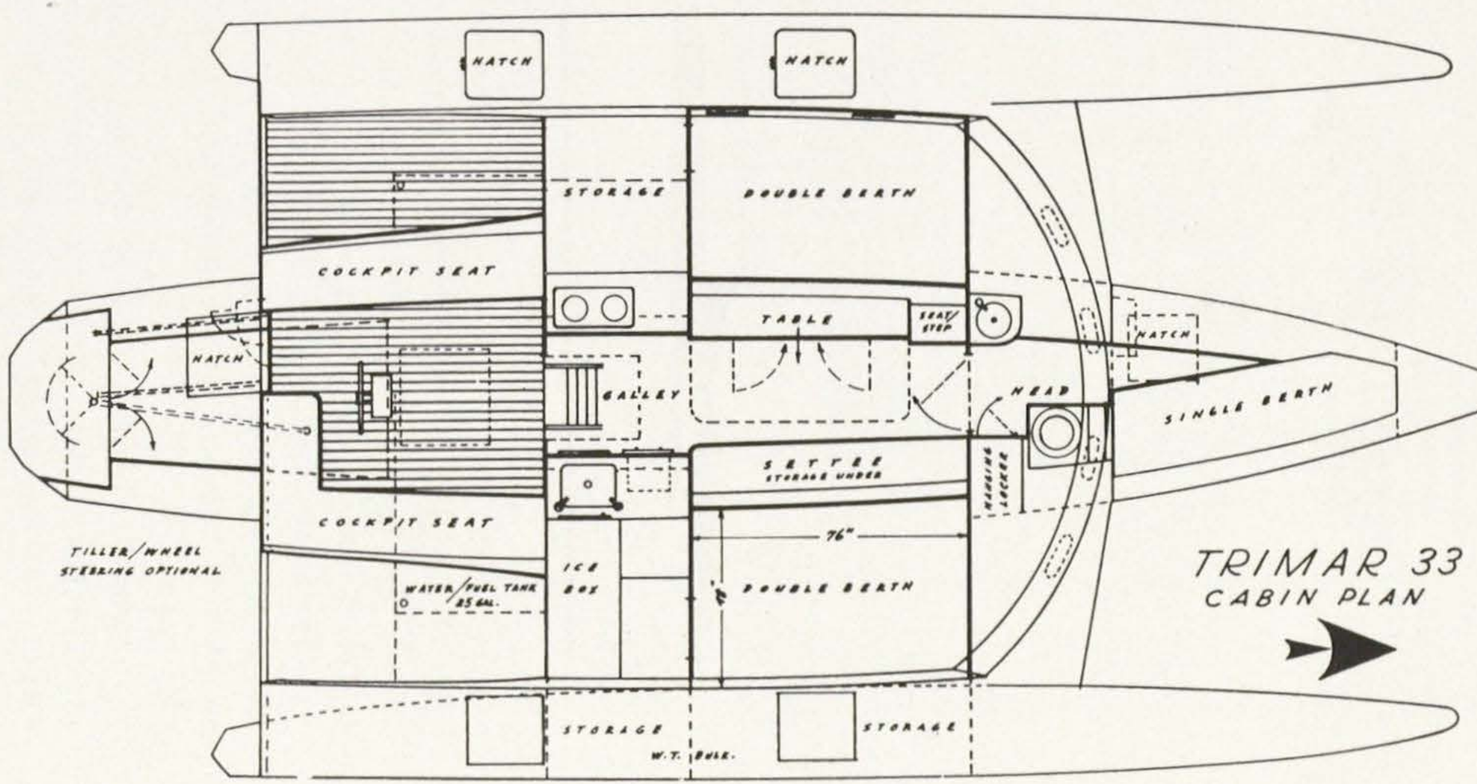
THE AMATEUR YACHT RESEARCH SOCIETY LIMITED

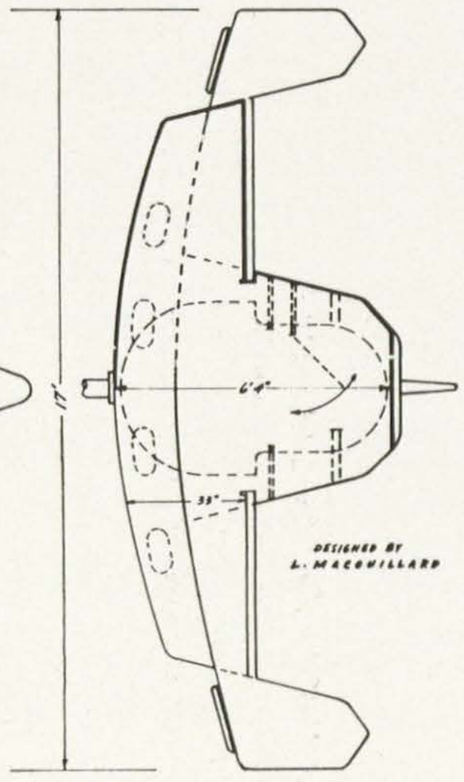
at 30th September 1966 and the annexed Income and Expenditure Account for the year ended on that elief, were necessary for the purposes of our audit. In our opinion and so far as appears from our ex- et and annexed Income and Expenditure Account are in agreement therewith.

n to us, the said accounts give the information required by the Companies Act 1948 in the manner e and fair view of the state of the Company's affairs as at 30th September 1966 and of the results for

BLACK GEOGHEGAN AND TILL
Chartered Accountants.

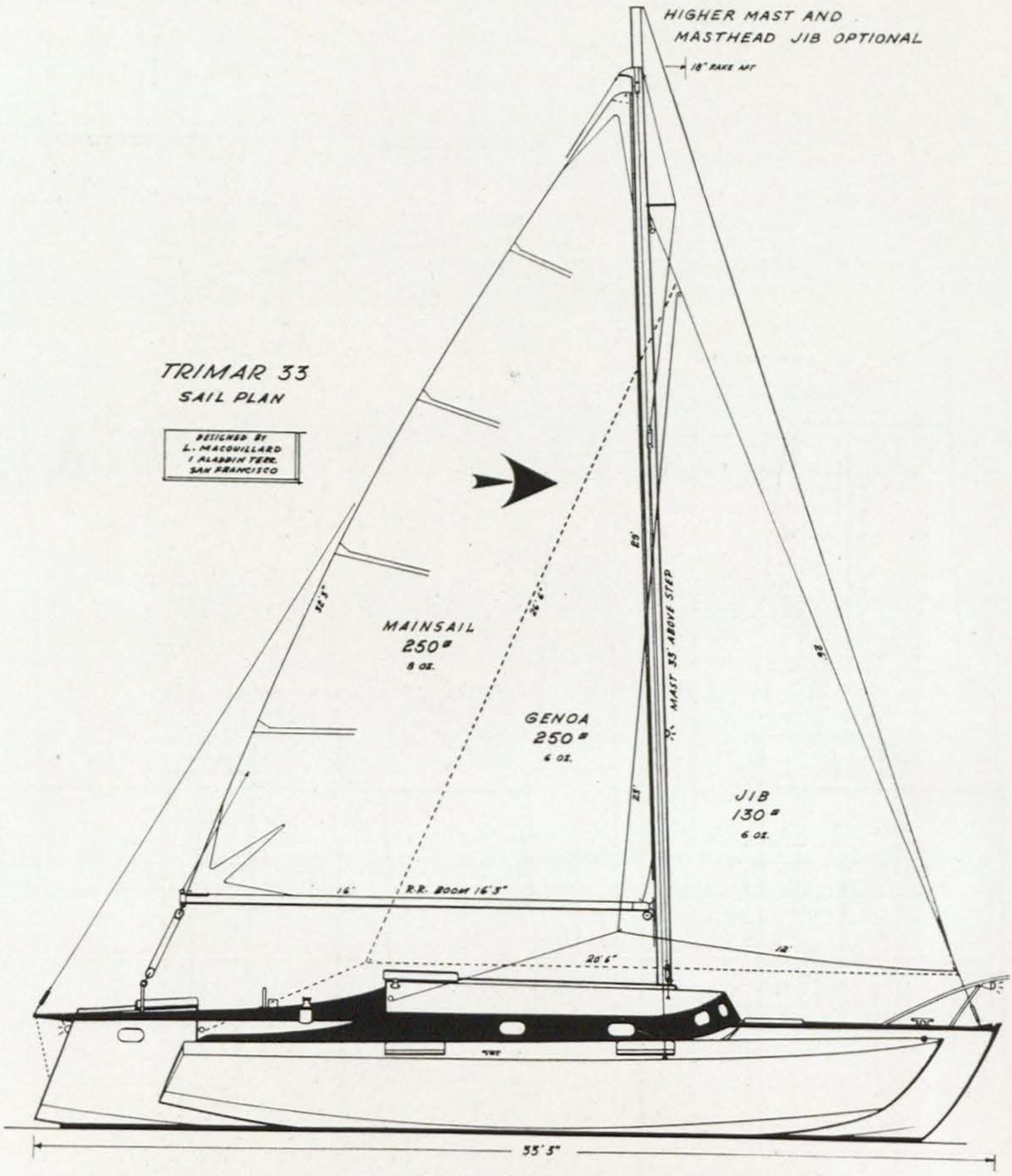






TRIMAR 33
CABIN PLAN

TRIMAR 33. Accomodation plans

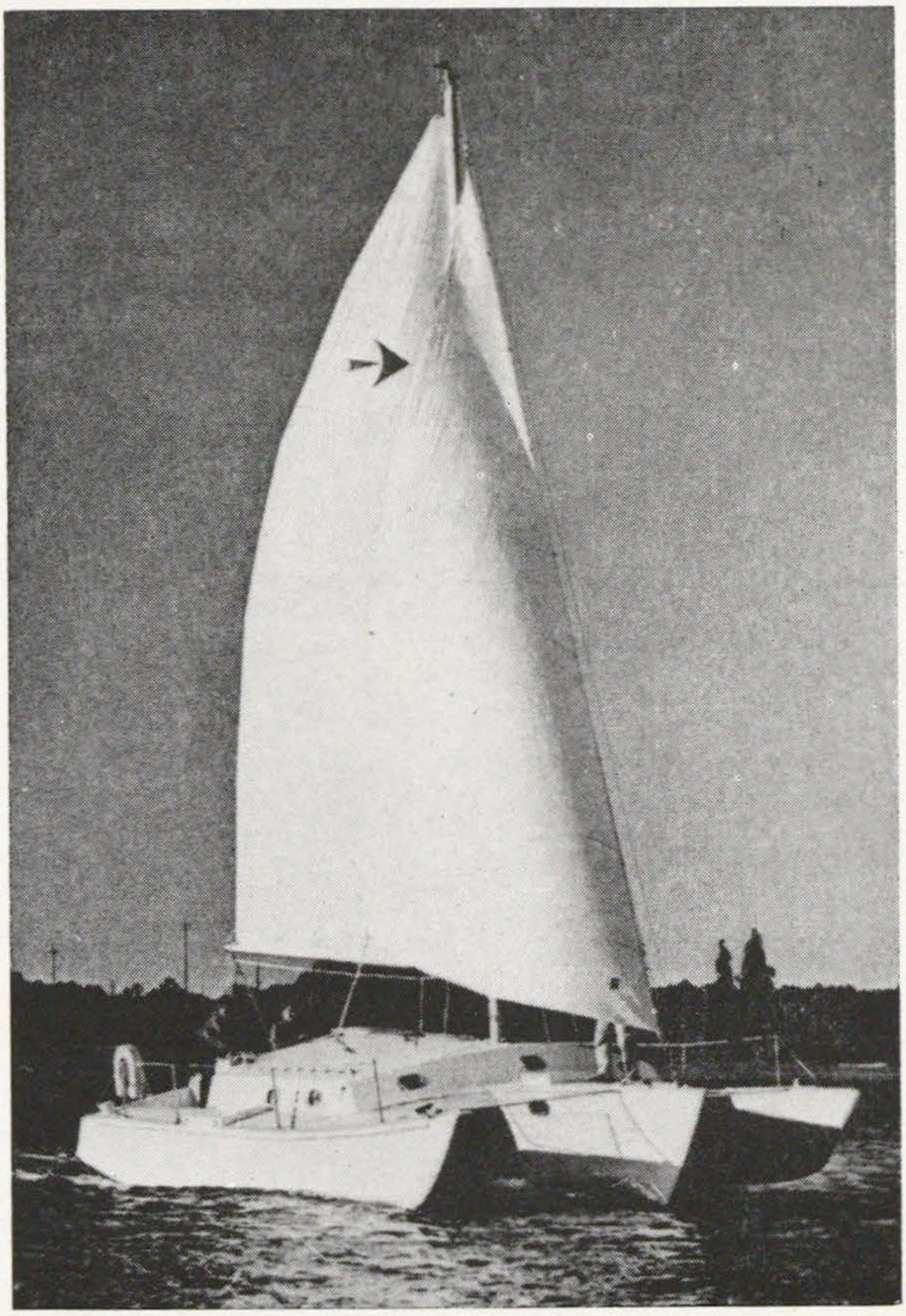


TRIMAR 33

One of the basic problems with many tris is the wave and spray action against the float beam, particularly where the beam intersects the float hull. The leading edge should be faired in such a manner as to offer least resistance to wind and water. It follows then that the floats have a generous freeboard. Which allows for a fairly thick beam in section and still ample room underneath for the passage of water and spray.

Length-to-width ratio at the waterline can be 15 : 1 or greater; perhaps the greater the better. Displacement is gained from length rather than too much beam. Stubby floats tend to slap and pound

and create more wake and turbulence. Some designers stress the advantages of usable living space in these outside hulls, but in any trimaran under say, 50 ft., sleeping in the hulls would be a dubious pleasure at best. To gain adequate living room the float hulls become inefficient for their prime purpose. An overly beamy float produces a wedging action against the main hull, thus slowing the craft down



TRIMAR 33

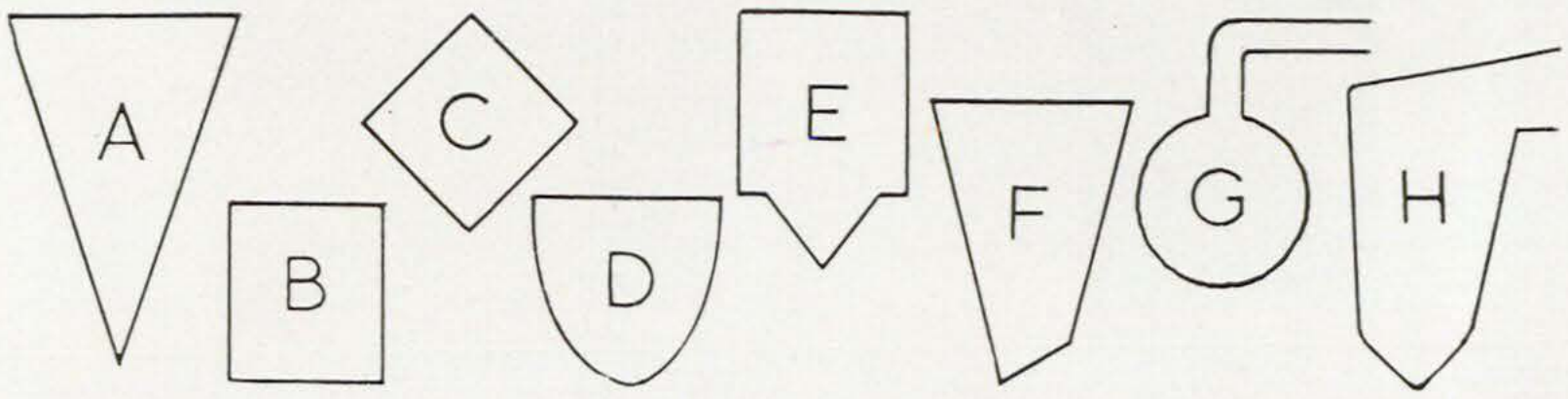
considerably. Fixed fins or dagger boards can be employed to gain lateral resistance but here again, in the case of fixed fins, if they are of any size to be effective they will be dragging through the water on the weather side and contributing nothing. Floats can be angled in

(pigeon-toed) a few degrees to provide some lift but if this is exaggerated it too will form a wedging action that may more than offset the original advantage.

One of the often overlooked dangers in float construction is lack of proper ventilation, particularly in the bow and stern sections; rot can quickly develop here and is difficult to detect. It is worth the expense to fill these voids with some kind of plastic foam. The positive floatation thus gained is a big safety factor in the event of a float being damaged.

Float Design. What is the most efficient shape for a float? In attempting to solve this riddle designers have come up with all sorts of answers. The diagrams shown illustrate some of the basic cross-sections that have been used.

A. The deep "V." Long favoured by Piver; easy to build but gives no dynamic lift, the large wetted surface resulting in drag.



Float sections.

B. Flat box. Difficult to submerge, tends to plane, gives considerable pounding.

C. Box on edge. Efficient and strong but creates problem in tying-in to float beam. Offers no footing and is impractical for an access hatch.

D. Parabolic shape. Desirable but tricky to build—fine for moulded fibreglass hulls.

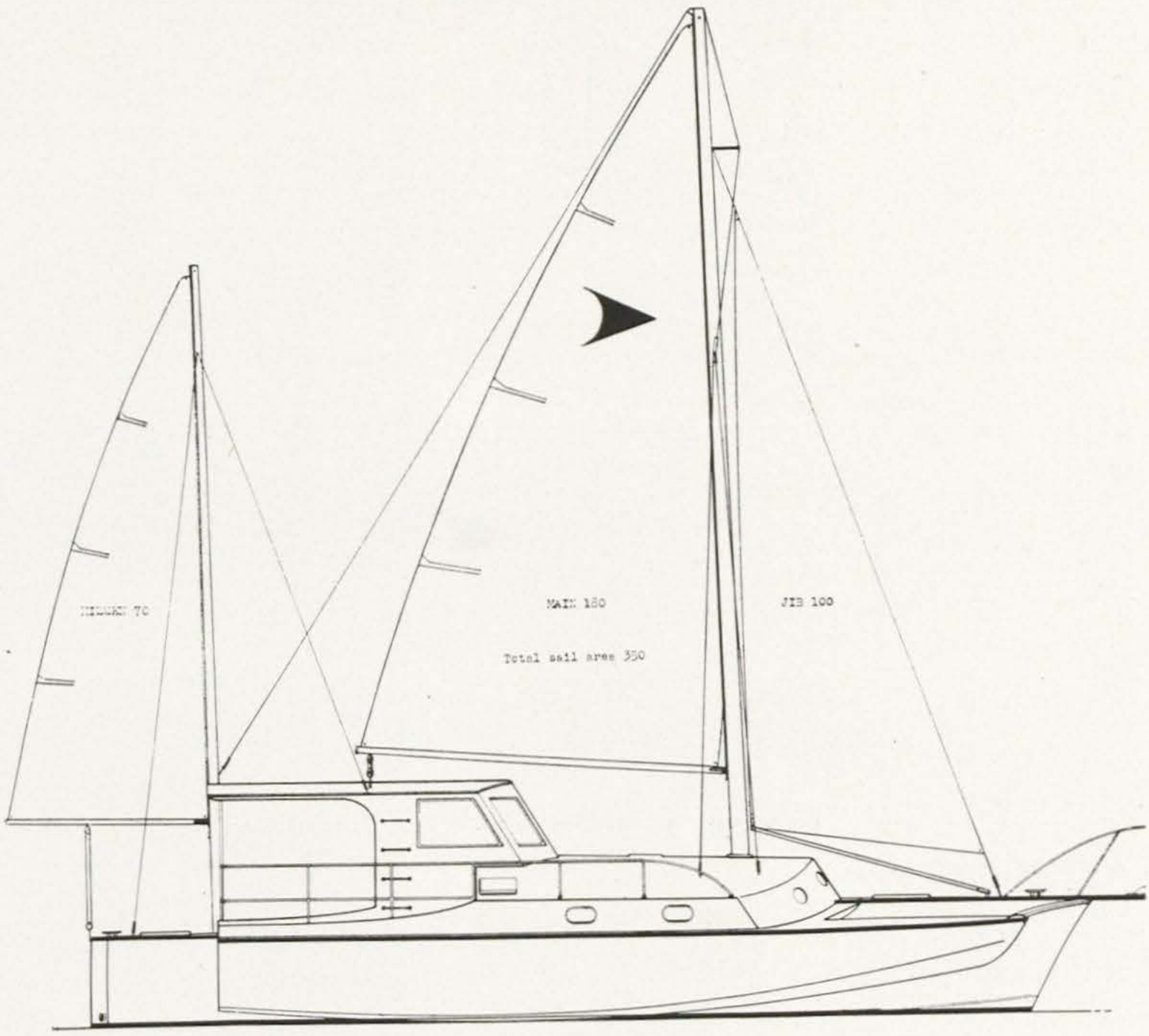
E. Combination box and "V." Overhang provides a planing surface.

F. Truncated "V." This offers many possibilities; superior to the deep "V."

G. Any round form. Offers minimum wetted surface but no footing and the beam must be elbowed in some manner; native outrigger design.

H. Flat " V " and box. An excellent compromise as verticzl freeboard furnishes maximum lateral resistance, rounded chines produce almost same shape as D.

This of course, is an over-simplification of the problem. The length of the float, the amount of displacement when the boat is on an even keel, the approach angle, the toe-in angle and joining to the beam are all factors that must be taken into consideration. Bow wave and turbulence is another major factor.

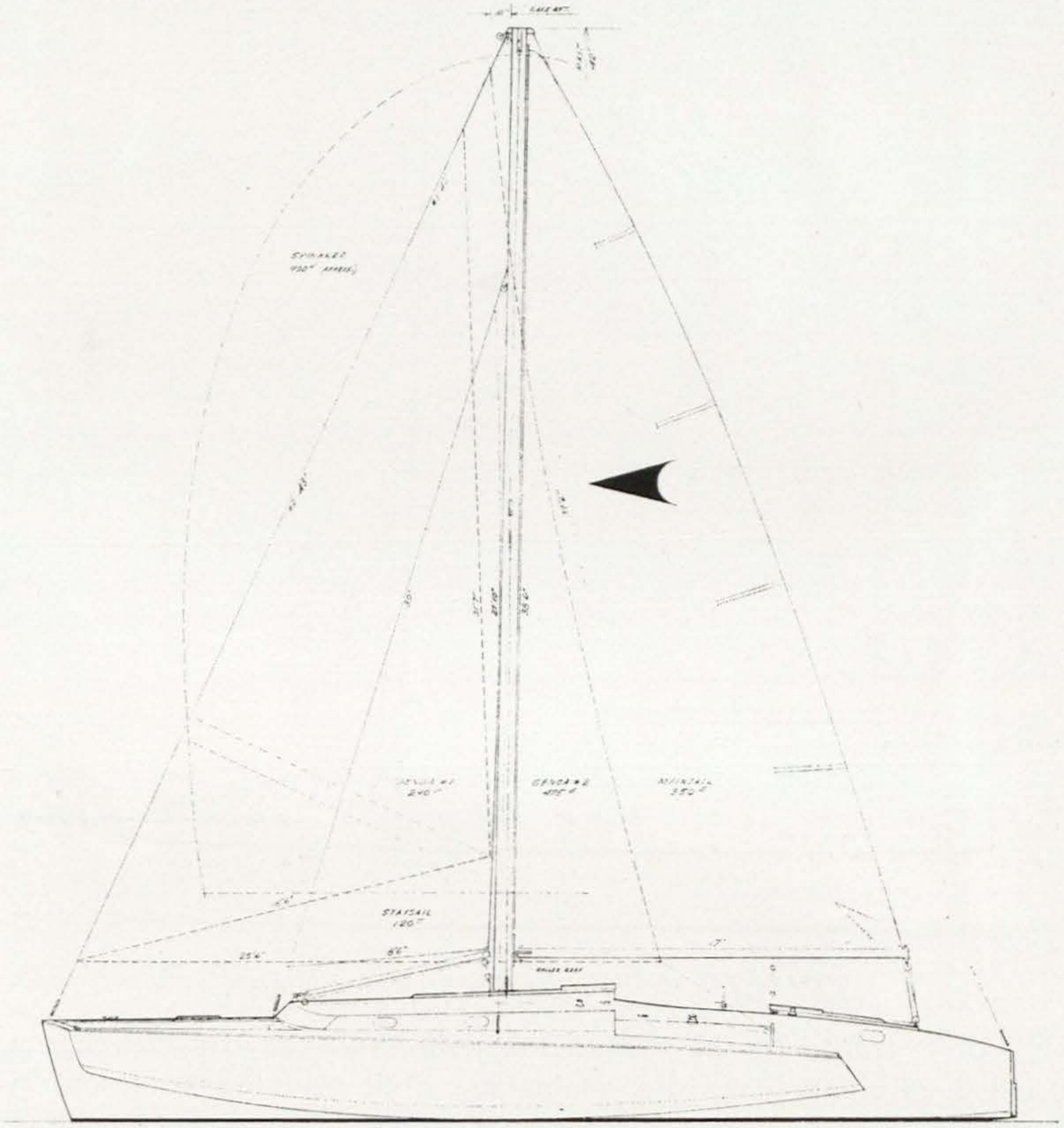


TRIMAR 36 " *Fisherman* " *Motor Sailer.*

Main Hull. In the use of the main hull the trimaran has a decided advantage over the catamaran. Full standing headroom is gained without building cumbersome superstructures or crowding into the outer hulls. My Trimar 33 has 6 ft. 4 in. headroom with only a 10 in. trunk cabin. The berths in the wing sections have sitting

headroom and can be made as wide as desirable. Visibility from the cockpit is not hampered by a high cabin which, in some boats, is so arranged as to force the helmsman to stand up to see where he is going—a situation both tiresome and dangerous.

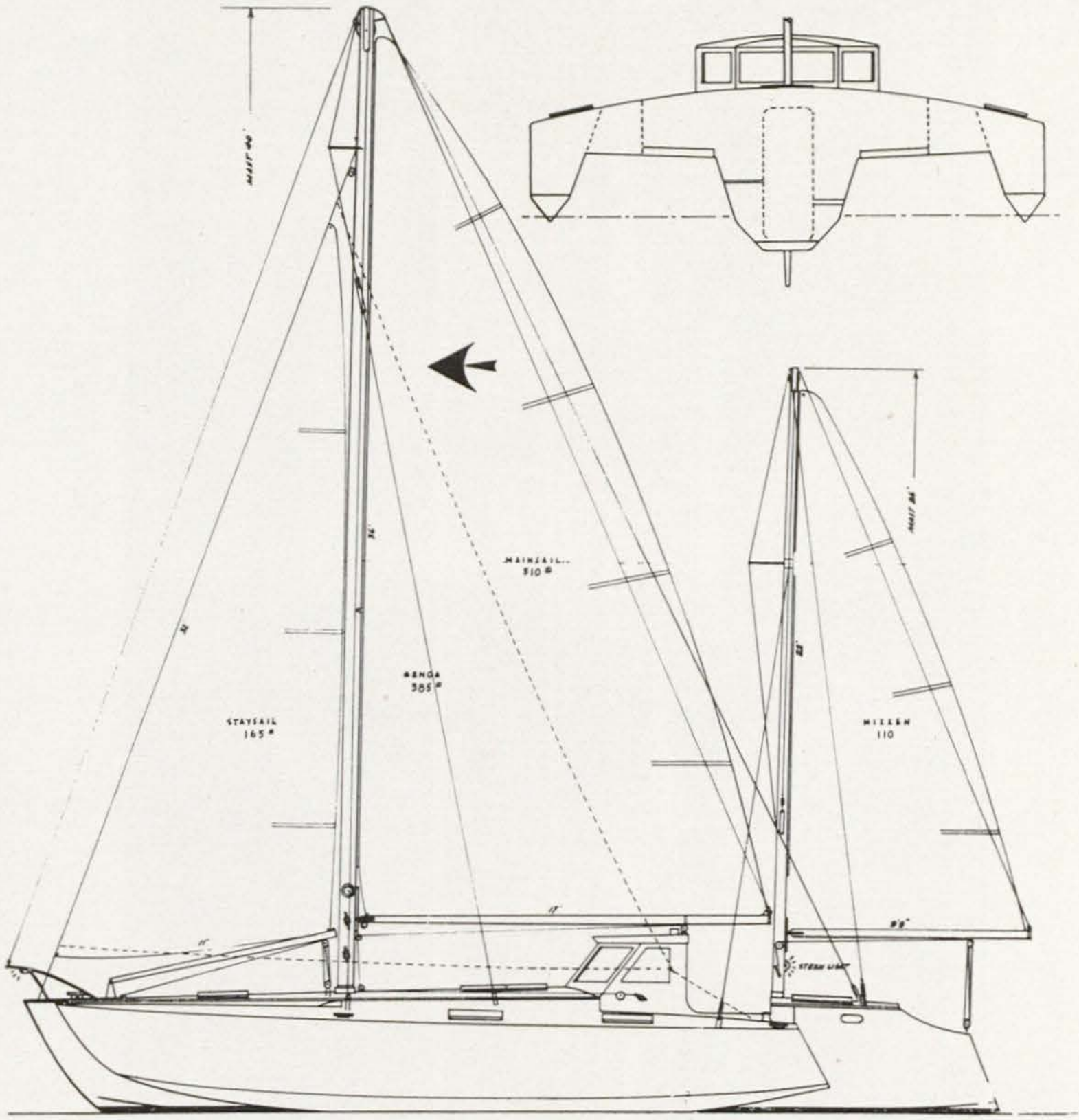
Main beams (either hollow box or solid) have, in the larger trimarans, just about been eliminated. This was an awkward arrangement at best. A much more sensible solution is to carry the major frames or sections out to the floats, forming an " I " beam of the entire float deck. This structure is lighter, stronger and does not interrupt the interior of the main hull. I favour a rather high crown to both the cabin top and deck. It provides ample headroom and prevents the



TRIMAR 42 Ocean Racer.

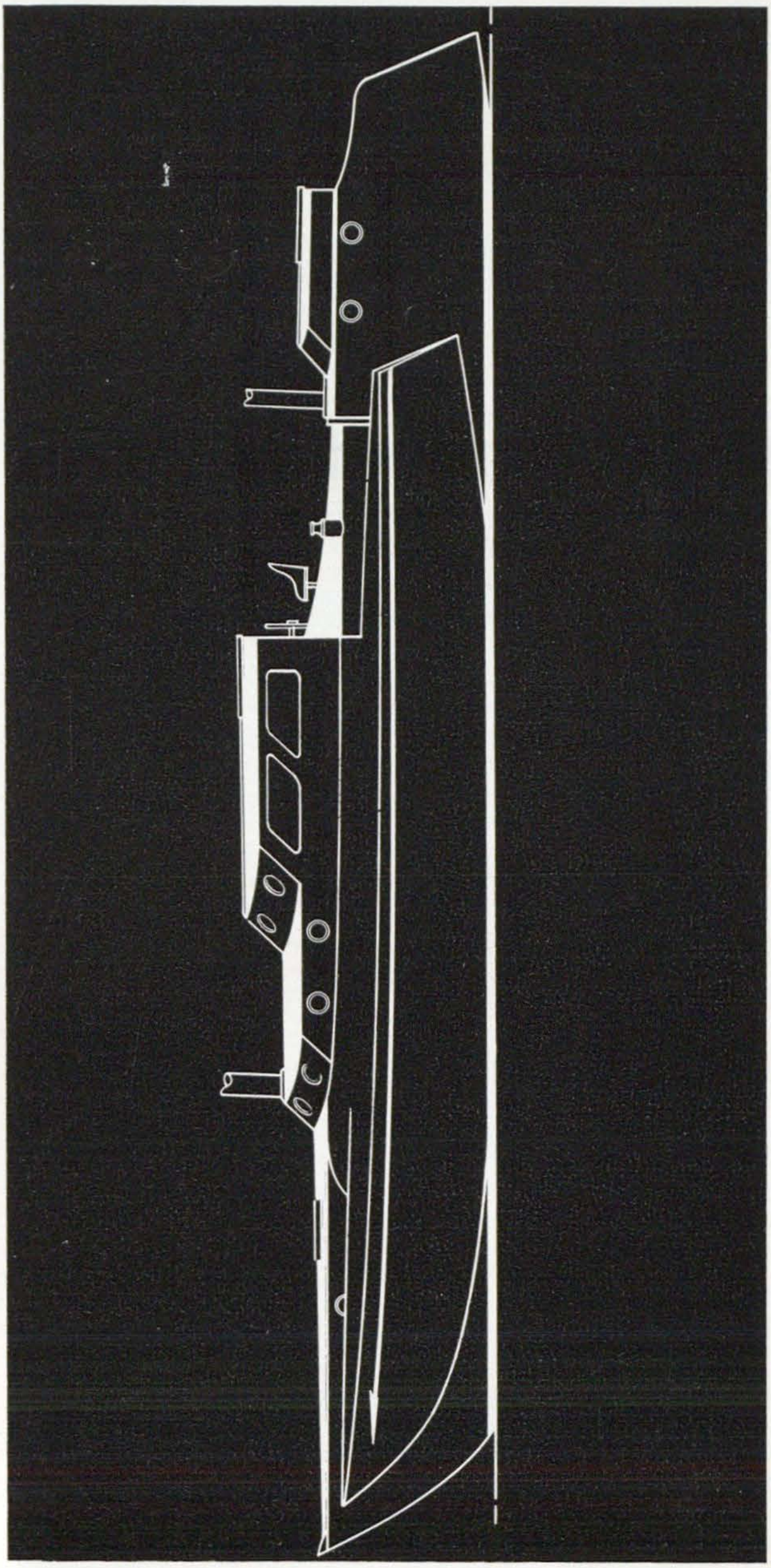
profile of the boat from appearing too high. This curve also lends considerable strength to the over-all structure.

As with the float hulls, the main hull should have its beam at the waterline kept to a practical minimum. All things being equal, narrower hulls prove to be faster. Double-ended hulls tend to squat at higher speeds, so I like to see the transom section almost the same width as midsections. It gives the craft something to " sit on " and dampens any tendency to hobby-horse. It has been my experience that catamarans are subject to this condition more than trimarans.



TRIMAR 42 note permanent wheelhouse.

To help prevent making leeway, or " crabbing," I use a generous skeg. Centreboards are often used but they take up valuable space in the cabin and cause any number of problems. Something must be in the water to offset the pressure from the sails and the resulting slip



TRIMAR 52

sideways. Small fins on the floats are not enough. Unless we are primarily concerned with high performance racing machines we will just have to overlook the added wetted surface produced by the skeg. The advantages are more important.

On larger trimarans the split cabin arrangement with a centre well cockpit has many things in its favour. For one, passengers in the cockpit will not effect the fore and aft trim to any great extent. Separate cabins have psychological advantages—particularly on extended cruises. People can get damned tired of each other living in confined quarters and divided staterooms give some measure of relief and freedom.

One other plus on the side of the trimaran is the use of auxiliary power. The cat must either have power in both hulls, or employ an extended shaft in the centre section. The trimaran can place the inboard engine under the cockpit where weight will not bother the trim. The propeller works directly against rudder action allowing maximum steering control.

In Northern California there is a dearth of racing competition between multi-hulls and mono-hulls but practically none among the multi-hulls themselves—so there is little to report on the relative merits of cats and tris. When I owned the Trimar 49 we had several brushes with some 40 ft. cats and was both surprised and pleased that my boat proved to be faster because she was on the heavy side. The experience gained from sailing this boat for over four years has been put to good use in the design of Trimars 33, 42 and 52.

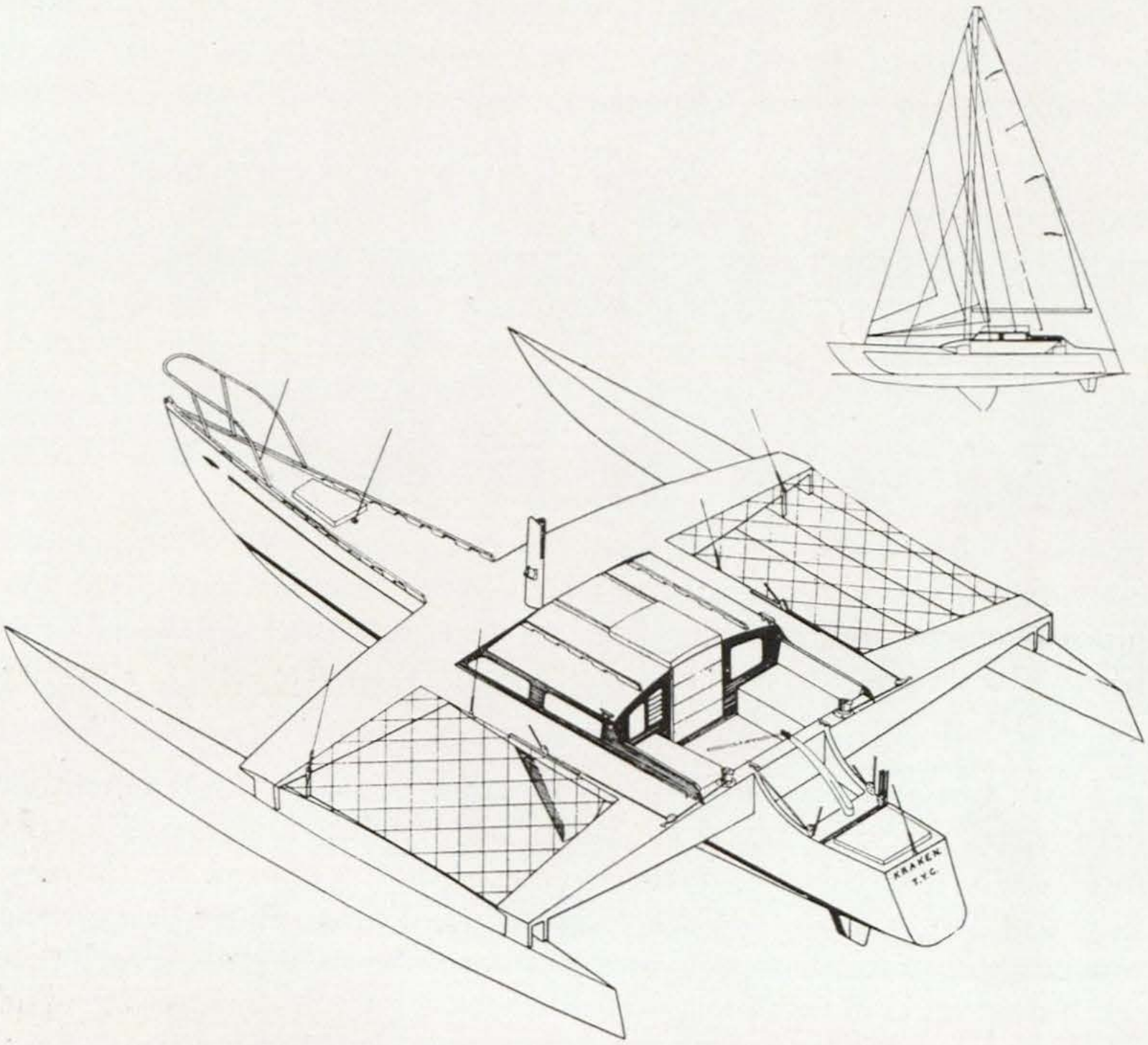
SWEET TRINITY, a Trimar 42 launched last year in North Carolina, made better than 20 knots on the second of her shakedown trials. Bob Bavier, skipper of *CONSTELLATION* in the America's Cup series, was at the helm; he wrote in the log; " We never went nearly so fast in *CONSTELLATION*."

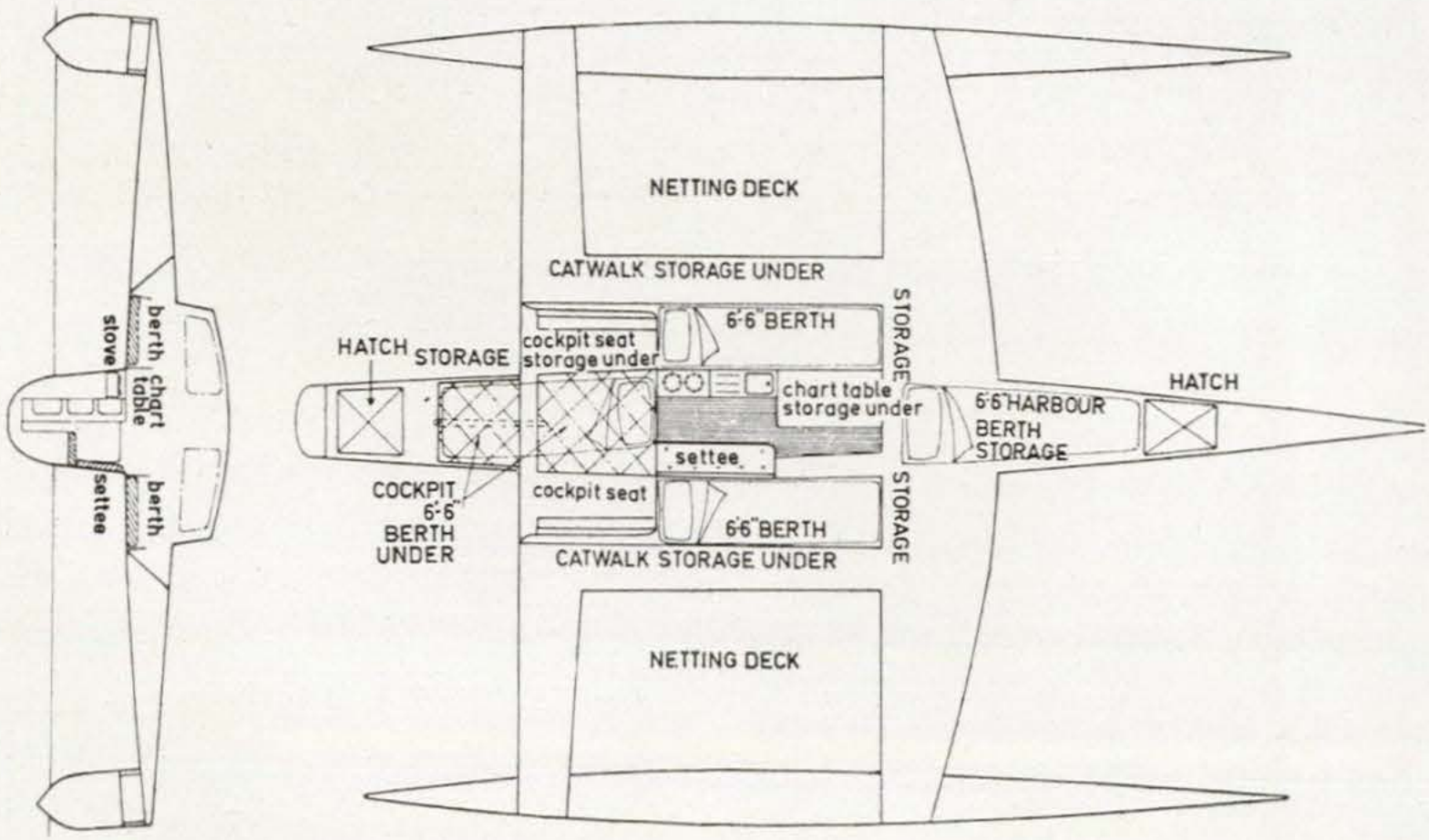
★ ★ ★

OFFSHORE TRIMARAN

By Courtesy of the Australian Magazine Modern Boating.

Lock Crowther's first ocean racer, the Kraken 33 *BANDERSNATCH* has new ideas to handle big seas. One of them got her into trouble on her first voyage, but her owner says the problem is overcome.


KRAKEN
T.Y.C.

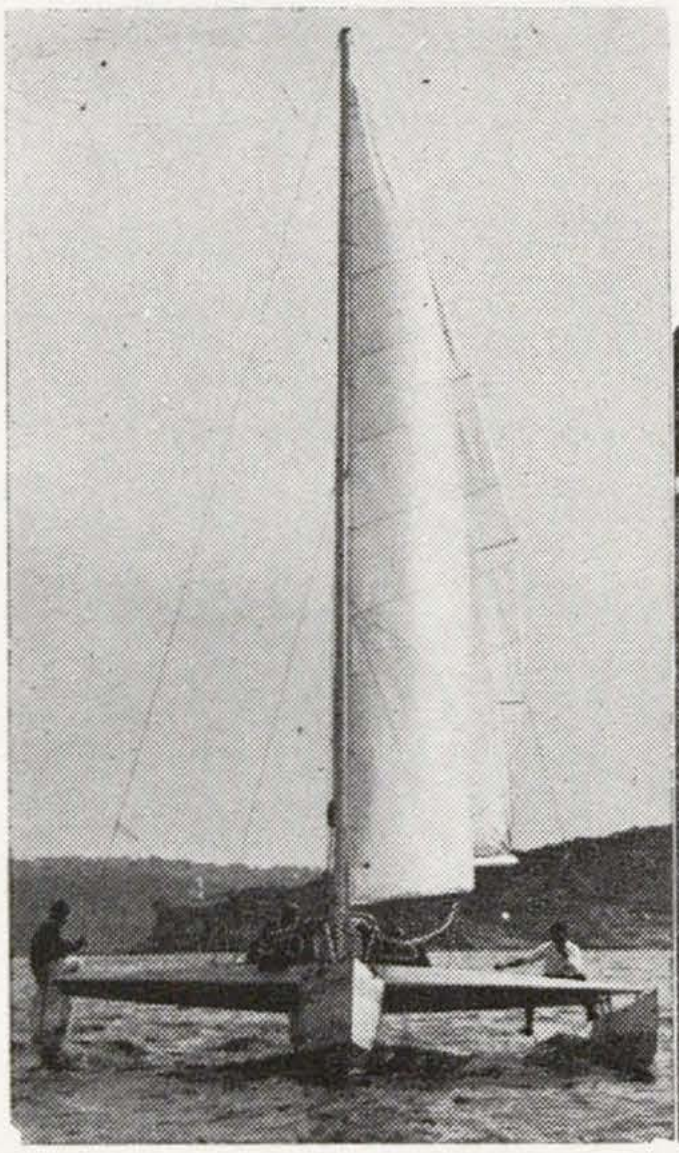

NETTING DECK
CATWALK STORAGE UNDER
HATCH
STORAGE
cockpit seat
storage under
6'6" BERTH
STORAGE
chart table
storage under
6'6" HARBOUR
BERTH
STORAGE
HATCH
settee
COCKPIT
6'6"
BERTH
UNDER
cockpit seat
6'6" BERTH
STORAGE
CATWALK STORAGE UNDER
NETTING DECK
stove
berth
chart
table
settee
berth

BANDERSNATCH, one of the four entries in the first Sydney-Hobart trimaran race at Christmas, hit the headlines earlier this year on her maiden offshore voyage to Melbourne.

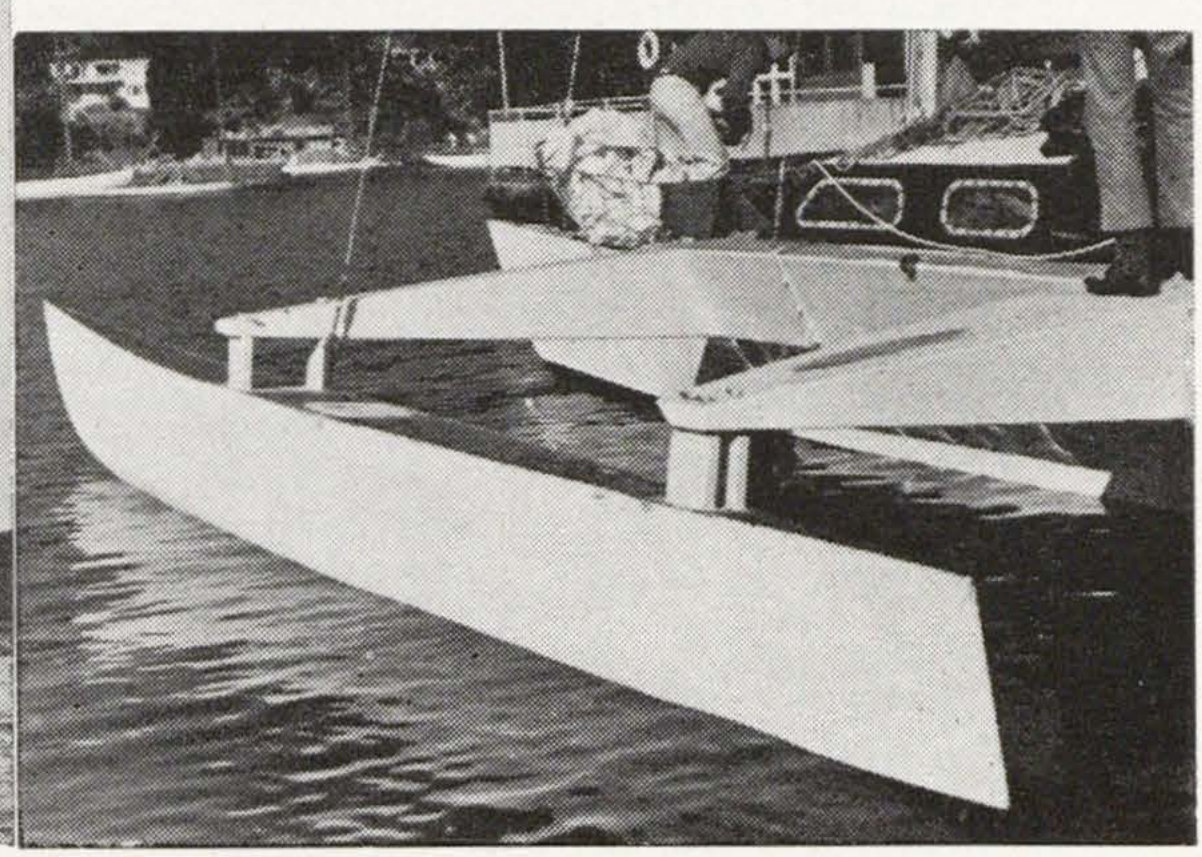
Hurriedly finished off in Sydney to go on display at the National Boat Show, she got into bad trouble in a gale off Wilson's Promontory when the leeward float filled up with water.

Owner-skipper John Hitch and his crew, with good seamanship, made it back to Eden after some furious pumping.

They found the bolts securing the floats to the mainbeams had worked loosed in the big seas and set up leaks.



BANDERSNATCH



BANDERSNATCH float.

Hitch and designer Lock Crowther, of Melbourne, still had firm confidence in the design and believe they have overcome the problem by a system of aluminium alloy backing plates and bulkheads in the floats and crossbeams to spread the load of the unusual " stilt " system used to raise the cross-beams above the seas.

They also decided to fill the floats with foam buoyancy.

The tri carries the class name Kraken 33—she is 33 ft. overall and follows the smaller Kraken racing trimarans which Crowther has developed.

She is Crowther's first offshore design and he says :

" This boat contains a number of features developed from experience with trimarans raced in rough waters. The crossbeams are built up off the floats so that the floats can be driven almost under without the beams dragging in the wave tops.

" The conventional wing decks have been replaced with nylon netting. This eliminates in one stroke much unnecessary weight, the danger of a capsize due to wind forces on the exposed underdeck when the boat is heeled, and wave-pounding on the underside of the leeward deck.

" When sailing to windward in strong winds, large-area wing decks tend to act like aircraft wings."

Crowther believes a centreboard is essential for outstanding windward performance, so the tri has a centreboard of $1\frac{3}{4}$ in. fibreglassed ply, and rudder set on an aerofoil-shape oregon skeg some distance forward of the transom.

This is claimed to provide fingertip steering under all conditions.

BANDERSNATCH was built of Klinki ply with a layer of $\frac{3}{16}$ in. and layer of $\frac{1}{8}$ in. in the central hull over 1 in. x $1\frac{1}{2}$ lb. oregon stringers and frames at 6 in. centres.

Her floats are of two layers of $\frac{1}{8}$ in. ply.

She carries her 472 sq. ft. of sail on alloy spars.

She has four berths in the main hull with 6 ft. 2 in. headroom, but, as she is intended for racing rather than cruising, accommodation is spartan.

She has extreme beam of 23 ft. combined with very narrow floats which knife rather than lift in a chop.

The crossbeams were fastened to the floats with stainless-steel bolts acting as " stilts " and these were the source of trouble on the trip to Melbourne.

Designer Crowther said that if a large backing plate had been used under the heads of the stilt bolts, the trouble would never have occurred.

He said: " The crew claimed that *BANDERSNATCH* is certainly seaworthy enough, probably invincible off the wind (20 knots downwind with 40 sq. ft. storm jib and 5 ft. of main hoisted), but slower than an equivalent-sized keel yacht to windward in very rough seas.

" The crew claim that this is due to the extreme light weight ; they were thrown backward by wave tops where a heavy keel boat would hardly falter.

" However, I still feel the style of design is along the right lines for a racing trimaran and I certainly can't see other trimaran designs developed to date being as fast to windward, mainly because of their much bulkier structure both above and below the waterline."

The plans cost $150, estimated cost of materials including sails is $2,500, and estimated cost of a professionally built boat, $8,000. in Australian currency

* *

HARTLEY'S *SPARKLES* AND *LIVELYS*

There are over 300 *SPARKLE* trimarans and over 100 *LIVELYS* in the world so there is not much on water they have not done including gun running, winning races, pearl diving and just cruising on salt and fresh water. There are *SPARKLE'S* on the lakes in Africa .

SPARKLES and *LIVELYS* are both basically the same type of trimaran. They have a main hull and two floats which are joined together with a laminated timber cross beam. The main hulls are conventional 45 degree types but the bottoms are extended so the chines are well above the water line. In this way we obtain sufficient room inside the main hull for all the accommodation while at the same time having a trimaran which can be taken to the water in three pieces and then assembled by bolting the cross arms to the main hull and floats.

None of the accommodation is suspended over the water between the main hull and the floats where it can be smashed in by a sea if the trimaran is overloaded so we do not have load limits on *SPARKLES* and *LIVELYS*. *SPARKLES* have been overloaded by 4 tons in rough ocean passages and *LIVELYS* by 7 tons without damage in heavy weather. As with all overloaded trimarans in rough water we do hear of the connecting platforms being damaged but in our tris this platform is only there for the crew to walk on, it does not effect the strength of the vessel or let water into the accommodation.

SPARKLES floats are symmetrical and *LIVELYS* are asymmetrical but both yachts come about in a positive manner under full sail or under mainsail only provided there are fins on the floats. Some owners do not fit fins and claim complete satisfaction but other skippers do need fins and find trimarans difficult to handle without them particularly when single handed.

SPARKLES have been sailed to windward single handed with one float and the main hull flooded after being wrecked and the owners report they sail and go about normally except it is in slow motion.

The main hull floods to a little over knee deep. This is because these boats have ample reserve buoyancy even when they have inboard engines.

Both *SPARKLE* and *LIVELY* are powerful enough to carry inboard engines and *LIVELY* has been fitted with success with diesels which make them 8 berth motor sailers which still draw less than 3 ft. 6 in. of water and sail well. Most *LIVELYS* have inboard engines of some sort and there is plenty of room under the cockpit for them.

* * *

SPARKLE, PLYWOOD CRUISING TRIMARAN

Length 28 ft. 6 in. Overall Beam 15 ft. 9 in.

Beam, main hull, 7 ft. 0 in.

Hartley's Boat Plans Ltd., Box 3009A, Takapuna North Auckland, New Zealand

Freeboard for'ard 3 ft. 6 in. Freeboard aft 2 ft. 6 in. Depth of hull 4 ft. 6 in. Length of cockpit 6 ft. 9 in. Length of galley 4 ft. 6 in. Length of bunks 12 ft. 0 in. Headroom in galley 6 ft. 3 in. Headroom in cabin 5 ft. 4 in. Length of floats 23 ft. 0 in.

Sail area—Mainsail 192 sq. ft. No. 1 Jib 82 sq. ft. No. 2 Jib 153 sq. ft. Genoa 230 sq. ft. Spinnaker 230 sq. ft.

Height of mast above water line 36 ft. 6 in.

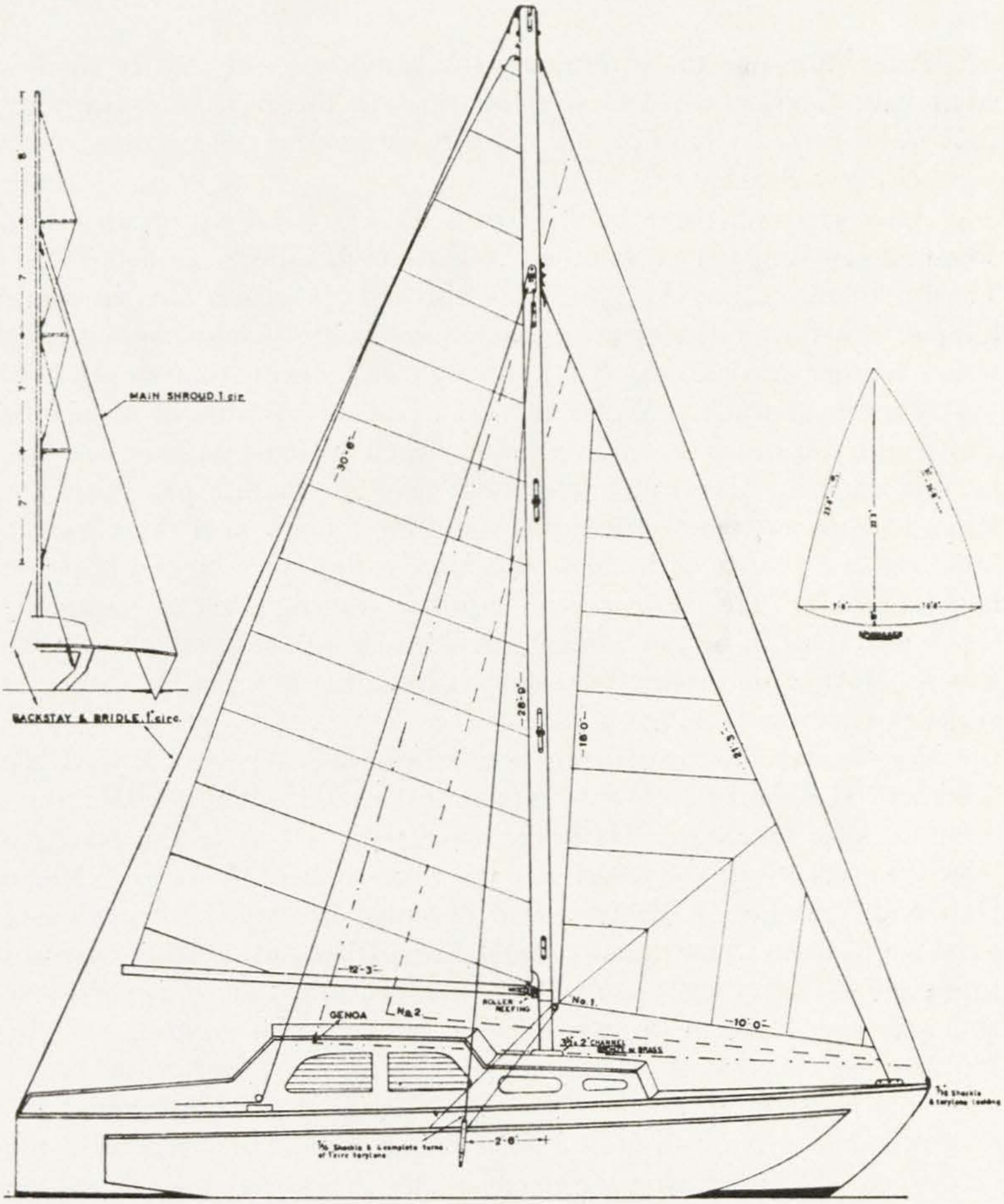
Construction is $\frac{3}{16}$ in. or $\frac{3}{8}$ in. plywood on stringers and frames. It takes 28 sheets of 8 ft. by 4 ft. marine ply, and 700 superficial feet of timber to build *SPARKLE*.

* * *

A *SPARKLE* CRUISE

In 1961, Norm Hart of Titirangi, New Zealand, started building a 28 ft. 6 in. Trimaran to a standard Hartley *SPARKLE* plan. Nine months of spare time and £430 (about £800 in 1967) later, *TOLU VAA* (Samoan for three boats), was launched on the Manukau Harbour on the West coast of North Island, New Zealand.

TOLU VAA has an 18 in. after-deck then a 5 ft. 0 in. cockpit, followed by another short bridge deck where the connecting beam goes across. Steps lead down into the main cabin which has 6 ft. 3 in. headroom. A 4 ft. 6 in. galley is to starboard and a W.C. and chart table to port. The main cabin has two bunks and there is the usual two bunks forward.



28 ft. 6 ins. SPARKLE.

After nine months of cruising the extensive, but mostly shallow Manukau, Norm decided to shift his boat to the Auckland Harbour, four miles away by land or 500 miles by sea round the northern-most cape of New Zealand.

After crossing three bars, driving *TOLU VAA* up on an Ocean Beach, and sailing her off again and 600 miles of sailing, we had *TOLU VAA* in the Auckland Harbour. We also had the answer to what would happen if a float filled up in a gale at sea; what would happen if an ocean coamer crashed into the $\frac{3}{8}$ in. plywood cockpit that would hold nearly a ton of water. Will a trimaran really surf without broaching and could you beach one on an ocean beach without damage and sail her off again ? Also will a float built of $\frac{1}{4}$ in. marine ply stand the strain of a ton of water surging back and forth inside it if there was no bulkheads or partitions ? Should a man with a very tight life-jacket half on and half off over his head continue putting it on or frantically try to pull it off so he can be violently sea sick into the sink or over the side ? How to determine just what is in a tin, apricots for desert or spagetti when the label has come adrift ?

We observed the usual courtesies when leaving port, and rang the Auckland Harbourmaster, who referred us to the Onehunga Harbourmaster. The Onehunga Harbourmaster enquired as to the strength seaworthiness etc. of the vessel, and the experience of the crew. Norm Hart had built her, R. Hartley had designed her and had previously passed a Marine Department Coastal Navigation test. Athel Gubb, a Company Manager and manufacturer had previous yachting experience and was also building a *SPARKLE* Trimaran for himself, as was Jeff Morris, a merchant seaman. Last, there was Jan Gorter, a Dutchman who had crewed in the *TOLU VAA* and helped build her. Jan also intended to build himself a *SPARKLE* Trimaran. Satisfied, the Onehunga Harbourmaster referred us to the signal station at the Manukau heads which overlooks the Manukau Bar. The station master was not too pleased to find we did not have a radio telephone which meant he would have to operate the semaphore arms by hauling them up and down by man power. His man power. He failed to give any signals.

The Manukau Bar is the scene of New Zealand's greatest marine disasters but it was calm when we crossed it with a weather forecast of north-westerlies, a head wind, backing to south westerlies, a fair wind. *TOLU VAA* carried the mast head rig best suited to a *SPARKLE* Trimaran with 190 sq. ft. in the main and 250 sq. ft. in the mast-head headsail. This proved too much in the freshening N.W. headwind which was kicking up quite a cross sea on top of the

predominant westerly swell, so we changed to a smaller headsail and hove to outside the bar. With the headsail down *TOLU VAA* peacefully rose and fell to the seas. With helm hard to leeward she laid to perfectly. It did not make much difference whether the main was hard in or right out, she lay quietly making slight headway or sternway, depending on whether the main was hard in or slackened off.

For the next five hours we lay our course up the coast into an increasing high wind sea and rain. For the first three hours she marched to windward in grand style but as the afternoon wore on she did not seem to carry sail as well and we reefed the main down. We put this down to the size of the sea, the driving rain and thirty knot wind. *SPARKLE* Trimarans have carried full sail of 470 sq. ft. in the same wind strength, but we were down to 200 sq. ft. An investigation seemed in order and we found the lee float was full of water. To say I was astounded is to put it mildly. While I have complete faith in my trimarans, I do not expect them to sail with 200 sq. ft. of sail in half a gale with the lee float full of water. This float also had the weight of the dinghy on it.

The dinghy a heavier and bigger one than usually carried was stored upside down on the after end of the float. It had hooked under a sealed-off ventilator in the float and had partly torn it off the deck. We did not know this at the time, but the float had steadily filled through the afternoon. If the dinghy had been stored upright in the normal way, we would have had no trouble. The float was full and we could not empty it either with the pump or buckets, in the existing sea. With the designer and the builder on board, we knew the float was built of $\frac{1}{4}$ in. plywood instead of $\frac{3}{8}$ in. as specified in the plan, but we did not know how the float had filled. We suspected the worst, that the odd ton of water surging back and forth inside had burst the float below the waterline. Without further pondering, the opposite float was partly filled and the Trimaran headed off on the other board. The wind as predicted by the weather office, was swinging to the south which was a head wind again. We could lay well out to sea down the coast at the time, but did not relish the prospect if having to go about in the middle of the night and then sail with the full and possibly damaged float, to leeward. We had learnt the lesson that a trimaran with a full float can be made perfectly seaworthy by partly filling the other float. We did the right thing, but we did not know if the float was damaged or not.

In the near gale conditions we knew that all the bar harbours for a 100 miles north, and over a 100 miles south were closed by ocean swells breaking for as much as 10 miles to sea. There was a suggestion that we could locate the northern passage back through the Manukau

bar but Boxing Day was hardly the time to expect the signal station to signal us in the dark, when they had not bothered in daylight.

The members of the crew who knew the bar, stated flatly that we would not make it, but that there was a Surf Club at Piha. Did anybody know Piha well ? No they did not. I had been to Piha once only, but I did see a chap bring a power boat into the beach, where he winched it on to a trailer behind a truck and towed it off home. I had noticed the way he hugged the southern line of rocks and reefs for shelter and came in quite happily. There was quite a sea but his seamanship made it look easy.

Piha is New Zealand's Bondi, so any Australians interested can go to Bondi in a near gale and see what our problem was. The seas on the Cornish coast in a westerly gale would be about the same.

On airing my views on how this chap came in at Piha, I was given the helm. The coast was out of sight in the rain and distance but a Japanese transistorized direction-finder gave us the course to steer. As the designer and father confessor of *SPARKLE* Trimarans I was really stuck with it. While pullling on my life jacket I was also struck with the problem of being seasick under it, over it, or through it. My life jacket was put on to show my confidence. The rest of the crew took the hint and put theirs on too. We later learnt from the surf club boys that a life jacket carries you to the top of the breaking surf where you are thrown forwards and down and killed. A man in a lifejacket has no chance in an open ocean beach in a big sea. Without the jacket and with a surf club handy he has every chance.

Dark was closing in when Lion Rock, to the north of Piha Beach, was sighted. A hurried compass bearing showed we were being carried up the coast by a strong tidal set, so the course was altered to take us directly off the rocks at the southern end of Piha Beach. By turning and running directly for the beach we had the wind and sea right behind us. The current carried us up the coast clear of the rocks, perfect, until we hit a tidal set further in, running down the coast on to the rocks. This forced us to run at an angle to the following sea, right on the point of a jibe, with the full float to leeward. At this point *TOLU VAA* was committed. The boom was lashed so it could not jibe, the dinghy turned right side up ready to float off, the anchor made ready if necessary, and spare rope broken out in the hope there would be somebody ashore to give us a hand to get the trimaran out of the surf before she broke up.

The stern of the trimaran rose to a sea made steeper by the beach still a mile away, and she drove straight on under the press of her lashed mainsail and jib; combined now with the drive of curling ocean

coamers. The stern rose again higher and higher. A short view of neatly dressed, ready to go to a dance, surf club boys sitting on surf skis, some stationed outside the rocks and reefs and waving us clear of them, and one straight ahead to board us and take us in. We ran him down. The sea crashed on over the stern filling the cockpit, pounding us up against the after end of the cabin. The full float drove three to four feet under the water and *TOLU VAA* started to broach and heel at an alarming angle. Two of us heaved the helm over and she straightened out for the beach again, with the lee float surfacing as the bulk of the wave passed underneath us.

TULU VAA on Piha Beach. Nearest float full of water and missing side deck.

By this time we were really travelling, but the next sea lifted *TOLU VAA* and hurled her with even greater force towards the beach. The timber side decks errupted in a mass of broken timber and a capsized surf board shot endwise bodily out of the water. This second and biggest wave roared right on over the stern with even greater violence than the first but this time we were braced by the waist deep water already in the cockpit, and were able to retain our hold on the tiller. *TOLU VAA* did as all sea going trimarans should do. She surfed on and answered her helm. Another sea broke aboard but we were through the worst. A surf club member on a ski waved us off a reef

and another further in waved us in behind it where we belted straight into the beach with all sail still drawing. The full float hit first and a following sea slewed us partly side on to the sea. A bronzed sea elephant of a man with a bull voice, ordered us to take the sail off the trimaran and everybody on the beach to unload the ship immediately. We had met Tom Pierce himself. The same chap I had watched bring his launch in and tow it away on his trailer.

The Piha surf club boys, helped by the hundreds of holiday makers on the beach, took everything out of the ship right down to the water tanks and stored them ashore in a shed. The floats were drained dry. Two ropes were fastened to the cross arms and run up the beach with all the available men tailing out on them. A third rope was run out which had mostly women on it. With an " all together now " from Tom the trimaran came bodily out of the surf to the accompaniment of yells and screams from the women whose rope had broken at the critical moment. As the trimaran hit the dry sand she momentarily slowed down so the surf boats oars were thrown under the keel and off we went again right above high tide mark, with oars breaking in all directions.

Piha deluged us with hospitality. Athol and myself found ourselves whisked off to a private home where a hot bath was waiting. Half a glass of whisky was pressed into our hands while sitting in the bath. I am a beer man myself, so Athol drank both lots. Another two glasses came in. By the time the bath was finished Athol was reasonably happy about the whole affair.

Next day a post-mortem was held. The pulled off ventilator was discovered under the dinghy which explained the float filling. The whole boat was thoroughly gone over and there was no damage anywhere at all except the timber side decks. The $\frac{1}{4}$ in. plywood float had taken the hardest battering particularly when it hit the beach full of water, but it was completely undamaged. I am firmly of the opinion if the side decks had been made of two layers of $\frac{1}{4}$ in. plywood, as specified, it would not have broken up as it did. The plywood slide which acts as a door into the main cabin did not give although the water surged over the top of it.

These *SPARKLE* Trimarans weigh less than two tons normally, but when we hit the beach we weighed seven tons, four tons of which was water. A 28 ft. 6 in. Trimaran of this design would be perfectly seaworthy in a big sea and gale conditions with both floats full, the cockpit full, and a couple of tons of water in the main hull. Not only would she be safe and seaworthy, but you could sail her to windward and she would go about and steer normally. Athel Gubb has since

beat his *SPARKLE* to windward single handed with the hull and one float holed and full of water.

The lighter a trimaran is, the faster she is for harbour sailing of course but she is steadier and more comfortable at sea if she is loaded down, which is just as we want a yacht to be.

For extended ocean cruising the only alteration I would make to a standard *SPARKLE* Trimaran design, is to have a pump in the main

Leaving Piha Beach.

hull that was connected with hoses so that either float could be pumped out or flooded at will. A small storm headsail could also be handy for sailing to windward in really bad conditions.

The owner and crew of the trimaran *TOLU VAA*, wish to express their thanks to the Piha Surf Club for their unstinted assistance. These clubs are voluntary. The members build their own club buildings, raise their own finance, and provide their own food and accommodation.

We subsequently sailed from Piha beach around the north of New Zealand and south to Auckland without incident.

LIVELY PLYWOOD CRUISING TRIMARAN

Length 34 ft. 6 in. Overall Beam 20 ft. 6 in.
Hartley's Boat Plans, Box 30094, Takapuna North, Aukland, New Zealand.

Beam of main hull 10 ft.; Waterline beam 5 ft. 9 in.; Freeboard for'ard 4 ft. 11 in.; Freeboard aft 3 ft. 2 in.; Depth of hull amidships 5 ft. 10 in.; Draft 2 ft. 6 in.; Floor space 15 ft. 3 in.; Headroom 6 ft. 6 in.; Length of Float 29 ft.; Width 3 ft. 8 in.

Sail Area: Mainsail 315 sq. ft.; No. 1 Jib 76 sq. ft.; No. 2 Jib 220 sq. ft.; No. 3 Jib 330 sq. ft.

The main hull and floats are built upside down with plywood planking on stringers on frames in a simple method. There are two skins of $\frac{1}{4}$ in. ply on the main hull and a single skin of $\frac{3}{8}$ in. ply on the floats. It takes 60 sheets of 8 ft. x 4 ft. x $\frac{1}{4}$ in. marine ply, 30 sheets of 8 ft. x 4 ft. x $\frac{3}{8}$ in. marine ply and 1,400 superficial feet of timber to completely build *LIVELY*. All the timber required is straight standard sized and does not need steaming.

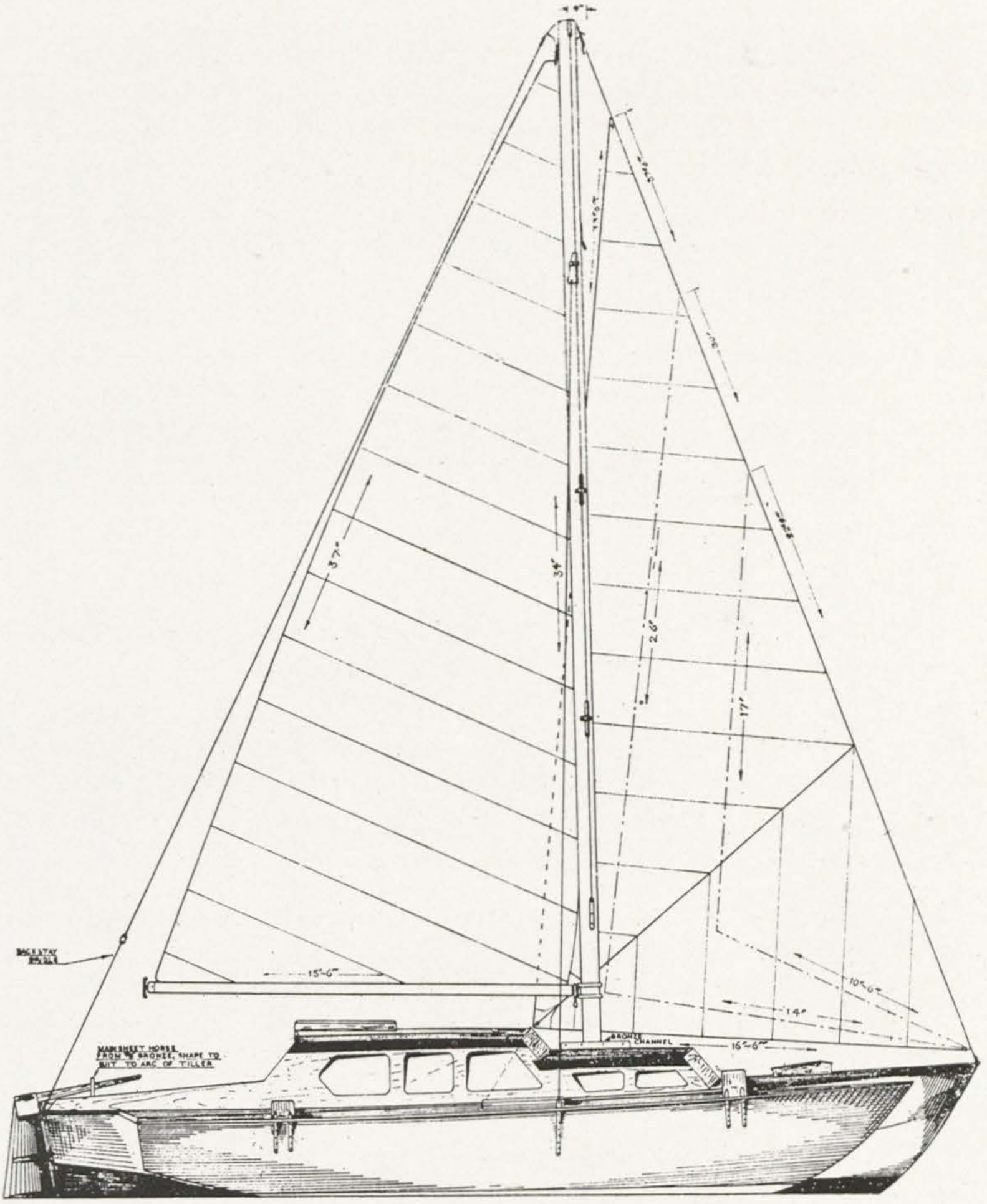
Hull and floats are built separately, transported to the water and then bolted to the cross-arms.

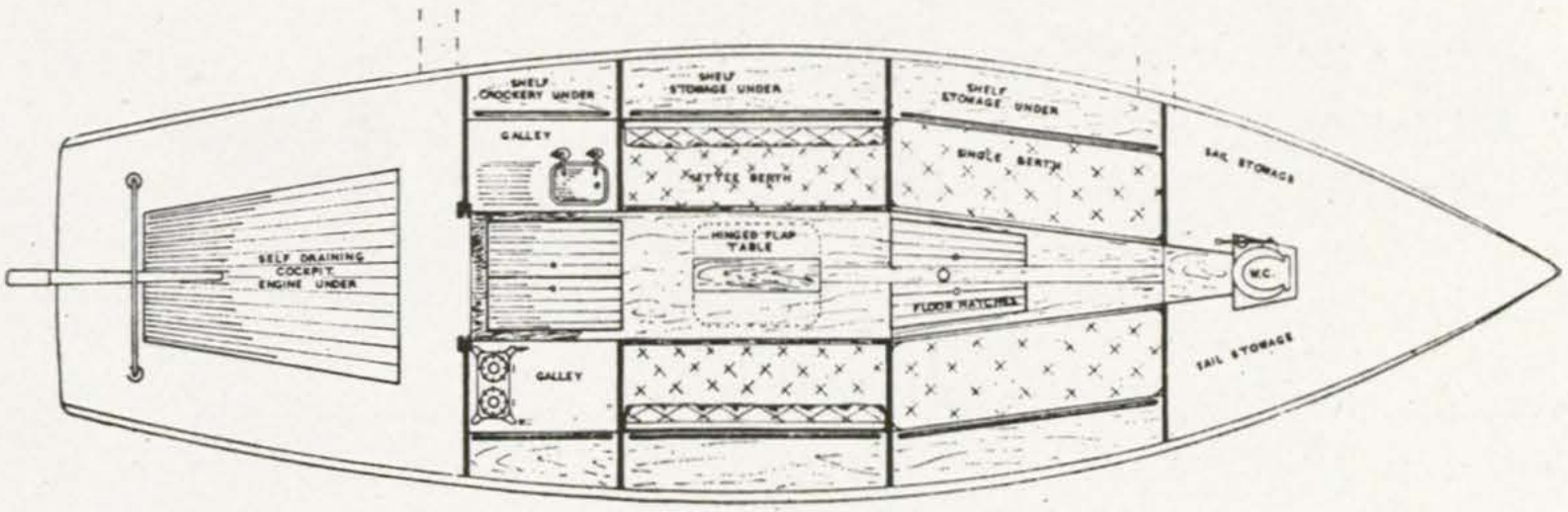
Besides having the size and power to carry an inboard engine, *LIVELY* has all the latest developments such as asymmetric floats and aerofoil fins.

The mast head rig, permanent backstays and general ease of handling inherent in a trimaran makes this boat virtually a single-hander, if needs be.

With limitless deck space, large cockpit, full width galley, six full-length bunks and a separate private W.C. and hand-basin, *LIVELY* provides day sailing for a large crowd or spacious cruising comfort for a party of six.

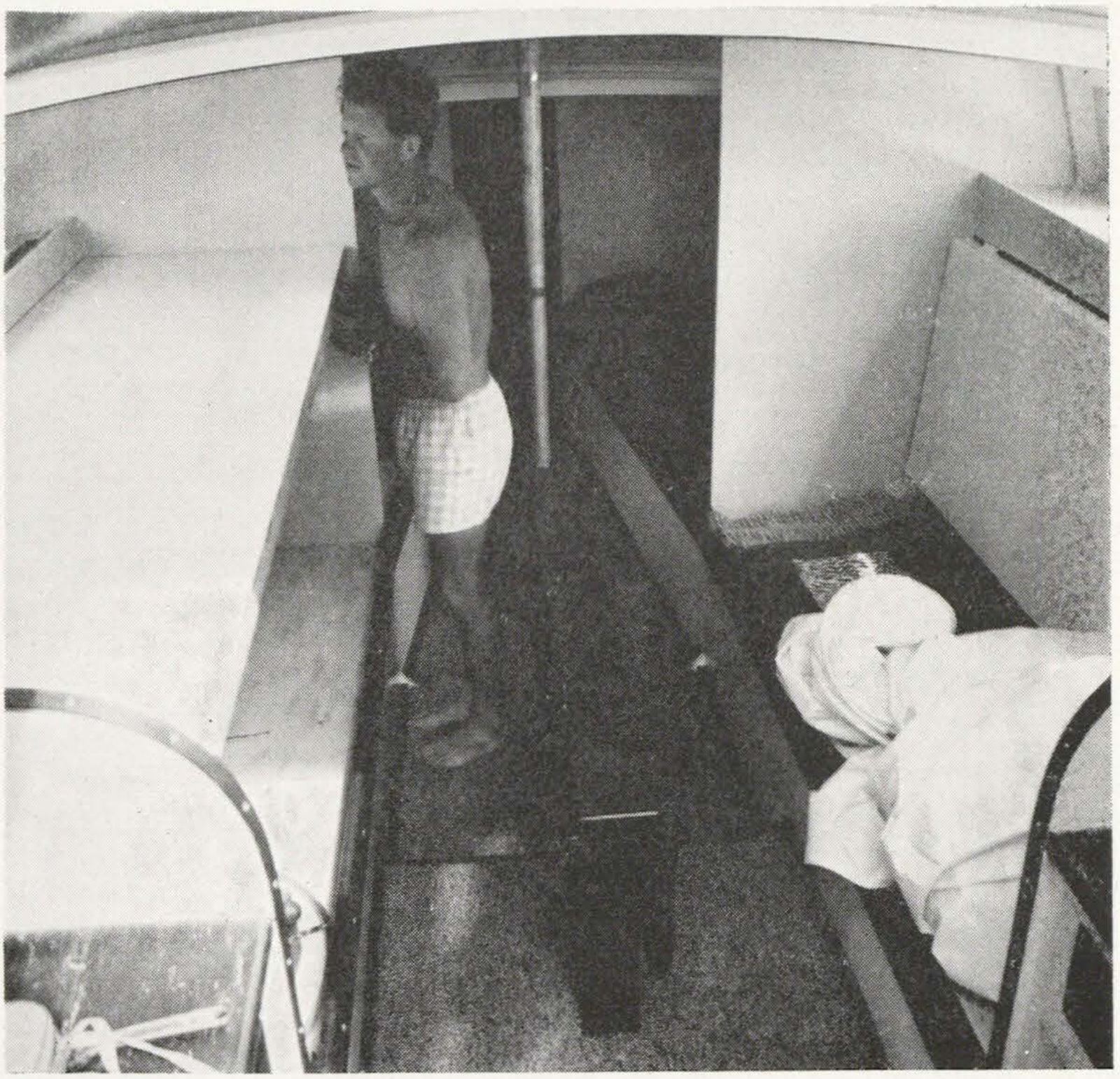
The plans are complete. There are detailed drawings of the building stocks, main hull, floats, accommodation, mast spares and rigging as well as lists of materials. There are full size patterns of the frames, deck beams, mast fittings, chain plates and rudder fittings, etc.
Price of complete plan, £36; Overseas, £42.





34 ft. 6 ins. LIVELY.

LIVELY sailing.



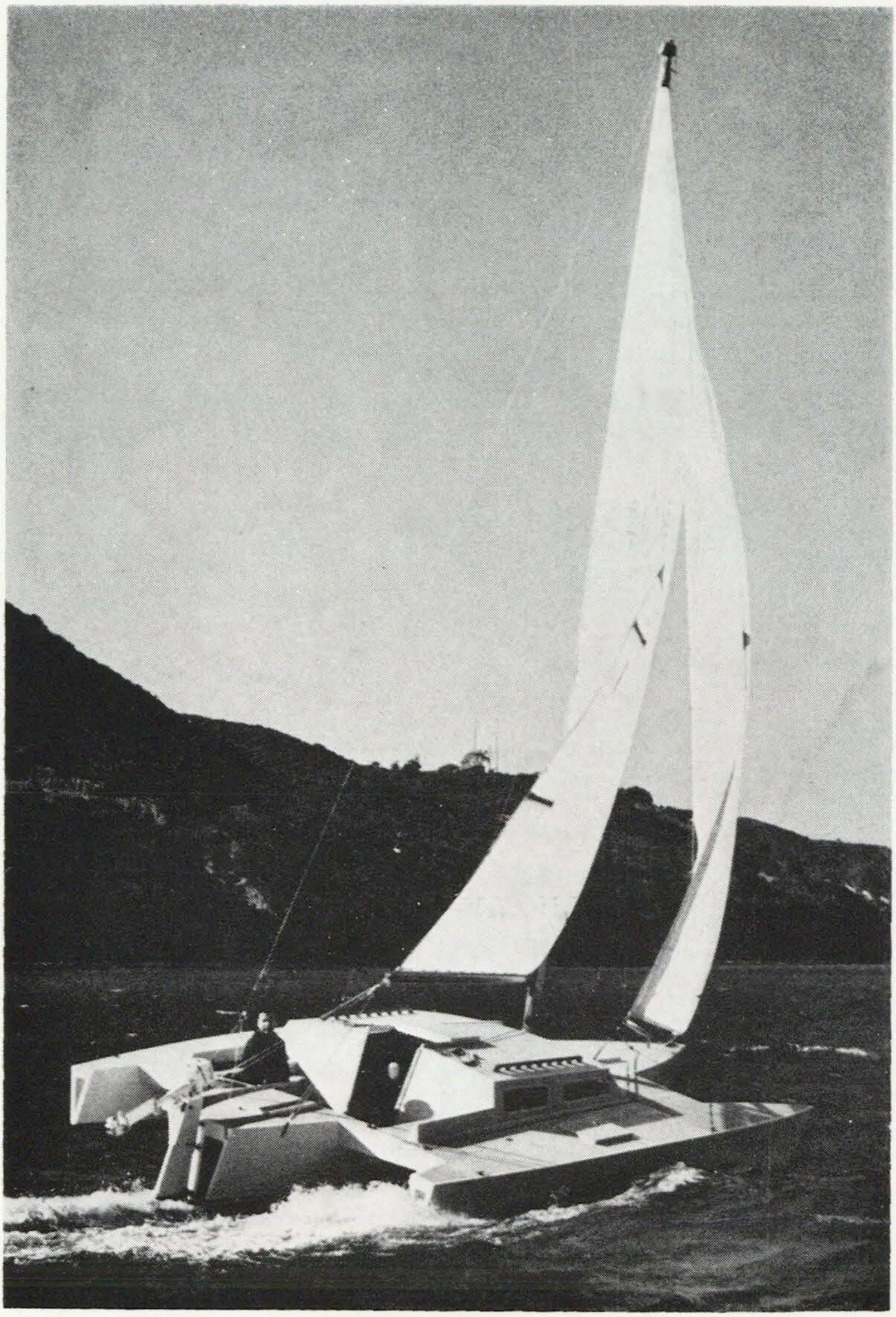
Inside LIVELY—35 ft. Trimaran.

★ ★ ★

THE *CROSS* TRIMARANS

Norman Cross produces a range of trimaran designs which have proved very popular for amateur building.

The CROSS 24 *and CROSS* 26. These are similar. The main hull has underwater chines to reduce wetted surface and a low aspect ratio keel. The floats have lots of buoyancy and are made with chines



CROSS 26

just above the waterline to give an approximately 90 degree angle to the section at the float keel.

The CROSS 30 *and CROSS* 36. The main hull is a right angled V with the chines above the waterline and again, a low aspect. ratio keel is used. The floats are of similar section to the 24 and 26 ft craft.

The CROSS 42. This is the latest in the *CROSS* range. The main hull is made up from curved sheet plywood and has no chines. All the other design features of the smaller craft are present. A ketch rig is used for the 650 sq. ft. of sail.

CROSS 36

CROSS Plans. A brochure giving the general outline of all the boats is available. Study plans of the 24 and 25 cost $3.00 each and those for the 36 and 42 cost $5.00. Building plans, which we believe are very detailed, cost from $55.00 for the 24 to $350.00 for the 42.

San Diego—Ensenada Race. This race of 60 miles down the West Coast to Mexico was sailed in very light winds and Norman Cross entered his *CROSS* 24. The fleet consisted of 80 yachts from 25 to 80 ft. in length, mostly ocean racers (monohulls). Norman was 5th boat to cross the finishing line, though he did not set a spinnaker while all the others did.

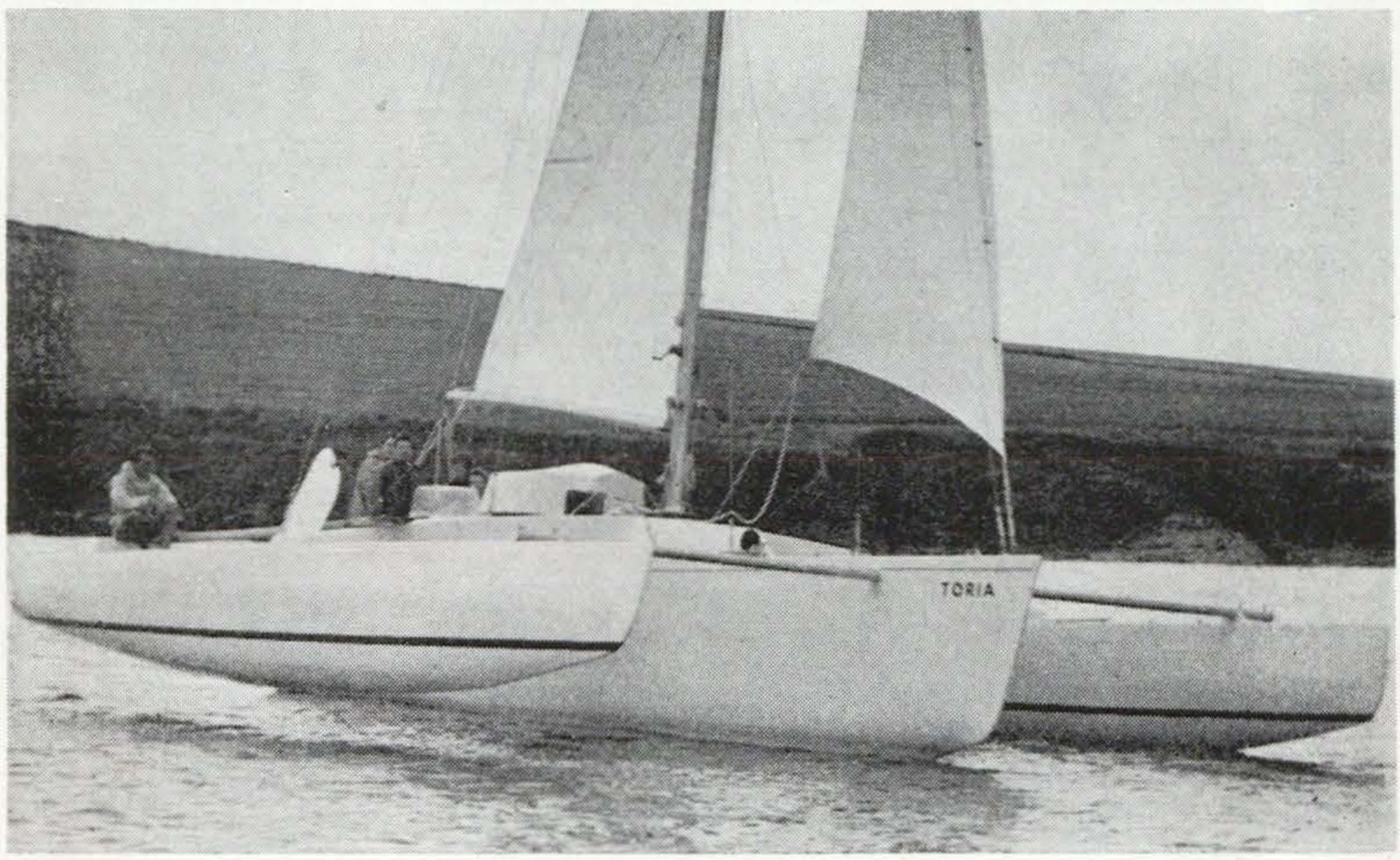
Information on the *CROSS* trimarans can be got from Norman Cross, 4326 Ashton, San Diego 10, California.

THE *TORIA* TRIMARANS

The success of *TORIA* in the Round Britain Race has naturally caused a great deal if interest and members have written asking for full details. We have not, at present, got these in a form suitable for publication but some information is to hand.

The Multihull Construction Co. Ltd., Wadebridge, Cornwall are now making a range of trimarans and one catamaran as follows :

TORIA 31	Trimaran	Sloop	5 berth	£3,350
TORIA 36	,,	,,	5 berth	£4,550
TORIA 42	,,	,,	ocean racing	£5,500
TORIA 42	,,	,,	cruising/racing 7 berth	£6,950
TORCAT 42	Catamaran			on application



Derek Kelsoll's TORIA

All these trimarans and the catamaran are of normal design and similar to the original *TORIA* and all are made from expanded P.V.C. foam and fibreglass sandwich. This gives an extremely light and strong hull. *TORIA* was built as follows :

1,500 sq. ft. of P.V.C. foam $\frac{1}{2}$ in. thick was used of 3.7 lb. per cubic foot density, coating 3s. 8d. per square foot in price.

The hulls were made on shadows and stringers. The foam sheets, which come in 3 ft. by $4\frac{1}{2}$ ft. in size were heated in a special oven to make them pliable and were joined on the former.

On completion of the foam hulls, they were glassed with from one to four layers of woven rovings of 2 oz. weight impregnated with polyester resin. When cured, the hulls were taken off the formers and glassed inside.

The foam was obtained from B.T.R. Industries Ltd., Silvertown, London, E.

* * *

KLIS

A 22FT. CRUISING TRIMARAN

Designer, builder and owner—Bernard Rhodes of Fell Foot, Newby Bridge, Lancashire, England.

DIMENSION :
L.O.A. 22 ft.
Beam 14 ft.
Draft 1 ft. 9 in. and 3 ft.
British Register Tonnage 3.93

Sail Areas :
Main 186 sq. ft.
Jib 73 sq. ft.
Genoa 168 sq. ft.
Light weight 1,100 lb. approx.
Loaded weight 2,200 lb. approx.

KLIS is my dream-ship come true, and her design was made possible by close study of all information on trimarans published by the A.Y.R.S.

My requirement was for the cheapest possible cruising yacht that would be my home, be fast and take me across oceans, and I had to be able to build her myself.

Construction was started in September, 1964 and she was launched a year later. Now (September 1966) she has been my home for a year, and has cruised from Barrow to the Isle of Man twice, and on a fortnight's holiday down the east coast of Ireland. At present I am preparing for a cruise to the West Indies by way of Spain, Portugal and the Canary Islands.

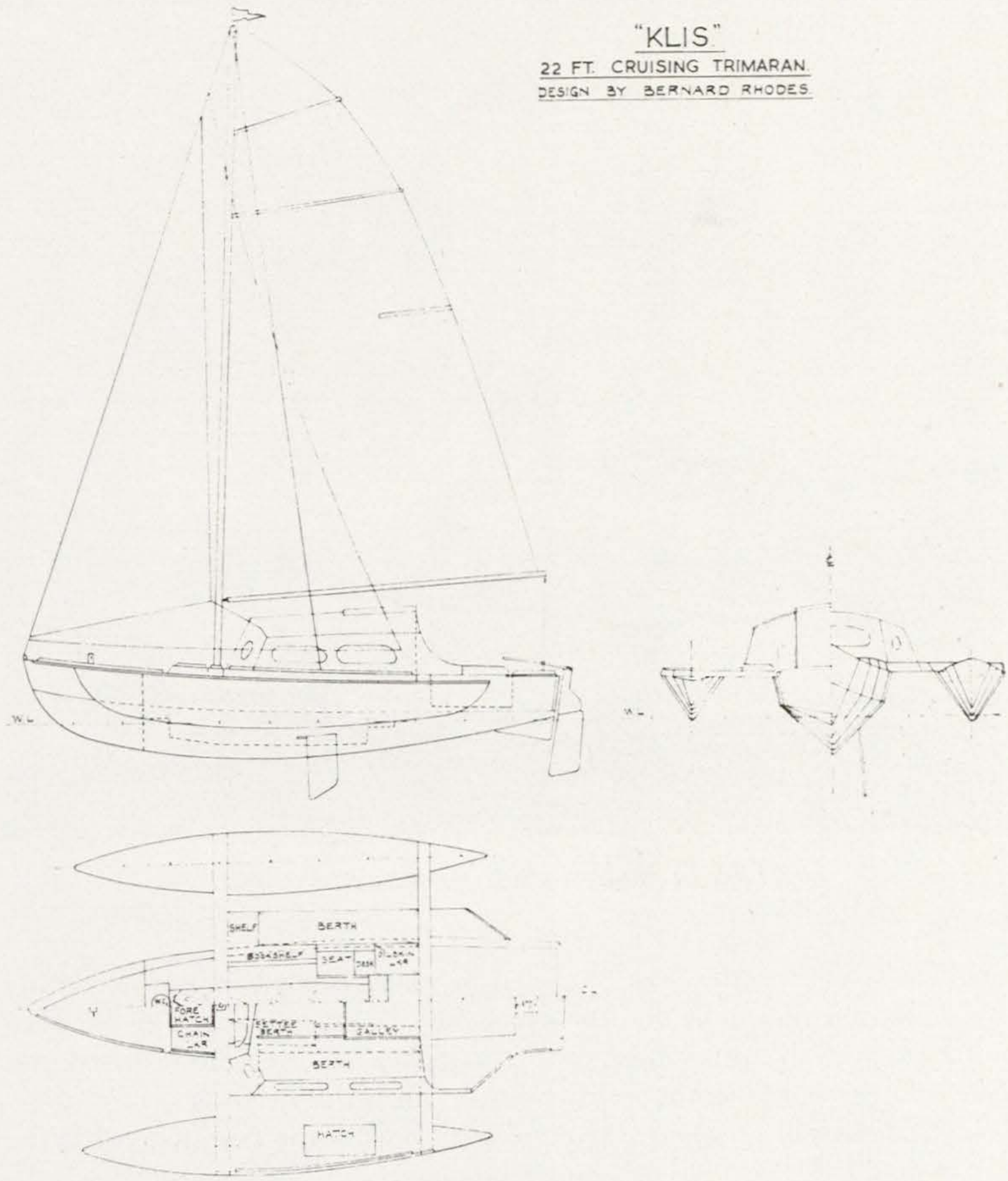
Features of the Design. My main argument against previous tri designs was their poor weight-carrying ability; I reckoned half a ton was the minimum for ocean cruising for two. I chose a right angled V midship section, with a fairly large transom and fine bows, and the centre of buoyancy slightly aft of amidships. The chine is placed 3 in. above the deepest load waterline, so the hull is as fair underwater as a round-bilge hull.

KLIS

The floats are V-sectioned and canoe-sterned, and are immersed about 6 in. fully loaded at rest, so that she usually sails to windward with the weather float flying. Their total buoyancy, fully immersed, is about 2,000 pounds. She does heel, and with full working sail in force 5-6 wind she can be made to bury the lee float, but at this stage she develops strong weather-helm (due to midships of floats being forward of midships of main hull) and feels to be at her stiffest. Both main-hull and floats have been given plenty of sheer and flare forward, to

counteract bow-burying tendencies when broad reaching in a steep sea, and no anxiety has ever been felt in this direction. These features also greatly enhance her looks, and I wanted her to look good.

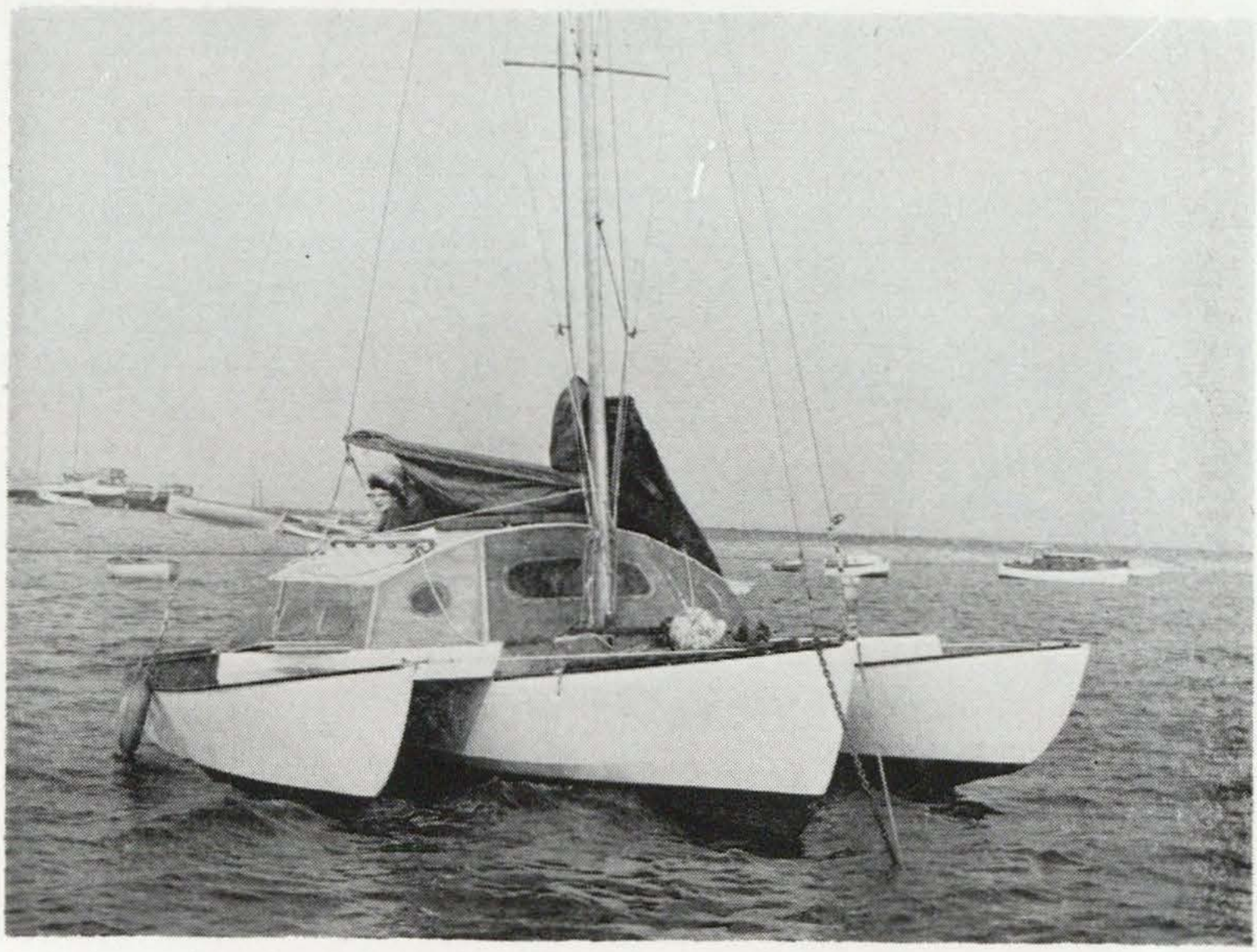
Lateral resistance is increased by twin dagger-boards in the main hull; these take up very little room and give two high-aspect ratio foils for very little increase in draught. She will sail to windward without them, but carries more weather-helm and makes slightly more leeway.



Plans and sections of KLIS.

In very strong winds beating to windward she is inferior to comparable keelboats. With the windage of the weather float and the fairly large cabin, coupled with the shoal draft, she jumps half out of the water over the waves and gets blown bodily to leeward. But if deeper boards were used, the strains would be greatly increased, and they would be a nuisance, as would be a fixed keel.

The small skeg just ahead of the rudder was added later to improve on self-steering, and she now sails herself to windward. It hardly affects her manoeuvring, she'll always spin on a sixpence, and I've wriggled her into all sorts of places where folks normally use their



KLIS at Roa Islandd, Barrow in Furness.

engines. The rudder was modified to make it semi-balanced, simply by drilling a new hole for the pivot bolt. Now, about 5% of the area is forward of the pivot-line, and this makes an incredible difference. She's finger-light on the helm even in the wildest going.

Criticisms of Design. My chief criticisms of the design are that the floats could do with slightly more buoyancy, say by making the keels 6 in. wide amidships, and they would be better angled outwards slightly. There is obviously a lot of research to be done with floats—

into wave interference, asymmetry, dynamic lift and lateral resistance. I couldn't afford to experiment, so I chose a proven design.

Also, when " Hull speed " is reached, the transom drags somewhat as it is in the crest of a wave. There is a definite " hump " as she starts planing, then she leaves a beautifully clean wake. I can see no way of preventing this turbulence, and yet retaining a good planing shape.

Rig. A masthead sloop was chosen, with a single pair of shrouds carried well aft, and no backstays. This enables a cloud of sail to be set on a fairly short mast. The large sail area (354 sq. ft.) overcomes any weight disadvantage she may have, and makes her a delight to sail in light airs. (I don't have an engine, just use the Genoa !). The Main has two full length battens, the lower part being soft to allow for roller reefing. It is very full-cut, and has a large " shelf " to carry the fullness right down to the boom. This " Shelf " makes a fine place for lying in the sun, providing the helmsman doesn't gibe ! For windward work in a good breeze, a turn on the roller-reefing takes the fullness out and stretches the luff.

One snag with the rig is that the mainsail chafes on the shrouds when running (on one 50 mile passage it chafed right through the batten pockets as it sawed up and down with the motion !). The chafing has been greatly reduced by the use of a preventer-vang from the boom to the rail, when reaching and running. It also eliminates twist, and prevents accidental gibes, but has to be altered every time the mainsheet is trimmed.

For long passages downwind I anticipate using twin staysails, with their sheets led to the tiller in the usual manner. I tried these, and although the sails were of unequal area, the system worked well.

I don't think a wind-vane steering gear would be much good downwind, for as she starts surfing the apparent wind falls to practically zero.

In strong winds she sails very well on all points under jib alone; she recently surprised a monohull friend by making four knots close-hauled, under jib alone in force 6, and towing his large and heavy dinghy !

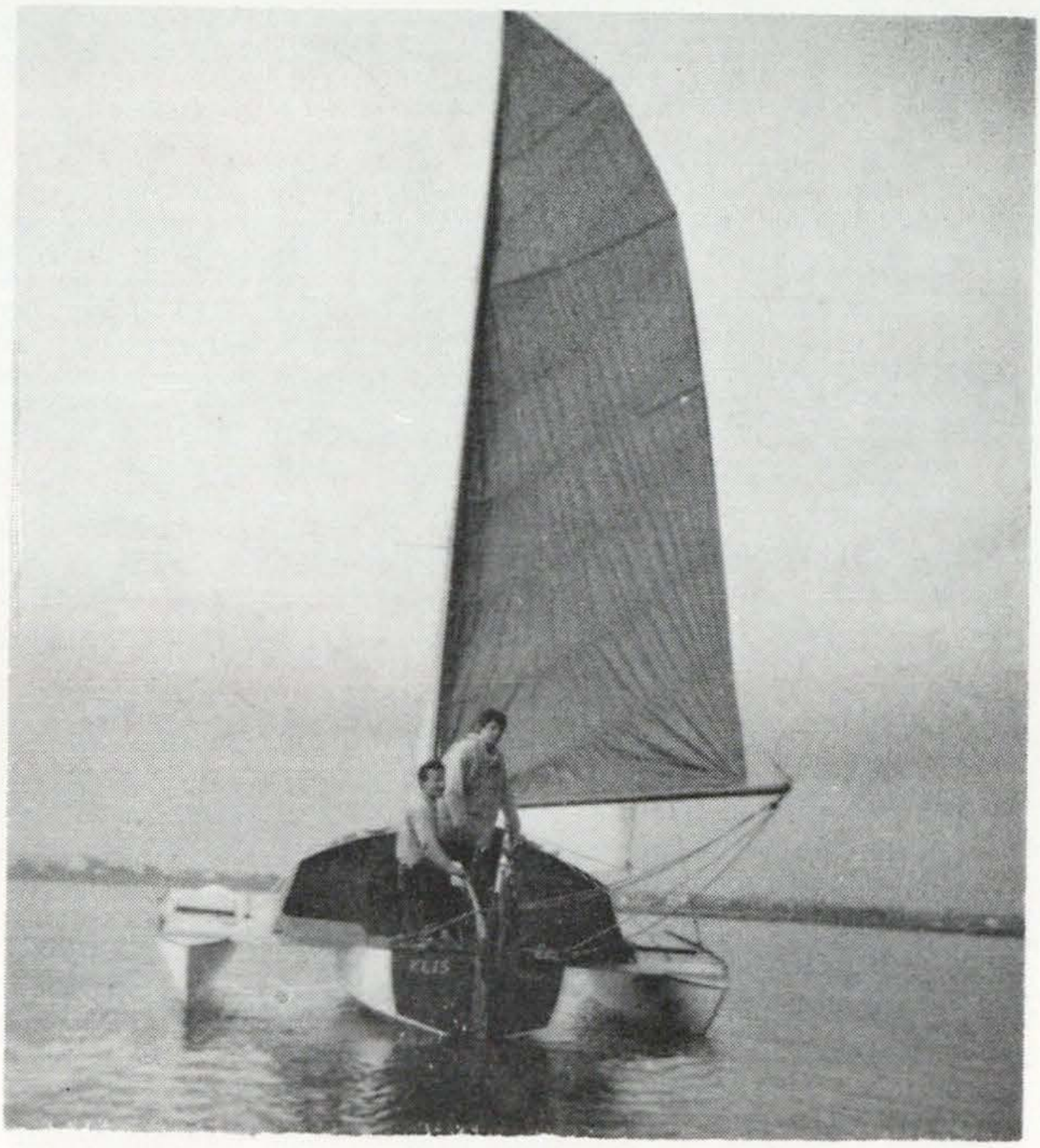
She won't handle under main alone, though. Once way is lost, the rudder becomes ineffective and the main springs her round into the wind.

Fastest speed so far is an estimated 15 knots, surfing in a force 6 in the open sea; on one passage she averaged 8.4 knots over 48 miles, reaching.

Structure. The main hull and floats are of $\frac{1}{4}$ in. exterior-grade ply, fibreglassed to the waterline, and decks are $\frac{3}{8}$ in. ply. Crossbeams are hollow boxes of Columbian pine, the forward one 4 in. by 6 in and the aft one 6in. by 4in. They are bolted to the gunwales, which are doubled and reinforced to take them.

The mast is solid 6 in. by 3 in. Columbian pine, elliptical section, with two sets of diamond stays, and is stepped on the forward crossbeam.

The framing and stringers are Columbian pine, the stems laminated oak, the trim and interior work is largely driftwood, and anything else I could find.



KLIS

The daggerboards and rudder blades are of $\frac{3}{8}$ in. aluminium. She had to be built in separate units to get her out of the building shed, and for transport to the sea 20 miles away, and therein lies the chief snag; for the crossbeams flex slightly when underway, and leak where they join onto the cabin. Those leaks have defied all attempts to cure them, so far.

Accommodation. The interior was laid out as a permanent home for one, and she can sleep three in comfort. There is 5 ft. 6 in. headroom, a large sliding hatch, and the cabin is light and airy. There are two permanent bunks in the wings, galley, food lockers, settee berth, toilet, two bookcases, writing desk, clothes locker and oilskin locker. There is also plenty of storage space in the fore-peak, around the self-draining cockpit, and under the after-deck. The floats have large hatches, and are used for spare sails, oars, boathook, paraffin, inflatable dinghy etc.

Possibility of a capsize. This seems remote, and can definitely be discounted for coastal work. I've dispensed with the idea of a masthead float, and I'll worry if it happens.

At least she will never sink, and due to this I think she can be considered safer in ultimate circumstances than a keelboat.

Ed.—As we go to press, we note that Bernard has just reached Bridgewater, Barbados from Las Palmas, Canaries in 20 days which is a record passage for a single handed passage, the best previous being 24 days by Bill Howell.

* * *

SHARK V. TRIMARAN

BY

J. R. ANDERSON

Anderson Aerosails, The Loft, 59 Penhill Road, Lancing, Sussex

International Cat Week at the Catamaran Yacht Club, Isle of Sheppey. Three *SHARKS* participated in International Catamaran Week at Sheppey, 19th to 25th August, 1966, and *TIGER SHARK*, J. F. Anderson, was awarded the Wills Trophy, as overall winner on corrected time for the weeks racing. *PELOROUS JACK*, J. R. Anderson, another *SHARK V*, was second overall, and *THUNDER II*, the C Class Catamaran was third.

All but the first two races during the week were in light and moderate airs and seas. These conditions favoured the *SHARK*, as the floats could be kept out of the water for long periods so that only the slim hull was in contact with the water, giving minimum drag with none of the bow wave interaction found with a Catamaran.

With this minimum drag condition there is also the high power/weight ratio 120 sq. ft. of sail/helmsman + 200 lb. and as the results proved, the *SHARK* is the fastest practical sailing craft for its length in the world.

In some races the *TIGER SHARK* was faster on elapsed time than the tail end C Class cats; and on one occasion was only one second less than the first *THAI* Catamaran. In three races *TIGER SHARK* was faster than the first *SHEARWATER III's.*

It is notable that on the first day of the meeting in high winds, the Tri's were reefed and had no difficulty, although several Catamarans of various sizes capsized, and others including two C Class cats were dismasted.

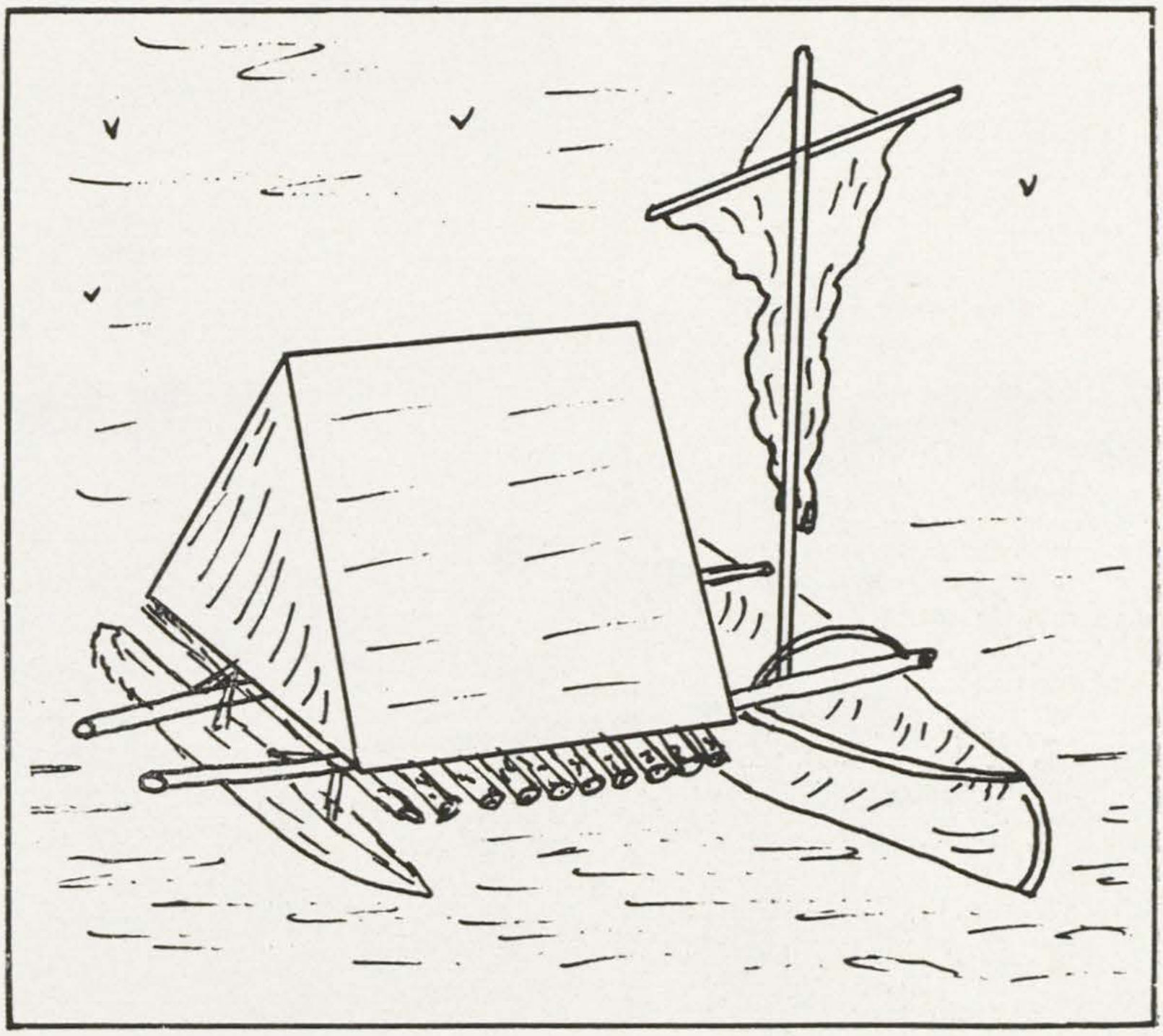
Cost. The *SHARK V* costs £235 complete with sail in wood Fibreglass £10 extra. Kits and part-built boats available. Weight of boat ready to sail 198 lbs.

★ ★ ★

Micronesian canoes in Denmark.

A. E. Bierberg, Skovbrynet 23, Lyngby, Denmark is, as many of us know, the indefatigable champion of the Micronesian canoe. He has now sent us this nice photograph of *ITATA*—a 6 meter asymmetric canoe built to the shape and measurements of the native Pacific single outriggers of today, and *FETU III*—a Canadian canoe altered into a single outrigger. He has also sent us the drawing of the tent on the single outrigger which could have a place for long distance river and canal voyaging.

The following letter from Chris Hughes shows the latest modification to his Micronesian. This is the use of the ends of the main hull for steering, rather than the use of a steering oar. The vertical line on the hull between the fixed and steering parts can be seen in the photograph.



A. E. Bierberg's idea for a cruising outrigger.

Dear Sir,

Thank you very much for sending on to me the letter from Mr. Bierberg.

As I had not seen any of the editions of C.A.T.I.N., I was particularly intrigued to hear that somewhere in England there is an original 20 ft. Gilbertese Canoe. For comparative purposes, I would be very interested to see it, so if by chance you come across it I would be very grateful if you could let me know its where-abouts.

CHRIS HUGHES at Weir Wood 1966

I have replied to Mr. Bierberg and enclosed several photos, two of which I enclose herewith. One of them shows fairly clearly the articulated " steering end " in use. Unfortunately the camera and the wind never arrived together so *KIA KIA* is not really showing off its paces.

There are several modifications which are at present in progress which should make the boat considerably more competitive and exciting (it can be quite exciting now !) and as soon as I have had the chance to fully try them out, and also as soon as I can get some photos of it smashing through some choppy water, I will, if it would be of interest for the publication, let you have a " write-up " on it.

C. HUGHES.

Windover, Grange Crescent, Crawley Down, Sussex.

★ ★ ★

Dear Sir,

I have just received A.Y.R.S. Publication No. 55 Trimarans 1965.

I think this is one of the most complete, useful, and interesting of the publications so far. There are however a number of points which seem to me to be important in connection with trimarans which do not seem ever to be considered in design.

(1) Many yacht-owners including those who own trimarans operate in hot climates. Therefore full consideration should be given to insulating the cabin roof with expanded polystyrene, and providing plentiful ventilation.

All ports and windows, not only along the sides but at the forward end of the cabin, must be made so that they can be opened (but do not leak when closed !)

I myself operate a *NIMBLE* here, where the water temperature is 82 degrees. She is insulated, and ports and windows open, but I regret to say sometimes leak. She is therefore cool while sailing, and cooler than any other boat that I know of when at anchor. Unless good ventilation for tropical conditions is provided, it is almost impossible to sleep below when at anchor however.

(2) *Rudders*—Many trimaran designs have their rudders below the hull with no skeg for protection, or have rudders without lifting arrangement. A fortnight ago in sailing someone else's trimaran from Port Swettenham to Singapore, we hit a floating log, and the rudder (non-lifting) carried away. Most keel boats' rudders are protected from such catastrophe. I do not think this should be overlooked. The loss of a rudder is no light matter.

(3) *Steering position* from a cockpit aft—The view forward from such a position is indifferent, particularly so, for seeing flotsam, or other floating hazards. I can see no justification for the steering position always to be from an aft cockpit.

I would suggest the advantages—if it can be conveniently in-incorporated—of a small raised dog-house at the fore-end of the cabin. If this contains a wheel and benches either side, the helmsman would be able to watch the sails through a plastic roof, and yet would have an excellent view forward. Here again in these latitudes, it seems to me essential when cruising to be protected from the sun. Evaporation and exhaustion is much more rapid when exposed to sun and wind sitting in an open cock-pit.

I suggest for consideration, that there should always be alternate internal steering for trimarans that operate (or may at any time operate) under tropical conditions. In many conditions of cold and bad weather also I would think there might be considerable advantage to be had from internal steering ?

Apart from the points I was also most interested to see Arthur Piver's suggestion for a self-steering gear.

PETER A. DEHNE-RADCLIFFE.
c/o Conzine Riotinto Malaysia Ltd., Bangunan Getah Asli, 150 Jalan Ampang, Kuala Lumpur, Selangor, Malaysia.

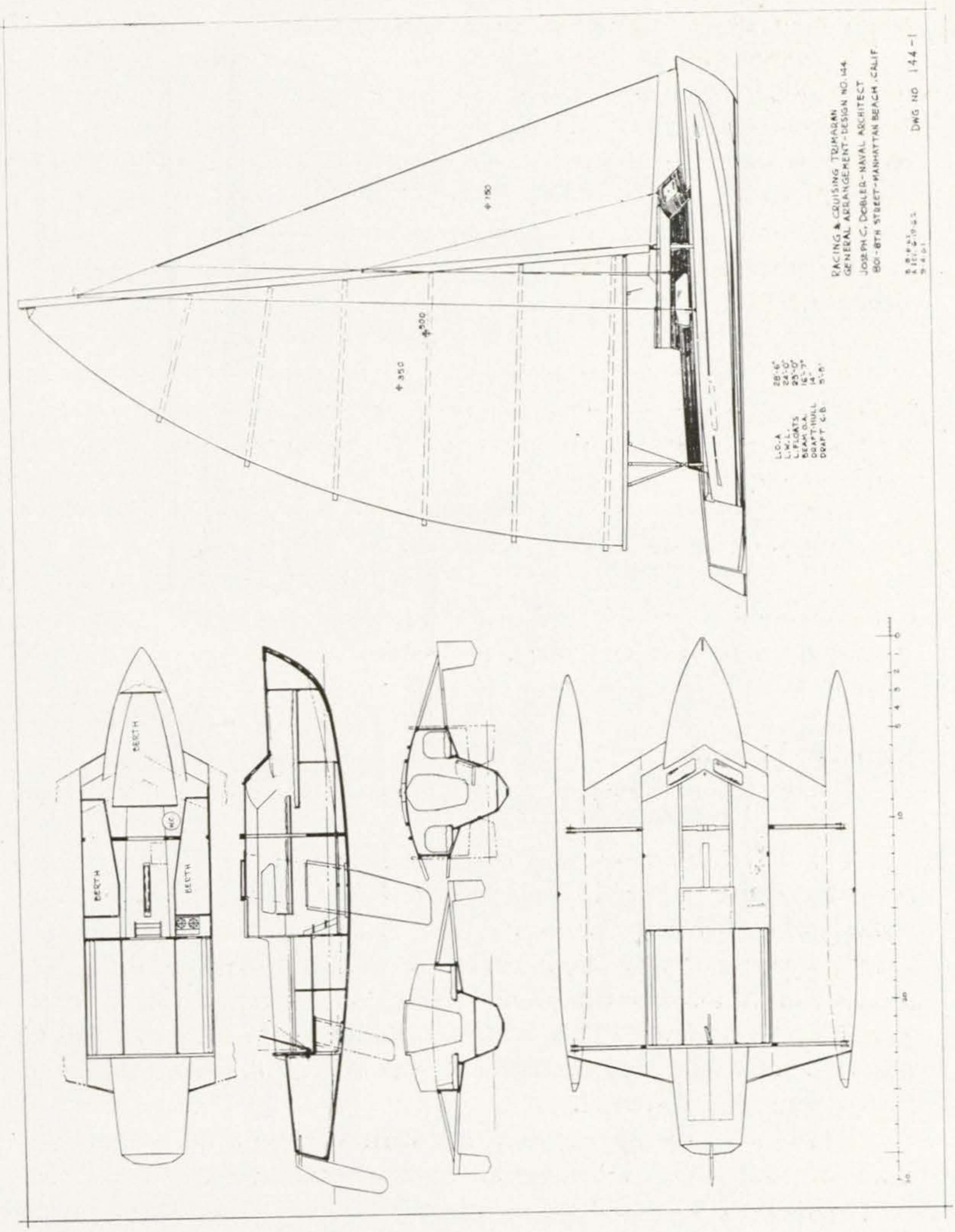
★ ★ ★

Dear Dr. Morwood,

I thank you for your letter and apologize for the delay in answering it.

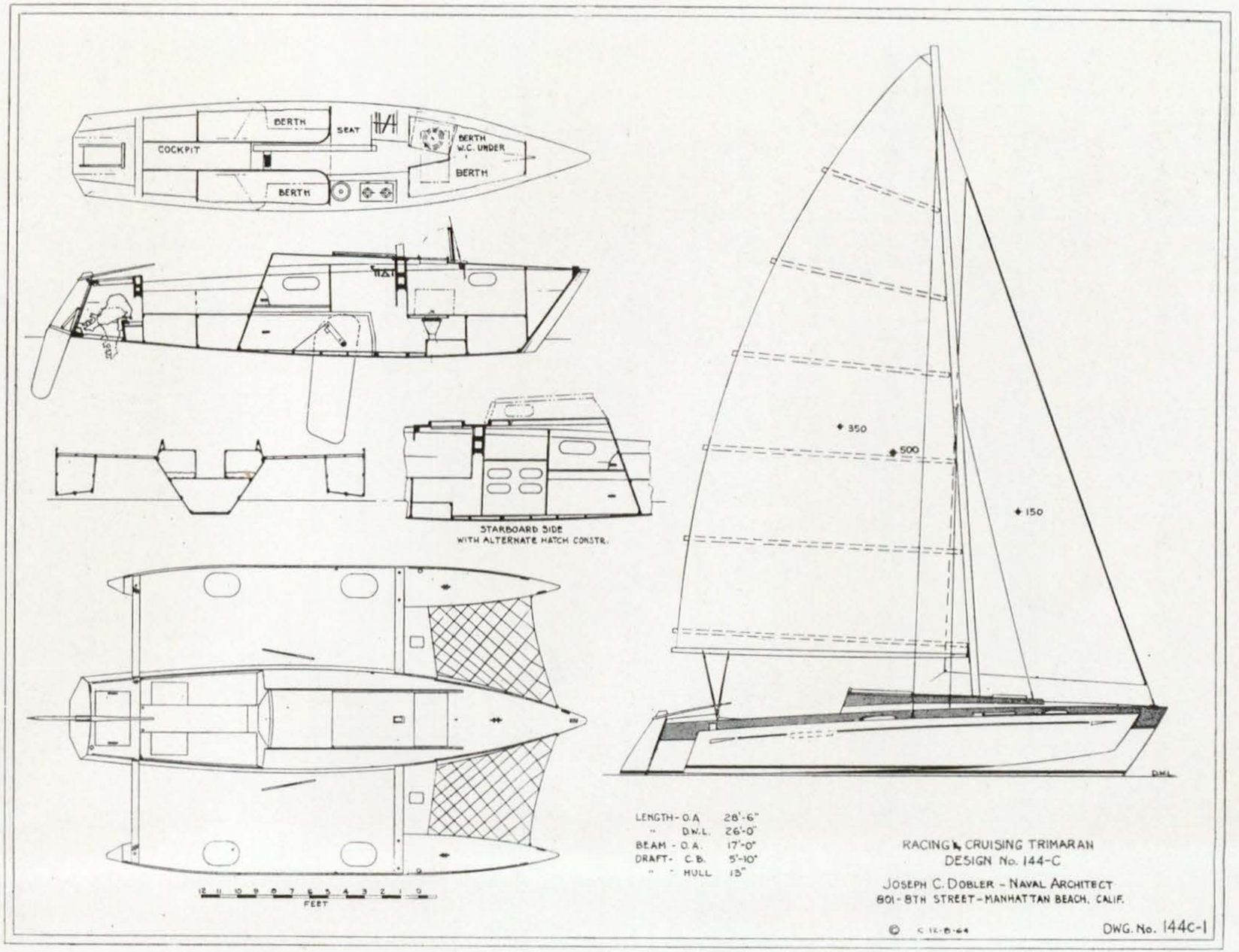
You asked about the angle on the float bottoms. Where speed is the main object, I try to make the bottom of the float parallel to the water surface in cross section. In a boat designed for cruising I usually give the float a slight angle, like half a V bottom hull. The idea is to give a softer ride, but actually, neither type is given to objectionable pounding. This is due, I think, to the fact that the lee float is pressed down on the water by the sails at all times, and is not free to leap like a power boat.

I have a couple of trimarans out with V bottom floats and these work very well, but it is a question whether the added cost is justified. Dwg. No. 144-1 enclosed shows one of this type. I have not pushed this design because it is rather more expensive than later models. It does make an attractive boat, however. One is owned by Major George Kabat of Honolulu. I quote from a letter I recently received from him, dated 8 June 1965 :



Joseph Dobler's 28 ft. 6 ins. racing Trimaran

Joseph Dobler's 28 ft. 6 ins. Trimaran design.



" Last week we entered the around Oahu race (our first). 40 plus boats entered including 5 other trimarans. We raced scratch against other trimarans. We had good winds, no spinnaker, good crew and won the trimaran class with ease. It was a series of 3 races of 28, 56 and 26 miles. We won by over 1½ hours ahead of other trimarans each day. They were 24 ft., 28 ft., 30 ft. and (2) 35 ft. Piver boats. They were amazed on the 35 ft. boats with spinnaker, which we walked away from using genoa and main wing and wing. I am now a real racing enthusiast but will get handicapped soon, I am afraid. She also sails close to wind and faster than other tris. Only boat faster here is *PACIFIC CAT*. We averaged 16 knots on 3 hours of reaching, which included surfing on every 4th wave for 15-30 seconds during the race. We felt like we were flying."

I imagine this race will be written up in the July or August yachting press. It is the first race I have heard about where the tris were able to get a class. I am going to write and ask Major Kabat to have the club officer send you the race results. I will also ask him to send you a photo if he can.

No. 144-C, enclosed, is intended to give equal performance at considerably less cost.

No action photos so far. If I get anything I will send it along, but many of our sailors are going in the Transpac, starting on the 4th.

JOE DOBLER.

801 Eight Street, Manhattan Beach, California 90266.

★ ★ ★

Dear Sir,

I am the owner of the windmill-propellor catamaran featured on page 43 of A.Y.R.S. publication No. 58. I built the model as an experiment to see if sailing straight into the wind was possible. As I have only been a member of the A.Y.R.S. for about a year, I was unaware that windmill craft had been built before. I was therefore very interested in the article on the full sized windwheel boat published in the same issue.

C. P. HANSFORD.

53, Sandy Ridge, Chislehurst, Kent.

Dear Sir,

This year (1966), I re-rigged *MORILD* (A.Y.R.S. No. 47) to mast top jibstay and built a shallow fin keel on the main hull—6 in. deep and 3 ft. long, 8 : 1 thickness ratio with parabolic nose according to Marchaj. This gave improved windward performance, but it will improve even more next year, when I plan to fit a semi-circular track for the main sheet traveller like Dobler's.

MORILD

Please find enclosed a translation of an article I wrote for SJOSPORT, No. 1, 1966 on the Gill hydraulic jet propulsion for which J. Samuel White & Co. Ltd., Cowes, Isle of Wight are the English factors.

This is in response to your notes in No. 55 on Diesel Engines for trimarans. Incidentally, *YANMAR* has a lighter air cooled diesel than *PETTER*.

HELGE INGEBERG.

JET PROPULSION FOR SAILBOATS

BY
HELGE INGEBERG
Eiksveien 52, Oslo 7, Norway.
By Courtesy of the Editor of SJOSPORT

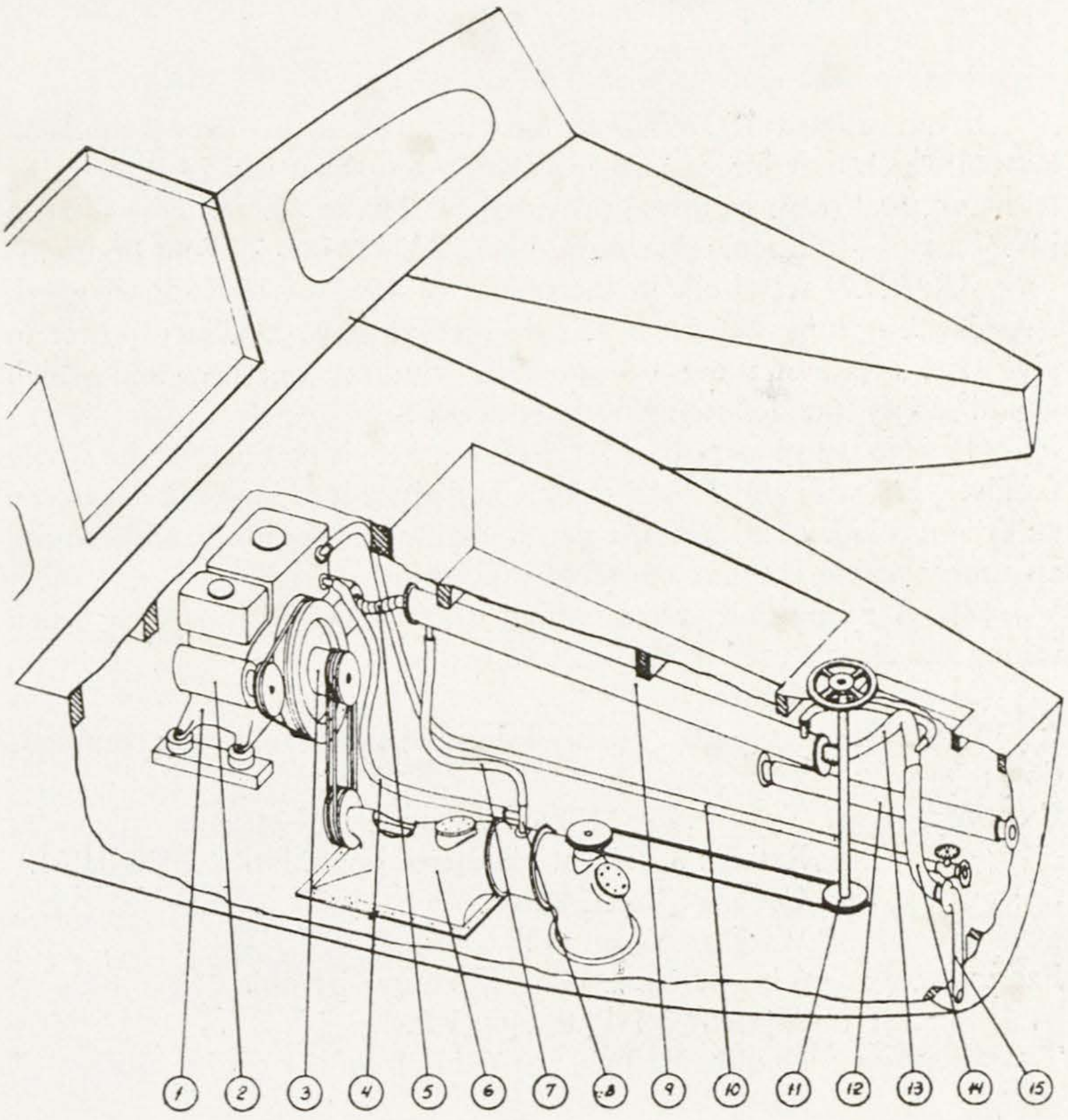


Fig. 1.

1. *Engine NT65M Yanmar.*
2. *Siba Dynastart.*
3. *Vee-belt transmission with clutch handled from aft locket.*
4. *Cooling water pipe to engine.*
5. 1 *in. flexible hose in* 316 *SS from engine to exhaust pipe.*
6. *Jet unit* 6 *in. Series I Gill.*
7. *Cooling water pipe to exhaust water jacket.*

8. *Water supply from pressure side of pump.*
9. 1 *in. exhaust tube with* 2 *in. waterjacket, all in* 316 *SS.*
10. Cooling water pipe from engine, with valve for flow control.
11. *Jet direction control.*
12. *Drain for cockpit.*
13. *Swan's neck in* 316 *SS.*
14. $1\frac{1}{4}$ *in. steam hose.*
15. 1 *in. exhaust outlet pipe in Yorcalbro.*

In our sailboat *MORILD* we have installed an auxiliary propulsion system which may interest other sailors. Our boat is a 23 ft. cruising trimaran, and main power is provided by 240 sq. ft. sail area total in jib + main + mizzen. We have done 12 knots in a 20 knot breeze.

MORILD was built in the spring of 1963 at Helle Batbyggeri, Arendal, but long before I had decided to have auxiliary power to give us a speed of some 4-5 knots in windless weather, and which would satisfy the following requirements :

(1) No petrol aboard. *MORILD* is a cruising boat for the whole family. My wife and I both smoke, and since it is impossible to keep an eye on 3 kids at all times, a petrol engine installation would require an unreasonable amount of safety precautions.

(2) A propulsion system which would give the least drag when sailing and also be used in conjunction with sail.

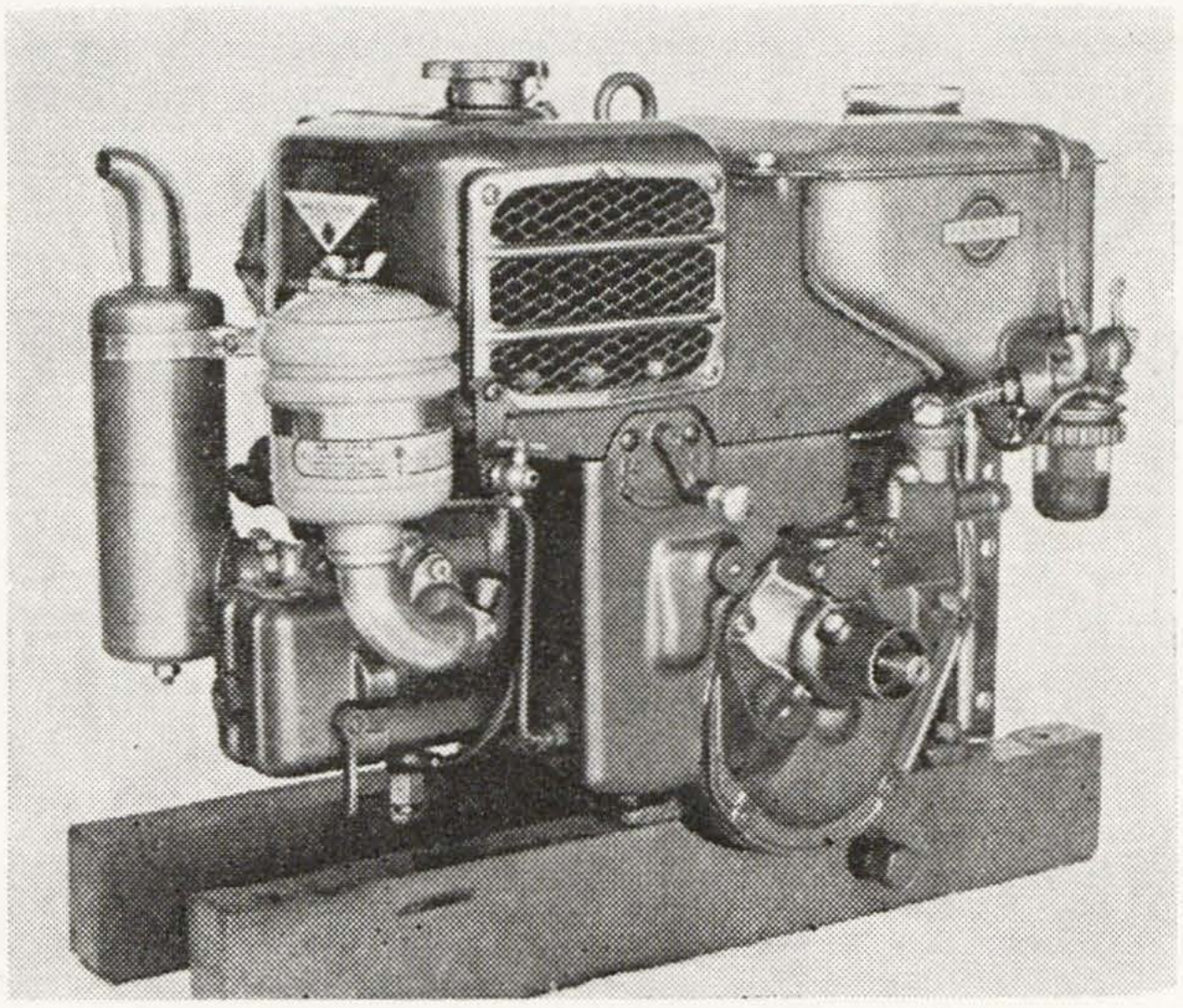
(3) Low weight.

The search was long. Finally I decided on the following combination :

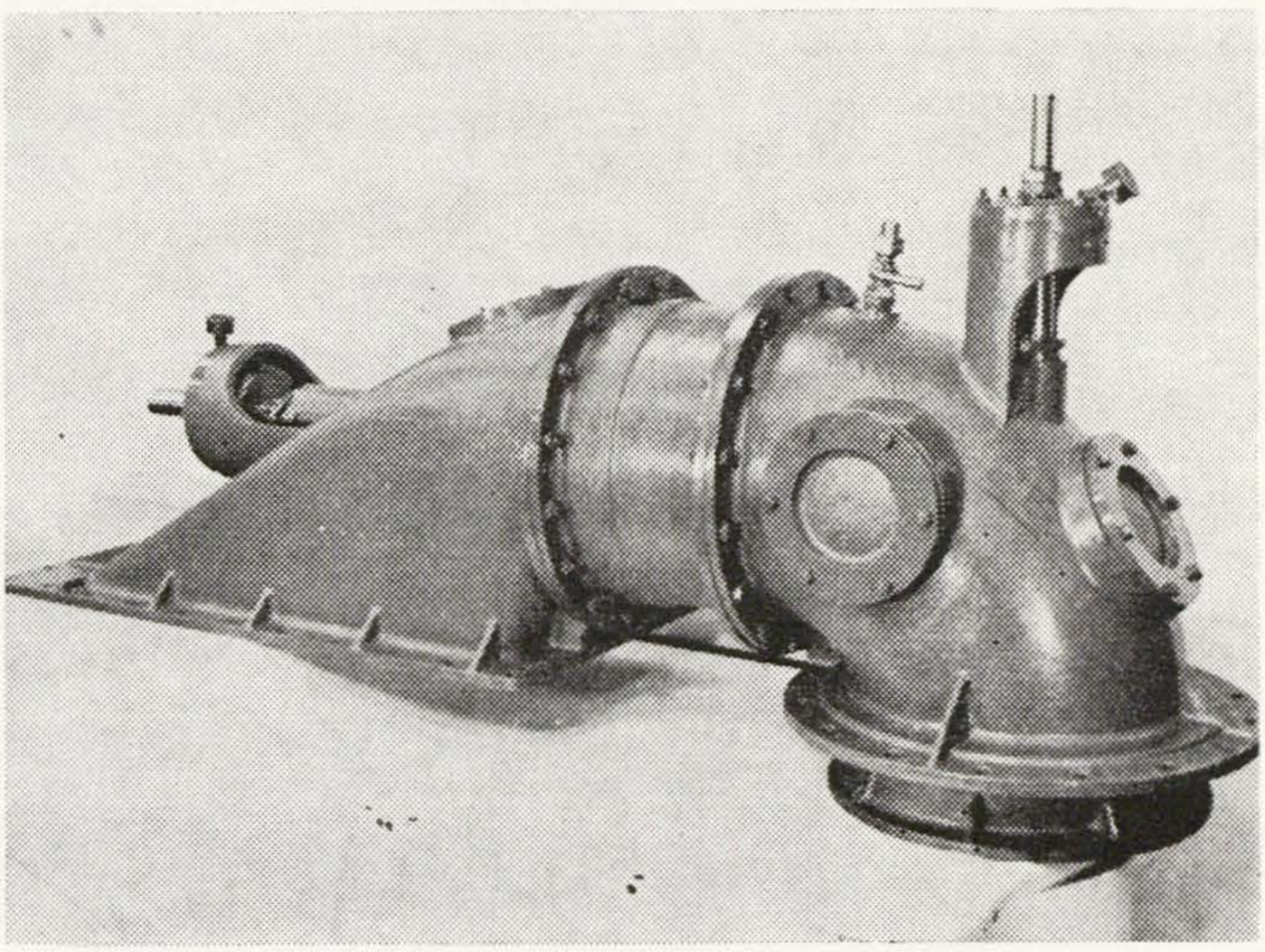
ENGINE :	Type NT65M Yanmar diesel. 4-stroke.
	Rating: 3 BHP at *continuous* operation at 2000 RPM.
	Cooling: Fresh water.
	Weight: 63 kg. (138.6 lb.).
PROPULSION :	6 in. Series I Gill underwater jet unit.
	Absorbs 3 HP at 2400 RPM.
TRANSMISSION :	Double Ve-belt, with clutch on the engine shaft.
	Ratio: 1.2 : 1.

It has taken us a couple of seasons to work out a decent installation. We do 5 knots on a mirror sea and are content with that, even though we could have wished for more power last summer when one of the stays broke, and we had to lower sail immediately, and start the engine in a heavy sea. Now I am looking forward to see the 20 BHP Wankel diesel engine come off the Yanmar test bench !

The Gill unit has no underwater projections. The jet can be directed in any direction, giving steering and reverse as with many outboard motors.



YANMAR diesel engine



GILL jet propulsion unit

Fig. 1. *Shows the complete installation as it now is.*
Fig. 2. *Shows the Yanmar engine and Fig.* 3 *the Gill jet unit.*

If any of the readers would like to know more about the installation, please write me.

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For further information write: International Amateur Boat Building Society, 1535 W. Farwell Ave., Chicago, Ill. 60626.

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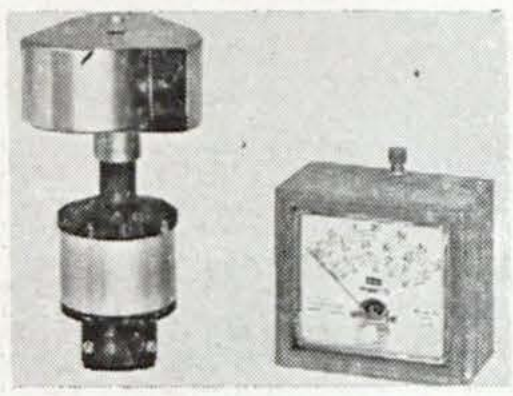

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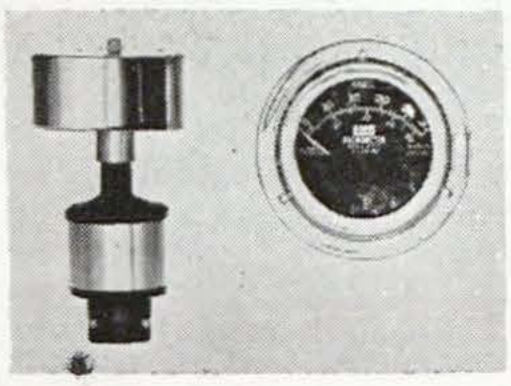

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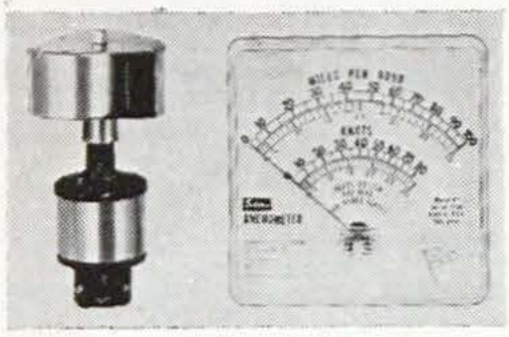

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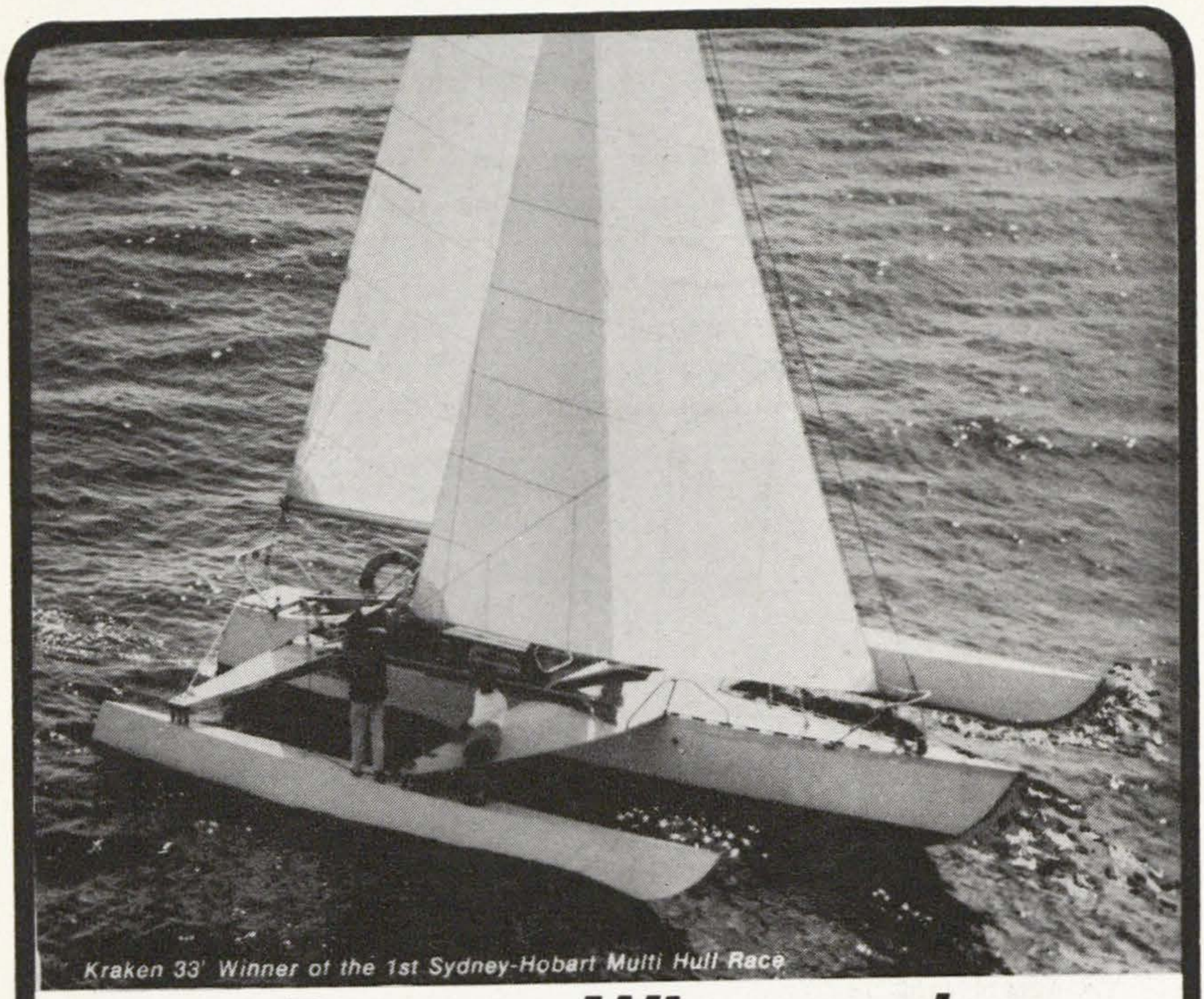

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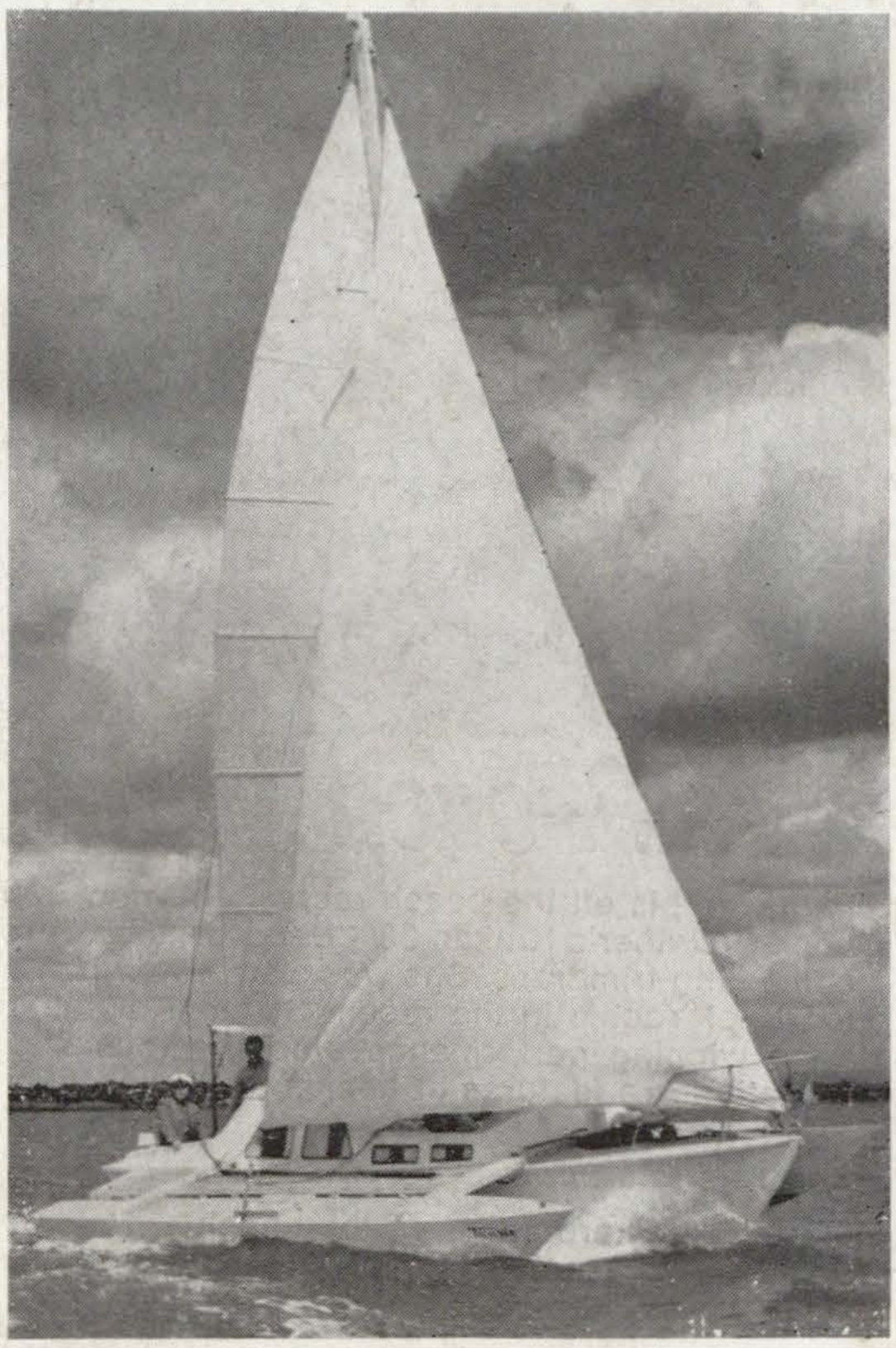

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