OUTRIGGERS 1969

A.Y.R.S. PUBLICATION No. 68

Chris Hughes "Flying Proa" Kia Kia

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THE AMATEUR YACHT RESEARCH SOCIETY

(Founded June, 1955 to encourage Amateur and Individual Yacht Research)

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EDITORIAL

Late publications

I am sorry that we still haven't achieved a system when the publications will come out on time. Somehow, we work and work but, when the last date for a publication appears, we are far from ready. Obviously a major re-organisation of our work is necessary. It is with that end in view that we are trying to buy a place in London for a headquarters where as much routine work as possible is done, leaving the Editorial function free of distractions. We hope to have a firm decision on that matter by the time this publication is in your hands.

Rogor Waddington

It is with regret that we announce the death of Rogor Waddington. He became interested in the A.Y.R.S. management shortly after helping to build the yacht wind tunnel at Woodacres. His main work was to formalise the running of the Society and turn it into a Limited Liability Company registered under the Charities Act. His guiding hand will be missed in our affairs and many of us have lost a personal friend of great worth.

Sir Peregrine Henniker-Heaton, Bt.

The Committee did me the honour to elect me Chairman on the 29th April '69. During my tenure of office I will do my utmost to serve the best interests of our members and will welcome any suggestions submitted by them for submission to the Committee.

The Committee decided not to proceed with the scheme to develop a site on Eel Pie Island for the following reasons:—

- (a) It was considered grossly unfair to spend our very limited funds on a project which only a few of our world-wide members could enjoy.
- (b) The best interests of our Society would be served through the publications acting as a forum for the exchange of ideas and technical information in continuation of past policy.
- (c) The scheme was not viable financially.
- (d) Our Articles of Association expressly forbid the Society to engage in trade.

Peregrine Henniker-Heaton.

Members' letters

We are only too happy to advise members on anything to do with yachting, if we know the answer. If we get our headquarters, we can have a panel of experts to advise on any problem but, for the moment, our capacities are limited to general outlines. Constructional details, for example, are beyond us

Material for the publications

This is, of course, our primary need. The vital kind comes from people who have worked with wind tunnels and test tanks which is why we want to encourage this. But we are very interested in boats of unusual kinds and boats brought to good perfection either in speed or comfort. Model experiments are also the first phase of much new development and we urge this to all, especially as such good fibreglass hulls can be bought from Ray Blick, 23, Bray Road, Guildford, Surrey (£1-18-0 for a cat or tri main hull, 36 in long). Hydrofoil experiments could well be tried with one of Ray's hulls.

Self steering gears

After our 14 years of study of these, the following facts emerge:—

1. A horizontally pivoted vane produces about 12 times the work of a vertically pivoted one.

2. A "Hasler" type "paddle" multiplies the vane work by a factor of about 17.

Conclusion

The "Gunning Gear" with *BOTH* the above has a power factor of about 200 times that of a simple running line gear such as the Henderson gears which have been shown to work perfectly well, even in light winds if the boat is well balanced or the rudder is "balanced" which is, of course, another way of multiplying the vane power.

Norman Naish has just made a "running line gear" for us, using a horiozntally pivoted vane. He thinks that £20 should be the sale price for this gear but, though he might be persuaded to make a few of these for AYRS members, he does not intend to take the matter up commercially.

Change of address

Would all members tell us when they move their homes. Otherwise, publications go astray.

The AYRS tie and burgee

Ties cost \$3.00 or £1-1-0 each. Colours are navy blue or black. The AYRS burgee is a windsock. The small size is 5½ in long and costs 14s or \$2.00. The large size is 16 in long and costs \$4.00 or 28s.

Subscriptions

Members often say that they don't know when their subscription is due. This is, of course, on October 1st. We remind people of this in the October publication, though with No. 66a, this did not come out till this year (1969).

Publication No. 66a

Publication No. 60 was misnumbered as "66." This caused us immense trouble. People then wrote "Where are the ones we have missed?" Numbering the genuine No. 66 as "66a" has again confused people—Sorry.

Ferro-Cement boats

The best book on this subject which looks very complete to me is that by John Samson and Geoff Wellens, "How to Build a Ferro-Cement Boat." The price is $9.75 or £4-4-0. A short resume of the subject is to be found in the paper back "Boat Building With Hartley," price $1.00 (US), $1.50 (Australia), $1.25 (NZ), 16/- (UK). Both books are available from Woodacres.

TRIMARANS 1969

Edited by Ian Williams 33 Powderham Road, Newton Abbot, South Devon

In order to avoid confusion, we have maintained the year of our annual review to the year of publication and not to the previous one as we used to do.

This year shows the gradual evolution of the trimaran to the stage of the luxury yacht—a far cry from the earlier trimarans we showed. Amateurs are still designing and building them but the work and cost is fast approaching that of a single-hulled yacht of similar length. Even so, a professionally built trimaran will be larger, faster and easier to work than a professionally built single hull costing the same amount of money.

The main difference between the AYRS publications and the yachting magazines is that we are not, in any way, influenced by our advertisers. If a professionally designed and built boat is of interest as having new features, we publish it. If it is perfection of its type, we also publish it. But we also show the probings by our members into new ideas of construction and design such as the excellent trimaran *KOLEK* by K. R. May, using inflatable floats and Rodney Garrett's hydrofoil-trimaran.

The Proas

Due to the success of Dick Newick's *CHEERS* in the 1968 Single-handed Trans-Atlantic Race, the Proa is likely to be the object of much interest and development. We will be describing *CHEERS* fully in our issue on the OSTAR later this year but the main principles of design are fully described by Chris Hughes in this issue and M. J. Beeton also shows a pleasant variety of the proa here.

Andrew Simpson Simpson Marine Partnership, 19 King's Road, Swanage, Dorset

Dear Dr. Morwood,

Enclosed are rough drawings of a 24 ft trimaran presently being built to my design. It is the prototype of a proposed range of boats up to 45 ft and as such embodies all the main design principles of the larger craft. I consider 24 ft to be the lowest reasonable overall length for an offshore trimaran.

The centre hull is round bilged with a fine entry and flat run aft. Wetted surface has been kept as low as possible although more attention has been paid to producing a sea-kindly hull form than trying to obtain the absolute

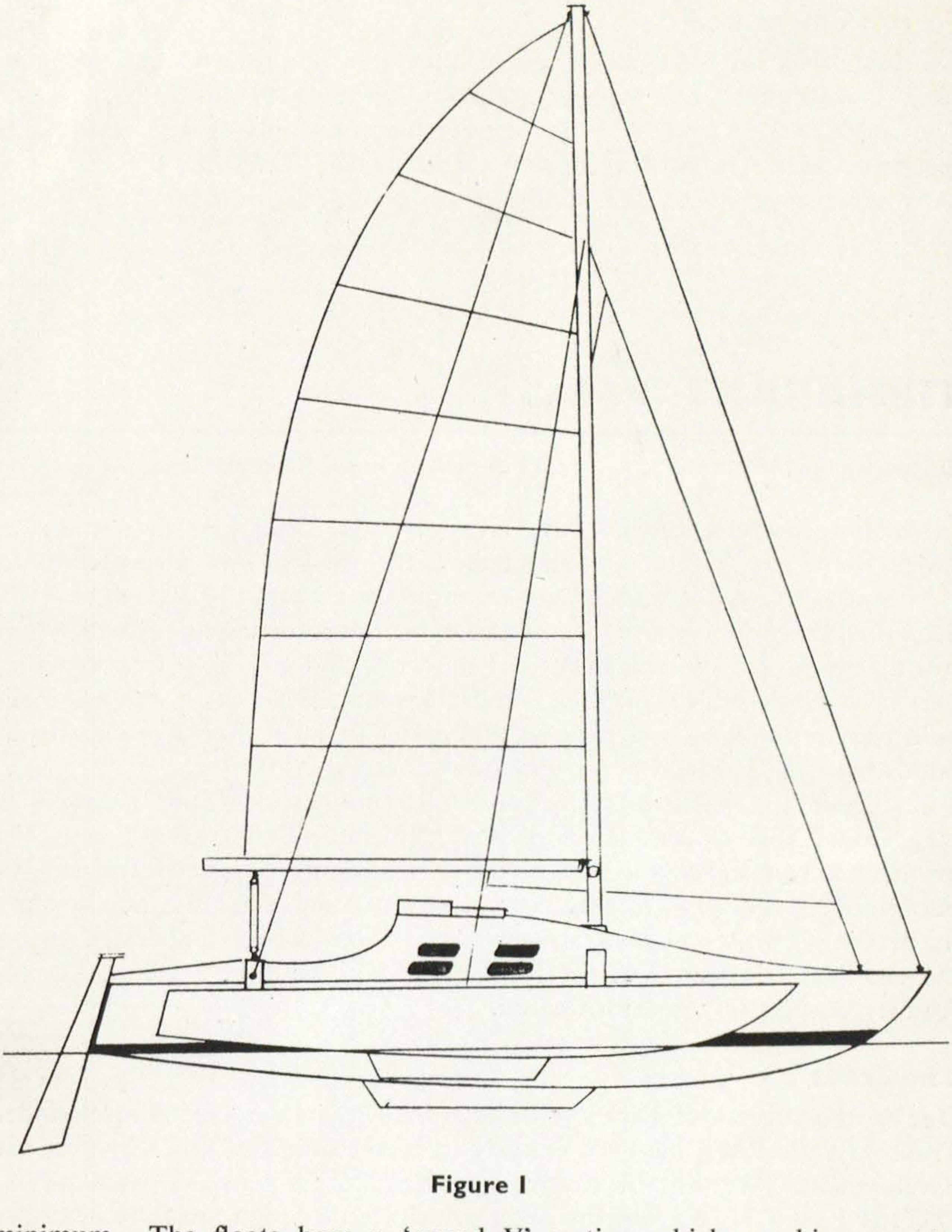
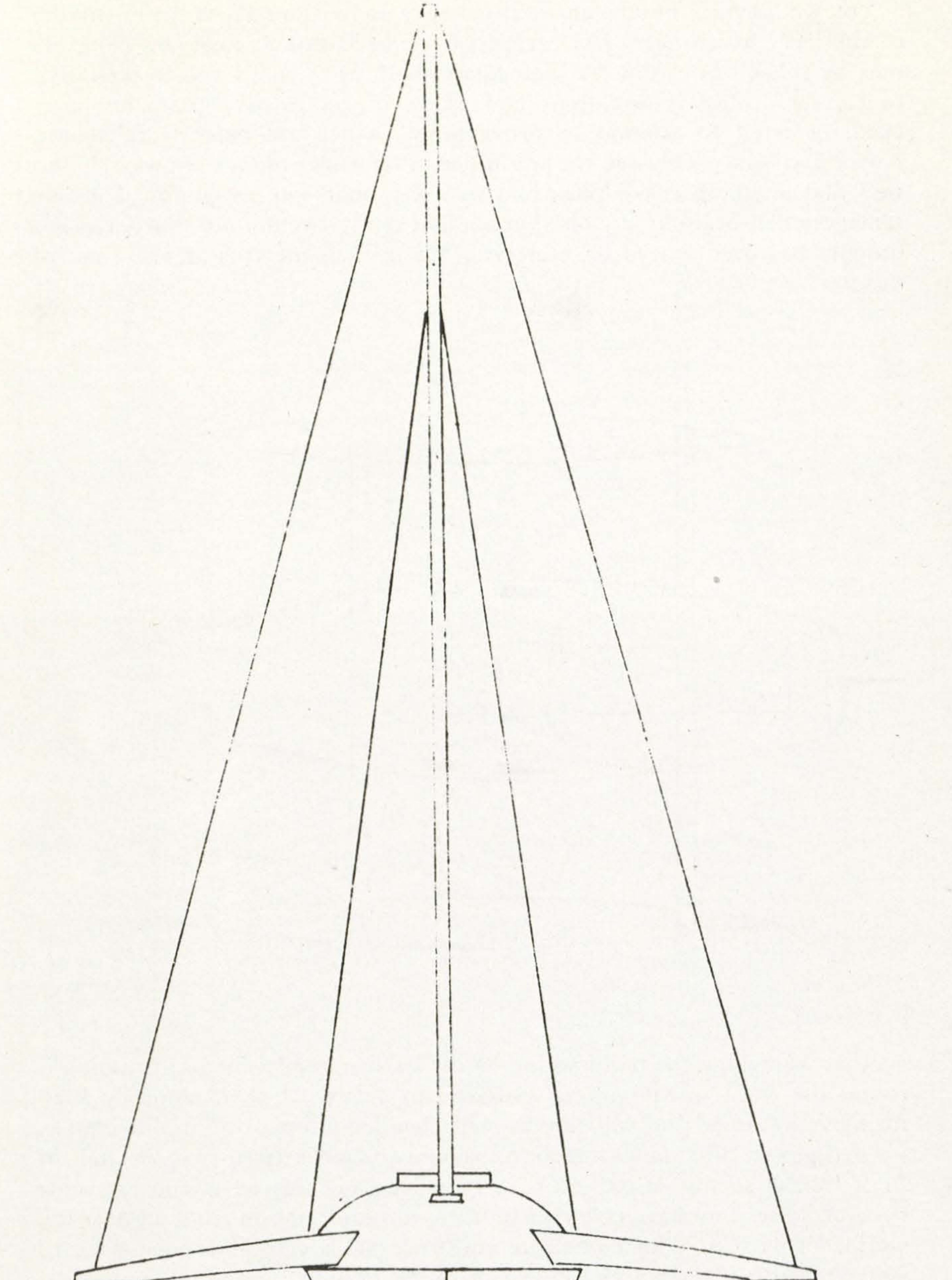


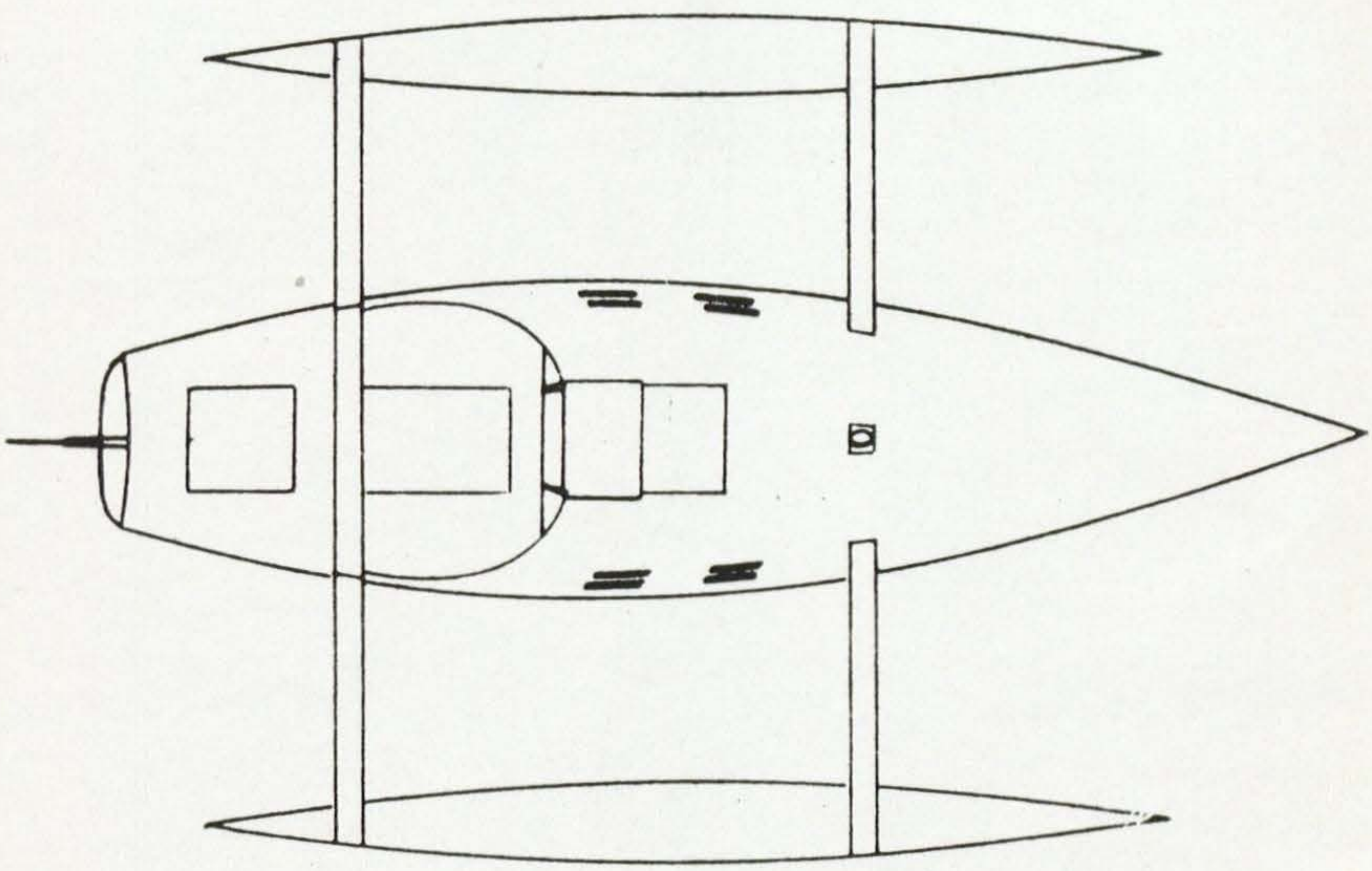
Figure I

minimum. The floats have a 'round V' section which combines greater buoyancy with greater strength and are of symetrical configuration to lessen side stress on the beams. Asymmetrical floats will also be made and their performance compared.

Construction is of epoxy/glass sheathed double diagonal ply (rather in the manner of Hedley Nicol). both for the hulls and also for the curved deck, and care has been taken to keep scantlings as light as structural integrity will permit. Beams are of laminated spruce reinforced externally with glass. The whole structure is dismantleable for trailing and also to enable the boat to be righted in the event of a capsize. Internal buoyancy has been placed so that she will float 'high' and thus remain tenable (though hardly comfortable) should this happen. The larger boats will have watertight hatches in the transom to allow the crew to enter or leave the upturned boat.



You will gather from the above that I have no illusions about the possibility of capsize. Much harm has been done to the multihull cause by designers making ridiculous claims for their boats; both as to speed and to resistance to capsize. Massive equations and reams of geometric explanation have been mustered to attempt to prove points which are patently fallacious. Anyone who has witnessed the sea in one of its wilder moods knows only too well that anything *can* happen and that any boat *may* succumb. I dislike sentences that begin 'in my opinion . . .' but in my opinion not nearly enough thought has been spared on preserving the lives of the crew in the event of disaster.



After launching the tri in spring 69 my partners and I intend thrashing it round the coast in the stiffest trial we can devise. I shall naturally keep members informed and will submit more detailed information in due course.

Last winter, after much research, we constructed a ferro-concrete hull of 27 ft overall to my design. I have been studying this technique for some two years now and have collected much useful information from all over the world. This boat is of composite construction, having a wooden deck to soften the rather bleak architectural effect and is shortly to be fitted out by a doctor in his spare time. We intend publishing full working drawings in the near future and if I can be of any help to members considering this method then I shall be glad to be.

Yours sincerely,

Andrew Simpson.

"ALPHA" III — Micronesian Canoe

by M. J. Beeton

Designed and built by: M. J. Beeton, Roslin Hall Hotel, Belgrave Road, Torquay, Devon

Main Hull	20 ft	Weight rigged	250 lb
Outrigger	10 ft	Sail area	110 sq ft
Total Beam	8 ft	Beam main hull	14 in

The intention was to build a multihull which would be easy to launch from a trailer with no need to fold or remove the outriggers. The micronesian configuration was found to be suitable as it can be carried on its side with the float in the air

In 1966 I decided to convert my catamaran into a platform on which I could experiment with the micronesian rig. The 20 ft main hull consisted of the two 10 ft bow sections of the catamaran joined in the centre. The outrigger was 8 ft long and of extreme deep vee section.

A rudder was mounted at each end of the main hull on triangular frames. These frames were controlled by wires and a single lever lifting the forward rudder high out of the water on each tack.

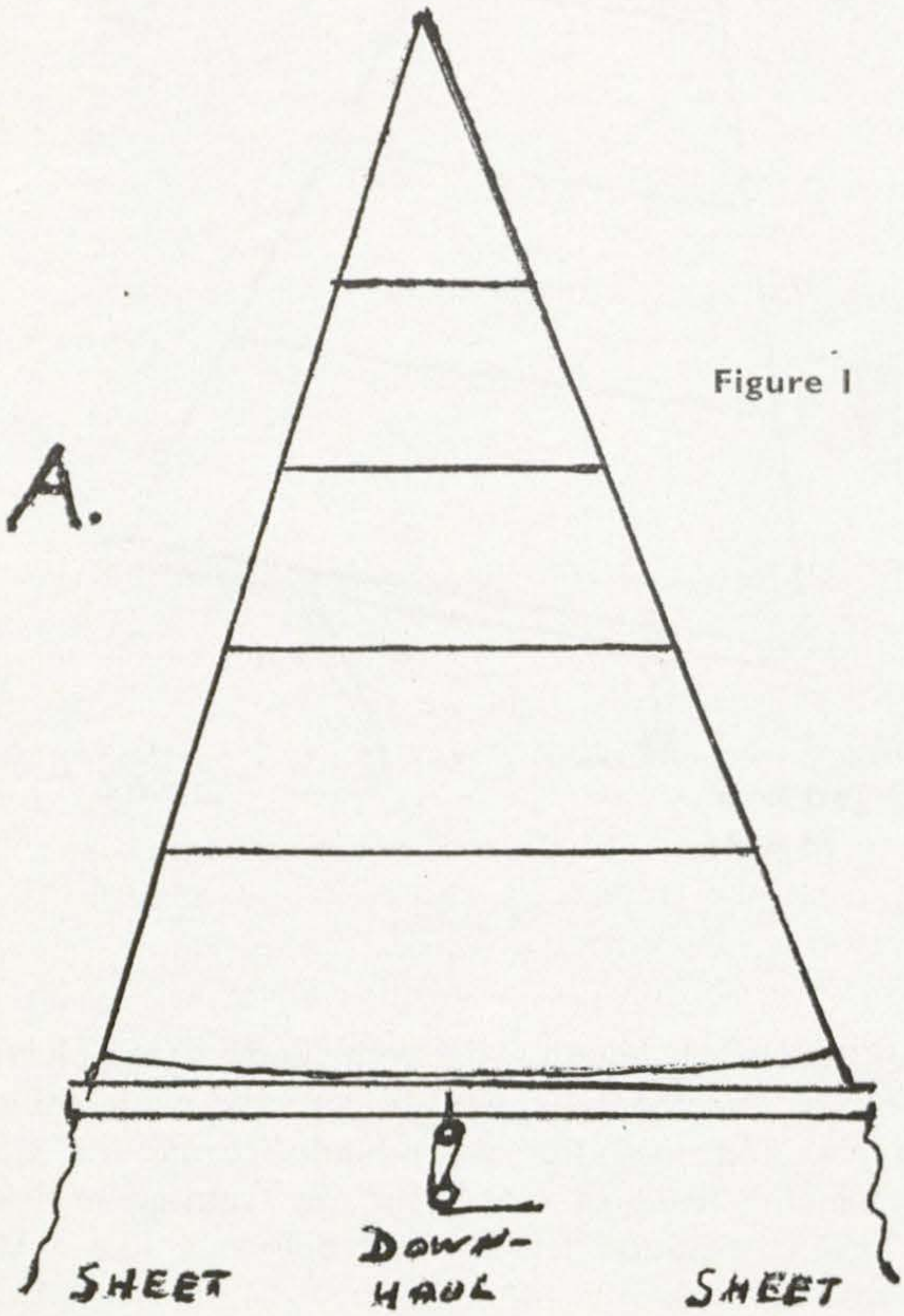


Figure I

A flat cut triangular loose footed sail of 120 sq ft was used with a wire in both "luff" and "leech." The curvature was controlled by full length battens.

In the first instance the sail was hoisted clear and to leeward of the mast and hauled down taut by a tackle in the centre of the boom, which was adjusted by a sheet from each end. (Sketch A). This arrangement proved satisfactory in light winds but very critical to manage in stronger conditions when considerable force was required to hold the desired angle of attack.

In spite of an adjustable centre-board, it was found that the centre of pressure was too far forward, giving lee-helm. To counteract this the centre down-haul was removed together with the sheets and replaced by two down-

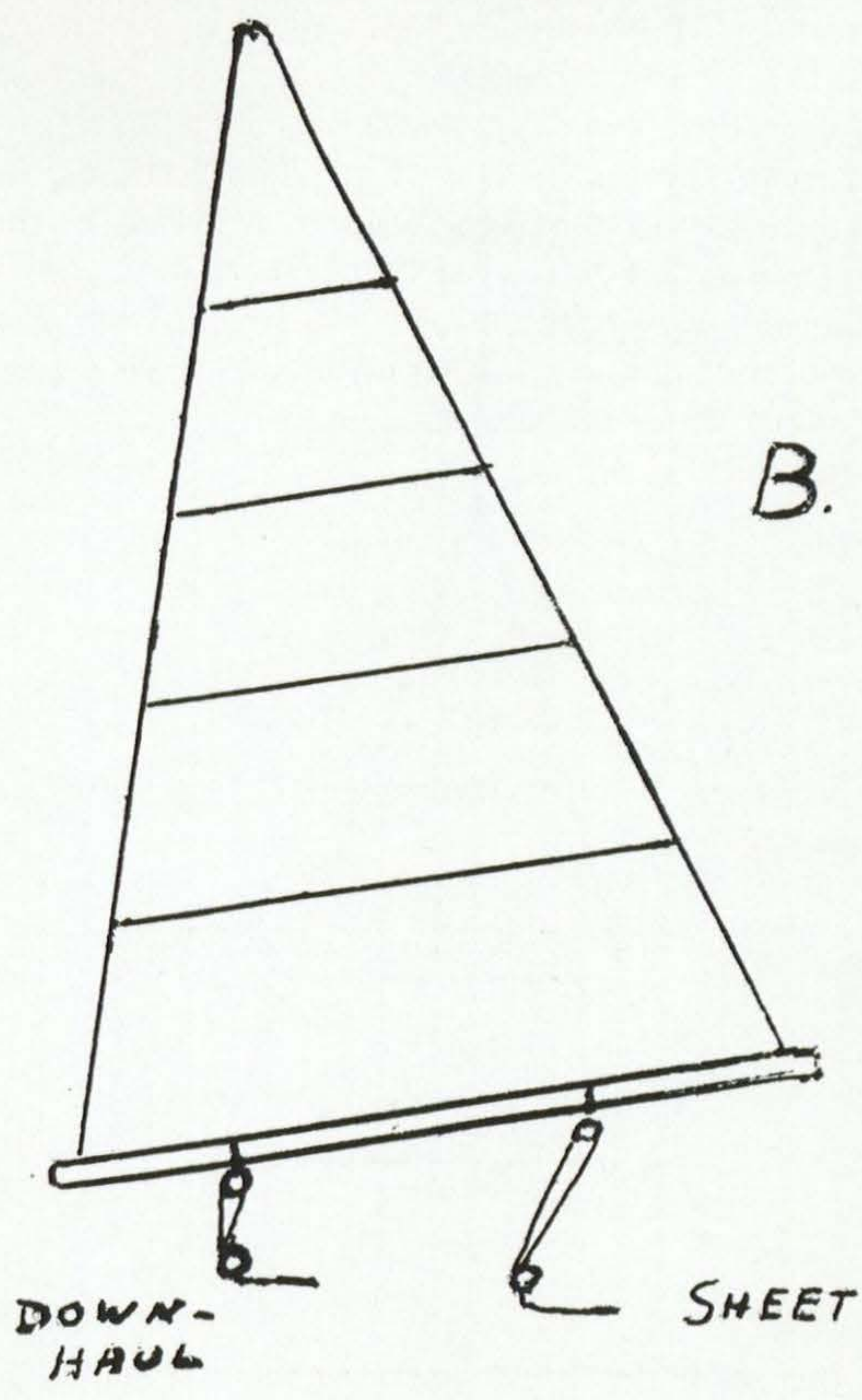


Figure 2

hauls each $\frac{1}{4}$ of the boom's length in from the ends. (Sketch B).

On each tack the forward down-haul became the pivot point for the now semi-balanced rig, and the after down-haul became the sheet. As can be imagined changing tacks in a fresh breeze required decision and good coordination. Any hesitation left the sail billowing like a spinnaker and resulted in several capsizes.

Unlike the first rig, this system did fail safe provided one of the down-hauls was tightened home.

At this stage I decided that the 24 ft mast was too heavy for the boat and tended to increase the rolling movement in a swell. A short number of experiments were carried out using a 2 in steel TV mast but this was not man enough for the job.

The problem now was to shorten the rig without losing too much sail area and if possible develop a system which would fail safe. A new 18 ft mast was constructed with the top 2 ft angled at about 45°. The head of the sail was shortened 6 ft and fitted to a 4 ft gaff. The halyard was shackled to the gaff about 1 ft from the luff end and the down-haul connected to the boom 3 ft from the tack. An endless sheet was led from the clew through pulleys

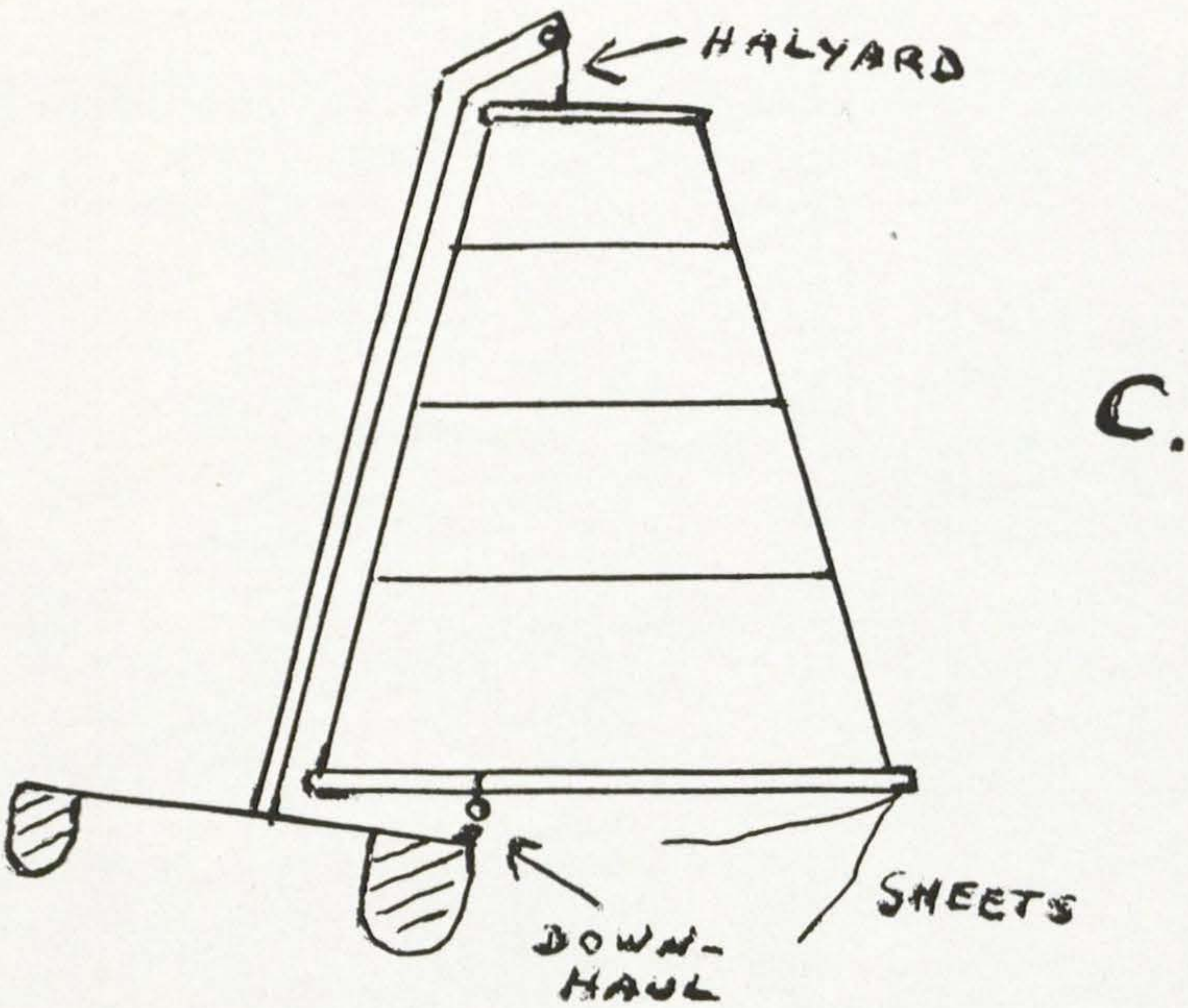


Figure 3

at each end of the main hull and past the helmsman. (Sketch C). On changing the tack the sail swings through the wind like a balanced jib, and provided the outrigger is kept to windward this rig fails safe.

For 1967 the rig and rudder systems were retained but I made a new main hull and outrigger using 4 mm ply, with a semi-circular underwater section amidships, joined with fibre-glass along the keel line, and with no frames except for the deck beams.

The centre-board is mounted on a trunion so that it can trail on either tack. The lower slot of the centre-board case is 4 ft long and curved setting the board at about 5° angle of attack.

As a detail improvement this year I have fitted spring catches to lock the rudders down, and these are released by the control wires.

The boat can be sailed by one person. We have found that the easiest way of rigging is to mount the mast horizontally, remove the trailer, and then roll the boat upright.

The next development, now that the rig is working satisfactorily, will be to increase the sail area.

KIA KIA – Flying Proa

by Chris Hughes

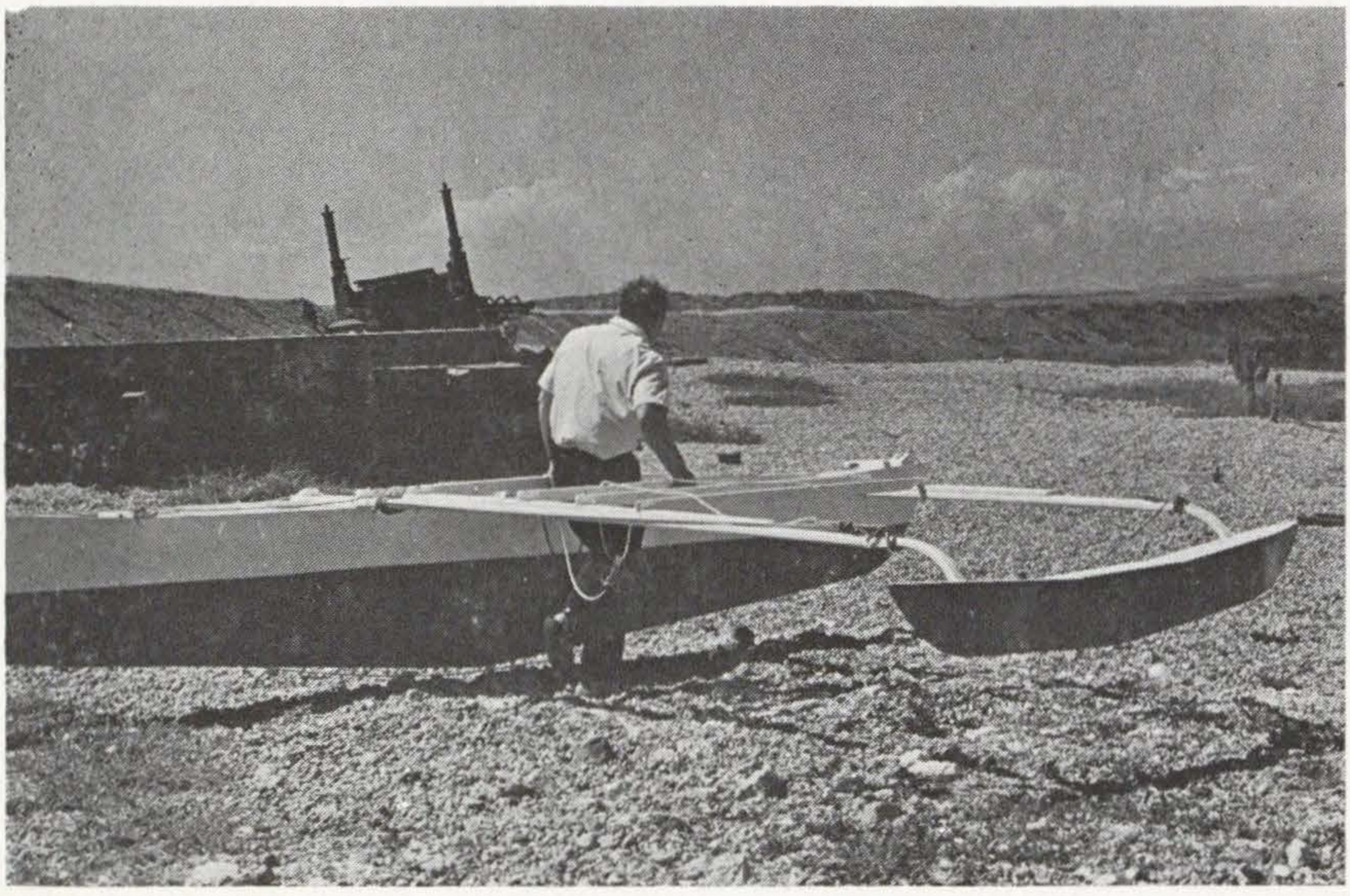
Designed and built by: C. Hughes, "Windover," Grange Crescent, Crawley Down, Sussex.

L.O.A.	20 ft	Sail Area	105 ft^2
L.W.L.	18 ft	Weight	170 lbf
Beam O.A.	11 ft		

Introduction

As a result of spending several years in the Central Pacific, I had had the opportunity of seeing and sailing the single-outrigger canoes still very much in use in the Gilbert Islands. On returning to this country the urge to build a similar type of craft became too strong, and hence *KIA KIA* was evolved. The idea was to retain the basic overall configuration, my reasoning being that this layout had emerged as a result of hundreds of years of development, but to use modern glues, plys and metal fittings in place of the system of planking and coconut-fibre lashings used in the Islands.

Basically, a main-hull length of 20 ft was considered to be the minimum size for this type of craft. Other factors affecting the design included a sixteen foot long garage and the necessity for the utmost in simplicity in construction, biased by a certain amount of experience in the repairs of wooden gliders and a distinct lack of funds.



Main hull

Most Micronesian canoe hulls possess a certain amount of lengthwise curvature to offset the drag of the outrigger. As I had little idea as to how much was required, and as a result of other factors, the hull was built in three separate water-tight sections connected together by stainless steel fittings so that the ends could be fixed at any angle required to give the boat the correct trim. The basic shape is a flat sided deep V section of about 30°, constructed from three main longerons of 1 inch square spruce planked with $\frac{1}{8}$ inch thick ply with light formers spaced about 1 ft 3 in apart. The deep V avoids the complication of a centre-board and gives a very strong hull for beaching. The central part of the hull is 12 ft long with a beam of 16 in, giving a beam at the water-line of about 10 in. The only complication to the three triangular sealed boxes was the two 9 in deep footwells set near the centre of the main hull to give a more comfortable sitting position for the crew.

Float

This was in the form of an 8 ft long triangular sealed box made from 1 in sq spruce and 4 mm ply with built-in laminated curved pieces to connect on to the straght outrigger booms.

Booms

Each was made from two 1 in sq pieces planked top and bottom with 4 mm ply. An additional $\frac{3}{4}$ in thick stiffener had to be added later. Each boom was connected to the main hull by two $\frac{3}{8}$ in dia brass studs, and stainless-steel plates were used to connect the booms to the float.

Spars

All were made from douglas fir cut to about $1\frac{3}{4}$ in dia.

Sail

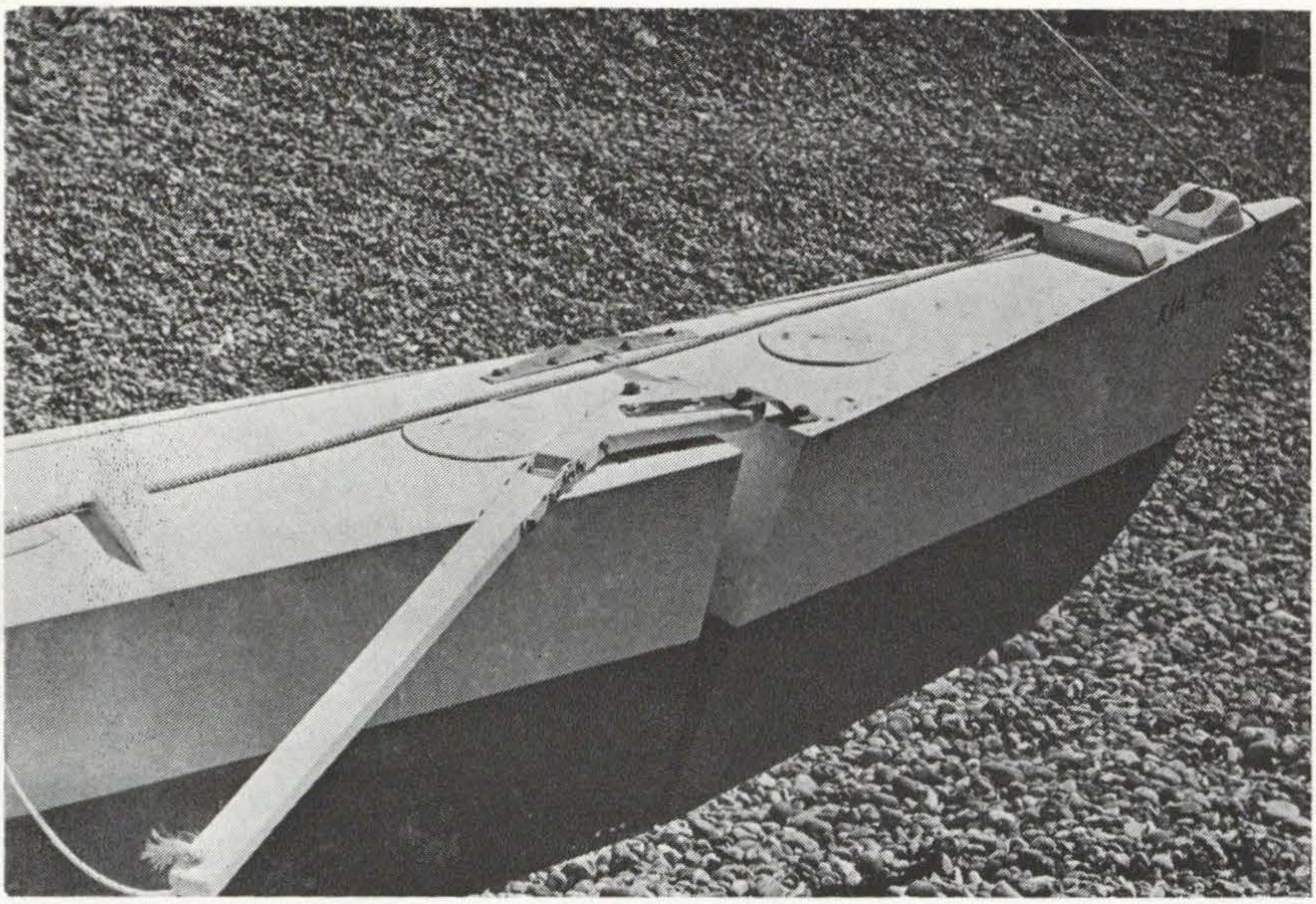
This was home-sewn from $5\frac{1}{2}$ oz cotton giving about 105 ft^2 area.

Rig

The conventional pacific lateen rig was retained, reversing being carried out by moving the foot of the sail from end to end in the normal manner, this being done originally by crawling from end to end to perform the manoeuver. However, the latest arrangement consists of a continuous rope attached to the foot of the luff-pole and passing through a pulley at each end of the boat. the foot of the luff-pole being allowed to rub along the lee side of the main hull. The pole is pulled up against a stop at each end and the rope held in position by a jamming-cleat. Two normally slack stays prevent the mast from leaning too far each way, and there are two sets of main-sheets, one passing round the front of the luff-pole while the other is in use. The end-changing procedure can be carried out single-handed without having to move from the mid-ships position.

Steering

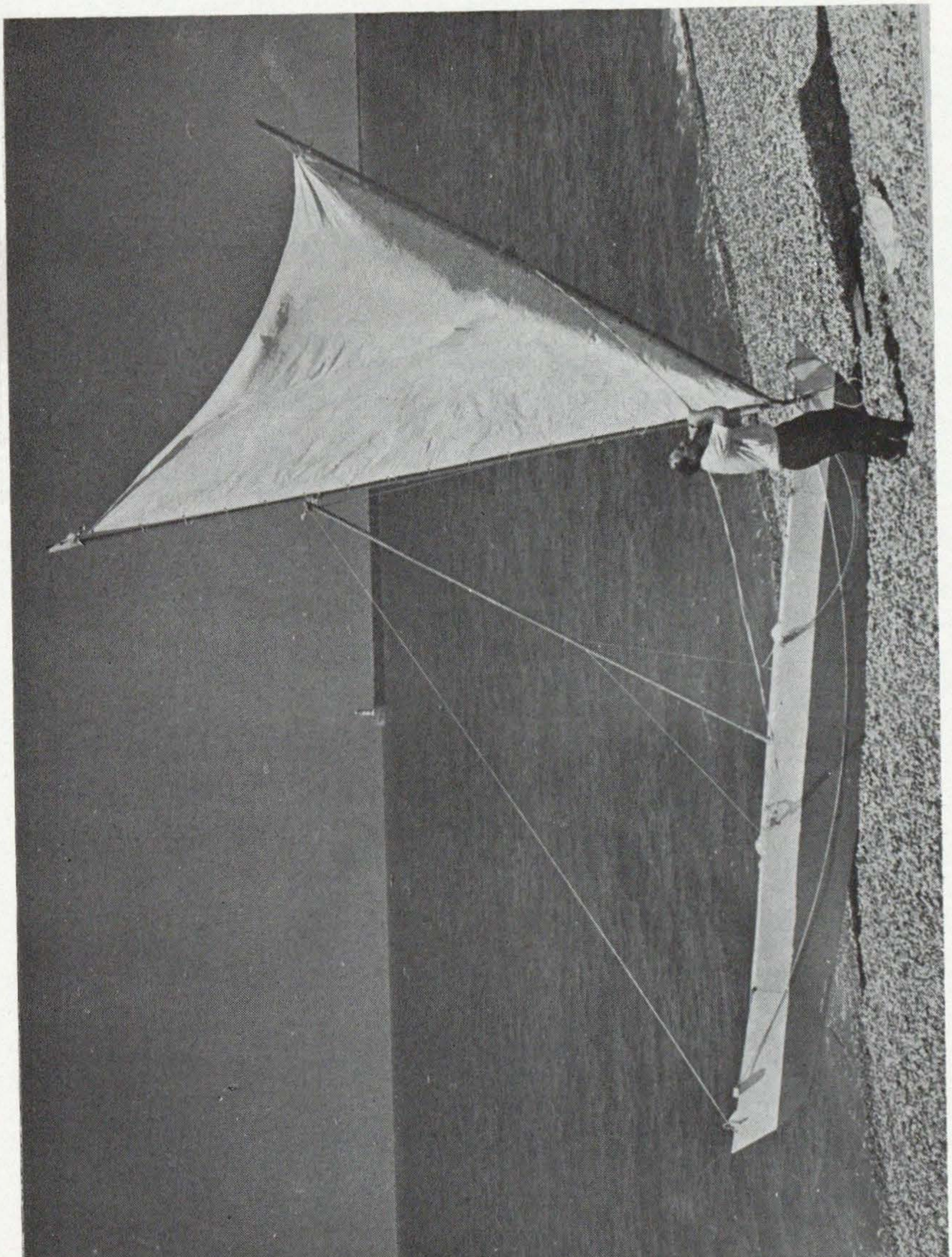
Initially steering was achieved in the traditional way with a trailing paddle which had to be moved to the opposite end when reversing. Later it was found that the three-part main hull construction could be modified to provide a



system of steering by moving the trailing end. As the boat normally tends to swing towards the outrigger, the ends were hinged down one side of the hull allowing about 30° of movement away from the outrigger. A tiller system has been arranged to allow locking of the front end while the rear is used for steering. For normal trim, about 10° of rudder is required, further adjustment being possible by moving the crew fore or aft. So far, this system has proved highly satisfactory.

Handling

Once it has been realised that the boat must neither tack nor jibe, there is little difficulty involved with the handling. With the float held firmly in the water the boat is exceptionally stable, and when changing ends, it seems to possess a stability which holds it cross-wind while the operation is being performed. It is only when the outrigger is being flown that difficulties arise because the boat tends to sail in a straight line. As I have found difficulty in shifting my own weight with sufficient rapidity, it is necessary to control the position of the float almost entirely by playing the sheet. In general, the longer the outrigger booms, the easier it is to control the float position. Initially the overall beam of *KIA KIA* was 11 ft, but due to a slight mishap, the boat is now being sailed with 1½ ft less beam, and although the float tends to be more twitchy, the sailing qualities seem unimpaired. To keep the overall weight to a minimum, the float was made as light as possible and therefore it is necessary for the crew always to bear down on it except in very light conditions. When sailing single-handed, I find that it is possible to operate the tiller with my heel while handling the main-sheet with both hands to obtain the best control. With two up, the most satisfactory solution is for one person to operate the tiller while the other controls the main-sheet and vice versa.



In general the boat is under-canvassed and it is only when the conventional dinghies are beginning to struggle that *KIA KIA* begins to move. In channel chop it gives rather a wet ride, not only due to the outrigger booms clipping the tops of the waves, but also, particularly on a very broad reach, due to the tendency for the float occasionally to dig in. As the main hull is bow-down surfing down one wave, the float may be still trying to ride up the other side of the wave causing the float to nose in. To reduce this effect, the float was cut in half and reconnected with several degrees of sheer.

Summary

Although *KIA KIA* is nowhere near the end of its development and is therefore not fully a practical proposition, it does possess some very enhancing features for a 20 ft long twin-hulled boat, such as:

(i) A ready to sail weight of about 170 lbf.
(ii) The ability to be housed along side a car in a 16 ft garage.
(iii) It is unsinkable.
(iv) It can be righted following a capsize.
(v) It can be assembled, launched, sailed, dismantled and loaded on to the roof-rack of a car by one person.
(vi) Seems to be very fast.
(vii) It is extremely simple to construct and
(viii) It has cost, to date, including modifications, something less than £40.

So far I cannot claim any amount of racing experience and there is no doubt that totally new tactics will have to be evolved. For example, the ability to "shuttle" at the starting line produces some intriguing ideas on gamesman-ship. Next year I am hoping to develop this side of the qualities of *KIA KIA*, which even now rarely fails to stagger the conventional dinghy man.

THE FLYING PROA – Advantages and Disadvantages

By Chris Hughes

Introduction

The following comments only concern the type of outrigger sailing craft in which the outrigger is always kept to windward, and excludes the "Polynesian type of outrigger."

General

There is little doubt that the flying proa is a fast sailing craft and comment to this effect is often made, but the reasons for their speed seem to be ignored, and the comments seem to infer that it just happens that way.

Weight

This, to my mind is the key factor. Providing the weight is very low, little buoyancy is required and hence a very narrow main hull can be used, presenting a minute frontal area with negligible wave-making capacity. Immediately

the overall weight is increased, due to one reason or another and the hull widened to provide the necessary buoyancy, the advantages of the flying proa are lost. In order to achieve this low weight, the float must be relatively light, and the rig allowed to rest on top of the boat, rather than be stayed hard down, necessitating a much stronger, and heavier hull.

Rig

It is significant that, although the Islanders for many years have had the materials to change their basic layout, they still persevere with the fully boomed pacific lateen configuration (which, incidentally, just rests on the canoe), presumably because they consider it to give the best overall performance, even though a loose footed sail would be easier to handle when reversing. In my limited experience, I am sure that, providing the rig is set well forward with the boom flying high, the rig is difficult to beat. The loose footed sail has to be sheeted and stayed very tightly inflicting heavy loads on the main hull. Also, it is very difficult to set a loose footed sail on a narrow hull without poles to hold the sail in position.

Reversing

This is probably the main disadvantage of this type of craft. As well as the mechanics of the problem, the boat has to lie across the wind and sea for some length of time which can be most uncomfortable in heavy weather.

Tacking and jibing

As the flying proa can do neither, it is particularly vulnerable to gusty and changeable conditions. If the mast is stayed to prevent it collapsing when back-winded there is a very great danger of an uncontrolled capsize when the float is pushed under the water. The boats manoeuverability is obviously limited and narrow river sailing is almost impossible.

Flying the outrigger

In order to reduce drag to a minimum and also give the boat the steadiest possible ride the outrigger should, if possible, be flown. However, this is a condition of complete instability and hence the position of the float has to be continuously controlled either by shifting ballast or by playing the main-sheet. Normally, on its own the float will lift with a very light breeze with a result that for a strong wind either additional ballast must be added, increasing the overall weight of the boat, or the crew must move out on the outrigger to provide the balance. It should not be forgotten that this condition is on the verge of capsizing and hence should be treated with considerable respect. The Micronesians can only sustain this sailing position when on long voyages as a result of years of practice and the experience of centuries.

Future

Away from the tropics the rigours of being perched on the end of an outrigger for hours on end may be beyond reasonable human capacity. This means that if it is intended to use a flying proa to its full advantage for offshore racing the crew would need to be very hardy. I would think that the most likely opening for the flying proa would be for day racing, when the occasional ducking would not be too much of a disaster.

Although we can obviously learn a considerable amount from the Islanders, we should use their experience as the starting point for development, and not, as we have tended to do in the past, build inefficient replicas.

LETTER

Dave Steele Petroleum Transport Services Inc., Singapore

Dear Dr. Morwood,

One of your AYRS members has now visited Red China, in a somewhat involuntary manner. I thought perhaps you might be interested in a few of the details.

I was sailing from Viet-Nam to Hong Kong, single-handed, on my 32 ft *HERALD* trimaran ketch, when captured by the Red Chinese in international waters off the coast of Hainan. My boat, the *LINDA NINA II*, got sunk in the encounter. I was taken ashore in Hainan, and spent the next month being interrogated and reading Quotations from Mao Tse-tung, prior to being released over the border to Hong Kong.

I had just been finishing up a four-year assignment as Supply Manager with Esso in Saigon, and had built the trimaran with the thought of sailing it up to Japan on my 2½ month bi-annual vacation. After spending a few weeks of vacation completing the fitting out, however, time was growing a bit short, so I finally decided to limit the cruise to a circum-navigation of the

South China Sea—to Hong Kong, then down to Manila, and finally back to Singapore, which was to be my next posting with Esso.

On Sunday, August 6, I left Saigon for Danang, accompanied by a friend, Warren Blake. Warren was an old trimaran enthusiast, having arrived in Saigon a few years previously on the *EDWARD BEAR*, a *NIMBLE* model out of New Zealand, after having cruised about the South Pacific for a year or so. Since I had never done any degree of sailing to speak of, let alone single-handed deep-sea cruising, I got Warren to go along on the trip up the coast to show me the ropes.

The boat sailed like a real princess. We made the first landfall at the Poulo Cecir de Mer Islands early the next morning and reached Cape Padaran that afternoon, after a first day's run of 170 miles, with a steady twenty knot southwest wind on the quarter. The rest of the week the wind slacked off to practically nil, however, in spite of cheery and unvarying Force 3/4 wind forecasts out of Hong Kong, and we limped our way up the coast with slack sails, arriving a week later at Danang. During this time I gained enough experience with the boat to give me confidence to take her on to Hong Kong alone.

After a few days in Danang for reprovisioning, I took off for Hong Kong. The first night out, a roughly easterly course was about the best I could get out of the self-steering with the prevailing wind, and next morning found me about 40 miles ESE of Danang. The wind shifted during the morning, and by afternoon the sea was up to choppy six-foot swells, and the skies were overcast. I got the wind-vane shifted over to hold a rough northerly course, bucking the swells and about a twenty knot wind from the northwest, and we pounded and banged into the sea all that afternoon and throughout the night. I was getting the fringe effects of Tropical Storm Iris, which was passing between Hainan and Hong Kong at that time.

On Thursday morning I awoke to moderated seas. Dead reckoning put me about forty miles south of Hainan. Presently the highlands of Hainan came into view, and I sheared off to the east, with the intention of keeping at least 20 nautical miles between me and the People's Cultural Revolution. I held off on changing course as long as possible, since the shift to an easterly course put the wind on my port quarter, and I was obliged to attend the helm full time.

About noon I was passing the southernmost point of Hainan, when I was accosted by two Chinese fishing trawlers. They were about 150 ft long, black and plastered all over with red Quotations from Mao. They came alongside, pointing rifles and sub-machine guns, and forced me to turn inward toward Hainan. Once we had gotten into Chinese waters, a few hours later, they again came alongside and forced me to approach. A dozen men were aiming rifles at me over the gunnels as I drew closer; one was manning a .30 calibre mounted machine gun on the poop deck; and another was readying several hand grenades. I thought I had *had* it, then and there, but apparently this is their way of playing at war games. At any rate, while waiting to be liquidated, I paid somewhat less than usual attention to the steering, and gave them a good belt amidships with the port float of the *LINDA NINA II*, as a result of which the tip of the float sheared off. As I slewed up alongside the trawler, a half dozen Chinese swarmed aboard, piratical looking types, and hustled me aboard the trawler. After searching me, they put me under guard in the forecastle, where I was kept prisoner overnight.

Meanwhile, the float of the *LINDA NINA II* became filled with water. They took her in tow at about 12 knots, and in the fairly rough seas she soon capsized. They continued to tow her upside down, and eventually she broke apart. They are not designed to be towed upside down at 12 knots.

I spent a somewhat nerve-wracking night in the forecastle. During the night the trawler came in to moor at Hainan. They took me ashore the next morning, fittingly blindfolded in nautical manner with the No. 4 numerical pennant from the trawler's flag bag. They put me in a truck and took me to some inland location, where they spent the rest of the afternoon interrogating me. That night we moved to another location, which I inevitably dubbed the "Hainan Hilton." Apparently they had dredged up a team of about half a dozen interpreters, mostly university students, along with several political types, to accompany me in the villa. I had a pretty comfortable room with two (somewhat sagging) beds and an adjoining bathroom. On the whole it was not too bad, although I got awfully fed up with eating rice in the month that followed.

For the first week they questioned the daylights out of me, and for the three subsequent weeks they bored the daylights out of me. The questioning took the form of daily interrogations before a Committee, for about three hours every afternoon. Questions ranged over my entire life, from time of conception up to the time I was accosted in Chinese waters. They spared no detail, but since I had nothing to hide it was not too gruelling, and at times almost a welcome break from what was otherwise boredom.

For two weeks thereafter I sat on my heels, reading Peking Reviews, Quotations from Mao Tse-tung, China Pictorials, and a variety of essays by the Great Red Father. When not occupied in perusal of this lively reading matter, I was invited to participate in so-called "free discussions," which usually dengenerated into long polemics on the US aggression in Viet-Nam, the American support of Chiang Kai-chek and his running dogs of US imperialism, the British fascist atrocities in Hong Kong, the Ne Win military regime in Burma, the Indonesian oppression of the Chinese, etc. It seemed they didn't like anybody except Albanians. Even the Russians took a good drubbing for their revisionist betrayals of pure Marxist-Leninist principles.

At the end of three weeks they woke me up in the middle of the night to sign a confession of my sins, and the next day shipped me off to Canton on a plane. I sat in the Canton airport hotel for another week, cooling my heels while "further details of my story were being checked." Finally, one happy Tuesday, they called me before a small Military tribunal, who read off an indictment of my transgressions (violating Chinese territorial waters and running into a vessel of the coastal militia), and announced that I would be "extradited" effective immediately. They put me on a train the same morning, and after a five hour ride we arrived at the border at Lo Wu, where they put me across the bridge. That Union Jack on the British side had never looked so good to an American since 1776.

And so I returned to the West, 15 pounds lighter, a bit scruffy, and with a month-old beard which I had been assiduously cultivating. For a day or two I was the toast of the Hong Kong press, which apparently didn't have much else to report on at the moment, and was subjected to exhaustive interviews, press conferences, and various stints on TV. After all of this was over, and I had gotten a new passport, etc., I retired to Japan for the final week of my "vacation," to relax in the placid atmosphere of Nikko prior to resuming work at my new assignment with Esso in Singapore.

I have since summarized it all in a book, *To China and Back*, which hopefully may see the light of publication one of these days. It was a somewhat unusual personal experience, and seemed to warrant a written account.

I am back to boat building again (some people never learn), this time a 31 ft plywood keel sloop, which I hope to launch next spring. This time I am looking at a trip to Borneo, Bali and Christmas Island, in hopes that the Indonesians prove to be less aggressive to casual yachtsmen than the Red Chinese.

Best regards,

Dave Steele

Bjorn Enqvist Karlberger v 68III 113-35 Stockholm, Sweden

11th October, 1968

Dear John,

I wrote you half a year ago about our trimaran, which we launched in June. Since then we have cruised and raced a lot this summer. We are very pleased with the performance, especially in light winds, though she does move when it blows.

The hulls are basically from Jim Brown's 25-footer, in GRP. Beam and beams, superstructure and rig are quite different.

We find the arrangement with an aft cabin with two bunks on the wing-deck, central cockpit with the centreboard under the sole, a pantry forward and then a good bunk superior—at least with a good sprayhood. You get most of the weight amidships.

In light winds there is hardly any boat which can beat us. We have sailed right through *RORC IV* to windward in heavy winds.

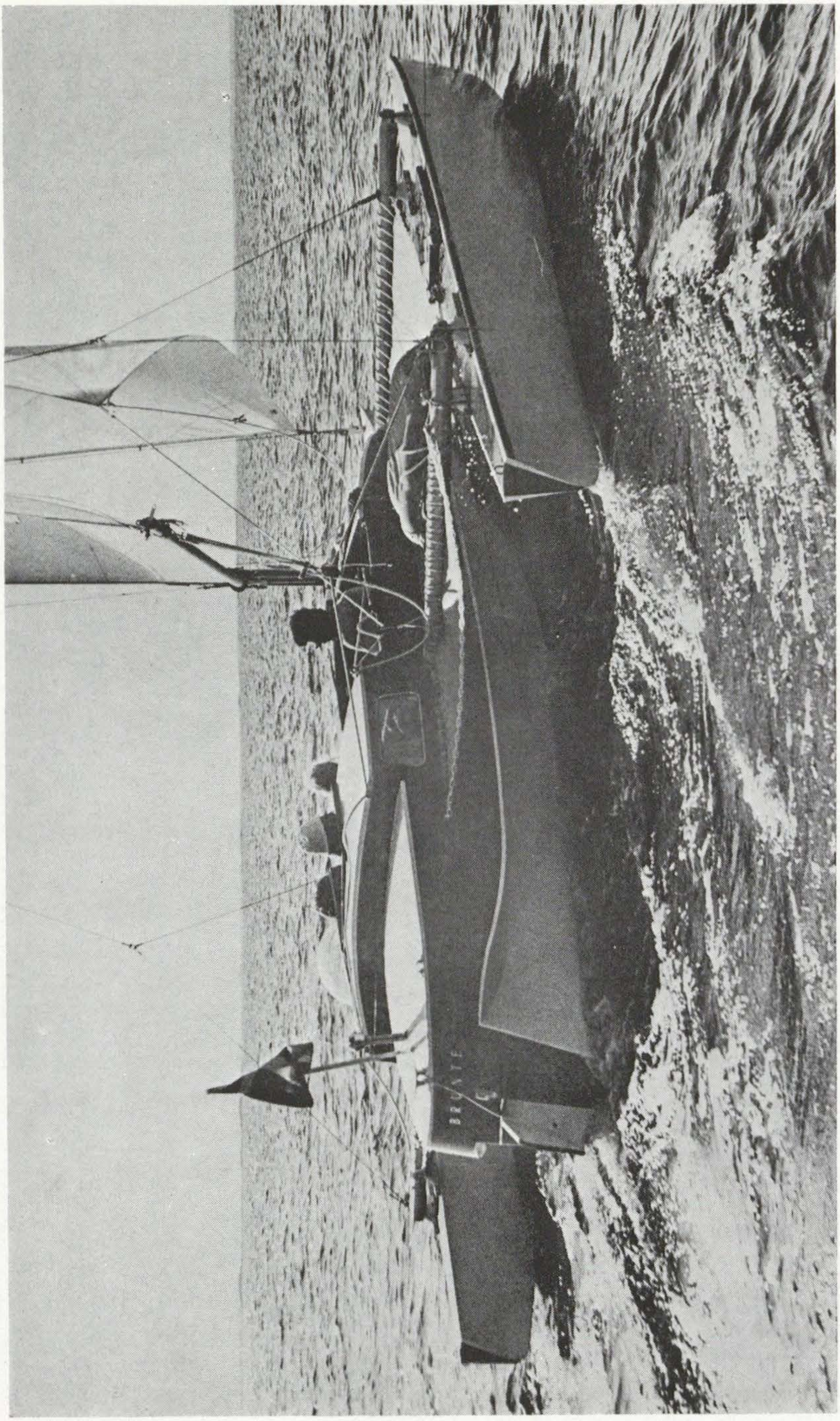
The problem with aluminium beams and stays is to get a rigid construction. When the lee rig slackens, and if the weather pontoon hits the water, the rig shakes.

Anyhow, I think this basic configuration with central cockpit, stern cabin and the rather big beam is the best for *this* size of trimaran—if you want to make them comfortable to live in.

The AYRS windsock which we have on the masthead is perfect as a wind indicator, but people in Sweden don't seem to realise what AYRS means!

Best regards,

Bjorn Enqvist

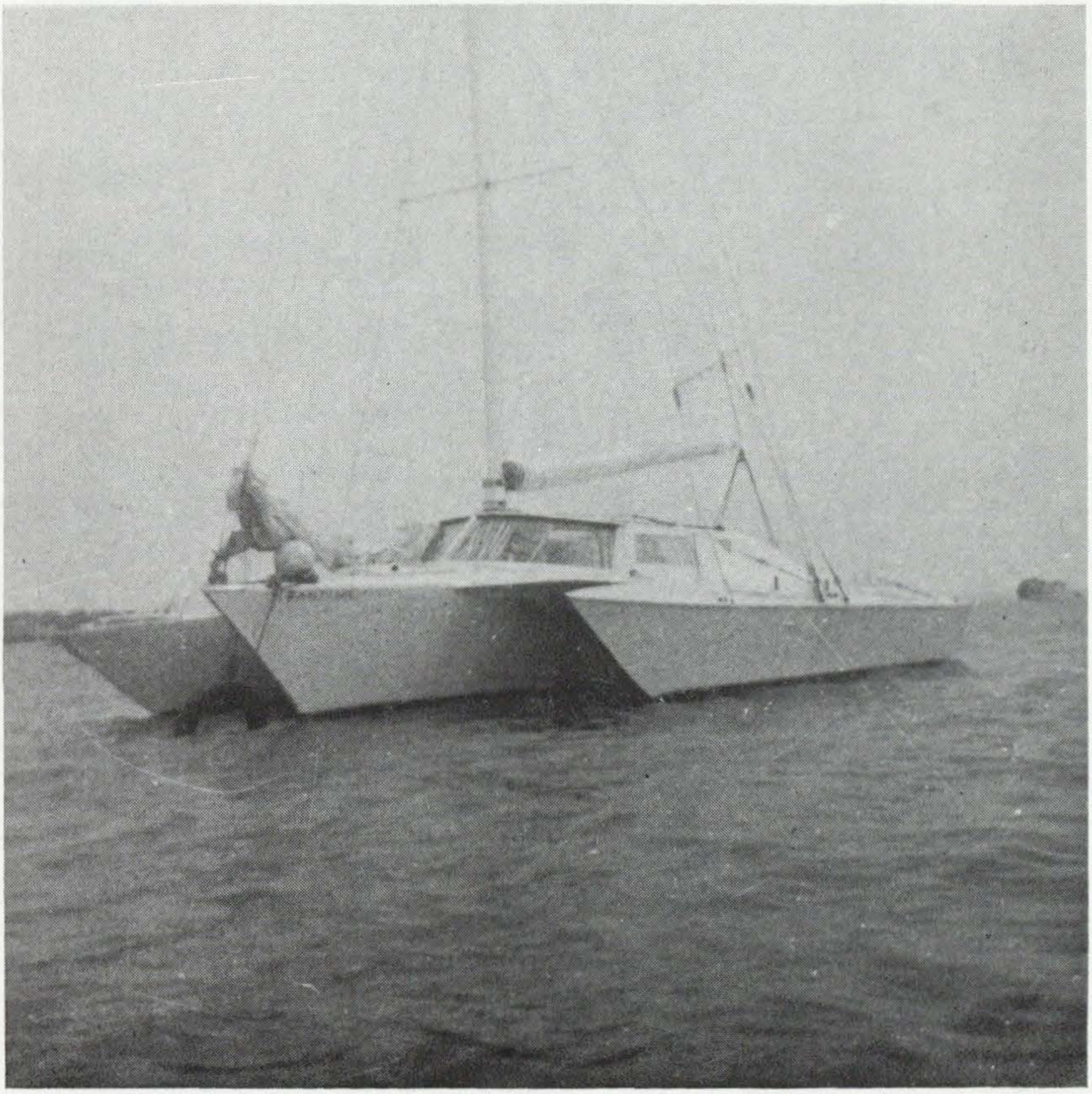


Bjorn Enqvist's trimaran

D. J. Cousins 'Kastanjes,' Lyddons Head, Chard, Somerset
17th December, 1968

Dear Mr. Morwood,

You may recall printing my letter in AYRS Publication 52, TRIMARANS 1964. Briefly, after 2½ years of construction in somewhat adverse conditions I am now the proud skipper of my 28 ft ocean cruising trimaran *ZANTINE*. As promised at the time, I am sending you all available information and we have to date approximately 190 miles on the clock.



Zantine

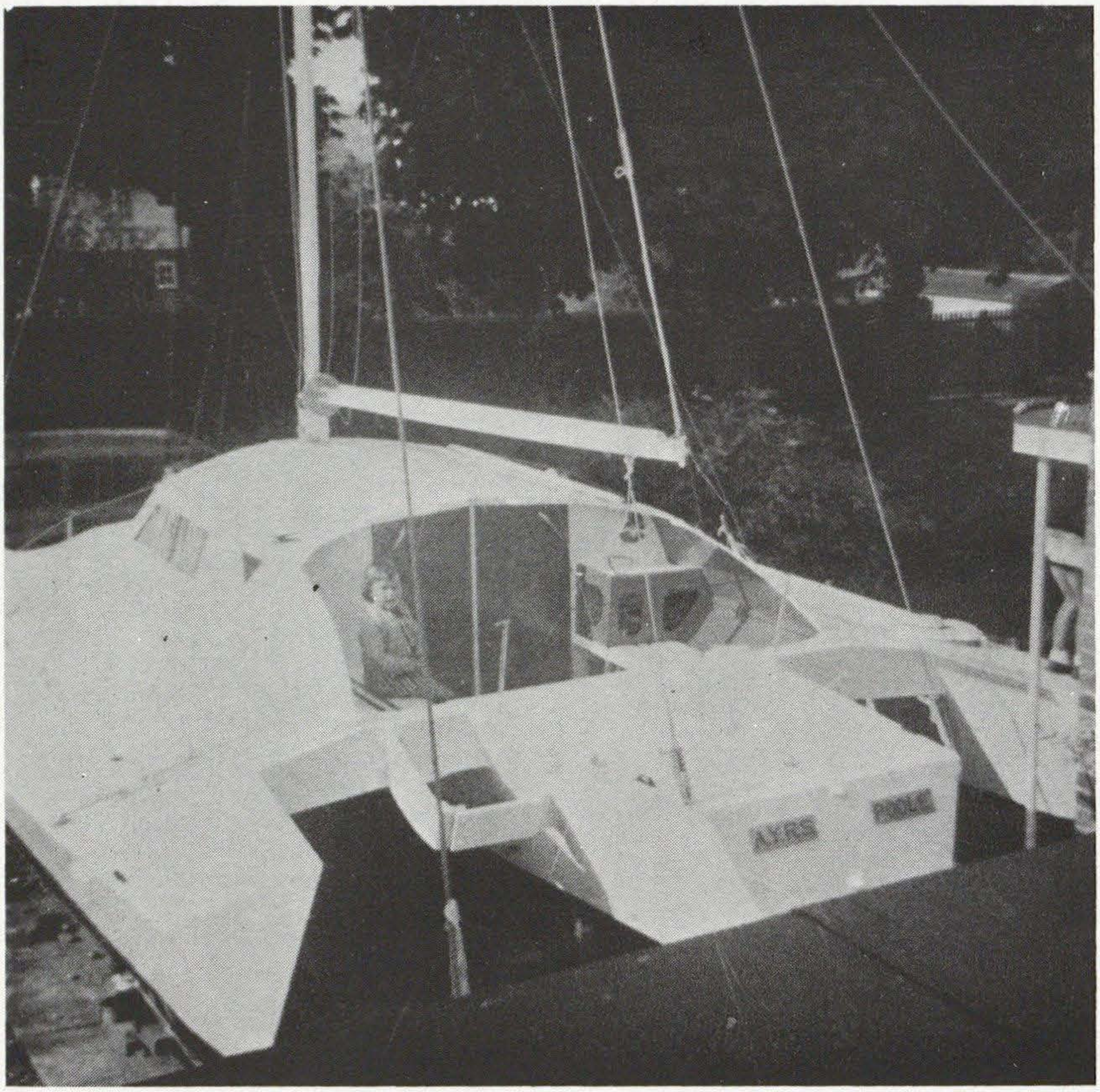
I must lay credit where it belongs by saying firstly, I am very grateful for the constructive criticism and advice I received from your good selves, and secondly the inspiration I received from our lost pioneer Arthur Piver, it makes us all very sad at this loss.

After many hours at the drawing board and studying AYRS publications, *ZANTINE* was designed.

Construction started in January 1966 under the following conditions. Lack of capital, a few hand tools, spare time of approx. 20 hours weekly, my skill as a woodmaker, professional engineering experience, a small 20 ft by 9 ft garage and a canvas sheet, plus a front lawn.

During construction, No. 1 priority was safety of the completed craft and no dubious components or construction were to be tolerated, as ocean cruising is the objective, with the ultimate of a family ocean passage to New Zealand "sometime." I'm no seaman as of yet.

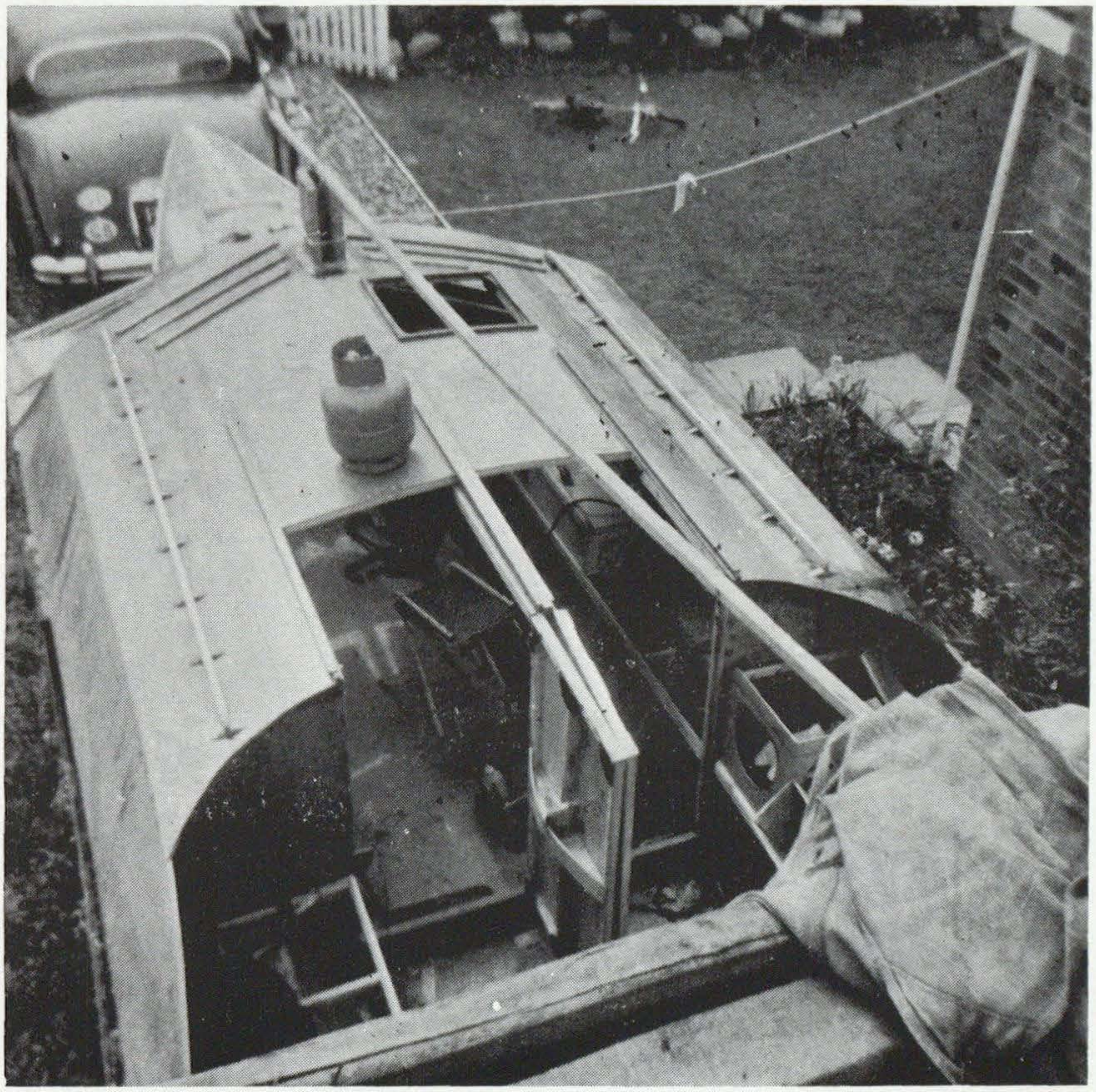
Therefore, the result was, after 2000 labour hours "solo", the craft safely in Poole. The cost was £246-9-0 including trailer, sails, outboard, cooker, toilet, rigging etc. All keels, chines and stringers were sawn by hand, all



fittings were cast in my own private foundry, some fittings went to one of your members on trial on his 20 ft cat and consequently passed "A, OK." In fact many fittings I designed are in use now. My dirt cheap prices and sound design seem to have paid off. The building of this tri has been a technical education in itself.

On design of the craft we have masthead, foredeck and twin cabin hatches, twin doors "lift off," self draining cockpit, low aspect retracting float fins, International Dragon sails, high aspect drop rudder, silicone rubber cross arm shock absorbers, fore and aft cross arm guard rails incorporating a tensile strength of 3 tons, under-wing stainless crossarm float/hull struts reinforcing the 9 in deep crossarms. Skin is $\frac{1}{4}$ in marine ply throughout, glassfibre sheathed to deck level. The mast is 32 ft box beam.

On performance, it would appear that the marriage of the float design, rig and hull is ideal. Tacking is effortless with the deep, balanced rudder even in rough water at force 5-6. Sitffness of helm slightly increases with wind speed. We have out-manouvered a *BOBCAT* 8 on two occasions, also sailing closer to the wind. I continually forget to drop the float fins, so it must be said that the 50° floats really do their work, one can sit on the foredeck and see the floats knifing through the water with no visible wave making in the tunnels. The craft just wants to go straight. A recent experience was to sail with a 25 ft ocean cruising monohull closer to the severe headwind prevailing at 8-9 knots. I had a glass of squash beside me on the after crossbeam, while the monohull was guardrails awash, and her crew were hanging on



with their fingernails—just another example of multihull sailing stability. We have made a few more conquests here. At first the locals pretended we were not there. Now, six weeks later, having shown our heels to so many, they come alongside to see 'what the hell makes us tick.' Forgive my enthusiasm, but after only six weeks afloat, all the splinters, blisters and 'glass-fibre itch,' not to mention near frosbite, have been worth it.

Reading designers detailed accounts, experience etc., and trying to draw an overall conclusion as to the best tri is a fascinating subject. I have obviously formed my own impressions—being a relatively experienced trimaran 'driver' by now.

1. The Piver wide-beam veed floats are ideal for ocean cruising provided they are long enough, both slightly immersed (9 in), and that the hull has a good rocker to pivot on. Rough water riding involves no pounding, however the design must not be altered too much upsetting the aerodynamic and hydraulic balance.

2. Round-bilged narrow-beam flying floats (*TORIA* and *KRAKEN* 33) are designed on slightly different principles, and again are ideal providing a high aspect centreboard is used, whereas the Piver craft really don't use fins for preventing leeway but for tacking. I believe the round bilge flying floats are faster due to reduced wetted surface, but are less sea-kindly when it gets really rough.

So really it all boils down, I suppose, to 'you pays your money and you takes your chances."

Yours sincerely,
D. J. Cousins

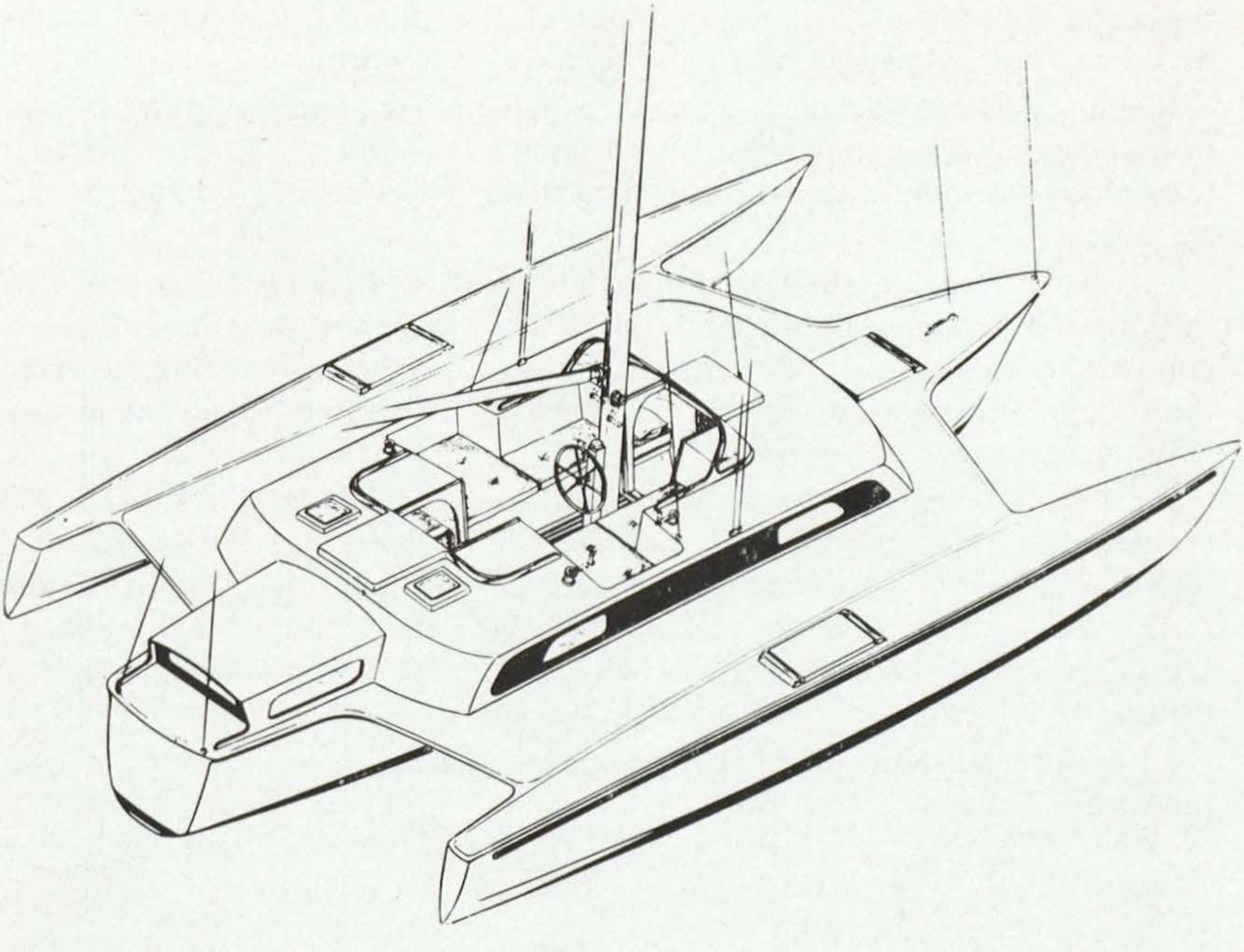
BROWN 17 — Design No. 107

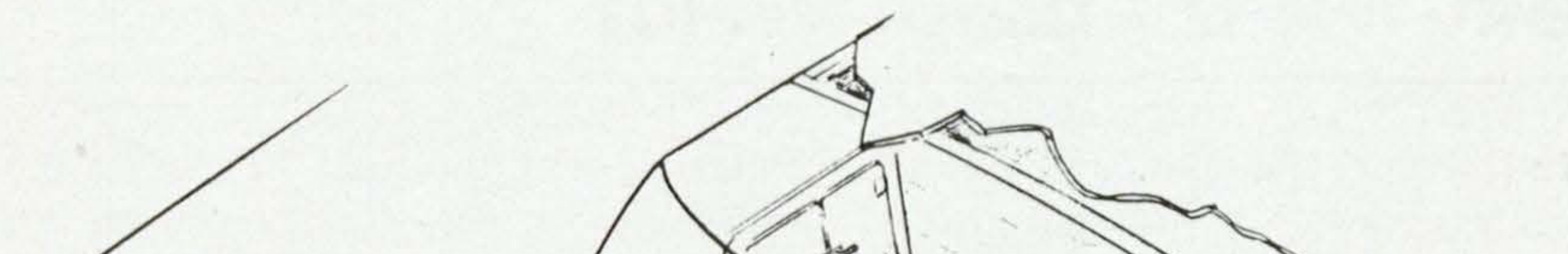
Introducing the new combination of cutter rig with the mast stepped in the central cockpit, this design promises both increased performance and greater ease of handling. The cabin arrangement offers a truly livable interior of separate-use areas with many features to gain privacy and spaciousness.

Accommodation

The key feature in the cabin layout is the central cockpit which divides the boat into two private cabin areas. There are two "sleeping cabins" which afford access to four wing bunks (each converts to form a double or single bunk). The bunks are arranged beside the cockpit so that there is sitting headroom over the head of the bunks. The sleeping cabins contain settees and large lockers under the cockpit.

Adjacent to the after sleeping cabin is the galley and lounge area in the sterncastle. This is a very generous space which includes a double galley which reaches the full width of the superstructure. There are two large counter spaces, one on each side, with stowage lockers and refrigeration space outboard of the counters in the wings. The lounge is just astern of the galley. It is a five-place dinette with deep seats, a nice table, and all-round eye-level windows. This sterncastle arrangement with galley and lounge is made possible by the absence of the usual cockpit, which now allows the entire stern of the boat to be used for accommodation.

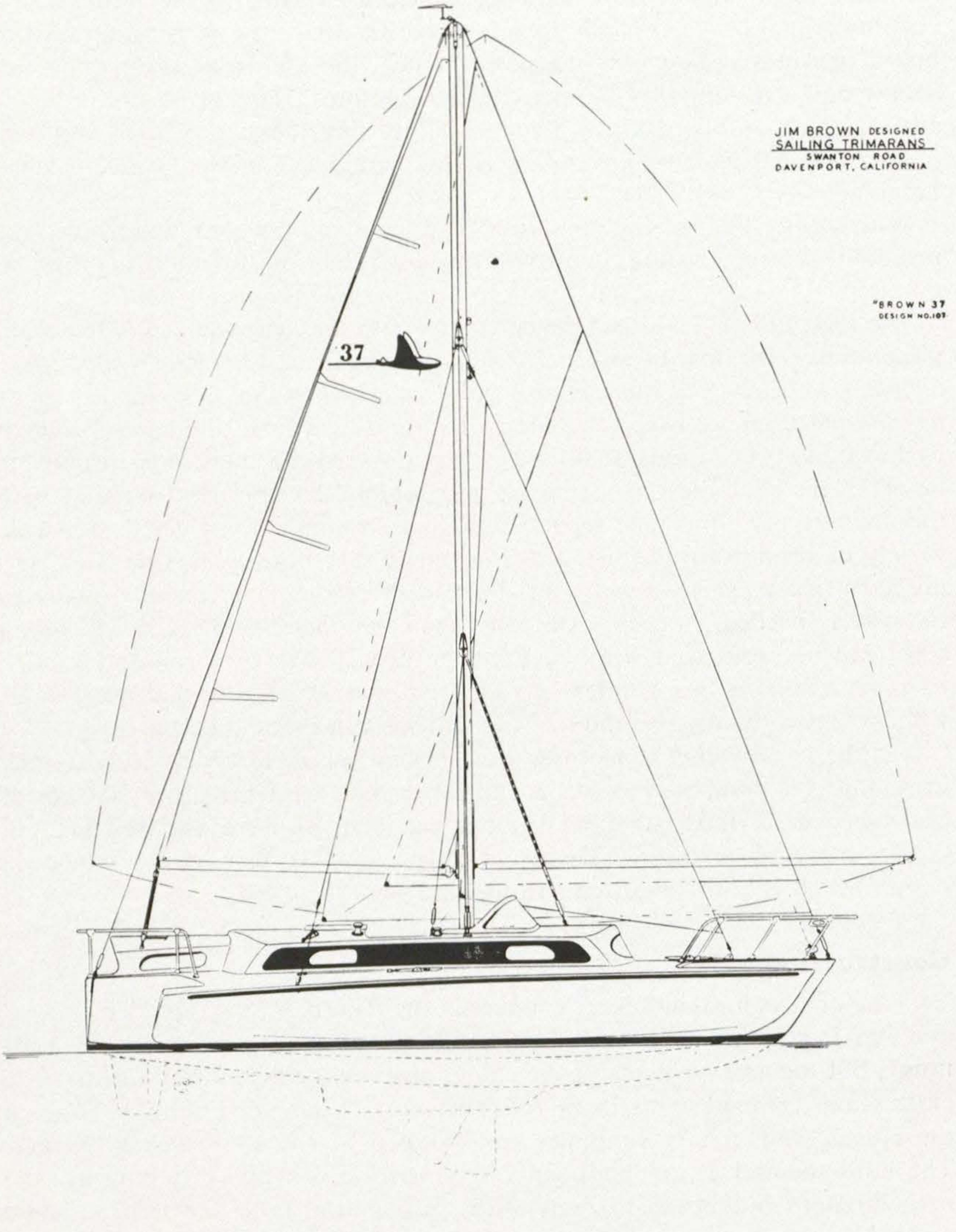




STERNCASTLE-LOUNGE & GALLEY

In the forecastle, a dressing table with lavatory and seat has standing headroom. The head is under the forward hatch. Passage through the accommodation is facilitated by large cockpit hatches and 6-foot-high passways through the main strength bulkheads. No ducking under beams!

The cockpit itself serves to greatly extend living space. It affords comfortable, well-sheltered deckside lounging and can be enclosed by a dodger while sailing, or covered with a large harbour boomtent. The accommodation as described, is intended to make the *BROWN* 37 the smallest practical family live-aboard trimaran.



Performance

If you contemplate competitive sailing, the *BROWN* 37 gives you a chance to win. The high-aspect sailplan carries 730 square feet. The double-chine main hull affords great load-carrying ability with low wetted surface, and the asymmetric outrigger further emphasizes speed. But the importance of performance to the *cruising* sailor is often overlooked. It develops that comfort, safety, and ease of handling—these features being of prime importance in cruising—are actually features of performance.

A boat which is truly comfortable (in terms of accommodation *and* motion); truly safe (in terms of seaworthiness *and* carrying capacity); and truly easy to handle (with positive steering and a versatile sailplan) . . . will also be *fast*. Comfort, safety and ease of handling are closely related to *performance* in a cruising trimaran. Especially in *this* trimaran where the large, deep centre-board provides peak windward performance (the ability to drive off a lee-shore) and substantially dampens lateral motion. The pivot centre-board and the deep outboard kick-up rudder afford firm steering control and they protect themselves from grounding, giving confidence in shallows and when beaching.

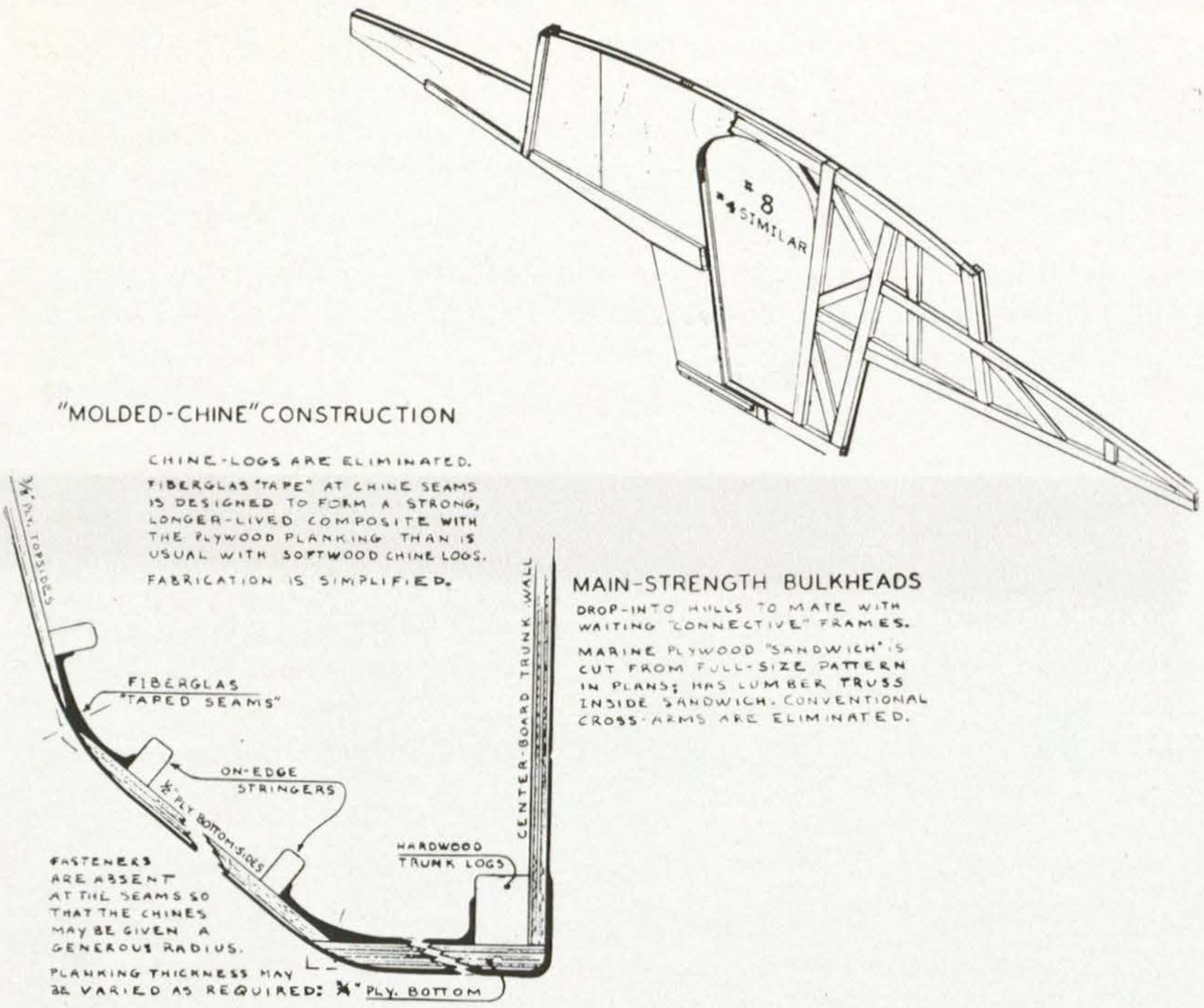
With centre-board, engine, tanks and crew all located amidships, the resultant central loading improves fore'n'aft motion by reducing inertial gyration.

The most unique feature is the cutter rig, with the mast stepped *in* the cockpit, on the centre-board trunk. *The helmsman has access to all lines and fittings including halyards and roller-reefing gooseneck and the self-steering vane may be adjusted from the cockpit.* The cutter rig differs from the sloop or ketch by having two head-sails of different sizes on separate stays, one behind the other. The boat may be operated with both sails at once (together with the mainsail) or either one separately. Sail area may be adjusted to a wide variety of conditions by raising or lowering either headsail. This is accomplished *without changing* sails: the downed sail remains *on its stay*, ready to re-hoist as needed. Because the mast is *in* the cockpit, many sail-handling steps can be performed without going on deck. The trimaran cutter, with its great available beam, offers a wide platform for rigging and sheet leads which relieves the disadvantage of the cutter rig in monohulls.

It is the *combination* of features which make the *BROWN* 37 truly unique in sailing; the combination of the central cockpit with the other features of centre-board, divided cabin, and cutter rig. All of these are well proven, firmly accepted features. Their composite in this trimaran produces a design which is both advanced and mature.

Construction

Two major structural differences appear in the *BROWN* 37: "moulded chines" and "main-strength bulkheads." Sheet plywood planking is used for economy, but the arrangements of the chines gives very efficient hull forms. The chine seams are made with fibreglass. This allows a generous radius to be given the chines, and greatly simplifies construction of the sophisticated shapes. The hulls themselves are built separately, then joined by "dropping in" the main-strength bulkheads to mate with waiting frames in the hulls. These



bulkheads are of sandwich construction, plywood sides with lumber truss inside, yielding great inherent strength and stiffness while being light and easier to build than cross-arms.

Other structural differences favouring simplicity and strength are: midships wing bulkheads; constant framing interval; "combination" frames to establish the interiors; and frequent longitudinal stringers laid on edge. The construction method in the *BROWN* 37 favours both amateur and professional builders. Materials cost and labour time are reduced by design to yield a yacht which is aesthetically pleasing and practical for racing, living aboard, and cruising.

Plans and costs

Plans for construction are to our usual high standard. Full-size patterns for all frames, including wing and superstructure, are included. Working drawings are uniquely complete and detailed. There is a lengthy step-by-step instruction manual with construction photographs. The designer's fee is $400. Cost of construction varies greatly, but based on an approximate cost analysis, the owner-builder may expect to invest $8,000 in materials for the basic "sail-away" boat.

Ralph Farrant

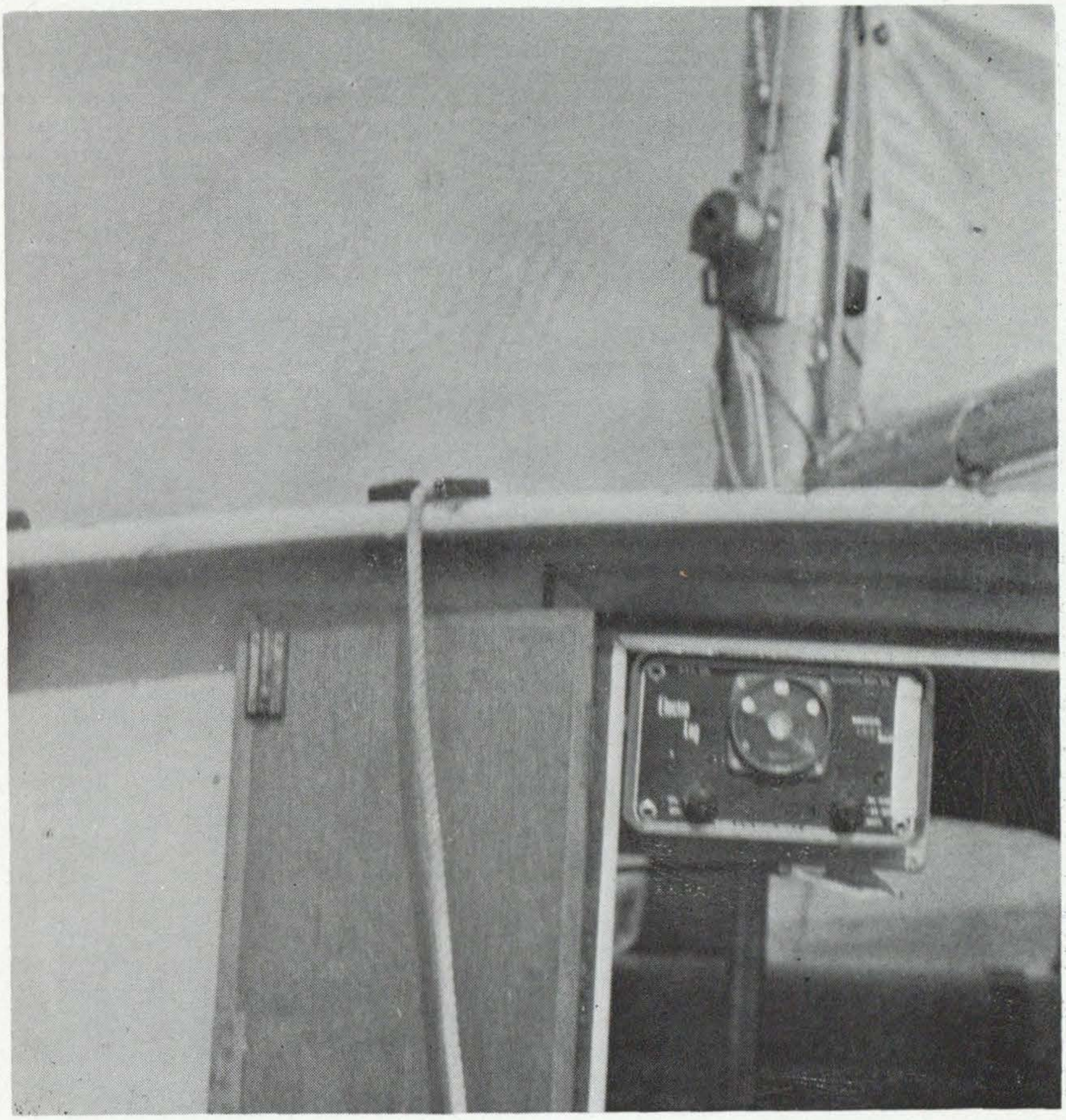
King's Acre, Grange Road, Wareham, Dorset

9th October, 1968

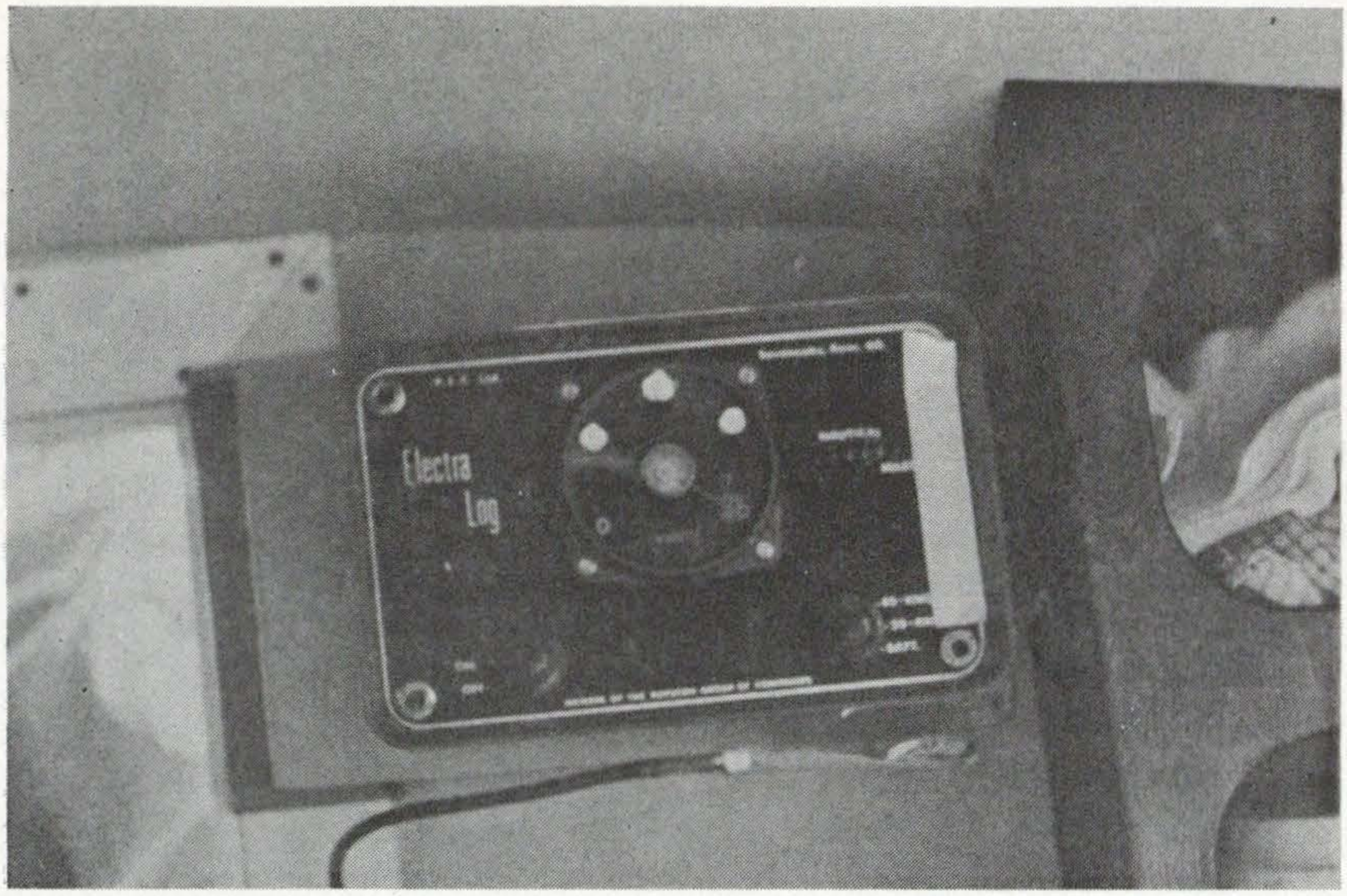
Dear John,

TRIFLE

I wonder if I am in time to catch your much belated Trimaran issue? In case I am, I enclose a couple of photos, taken on different occasions, of *TRIFLE'S* Electra Speedometer reading 20 knots.



Multi-hull enthusiasts, on the whole, tend to talk too much about the astounding speeds they achieve, with the result that the keel yacht fraternity disbelieve all claims. I thought it would be of interest to publish these photos.



TRIFLE continues to give me great pleasure and to behave in an exemplary manner. I think I can claim that she is the fastest cruising multi-hull in England, after being the first home in this year's Crystal Trophy, by a comfortable margin. By the way, we need some new entries for next year's race.

Ralph Farrant

MULTIHULL CRUISER RACING IN 1968

R. H. Farrant

King's Acre, Grange Road, Wareham, Dorset
March, 1969

Last year's programme for Cruising Multihulls was rather limited, there being only two main events—Round-the-Island and the Crystal Trophy around the Wolf Rock via Cherbourg. The Lymington Town Sailing Club included Multihulls in their Hamble Scramble and this brought in a few entries. An invitation to join in the R.O.R.C.'s Morgan Cup race was unfortunately issued too late for most craft to be able to arrange to compete.

However the I.S.C.'s Round-the-Island race was very well supported; 27 multihulls started and 25 finished. The Island was, of course, the first club to include a multihull class, originally a catamaran class and Don Robertson's *SNOW GOOSE* holds the record for the shortest time around the Isle of Wight.

His record was not in danger in 1968 because of the variable wind which started as a light Northerly, gradually freshened to moderate N.E. and then died away through S.E. to almost nothing, before coming in light to moderate Southwest.

The Multihulls started last, as usual, 15 minutes after the other four hundred yachts and among the 27, in order of rating, were *MIRRORCAT*, *PELICAN*. *TRIFLE*, *SNOW GOOSE*, *SWINGALONG*, *TOMAHAWK*, *TRINCULO* and right at the bottom in rating, *SAFARI OF MEON*, the winner on corrected time.

At the Needles, *TRIFLE* and *MIRRORCAT* were leading their class and had passed about half the earlier starters. *TOMAHAWK* lost her wind under the cliffs for a time while these two were overhauling the leading monohulls, close reaching towards St. Catherine's Point. Here *TRIFLE* lead the whole fleet, ahead of *PHANTOM*, *CLARIONET*, *SUNMAID V* and *DRUMBEAT*. At Bembridge Ledge, in very light airs, the order was *PHANTOM*, *TRIFLE*, *MIRRORCAT* and after several more changes these three crossed the line in the order *PHANTOM*, *MIRRORCAT*, *TRIFLE*.

The elapsed times and leading places on corrected times were:—

	hrs.	min.	Corrected Position	
Mirrorcat	9	13	9th	Multihull
Trifle	9	14	5th	Multihull
Phantom	9	24	2nd	Division I
Tomahawk	9	30	2nd	Multihull
Sunmaid V	9	36	1st	Division III
Breakaway of Parkstone	9	55	1st	Division I
Trinculo	9	58	3rd	Multihull
Safari of Meon	10	08	1st	Multihull
Melody of Wight	10	19	5th	Multihull
Catapult	10	20	4th	Multihull
Olgina	10	36	1st	Div. VIII & Winner Overall

It is interesting to note that the elapsed time of the 52 foot ocean racer *PHANTOM* was 11 minutes more than that of *MIRRORCAT*. However in the light conditions, the smaller, low rating craft did best in all classes and indeed *SAFARI OF MEON's* corrected time was 2½ minutes less than that of *OLGINA* the Galion Class overall winner.

Lengths and details of the above boats are as follows:

Mirror Cat	40ft 'Comanche' Class Cat, designer Macalpine-Downie.
Trifle	42ft foam sandwich tri, Kelsall & Farrant. (AYRS 65).
Phantom	57.5ft Camper & Nicholsons ocean racer, owner Pettingon.
Tomahawk	30ft 'Iroquois' Class Cat, by Macalpine-Downie, owner Tinsley & Isked.
Sunmaid V	37ft Sparkman & Stephens 1 ton Cup ocean racer, owner Bowler.
Breakaway of Parkstone	41ft Parker ocean racer, owner L. Smith, sailed Latham.
Trinculo	30ft Musters' 'Triune' Class tri, owner Ker.
Safari of Meon	22ft prototype 'Hirondelle' Cat, designer Hammond.

Melody of Wight	30ft 'Iroquois' Class Cat, owner Bone.
Catapult	30ft 'Iroquois' Class Cat, owner Passmore.
Olgina	22ft Hannay 'Galion' Class keel boat cruiser.

Crystal trophy

The second B.P. Crystal Trophy from Cowes to Plymouth, via Cherbourg and the Wolf Rock attracted fifteen entries, but, unfortunately, Eric Tabarly's *PENDUICK IV*, the only exciting new entry, failed to reach the starting line.

However the weather itself provided plenty of interest and a quick race for the faster craft, in spite of a slow beat across the Channel on the first leg of the course.

TRIFLE and *MIRRORCAT* lead the fleet at the Nab which was reached 3½ hours after the start and this order was maintained to C.H.1 Buoy off Cherbourg 10¼ hours later, twice the time taken in 1967.

MIRRORCAT's large mast-head spinnaker drew her past *TRIFLE* soon after, but during the night the wind veered so that the course became close hauled after passing the Casquets.

TRIFLE reefed early next morning as the wind increased to Force 5/6 and the sky looked as threatening as the weather forecast, but the promised gale did not materialize. In fact the centre of the depression passed up the Channel, so that *TRIFLE* had a "drifter" set for half an hour and *SWINGA LONG*, astern and a little to the North, reported several hours of light following winds.

In the afternoon the wind came in N.W. Force 5 and *TRIFLE* made fast time from the Lizard to the Wolf Rock, a wet leg just free, in bright sunshine. She was first round in 18.25 and identified *MIRRORCAT*, well down to leeward and, later, *PELICAN*, under reduced sail still heading for the Wolf.

TOMAHAWK rounded fourth and along with the leaders reported a most exciting ride back to Plymouth, with a Force 5/6 Northwester chasing us home, giving speeds of 18 to 20 knots at times. At these speeds the apparent wind was just ahead of the beam and there was enough sea to test the watch below as well as the one on deck.

TRIFLE finished first with an elapsed time of 41 hours 6 minutes for the 305 mile course. *MIRRORCAT* finished 20 minutes later, followed by *PELICAN*, *SNOW GOOSE* and *TOMAHAWK*, the latter saving her time on *TRIFLE* by 20 minutes to win the Crystal Trophy for the second time.

The rest of the fleet had a hard beat to reach the Wolf, with the result that there was a large gap, but *SWINGALONG* and *CATAPULT* finished in good time for the reception at the Royal Western Yacht Club at which Sir Alec Rose presented the Trophy and prizes; the others became discouraged by the weather as forecast and retired to various ports on the way.

Crystal Trophy, besides those already described:

Pelican	45ft Prout designed & built Cat, owner Bennett.
Swingalong	30ft Westell 'Swingwing' Class, folding outrigger tri, owner Heseltine.

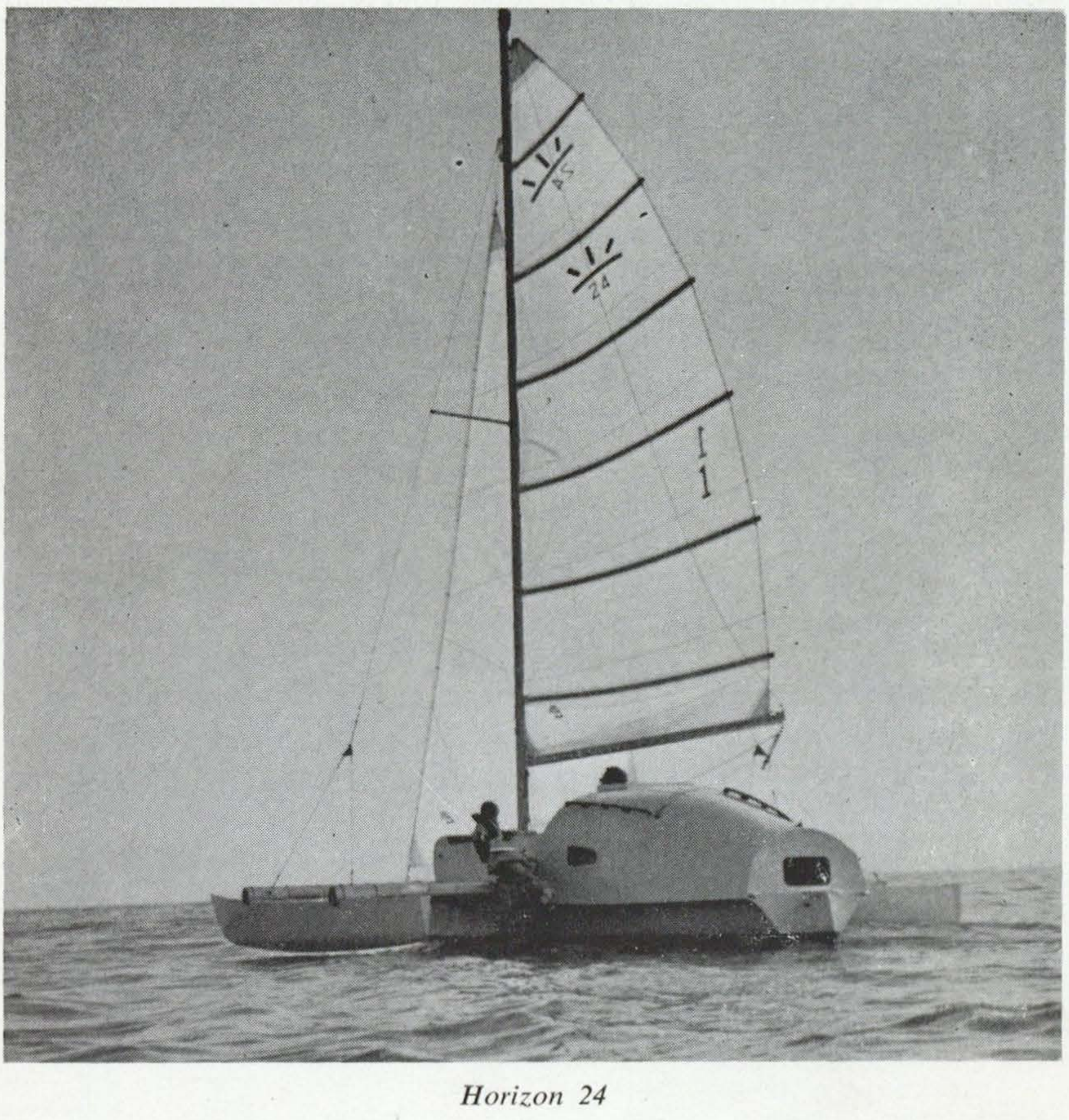
HORIZON 24

by Peter Hart

Designer: Dick Newick
Builder: Horizon Boat Company 326 Rosebank Ave., Baltimore, MD, 21212

L.O.A.	24 ft 0 in	Beam:	17 ft 6 in
L.W.L.	22 ft 6 in	Draft:	11 in
Sail Area:	276 sq ft		

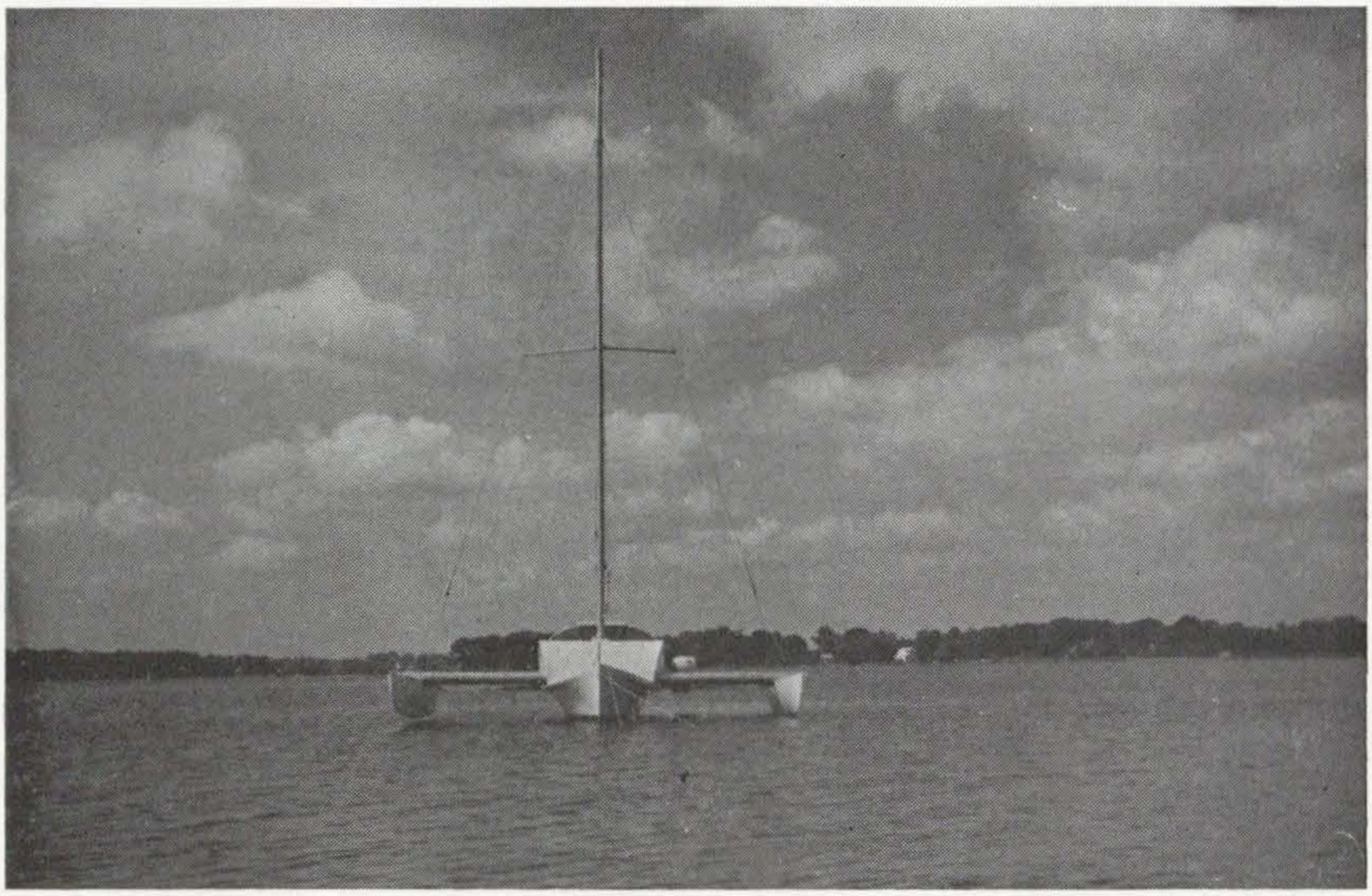
A few years ago, I started building one of those "easily built by the amateur" trimarans, convinced that multihulls, in general, and trimarans in particular, had the most to offer in terms of stability and performance. I was particularly interested in a cruising boat that would offer the speed and excitement of the multihull. After reaching the "fairing" stage on the frames, I decided I had neither the time nor talent to finish the boat in a reasonable time, so I turned to a commercial boat builder, He was not impressed by the "amateur" lines of the tri under consideration, and suggested looking for a better boat that might be suitable for commercial production.



Horizon 24

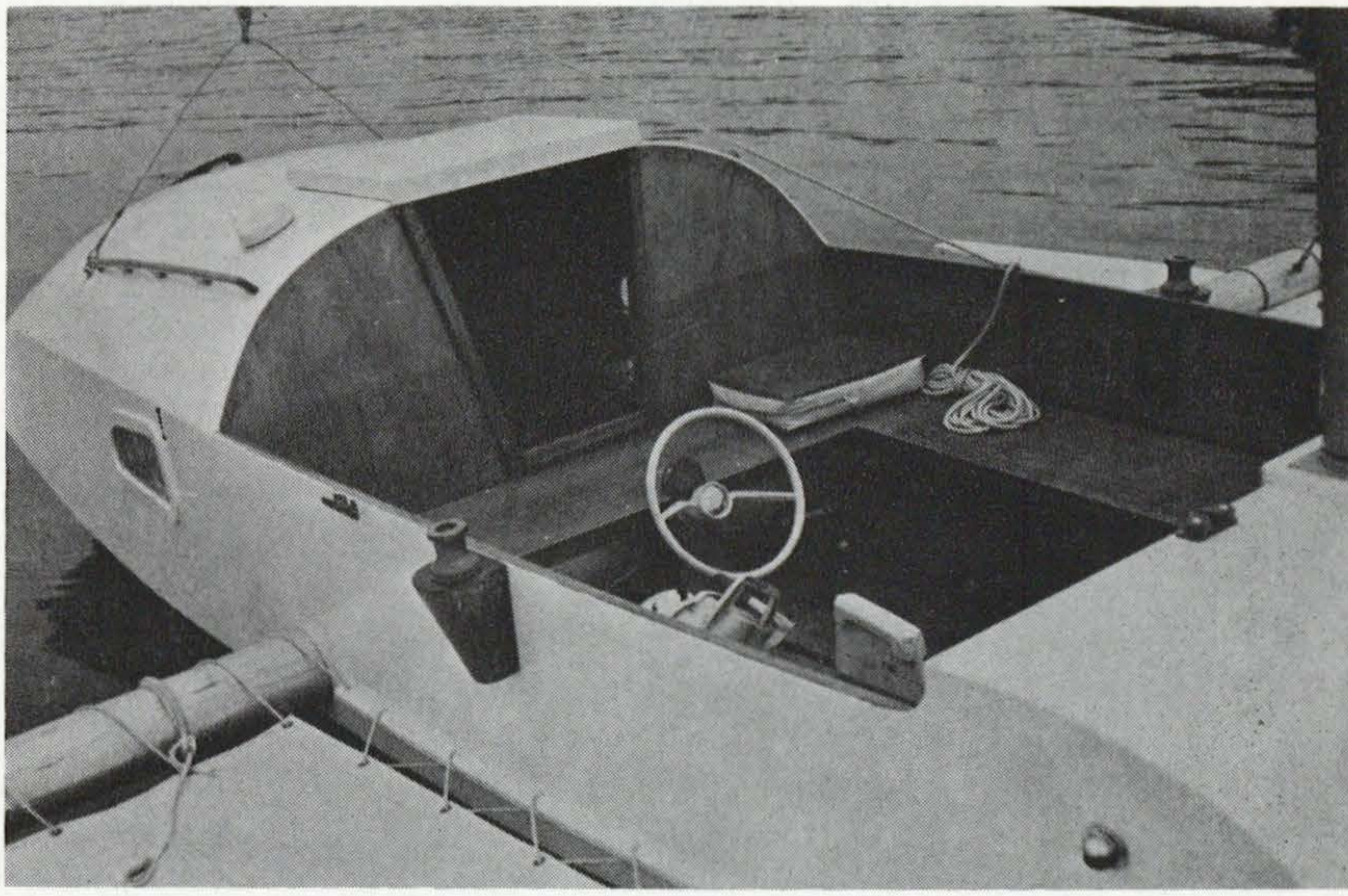
So, a search started for a new design, for a newer and better trimaran Letters went out to all the better and lesser known multihull designers on east and west coasts of the USA, to England, Australia and Europe. The ideas we liked the best were those of Dick Newick in the US Virgin Islands. The real clincher was a sail on Dick's fantastic *TRICE* off Annapolis, after which I asked him to design us a 24 footer. So, after some correspondence, Dick sent us the final drawings for his Design No. 21, which we promptly called, over Dick's objections, the *HORIZON* 24 (the significance of *HORIZON* being either "way out there" or "nothing can pass it").

The prototype called for construction in moulded plywood, although later production models may be built of foam-glass sandwich. The main hull is round-bottomed, with a very sharp entry, and pronounced flare at the sheer line. Two major advantages are realized in the greater-than-usual beam; first, a smaller ama (float) provides the same buoyancy or righting effort with less wetted-surface, and second, there is little, if any, wave interference between the main and ama bow waves (which on the *HORIZON* are small anyway). When sailing the weather ama is always out of the water.



Horizon 24

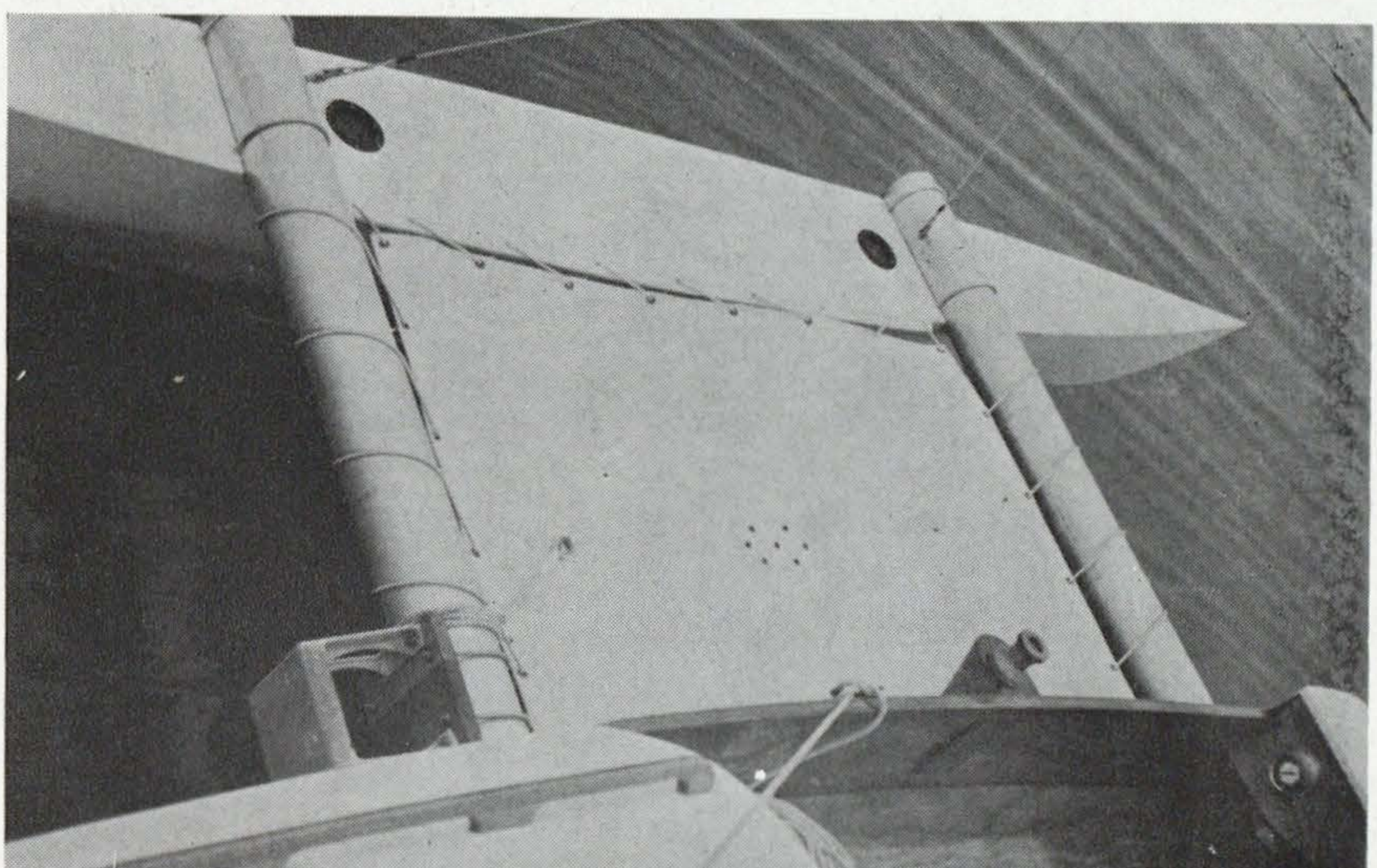
Another unusual feature of the *HORIZON* 24 is that the cockpit is in the centre of the main hull, so that no matter what the crew numbers or weight, the trim of the boat is not affected. All sail raising and handling, and *reefing*, can be done without leaving the cockpit. The main cabin is aft of the cockpit. so forward vision is unobstructed. Because of the sharp flare at the sheer line the cockpit is very wide and spacious, the boat is very dry, and the aft cabin can provide a full-width double berth.



Cockpit and stern cabin

Still another unusual feature is the use of one-piece, large diameter aluminium tubing for connecting cross arms between the main hull and amas (floats). They provide an extremely strong and rigid connection, and yet mean that the whole rig can be taken apart for trailing in less than 1½ hours. The space between hulls and tubing is filled in with laced-on dacron "hammocks" (or, for ocean use, nylon netting).

The spars are anodized aluminium, with rotating mast and roller-reefing boom.



Note alloy cross beams

Performance of the *HORIZON* 24 has been even better than we hoped for. She is very fast, very stable, and very comfortable. Highest recorded speed to date is 12 knots (where the speedometer always seems to quit), but we know we have gone much faster. We have recorded 8 to 10 knots for several hours going *to weather*, in moderate to fresh breezes. She comes about easily in all weather, and almost sails herself on all points. In a calm the *HORIZON* makes 5 mph with only a 3 hp outboard motor.

We have been out in winds estimated at 40 mph with main and genoa, and have not been able to drive under the leeward ama. In the short, choppy seas we get here on the Chesapeake Bay, the ama knifes or drives through without any perceptible slowing down or vibration.

Last Summer we took the *HORIZON* on a two-week cruise down the Eastern Shore of the Chesapeake, and found her most enjoyable for two adults and three children. On rainy nights the adults slept in the big double bunk, and the children on air mattresses in the "storage area" under the cockpit. In fair weather the adults borrowed the air mattresses and slept under a canopy in the cockpit while the youngsters moved to the berth. The cabin also has a galley with 2 burner stove, sink, head, and lots of stowage space. We found that the dacron "hammocks" were particularly comfortable for lounging or as a fishing platform, and the children enjoyed "riding" the amas, especially in a good sea. Perhaps what was most gratifying about our cruise was the interest and enthusiasm so many people showed in the *HORIZON*, which is after all unusual even for a trimaran, here in what is considered a stronghold of conservatism and traditionalism; ie, the home of the last working sail fleet (oyster dredgers) in the US. It seemed like the older and more traditional the boat, the more interest the crew showed in the *HORIZON*.

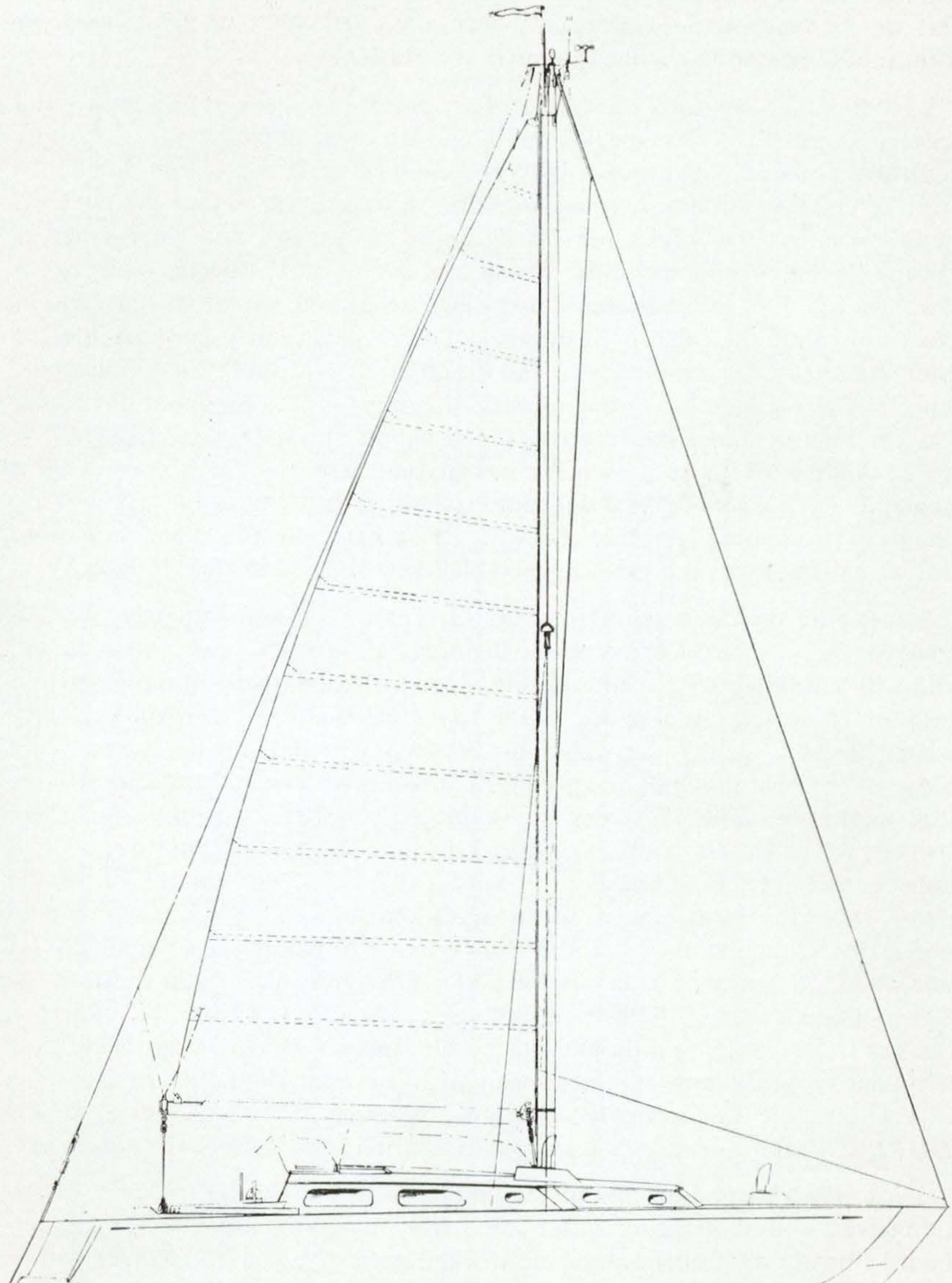
Depending on one's point of view, fortunately or unfortunately, we discovered that the *HORIZON* 24 is definitely unsinkable, even when holed, and will handle under power with no apparent loss in speed or agility with a bellyful of water. Where we moor the *HORIZON*, prolonged northerly winds literally "push" the water out of the cove, and during a week long blow set the boat down on a jagged rock on an otherwise soft bottom. (Now that we know about that rock we've picked another mooring). So, there she sat, for at least a week, pounding on that rock which finally put a small hole in the bottom of the boat. Apparently she filled and settled to the point where the amas picked up the load, and that was it. It was not even noticeable from the shore, and I didn't know anything was wrong until I was about 50 ft away in the dinghy, and saw she was about ½ in down at the transom and about 1½ in down at the bow. We just started up the outboard, ran her to the ramp, and up and out on the trailer. Repairs consist of filling with epoxy putty and reinforcement with an extra layer of FRP. Such experiences are discouraging, but give me even more confidence in the *HORIZON*, as I am sure that even with a hole in the bottom she would sail.

Dick Newick has done an outstanding job with the *HORIZON* 24. Everything was well thought-out, and aside from a few changes in the daggerboard (mostly my fault) everything worked perfectly, and no changes will be made from our prototype *HORIZON*.

THE HARRIS 40
A 40 Foot l.o.a. Auxiliary Trimaran

High Speed Ocean Racer and Comfortable Family Cruiser

Designed by: Robert B. Harris, N.A. Great Neck, N.Y.



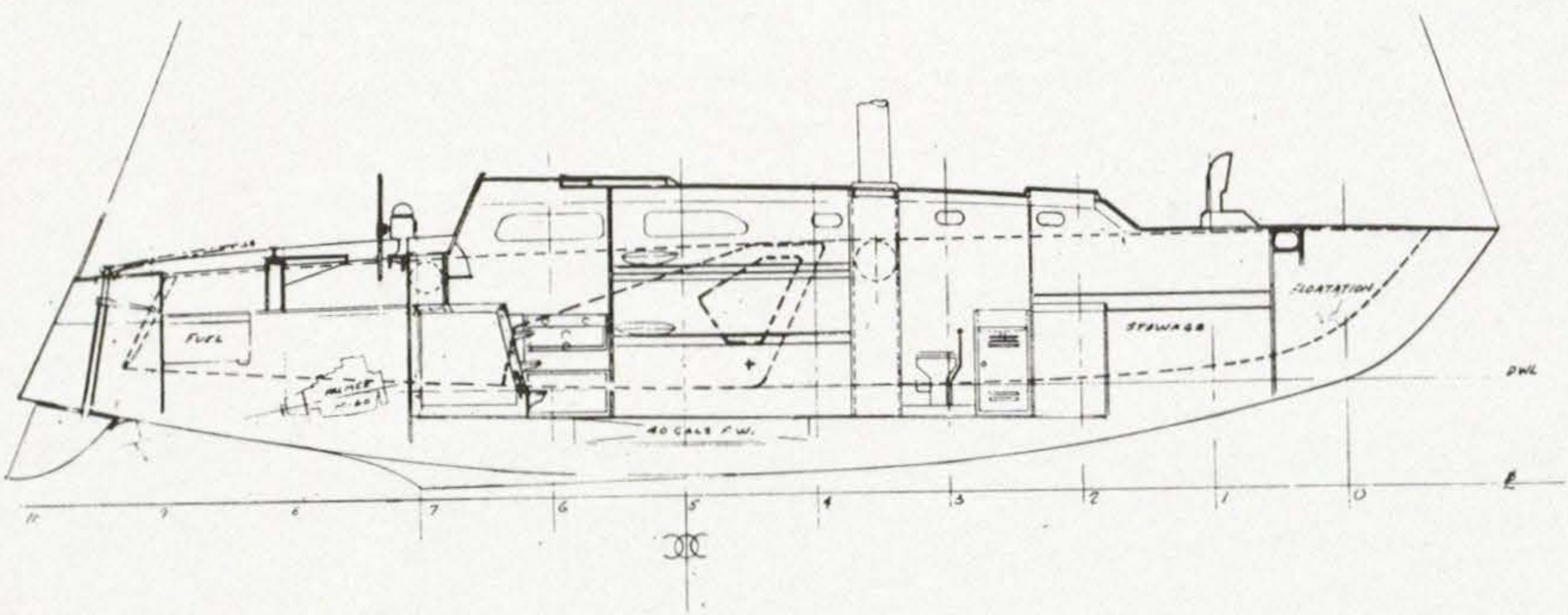
Principal characteristics

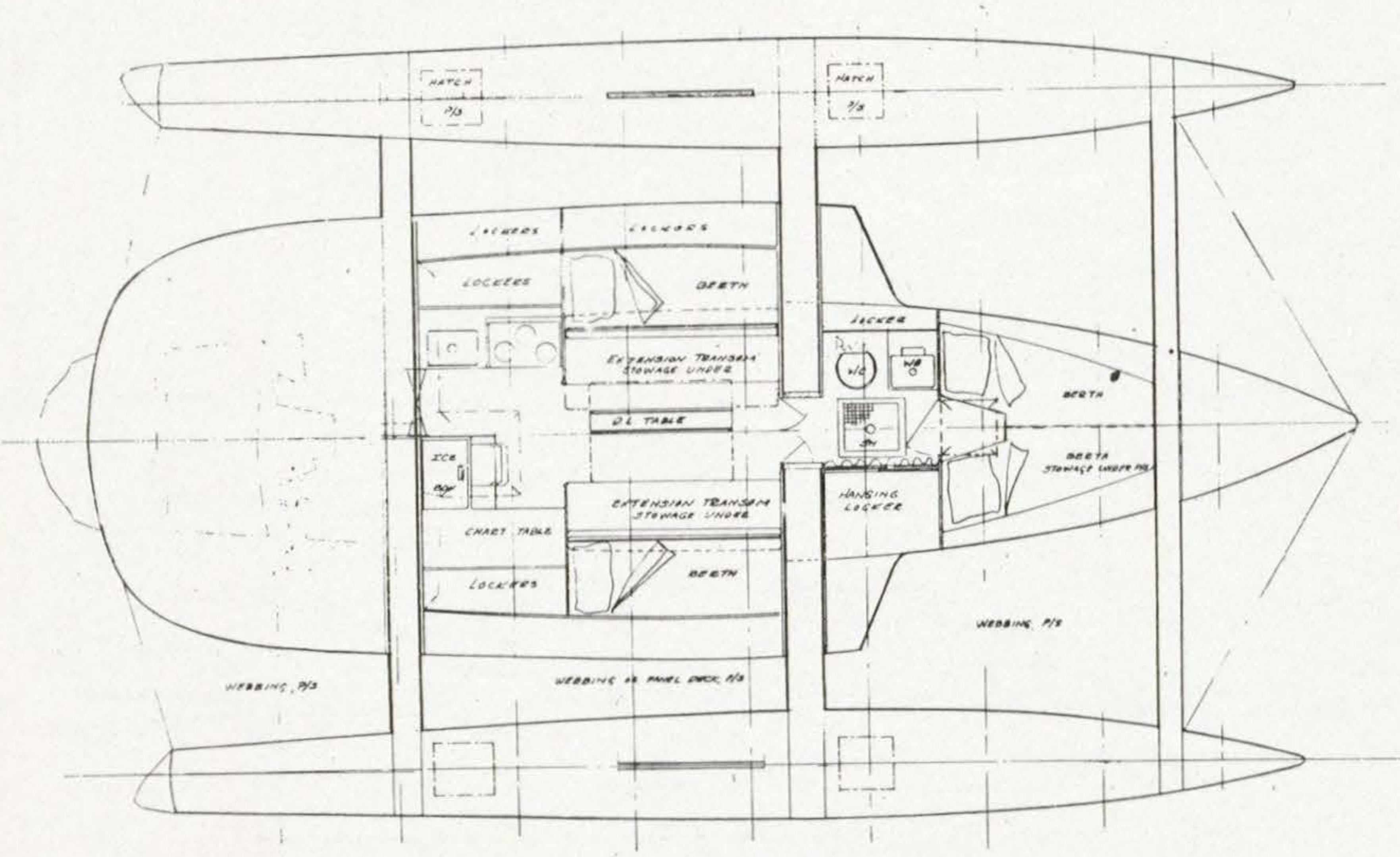
Length Overall	40 ft 0 in	Beam, Float	3 ft 9 in
Length Designed Waterline	35 ft 10 in	Draft to DWL, Bd. Up.	2 ft 9 in
Beam, Extreme	24 ft 0 in	Draft to DWL, Bd. Dn.	6 ft 0 in
Beam, Main Hull	13 ft 9 in	Displacement, up to	11,000 lbs
Accommodations	Sleeps 6	Sail Area (Sloop) 100% F.T.	734 sq ft

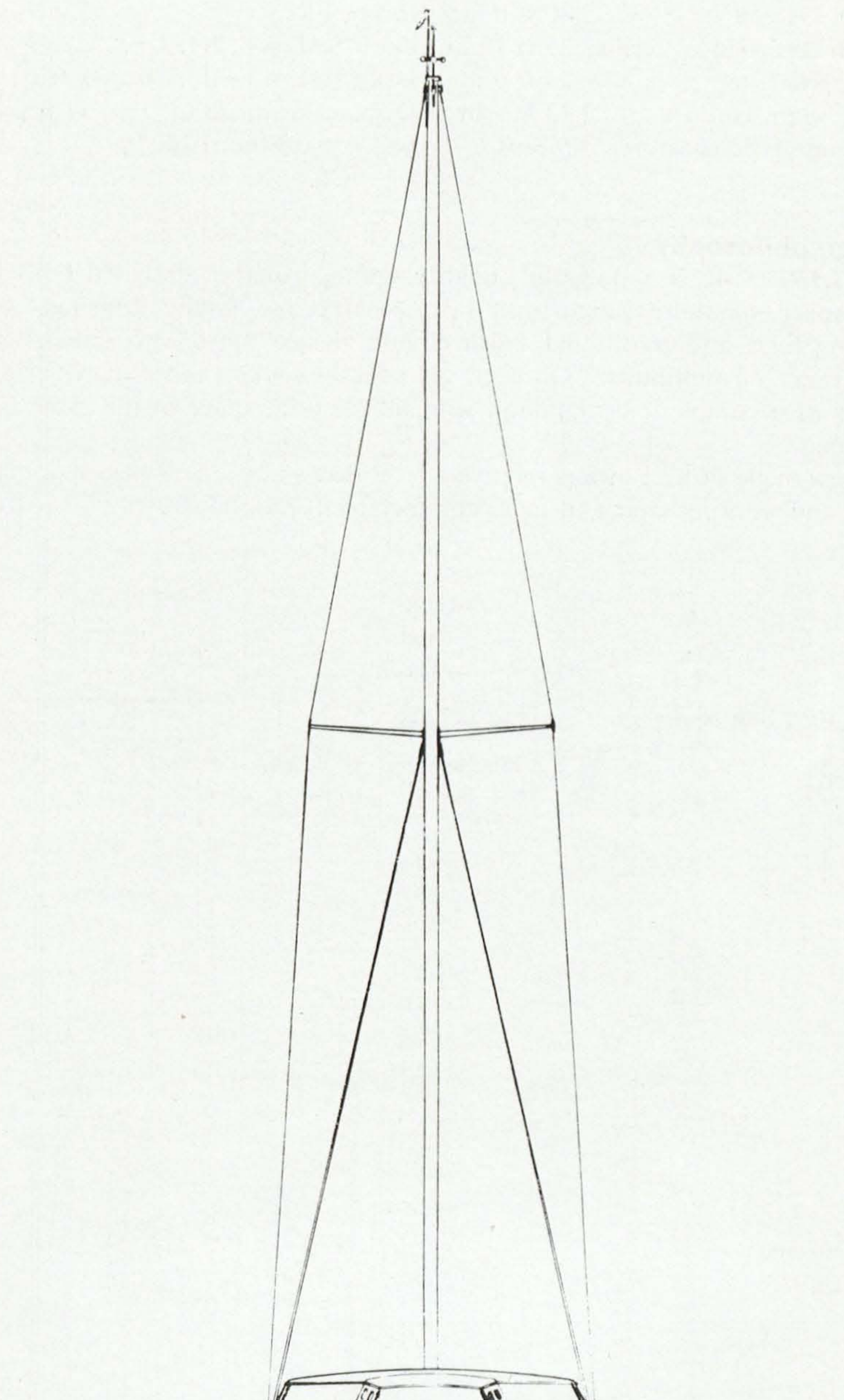
Design philosophy

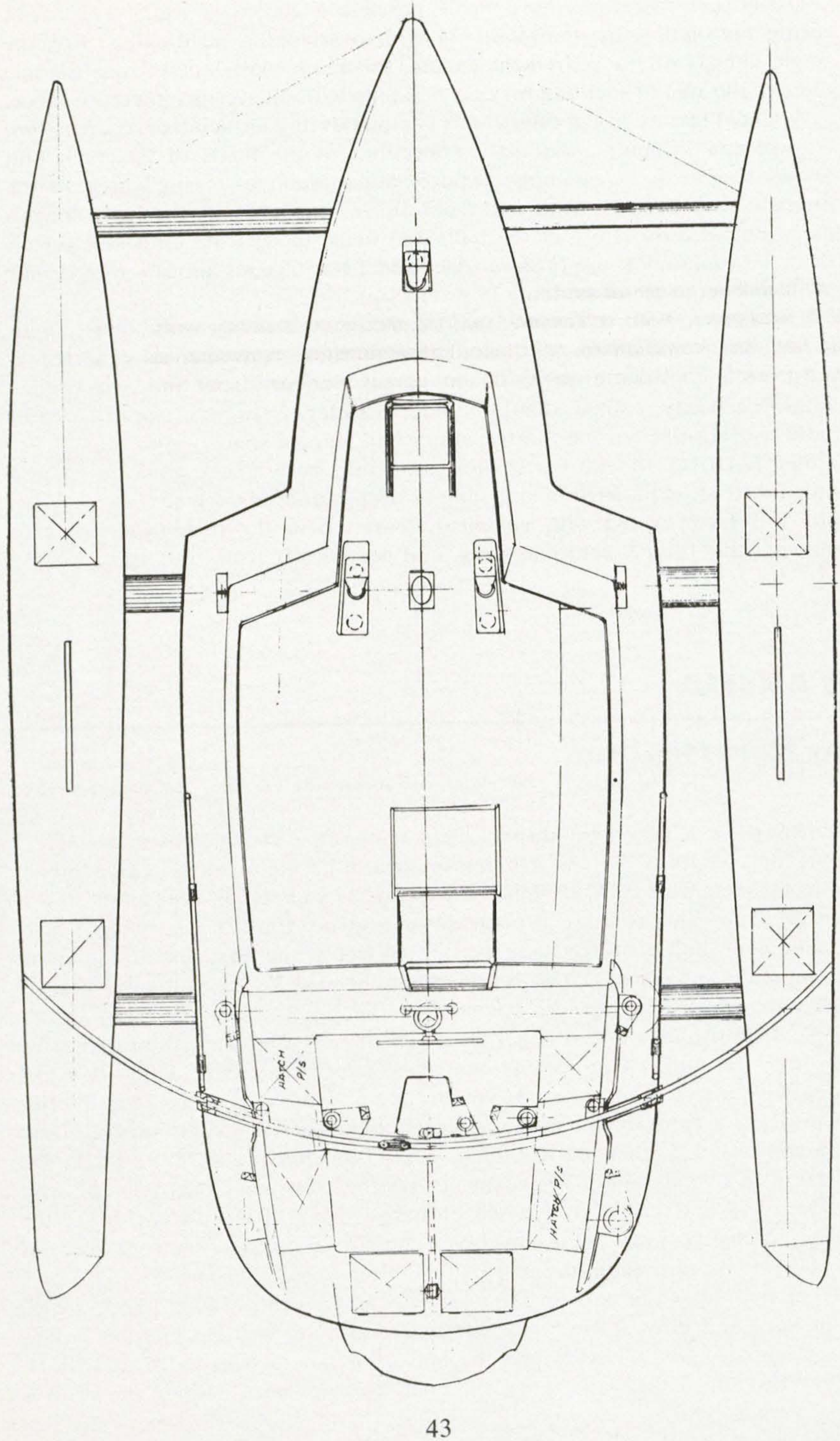
The *HARRIS* 40 is a powerful, quality sailing trimaran designed both for high speed off-shore racing and fast, comfortable family cruising. Her pleasing lines and traditional finish should silence those who criticize the appearance of multihulls. On deck she offers a cockpit more than twice as roomy as a comparable monohull with usable deck space in the same proportion.

A low angle of heel means relatively level decks above and below to make living and working safer and more comfortable for all hands.








HATCH P/S
HATCH P/S

Design considerations have made possible a choice of rigs. The ocean racing man will want the sloop rig with overlapping head sails. For the single hander or the retirement couple, the ketch, with a split fore triangle reduces the area of each sail for easy handling without sacrificing performance.

A salient feature of the design is its demountability to facilitate construction, storage and shipping. Tubular connections of the floats to the main hull allows simplicity in assembly, exposes a minimum of "wing" area to the pounding sea from beneath and from above, and presents the least drag to the wind. Construction of the hulls and floats in separate units will permit the most economical use of shop space and advantageous allocation of labour skills and sequence of building in production.

The *HARRIS* 40 is designed with sufficient sail to perform smartly with a reasonable margin for the installation of those conveniences expected in most yachts at the present, including gasoline or diesel inboard engine, ample electricity, comparable plumbing to galley, head, and shower for hot cold water, sufficient fuel, water, stores and storage space.

The *HARRIS* 40 with her shallow draft may be beached, gunk-holed, and sailed into areas hitherto inaccessible to deeper drafted yachts.
She will be provided with sufficient floatation in the tubes and fioats to give positive 100 per cent buoyancy, and prevent her from sinking.

YAKSHA

by Marc Menahem

"Herewini," 15 Avenue de Verdum, 14 Cabourg, France

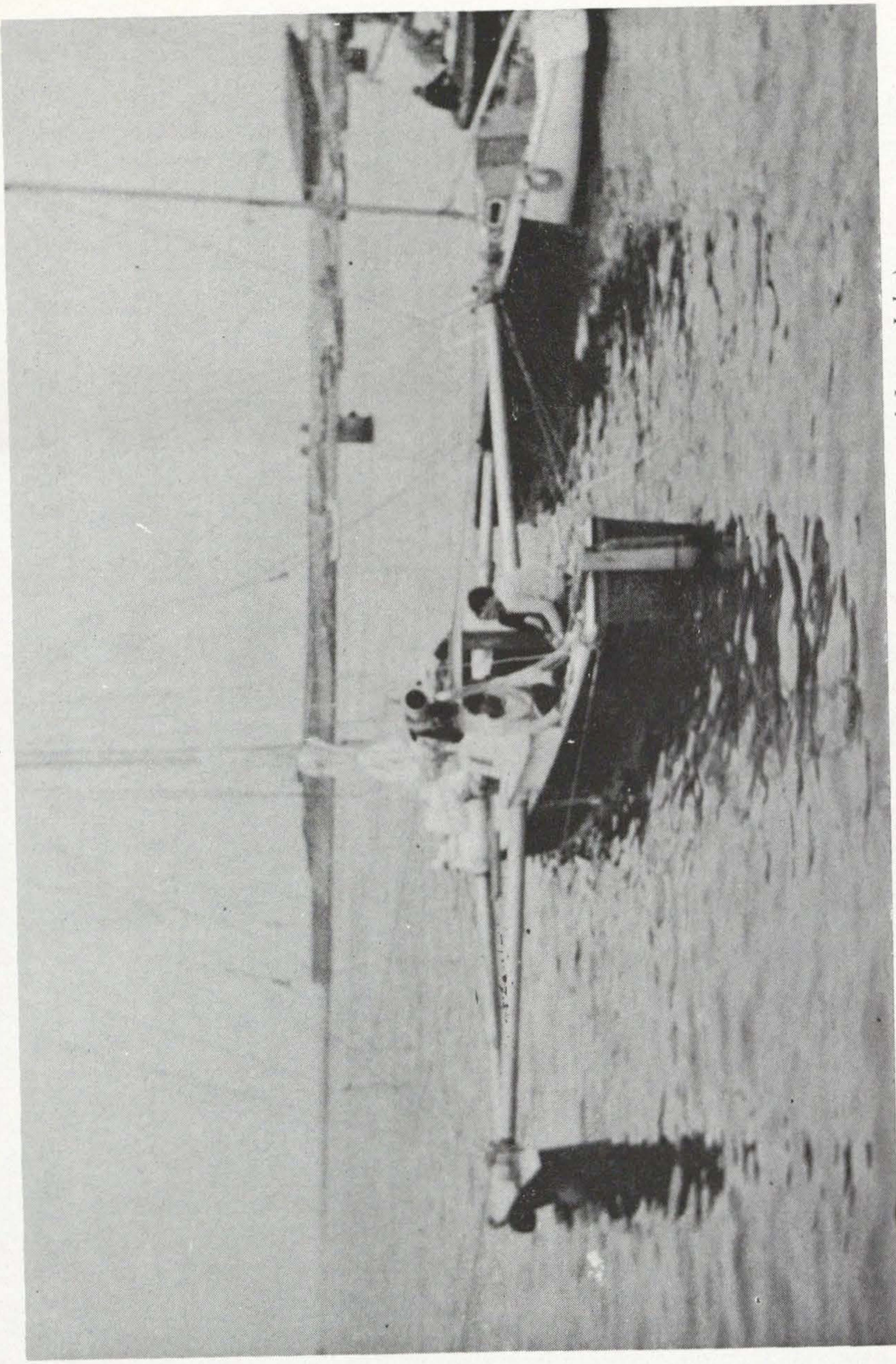
YAKSHA is a very light displacement trimaran. Her weight is about 2.5 tons for a length of 50 feet—(to give an idea of her lightness, we can compare it to the weight of *PEN DUICK IV* which is 12 tons for 66 feet long).

The whole boat is made in plywood on a spruce frame.

The main hull is 50 feet long overall, 40 feet at the float line and is about 6 feet wide. It is planned with a gradually opened V, flat at the stern under the water line. The topsides are nearly vertical.

As there is only 1.5 foot under the water there is a central gangway passing through the hull. The accommodation is simple: a cabin, which is 6 feet long with 6 feet headroom. Here you can find the chart table, the interior wheel with a comfortable seat, the petrol cooker and the radio (and even an US courtesy flag when we met Joan . . .). Just after this cabin, there is one berth with a perspex hood above the head of the lonesome sailor. The cockpit is deep and not very large, but self draining. To go from the cockpit to the deck, to change a sail for instance, you must walk on a very narrow piece of wood, as you can see on the photos.

The two floats are built in the same way as the central hull. They are 30 feet long and only 3 feet wide. They are asymmetric, the interior face is nearly plane (photo No. 2) and the bottom is flat to help the boat to surf. They just touch the water when the boat does not heel. When the wind is



Joan De Kat's "Yaksha" (Joan is an old French form of Jean=John)

rather strong, one float presses on the water, the other being about 6 feet above the surface. They are full of foam to keep them from filling with water.

The junction between the main hull, and the two floats is made of two metal poles which are hollow.

The aft pole is fixed in a collar bolt butted onto the float and crosses the main hull (photo No. 2). The fore pole crosses the float and is bolted onto the deck of the main hull. Both are guyed with single shrouds.

The rig is a cutter with a Bermudian main sail, a boomed foresail and a jib which is an old genoa from *STRIANA*.

Yaksha

The metal mast is about 50 feet high and the shrouds are attached to the end of the cross poles—this mast can turn and is made of 3 poles, just put one on top of another.

Joan de Kat built his boat to reach the maximum speed in winds of force 3 or 4 Beaufort that are usual during the month of June on the North Atlantic Ocean, as we can see it in the pilot charts. He designed the lightest boat for the length, and was obliged to use the lighest scautlings especially for the floats. The whole boat was not stiff enough, so that in the waves the junction poles had too much play. One took the wrong direction, breaking the parallelism, and the pole destroyed its wood support and the float broke up—the mast was then only held up by the shrouds to the remaining float. Joan had to cut the shrouds to prevent the mast from making the boat capsize. A short time afterwards this float sank.

The wreck was due to the general conception of the boat (lightness and not enough stiffness) and not to the construction itself, although the junction poles were too weak to bear the efforts imposed on the floats.

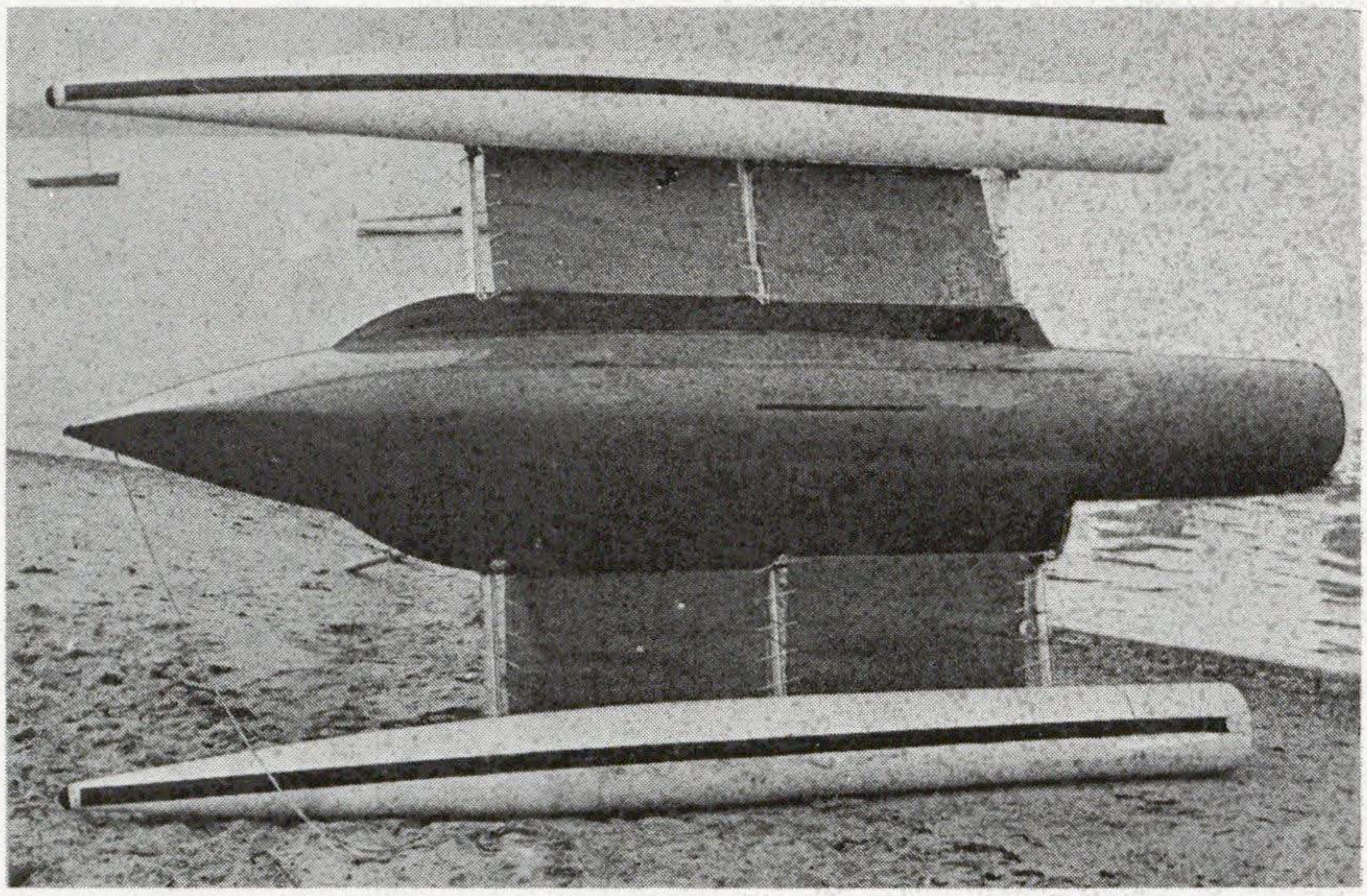
KELEK
A Day Sailing Roof-Rack Trimaran

by K. R. May

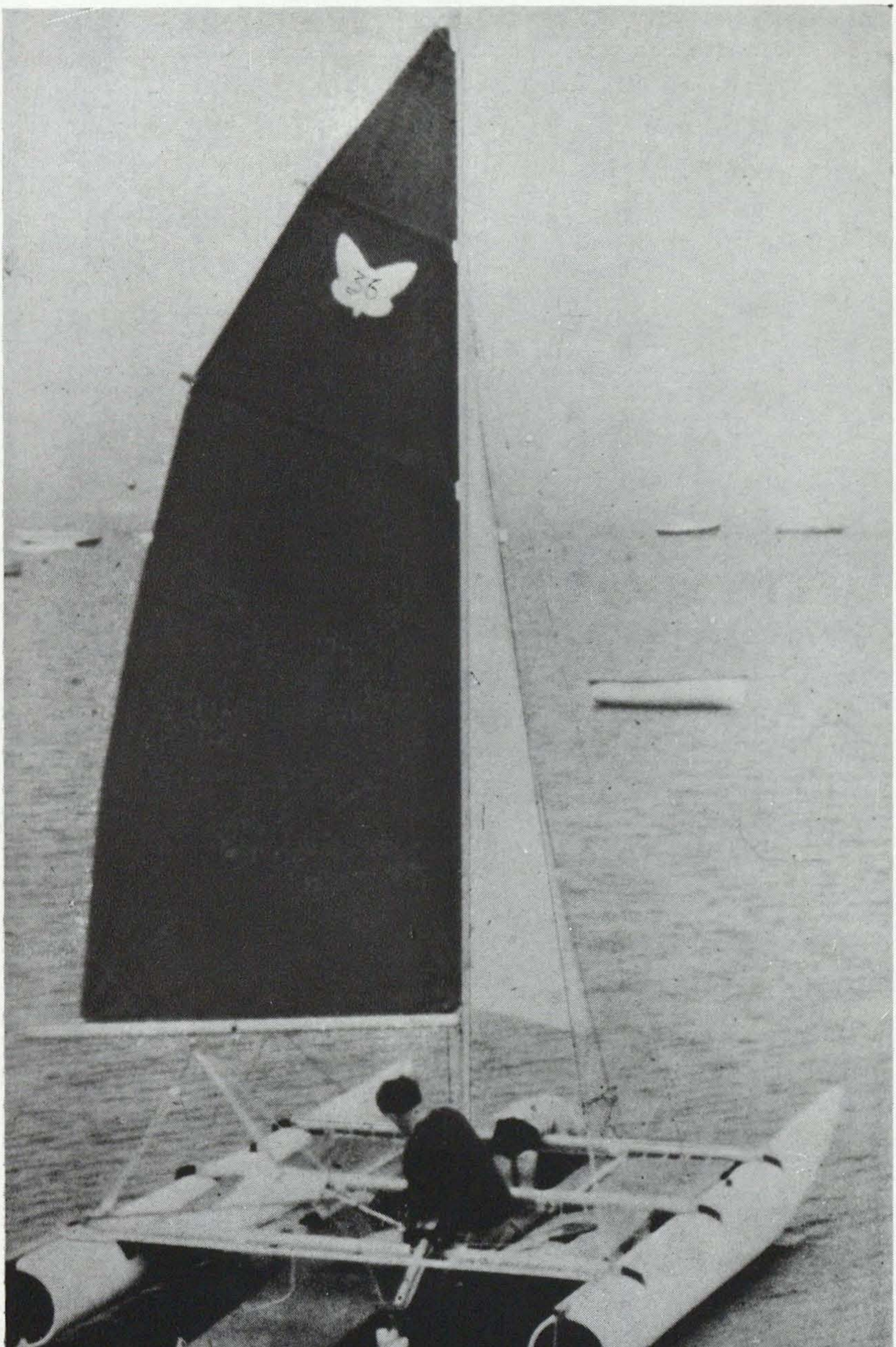
Brook House, Middle Street, Salisbury, Wilts

Main hull LOA	16 ft 4 in	Float LOA	14 ft 9 in
Main hull weight	112 lb	Float diameter	16 in (max)
Main hull draft	8 in (board up)	Float weight	21 lb (each)
Pivoted centreboard	1.6 sq ft	Float displacement	750 lb (each)
All up weight	220 lb (rigged)	Sail area (main)	70 sq ft
Beam	10 ft	Sail area (foresail)	50 sq ft

Last year I bought one of Fred Benyon-Tinker's *VANESSA* inflatable catamarans (AYRS, No. 54) and had a lot of fun with it. However, in anything but the best weather, the deck of a small cat is somewhat bleak—especially for a child—and we lacked stowage space. It seemed to me that our inflatable floats should have some special virtues on a trimaran. It should be possible to make a main hull light enough to go on the car roof-rack as did the *VANESSA*—one giving plenty of comfort, stowage, shelter for children, performance and safety.



The long float tubes have little lengthwise rigidity so I reckoned that it would be essential to make the hull and cross-beams very rigid to avoid unpleasant wringing movements. A tube-like cat hull is automatically rigid, but an open topped tri hull is very different. So I made several scale models of the projected hull in thin cardboard to find just where bracing was needed to give rigidity but minimum weight. The models clearly showed that to



K. R. May's "Kelek"

resist wringing strains, the one essential was to have rigid gunwales. As the diagram shows, I therefore made my gunwales in the form of hollow three-sided beams. This design has proved to be extremely stiff. It is very light, provides comfortable broad seating and a large reserve of emergency buoyancy It also serves as a spray deflector and gives a wide (44 in) base for the cross-beam attachment.

I decided that the maximum length of hull I could take on the car roof was about 16 ft so I bought a *SHEARWATER* shell moulded with an extra 2 in of height. To increase the carrying capacity I opened up the underwater radius from the *SHEARWATER's* 7 in to 9 in by means of strengthening bulkheads under the crossbeam stations, and brought the transom to 11 in radius to increase buoyancy aft. The internal layout gives two deep cockpits fore and aft of the mast with large cubby holes in bow and stern. There is also a lot of built-in expanded polystyrene buoyancy. Timber joints are screwed and pinned and Aerolite glued with all plywood joins taped over with g.r.p. for extra strength.

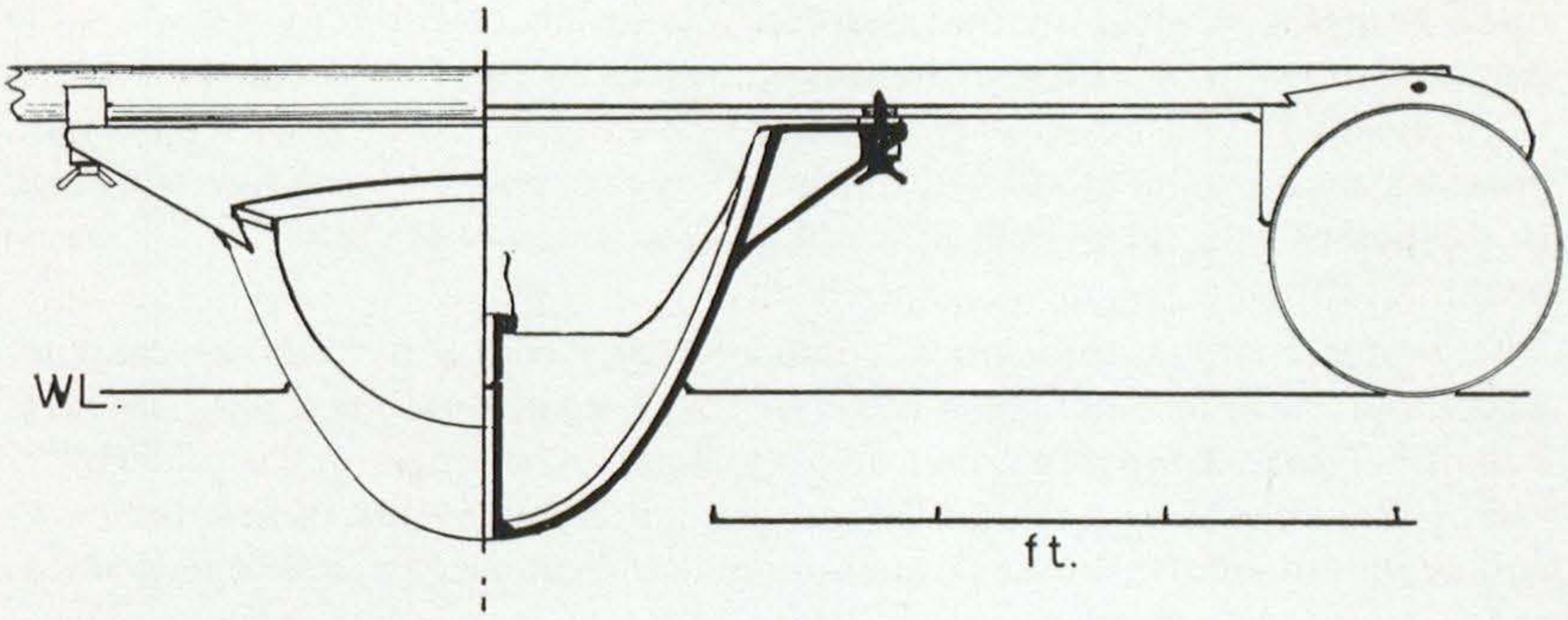
As the hull has to ride inverted on my car roof ladder-rack, the upper surface of the hull from bow to rear crossbeam is flat. In any case, the flat form is the most convenient as an attachment base for the quickly-removable aluminium mast sections I used for the crossbeams. The spacing of the three beams was of course dictated by the existing attachment points on the *VANESSA* floats.

How to place the floats and centreboard in relation to the main hull and sailplan was a headache. I allowed some latitude by making the centreboard slot long enough to take either a pivoting board or a dagger board with a foot of fore and aft adjustment. My 'guesstimates' were not far wrong and *KELEK* is perfectly balanced with the board in its after position and stays so at all times. The special advantages I anticipated for the sturdy inflatable floats were amply bourne out in practice, namely:

1. Very light (21 lb each) and easy to dismantle and transport in the deflated state.
2. Great buoyancy (9750 lb each) giving tremendous stability and safety.
3. Their resilience gives a remarkably smooth and quiet ride, free from any suggestion of slap or pound at all times.
4. Low air and water drag; they slip along with almost no wavemaking and throw up very little spray at speed.
5. A trimaran's floats are delicate and easily damaged. Not so with *KELEK*—if you ram something with your horns they just fold over, you bounce off, and they spring back into shape again!

I sawed off the three original rather clumsy struts on the floats in the *VANESSA* configuration (sorry Fred!) leaving only small arcs of wood still attached to the Hypalon skin (this also greatly improved the portability of the deflated floats). These arcs key into slots under the ends of the cross-beams, and each is very securely fastened by a ⅜ inch bolt, which is tightened by a Tufnol wing-nut to avoid spanners.

The crossbeams themselves have their luff-groove downwards so that the are in their stiffest mode to resist upthrust from the floats, the pull of the stays and the weight of the crew if sitting out. Each beam is supported on the



Kelek : stern view & section at central beam.

gunwales by two saddles into which the beam fits exactly. Very secure and quick attachment is achieved by two $\frac{3}{8}$ inch stainless steel bolts which are passed upwards through strong-points in the triangular gunwale girder then through each saddle to engage with nuts shaped to fit exactly inside the luff groove. To avoid spanners the bolt heads have wings, and also serve as very convenient cleats under the gunwales for making fast the lashings of the inter-beam canvas trampolene and the front cockpit spray cover.

I use the mainsail and very convenient two-piece mast of the *VANESSA* but had a new 50 sq ft foresail made. This necessitated running backstays to keep the forestay taut but the rigging base of the backstays, to the ends of the rear crossbeams, is so wide that the lee runner needs only to be released when sailing off the wind. The runners are single purchase tackles cleated by that fine invention, Clamcleats.

Kelek

I have a choice of using the original twin cat rudders on the floats or a single one (*MIRROR DINGHY*) on the stern and don't know which I prefer. The former give a finger-light and highly sensitive control in all winds, the latter doesn't have quite the same feel but is only half the trouble to fix on and to drop or lift.

Without moving, the helmsman has all the sailing controls to hand so that *KELEK* is an easy singlehander. Though above force 4 an extra hand is needed for the big foresail—she sails like a cow without it. A bracket attached to the rear of the cockpit on the starboard side enables my small outboard to be fitted where it is not in the way of the sailing gear. *KELEK* is no object-lesson in the art of woodwork but I feel that too much fine finish is out of place in an experimental boat.

KELEK was heavier than I hoped (was there ever a boat that wasn't!) but her performance exceeded my expectations and she will whizz through the lee of racing dinghies of similar length. I have no use for a boat that will not beat up a narrow channel and *KELEK*, spinning rapidly and easily through the wind, does this very nicely, unlike some cats and tris. Her modest sail area comes into its own in force 4-6 and could undoubtedly be greatly increased in lighter winds, but is a fair compromise for my purposes. With three up she is distinctly more staid than with two but the reserve displacement is so great that I have motored her happily with five aboard and there is plenty of room for them. Her sailing characteristics seem to be viceless. The large floats are set well forward and there has never been a sign of lee-bow burying.

The hull is light enough to be easily manhandled singlehanded up on to the car roof, bow first on the rack (which has rubber rollers on it) then up and forwards with the stern. I am happy cruising at 60 mph with her up there.

Kelek ready for transport

As she is faster than I expected, the rather full *SHEARWATER* bow throws up considerable dollops of green H_2O, in stronger winds, straight into the front cockpit. This was cured by my wife's neat and quickly fitted spray cover. Again, at speed, water surged up through the centreboard slot so I extended this upwards another 4 inches by rubber strips which could be closed with Velcro when the board was down. Closehauled, the foresail backwinds the main badly and I shall have to move the tack and forestay further aft. I now think that a hull of the Dobler form (AYRS, No. 55) would have been quicker to make from scratch than wrestling with the complex curves and rough-surfaced moulded ply of the *SHEARWATER* shell, and would have been much cheaper. The Dobler form could give a better hull for a trimaran, i.e. finer bow and more buoyancy aft. A flat floor above the LWL would give a self draining hull which would be worry-free at speed, though at the expense of internal accommodation. The tough and well made *VANESSA* floats would be lighter and perhaps better with coned sterns instead of the circular wooden transoms, and I would like rubber rubbing strakes to be moulted along the outer sides to relieve anxiety when tied up against something solid. The centreboard area will have to be increased somehow as I think she makes too much leeway.

But taken all round I am delighted with *KELEK*. *KELEK?* This is the name given to a raft supported by inflated goat skins which for centuries used to ply down the Tigris.

TRI-BELLE

LOA	14 ft 8 in		Height	21 ft
Beam	9 ft		Sailing weight	130 lbs
	Sail area:	sloop	120 sq ft	
		una rig	80 sq ft	

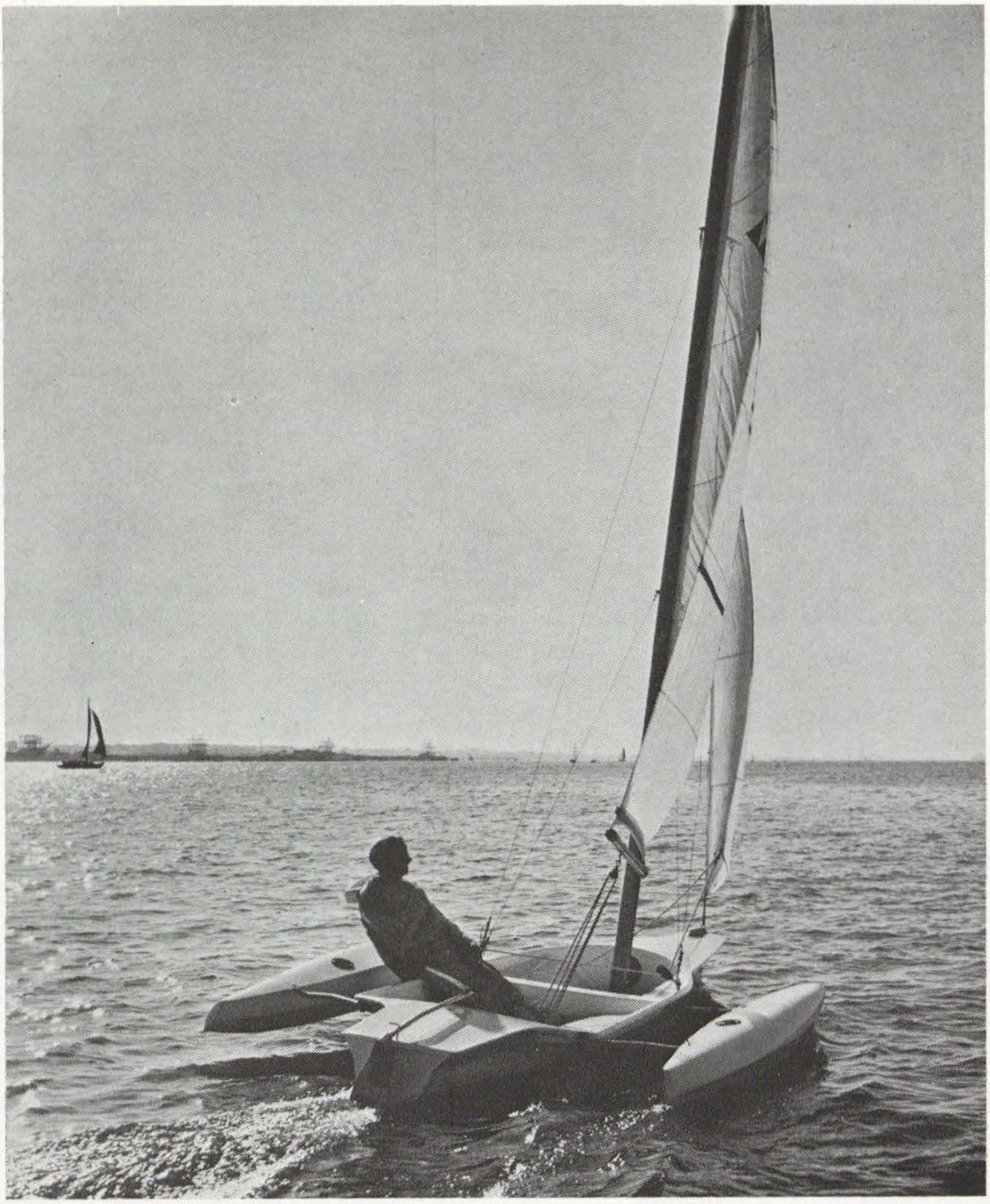
Builders: Basset-Lowke Structural Plastics Ltd., Fair Mile Wharf, Gads Hill, Gillingham, Kent

This is a pleasant little trimaran built of fibreglass with the hull in one moulding and the deck and wings in three others—the photograph shown here is of the prototype. It is being sold commercially for £235.

The craft is essentially a day-sailer with a dinghy-like performance and seating accommodation but without the instability of the dinghy. There is no centreboard, a short fixed keel being used so the work of sailing and terrors for the novice in gybing and other manoeuvres have been abolished.

The floats are a bit short for high speeds and must hold her back a good deal. They are also placed rather far back and this might cause trouble if the crew did not move aft sharply when reaching in strong winds.

Capsizing is, of course, possible but the fore and aft buoyancy compartments and floats should keep her from sinking.



"Tribelle" sailing without side decks

The floats and side decks may be taken from the main hull for trailing.

The need for such a craft as this is great, though sales might be slow at first until people take to the type. With some slight attention to the points above, there well could be a great future for it.

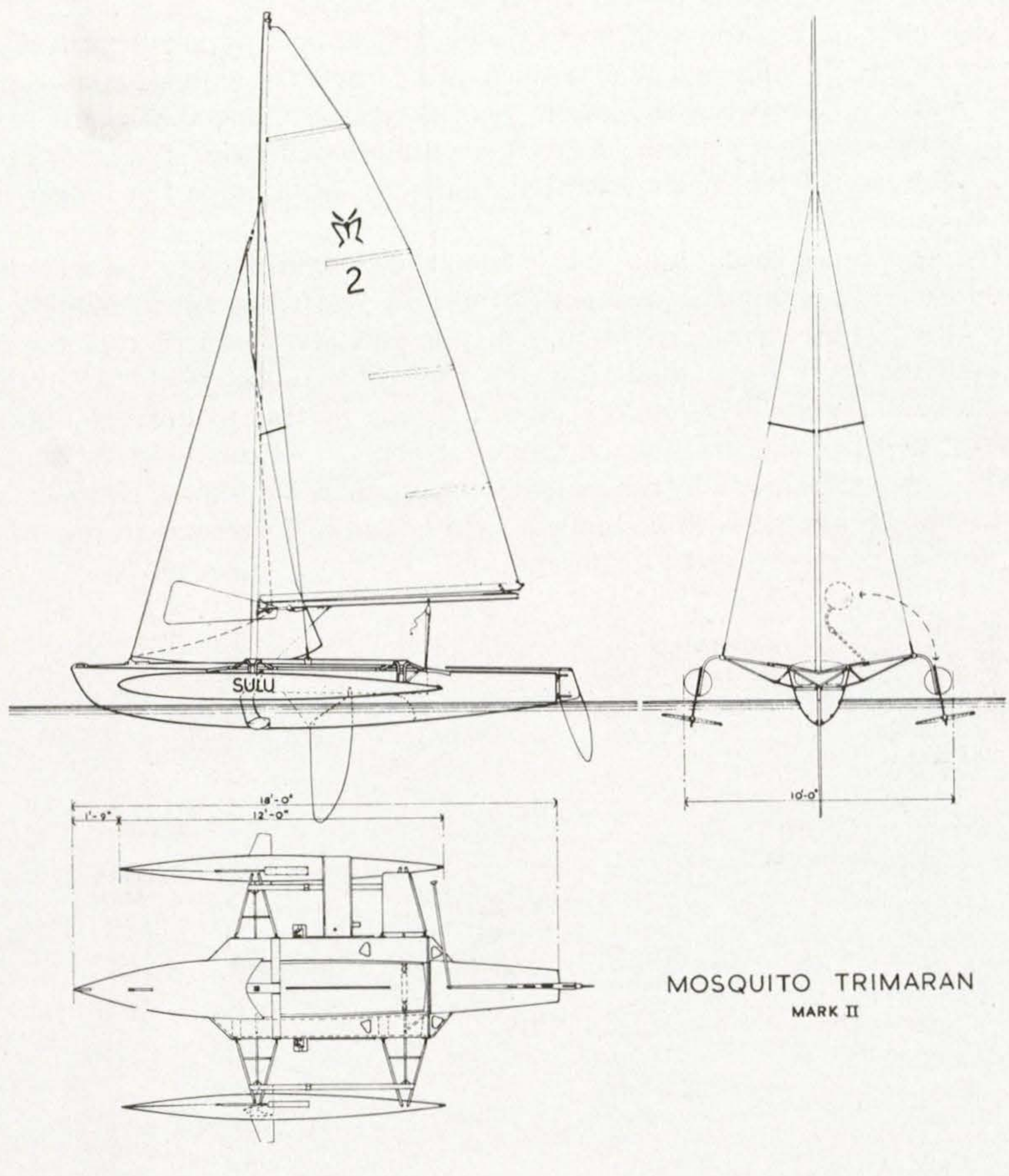
SULU — Mosquito Trimaran Mk.II

Hull Displacement	610 lb	Sail Area	178 sq ft
Float Displacement	325 lb	Draught	10 in
Length OA	18 ft	Draught Plate Down	4 ft 3 in
Beam	10 ft	Beam Folded	3 ft 9 in

Designers and builders: Derek Norfolk and Rodney Garrett 36a Duke Street Brighton, BN1 1AG

Trimarans in the cruising classes are available in ever increasing numbers, but for those who prefer the cheaper sporty type of boat, the choice is very limited. For lively performance combined with stability and effortless sailing the trimaran configuration seems to offer one of the best solutions for two sailors (in this case not so young) who like to join in the racing without having to endure the strenuous efforts required for dinghy racing.

Thus *SULU* was evolved by her joint owners for their enjoyment and ease of operation and also to be capable of a good all-round performance. Not least among her attributes she has provided an excellent "test bed" for further trials with the fully retractable variable incidence foils which are installed in the floats.



MOSQUITO TRIMARAN
MARK II

She was not constructed with the intention of being a production prototype, the fabrication being somewhat involved in order to achieve the desired hull shape and to effect the special degree of foldability for ease of transportation and at the same time come within the limitations of the home workshop.

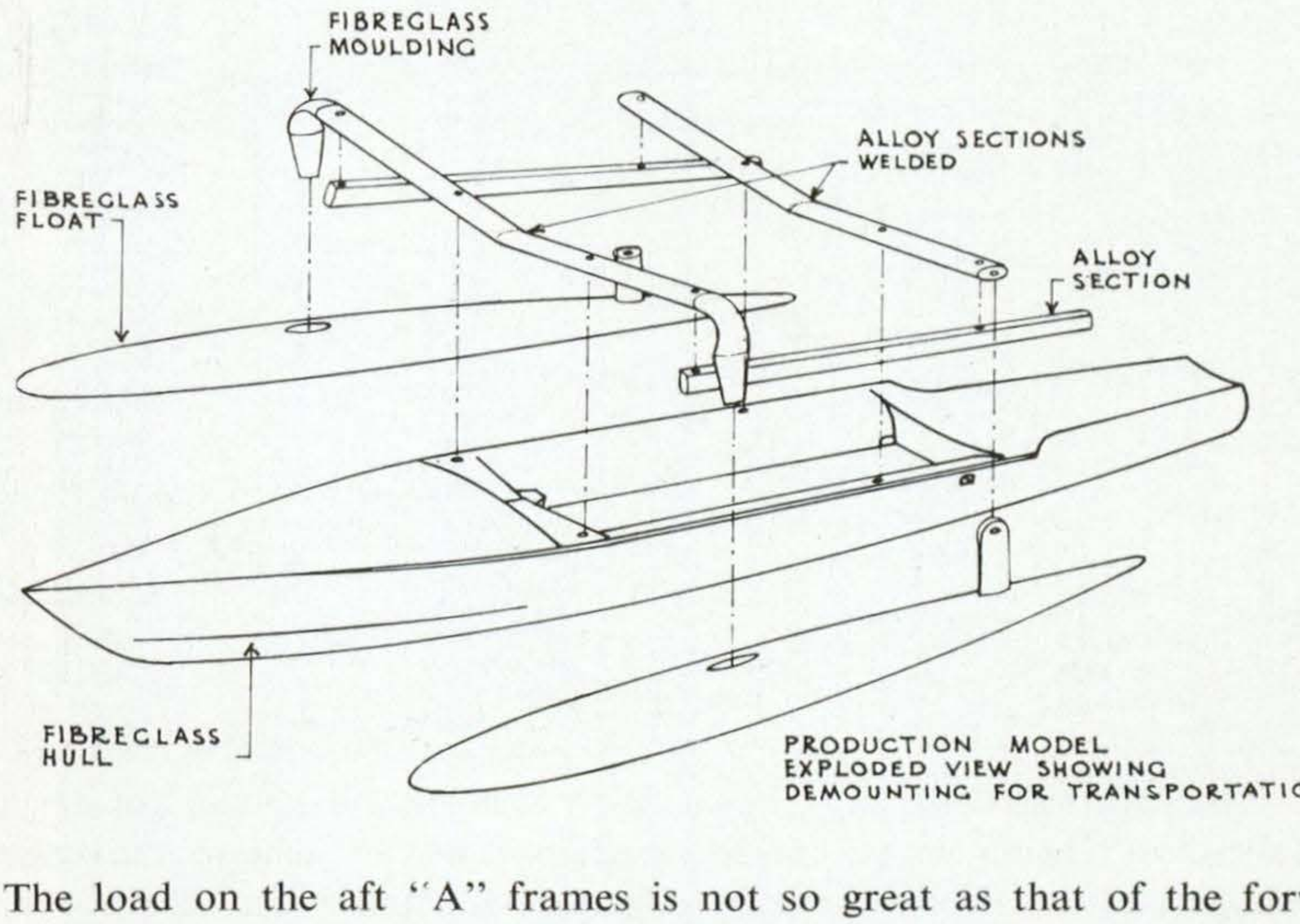
However, now that the inevitable problems have been ironed out and an efficient design has been created, simplification of detail and economy of construction employing factory techniques could no doubt be made. The cost of materials including building frames for the hull, plug and mould for the fibreglass floats, spars, rigging and sails complete, worked out at approximately £285. This figure is without the foils which would amount to about an additional £15.

The hull

The hull was built on a framework consisting of eight cross frames with six longitudinal stringers, each side, gunwhales and keelson. Three stringers each side were temporary and were taken out after the shell was completed. The stem was formed of obeche strips bent to shape.

The lower part of the hull, up to the cockpit floor, was constructed of two layers of ply 1½ mm and 3 mm thick glued together with cascomite glue. The butt joints between the sheets were staggered along the length of the hull, the sheet edges being held down with thin wood strips and screws until set. The size of the sheets was about eighteen inches wide but longer near the stern.

The upper part of the hull, that is from the cockpit floor to the gunwhale, was formed of a single thickness of 4 mm ply scarfed at approximately 4 ft intervals. Three permanent 4 mm diaphragms were built across the hull to take the three point load from the forward stainless steel "A" frames. These diaphragms were reinforced with spruce battens to prevent buckling due to the heavy loads from the frame members. As the lower tie member of the forward frames may take a load of more than ½ ton these two members had to be connected with a stainless strip bolted and screwed to one of the reinforcing members of the diaphragm.



The load on the aft "A" frames is not so great as that of the forward ones, the bottom member being mainly in compression is taken directly on to a wooden cross beam. To allow freedom of movement in the cockpit the top forward members of these frames are connected to the side decks which act as horizontal beams spanning the length of the cockpit.

The hollow curved deck aft was adopted so that the material could be as thin as possible to allow the crew to climb over it without bending the ply. This hollow deck, apart from lining up with the angle of the side decks, makes the risk of slipping off less likely, as even the best of rudders is liable to become jammed at times. A generous amount of rocker was given to the hull which, together with the small, although adequate, amount of weather helm, ensures that the boat goes about easily in both light and heavy weather.

The fore and aft line of the cockpit floor, the gunwhales and the two floats are slightly higher above the water at the forward end, and when the boat is heeled over, the centre line of the lower float, due to the geometry, will toe out. To counteract this, the dimensions of the "A" frames have been arranged so that under normal sailing conditions, the lee float will toe in about $\frac{1}{4}°$ to $\frac{1}{2}°$.

The floats

The fore and aft position of the floats, relative to the hull have been found in practice to be about right. Under all sorts of weather conditions the hull always lifts bow first. On no occasion has the boat taken any water green over the forward deck even in conditions when an A Class Cat has pitchpoled.

The shape of the floats is circular in section aft and elliptical forward, becoming a pointed ellipse right forward. This arrangement gives a fine entry on the surface of the water reducing wave making, and also prevents the forward end of the float from pounding.

If the conditions are such that the bow of the float digs in, it lifts out very quickly because the water will slide off the elliptical section easily and without disturbance.

The foils

Each float is fitted with hydrofoil blades which are fully retractable into the body of the float, with an automatic "bomb door" to close the opening on the underside. The foils are raised and lowered by a wire tackle which may also be used to alter the angle of attack as desired. The blades are hinged to enable them to retract into the float and to open automatically when lowered. The hinge arrangement also makes it impossible to get any negative lift which would tend to pull the float lower down into the water. A detailed description of the foils and their operation will be given in another article in the AYRS this year.

Stability

When the boat is sailed upright in light and moderate winds there is no advantage in using the foils. If the wind is strong enough to keep the float nearly submerged and the sea is fairly smooth, the use of foils can give quite dramatic speeds, but unfortunately so far not measured. The best that has been recorded to date is a two way race of approximately 11 miles in 65 minutes leaving *Flying Dutchmen* and *Fireballs* far behind. When the boat is hard pressed by a heavy gust (without foils) the lee float submerges, the hull will lift a few inches and in this position she seems to stay giving time to ease off the sheets. The heel angle reduces the effectiveness of the sails, the A frame tubes hit the water and the boat slows up. This is, of course, not recommended but if it happens no harm is done.

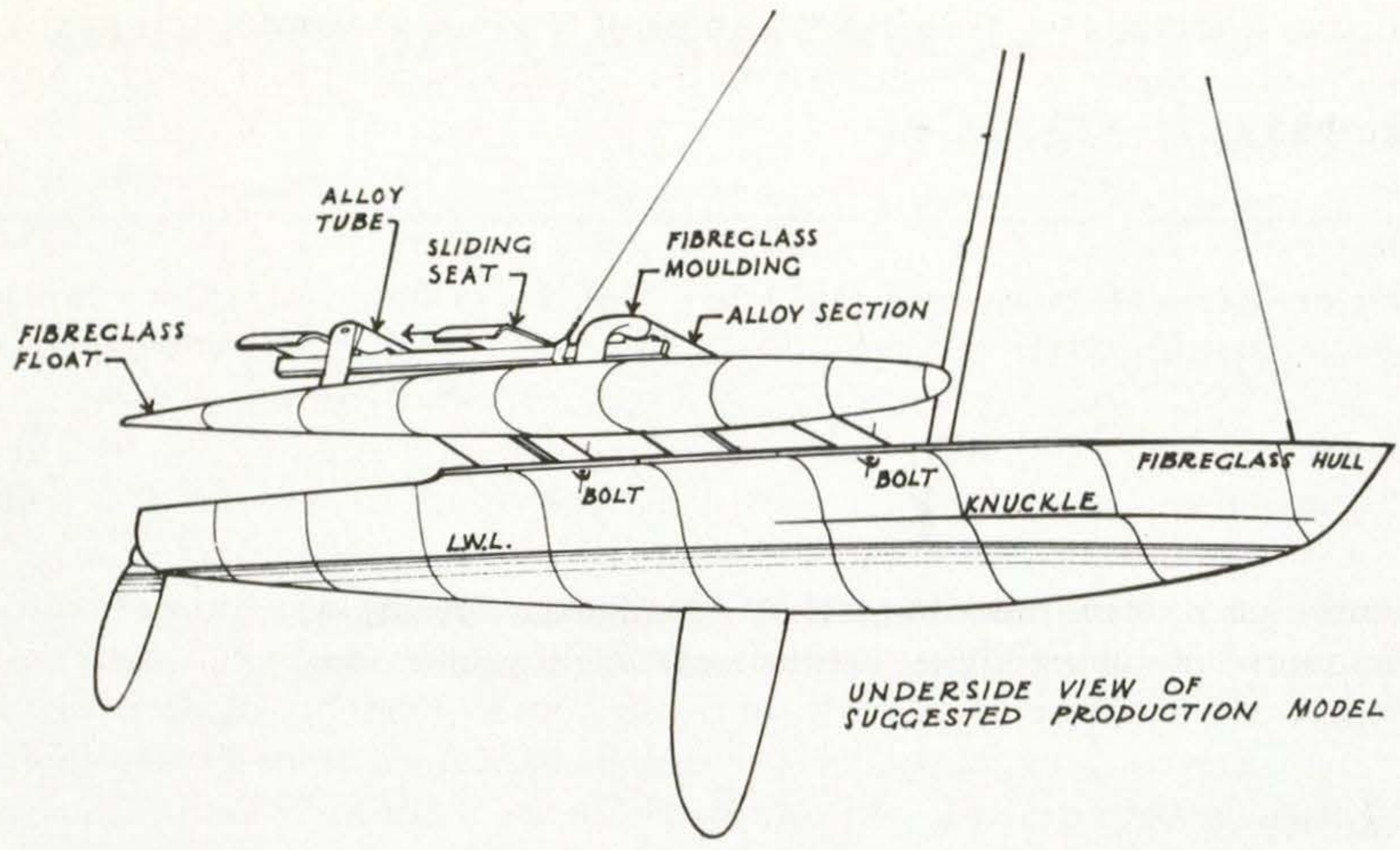
Capsizing

The boat has not yet capsized, or in fact approached it, and it is not known if it could be righted, without external assistance. The two crew would just about be able to submerge one float in the event of a complete inversion, but from then on it is, up to the present, a matter for conjecture.

Mast, boom and rigging

The alloy mast (International Yacht Equipment Ltd.) is of standard pattern with swing spreaders but was altered to rotate by the addition of a ball and socket at the heel and a wire strop and pulley to take the forestay and jib. The gooseneck fitting has been reinforced to take a lever, the aft end of which passes through a notched gate fixed to the boom. By moving the lever into the notches of the gate the relative horizontal angle between the boom and the mast may be altered.

The boom is made from an alloy tube and fitted with a short length of track and slide at the aft end. The slide is attached to a large batten which runs the full length of the mainsail foot. The slide is controlled by a wire passing forward and connected to a lever on the underside of the boom. By operating the lever the aft end of the batten can be moved forward or aft along the boom thus controlling the amount of flow to the mainsail.



Mainsail "flow" control

The mainsail which was supplied by Anderson Aerosails was cut with this arrangement in mind so that by altering the flow along the foot the flow over the whole sail will also be altered. The desired shape of the curve produced by the bending batten, after a few trials, is done by increasing or reducing the thickness of the batten. In practice this has been found to be a considerable advantage when sailing off the wind, allowing the batten to bend away from the boom as much as 14 in or so when on a reach.

Trapeze

A trapeze wire is fitted to the mast which enables the crew to climb out with his feet on the fore and aft alloy tube which is just inboard of the float. With the leeward float just submerged, the centre of buoyancy of the boat is about midway between this float and the main hull. With the crew on the trapeze this gives a lever arm of about 9 ft for the righting moment due to the weight of the crew.

Trailering

For transporting the boat by road trailer, the mast is taken down and the two sets of tubes under the "A" frames are unbolted at their outboard ends; the floats and "A" frames are hinged up over the top of the hull. The unbolted tubes are swung round alongside the hull, reducing the overall width to about 3 ft 9 in. The mast is then lowered down between the floats on to the transome and the crutch of the road trailer. The whole operation, either folding or unfolding ready to launch, takes about 30 minutes.

The racing trimaran disadvantage

Whatever type of boat is designed there always seems to be some disadvantage in comparison with some other type. The floats of a racing trimaran of necessity have to be of light construction and will not withstand much of a collision with another competing boat nor a heavy bump against a quayside. The floats of this boat are no exception, although for sea conditions, launching and landing on concrete slipways and shingle beaches, the floats and their supporting members are amply robust.

A GRAPHICAL/MATHEMATICAL METHOD OF HULL DESIGN

by Major Calvin H. Markwood (USAF) 7708 Dublin Drive, Camp Springs, Md. 20023, U.S.A.

Traditionally, yacht hull lines have been developed by a tedious iterative technique of matching cross sections, water lines, entry and exit angles, etc. To construct a vessel from these lines they must then be lofted in detail full size, again very tediously. Purely mathematical methods of developing hull lines have been devised. Most notable for the multi-hull yacht enthusiast is the Myers-Ewing Method (AYRS, No. 54) where a cubic equation is written which describes the hull form and a computer is used to solve the equation for a numerically-perfect set of offsets.

The following method is a blend of the graphical and the mathematical techniques. It requires that only a few key lines be lofted, and, based on these lines, segments of ellipses are then drawn to define the station cross sections. These key lines will be seen to determine the major and minor axes of the ellipses and, if the key lines are carefully drawn, the corresponding water lines and buttock lines must join perfectly. The amateur who has a computer at his disposal may use it to develop his offsets once the basic lines are known. The offsets thus obtained are as accurate as the basic lines. The rest of us can simply, and quite satisfactorily, develop them by graphic means.

Using this method, the hull form may be developed to conform to whichever school of design may be favoured—asymmetrical, symmetrical, varying amounts of rocker, submerged stern, high or low length-to-beam ratio, etc. The semi-circular hull form is also included in the family.

The ellipse will be discussed first and then the lines.

The ellipse

The ellipse is familiar to all goemetry students. Mathematically, it is a conic, expressed, in rectangular coordinates, by the equation

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

where the semi-minor and semi-major axes are, respectively, a and b as shown in Figure 1. Varying a and b relative to each other permits definition of ellipses ranging from a circle (a = b) to one as skinny as a line (a or b = 0).

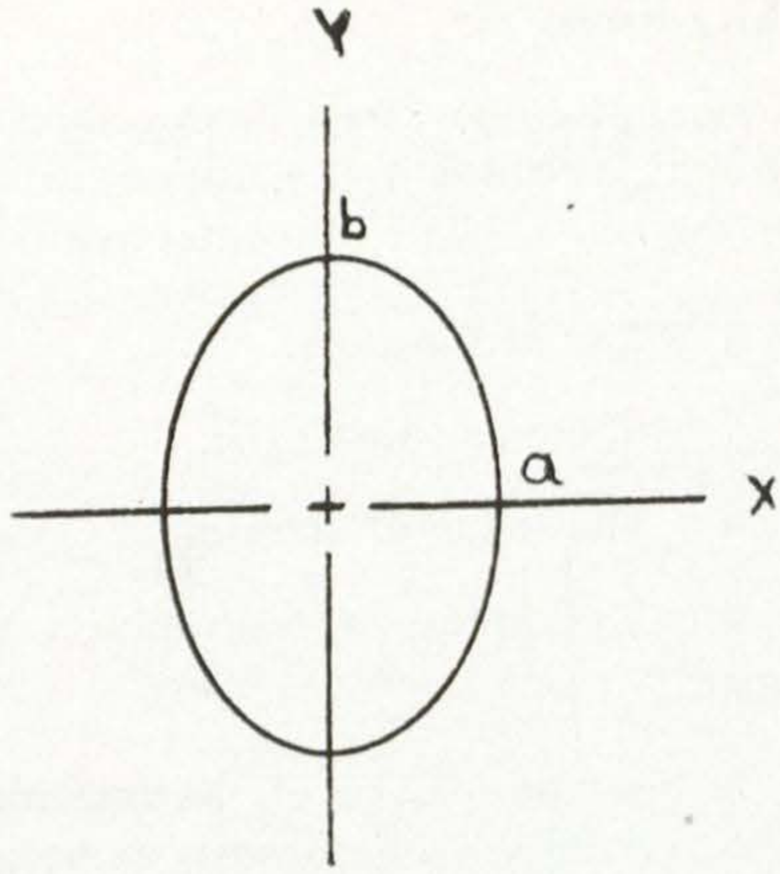


Fig I

Lest it appear that the method might force a rounded section, as might be inferred from Figure 1, a look at Figure 2 shows that a variety of section shapes with varying fullness and Vee are available. These are obtained graphically as shown, mathematically by an axis shift where the new form of the equation becomes

$$\frac{(x' + c)^2}{a^2} + \frac{(y' + d)^2}{b^2} = 1$$

where d and c are, respectively, the distances the x′ and y′ axes are shifted from the original ones.

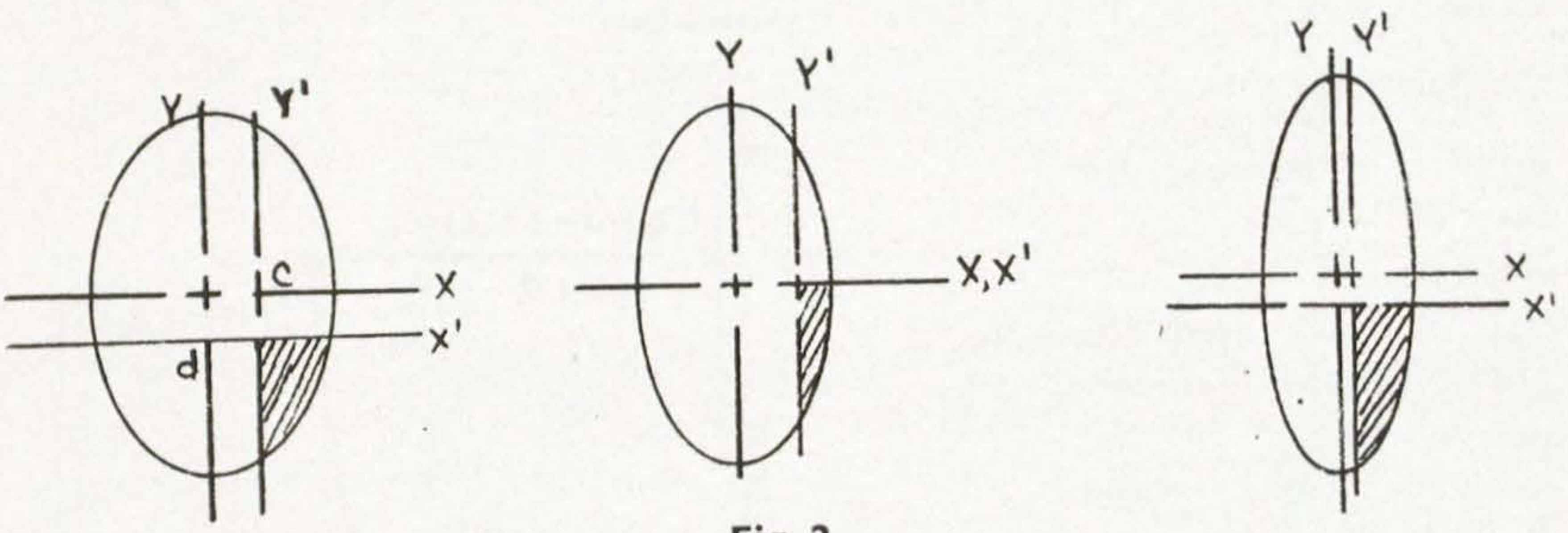


Fig. 2

A few simple guides for manipulating the ellipse to shape the sections are:

1. To "fatten" the section, reduce the ratio of the semi-major and semi-minor axes; remember the two extremes, the circle and the line?

2. To "sharpen" a section at the lower (keel) edge, shift the major-axis away from the centerline.

3. To give slope to the hull at the sheer, shift the minor axis above the sheer.

The drawing of an ellipse is accomplished by plotting points using the equations, or, most simply and quite accurately, by the Trammel Method which is presented in any good descriptive geometry text.

The lines

Four basic lines must be developed to define the pseudoellipsoid to be used; pseudo because it is elliptical in two dimensions and artistically selectable in the third. The four lines are:

1. The keel profile.

2. Some key waterline.

3. The locus of semi-major axes relative to some reference water line.

4. The locus of semi-minor axes relative to some reference buttock line.

A brief discussion of the interplay of these lines is necessary before they may be chosen intelligently. As in all yacht design the shape of the keel profile and the load water line are subject to "good" and "accepted" design practices. Overhang, ratio of LWL to overall length, transom type, draft, etc., go in to the choice of the keel profile and considerable guidance and conflict are available to aid in developing this profile. Entry and exit angles, length-to-beam ratio, water-plane area and coefficients, etc., play their usual role in the determination of a good load water line. Now if a horizontal water line at a normal sheer height is chosen as the locus of the semi-minor axes and the hull centreline is chosen as the locus of the semi-major axes, a hull section could immediately be drawn using the two known points on each section at keel and LWL. Figure 3 shows this.

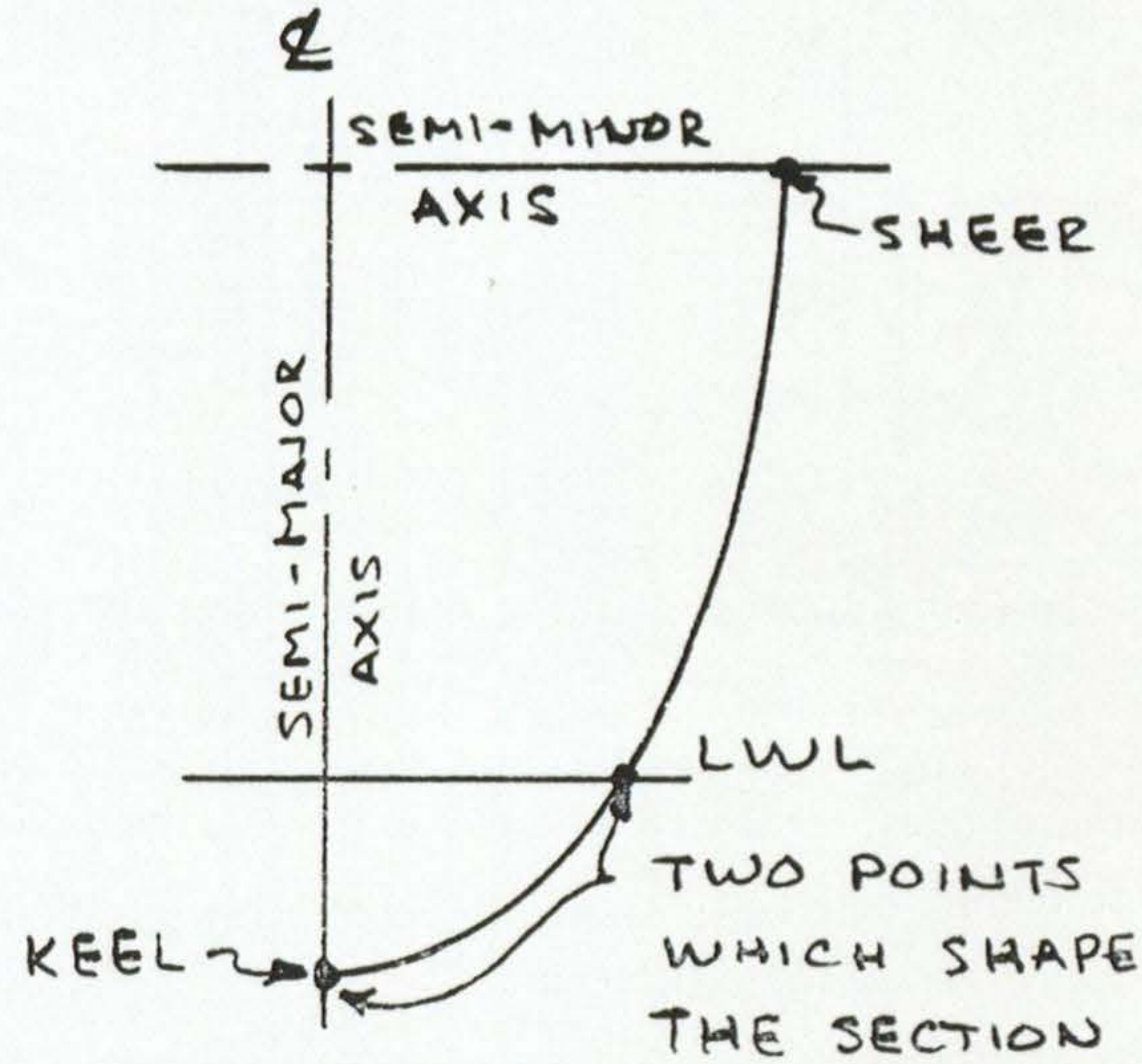


Fig. 3

This shape may be quite satisfactory for the well-submerged stations of the hull, but, if used near the bow, it would obviously put a "bone in her teeth" which would strangle "her." To reshape the sections forward (and astern if desired) for a sharp entry, one merely has to allow the locus of the semi-major axes to assume a smoothly controlled departure from the hull centreline toward the bow (and stern). And if some outward slope of the section toward the sheer is desired, a similar controlled drift of the locus of semi-minor axes from the reference water line will accomplish this. All four desired lines are shown in Figure 4 for a typical hull shape along with the resulting sections.

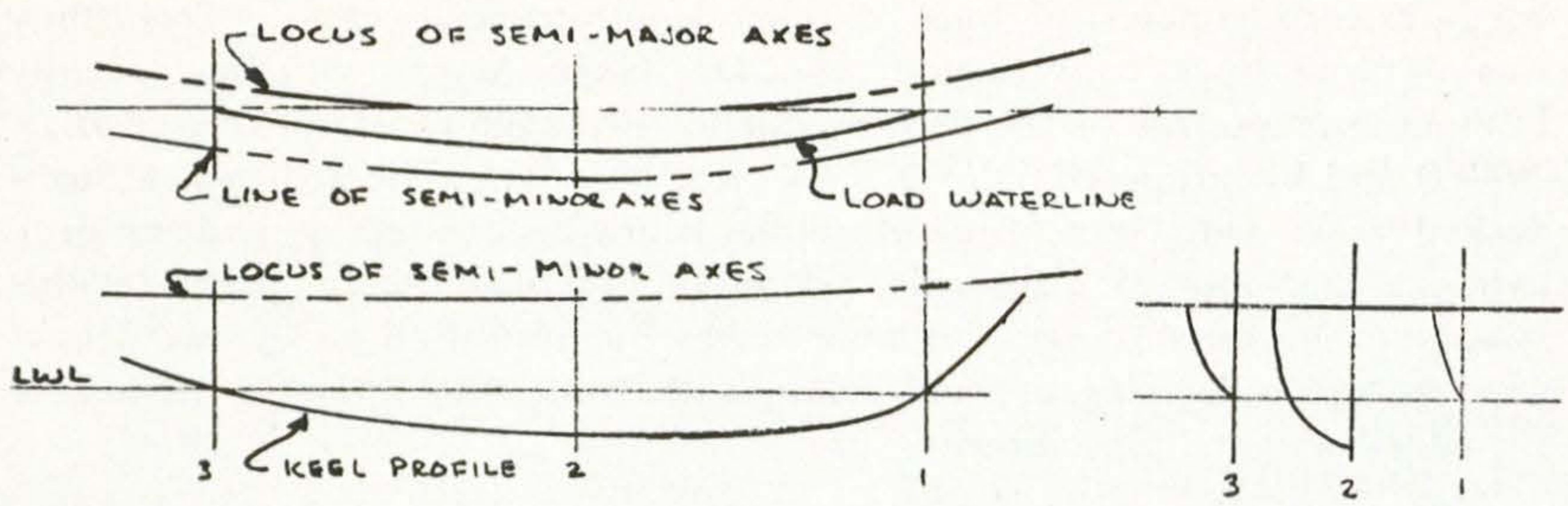


Figure 4

It may be seen that for each section the semi-major axis is the distance between the keel profile and the locus of semi-minor axes, and the semi-minor axis is the distance between the line of semi-minor axes and the locus of semi-major axes. Two reference water lines shapes appear in the sketch. There are the load waterline and the line of semi-minor axes. These two lines are dependent on each other because of the elliptical form and in practice are developed together: the load waterline is used for the development of the central half or two-thirds of the hull and the other line is then smoothly continued to shape the ends. With practice one may work with only the line of semi-minor axes, using the point of maximum water line beam as a single critical key water line point.

There remains only to look at several hull cross sections to see how the different hull types may be developed. The symmetrical hull is simply that, symmetrical about the centreline. Figure 5a shows such a section.

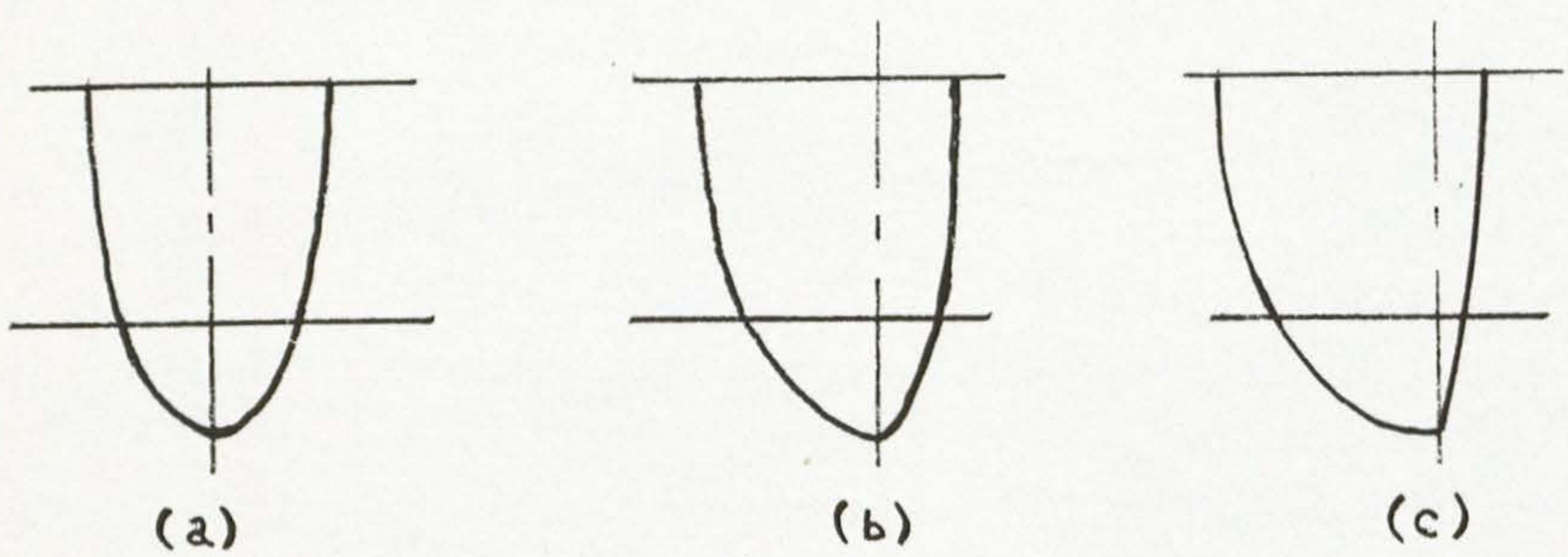


Figure 5

Asymmetry can be had with a soft or hard keel by making the slender side elliptical as in Figure 5b or merely a circular arc as in Figure 5c. It is interesting to note that these three sections have underwater perimeters (for wetted surface consideration) which are only 1.5 to 3 per cent greater than for a semi-circular section with the same area and water line beam (the centre of the circle located one quarter radius above the water line).

Application

As part of a design study for a 36 foot racing/cruising catamaran, a set of lines have been developed by the above method and are presented as an example of what can be done with the technique. A student of recent catamarans can see that its style is strongly West Coast U.S. with Choy-style hard-keeled asymmetrical hulls of high length-to-beam ratio. This study was inspired by a conversation with Dr. Hugo Myers who has recently become an exponent of the light-weight low-windage racer, such as *WILDWIND* and his proposed *EUNIKE* (AYRS, No. 54). The goal was a flush-decked racer with lots of comfortable below-deck sleeping and on-deck living, a la Southern California. A more practical design might involve swapping one forward set of double berths for an in-hull galley and a low-windage cabin forming a small salon, with some hull fattening to handle the added weight. Specifications are:

Length	36 feet	LWL	30 feet
Beam	18 feet	Hull Beam	1.9 feet
Draft	18 inches		
Water line length-to-beam ratio		16	
Displacement		4300 pounds	
Prismatic coefficient		0.67	

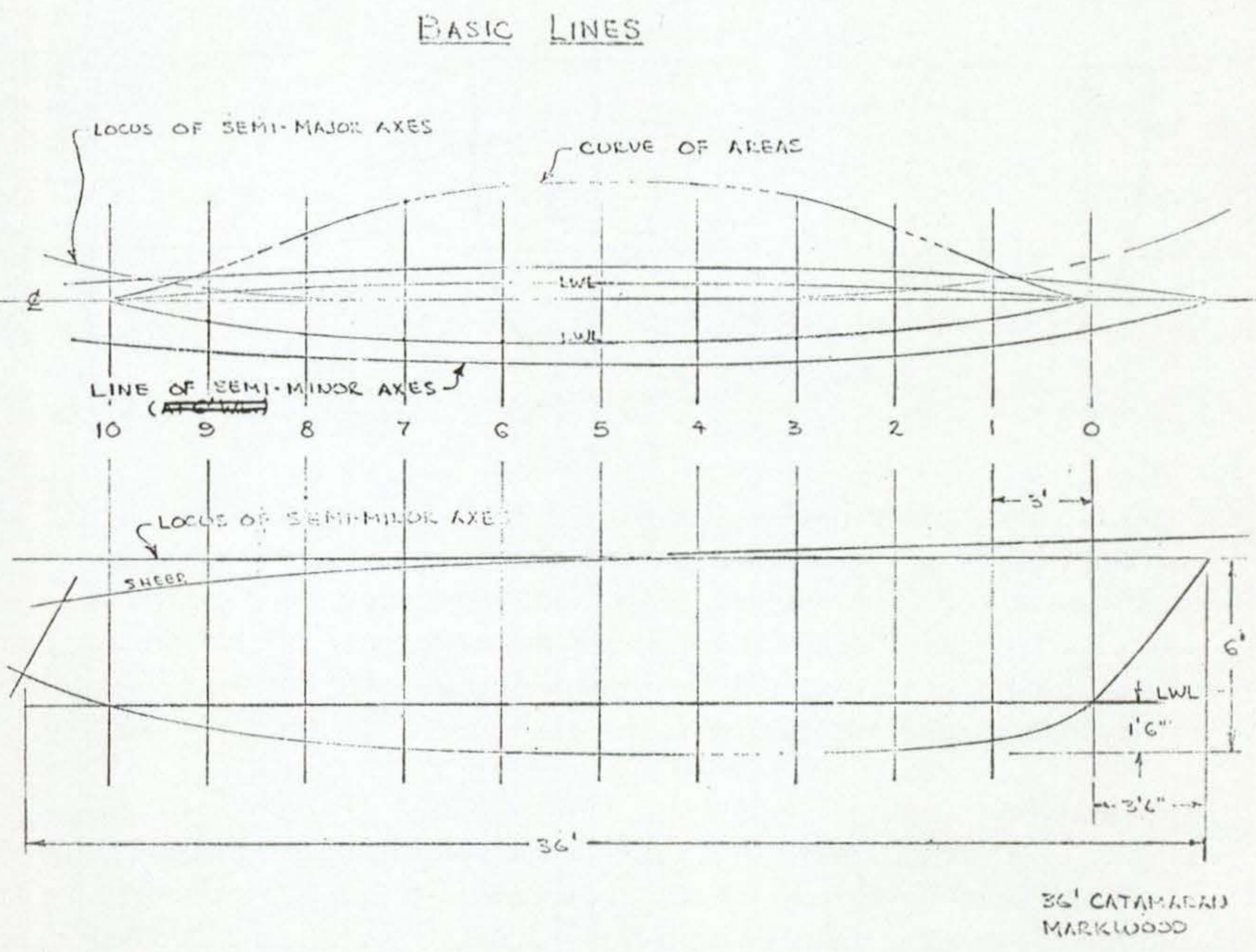


Fig 6

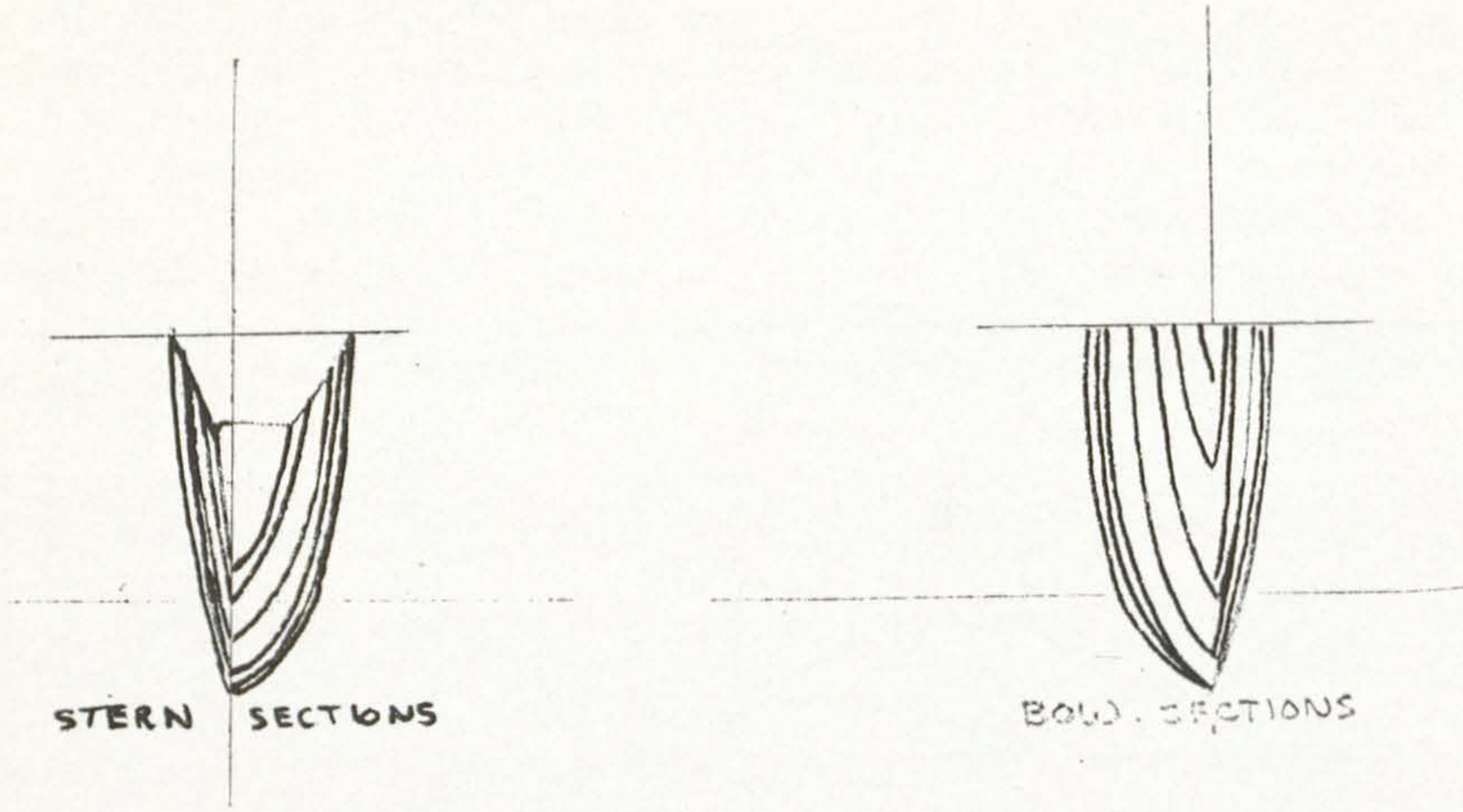

STERN SECTIONS
BOW. SECTIONS

Fig. 7

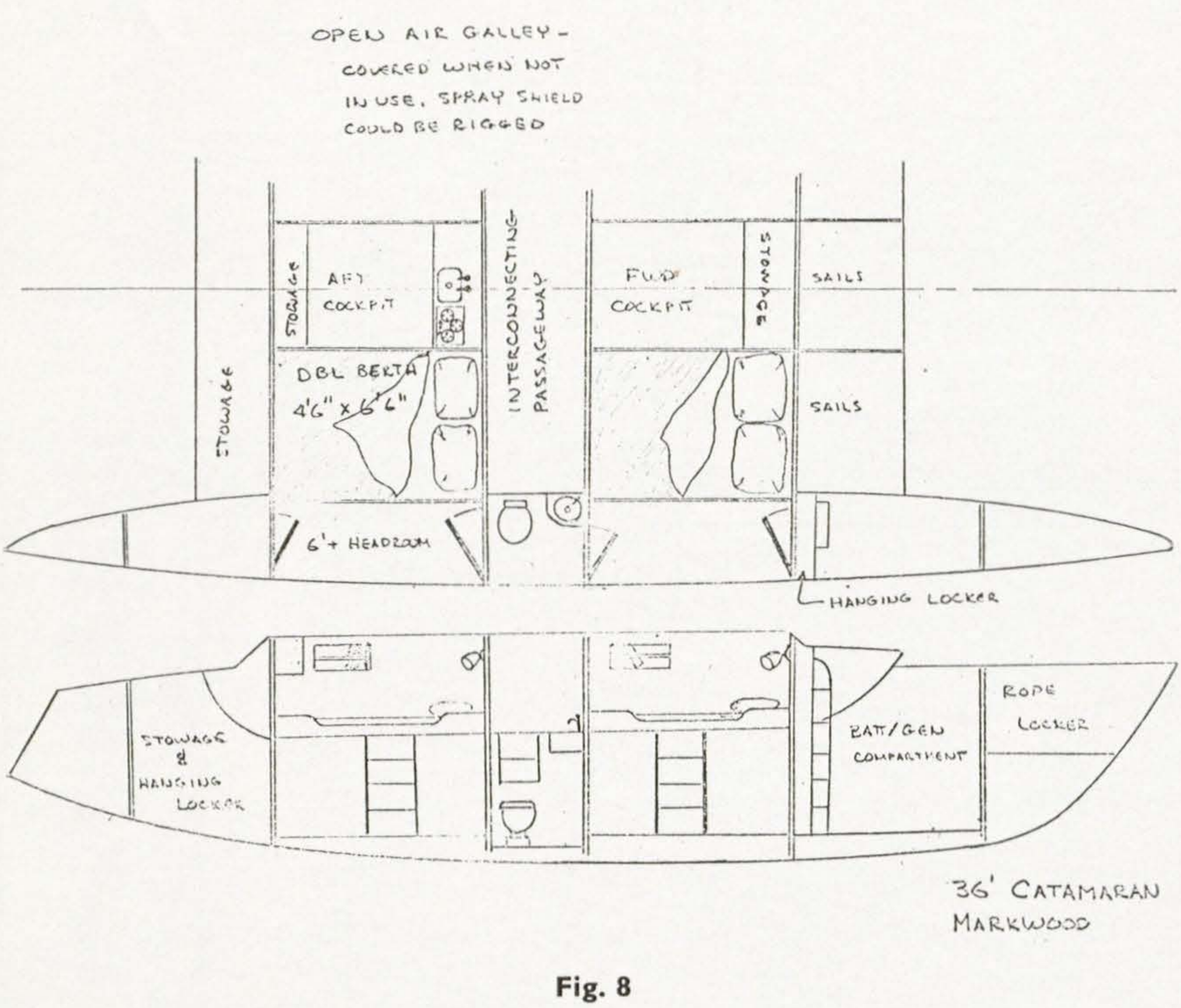

OPEN AIR GALLEY - COVERED WHEN NOT IN USE. SPRAY SHIELD COULD BE RIGGED
STOWAGE
STORAGE
AFT COCKPIT
DBL BERTH 4'6" x 6'6"
INTERCONNECTING PASSAGEWAY
FWD COCKPIT
STOWAGE
SAILS
SAILS
6'+ HEADROOM
HANGING LOCKER
STOWAGE & HANGING LOCKER
BATT/GEN COMPARTMENT
ROPE LOCKER
36' CATAMARAN
MARKWOOD

Fig. 8

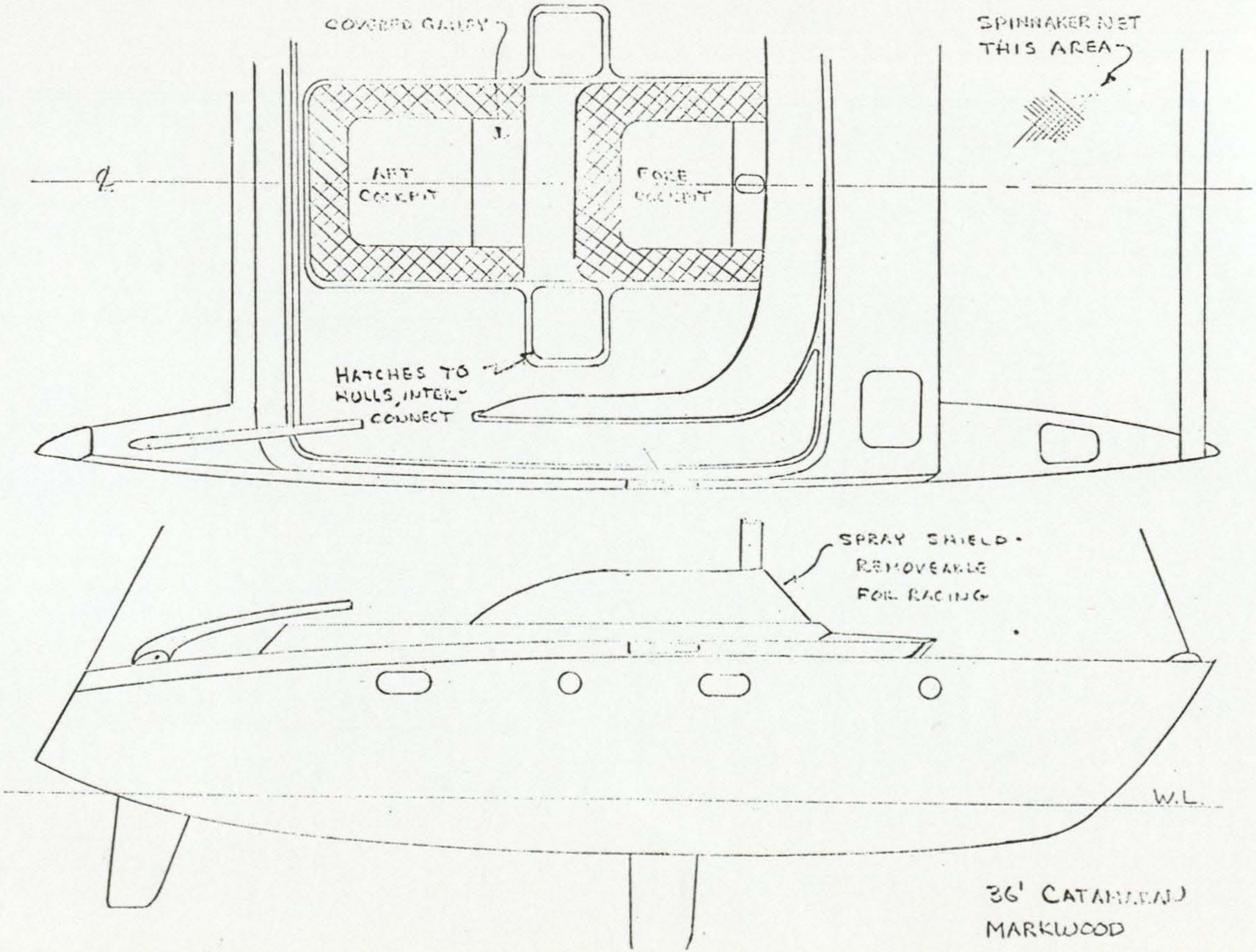

COVERED GALLEY
AFT COCKPIT
FORE COCKPIT
SPINNAKER NET THIS AREA
HATCHES TO HULLS, INTER-CONNECT
SPRAY SHIELD - REMOVEABLE FOR RACING
W.L.
36' CATAMARAN
MARKWOOD

Fig. 9

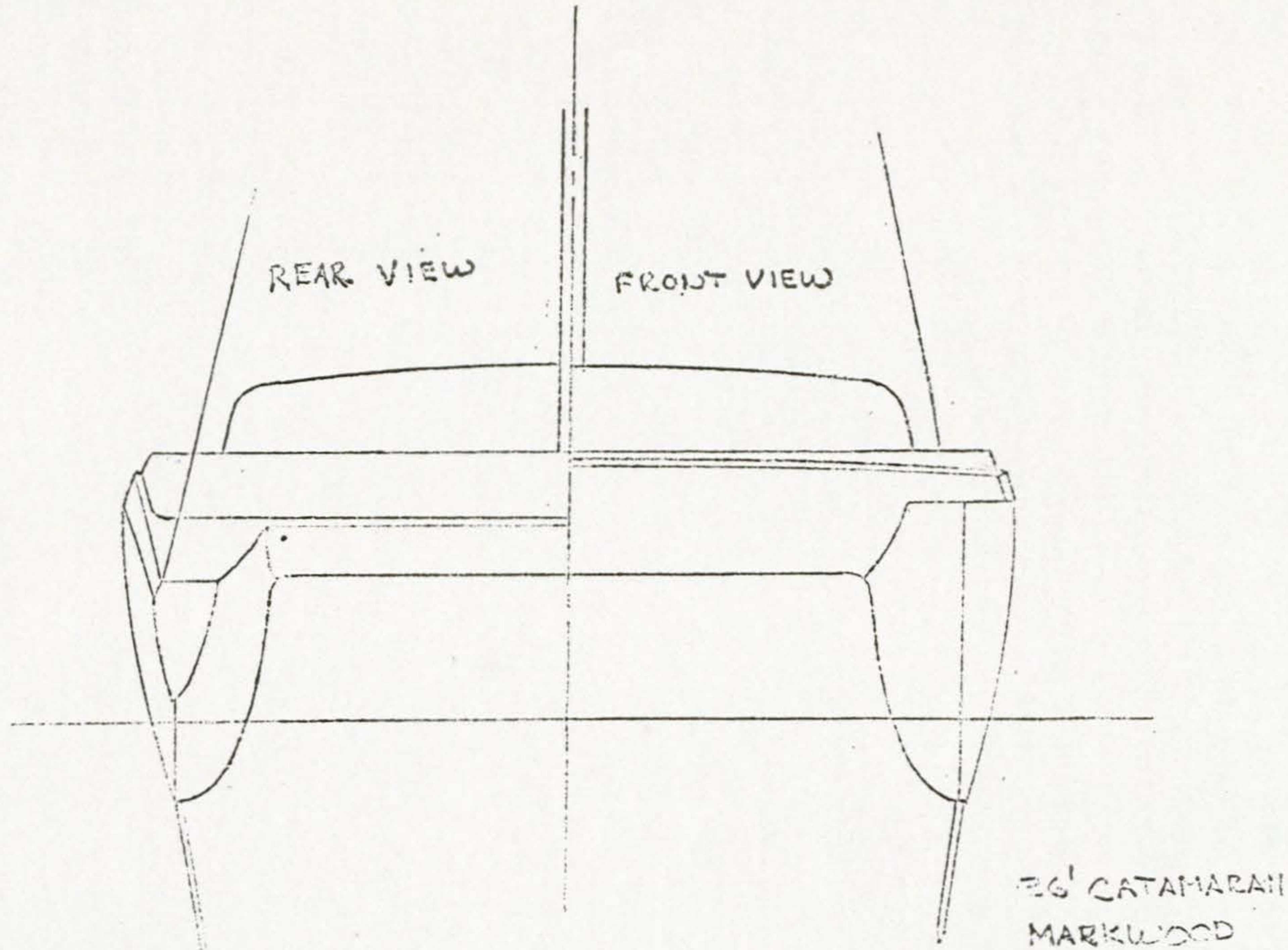


Fig. 10

TRIMARAN TRENDS

by Lock Crowther

(*By Courtesy, Martin Cooper, Editor of "Trimaran"*)

Stability curves

Figure 1 is a typical stability curve for an offshore trimaran of about 35 to 40 ft LOA. Curves like these are being published with increasing frequency in yachting magazines with various authors pointing out advantages for different configurations. For this particular curve the stability is a maximum at 26°, by the time 60° is reached it is down to 50 per cent of maximum and disappears entirely at 86°. Does this mean a tri is safe up to 86° heel? Far from it, this curve is rather academic and applies to still water with no wind conditions and is virtually useless when considering the rough sea and wind dynamic condition of an actual capsize.

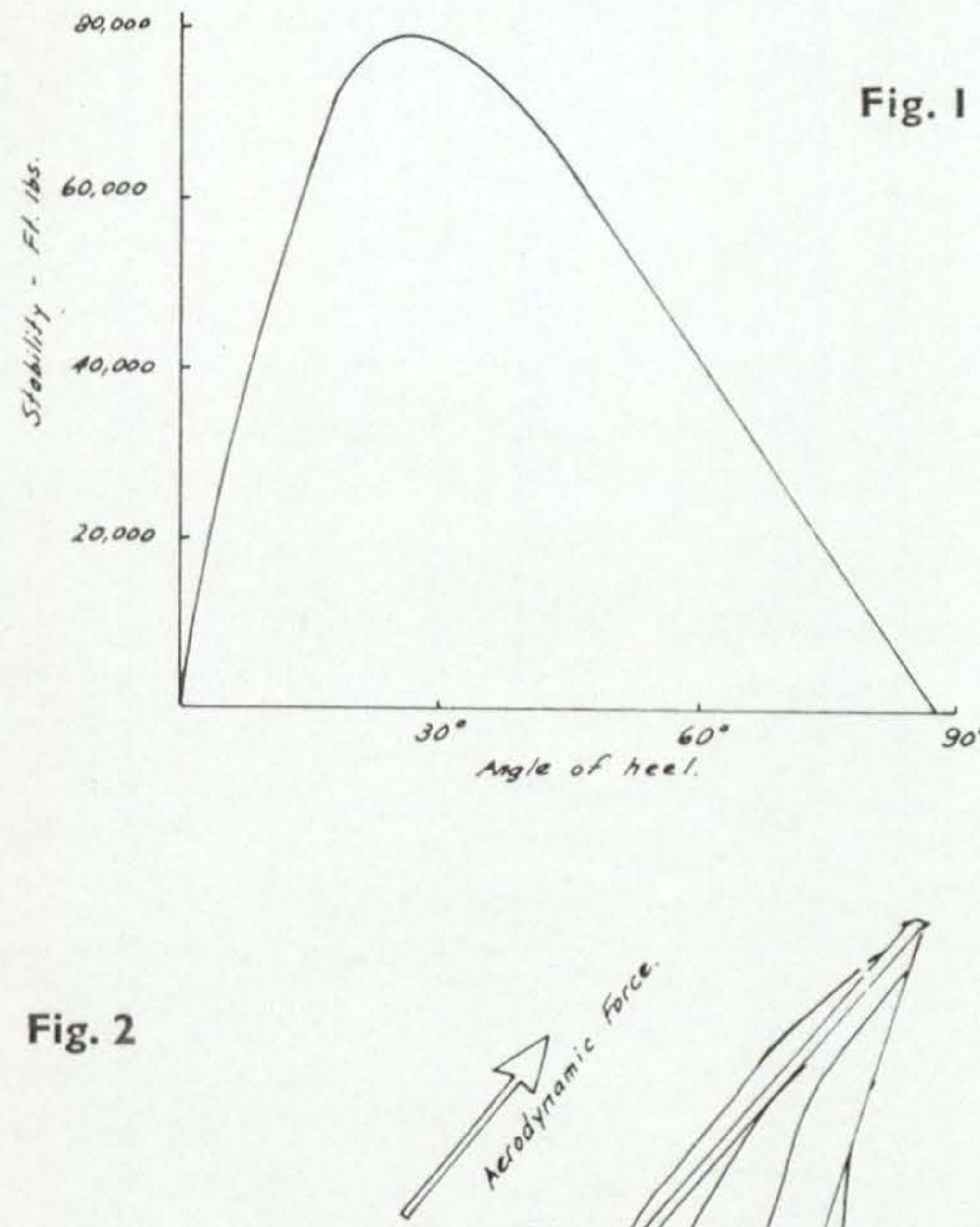
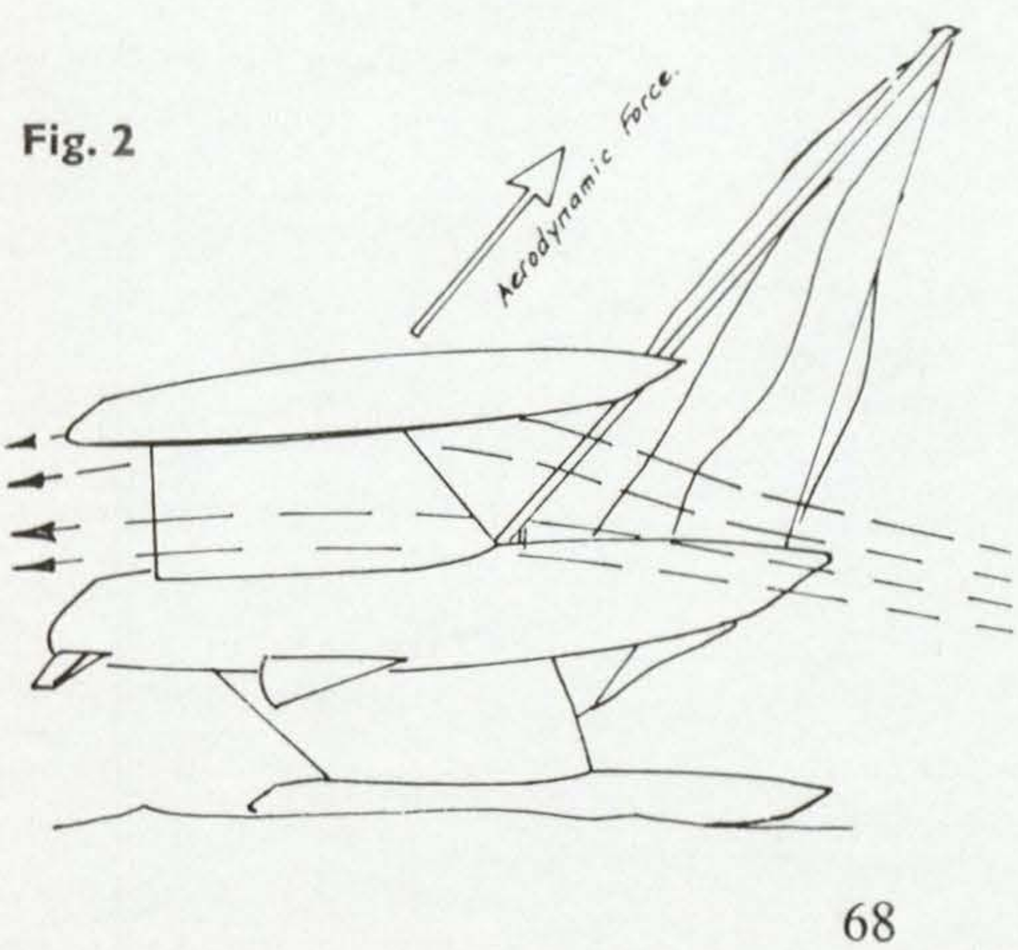


Fig. 1

Fig. 2



Anyone who has sailed small catamarans, which have a similar shaped stability curve, knows that 45° to 60° is the usual point of no return but the stability is still 50 per cent! Why is this so and does a large tri or cat follow the same pattern?

The other factors which come into play are wind pressure on decking and sails, wave action and inertia. The last is becoming significant with heavy plank masts in C class. To luff up violently from a reach is to ask for a capsize from centrifugal force generated by the mast. This can be ignored for large tris as the masts are relatively light.

Wind pressure on the wingdeck can generate large forces. In heavy weather, if a tri is knocked by a puff when the sails are well reefed, these forces can be comparable to those of the sails.

Figure 2 shows a tri at the point of no return with the breeze flowing across the aerofoil shaped deck. A coefficient of lift of 1 should be easily obtained and a typical half wingdeck area for a 35 to 40 footer is 200 sq ft (assuming the leeward deck is blanketed by seas and hulls) and from the formula Lift—$\frac{1}{2}C_L\ V^2A$ the force for any wind strength can be calculated.

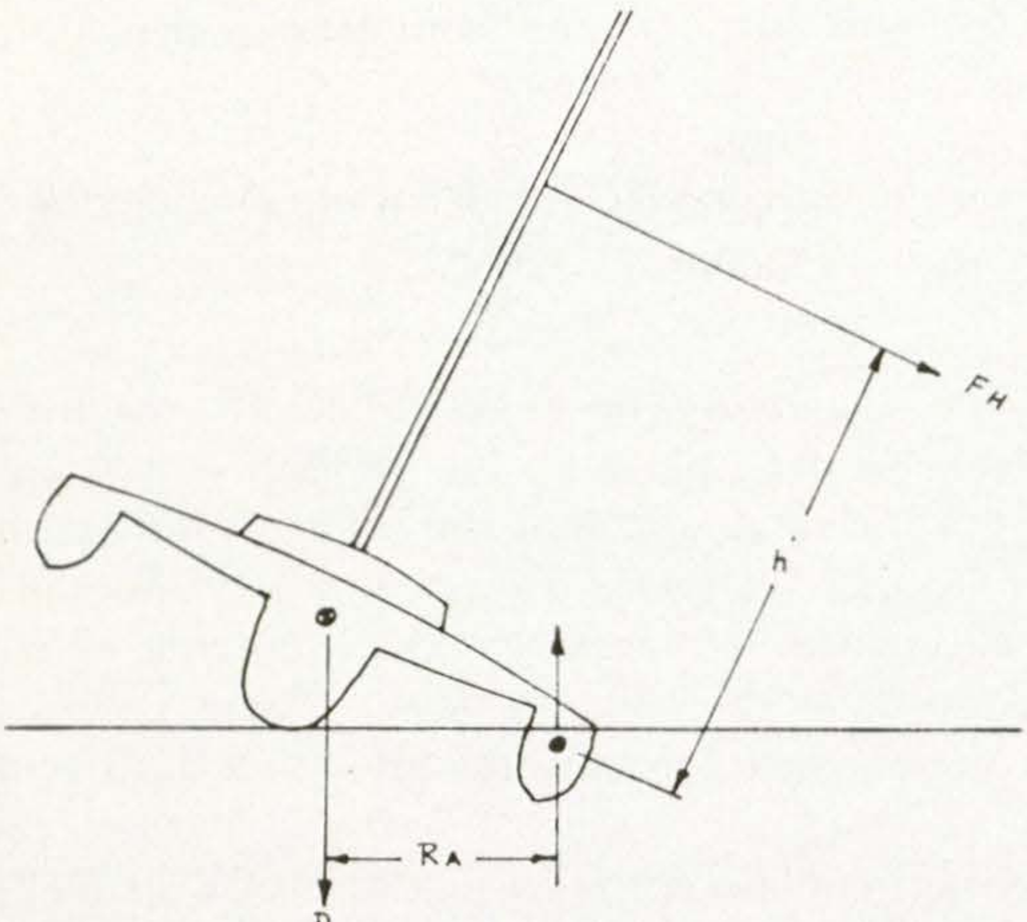


Fig. 3

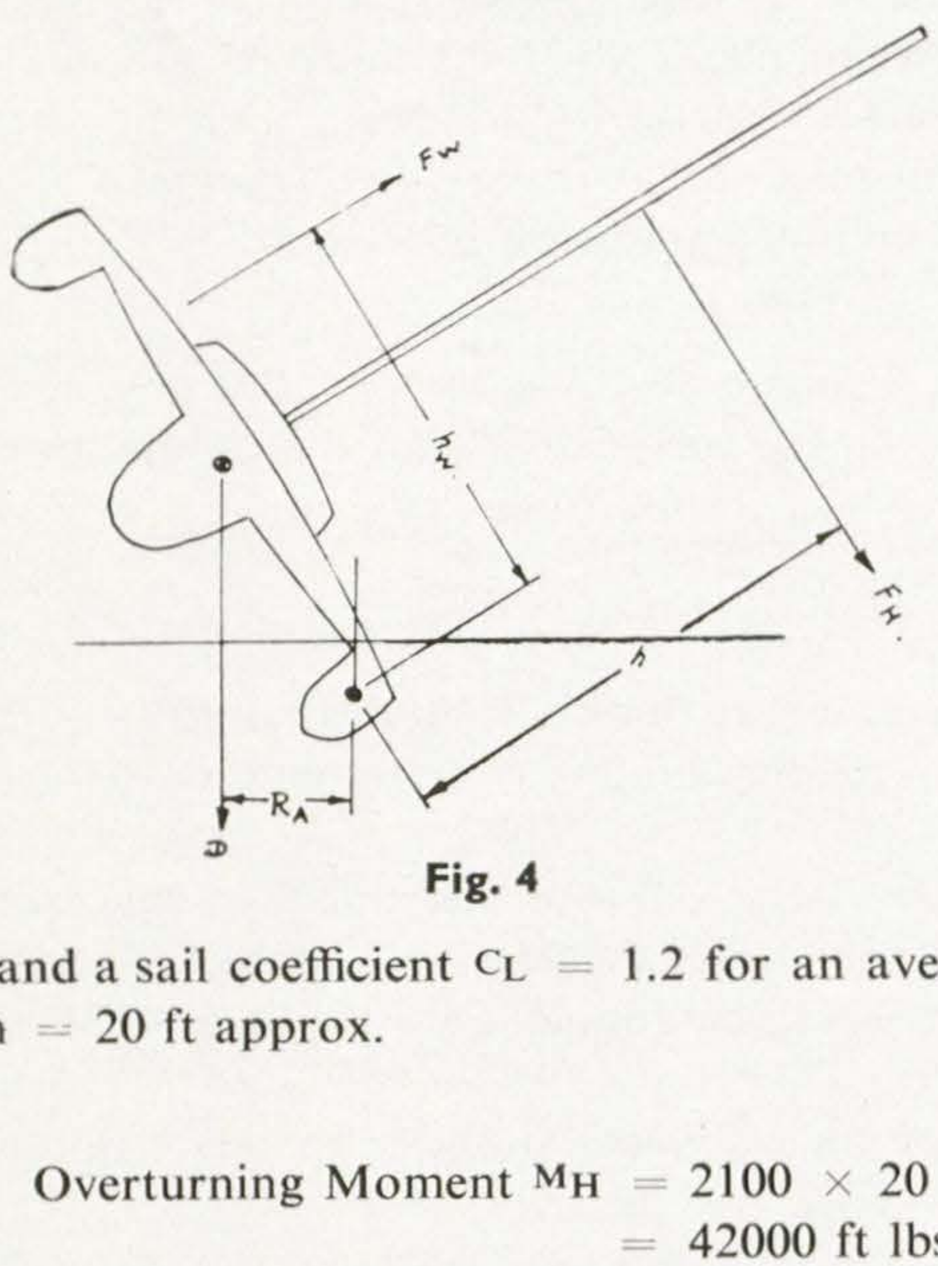


Fig. 4

In Figure 3 our tri is at the point of maximum stability, where all the weight is taken by the float.

Stability moment M_R = displacement × righting arm or $D \times RA$.

Overturning moment M_H = sail force × overturning arm or $F_H \times h$.

Figure 4 shows the same boat at 60° heel where the stability is only $\frac{1}{2}$ the maximum and where the deck overturning force is appreciable. Now overturning moment = $F_H \times h$ plus wingdeck force × wingdeck overturning arm. $C_H = F_H \times h$ plus $F_W \times hS$.

Now suppose the tri is reaching in an apparent wind of 25 knots and is fully rigged with 700 sq ft of sail and she has 80,000 ft lbs max stability moment at 26° heel—See Fig. 1. Using the same formula, Sail Force = $\frac{1}{2}C_L\ V^2A$ (and a sail coefficient C_L = 1.2 for an average sail plan) F_H = 2100 lbs and h = 20 ft approx.

Overturning Moment M_H = 2100 × 20
= 42000 ft lbs which is only half our maximum stability. A sudden hard puff of 35 knots or so hits her and her crew do not have time to free sheets and she heels to 50 or 60°, the point of no return. Now she only has half her maximum stability, not only that, the wingdeck force even if the puff drops back to 25 knots, is 500 lbs and the wingdeck

overturning area is 15 ft giving a total overturning moment

$M_H = 2100 \times 20$ plus 500×15

$= 49{,}500$ ft lbs which exceeds her stability and over she goes. 7500 ft lbs is relatively small compared to the 42000 ft lbs moment of the sail, but if the sails were well reefed for a 50 knot blow this would not be so. With 250 sq ft sail and 13 ft of moment arm at 50 knots $F_H \times h = 3000 \times 13.$

$= 39000$ ft lbs.

Should the same type of hard puff hit her, the wingdeck overturning moment at 60°,

$$F_W \times h_W = 2000 \times 15$$
$$= 30{,}000 \text{ ft lbs at 50 knots}$$
$$\text{and } M_H = 39000 + 30000$$
$$= 69{,}000 \text{ ft lbs}$$

Thus, this tri would have capsized well before this angle of heel was reached. It is safe to assume that wingdeck windage plays an increasingly important part on safety as the wind strength increases and that the point of no return occurs at less and less angle of heel as we reef. Therefore all offshore tri and cat sailors should prevent all chances of excessive heel occurring either by over reefing, crew vigilance or sheet releasing devices. There is some justification for the axiom that keelers reef for the lulls and multihulls reef for the puffs.

The above argument could perhaps explain the recent capsize of *GOLDEN COCKEREL.* (Choy design, catamaran entrant for the 1968 single handed Trans-Atlantic race). The crews failed to release a genoa sheet in time when a puff hit and over she went. Hinged cam cleats which flip up to release sheets at a certain tension have been used by Piver for main sheets. For modern rigs with large genoas some form of releasing, or tripping genoa winch with adjustable trip point for windward and reaching work is needed.

Size versus safety

Looking at Figure 3 again, stability moment $M_R = D \times R_A$. For any boat, the displacement is proportional to length cubed or L^3 and the righting arm is proportional to beam or length so R_A is proportional to L.

$$\text{Therefore } M_R \propto L^3 \times L$$
$$M_R \propto L^4$$

If we have a 25 ft tri and scale it up exactly to 50 ft, L is doubled and $M_R \propto L^4 \times M_R$ for the 25 footer. In other words the stability of a 50 footer is 16 times that of a 25 footer.

The overturning moment $M_H = F_H \times h$. F_H is proportional to sail area. In the 50 ft tri the sail area will be four times the 25 footer's and the centre of sail area will be twice as high, i.e. h will be double. M_H will be $4 \times 2 = 8$ times as great and $M_H \propto L^3$.

The ratio $\dfrac{\text{stability moment}}{\text{overturning moment}}$ or $\dfrac{M_R}{M_H}$ compares stiffness or the maximum wind strength in which full sail can be carried and it is easy to see that the 50 footer will take twice as much wind pressure ($\dfrac{M_R}{M_H} = \dfrac{16}{8} = 2$) as the 25 footer before reefing.

Figure 5 graphs M_R and M_H for tris of various lengths. A 30 ft tri has $\frac{M_R}{M_H} = 3.5$ whereas a 50 ft tri $\frac{M_R}{M_H} = 6.5$ for typical designs. A larger tri is much stiffer and safer than a small tri.

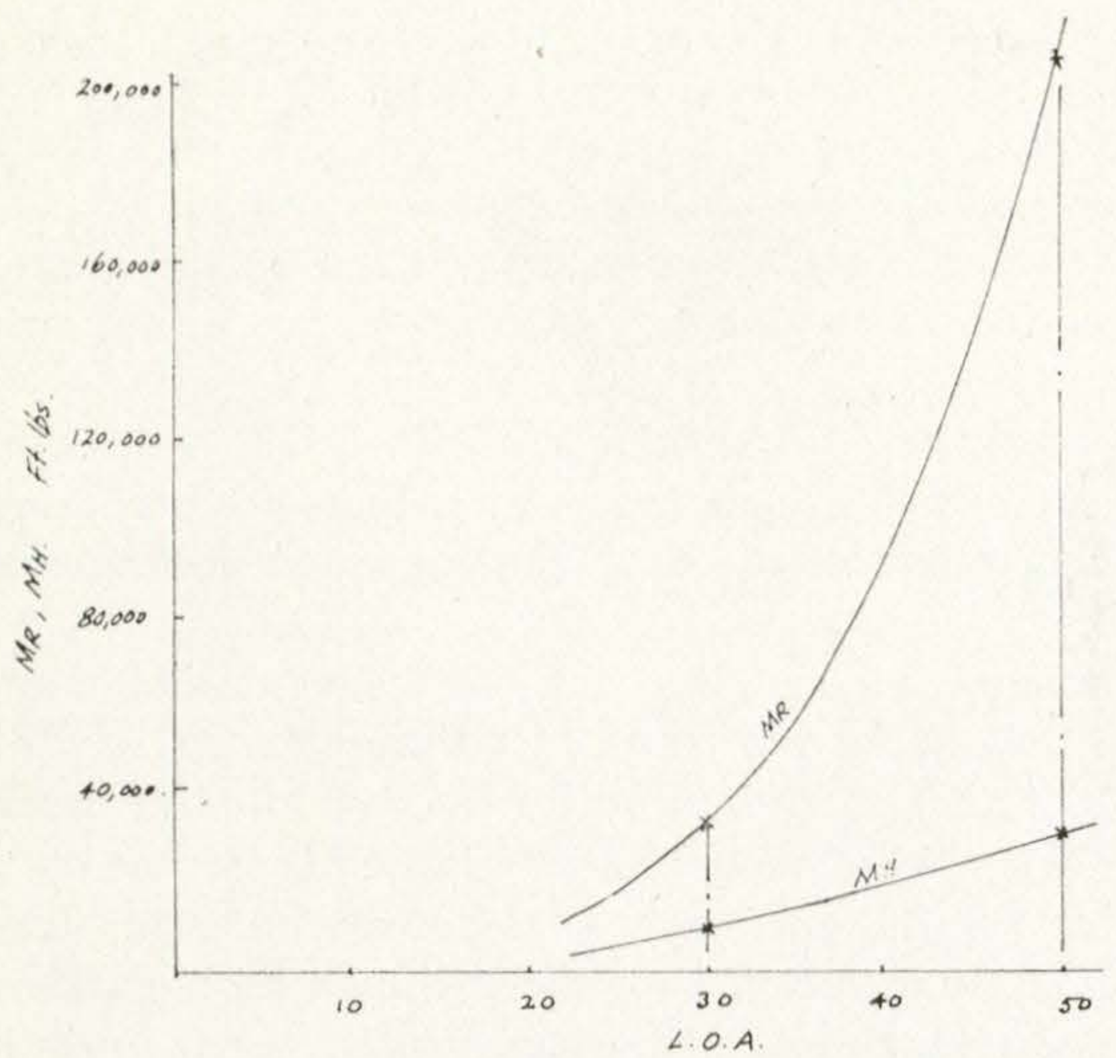


Fig. 5

Cruising and racing design

Those newcomers to sailing who have owned a tri for two or three years are now looking for improved performance. They and a few converts from other craft are forming scattered nuclei of tri racing fleets. Competition is forcing designers to strive for increased speed and seaworthiness.

Over the next few years the design configuration should standardise to the point where detail improvements become more important. The day of the floating apartment house tri is gone; sleeker low windage designs and round bilge hulls are in. Structure design has improved and fewer disastrous failures should occur. Moulded ply techniques are common knowledge even for amateurs and PVC foam glass sandwich or all glass is coming into vogue.

Racing designs

At the moment there are two separate configurations. The configuration used by *TORIA*, the round Britain race winner, and *BANDERSNATCH* has two crossbeams and a large hole covered with netting instead of a wingdeck. This greatly reduces the windage and lessens the chance of a capsize.

The other configuration used in nearly all other designs including *VIVA*. the Piver *Stiletto*, has a full wingdeck and large non-submersible floats, Relatively heavy displacements allows sufficient stability to be obtained with less beam and wingdeck forces become relatively less important.

Ocean racing trimarans are becoming lighter and to obtain the necessary stability, the righting arm or beam is increasing. With the increased beam the conventional wingdeck has greater area and a longer moment arm. Couple this with low displacement and wingdeck aerodynamic force is a major capsizing force.

BANDERSNATCH (*Kraken* 33) and *Kraken* 40 carry the reduced windage idea a step further by means of submersible floats. Thus only half the wingdeck is exposed at large heel angles and the moment arm is lowered similarly. Since submerging floats reduce the maximum stability slightly, overall beam has been increased over the *TORIA* type. This results in excellent stability and approximately one third of the windage moment.

Cruising designs

These have standardised on the non-submersible float style but there is a lot of room for improvement. One of the main causes of delay in development is the average person's tendency to equate length with cost. Tubby, speed restricting hulls provide plenty of room for their length but not much else.

Stretching these hulls a few feet and reducing beam a few inches would make all the difference to performance and ease of motion, yet would cost very little extra.

I foresee the cruising tri's hull narrowing to around 8 : 1 L/B ratio with round bilge hulls providing sufficient payload capacity. Floats are becoming longer and narrower removing much of the drag causing wave interference between float and main hull.

Broaching is another tendency induced into tris by faulty design compromises. Like catamarans, tris do have a tendency to bury the lee bow of the float when hard pressed. Reverse sheer looks attractive but too much helps to hold the lee bow down when surfing and running under waves on a downwind course. Some recent designs have enormously buoyant float bows with a lot of flare in an attempt to overcome the lee bow running under. These designs exhibit a remarkable tendency to broach and to screw up into the wind when hit by a puff on windward work. One would think a float pushed well down would slew the boat around leeward.

Figure 6 shows a dotted outline of the float waterline shape and the resultant wave formation with the float well down and heeled. It is this leeward wave which causes the rounding up and broaching. Leaning the floats out at the bottom reduces asymmetry of the waterline or alternately asymmetric floats with flatter outsides have the same effect.

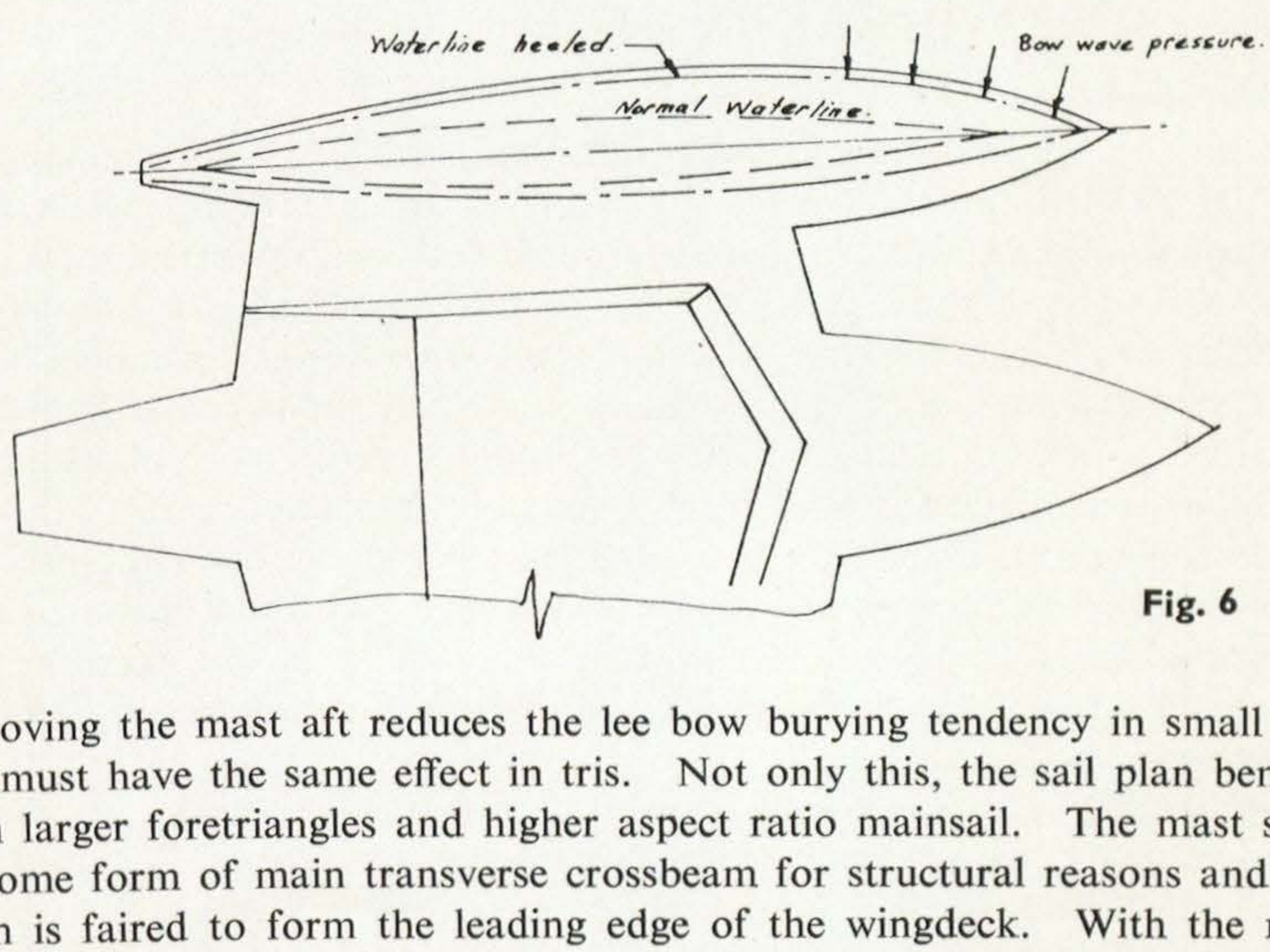


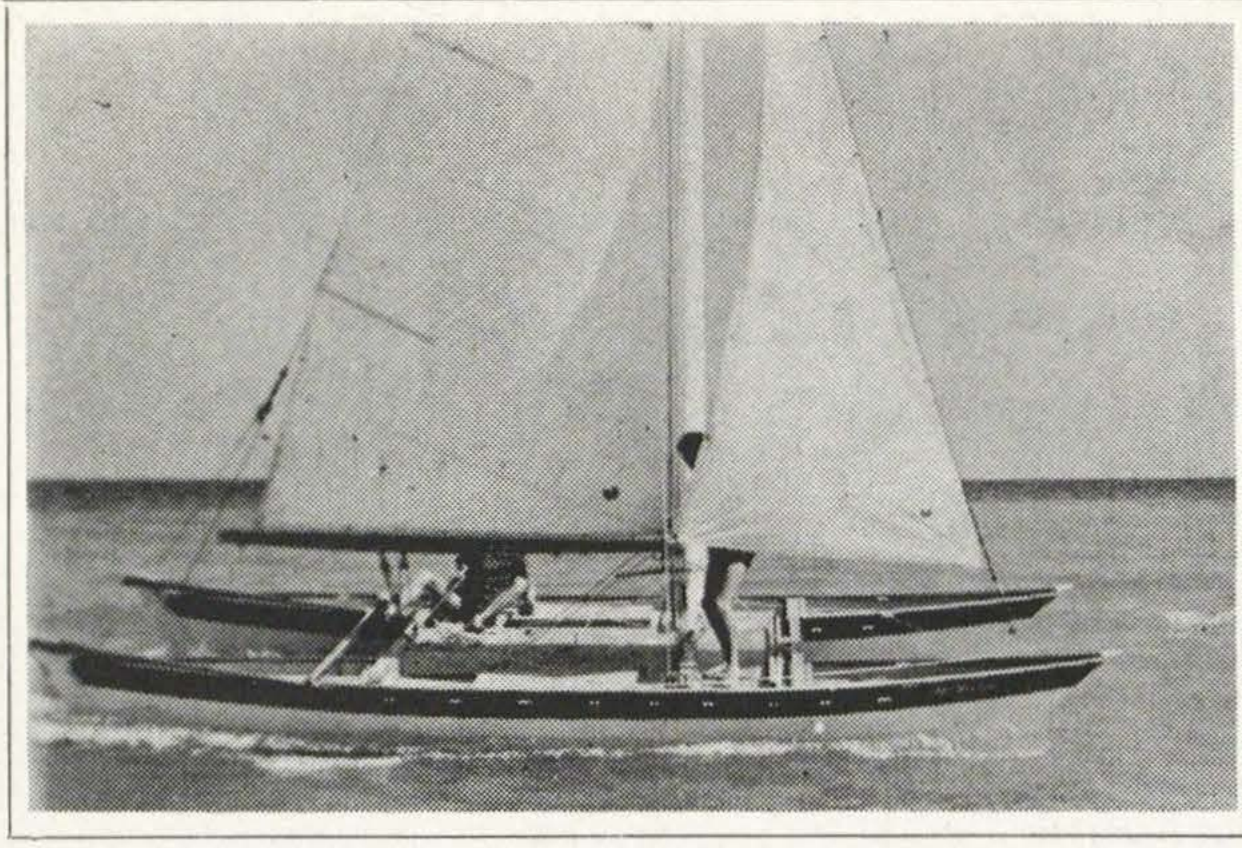
Fig. 6

Moving the mast aft reduces the lee bow burying tendency in small cats and must have the same effect in tris. Not only this, the sail plan benefits from larger foretriangles and higher aspect ratio mainsail. The mast steps on some form of main transverse crossbeam for structural reasons and this beam is faired to form the leading edge of the wingdeck. With the mast further aft the wingdeck is shorter and of less area, increasing safety and concentrating weight more around the centre of gravity. The one disadvantage of moving the mast aft is the reduction in cabin length.

The cruising tri, ten years from now, will be more pleasing in appearance than today's designs but the accommodation layouts will not have changed much. The obvious and best place for bunks is in the wingdeck, preferably aft close to the pitching centre of gyration. Here it is reasonably quiet and away from the central passageway. Galley and chart table are located aft alongside the companionway as in a keel boat. The icebox can be under the cockpit seat, up against the aft cabin bulkhead with access from the galley as well as the cockpit and drainage through the wingdeck. The dinette is at the fore end of the cabin and the head, sail stowage etc. are for'ard of the main beam. Further bunks and stowage can be located under and aft of the cockpit.

Construction will probably finish up with a mixture of fibreglass, PVC foam sandwich and straight fibreglass combined with wood, aluminium alloy and stainless steel at stress concentration points. Noise in a seaway and condensation through poor insulation and ventilation will undoubtedly be improved. The insulating properties of sandwich construction should have a marked effect.

There is no reason why cabin heating couldn't be incorporated, removing that horrible damp, cold feeling one can get going below after a dousing in inadequate oilskins.



a WHARRAM POLYNESIAN CATAMARAN

The 22 ft. HINA, built for £190.
Demountable for easy trailing.

Sleeps 2 adults, 2 children in special harbour deck cabin.

Over 200 being built.

Owners reporting offshore cruising speeds averaging 9 knots.

Top speeds of 15 knots without the aid of trapezes.

The Basic Principles of the Ancient Polynesian Catamarans were:

- ★ Narrow beam-length ratio hulls.
- ★ "Veed" cross-section.
- ★ Flexibly mounted beams joining the hulls together.
- ★ No permanent deck cabin between hulls.

The narrow beamed hulls give speeds above the square root of the Waterline Length, due to minimum water disturbance, (Without the necessity of planing with large sail areas, so avoiding the multihull leap).

The shallow draft Veed hulls require no centreboards or fin keels, for good windward performance. (The absence of projecting centre-boards or fin keels has been shown to increase stability on catamarans.)

The hulls joined flexibly together decreases capsizing possibility, as both boat and masts give like trees to wind gusts.

Having no deck cabin lowers centre of hull gravity, which again increases stability.

WHARRAM POLYNESIAN DESIGN PRINCIPLES = MAXIMUM CATAMARAN STABILITY.

Using modern material and building methods, Wharram 'Polynesian Caramarans' require no building stocks, or level floor to build on. The simple Veed cross-section is the easiest known method of boat construction. Demountable, complete boats are easy to transport, for quick assembly on the sea shore.

This design philosophy and construction has been tested in 4 Atlantic pioneering voyages, the first being in 1955-56, Britain-West Indies.

Plans: from 22 ft.-51 ft. available from James Wharram, Poste Restante, Deganwy, N. Wales. Send 2/-. (3/-. overseas) for details.

U.S. Plan Agent: W. M. Cookson, 1757 N. Orange Drive, Hollywood, California 90028, U.S.A. Canadian Plan Agent: P. McGrath, Canadian Multihull Services, Suite 706, 43 Thorncliffe, Toronto 17, Ontario, Canada.

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