TRIMARANS 1968

A.Y.R.S. PUBLICATION No. 65

NIGHTHAWK

THE AMATEUR YACHT RESEARCH SOCIETY

(Founded June, 1955)

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EDITORIAL

July, 1968.

Arthur Piver. Arthur Piver is now three months overdue from a single-handed cruise from San Francisco to San Diego in a borrowed, home made trimaran, a voyage which he was doing to qualify for the 1968 Single-Handed Trans-Atlantic Race. The loss of any friend is a tragedy but Arthur's loss is not only a personal tragedy for the members of the A.Y.R.S. but a loss to the whole trimaran movement.

Arthur's contribution to yachting was that he took the trimaran from being a small day-sailing machine and made an ocean-going yacht of it. But he was not content to sit at his desk and draw out pretty lines on pieces of paper. He sailed the oceans in his designs, always being prepared to risk his own life first, like an aeroplane test pilot, to find out all the snags and difficulties. He was the great pioneer who convinced us that here at last was a type of yacht which we could afford to build or buy which could cross oceans with greater speed, comfort and safety than a comparable single hull. And, by crossing first the Atlantic and then the Pacific, he spread this message by the only way sailors understand, to Europe, New Zealand and Australia.

Very many of us have met and spoken to Arthur and have been impressed by his tremendous enthusiasm not only for trimarans but for the Sea itself. But we have mostly regarded him as a friend through his vital writings with their incisive appreciation of the hazards of the Ocean and his simple and practical methods of dealing with them.

Throughout all the history of yachting, or indeed ship design, one can think of no other man who has not only done so much to develop any new type of ocean-going vessel but has also risked his life so much to find out and perfect both the design and seamanship.

Arthur's yacht designing career was dedicated to our pleasure, comfort and safety at sea. He was lost while striving still further for our benefit, as I feel sure he would have wished.

We have lost a friend whose name will never be forgotten while trimarans sail the seas. He leaves a widow and two grown-up daughters.

Winter Meetings for 1968-1969. These have not yet been arranged.

Increase in Subscription. As from 1st October next (1968) all Sterling subscriptions will be raised to £2. The U.S. subscription will stay at $5.00 which is the equivalent. Members who pay by Bankers Order will be sent a notice with which to advise their banks in the next issue. For convenience, the Australian and Canadian subscriptions will also be $5.00, though this gives a slight discount to the former. It appears to have rankled a bit for these past few years that the U.S. and Candian subscription was $5.00 while the Sterling members paid £1. To explain this, one must remember that the subscription was raised from $3.50 to $5.00 originally in order to finance A.Y.R.S. local activity in North America. Though very few meetings actually took place before the American administration was passed back to us, we saw no point in lowering the subscription again to $3.50 and so kept it, especially as we needed the money to finance our larger publications.

TRIMARANS 1968

Ruth Evans and Jock Burrough have most kindly assembled and edited this publication. It will be noted that my system of titling by year has been altered so that the year is that of publication.

It is indeed refreshing to see an outlook different from my own and I think they have made a much better job of it than I usually do. Jock was already fully employed taking his Ministry of Transport Yacht Masters Qualification when I asked him to take on this publication, which he did without complaint. B. T. Bennett helped with the drawings. They are to be thanked and congratulated upon a really fine job.

The Yachting World Multihull Design Competition. In 1967, the Yachting World had a design competition for multihulled boats. There were entries from all over the world with some very interesting craft. The Editor of Yachting World most kindly wrote to all the entrants, asking them to send their designs to us and several have been included in this publication.

TRIFLE

Designers: Maj.-General R. H. Farrant, C.B., and D. Kelsall

Length over all	42 ft.	Beam over all	27 ft.
Main Hull Beam	4 ft 3 ins.	Accommodation	4 berths
Registered Tonnage	9.9 tons	Displacement	2.5 tons (approx.)

Main Beam — Composite construction, H.T. Steel wire for tensile and Fibre-glass for compressive stresses.

Fore and Aft Beams — Light Alloy extrusions

Assembly — Beams secured to chain-plates in hull and floats by stainless steel straps and nuts and bolts.

Sail Area:

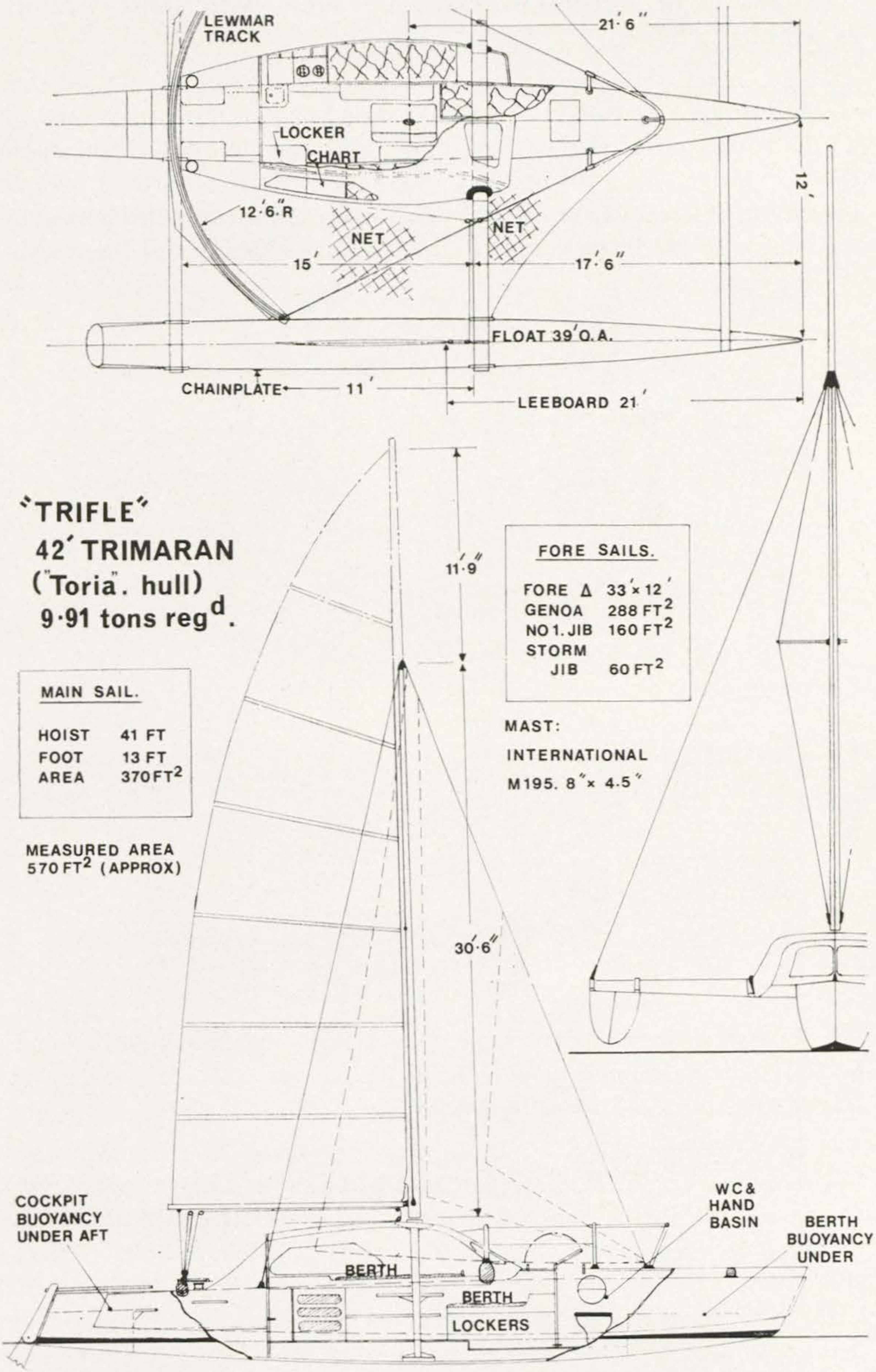
Mainsail	370 sq. ft.	Foretriangle	195 sq. ft.
R.Y.A. Rating	34.59 ft.		

Background

I had been following the development of multi-hull craft in A.Y.R.S. publications for some years before 1962, when I began to think seriously about a large, easily driven trimaran as a practical cruising yacht. Having spent a large part of my sailing life racing International Fourteen Foot dinghies, and having given up the 60 lbs. of lead ballast we were allowed on our centre-boards as long ago as 1936, I have a well developed aversion to dead weight in fast boats.

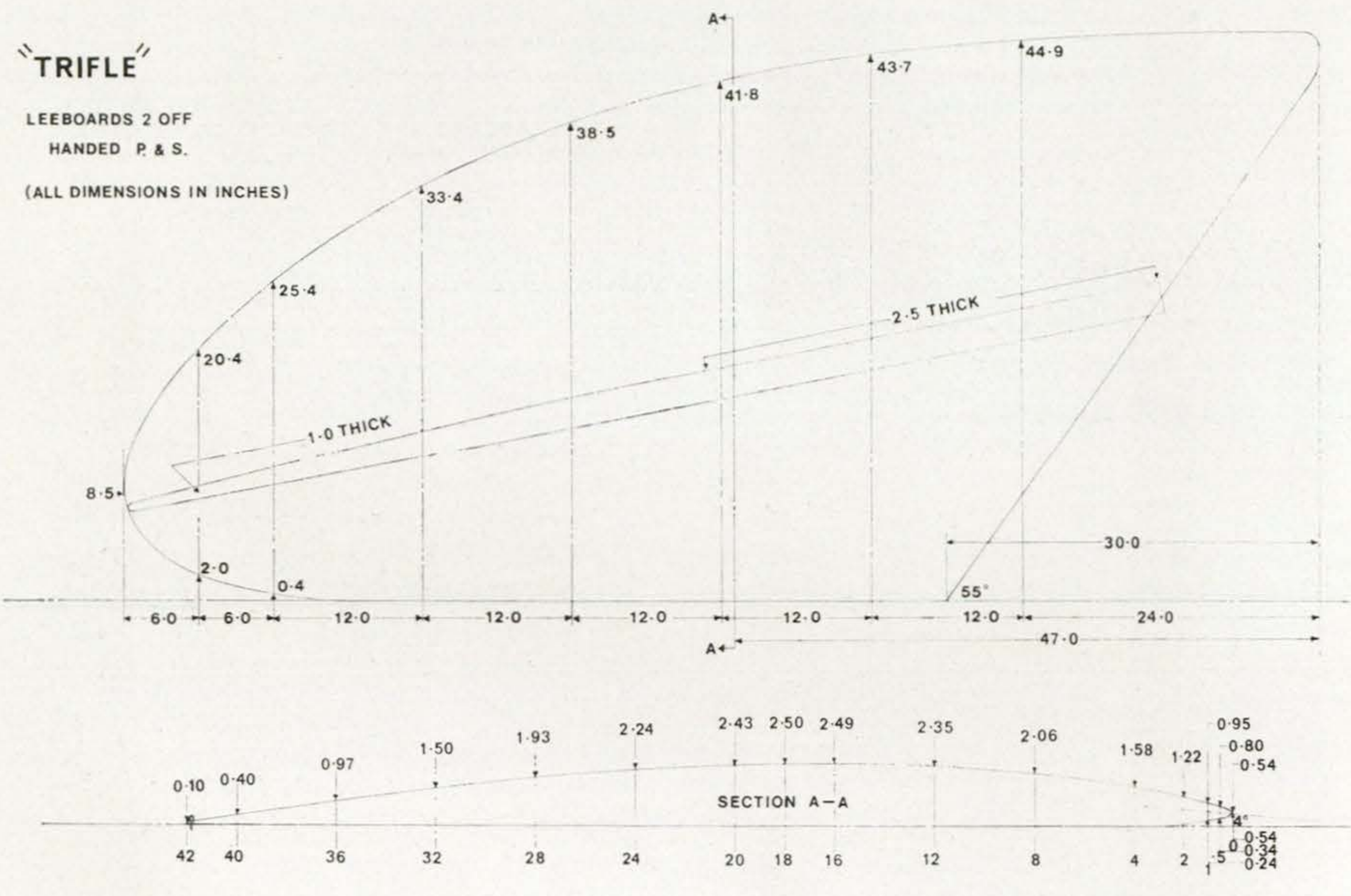
My first thoughts about a cruising trimaran, with a beam/length ratio suitable for speed, were that an overall length of about 60 feet might be necessary and I was undecided as to what the best type of floats might be. In 1964 I bought an International 10 sq. meter canoe intending to do float experiments, but in the end I only sailed it as a canoe and, instead experimented on a small Zanzibar outrigger model which I had been given when visiting Tanganyika in 1962.

In 1965, on seeing the description of *COMANCHE*, later christened *MIRRORCAT*, I started to design a 40 foot trimaran based on a *COMANCHE* hull and finished the general arrangement drawing of a demountable trimaran—the basic *TRIFLE*—in November 1965. I sent a print to J. R. Macalpine-Downie and had some correspondence with him about my ideas, but in the end I found it to be too difficult to obtain a *COMANCHE* hull. Meanwhile my model experiments with various outrigger floats, water-ski, sea-sled and 90°V types, showed me that they were unlikely to be as satisfactory


LEWMAR TRACK
21'6"
LOCKER
CHART
12'
12'6"R
NET
NET
15'
17'6"
FLOAT 39' O.A.
CHAINPLATE
11'
LEEBOARD 21'
"TRIFLE"
42' TRIMARAN
("Toria". hull)
9·91 tons regd.
MAIN SAIL.
HOIST 41 FT
FOOT 13 FT
AREA 370 FT2
MEASURED AREA 570 FT2 (APPROX)
11'9"
FORE SAILS.
FORE Δ 33'x 12'
GENOA 288 FT2
NO 1. JIB 160 FT2
STORM JIB 60 FT2
MAST:
INTERNATIONAL
M195. 8" x 4.5"
30'6"
COCKPIT BUOYANCY UNDER AFT
WC & HAND BASIN
BERTH BUOYANCY UNDER
BERTH
BERTH
LOCKERS

as the type of sections used in "C" Class Catamarans and I discussed the building of scaled-up "Manta-C" floats with John Mazzotti, as a likely solution.

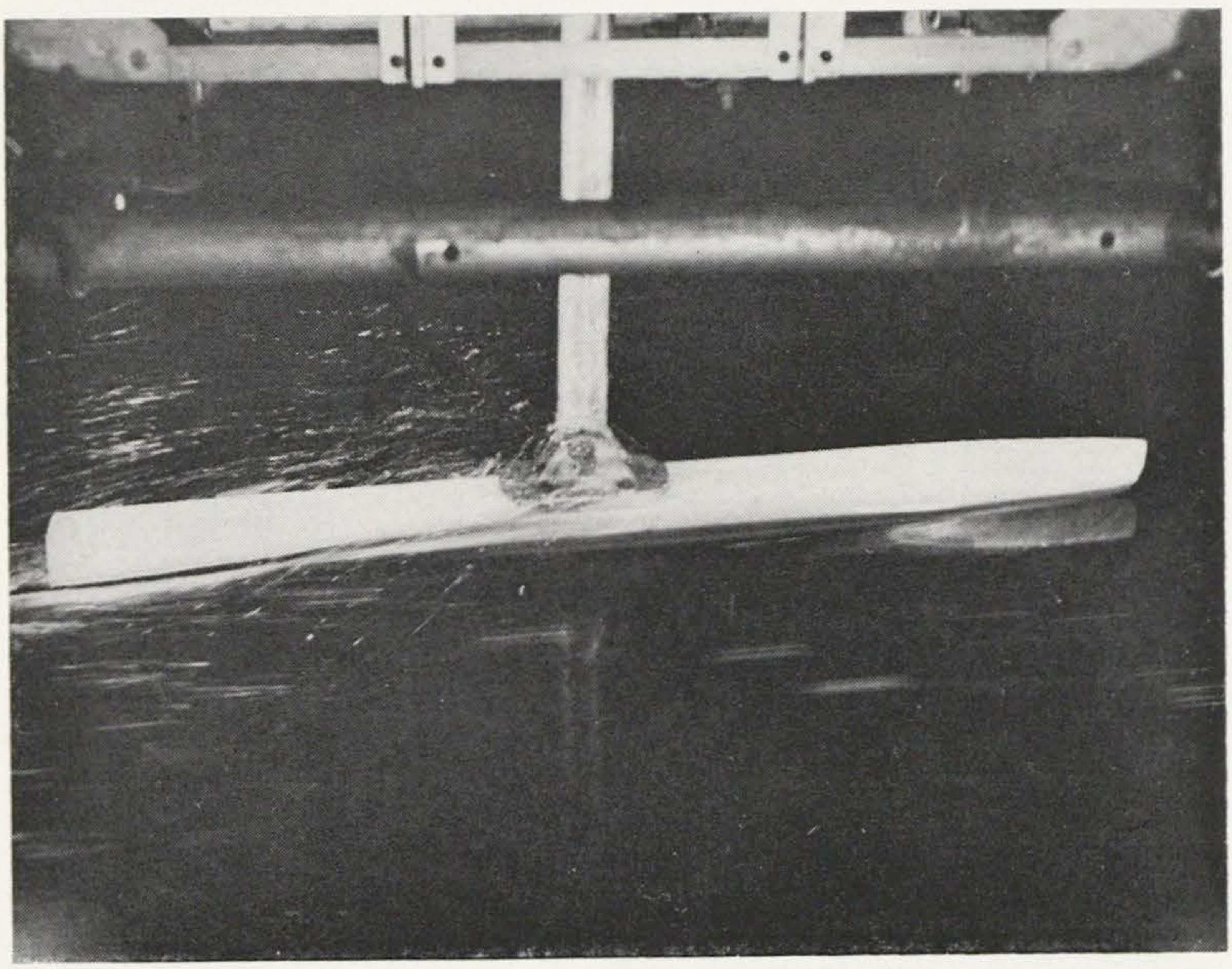
To match this concept, I decided I must have a really efficient rig, so I designed a very clean sailplan based on a rotating mast carrying a fully battened mainsail with no stays above the hounds. After seeing the "C" Cats in the 1966 match I added the circular arc track to get the maximum efficiency from the mainsail. Asymmetrical hydrofoil section lee-boards in the floats complete the dynamic efficiency of the craft.



I next made a 1/24th scale model from my drawings to check general appearance and behaviour, as well as sail balance and capsizability, with most encouraging results.

In November 1966 I had an opportunity to visit the Multihull Construction Co., at Wadebridge, and had a most interesting talk with Derek Kelsall during which I found that his *TORIA* hull would suit my lay-out even better than would a *COMANCHE* hull. After a short time I decided to accept Multihull's quotation and to go ahead with a 42 ft. trimaran constructed in foam and G.R.P. sandwich, using the main hull and float forms as built for *TORIA*. I asked for the main hull buttock lines to be dropped at the stern which we found to be possible and, later, after tank tests by the courtesy of Southampton Technical College, with 1/12 scale models which I made, I had the bows of the floats altered to try to provide some dynamic lift at high speed and this resulted in a slight chine or knuckle.

Derek Kelsall and I worked closely together to settle the many details which were not included in my general arrangement drawing. I did all the stressing calculations for the beams, but he decided the



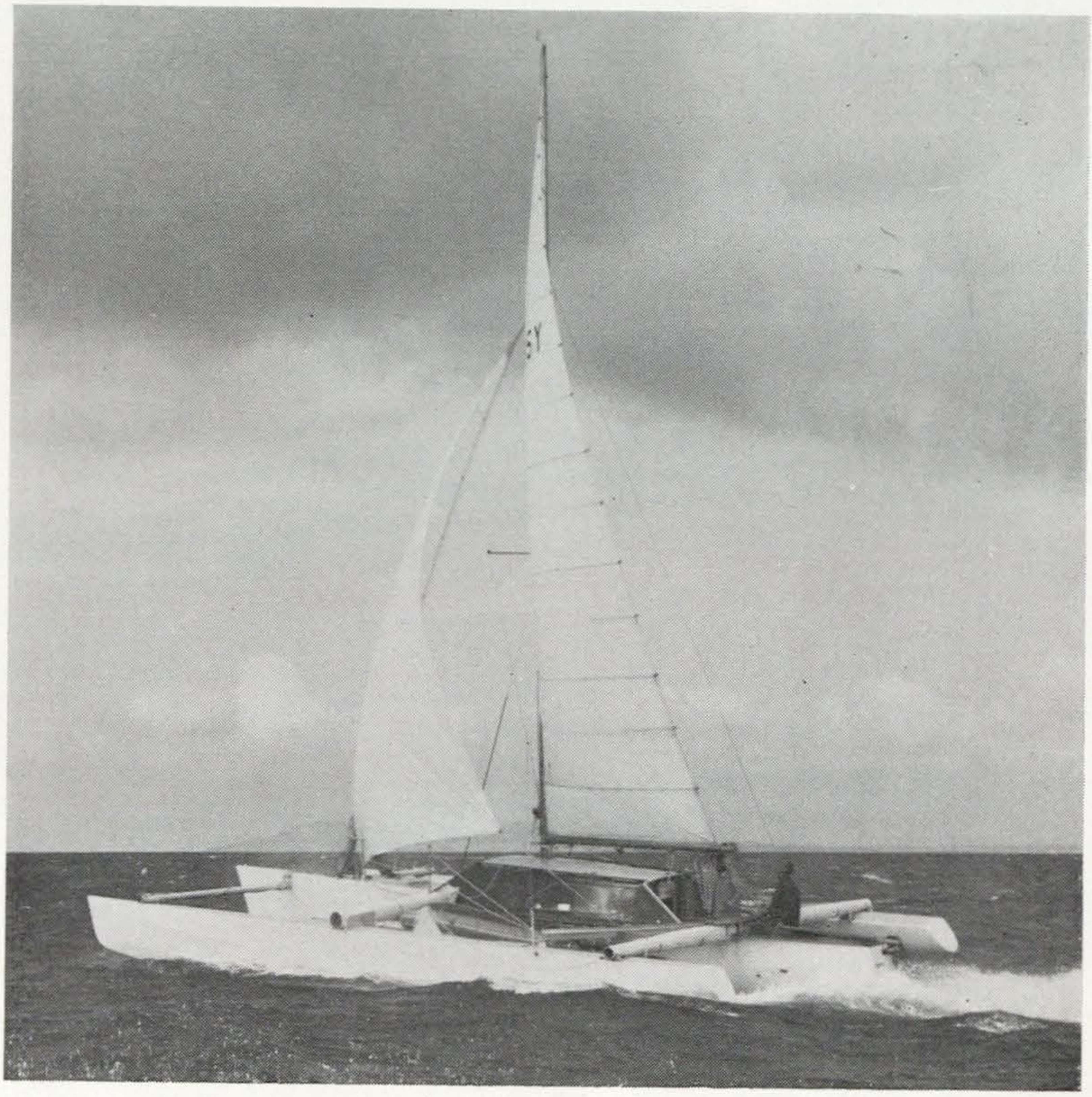
Model float being tested

amount of reinforcement of the hull sandwich in way of the beam attachments and the positioning of the floats with respect to the main hull. His construction of the cabin-top is an excellent example of the potential of sandwich construction.

The main beam was made by Multihull from fibreglass and high tensile steel wire because we could not find a suitable light alloy extrusion smaller than the 16 inch diameter masts of *SIR WINSTON CHURCHILL*. Terry Pearce of International Yacht Equipment, who supplied the spars, contributed considerably to the design of the rig from his own experience.

Performance

In the Crystal Trophy when we raced across the Channel, neck and neck with *MIRRORCAT*, until we broke our main halliard, due to the power of the down-haul of "Go-Fast" sheet on the circular track—and averaged 11 knots in spite of this contretemps—my hopes of the trimaran lay-out were fully justified. It is literally a new dimension in sailing for it to be possible to have a cruising yacht with comfortable accommodation and such speed potential. (The apparent wind was about 45° off the bow).



TRIFLE

Derek Kelsall's hull and float designs and construction behaved perfectly throughout the race and there is no doubt in my mind that they combine low resistance, good sea-keeping qualities and easy manoeuvrability to a remarkable degree.

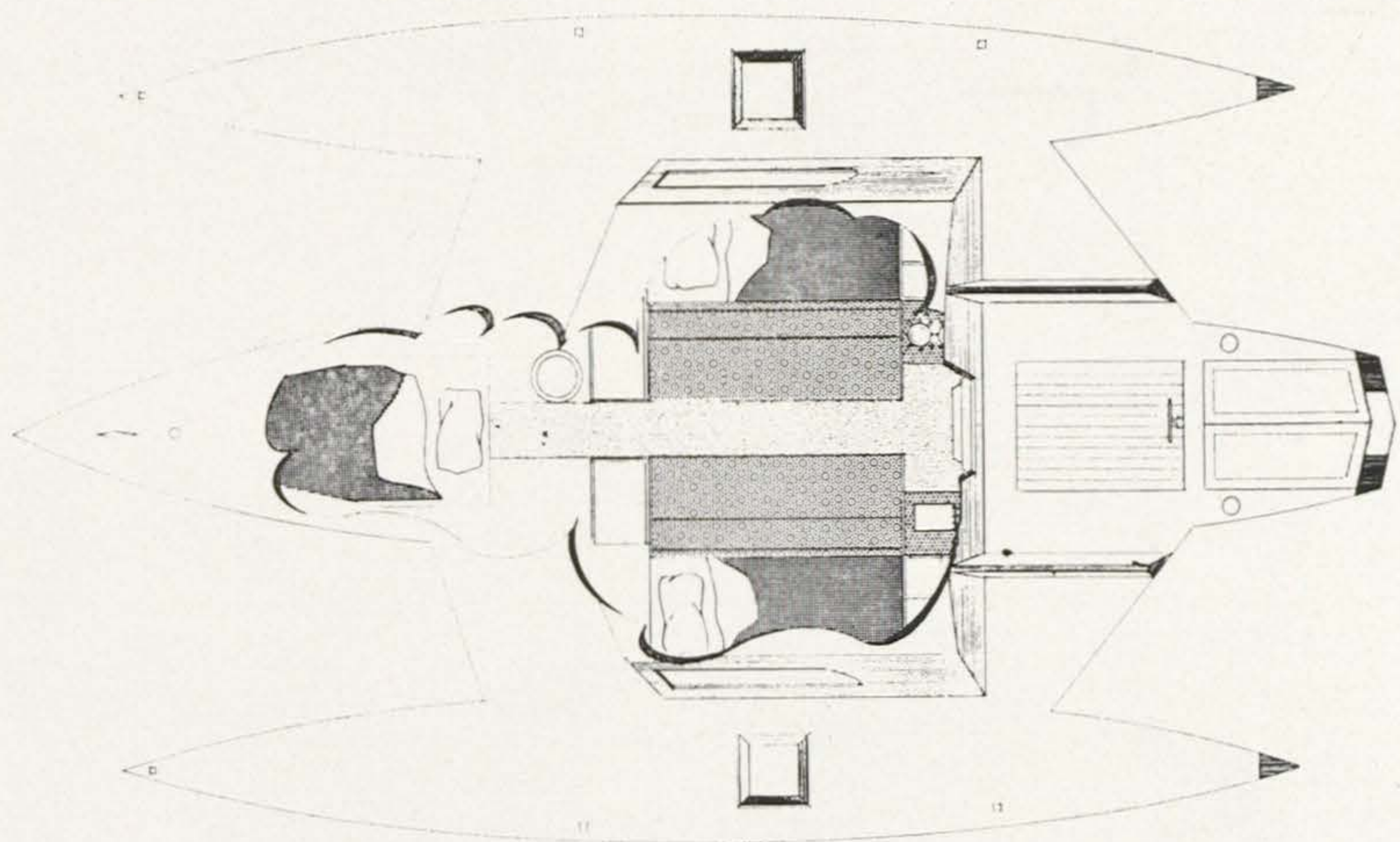
On July 29th, 1967 we did the 15¼ miles from Poole Harbour entrance to Hurst in 1¼ hours, an average of over 12 knots, ignoring a bit of fair tide. We had one reef down for comfort and the apparent wind was on the beam.

RALPH FARRANT.

STILLETTO AND *DART*

Hello John,

Enclosed is a revised drawing of *STILLETTO*, (Original plan Publ. 55). In order to carry the greater weights now required she has a fatter hull and broader transom. We have augmented the cabin so she can also be used as a family cruiser. (Test sailing Stilletto Publ. 60 (66)).



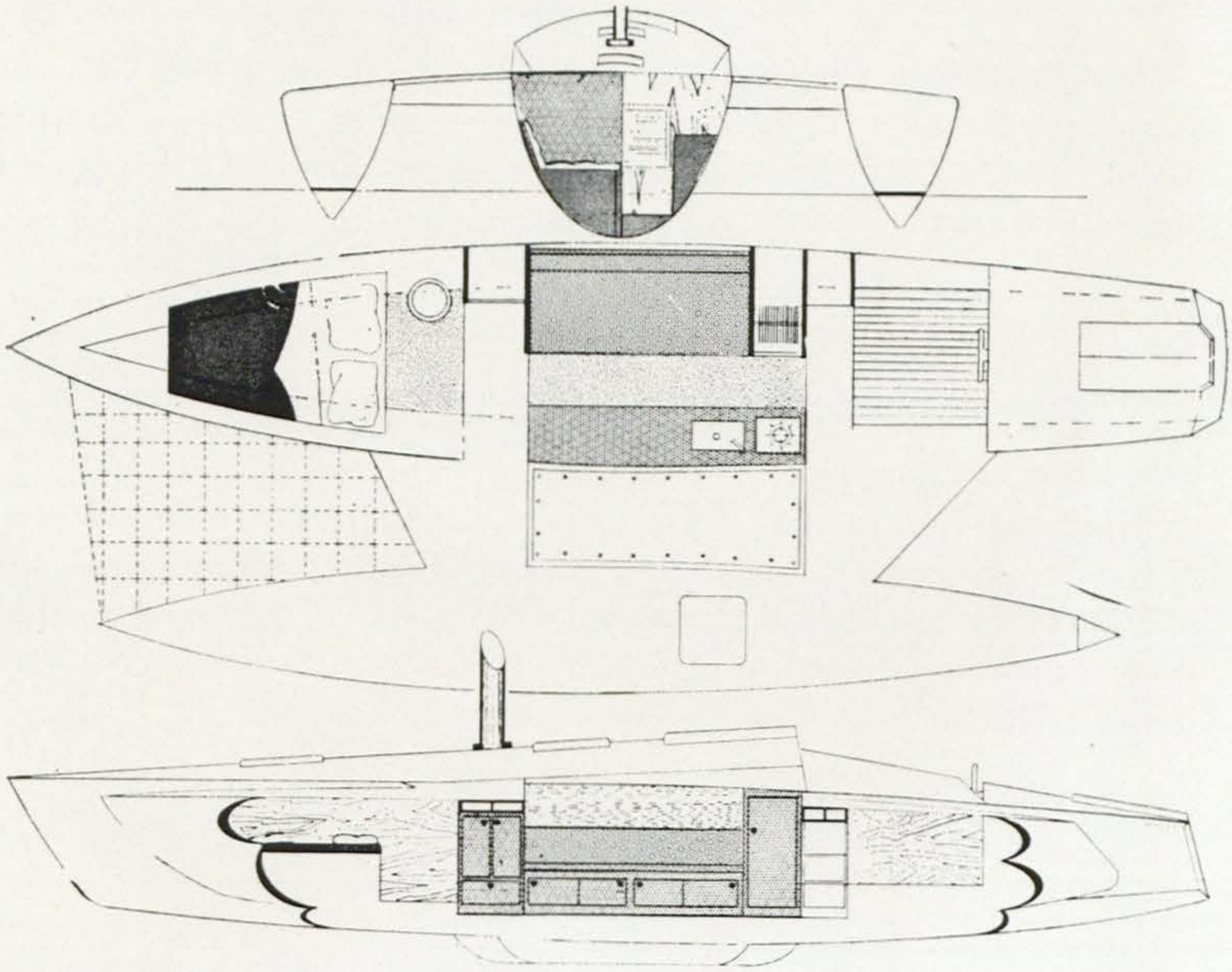
Also enclosed are drawings of our new 36 ft. ocean-racer, *DART*. She has two versions—Hot-Rod and Cruiser. The sail plan drawing is of the Cruiser model. The Hot-Rod has fabric side decks.

Chief distinguishing feature of the *DART* is the absence of a coach roof front and forward windows. As these more heavily laden boats may have to go through waves rather than over them like the lighter models, water coming aboard forward is expected to sluice off the decks unimpeded.

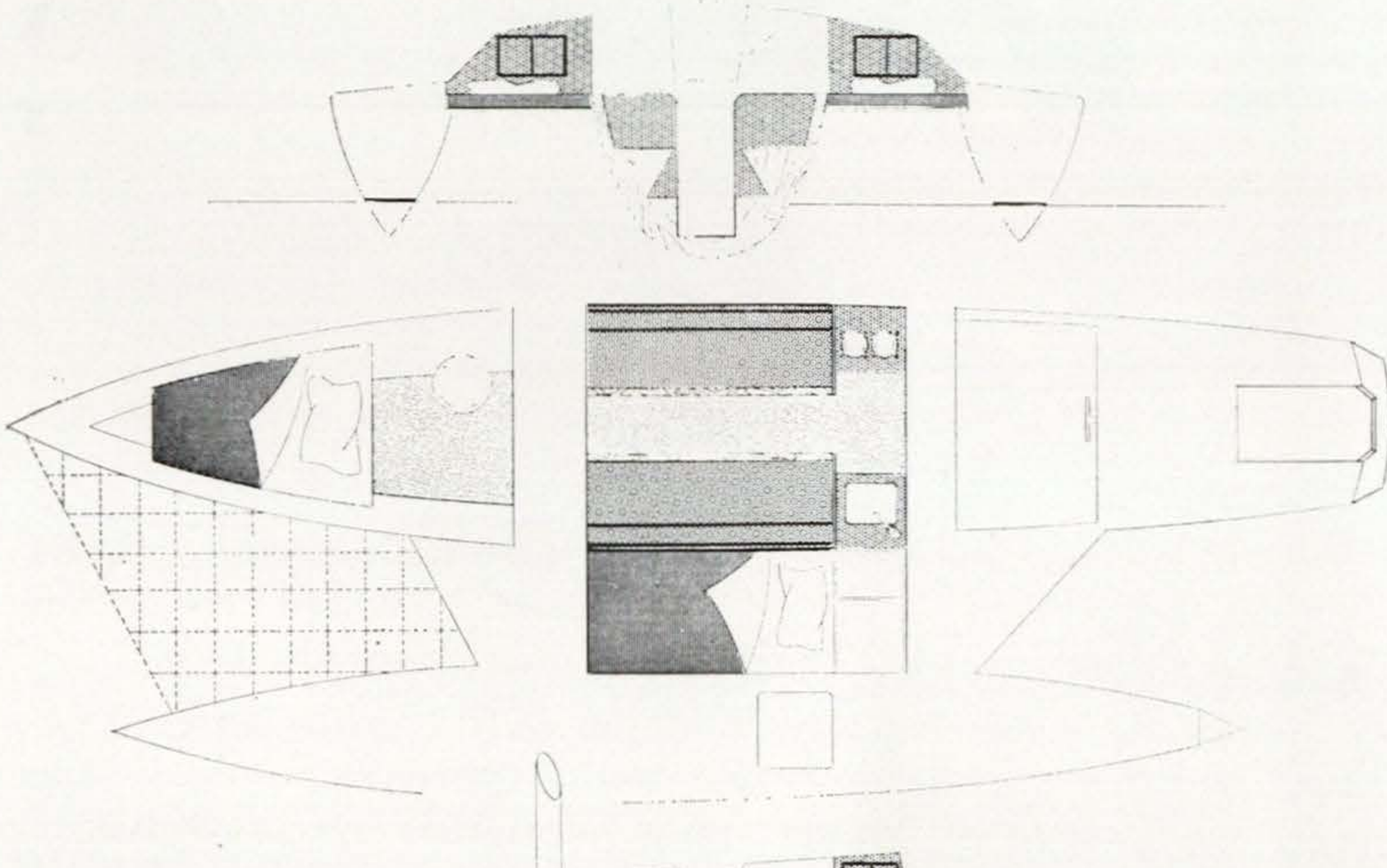
Regards,

ARTHUR PIVER.

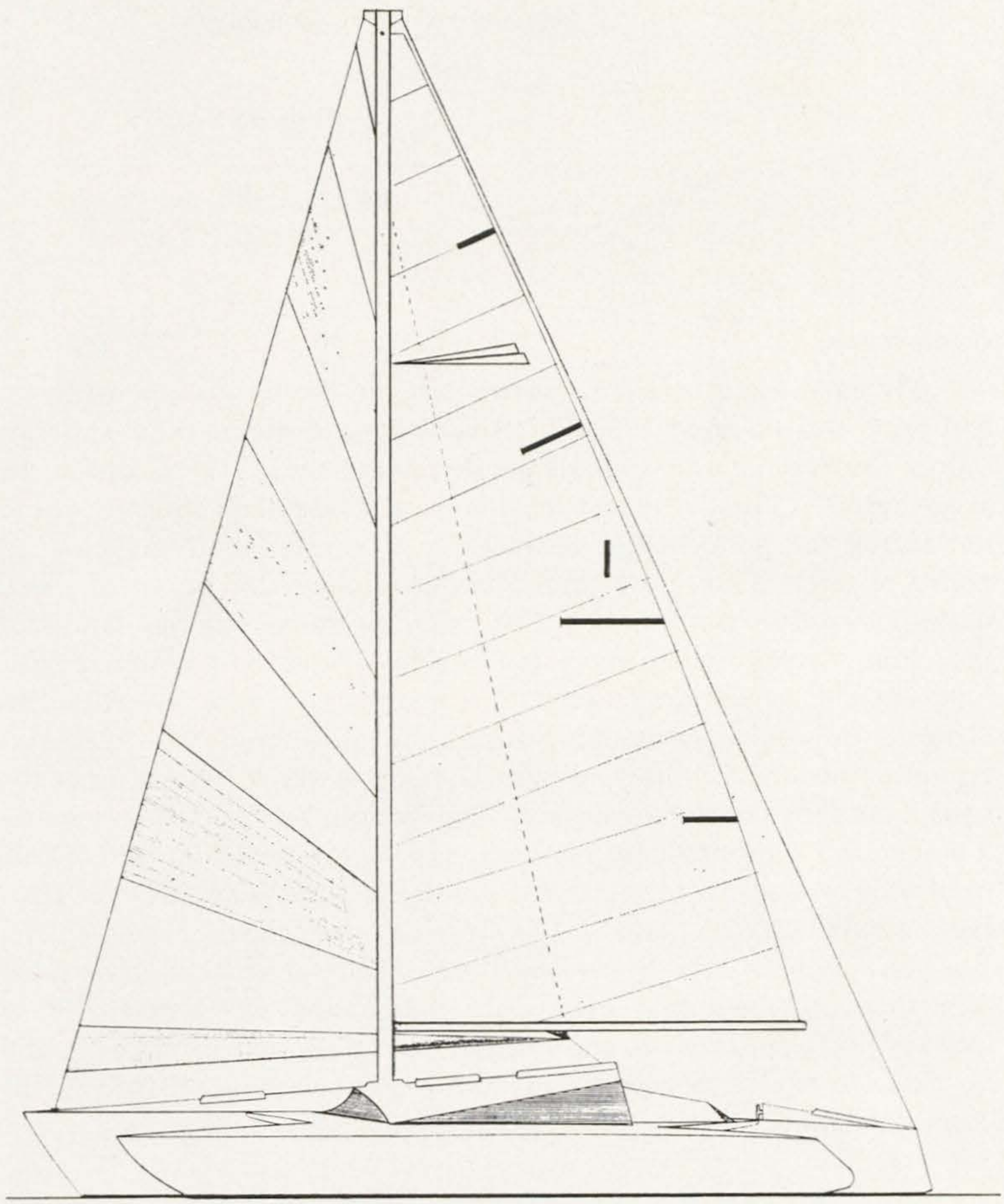
Box 449 Mill Valey, California 94941.



DART Hot-rod version



DART—Cruiser



DART—Cruiser Sail Plan

SOME NOTES ON THE DEVELOPMENT AND TESTING OF THE YACHT *NIGHTHAWK*

Designer: R. C. Johnson

Owner: D. L. Stewart

PREPARED BY

R. C. Johnson

1033, Cornish Drive, San Diego, California 92107

L.O.A.	28 ft.	Sail Area	400 sq. ft.
Beam	18 ft.	Weight	3,100 lbs.

Introduction

My early exposure to trimarans left me keenly disappointed. I had read and believed much of what was said about their superior sailing characteristics. Experience revealed some of the claims to be exaggerated. They were not in fact close winded and did not, could not match the performance of an efficient conventional yacht on all points of sail. True, they offered hitherto impossible bursts of speed under controlled conditions, justly earning them the reputation of "reaching freaks". The more favourable aspects, low material cost, light weight, shoal draft, ease of construction, were clearly valid claims. But one paramount feature was most engaging: the configuration no longer limited speed to something like 1.3 or 1.4 times the square of the waterline length. This ageless barrier was no more. The day sailor profited, for his designers have served him well. One need only look about to see and enjoy the *HELLCATS*, *COUGARS*, the various *LIONS*' and *P-CATS* that gladden the sailor's eye. But too often in the background we see overburdened slab-sided craft that combine a great deal of accommodation with a great deal of leeway. *NIGHTHAWK* was born of the belief that trimarans could be made to exceed normal yacht performance without sacrificing the accommodation.

General

NIGHTHAWK was intended to represent the smallest practical multihull to accommodate a man, his wife and say three children or another couple, at the same time fulfilling these requirements:

1. Full galley with adequate counter space.
2. Enclosed head.

3. Persons six feet in height must be able to walk about, cook, sit down or sleep without stooping or being cramped. Accommodation to be light and well ventilated. In other words the accommodation is to be enjoyed rather than endured.

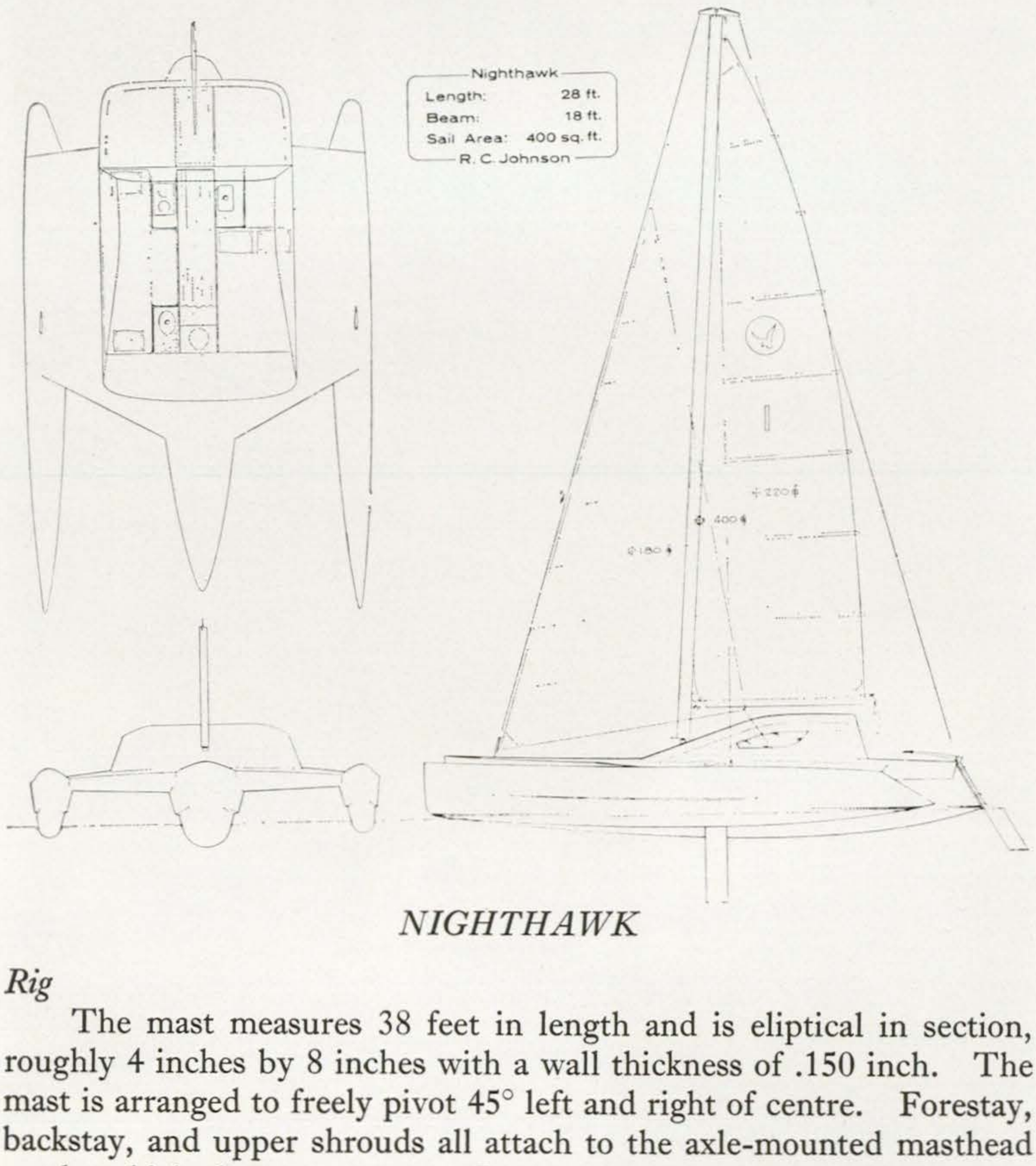
NIGHTHAWK

4. Must equal or exceed the performance of any yacht so equipped on any point of sail in all weathers.

Inevitably this required a trimaran configuration for the headroom requirement would indicate a catamaran of not less than 40 or 45 feet in length. The performance desired could only be attained by an easily driven hull with a powerful rig.

The resulting craft is 28 feet overall with 220 square feet in her main and 180 in her jib, 400 square feet all up. She is stoutly built and weighs in at 3,100 pounds ready to sail.

She is indeed fast, and shows every indication of fulfilling her design objectives.



NIGHTHAWK

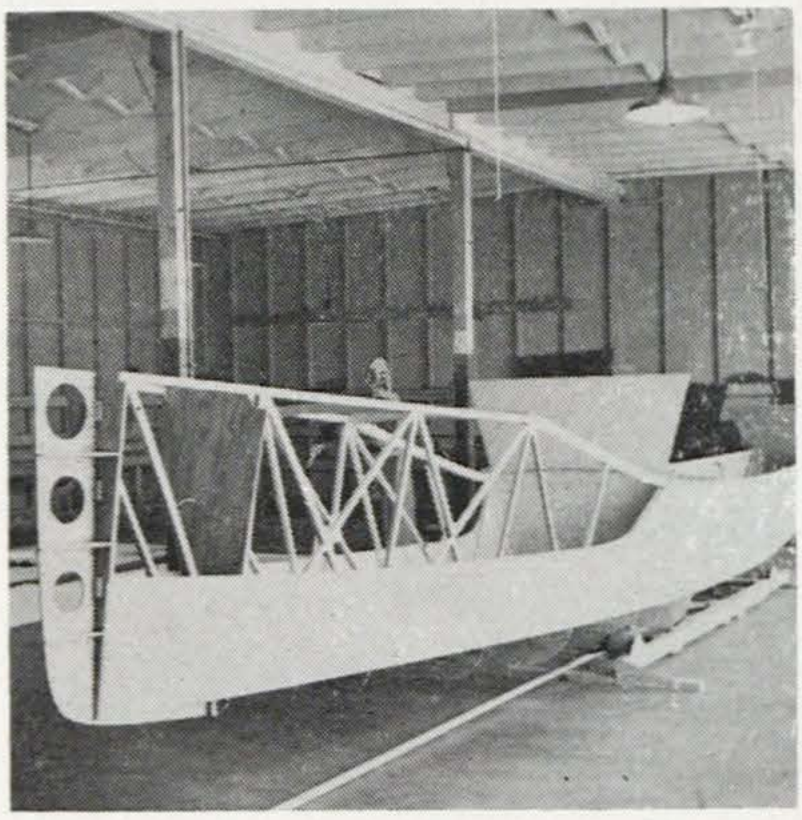
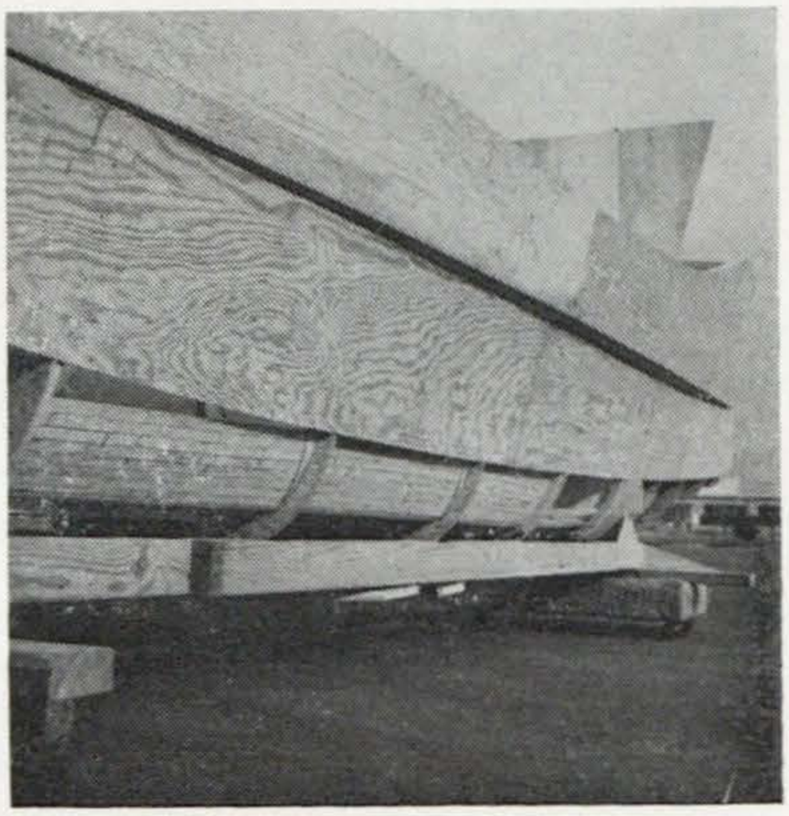
Rig

The mast measures 38 feet in length and is eliptical in section, roughly 4 inches by 8 inches with a wall thickness of .150 inch. The mast is arranged to freely pivot 45° left and right of centre. Forestay, backstay, and upper shrouds all attach to the axle-mounted masthead truck, which does not rotate. Lower shrouds and a single diamond stay complete the standing rigging.

The sails are both 8 ounce dacron. The main is fully battened, and is rigged for roller reefing. The rather high aspect ratio (5.7:1 by the span squared over area method) was dictated by a desire for outstanding windward performance and in this we have not been disappointed. Among the local trimarans she has no peer. Among the keel yachts only a six meter has out pointed her. (This was not true until daggerboards replaced the original centreboards. See below). Her drive to windward is truly gratifying and the high aspect ratio along with the rotating mast are major factors. We have tufted both sides of the sail with yarn wool to permit flow visualisation of the effects of mast rotation. No one seeing the behaviour of the tufting, as the mast is centred, then rotated, could ever abide a non-rotating mast on his yacht. With the mast centred and the yacht close hauled, the leeward row tufts, located 8 inches abaft the mast, flail about in an alarming manner pointing more or less straight forward. There is total separation in the luff area, indicating a powerful vortex system revolving about a vertical axis. Ease the mast round and, as it approaches the proper angle of attack, the tufts turn 180° and snap back with great energy to lie precisely, smoothly, and powerfully against the sail. The yacht accelerates perceptibly.

Of course nothing is free and *NIGHTHAWK* suffers on two accounts from her rig. First, the mast is both tall and heavy, 122 pounds. When the weight of the sails, battens, and rigging are added, we have a goodly weight aloft. This, taken together with the light overall weight and the fine ends, has, on occasion, caused some bothersome pitch oscillations. These are ordinarily caused by a large powerboat wake or a steep wave. In light airs this can be annoying, but is readily damped by the sail at higher speeds. Secondly, the mast is a tall slender column and can develop some alarming flexure, when rotated in winds of 20 knots or more. The combination of high winds and rough seas require the mast to be centred, under which conditions it behaves normally. We will work on this problem. A further drawback associated with the high aspect mainsail was illustrated by behaviour of the wool tufting in the upper 10 per cent of the sail. Flow separation is evident down to three or four feet below the headboard. In this region the sail becomes quite narrow. The untapered mast, providing an excellent leading edge further down is (at 4 inches) too wide. The sail is literally blanketed by the wake of the mast. This fault occurs on every Bermuda rigged sailboat not sporting a wingmast, or at least a tapered mast. The problem worsens with aspect ratio, for it is a function of the ratio of mast size to local chord width. I have conducted flow tests on a *COUGAR* with the standard narrow teardrop mast and high roach head and could discern no flow separation.

Inevitably the question arises, "Is the high aspect ratio worth the penalties incurred?" For the all out racing enthusiast I suspect the answer is yes. Particularly when the funds and technology are at hand to aerodynamically integrate the mast and sail. The reduction in induced drag provides a favourable drag angle that will allow sparkling windward performance. For the less zealous, and for the passage making yacht, perhaps 4:1 comes closer to striking the proper balance between aerodynamic efficiency and ruggedness. (As used in this report aspect ratio is the product of the length of the luff squared divided by area).

NIGHTHAWK's *Construction*

Construction

The enclosed photos reveal the hull construction method. Select clear spruce stringers are made up in a jig to form the hull sides which are classical trusses. Plywood bulkheads and formers are nailed and glued to vertical truss elements and presto, the hull takes shape! The round under-bodies are constructed much like surfboards, i.e. glass reinforced plastic over polyurethane foam. Plywood skin covers the balance of the yacht. She is glassed all over. Cabin sides are of sandwich construction combining plywood skins with a foam core. Cabin roof beams are laminated spruce.

Hull Configuration

Persons viewing *NIGHTHAWK* for the first time invariably comment on the ama bows, which extend slightly ahead of the main hull. Noted too is the sort of bob-tailed appearance, caused by the cockpit, cabin, and rig being set well aft. This unusual configuration is employed to prevent bow burying, when driving hard to windward, while at the same time retaining fine bows. The centre of buoyancy is well aft, maximum hull fullness occuring at 66 per cent of length. The bows are fine and well forward. The result is more than ordinary buoyancy at the point where one ordinarily finds the ama bows, say 3 or 4 feet aft of the main hull bow. This added buoyancy acts on a longer than normal arm due to the aft centre of gravity (or pitch axis). The results have been excellent. *NIGHTHAWK's* bows, however fine, are light and responsive and exhibit no tendency to bury, even when hard pressed. We have forced a bow under while surfing, and, aside from some difficulty in steering, there were no ill effects. The bow just seems to slice lightly and naturally through a wave under these conditions and does not convey the slightest feeling of precipitating any sort of disaster. In all candour I will say we have not done this at anything above 10 knots or so.

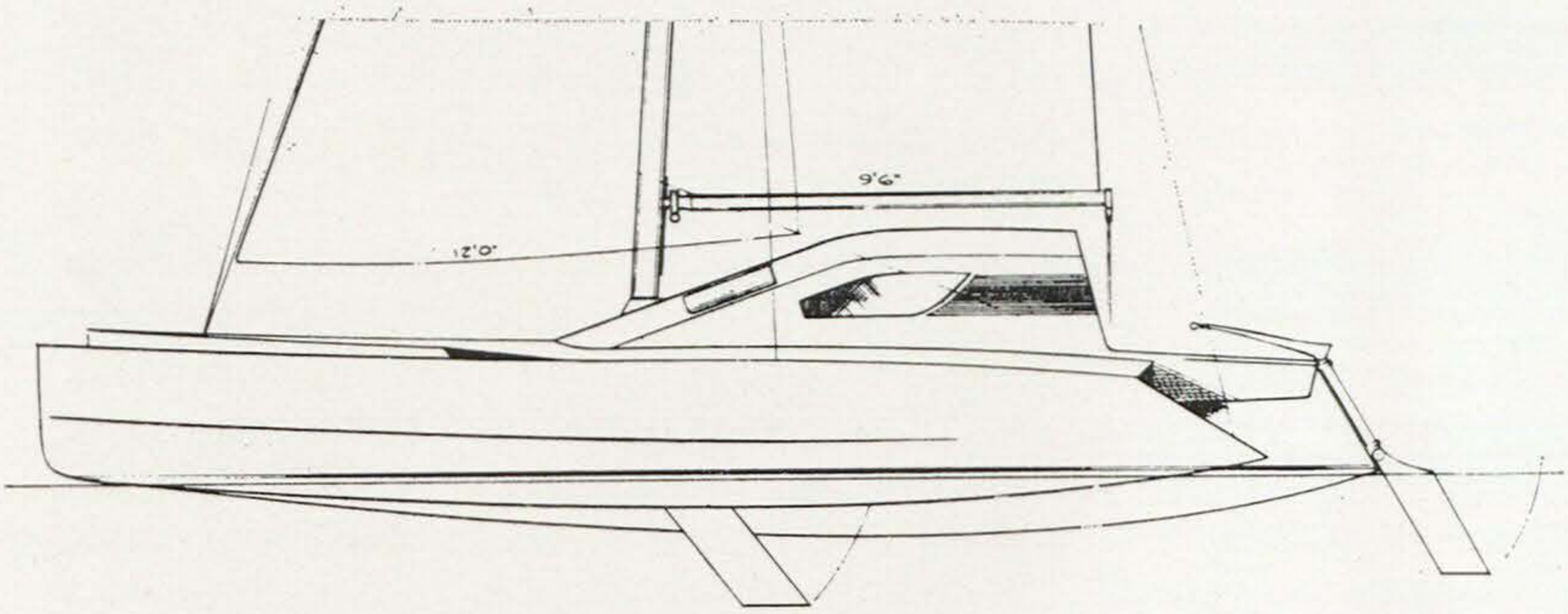
Some have wondered if the rocker, or upswept sterns (inevitable with the aft fullness), would not induce a speed-limiting base drag. I cannot really evaluate this phenomena beyond observing that this is a very fast yacht that is not pressed at all by yachts with vestigal houses and weighing much less. However a great deal of *NIGHTHAWK's* speed derives from her efficient rig and high fineness ratio hulls. Perhaps they provide the high thrust and low drag to carry inefficient afterbodies fast. With so many variables it is difficult to assess the contributions of each of them. Oh, for the wherewithall to allow comparative tests! Main hull fineness ratio is 10.8:1, while amas are 18:1. All hull bottoms are semi-circular in section.

NIGHTHAWK's amas draw about 7 inches sitting at the dock displacing some 375 pounds each. The yacht thus has a high initial stability. It takes approximately 20 knots of wind to fly an ama. There is no doubt she would be faster, if it were possible to fly a float most of the time as most tris do. The floats will accordingly be raised on future models, to just above the L.W.L.

While the amas on this yacht are asymmetrical, it is believed any lift to windward achieved thereby is negligible. The round hull bottoms limit the effect. The yacht is so stiff that the ama rarely penetrates enough to produce a favourable side thrust.

Centreboards/Daggerboards

The vessel was originally fitted with a retractable centreboard in each ama. A single central board was considered but rejected for the trunk simply could not be accommodated in the narrow hull. These boards were considered to be only an experiment and turned out to be a bad one. The boards were swept aft, so as to shed kelp, a necessary precaution in San Diego. The cross section was a 4° wedge blunt edge aft, knife edge forward. The theory was that flow about the board would always be laminar, owing to the absence of reentrant curves. The wake would be turbulent, of course, but no worse than that of conventional section at speed according to my reference data. The appeal was a hoped for overall drag reduction owing to laminar rather than turbulent flow over the majority of the side area. A further unusual feature was the fact that the boards were so arranged



NIGHTHAWK

as to automatically establish a 2° angle of incidence on either tack. It was realised that the low speed L/D might be poor, but a superior L/D might be realised at higher speeds. Our first few informal encounters with contemporary trimarans were inconclusive. *NIGHTHAWK* seemed more or less their equal, which was disappointing for we had laboured mightily to produce a superior machine. In our first formal race we were crushed! 15 out of 21 yachts beat us! There had to be a bogey for our rating has us giving time to all of the other tris. It had to be hull shape or the centreboards.

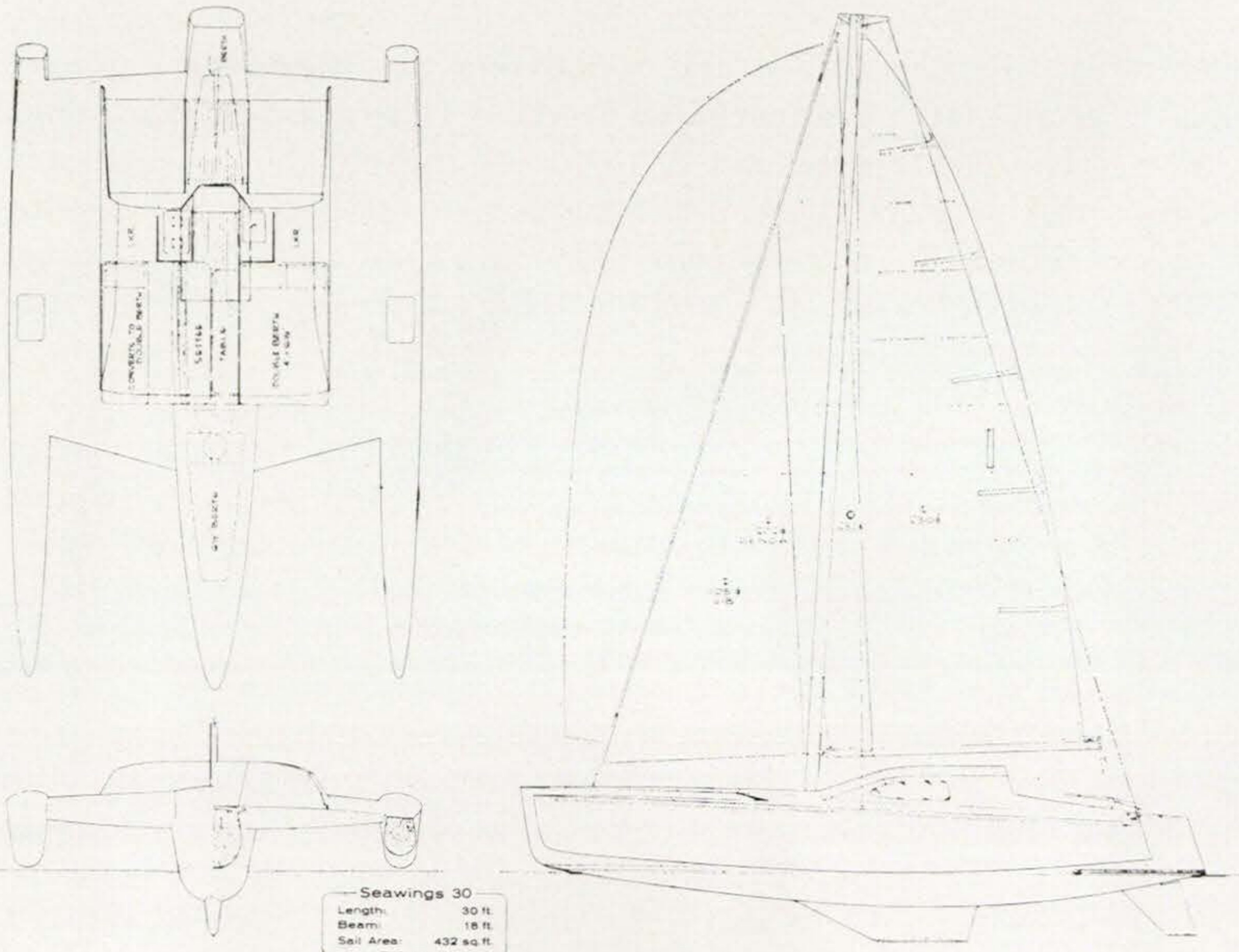
Two weeks later *NIGHTHAWK* went looking for a fight with a pair of high aspect ratio daggerboards in close fitting trunks. The two 54 inch x $1\frac{1}{4}$ inch centreboard slots were sealed. *NIGHTHAWK* won that encounter and has not been beaten boat for boat by any trimaran since. She handily won the multihull division of the San Diego to Ensenada Classic, arriving 35 minutes ahead of the next trimaran, but losing to Norman Cross by 1 minute and 3 seconds on handicap. The daggerboards are of the type developed by Bob Reese, Norman Riise, and Harry Burgeois on the 32 foot Class "D" Catamaran *WILDWIND*, which has dominated for more than two years on this coast. The sections are symmetrical and are 13 per cent thick. Area is equal to 2.33 per cent of the sail area. Aspect ratio is 4:1. Thicker sections of higher aspect ratio are being experimented with on this coast. It may be concluded that, while wedge shaped sections may be desirable at very high speeds, as has been shown, they are distinctly not satisfactory below twenty knots.

Directional Stability and Manoeuvring

NIGHTHAWK is agile about her vertical axis. She may be sailed through a tack with very little rudder deflection in ordinary conditions. In high winds and rough seas the rudder is put over smartly as she lacks the inertia to describe a large arc in those conditions. It is never necessary to backwind the jib, though prudence suggests this on a lee shore. She tacks with the boards full up but with less authority. Her cutaway ends and round underbodies are no doubt responsible for her tacking characteristics. However the fiddler must be paid and she is difficult to sail in a straight line, responding to the minutest movement of the tiller. With a visual reference ahead and constant monitoring of the helm she sails straight enough. Holding a compass course with no other visual reference produces a sinuous wake, even in the case of helmsmen not ordinarily struck with this malady. Close hauled at 16 to 18 knots she starts to become difficult to turn down wind. Her tiller, (always neutral and lacking "feel" at lower speeds) develops a moderate weather helm as the centre of pressure moves aft on the sails with increased speed and reduced angle of attack. Now hit her with a 25 knot puff and the rudder stalls should you attempt to bear off. I believe this phenomena is caused by ventilation, i.e. an atmospheric bore on the low pressure side of the blade. While easing the main sheet will restore control I believe the proper solution is an end plate to prevent ventilation. The cure I have recommended for *NIGHTHAWK* (and which I will use on future designs) is to suspend the rudder from a skeg below the hull. The hull bottom will provide an end plate. In addition the skeg, or fin, will improve the directional stability. Lastly the leading edge of the skeg may be inclined to 40 or 45° to positively shed kelp. Though inclined 30° *NIGHTHAWK's* present rudder occasionally picks up kelp, partially stalling the blade and creating tremendous drag.

Conclusion

Every designer strives to design the perfect yacht. While attempting to fulfill the design requirements in terms of comfort, performance and seaworthiness, he finds himself confronted with the realities of cost, weight, producability, strength, and time. The measure of his success will depend on his ability to blend these overlapping variables without sacrificing performance. Too much emphasis here, or preoccupation with a pet theory there, and she may not sail too well, may cost too much or disaster, both! How does *NIGHTHAWK* measure up in retrospect? She has fulfilled her design objectives. Q.E.D. Round bottoms plus efficient powerful rig plus efficient foils to control leeway add up to a very fast, comfortable trimaran. Let us hope our leeward going brothers profit.

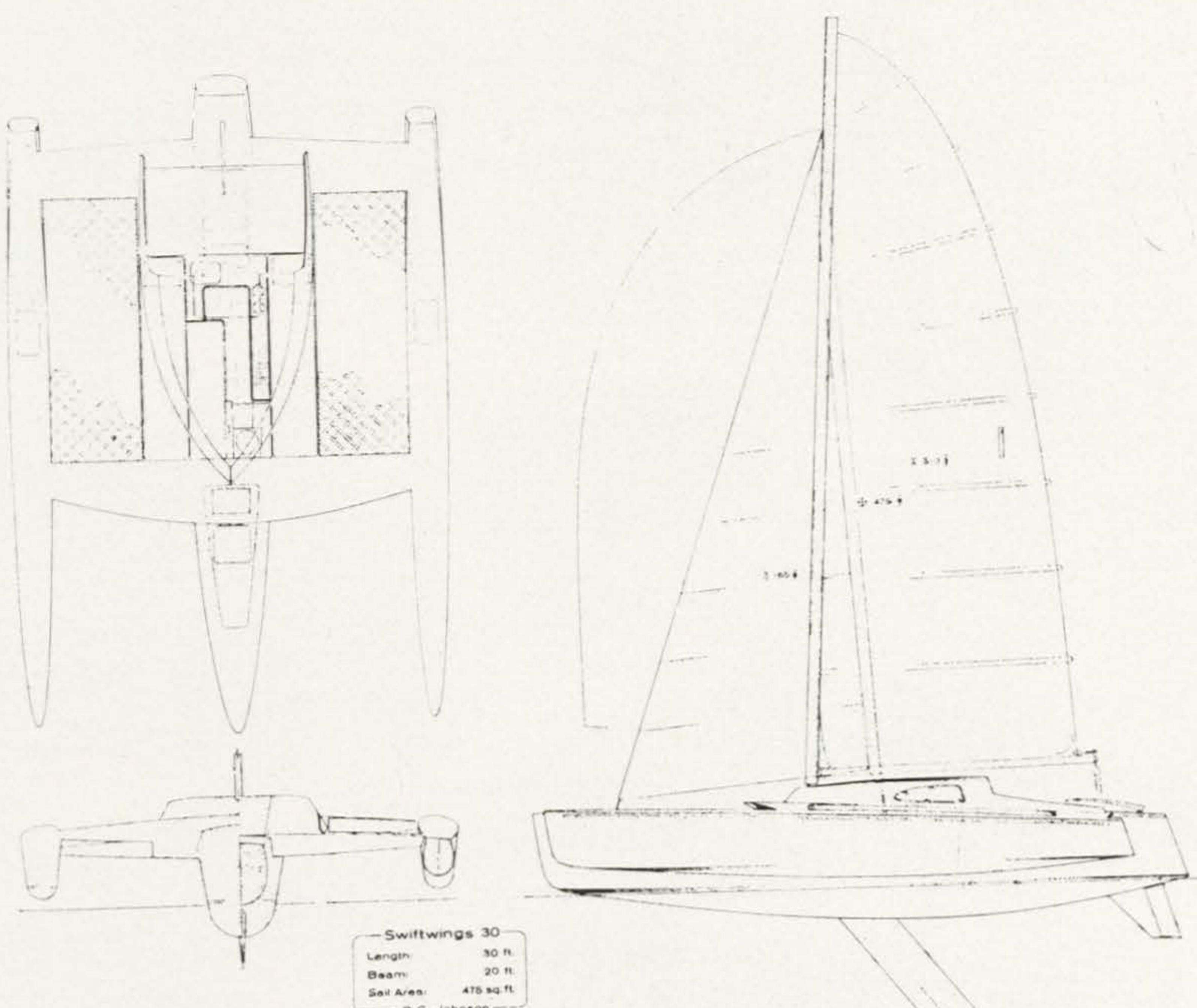


SEAWINGS 30

L.O.A.	30 ft.	Beam	18 ft. 6 ins.
Sail Area	432 sq. ft.		

Designer: R. C. Johnson

Building on the lessons learned from *NIGHTHAWK* I have designed *SEAWINGS* (who makes her debut here). She is designed to the same set of requirements, but is slightly detuned to provide a more rugged rig, improved directional stability, and general ease of handling. The amas have been raised to the point where one will always fly. The daggerboards have given way to a fixed keel, somewhat less effective, but requiring no attention from the crew. Daggerboards must be frequently adjusted and in some locations cleared of kelp now and again. The inboard skeg-mounted rudder will not stall and will shed kelp. The aspect ratio of 4.2:1 provides a rugged rig. She is just enough longer (at 30 feet overall) and wider (6 inches) to provide a settee and folding dining table which her sister lacked. Reverse sheer and a lower floor line combine to reduce the size of the house. For the enthusiast we are working up a full race version employing the full bag of tricks to extract the last ounce of performance. This yacht will be known as *SWIFTWINGS*. She will incorporate full flying amas (a la *TORIA*), fully battened high roach sail, open wing decks, central daggerboard, and an aerodynamic seal between the house top and boom. Following this on the board are 36 or 38 foot versions to the same format.



SWIFTWINGS 30

L.O.A.	30 ft.	Beam	30 ft.
Sail Area	475 sq. ft.		

Designer: R. C. JOHNSON

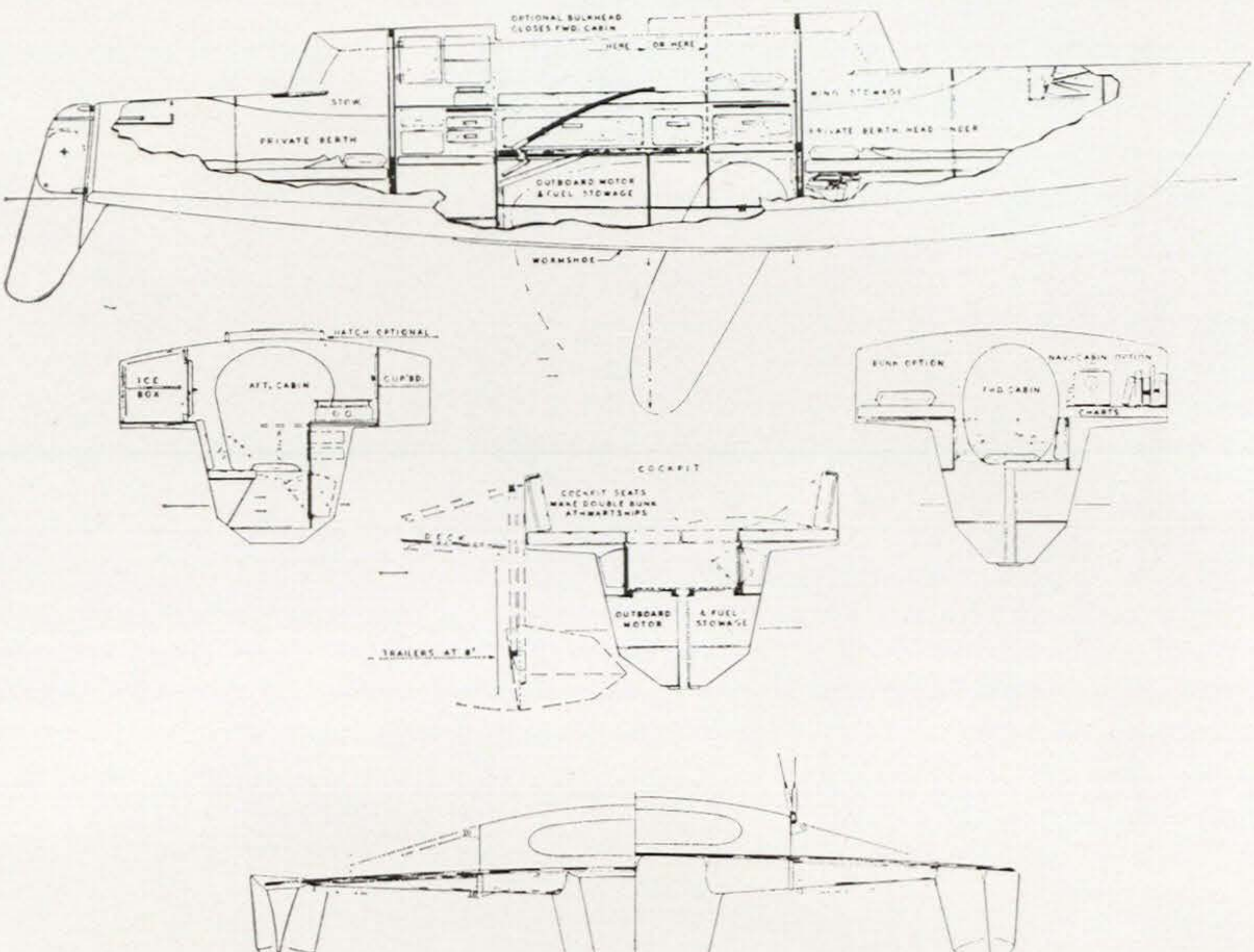
THE *BROWN* 25

Jim Brown-Designed Sailing Trimarans
2301, Seventh Avenue, Santa Cruz, California

Length	25 ft.	Beam	15 ft. 9 in.
Draft	1 ft. 4 in.	Sail Area	400 sq. ft.

The *BROWN* 25 is the latest addition to the series of Jim Brown's designs (See Publication No. 55, p. 73).

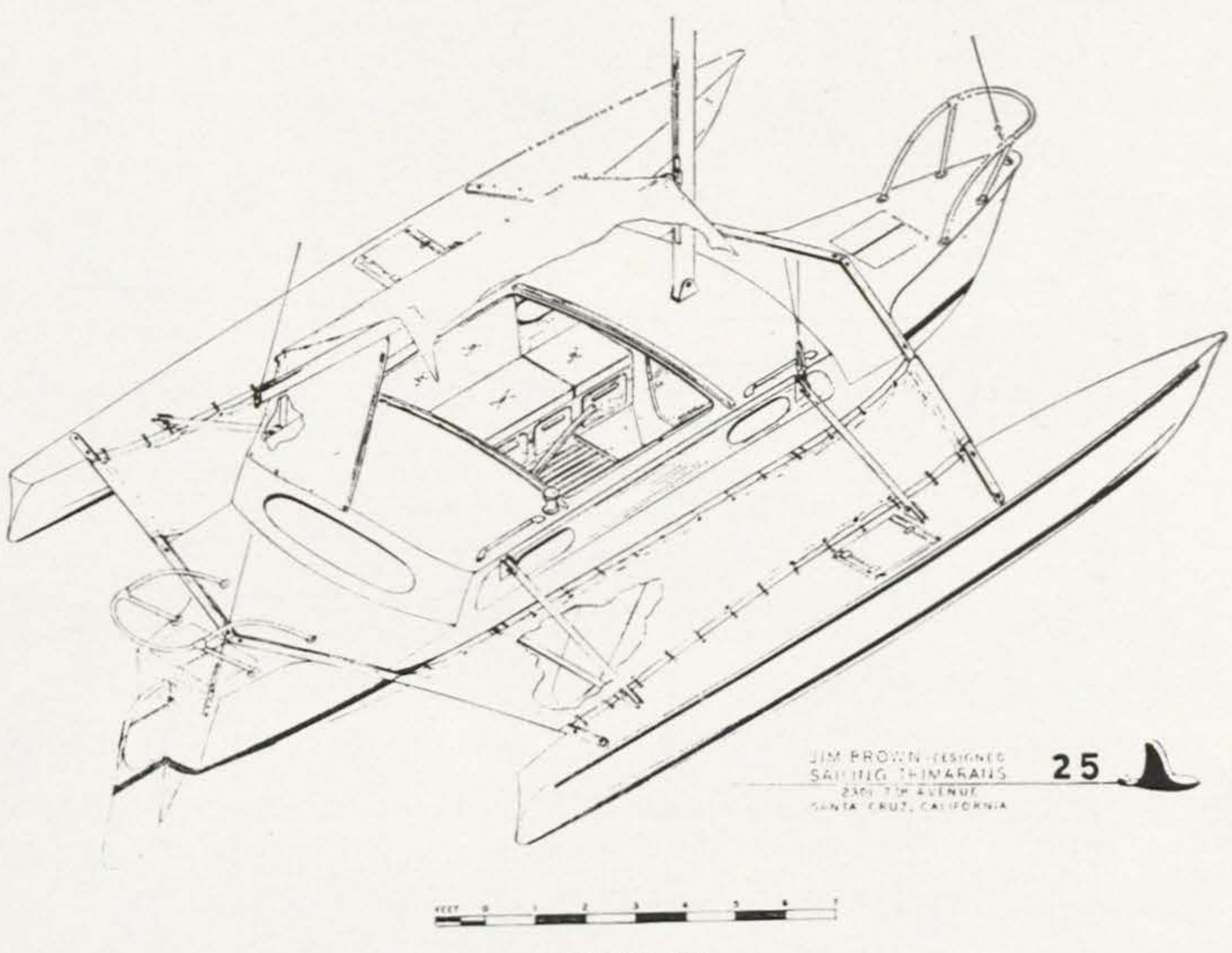
There are two versions, one intended for deep-sea work and the other for easy trailing. Instead of the usual full width beams supporting the floats these are connected to the main hull by A-frame outriggers of tubular construction fastened to specially strengthened bulkheads



The BROWN 25

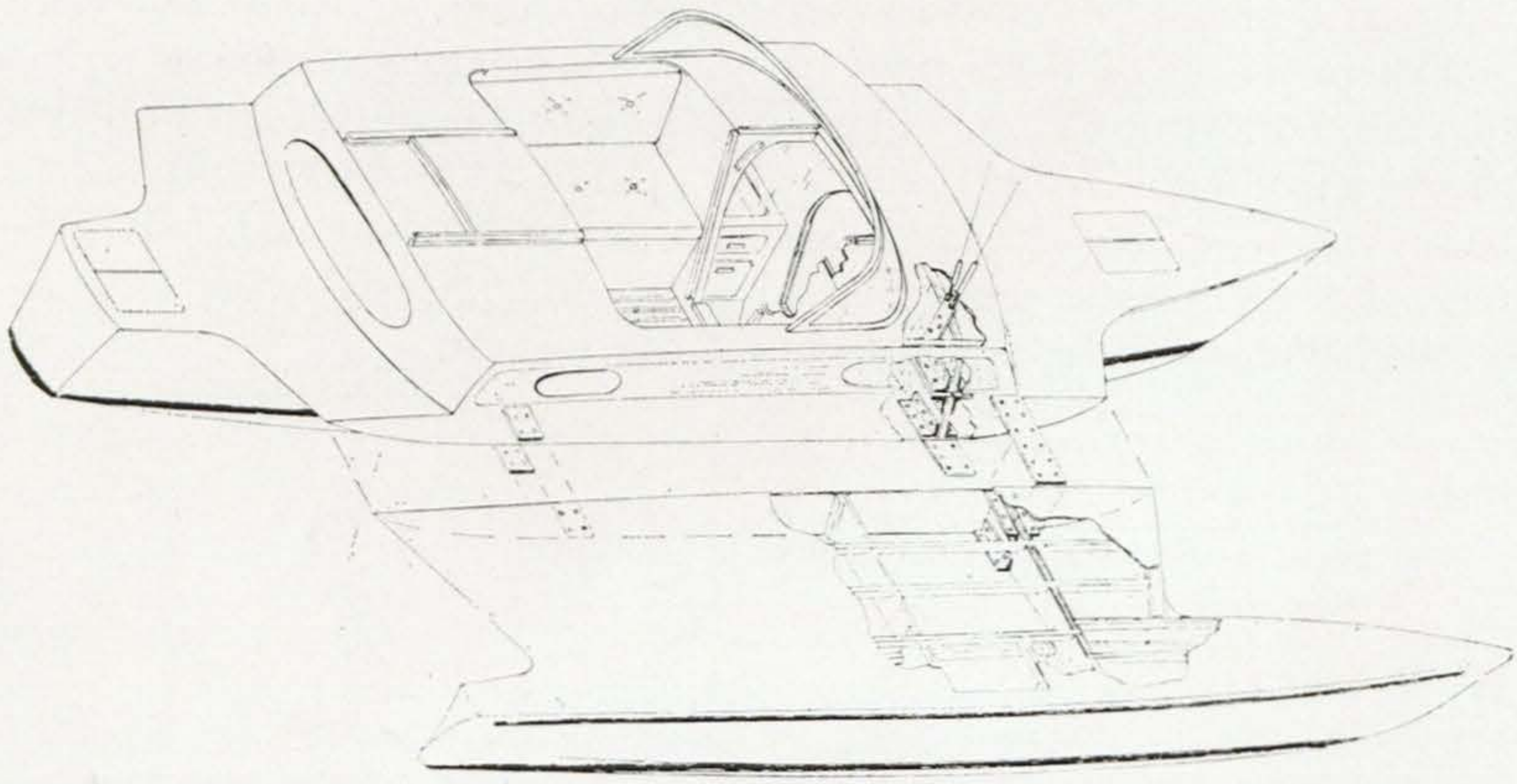
in the main hull. These bulkheads have large passage ways through them which allow easy access to the ends of the hull. In the Trailing version the floats are folded by removing 4 terminal pins in the lower struts of the A-frames and 4 bolts in each of the mahogany spars which run from hull to floats and carry the ends of the dacron trampolines or optional ply-wood side decks. They then hinge downwards on the upper struts at their attachment to the main hull and tuck in under the main bilges. This keeps the centre of gravity low and makes fast towing safer. In the Deep-sea version the A-frames are welded and do not fold.

Both versions have a centre cockpit. This allows a centreboard to be housed under the floor without obstructing the accommodation and centralises the non-structural weights, i.e. crew, outboard motor and tanks. With a boom tent for harbour use it makes a saloon which will seat 6 people. The seats convert into 2 single or 1 double berth and there is a single berth right aft in the main hull and another right forward, both with sitting head room. A marine head is housed under the forward berth. A full-sized galley is sited aft of the cockpit and a cuddy cabin for shelter and navigation at the forward end. In the Deep-sea version the cockpit is smaller and the cuddy larger with a weather-dodger at the forward end of the cockpit.



THE TRI-SECTABLE TRIMARAN

The Brown range of trimarans can now be built in a "tri-sectable" form which allows them to be easily transported or stored under cover in much less space. The method of construction permits the craft to be built in one piece and, by the addition of a set of simple metal fittings made of standard angle and flat plate, to be made dismountable at a later date or to be built as a tri-sectable unit in the beginning. The cross-arms are eliminated and the floats are supported by extensions of the specially strengthened bulkheads in the main hull. These have large openings in them and make access to the ends of the hull easier than is usual when large spars pass through the accommodation. The metal fittings which allow the removal of the wingdeck and floats can be fitted before the wing structure is separated from the main hull and this ensures proper alignment of the components.



The BROWN Tri-sectable

THE *CROSS* TRIMARANS

DESIGNED BY

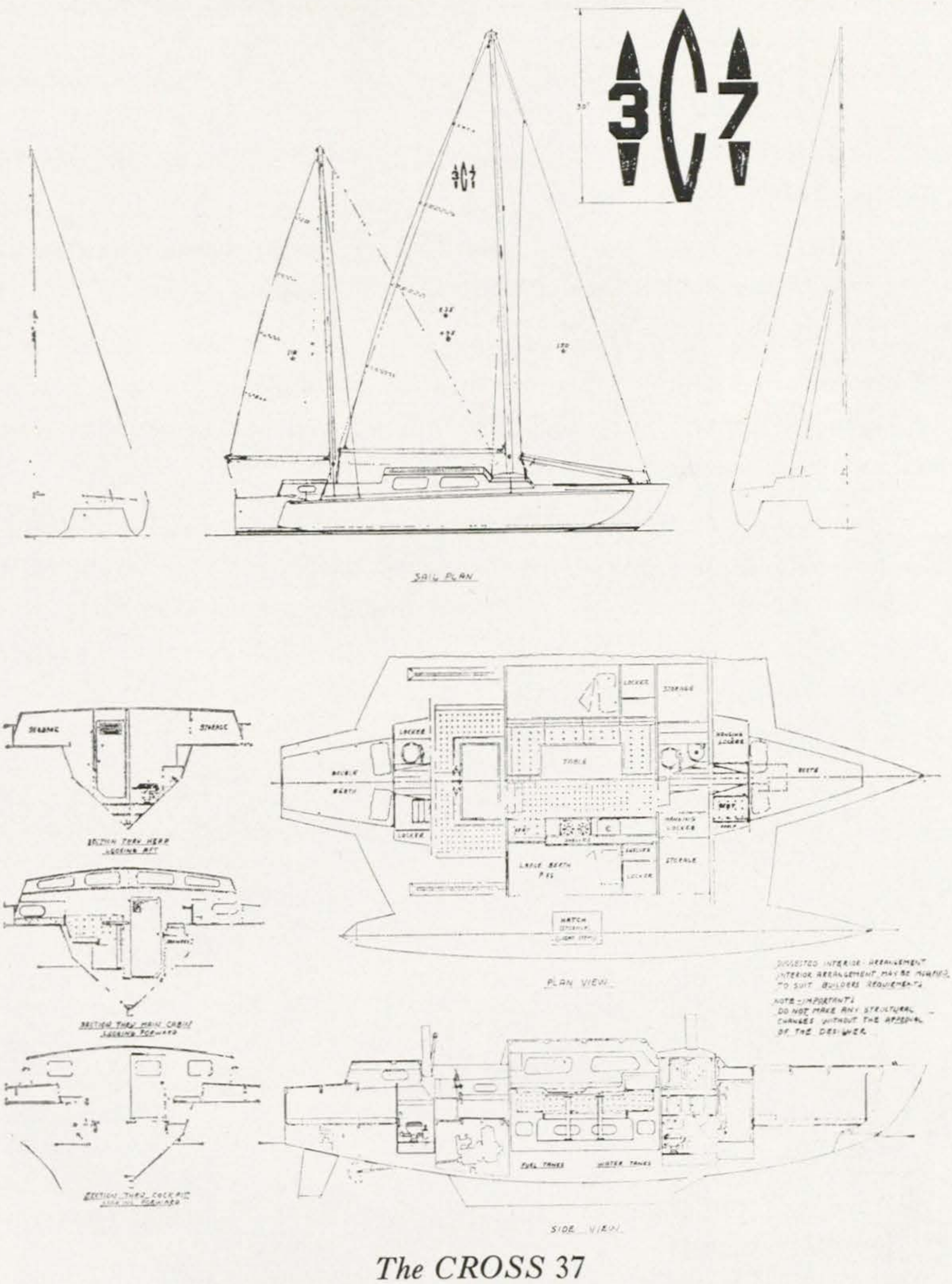
NORMAN A. CROSS

4326, Ashton, San Diego, California 92110

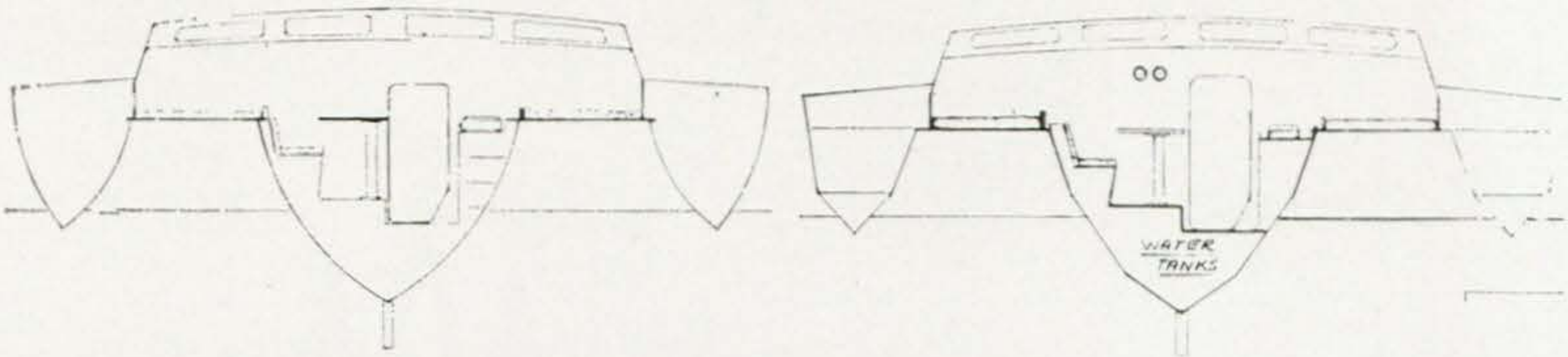
The *CROSS* 37 and *CROSS* 42 are the latest of the *CROSS* range of trimarans designed primarily for amateur building (Publication No. 55).

The right-angled V sections of the main hull of the *CROSS* 37 with the chines carried above the waterline, are similar to the *CROSS* 30 (Publication 55) and the *CROSS* 36 (Publication 60 (66)) as are the floats.

In the *CROSS* 42 the main hull can be built either with double chines using sheet plywood or with a radiused section using double diagonal strip ply construction. In the first instance the floats are the same section as those of the *CROSS* 30, 36 and 37 but in the radiused version they follow the section of the main hull.



The CROSS 37



In the 1967 Newport-Ensenada Race of 135 miles the *CROSS* 36 finished 10th in the multihull division, was 1st trimaran to finish, first on corrected time and finished 136th out of 543 entries having passed over 400 boats, some of which started up to an hour earlier.

In the 1967 San Diego-Coronado Race (35 miles) *CROSS* trimarans finished 2nd, 4th, 5th, 6th and 7th and took the first five places on corrected time. They accounted for five out of thirteen trimaran entries in the race.

In the 1967 International World Multihull Regatta at Long Beach the *CROSS* 24 was second in the speed trials: 1st place went to a 17 foot "racing" trimaran. She was first on corrected time in the Day Sailing event and won the "Best Trimaran Overall" Trophy. Her speed was 9.63 knots in a 12.1 knot wind in the speed trials.

KRAKEN 33

DESIGNER: LOCK CROWTHER

Ed.: This article was written before the tragic loss of *BANDERSNATCH* which, in my opinion, does not invalidate the reasoning in it. *BANDERSNATCH* is described in AYRS 60 (66).

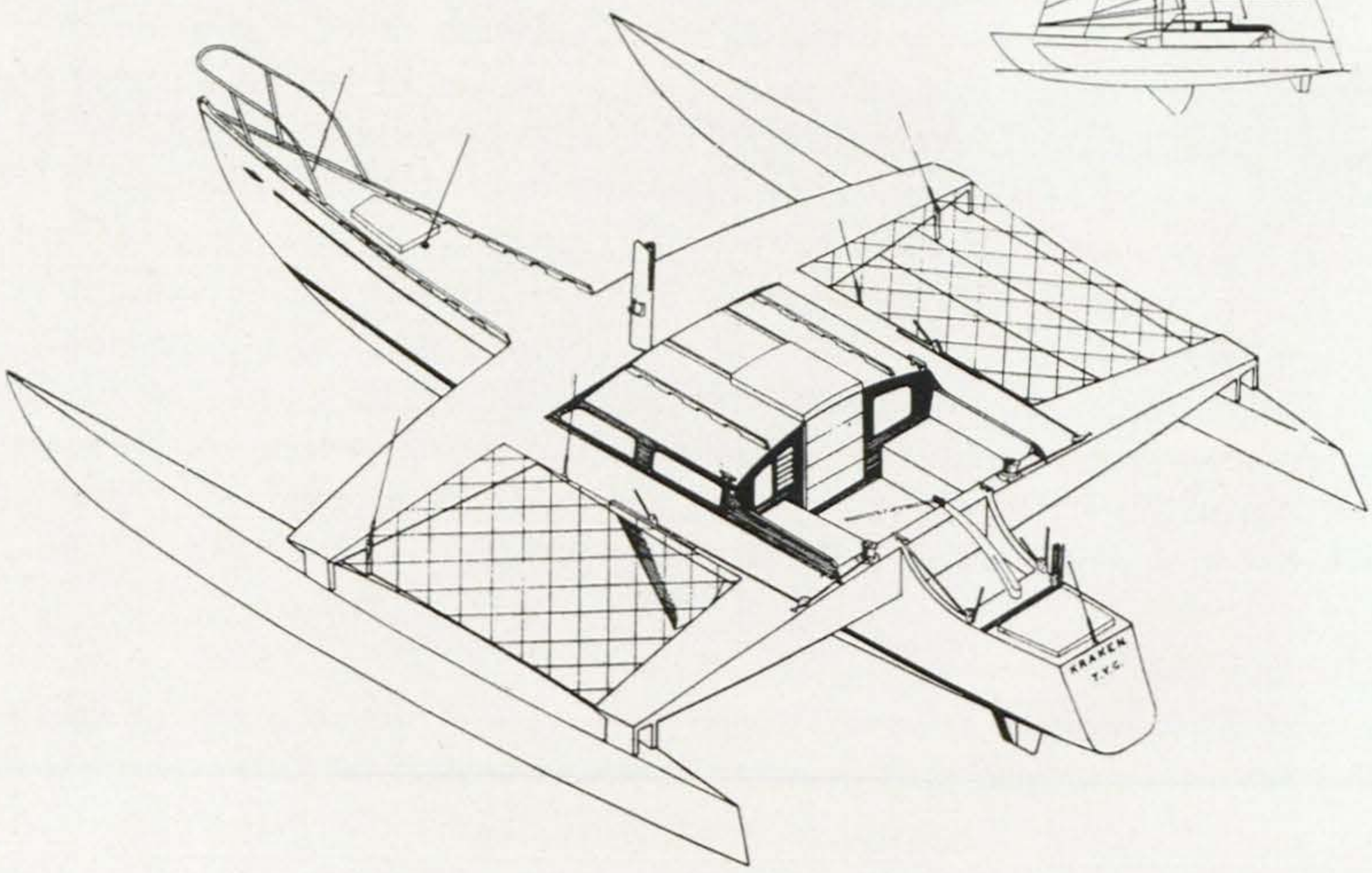
KRAKEN 33 was designed as the absolute minimum size of ocean racing trimaran for a race such as the 640 nautical mile Sydney-Hobart event. A 4 man crew is the smallest one can have for effective racing and this virtually dictated the displacement of the boat since stores, gear etc. are roughly proportional in weight to the number of crew members. *BANDERSNATCH*, the prototype *KRAKEN* 33 weighs around 2,000 pounds complete and has a designed displacement of 3,300 pounds. In practice the 1,300 pounds allowed for crew and gear was not enough and we were 2 or 3 inches down on our marks during the Hobart race. We had not counted on carrying gear such as 250 pounds life raft which the Trimaran Yacht Club's stringent safety regulations required. However, for shorter races she is ideal and the slight reduction in performance for the long race is acceptable when you consider she was built and completely equipped for $5,000.

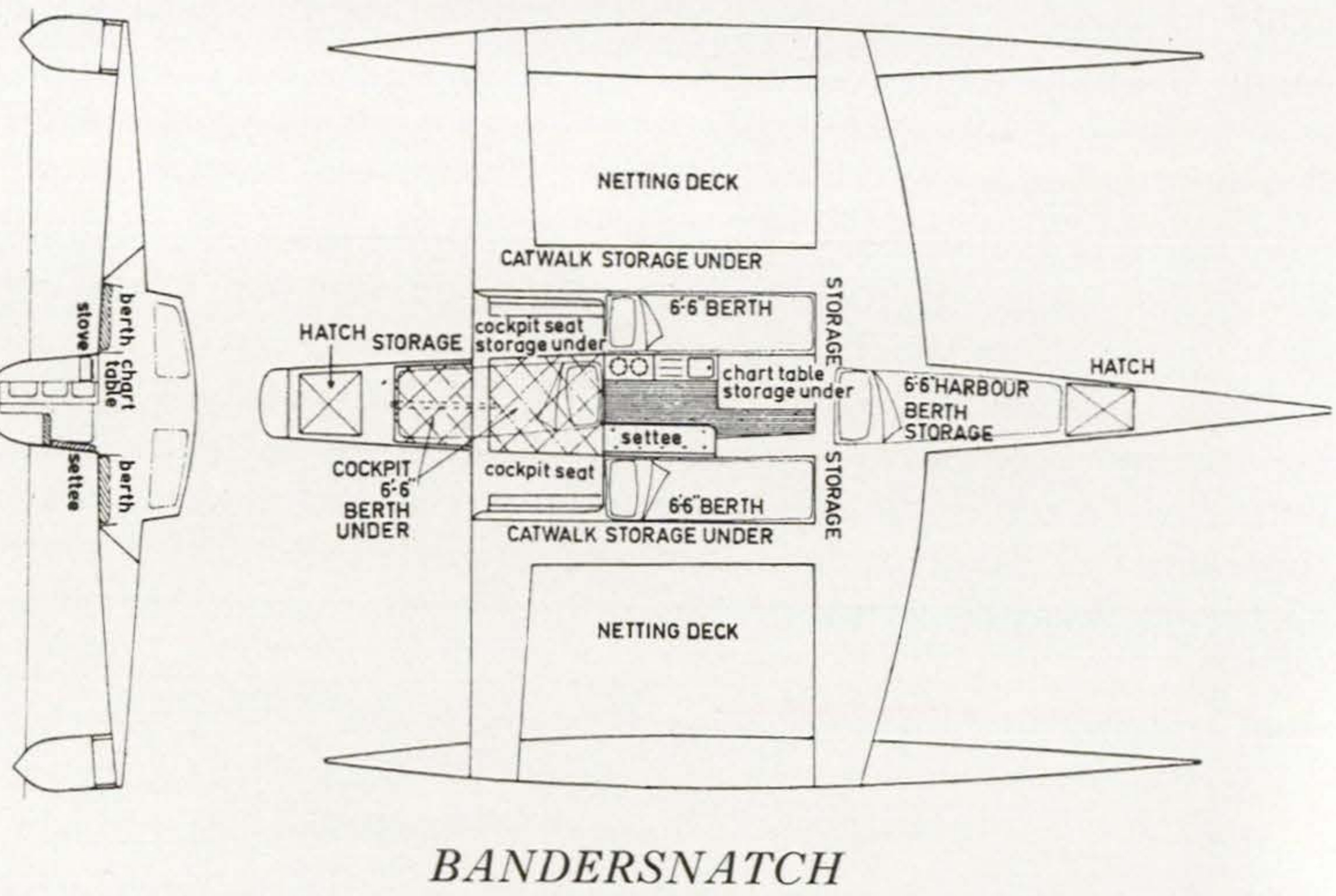
Accommodation

4 men require 4 bunks whilst in harbour but at sea 2 of these can be used for storage purposes. The wing deck is by far the most pleasant sleeping place being freer from disturbing water and deck noises than the main hull. Her cabin was laid out so that 2 berths could be located in the wingdeck and the rest of the design evolved round this cabin (Publication No. 60 (66) p. 64).

Overall Configuration

The first requirement for speed is the largest possible stability go weight ratio and with the maximum usable buoyancy of a float being equal to the all up weight of the craft. The only means of increasint stability is by increasing the overall beam. This increase must not be overdone because it reduces rigidity, making crossbeam design difficult. In addition, one can easily go too far and achieve so much transverse stability that fore and aft stability becomes a limiting factor. 23 feet of beam on an overall length of 33 feet gives us 35,000 feet/pounds of stability and, with the sail centre of effort 17 feet above the overturning centre, the capsizing force is round 1 ton. In certain directions of sailing we can have a similar force driving the boat forward and 1 ton can push $1\frac{1}{2}$ tons of boat through the water fairly fast.





BANDERSNATCH

The earlier smaller day racing tris, *KRAKEN* and *BUNYIP*, had used the float burying principle and this had proved so successful in preventing capsizes that it was adopted again. (Publication No. 55, p. 31). The only change was the stainless steel stilt system jacking the crossbeams up off the floats and clear of the wave tops, enabling full advantage to be taken of float buoyancy. The burying floats principle proved to be a real safety factor on the Hobart trip. The helmsman knew from the float level exactly how hard he was driving the boat and the float could bury slightly in gusts with no danger and no loss of speed. This way sails can be set to take full advantage of stability without any fear of overdriving causing a capsize. Most trimaran designs have huge area wingdecks, almost as large as their working sail area and if a large angle of heel is reached the windage must be sufficient to complete the capsize. Because *BANDERSNATCH's* floats bury, only half the wingdeck is exposed and since this is mostly netting she cannot capsize in this manner.

Accommodation requirements for hull beam caused us to settle for a $10\frac{1}{2}$:1 L/B ratio on a 30 foot waterline with the normal semi-circular hull sections. To minimise the effect of overloading, particularly towards the stern, with a generator, outboard motor and a cockpit full of crew, the main hull was given a wide flat stern. This certainly makes fore and aft distribution of weight less critical but probably adds too much wetted surface.

To prevent broaching a fairly deep forefoot and a skeg rudder were used, again more wetted surface but if better control under spinnaker could be achieved it is worthwhile. Broaching under spinnaker is a dangerous pastime and could lead to a capsize from which there would be no return. However, when racing a fantastic amount of ground can be covered under these conditions and the losses due to wetted surface may be recouped. *BANDERSNATCH* never looks like broaching and has achieved a peak 23 knots, averaging around 15 knots for some hours.

For a good windward performance a centreboard is essential, local tris with low aspect ratio fins make far too much leeway and actually will not go to windward at all in rough conditions. Deep float fins are second best—O.K. for cruising if the inconvenience of a plate case in the main hull is inacceptable.

KRAKEN 33 has 18:1 L/B ratio floats with canoe sterns and a cross section similar to that used on the smaller racing *KRAKENS*. It is difficult to see how these floats could be improved as they operate without fuss at varying waterlines up to deck level and the buoyancy is concentrated lower down than usual, reducing the angle of heel and keeping the crossbeams further from the wave tops for a given wind strength. With the stilt system and the extreme fineness of the floats, the float bows can lift in and out of waves with consumate ease, the decks being awash a lot of the time. Thus the floats do not supply any fore and aft stability, removing wringing strains from the crossbeams and leaving the main hull to ride naturally with the waves. The whole concept gives a very easy motion which enables the off watch crew to get essential rest.

Construction

The necessity for lightweight leads to aircraft style construction with a stressed skin stiffened by compound curvature and a few light stringers and frames. On hulls of this size skin panel stiffness requires a certain minimum thickness which does not alter much for different materials. With heavier materials such as aluminium and fibreglass it would be essential to use some expensive honeycomb or foam sandwich skin construction. This would be all right for the professional where labour is the main cost but for amateurs, material cost is all important. Plywood is an ideal honeycomb material and we used Klinkii pine ply as this has the highest strength/weight ratio of all available suitable plywoods.

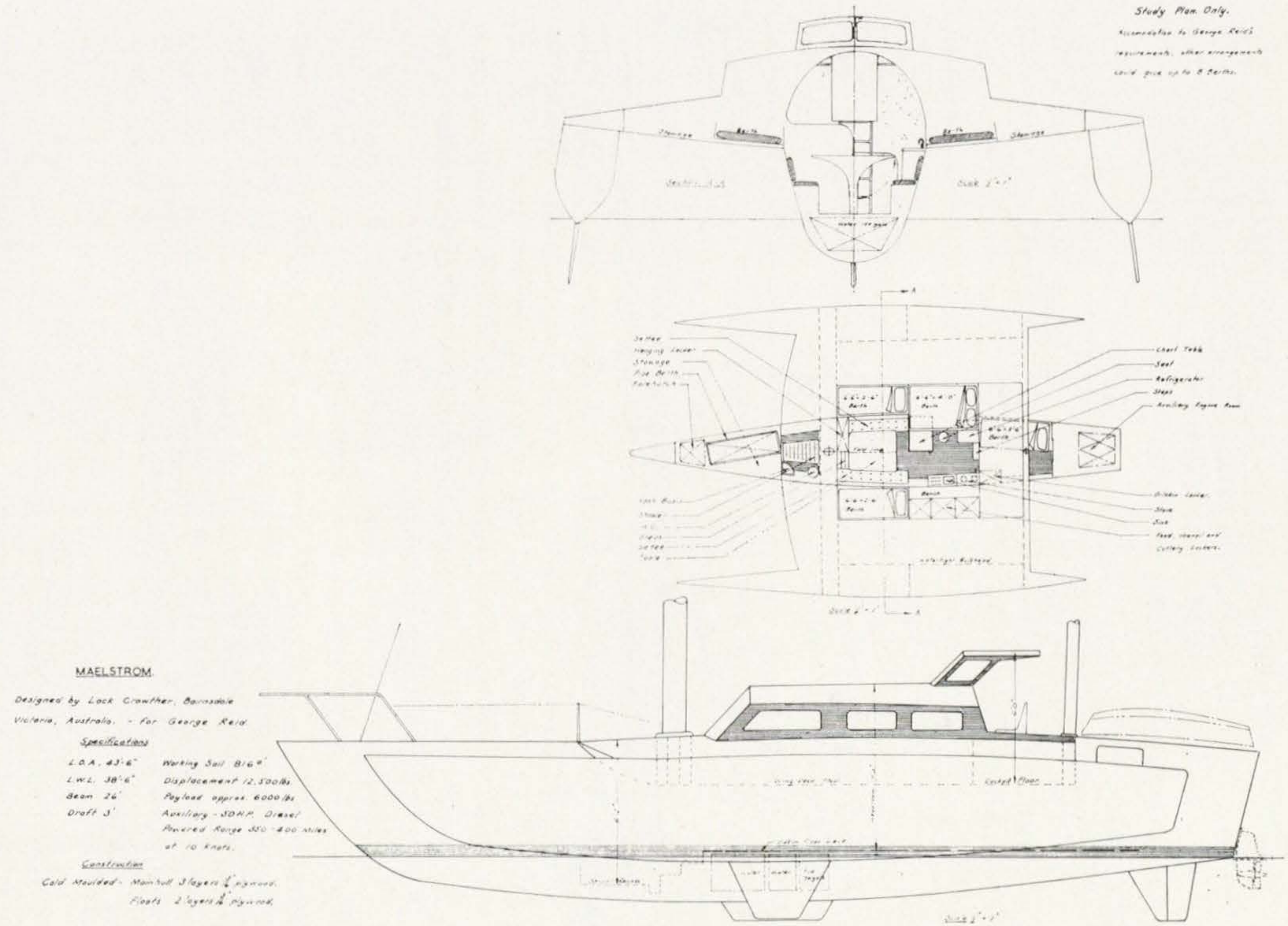
Crossbeams present two conflicting requirements, minimum deflection to keep the forestay tight requiring a deep section and water and wind resistance requiring a shallow sharply faired section. *BANDERSNATCH's* main crossbeam deflects ⅜ inch and Jeff Arnall did a mighty job on cutting the fore sail to suit the forestay sag produced by this deflection and other causes of stretch in the rigging.

CRUISING DESIGNS

ZEPHYR, *TEMPEST* and *MAELSTROM*

ZEPHR, 26 feet 6 inches, *TEMPEST*, 33 feet and *MAELSTROM*, 43 feet 6 inches are based on the *KRAKEN* 33 but have 8:1 main hulls giving a much increased payload and better accommodation. *TEMPEST* for example, has almost double the displacement of *KRAKEN* 33 yet has the same overall length. Due to the extra displacement these boats have relatively larger floats and smaller overall beam and still retain the float burying characteristics.

Deep fixed fins are used on the floats for accommodation reasons and the wingdeck is desirable to take the strain imparted by these fins. The decking is kept as short as possible in a fore and aft direction for windage reduction.



Study Plan Only.
Accommodation to George Reid's
requirements, other arrangements
could give up to 8 Berths.
MAELSTROM
Designed by Lock Crowther, Bairnsdale
Victoria, Australia. - for George Reid.
Specifications
L.O.A. 43'-6"
L.W.L. 38'-6"
Beam 26'
Draft 3'
Working Sail 816 ft²
Displacement 12,500lbs
Payload approx. 6000 lbs
Auxiliary - 50H.P. Diesel
Powered Range 350-400 Miles
at 10 Knots.
Construction
Cold Moulded - Mainhull 3 layers ¼" plywood.
Floats 2 layers ⅛" plywood.

MAELSTROM

All these boats are double diagonal planked with ply over permanent frames and stringers, a method giving stronger and more satisfactory hulls but one which does take a little longer than sheet ply hulls. The actual planking is very simple but somewhat tedious.

In this modern age one has not much time for sailing so if one has a fast boat there are many more places within range. Some trimarans look like floating caravans and generally spend all their time at moorings because they give no joy in sailing.

KRAKEN 40

KRAKEN 40 has been drawn up as a larger ocean racer with a 5 or 6 man crew, much more suitable for long races, and with some more improvements over *KRAKEN* 33. A trimaran of this size should be able to keep up with those fine Californian catamarans and may even be faster in light weather.

The main difference in this larger boat is in the main hull design. Other differences such as flush deck with low dog house are natural results of the extra headroom available in a larger boat. The main hull design is based on the latest from that fast developing and most futuristic of all classes, "C" Class. Here experience has proved that maximum length/beam ratio and minimum wetted surface is required, hence Quest type 22:1 hulls with canoe sterns. With the payload and fore and aft stability requirements and relatively lower—$\sqrt{L}$ speed we cannot do much better than a 10:1 hull for the Tri. A canoe stern is out because a transom is needed to mount the outboard auxiliary and to damp out pitching, the next best from a wetted surface point of view is a narrow vee'd transom. The main hull overall length is not so important under T.Y.C.A. rating rules and a pleasing overhanging bow with plenty of buoyancy and deck space is provided.

In this craft from 6 to 8 berths can be arranged, 4 of them in the wingdecks, 1 double under the cockpit and others up forward. A complete galley, fixed chart table, W/C, in fact all the necessary comforts for cruising can be arranged. With her light overall weight meaning relatively little material the actual cost for the accommodation available is very reasonable. This type of trimaran could be said to come closest to the much used phrase, "the best racing yacht makes the best cruising yacht".

LOCK CROWTHER.

Editor's Note: Lock Crowther is not in favour of low aspect ratio keels and considers for windward work a deep centreboard is essential. This has been the experience in *TAO*, a 30 foot *TRIUNE*. Comments on this aspect of trimaran design from our members would be interesting.

BANDERSNATCH in the Sydney-Hobart Race

In MODERN BOATING, John Hitch owner-skipper of winner, sums up the lessons learnt from the first Sydney-Hobart trimaran ocean race.

The main lesson we learnt from our first Sydney-Hobart trimaran race was that for this type of racing you really need bigger tris. Both *BANDERSNATCH* and *VIVA*, an Arthur Piver *STILLETTO* design, which finished second to us, are 33-footers.

We both found it a struggle to accommodate the load of 4-man crew with their gear, stores, and safety equipment for the long race.

We were a couple of inches down on our marks. Weight is a critical area in trimaran design and being over-loaded can take away a lot from performance.

One of the 4 starters in the race turned back mainly because she was overloaded and was just getting nowhere in the light conditions.

You can overload a trimaran to a degree without any harm and we don't want to be lax on safety equipment, but performance does suffer. In our handicapping system, the main factor next to sail area is weight.

Apart from this, the race was a howling success from our point of view.

We would have liked a lot more wind. We don't have any real light-weather sails.

I don't think we could have sailed with a crew of less than 4 and, anyway, our safety regulations require that number for ocean races of 100 miles and more.

Lockie Crowther, who designed *BANDERSNATCH* and navigated her, and I had some discussions on this problem of weight, load carrying, and performance after the race.

We reckoned you need something around 37-40 feet. We are toying with the idea of building one—similar in concept to *BANDERSNATCH* with minor modifications.

We didn't feel cramped aboard *BANDERSNATCH*. She has a surprising amount of room really, with full headroom and sitting headroom over the bunks. Everyone got their rest on the way to Hobart. The bunks are situated so the off-watch crewmen are out of the way and undisturbed.

She is a very easily-worked boat and exceptionally dry. We hardly got wet at all and walked ashore in Hobart in the same gear we went aboard with.

The crew had only sailed together once before, and three of them had never been in an offshore race before, but they welded into a good team.

We had our best sail in the southerly of the first night out. We got down to number three genoa and she was going like a train. From there on it changed between a spinnaker and genoa.

We took an inshore course off Tasmania and spent a very bad 36 hours in calms off Freycinet and I think this is where *VIVA* caught up a lot.

I don't think there is any doubt we have the faster boat, but I think *VIVA* is a very fine boat and by far the best of Arthur Piver's designs.

In the future, I think the trend will be more toward the racing trimarans than the cruising type exemplified by Piver's earlier designs. Costs are roughly proportional to weight. The racing boat is going to be lighter than the cruising boat, can be longer, and offer more room.

Sailing Techniques

In sailing technique, I don't think there is much difference between the trimarans and the conventional ocean racer.

You have to be a bit more cautious in a small trimaran and you can't afford to lug sail to the point of being overpowered, although you could drive a bigger tri a lot harder than we did with complete safety.

The only real difference in technique is in down wind sailing, where it could pay you to tack downwind to pick up speed.

Our radio links with the motor sailer *UNA J*, which accompanied us, worked quite well, although static gave us some trouble on the first night. We had only a small 15-watt set and had to relay through *VIVA* to *UNA J*. I think a more powerful set is needed.

The race has an assured future. We had useful discussions with the Derwent Sailing Squadron, which looked after us in Hobart, and they were quite happy to work with us again.

They offered some constructive suggestions—one of the best was that we have a qualifying long ocean race in which a boat must put up a good performance before being allowed into the Sydney-Hobart. I think that this is a great idea.

I think it will be a long time, if ever, before we get together with the Cruising Yacht Club, on a Sydney-Hobart—fair enough, their constitution restricts them to single-hulled yachts.

Among the crews of the boats down there we were generally well accepted, although occasionally we were on the receiving end of some nasty cracks.

No matter what was said about us being lucky it was a light-weather race, I think boats like *BANDERSNATCH* and *VIVA* would have done well in a hard blow. I know *BANDERSNATCH* goes like a train in a big breeze.

The main thing holding back off-shore trimaran racing in Australia at the moment is lack of experienced skippers and crews and this is going to take us some time to overcome.

Our entries were low this season because a number of would-be starters couldn't get the gear together in time to comply with our rigid new safety regulations.

Next season we should have more starters and a couple of new tris are being built specially for the race. The following year should be better still, as we should have some really big boats in it.

IMPALA

DESIGNED BY LOCK CROWTHER

Dimensions

L.O.A.	38.0 ft.	11.58 metres
L.W.L.	34.0 ft.	10.35 metres
Beam	25.7 ft.	7.82 metres
Draft	3.3 to 5.5 ft.	1.04 to 1.67 metres
Design Displacement	3.4 tons	3460 Kilograms
Sail Area	730 sq. ft.	67.6 sq. m.

SPECIFICATION

Scantlings and Materials

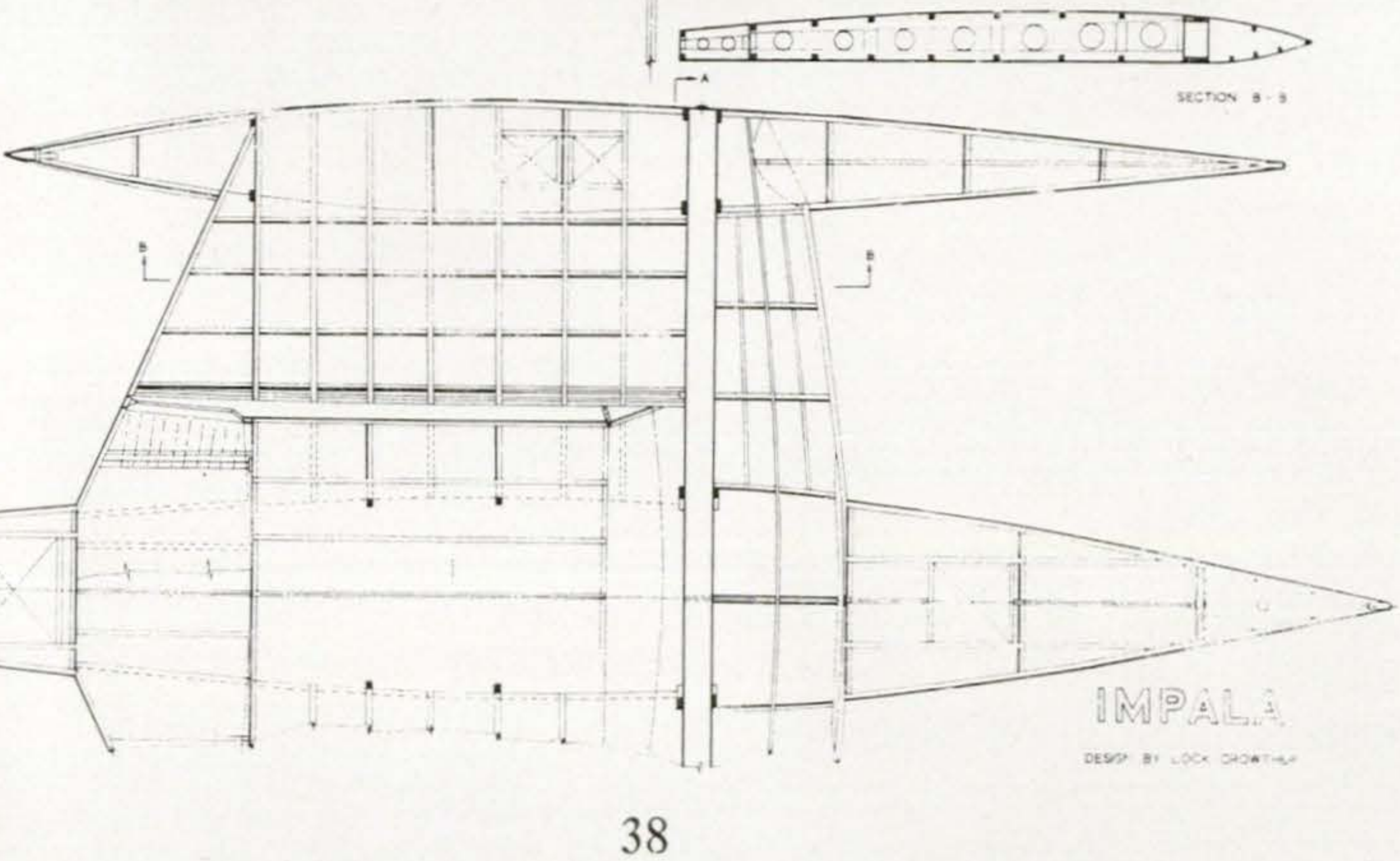
IMPALA's hulls are of resorcinol or epoxy glued, double diagonal cold moulded plywood, stressed skin construction stiffened by 1¼ inch x ¾ inch longitudinal stringers over ⅜ inch ply bulkheads. Bulkheads have 3¾ inch x ¾ inch edging, gunwhales are 1¾ inch x 1¼ inch and the keels are laminated with external capping strips over the planking. The mainhull is skinned with two layers of 3/16 inch plywood and the floats with an inner layer of 3/16 inch and an outer layer of ⅛ inch plywood. Wingdeck structure is $\frac{3}{8}$ inch plywood skinned over longitudinal bulkheads and $1\frac{1}{4}$ inch x $1\frac{1}{4}$ inch transverse spars and a main crossbeam which consists of two $7\frac{3}{4}$ inch x $1\frac{3}{4}$ inch laminated members between $\frac{3}{8}$ inch ply webs. Her foredecks are plywood and her cabin is constructed of $\frac{3}{8}$ inch plywood with longitudinal stringers only. The fibreglass sheathed laminated timber centreplate swings in a $\frac{1}{2}$ inch internally fibreglassed case. The whole craft is sheathed in 5 ounce fibreglass or 12 ounce "Kuralon" cloth impregnated with polyester or epoxy resin.

Special Equipment

The series 200 Fairey hydraulic propellor unit drops through a 12 inch x $4\frac{1}{2}$ inch stainless steel well. In the retracted position a plate on the bottom of the unit seats flush with the hull.

Description

IMPALA incorporates many lessons learnt from *BANDERSNATCH*, the inaugural Sydney-Hobart 640 mile multihull winner. First and foremost she is a family cruiser suitable for amateur construction. Hence the 6 permanent berths including a double, all with sitting headroom, the permanent seating at the table and in the cockpit for 6, and the wooden construction.



One of the bugaboo's of multihulls is load carrying capacity and with the tendency for people to judge cost by length, hulls are becoming short and tubby. I feel this is a mistake as it adversely affects one of the multihull's best features, speed, and a slightly larger multihull of the same weight is only slightly more expensive. A built weight of around 2 tons leaves a 1.4 tons payload which is ample for most purposes. Overloading to a minor degree, say 2 tons payload, would have a negligible effect.

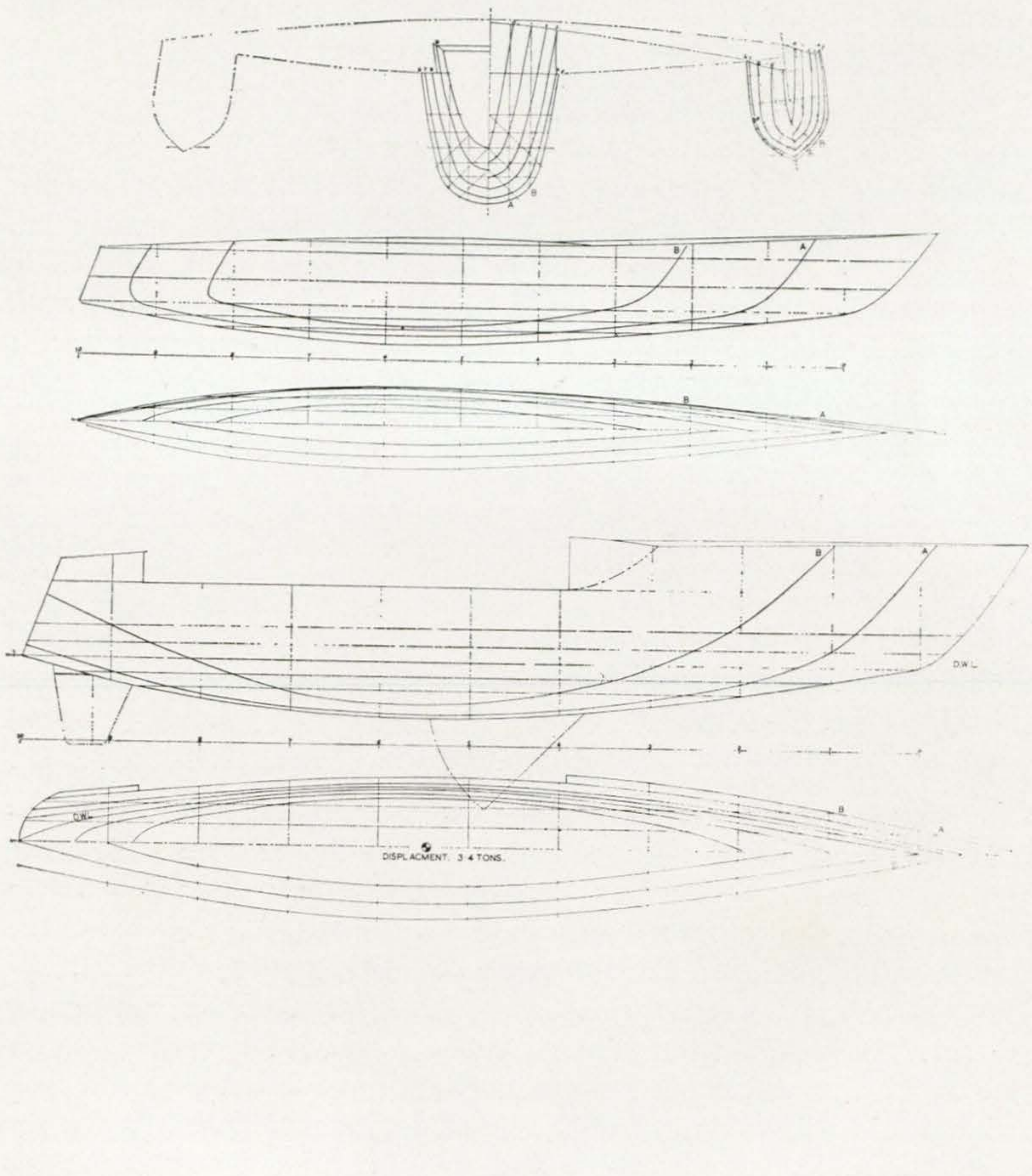
The displacement requirement and the desirability of not less than 8:1 hulls forced the waterline length to 34 feet. It is now well known that for average speeds skin friction is by far the greatest resistance factor, even at $3\sqrt{L}$ speed the skin friction is $\frac{2}{3}$ of the total. Therefore, *IMPALA's* mainhull sections are close to a semi-circle with depth approximately $\frac{1}{2}$ width for the full length of the hull. Thus the keel rocker follows much the same curve as the waterline.

The principle of the mainhull supplying all fore and aft stability has worked well with previous designs. Fine ended floats lift easily in and out of waves without resistance and any slop thrown back is neatly sliced through by the thin finely faired section of wingdeck alongside the float. *IMPALA's* floats just touch the water at moorings and the weather float lifts well clear at sea saving pointless drag. The vee'd rounded sections provide low wetted surface over the normal depths of immersion, keep the wingdecks clear of the water as far as possible for a given righting moment and prevent occasional annoying slaps or jerks from waves passing under the weather float.

The centreboard is raised and cleated just inside the companionway, shockcord under the cabin sole holds the board down. A single central centreplate is far more efficient, satisfactory and stronger than fins or boards in the floats and causes very little inconvenience in the cabin. The skeg rudder proved extremely good on *BANDERSNATCH* and is slowly being adopted in some form for ocean going yachts. In-board lifelines are extremely practical for use with safety harnesses, one can clip on alongside where one is working and feels with the lifeline close handy, psychologically secure. With the mainsail, outhauls—downhauls and the travelling spinnaker—genoa block all worked from the cockpit, there is little need to work outside the lifelines.

A cheaper alternative to the 21 h.p. Wankel mounted in the self draining stern locker would be an outboard sliding on tracks through a cutout in the transom. There would however, be the problem of pitching the propellor clear of the water in a chop.

Finally, why not a catamaran? The difficulties of achieving full headroom without a boxy appearance and the poorer light weather performance caused by greater wetted surface made a trimaran a better proposition. There is no doubt that once a cat gets around 45 feet overall it becomes the better multihull.



THOUGHTS ON CRUISING IN TRIMARANS

BY

PETER CAMPBELL

From 'Trimaran', journal of the Trimaran Yacht Club of Australia

After 18,000 miles cruising on *TORU* some thoughts have been kicking around in my head. With a nudge from Martin Cooper we'll try and organise some ideas.

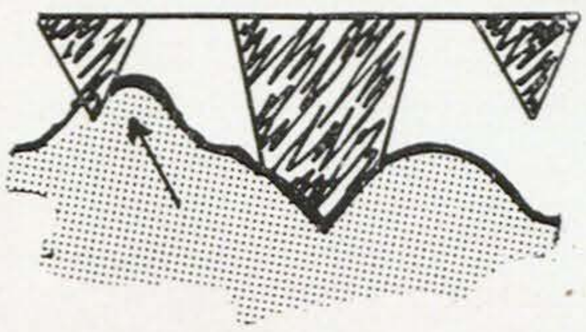
It wasn't until we had reached Australia and someone said "Well you got here O.K." that I realised that I had confidence in my ability to handle her under a variety of conditions.

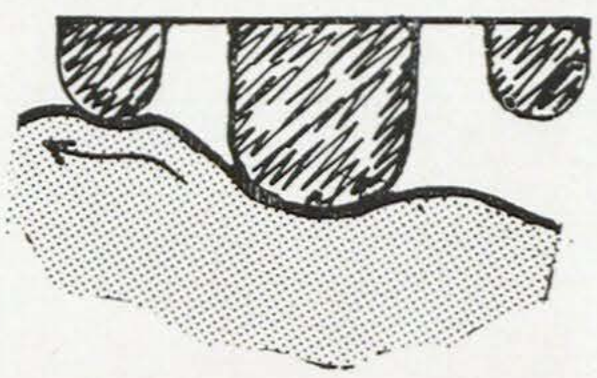
San Francisco to Hawaii is a down wind run and gave us our first thoughts about broaching. Walt. Glaser, after the same crossing in his much modified *LODESTAR*, thought that fixed rudders on the float sterns would help stop the broaching tendency. He had trailed a warp astern for one day to ease the steering. We didn't go to this extreme but our transom rudder was a foot deeper and half the fore and aft dimension as designed. In addition we carried our sails as far forward as possible; two genoas wing and wing. The weather genoa sheet being led through a block on the end of the winged-out main boom, the other genoa being carried the usual way with a lead on the float side. We kept the wind on the quarter rather than dead astern We did not broach but when surfing often found the rudder immovable in the direction necessary to correct a broach. The strain would ease immediately the fast surfing slowed and we could then correct. A good helmsman had a much easier time of it than an inexperienced one because he was able to anticipate the direction of the surfing and correct or rather pre-correct accordingly. It appears with trimarana that the deeper the rocker the more the tendency to broach.

Confidence, not keeping rigidly to a course line, willingness to carry sail and shorten sail before it's necessary are all part of cruising. We learned to fall off 10° or 20° if the motion became too uncomfortable. We learned to slow down, by single reefing and perhaps taking off the jib at nightfall and making the motion slower and more comfortable for the night's rest. When cruising, speed comes after comfort and safety.

On the way to Australia we originally intended to go to Tahati after Honolulu; but the North East Trades were Easterly and although hard on the wind we just weren't making it. We decided to hold on for one more day and under double-reefed main and club jib did 167 miles in 24 hours, course made good being 50° off the wind. This was a test and was very uncomfortable so we fell off and headed for Samoa to the heartfelt relief of our seasick crew members. Five days later, the wind had shifted and we could easily have laid Tahiti but kept on to Samoa. The point being that, when cruising, it is rarely necessary to beat your brains out going hard on the wind for days into the Trades. Incidentally in spite of various claims to the contrary we found *TORU's* motion to be very uncomfortable when sailing fast and hard on the wind in the open ocean.

During this period I noticed what seems to me to be a defect in the hull configuration of types similar to *TORU*. With the waves coming from either bow the inboard side of the lee float bow receives a terrible beating. Sometimes it's from the waves being pushed sideways by the underwater V shape of the main hull.





Sometimes a wave passing under the shallow forefoot as it rises, slams into the lee float bow. The float being a simple V tends to trap and arrest the flow of water. I feel that a more compound shape, as developed in Australia, which would deflect the water is to be preferred. I also feel that for ocean cruising, a long straight underwater profile is to be preferred over the rocker-like configuration. The latter makes a trimaran more manoeuvrable but it also allows it to screw sideways on the crest of the wave, i.e. the broaching tendency. I think Joshua Slocum had a similar idea some time ago.

I think dismasting is probably the most real danger facing cruising trimaran sailors. To get through the Doldrums you have to use the passing rain squalls. Sometimes these are sudden and at night it's sometimes difficult to foretell the direction or force of the wind. The trimaran's stiffness is a drawback under conditions like these. The ability to accelerate is a safety feature but trimarans, when cruising, are sometime heavily laden. There should be a constant emphaiss on weight saving, because when that squall hits, there is a pause before acceleration begins.

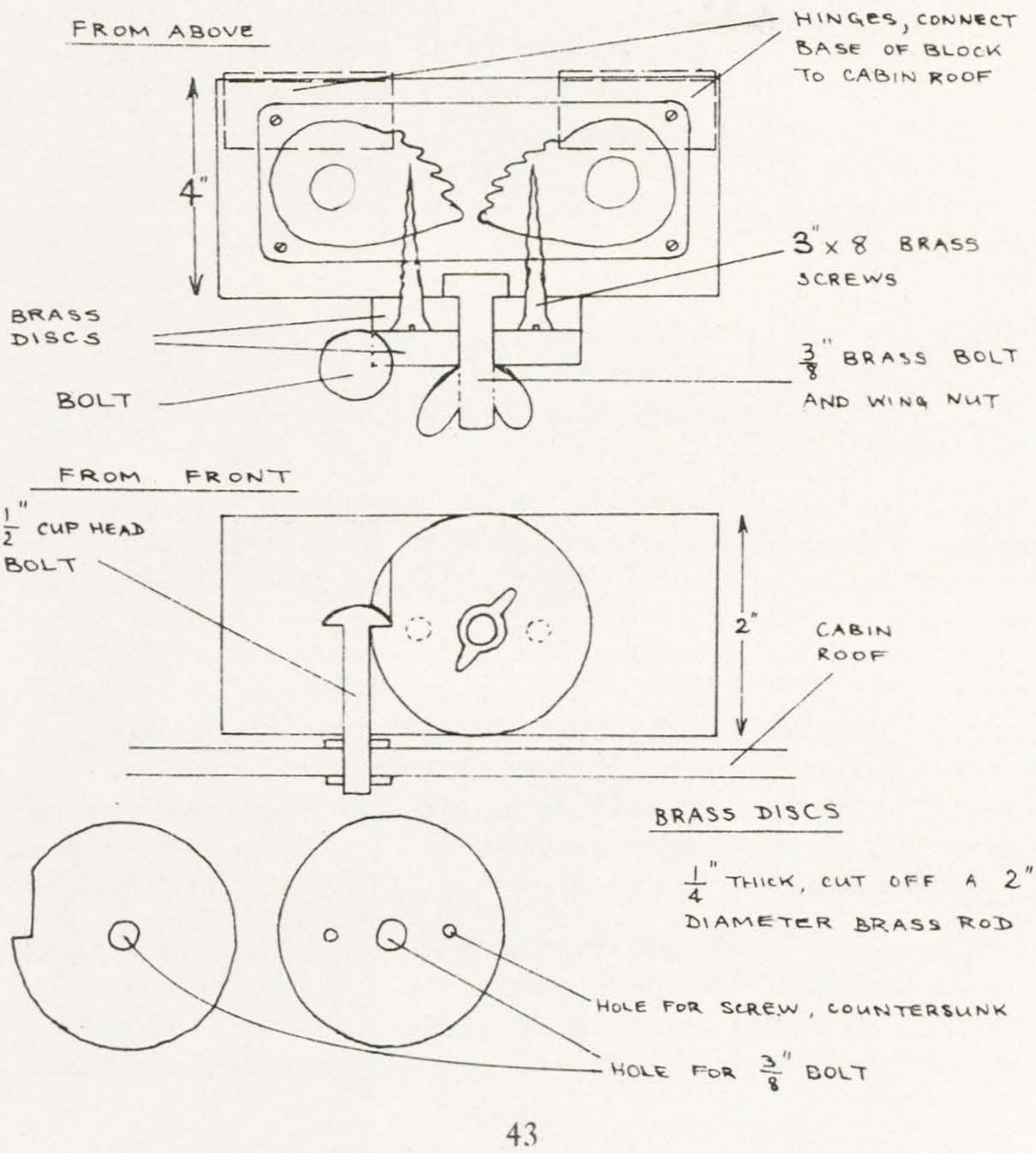
I hope these personal thoughts may be of some use to those interested in cruising trimarans. Be prudent but DO GO because it's a wonderful way of life.

Note: Peter Campbell sailed the 40 foot Victress *TORU* from San Francisco to Maryborough (Queensland) and later from Brisbane back to San Francisco, taking in the Brisbane-Gladstone Race on the way. He is now in North Queensland.

THE AUTOMATIC SHEET-RELEASE CLEAT

By Courtesy of the Trimaran Yacht Club of Australia from their journal "Trimaran".

The automatic-release cleat is a useful and perhaps indispensable device for the off-shore multihull, especially in a squally conditions when good speed is desired. The following details and particulars are for such a cleat. This cleat has proved quite successful; it can be easily constructed and cost only about $4.00.



The cleat can be set to release in any desired wind strength by varying the tightness of the wing nut.

Construction Points

a. The sliding (mating) surfaces of brass discs must be smooth so jambing will not occur.

b. Cup head bolts must be on the side shown so that the wing nut releases once slipping starts.

c. The sheet must lead squarely into jamb cleat.

d. Fairlead for sheet must not be fastened to block.

e. The head of pivot bolt must be carefully recessed into block so that it cannot turn.

KELSALL 31

Derek Kelsall Ltd.

Sandwich Marina, Sandwich, Kent

The G.R.P. foam sandwich that we use offers the following advantages:

High strength for weight ratio
Excellent thermal insulation
Built in buoyancy
The same durability and low maintenance as solid G.R.P.

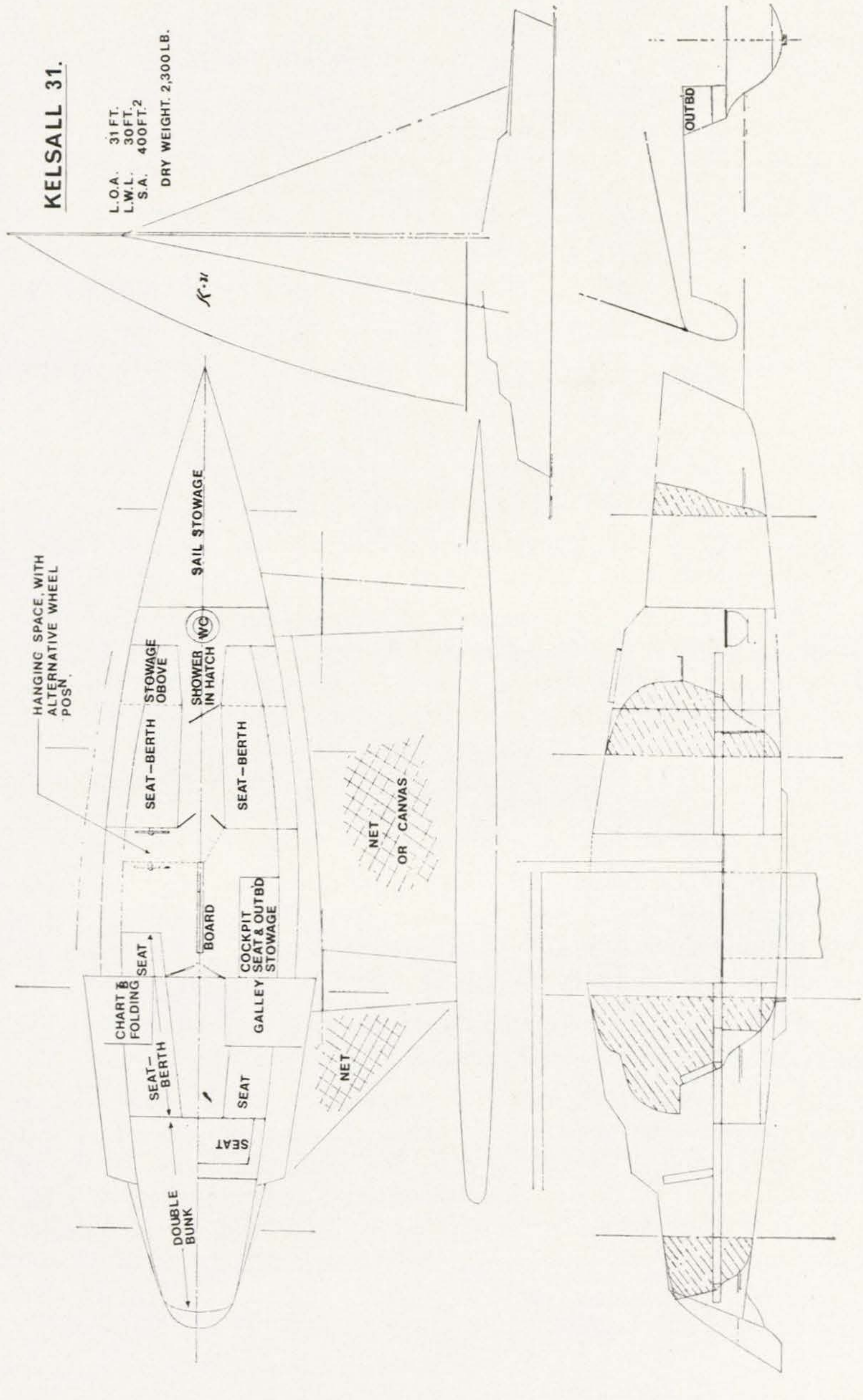
The *K*.31 is a lightweight, fast cruising design. An important feature of the design is the detachability of the outriggers that allows the beam to be reduced to 8 feet for storage, trailing or packaging for export.

The central cockpit allows:

Most sail handling to be carried out from the cockpit,
No change of trim with large crew,
In harbour, a simple canvas cover over the cockpit turns the whole of the accommodation into a practical unit which is most spacious for the size of boat.

The "flared" hull of this design serves to provide maximum space without detracting from performance. This "flare" also completely solves the outboard motor auxiliary mounting problem. An opening in the "flare" allows the motor to be tilted down from its stowed position under a cockpit seat and avoiding the usual lifting of the motor in a tossing boat and the connecting up of fuel and controls.

The pivoting mast and fully battened mainsail increase the efficiency of the sail plan.



LUNGA

Offshore racing trimaran

DESIGNED BY

JOAO MENDONÇA

Mandimba, Nova Freixo, Mocambique, Portuguese East Africa

Dimensions

L.O.A.	31 ft. 9 ins	9·68 metres
L.W.L.	28 ft. 8 ins.	8·64 metres
Beam	16 ft. 4 ins.	5·0 metres
Draft	1 ft. 2 ins. 5ft. 6 ins.	0·37 metres
Design Displacement	1·6 tons	
Sail area	322 sq. ft.	30 sq. metres

Dear Mr. Morwood,

I have today received a letter from the Editorial Office of Yachting World Magazine telling me I can send my plans to anybody as they are my property, and I enclose a set.

As you can see the trimaran *LUNGA* was designed to enter the Yachting World Multi-Hull Design Competition. Although I hadn't a chance of winning a prize as I am a 100 per cent amateur designer, I decided to enter with a boat that I would build for myself with several new ideas and . . . just for fun.

Designers' Remarks

LUNGA was designed for Yachting World Multi-Hull Designing Competition as the answer for short-of-money yachtsmen. Being easy to build she can be sailed at a figure well under £1,000 even if an aluminium mast and terylene sails are used.

Several features were introduced in order to produce a cheap, light, fast, safe and trailable trimaran.

1. The use of nets instead of a rigid flying bridge enable one to dismantle the floats not only for trailing purposes but also to right it after capsize and to "build" at sea a life saving catamaran by use of both outriggers; the net reduces the windage and the danger of a big sea falling over the bridge at a price of less deck area and smaller inside space;

2. The use of a top mast buoyancy prevents the 180° capsize but I must state that even in this situation it is possible to right the trimaran without exterior aid;

3. The floats are very small and of hard chine type not only to support their own weight but also to help the main hull to float on the designed waterline; they will dive in case of capsize as each one displaces less water than the full weight of the trimaran.

4. Automatic steering vane coupled to a rudder of folding blade type which I think is something new; it works on Hasler system but the vane post is not directly connected to the trim tab but by means of a steel cable passing in two pulleys, the last one being on the centre of the circumference described by the movement of the blade—Lunga system.

The sail plan presents a modest area that can be increased in light conditions to 65.8 square metres (707 square feet). In a force 5 wind the area of 30 square metres will never overpower the rig even at close wind work. Driven carefully it is possible to fly all sails at a force 5, running with the wind, an occasion in which *LUNGA* will show the qualities of its planeing hull.

The building is extremely easy and only the metal pieces for mounting the booms present some problems that must be solved by professionals.

Any kind of marine plywood or waterproof plywood, any kind of glue and wood screwed every 2 inches below waterline and 4 inches above it.

For safety the floats must be filled with foam as shown on the plans.

The accommodation is spartan but gives a reasonable saloon. Below the cockpit there is enough space to keep a small outboard engine 7.5 h.p. fitted on the transom.

Strongly recommended the use of professionally built aluminium mast and terylene sails for a question of better tuning.

The ideal crew for round the buoys races will be of 4; for offshore racing only 3 and for cruising, 2. Not recommended single-handed cruising as it would be impossible to right the trimaran alone or even to build the life saving catamaran.

Unfortunately I could not include in the above the method of righting *LUNGA* after a 90° or even a 180° capsize. One condition of achieving this is that the crew must swim and dive well.

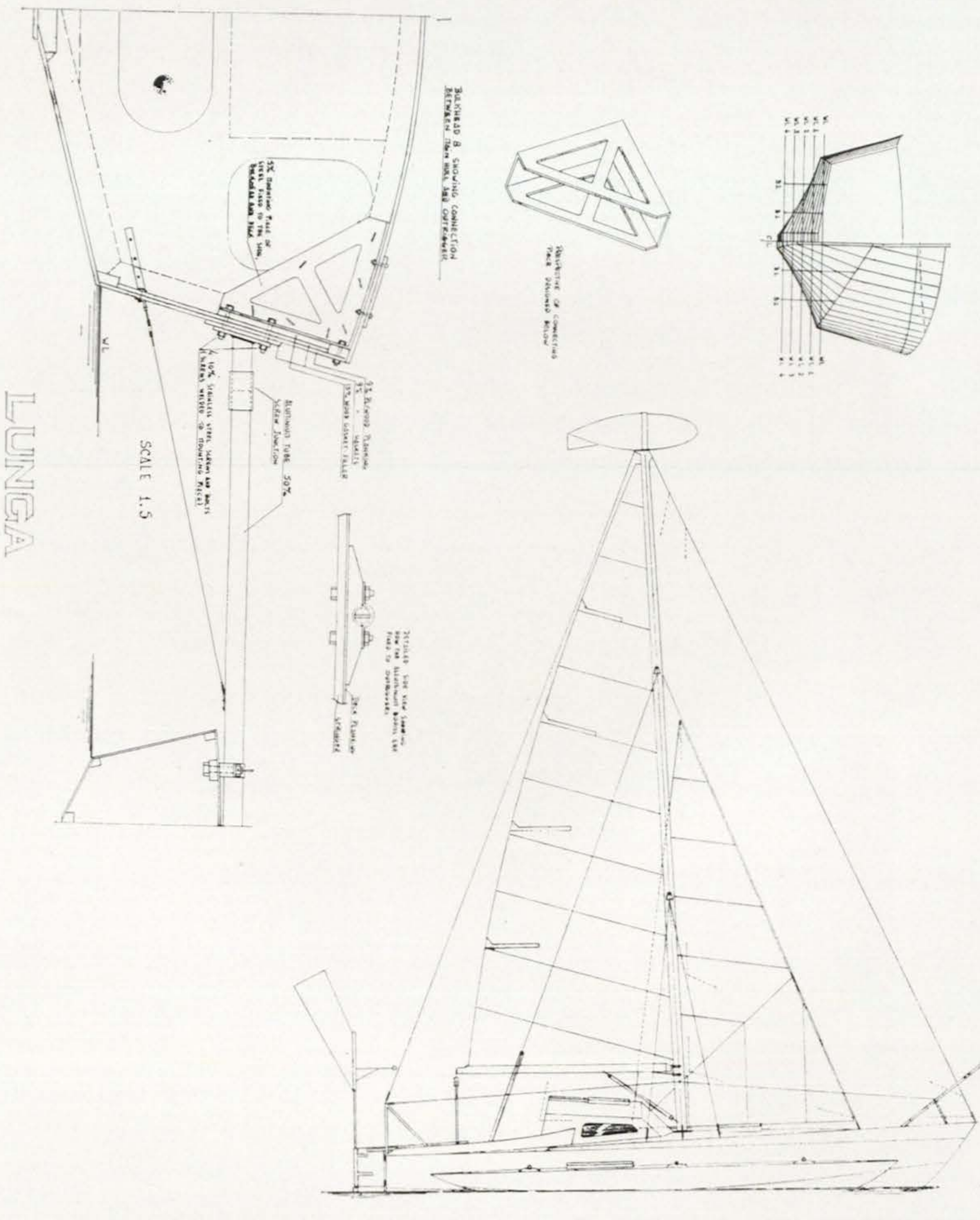
The 90° capsize:

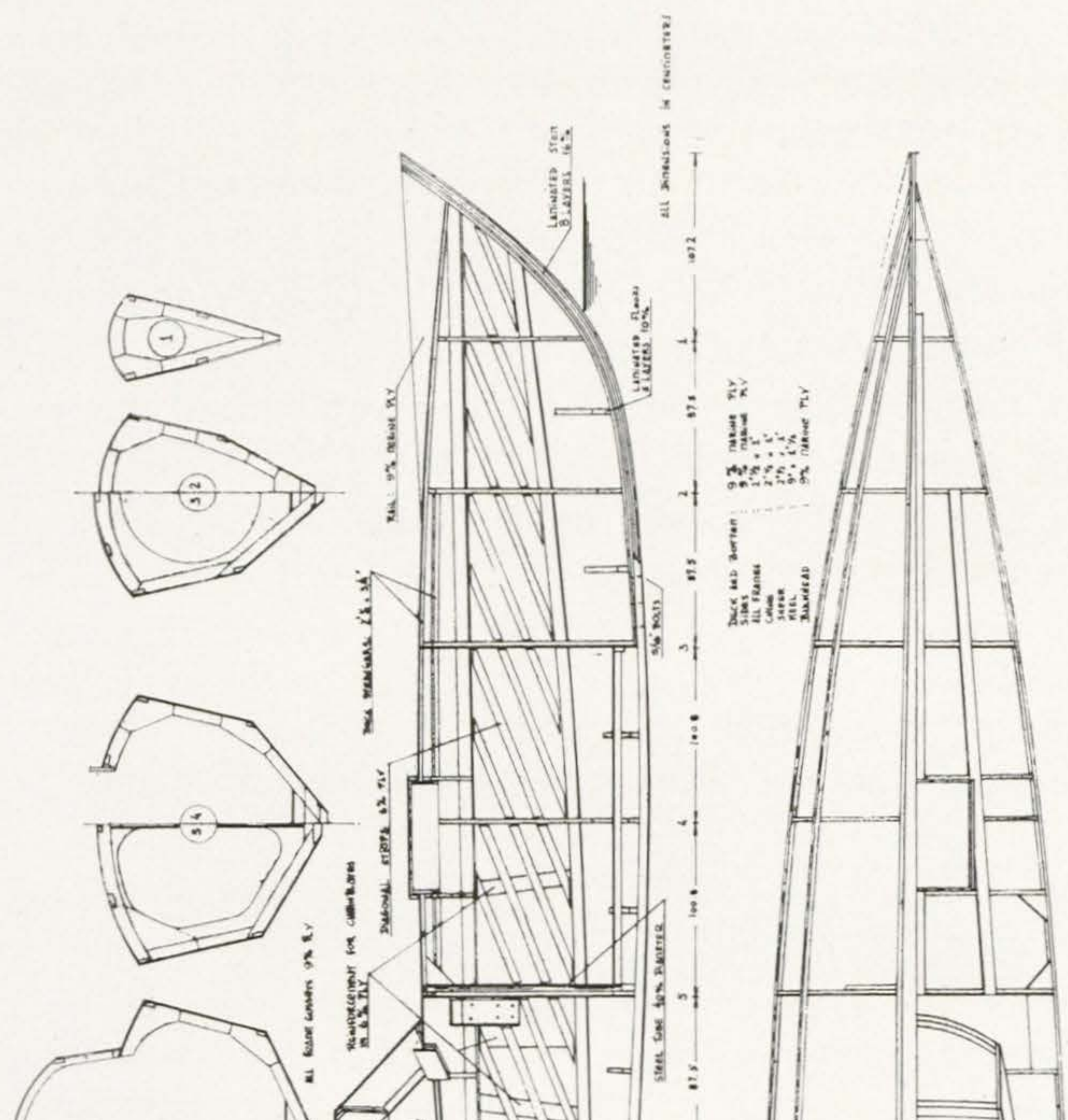
1. The float that is some 8 feet above the sea must be unscrewed and lowered to the water;

2. Using a rope one member of the crew must tow it to the mast top;

3. Now he will try to put the float under the top of the mast by lifting the mast about a foot;

4. After that he must get onto the float and lift the mast as much as possible, pulling himself and the float towards the hull by one of the stays until the mast is at an angle of about 85° to the water;





LUNGA

5. At this moment the float that is submerged will produce the necessary lift to right the boat even with wet sails;

6. The float that was unscrewed must be replaced.

All this seems complicated and troublesome but I think it is better to work a bit than to have a trimaran capsized for ever in mid-ocean. The estimated weight of one float is 130 pounds and therefore I think that it is possible to do all this work of mounting and dismounting it at sea.

About the 180° capsize which could happen by the combined action of enormous waves and strong winds:

1. Both floats have to be removed and in consequence the top mast buoy will reduce the capsize from 180° to only 90°;

2. One float must be replaced on its booms over the sea as it would be impossible to dive the other to the opposite position;

5. Now one member of the crew must do the same as in 3 and 4 for the 90° capsize but the rest of the crew must sit on the upper float to produce the necessary righting moment;

4. When the boat has been righted the second float must be replaced.

Also, unfortunately, I could not make any remark about the strange "life saving catamaran" and about the necessity for it.

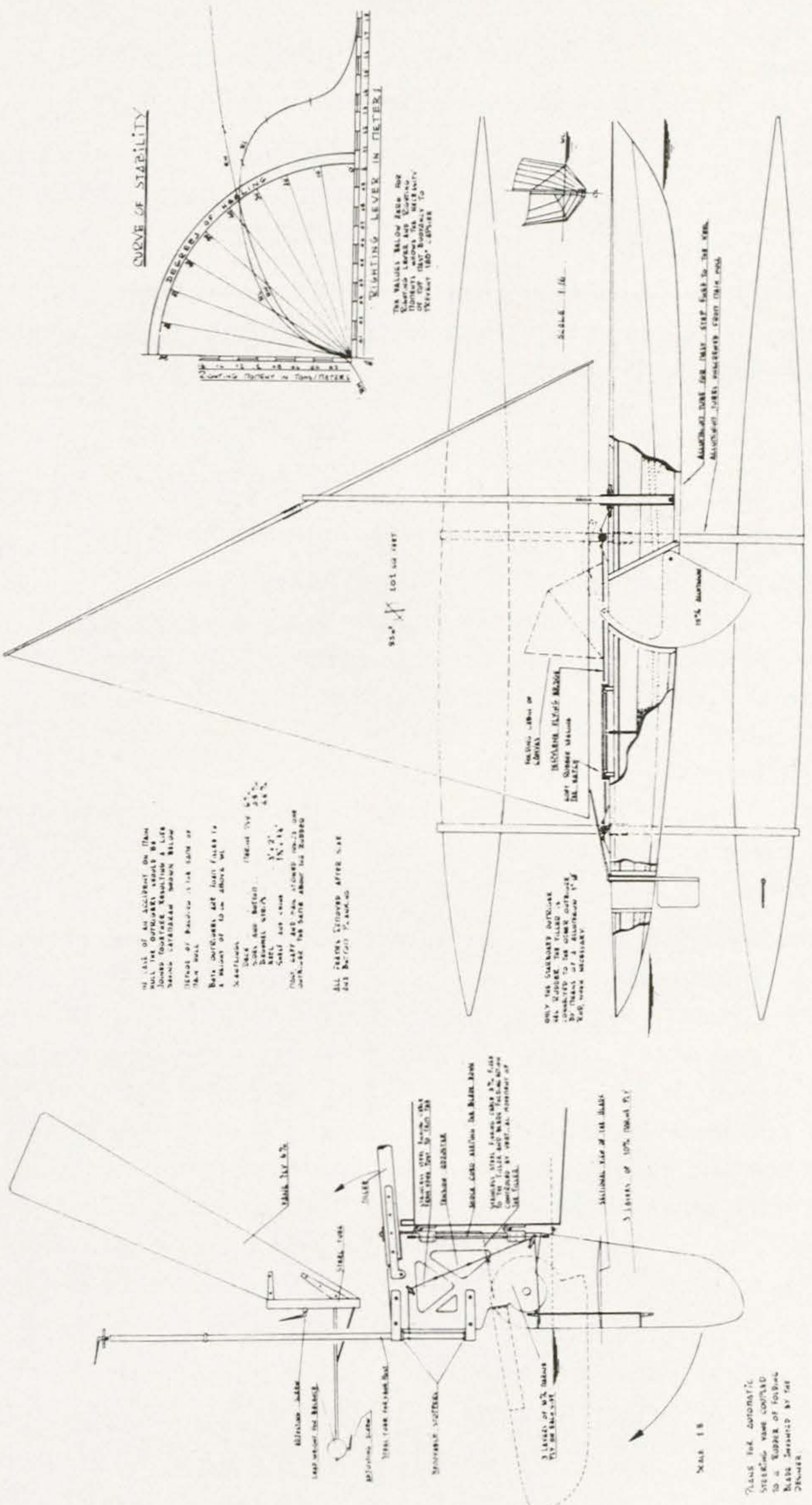
As the whole boat is built of very light material in order to have a light displacement which is a feature of most multi-hulls, it is very possible that one day, sailing very fast, the main hull might hit a submerged log and be flooded in seconds. The only possible escape from this situation is to have another boat which can be provided by using the two floats joined together by the booms which formerly attached them to the main hull to form a catamaran, a very fast one I must say. The floats could never be flooded as they are partly filled with foam.

What do you think of the idea of an automatic steering vane coupled to a rudder of folding type? I think it is a very new one.

One tri will be built in Rhodesia to the plans of *LUNGA*.

Yours sincerely,

JOAO MENDONÇA



LUNGA's "life saving catamaran"

INCA

DESIGNER

J. R. MACALPINE-DOWNIE

15, West Heath Road, Hampstead, London, N.W.3

L.O.A.	42 ft.	Fixed Draft	2.75 ft.
L.W.L.	37 ft.	Maximum Draft	3.84 ft.
Beam	25.25 ft.	Displacement	5.2 tons

INCA, J. R. Macalpine-Downie's first and, so far, only trimaran design was chosen as joint winner of the Yachting World Magazine's Multi-hull Design Competition.

Construction

Main Hull. 6 ounce mat, 3 x 24 ounce woven rovings with expanded polyurethane buoyancy and reinforcement.

Floats. 4 ounce mat, 1 x 24 ounce woven rovings. $\frac{1}{2}$ inch ply frames at 2 feet 10 inches centres glassed in to stringers and skin with 4 ounce mat, wood to bear only on stringers. Stringers formed in 3 ounce mat strips laid continuously from gunwale to gunwale over 3 inch diameter paper tubes. Section containing centre case to be filled with foamed-in-place polyurethane.

Decks. 4 ounce mat and 1 x 24 ounce woven roving with moulded non-slip pattern reinforced by 2 inch diameter tube covered with 3 ounce mat.

Coachroof, float decks. $2\frac{1}{2}$ ounce mat, $\frac{1}{2}$ inch end grain balsa wood, $2\frac{3}{4}$ ounce mat.

In the floats there are asymmetrical daggerboards with square ends and a fore and aft measurement of 2 feet and a maximum thickness of $3\frac{1}{2}$ inches which are set at angle of 3° to the centre line of the floats.

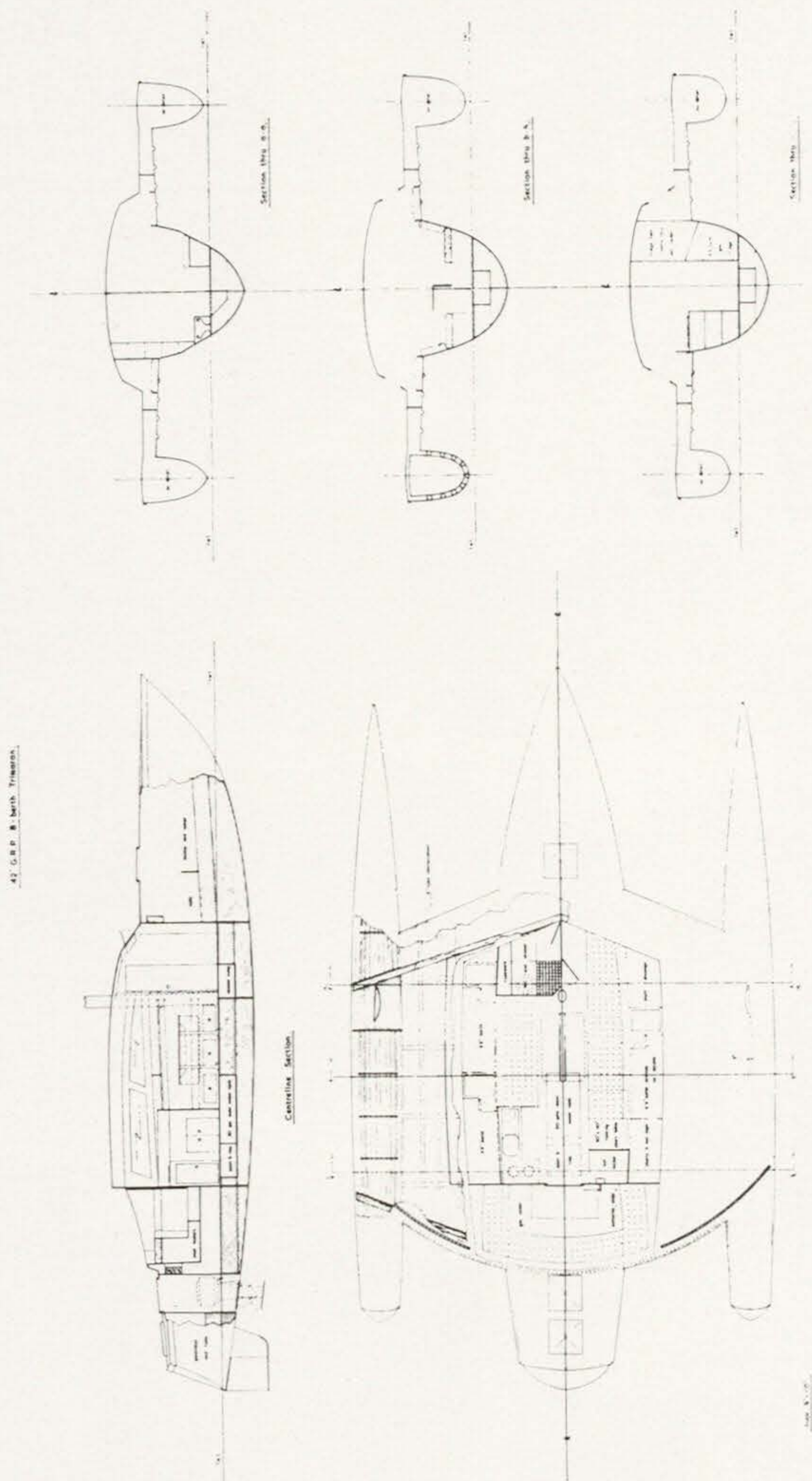
The rudder is hung under the hull on a skeg which should contribute towards steadiness on the helm and protect the rudder.

Auxiliary power is provided by an outboard motor in a well aft of the cockpit. When raised there is an end plate which covers the hole and keeps the hull surface fair for sailing. (Design in Publication No. 55, pages 107-108.)

A flexible sail plan is shown which should take care of any changes in the multihull rating rules, and provides:

Mainsail	405 sq. ft.	No. 1 Jib	320 sq. ft.
No. 2 Jib	188 sq. ft.	No. 3 Jib	110 sq. ft.
150% Genoa	441 sq. ft.	180% Genoa	539 sq. ft.
Unlimited spinaker	1,500 sq. ft.		

The main sheet works on a semi-circular track along the after edge of the wing decks and cockpit with the genoa sheet leads on tracks just forward of it and extending from the cockpit to the outboard edges of the floats.



INCA

Inca.

42' G.R.P. 8 - berth Trimaran.

Mainsail	405 sq. ft.
No. 1 Jib	320 sq. ft.
No. 2 Jib	188 sq. ft.
No. 3 Jib	110 sq. ft.
150% Genoa	441 sq. ft.
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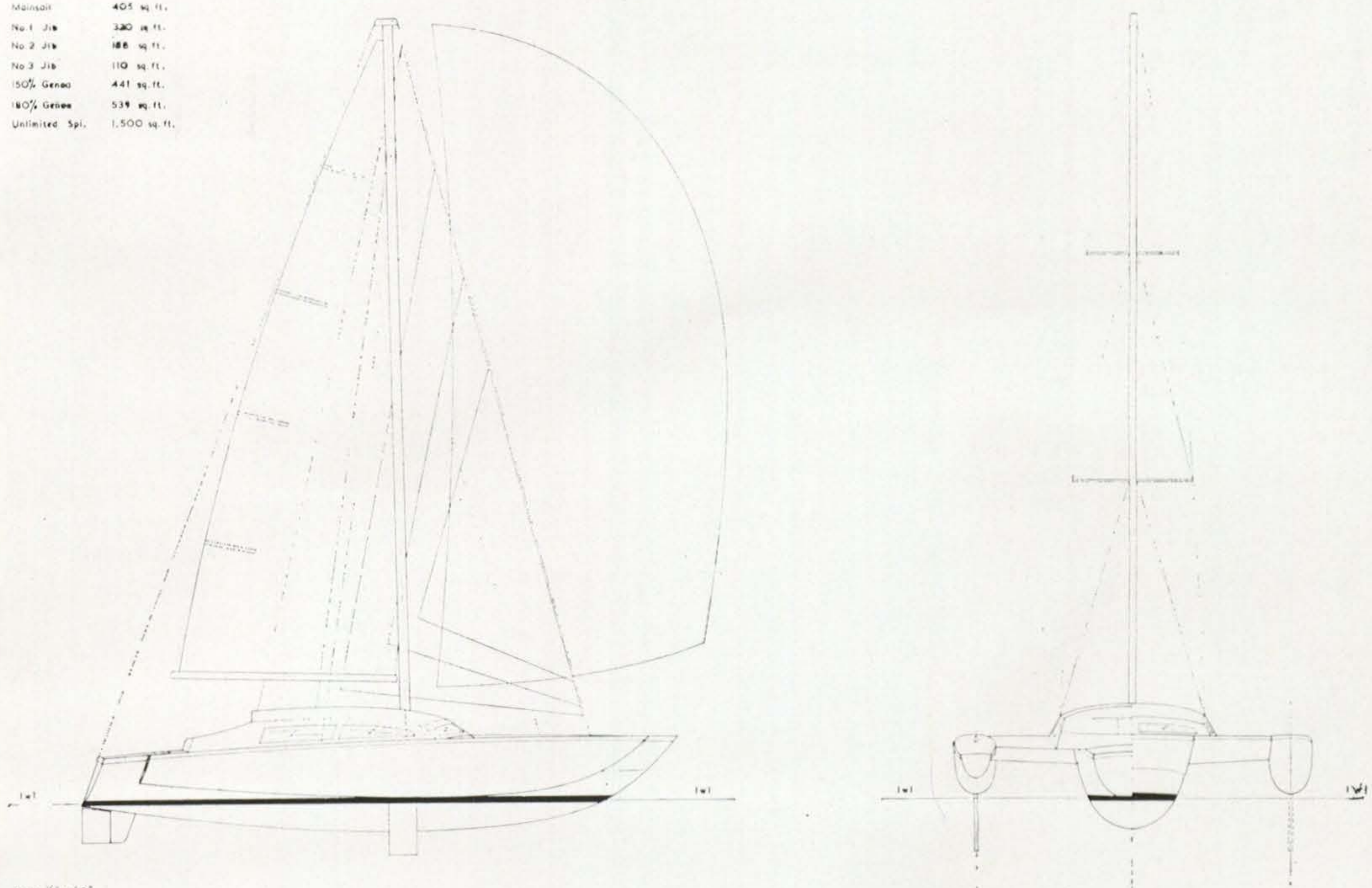
Unlimited Spi.	1,500 sq. ft.



Scale ¼" = 1' 0".

TRIUNE 30

Cruiser Racing Trimaran

Designer: Robin Chaworth-Musters

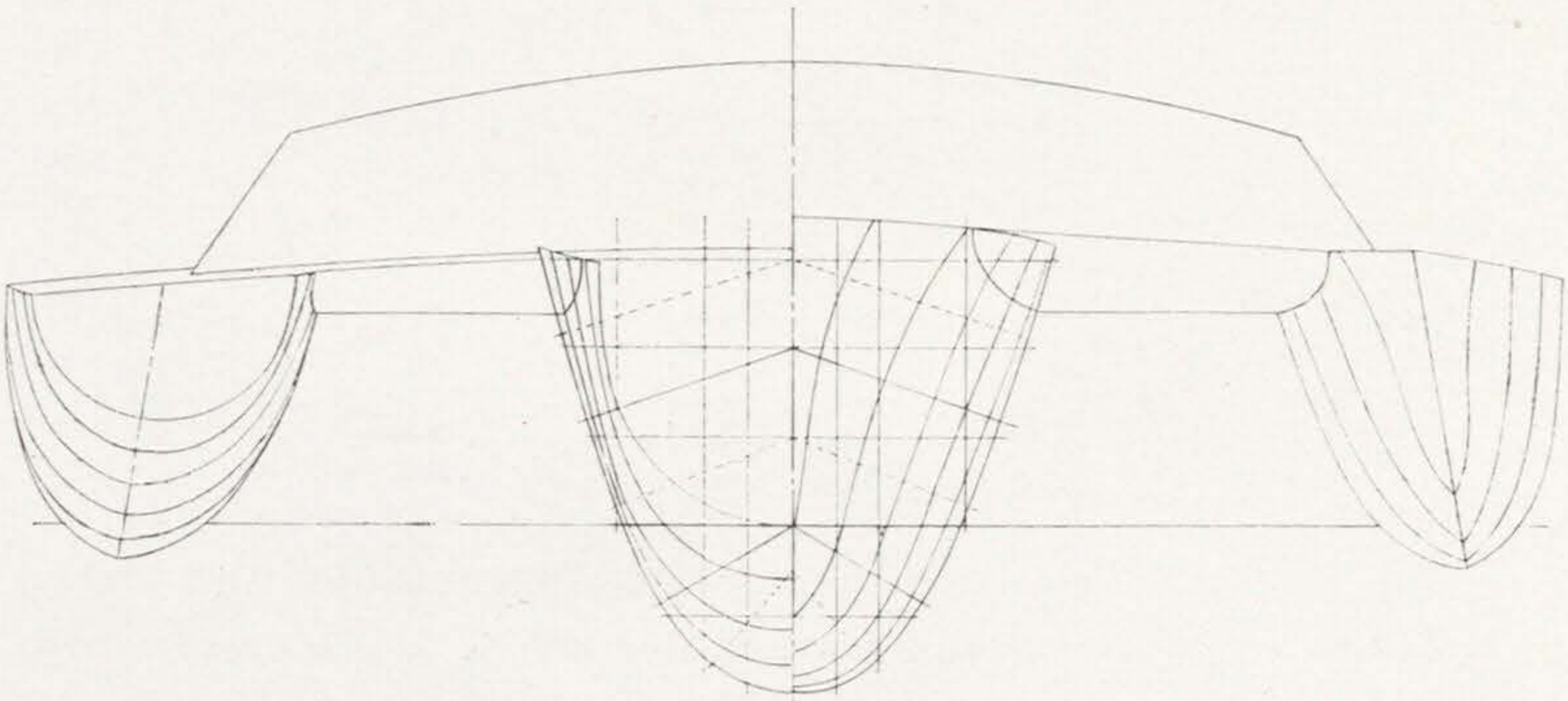
Builders: Musters Marine Ltd., New Quay Road, Poole, Dorset

L.O.A.	30 ft.	Draft, board up	2 ft.
L.W.L.	28 ft. 6 ins.	board down	5 ft. 6 ins.
Beam	18 ft.	Sail area	485 sq. ft.
Displacement	2 tons	Register tonnage	9.1 tons
R.Y.A. Rating	21.3 ft.		

The points made in Publication No. 39 explain why we chose the trimaran for a family sized cruising multihull. It suffices to say that for cruising and indeed for racing too, when the boat is driven that much harder, safety is a prime consideration.

Hull Shape

The requirements for *TRIUNE's* mainhull became clear while the designer was ocean racing a trimaran in 1963. The majority of owners may never want to ocean race, but there is nothing like it to show up the deficiencies of any design. The lines drawing shows the "sewer", or egg shaped centre section, fine entries coupled with relatively full after sections to minimise pitching, which is detrimental to windward performance.

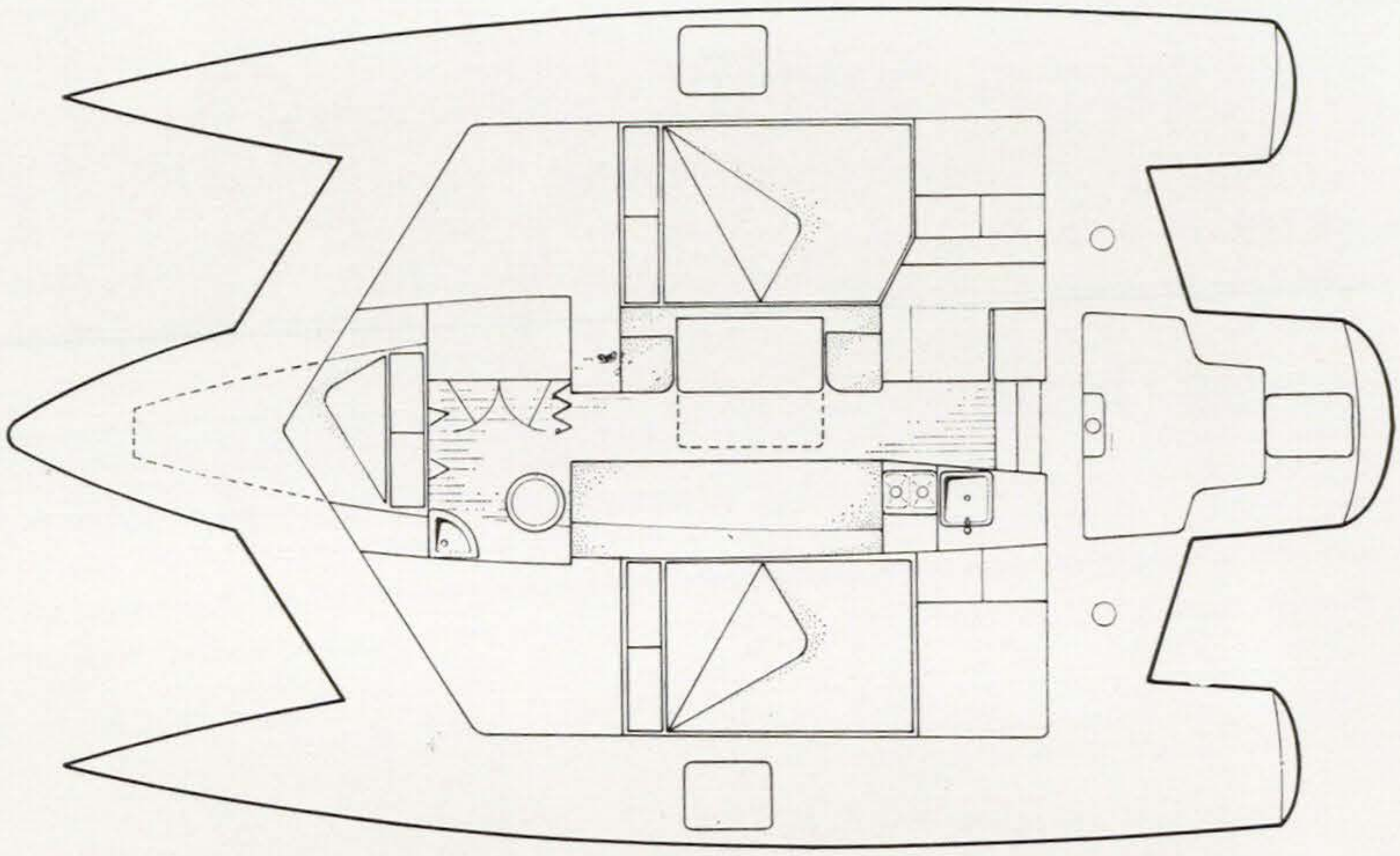


The mainhull prismatic coefficient is .56, the length to beam ratio 7.25:1, beam to draft 2:1. The wetted surface and prismatic coefficient have been kept low as one of the lessons learnt, both racing and cruising, is the relative importance of light weather performance. For example in the English Channel on 72 per cent of summer days

(May to September) the wind is light to moderate (Force 1-4)*. On the eastern seaboard of the U.S.A. and in the Mediterranean the proportion is rather greater. The transom just touches the water for minimum drag at moderate speeds. Gentle rocker combined with the centreboard in the mainhull makes for ease of tacking, another important consideration for family cruising.

Accommodation

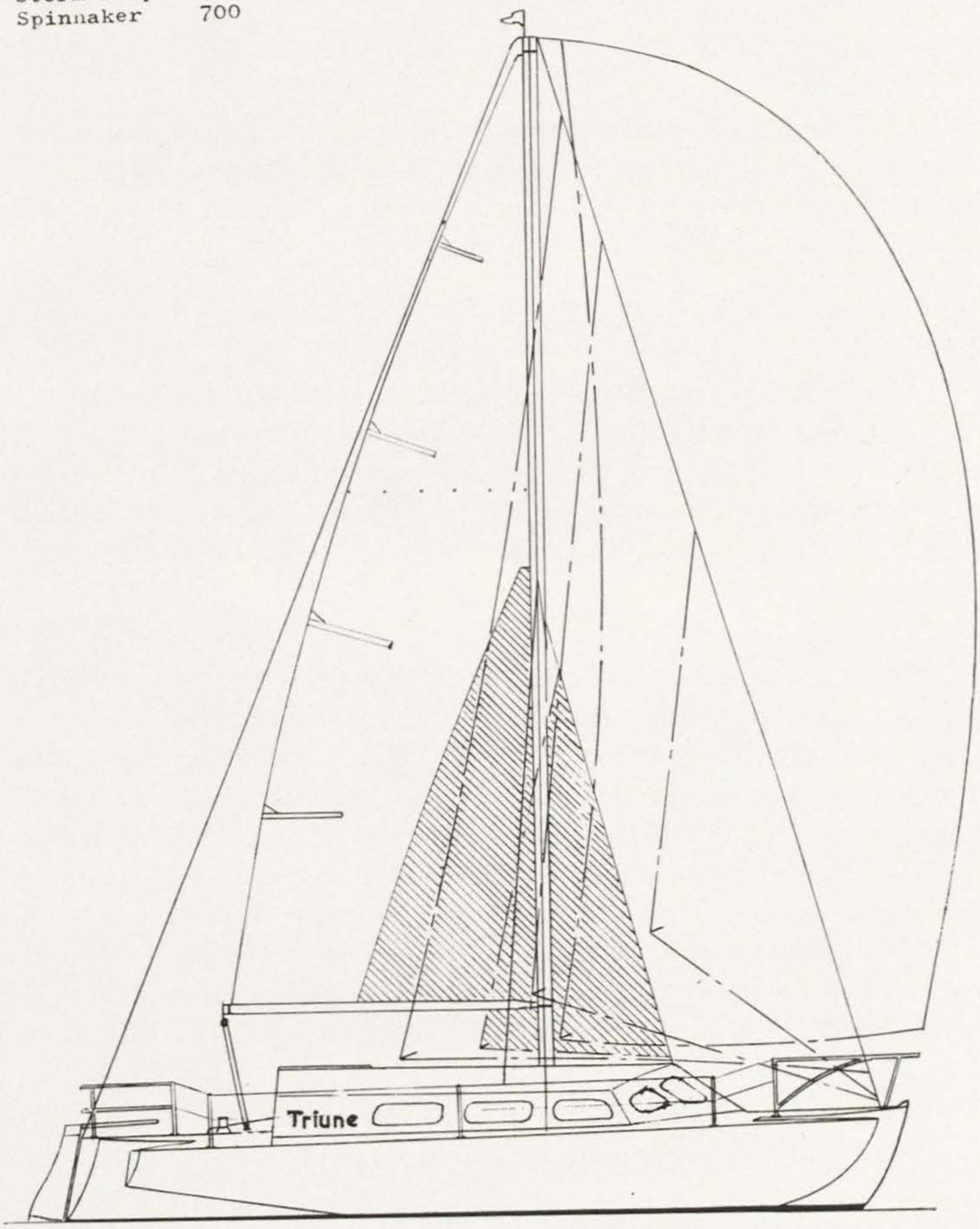
Widening the coachroof has resulted in a much improved layout. Just inside the companion way to port is the galley equipped with a cooker, stainless steel sink and fresh water pump. There is ample stowage space for crockery, cooking utensils and provisions. To starboard is the full-sized chart table with a seat for the navigator.



The dinette with a large folding table is amidships, and tucked away in the wings are two full-sized double berths. The curved main beam forms a natural partition and a door leads to the toilet compartment and double forecabin. Each float has watertight compartments fore and aft; the sails, warps, fenders and the dinghy stow in their centre sections.

*(Climatological Atlas of the British Isles, Meteorological Office.)

Mainsail	200 sq. ft.
Genoa	285
Working Jib	170
No. 3 Jib	75
Storm Staysail	50
Spinnaker	700



TRIUNE

Rig

The modern sloop rig has a small mainsail with an aspect ratio of 3:1 and a foretriangle of 58 per cent. Full use is made of the beam to simply and strongly stay the mast without crosstrees. The mainsheet is on a 10 foot slide, which makes a kicking strap redundant. The wide sheeting base makes it possible to use the spinnaker to particularly good effect.

Auxiliary Power

TRIUNE is so easily driven that an inboard mounted 9.5 h.p. outboard drives them at 5 knots in calm conditions. For owners requiring more powerful auxiliaries there is a choice of petrol or diesel inboard engines.

Construction

The hulls are moulded of solid glassfibre to stand up to hard use with minimal maintenance. The decks and coachroof are of light weight Thames marineply epoxy glass fibre sheathed,so that undercover winter storage is unnecessary. Approved by Lloyds and classified + 100 A1, they have shown that they can stand up to considerable punishment at sea.

Editor's Comment. A well tested trimaran in the conventional manner, developed from *NIMBLE PLUS*, which was ocean raced throughout the 1963 season with R.O.R.C., including the Fastnet, in which she put up the fastest time from the rock to PLYMOUTH, beating even the 70 odd foot *STORMVOGEL*. *TRIUNE* has outstanding features including a *curved* forward cross arm of great strength giving easy access to the forecastle and a centre board offset to port in the main hull thus no hindrance to the accommodation. More than six *TRIUNES* have now been built. One sailed from POOLE to BERMUDA; *TAO* completed the 1966 ROUND BRITAIN RACE.

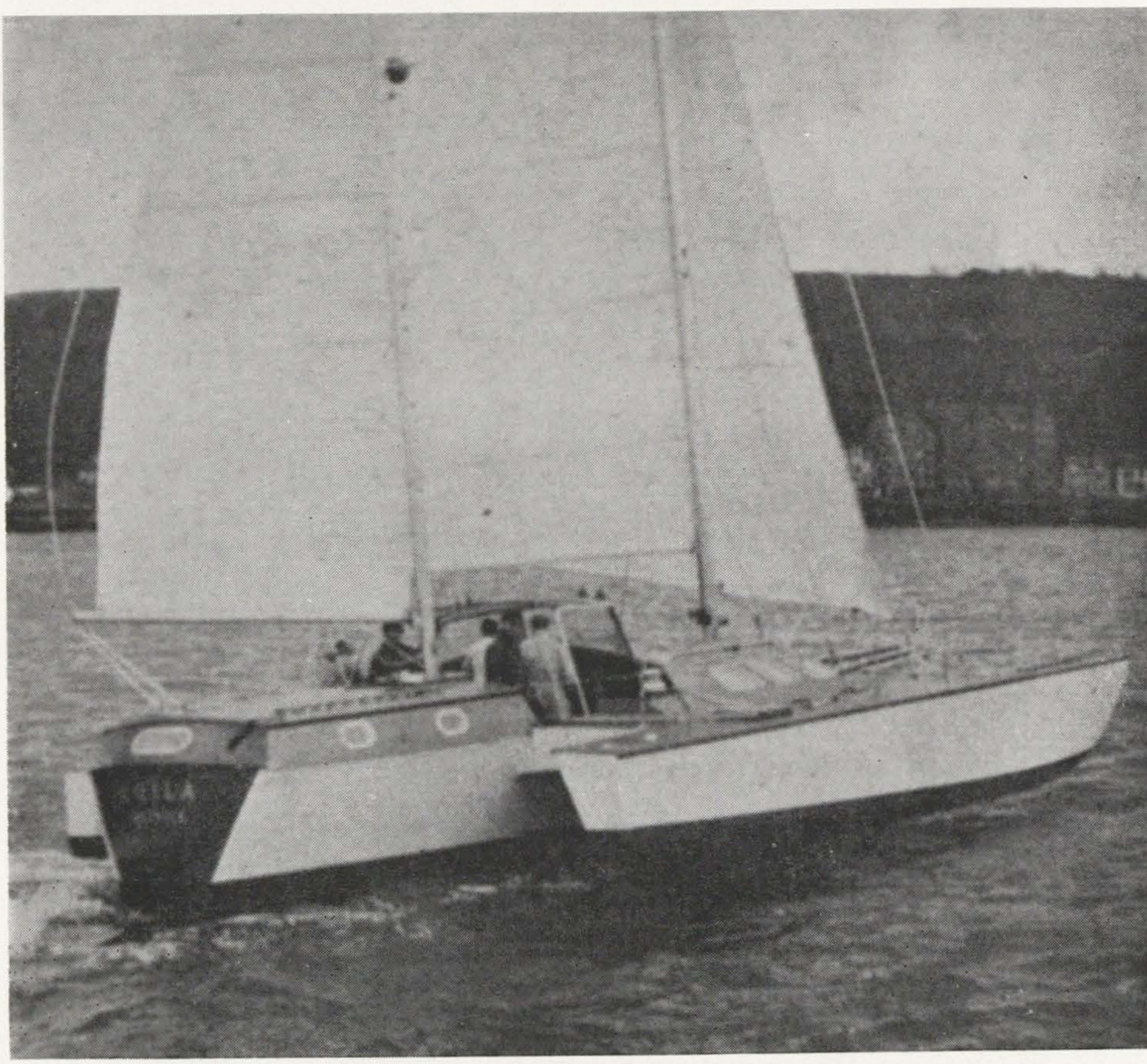
COILA of GREENOCH

Mungo Campbell's trimaran to be sailed by Eric Willis in SHTAR

Designers: ERIC WILLIS and A. MYLNE & Co.

L.O.A.	50 ft.	Beam	25·5 ft.
L.W.L.	45 ft.		

Built to Lloyd's as a fast cruising yacht but suitable for the SHTAR, *COILA* shows some resemblance to *STARTLED FAUN*, Stiletto of Arthur Pivers design, in which Eric came fourth in the 1966 Round Britain Race. She is larger and more heavily built with a proportionally lower sail plan. She has rounded bottoms both to main hull and floats. The floats are asymmetrical with outer sides vertical. The Main hull has a fine entry but swells quickly above the waterline to give great reserve buoyancy. She will, with her low sail plan and fine entry thus have little tendency to pitch when going to windward and will be well covered against burying her bow when running fast before the seas.

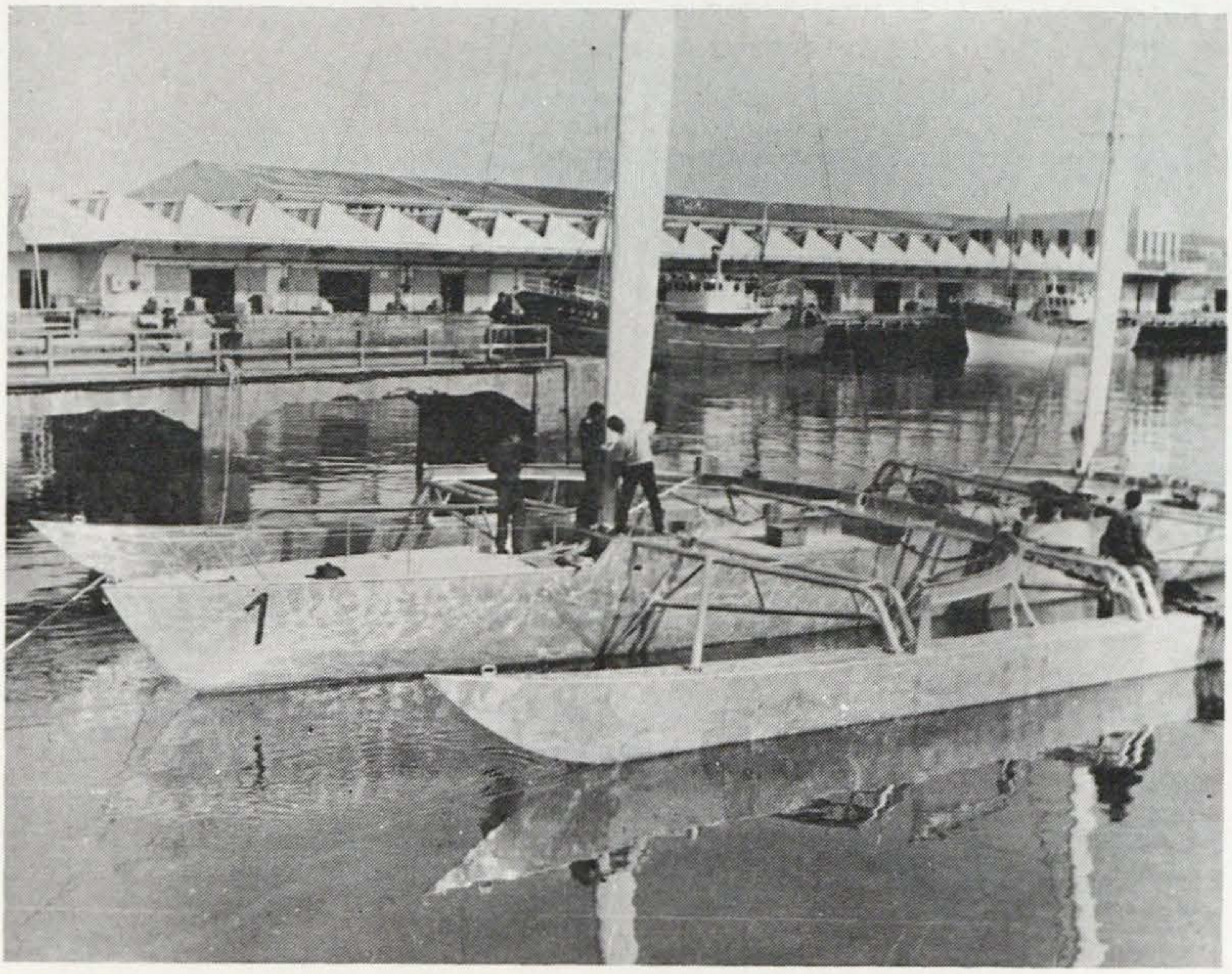


COILA OF GREENOCH

PEN DUICK IV

Eric Tabarly's Trimaran

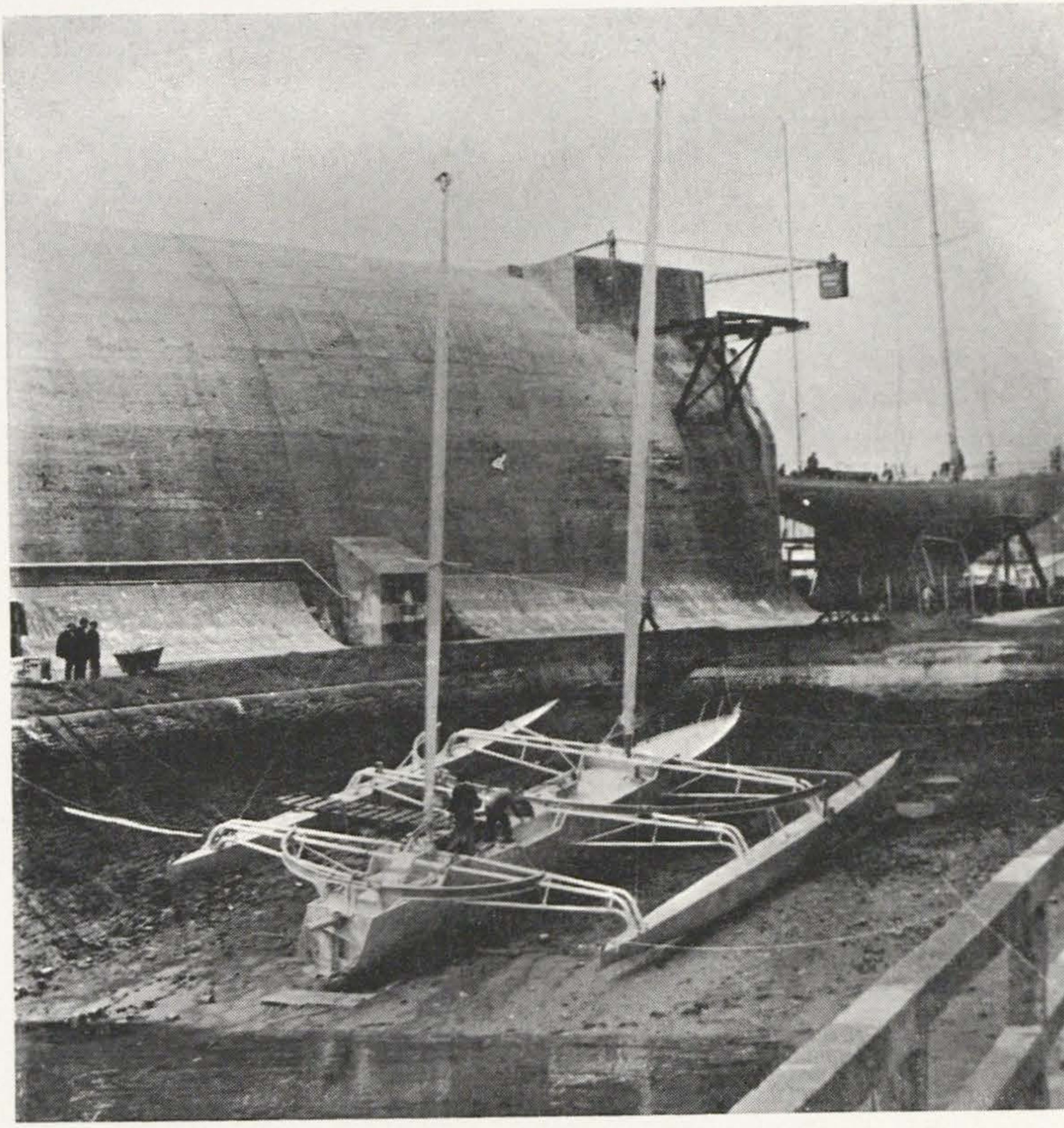
Centre Hull		*Floats*	
L.O.A.	63 ft.	L.O.A.	52 ft.
L.W.L.	58 ft.	Beam	1·84 ft.
Beam	6·2 ft.	Depth	2·45 ft.
Draught	3·7 ft.	Overall Beam	34 ft.
Displacement	5 tons		
Sail Area			
Jib	350 sq. ft.	Main	530 sq. ft.
Mizzen	310 sq. ft.	Total sail area	1190 sq. ft.



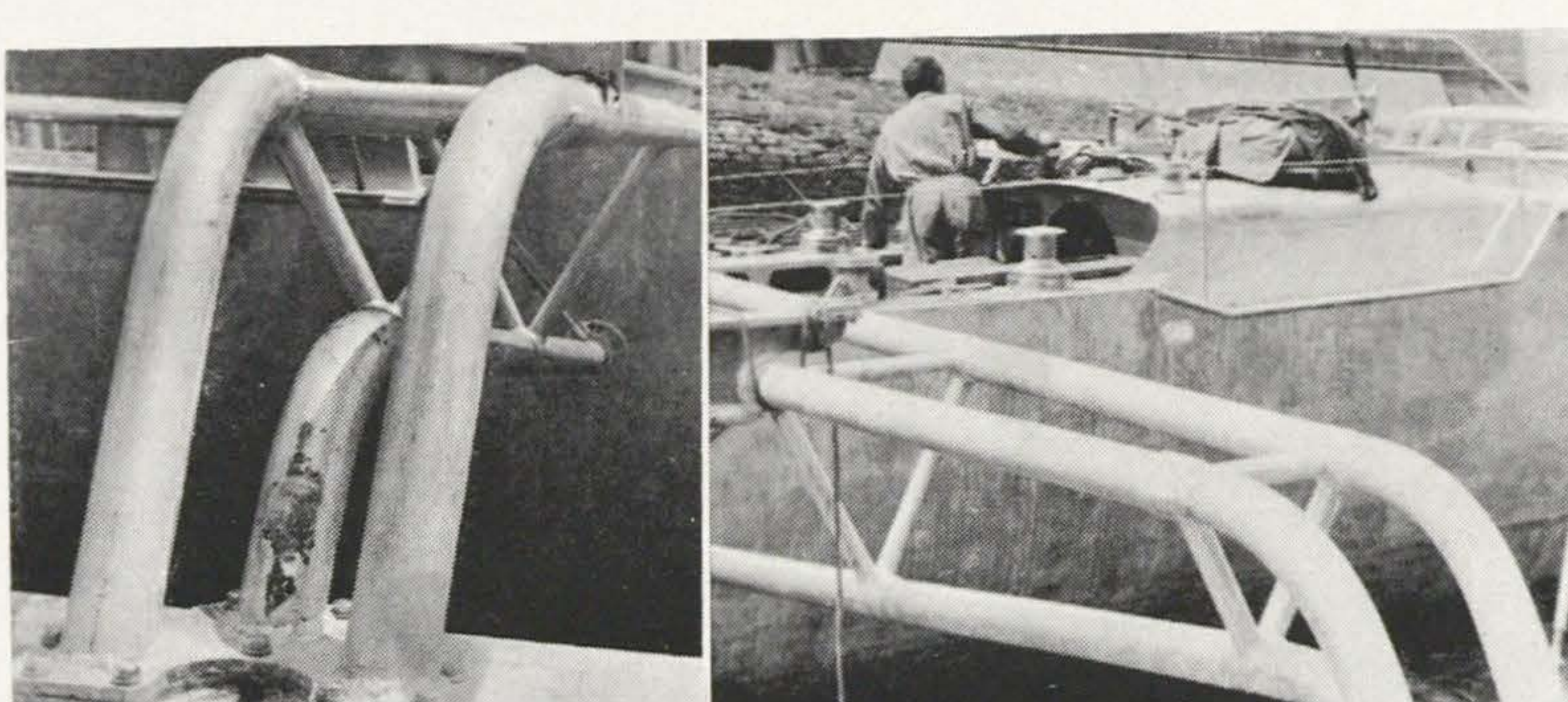
PEN DUICK IV

The centre hull carries two dagger boards in tandem to give easy adjustment to the centre of lateral resistance. Tip fences reduce hydrodynamic losses and close the slot when retracted to avoid parasitic losses.

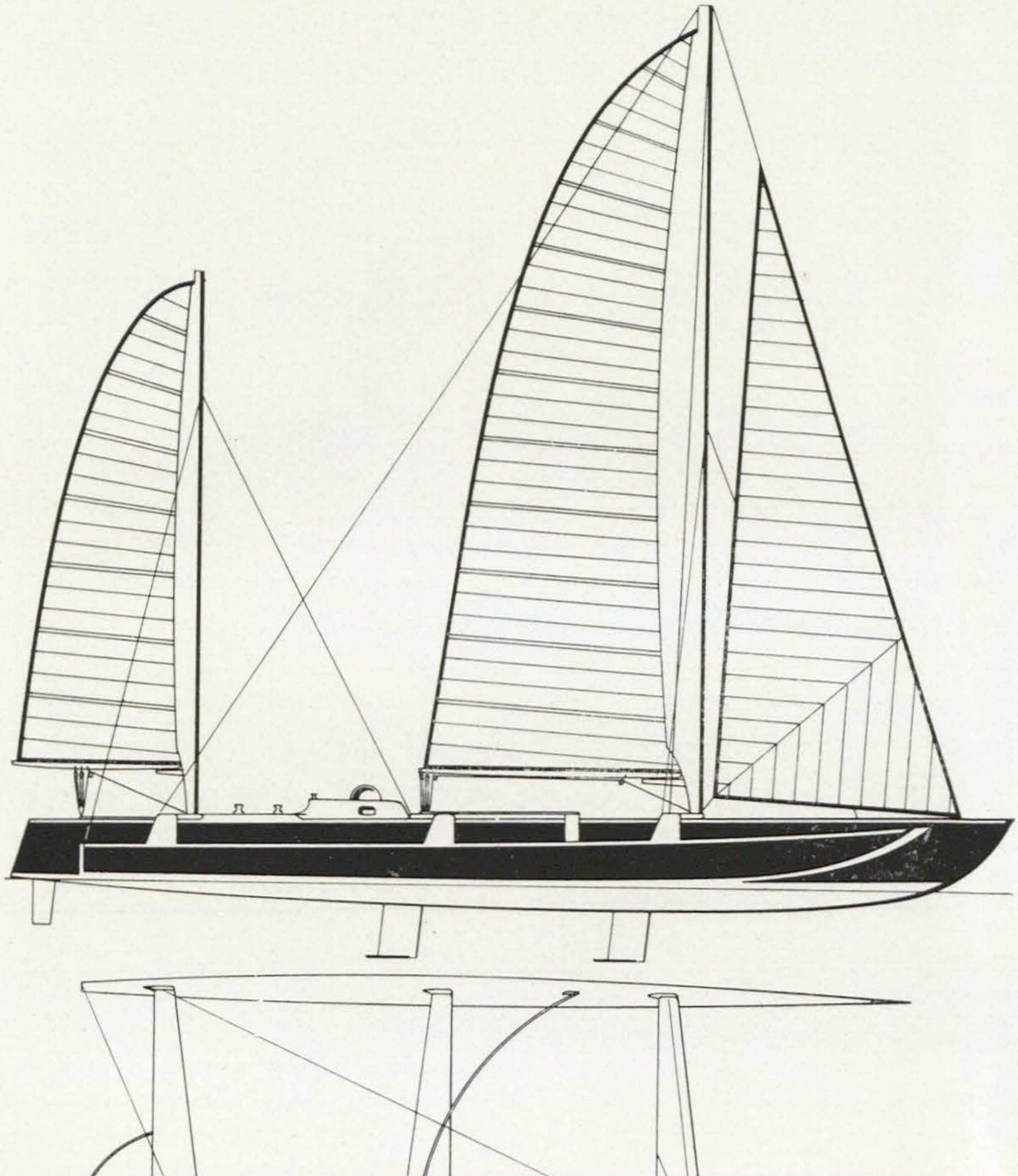
Ketch rigged with two rotating masts carrying fully battened sails on the Lady Helmsman principle she will be quite a handful for one man. Her self steering will probably be the key to her SHTAR performance.



PEN DUICK IV



PEN DUICK's cross arms



PEN DUICK IV

PUT YOUR BEST HULL FORWARD!

The story of multihulls is only just beginning

BY

DAVID PELLY

By courtesy of the Editor of Yachting World

It has been justly said that yachts are now going through the sticks and string era that aircraft experienced fifty years ago. If this is true, it ought to be possible to learn from some of the mistakes made then. Very early in the development of aircraft, designers realized that the monoplane layout was lighter, cleaner and superior in almost every way but a series of bad accidents to monoplanes before the first World War led conservative opinion to assert that this form of construction was "unsafe", thus condemning themselves to the bi-plane era which took nearly 30 years to shake off. With the benefit of hind-sight we would say that they should have realized that the advantages of the monoplane were so great that it would have been worth risking further accidents in order to perfect it.

It is just possible that unballasted multihulls may be about to be subjected to the same kind of pressure to take backward steps in the name of safety. Accidents there have been. The strange period in which it could never be admitted that multihulls ever got into trouble seems happily to be over, but the true situation certainly seems, on the face of it, a little frightening. In this country we had the capsize of the catamaran *GOLDEN COCKEREL* during the Crystal Trophy Race. Luckily, this happened in broad daylight close to land so all her crew were quickly rescued but it is difficult to believe that this would have been the case had the capsize occurred farther off shore and at night.

In Australia much worse has occurred. Just as a worthwhile racing fleet was beginning to build up, one of their leading trimaran designers, Hedley Nicol, has been lost at sea while sailing his own boat, while Lockie Crowther's *BANDERSNATCH* was also wrecked with his brother on board. In a little over a year, nine lives have been lost off the East Coast of Australia in trimarans.

This sounds very shocking on the face of it but ought only to be looked at against the background of uneventful miles sailed. Public transport concerns always give their accident record in terms of deaths per seat/mile and if it were possible to work this out for multihulled yachts I think they would prove to be a fairly safe means of travel.

Furthermore, the only accidents that ought to concern us are those that would not have happened had the same people been sailing a different type of yacht. In other words, accidents caused by bad navigation, hitting whales, or being hit by hurricanes could happen to any yacht and are not germane to a discussion about multihulls. Much more relevant are the achievements of people like David Lewis who has successfully lumbered round the World in his overloaded and undercrewed catamaran *REHU MOANA;* the Choy-designed *WORLD CAT*, well on her way round the globe; young Tom Corkill who is doing the same thing single-handed in his little 25 foot tri *CLIPPER* 1, not to mention the numerous less spectacular passages which are going on all the time. Arthur Piver seems to cross the Atlantic like the rest of us cross the English Channel, and Rudy Choy is positively blasé about the Pacific.

In this country at least, some authorities have reached an almost hysterical attitude to safety, so that one is made to feel almost a criminal for taking the slightest risk. I am not going to suggest that boats of dubious stability or unproven safety should be put on the general market, but I do suggest that designers, builders and a small band of dedicated experimenters certainly should be out there sailing them. After all, someone has to try each of the berries in the forest in order to find out which is poisonous.

Racing is still the best test of a boat. You do not have to win to prove your boat is worth considering, but you do have to finish the course. The chief reason why there are so many good, safe, healthy cruising yachts around to-day is that their prototypes and predecessors have had to survive being thumped around the seas in bad weather by heavy-handed racing crews. In other words, racing multihulls offshore may seem a somewhat risky business—but we need it, to produce those safe reliable cruising boats of the future. To take another air analogy: the R101 disaster was taken by many to show that airships were a Bad Thing. What it really proved was that R101 was a bad airship.

Well, racing got off to a modest start in 1967, so what, if anything, have we learned? The crew of *GOLDEN COCKEREL* learned a host of useful hints, such as the fact that safety harnesses should have carbine hooks on both ends of the lanyard and that liferafts need to be accessible from the underside of the boat. Most people are now realizing the importance of underbridge clearance in boats with solid bridge decks. *SNOW GOOSE* was put out of the Crystal Trophy when she walloped the water and split her bridge and the same thing happened to *GOLDEN COCKEREL* inside the Solent. Designers

MIRRORCAT solved one problem and discovered another. Behind her is the Prout 45 footer PELICAN, the heavy and moderately rigged cruising boat that refused to be left behind.

may wring their hands and say their boats are being overloaded, but then cruising boats always are—it shouldn't make them unsafe. It was to overcome this very problem that Rod Macalpine-Downie designed *MIRRORCAT*, a 40-footer on "C" class lines that has nothing but netting between the hulls. She solved the slamming problem completely, but, in her second season with increased sail area, discovered a new one instead. In a seaway, the whole boat flexes, with the result that the rigging goes alternately tight and slack, and the mast waves about like a salmon rod. Her crew spent much of the season adding more and more wire until the final result looked a bit like the *CUTTY SARK*. Careful development sould go a long way to solving this problem, in which case she would be an exceptionally fast boat.

Derek Kelsall has already sidestepped this problem with *TRIFLE*. Here, the all-important open spaces between hull and floats are retained, but the trimaran layout is more rigid and anyway most of the rigging comes down to the main hull. What he perhaps did not appreciate is how dead a multihull goes in light airs; due to the large wetted surface. It was solely due to the fact the *MIRRORCAT* had a masthead genoa and *TRIFLE* did not, that gave her the lead in the Crystal Trophy. In Australia, the Crowther designed *BANDER-SNATCH* (the boat that was lost—believed to have hit a whale), had a similar sort of layout to *TRIFLE's* but with masthead rig and seems to have been the fastest boat in those parts.

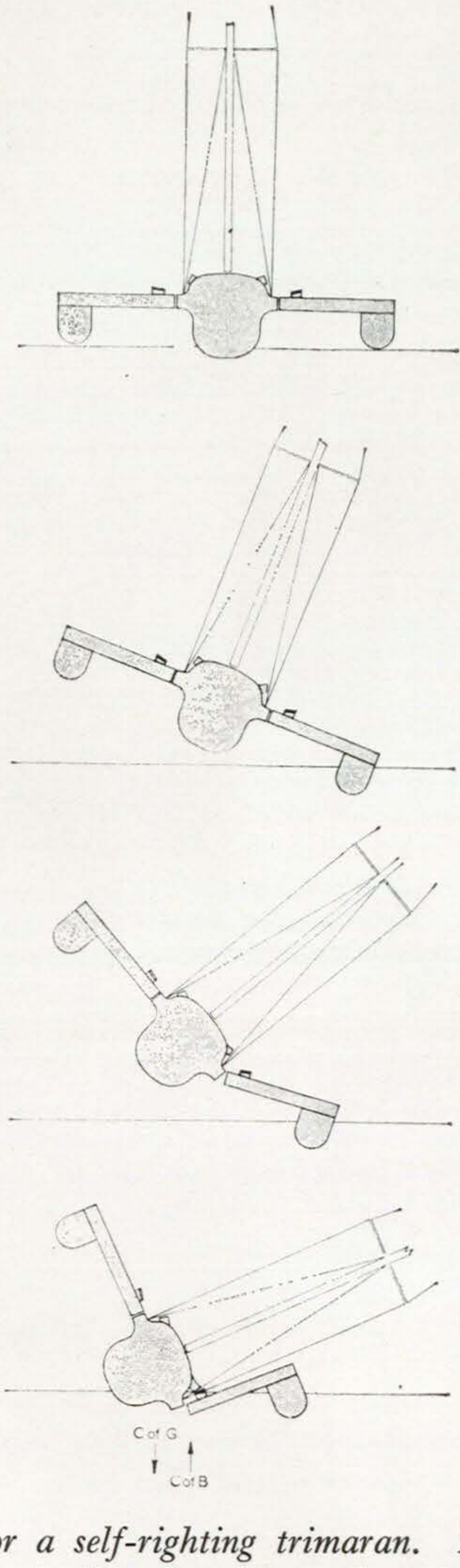
The chief disadvantage with this sort of trimaran, as I see it, is that if pressed hard enough to raise the main hull partly out of the water, the boat starts to sail in a circle round the lee float. This might be cured by toeing in the floats, but toe-in is a rather undesirable characteristic as it causes head resistance and makes the water flow at an angle to the lines the designer had in mind. Incidentally, I am certain that the idea that trimarans are *per se* less easy to capsize than catamarans is a complete red herring, though it may be true that they give more warning.

These light, spidery boats such as *TRIFLE* and *MIRRORCAT* are pushing back the frontiers of sailing knowledge but it would be hard to pretend that they are likely to become popular cruising boats. For their size, they have very little accommodation and they demand a fairly attentive crew. What is interesting is how well some much less racy boats have gone. For instance, *PELICAN*, the big Prout 45-footer, was right up with the leaders in the Crystal Trophy. She is a great hotel of a boat, with private cabins and bathrooms and is alleged to weigh at least seven tons. Her sail area is quite modest. The explanation seems to be that she is easier to sail than the "flat out" boats. Her crew are high above the water and from their lordly perch seemed able to keep their boat trundling along at a very respectable speed without frightening themselves. This could bode well for her sister-ship *OCEAN HIGHLANDER* which will be an entry for the Single-handed Transatlantic Race.

The news that Eric Tabarly may enter for this race in a trimaran is fascinating—he had a trial sail in *TORIA* a year ago. Apparently he has come to the conclusion that his schooner, *PEN DUICK III*,

TRIFLE, a fast and relatively trouble-free trimaran designed by Derek Kelsall for Maj. Gen. Ralph Farrant. She is built of foam plastics, covered with glass fibre.

may be too much of a handful; even for him. This boat, which wiped the floor with the R.O.R.C. fleet, has only once competed against multihulls: in the 1967 Morgan Cup Race. In fact, she finished hours ahead but it was a race plagued by blobs of still air and aboard *MIRRORCAT*, the leading multihull, we were crippled by not being able to set the genoa. But by a coincidence, during the only period



Sketch of an idea for a self-righting trimaran. By a means (not yet invented!) the lee float is allowed to hinge when a critical angle of heel is reached. The boat should right itself unaided from the final position. Addition of masthead buoyancy would make it self-righting from any attitude.

that we had a decent breeze, say, Force 5, we also had *PEN DUICK* in sight and were fairly tramping past her, hard on the wind. My guess is that Tabarly in a big tri would cross the Atlantic in 20 days!

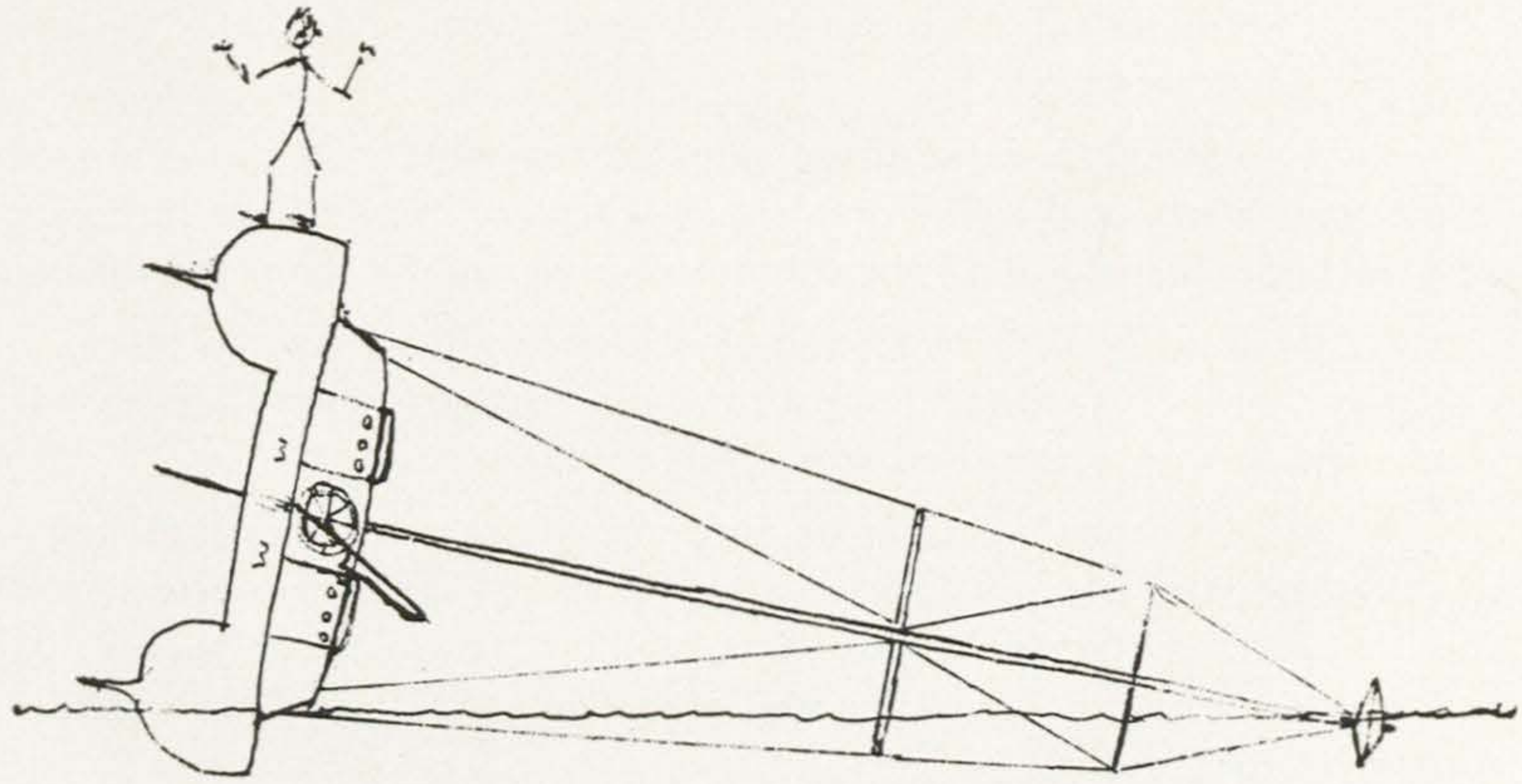
One of the most important things about Kelsall's tri's is that they "fly" their weather hull, with consequent large reduction in wetted surface. Since starting to write this article I have sailed 150 miles in the 52 foot Louis Macouillard trimaran *TACITIMU* which makes use of the same idea, and it was very interesting to find that it seems to be a perfectly satisfactory technique, even on as big a boat as this. As a result, her performance was well in excess of what one would expect for a lightly canvassed cruising boat of this size. And, finally, may I say that if one must go sailing in December, with snow and ice on the decks, I cannot think of a safer or more comfortable type of boat in which to do it!

Dear John,

Here are some comments on "Multihull Capsizing", A.Y.R.S. 63.

I read with interest Burnaby Lautier's article (page 54) on how he would right a capsized catamaran. Whilst it might possibly work on a day boat I feel that it would be quite impracticable on an ocean going catamaran for the following reasons amongst others.

a. There is a considerable buoyancy in the hull of any reasonably designed cat which ensures that even when flooded each hull would still be more than half out of the water when fully capsized (and considerably more than this if the despised masthead buoyancy is fitted). In my own boat the flooded position is about as shown in the crude accompanying sketch.



b. This position referred to is when the boat is in cruising trim which assumes that half the weight of anchors, chain and other heavy objects are already located in each hull. So that the addition of the weight from the other hull, assuming that all weights are readily movable when in the inverted position, which is unlikely, should not make much difference. Certainly not enough to sink that hull, one hopes!

c. If you capsize you will almost certainly have been asleep with all sail set so that it would not be a simple matter to haul the mast to the surface or get it to do its pendulum act.

d. At the same time as having so little buoyancy in one hull that it can be sunk with ease Mr. Lautier is lucky enough to find the other hull has enough buoyancy to float all the rest of his submerged boat.

e. Even if the manoeuvre could be achieved, which as I have shown, I doubt, Mr. Lautier would be in a sorry state with all his dry foods ruined, his bedding and clothes all swimming about and his cooker unlikely to work for a considerable while, not to mention corks being all that stopped a repeat performance of the Barker roll (he stated in his article that he would drill holes in the hull to let in the water and would stop these holes up with corks after he had completed his manoeuvre. I am saying that if his theory is correct he would capsize again involuntarily if the corks get vibrated out of the holes). True if you capsize some water is likely to get into the cabin anyway but surely one should try to limit its extent as much as possible. I will not be responsible for what would happen to any helpful eager beaver I find drilling holes in my hull!

Now see his reasons for dismissing masthead buoyancy:

1. It will not of itself reright the boat (which is nearly always quite true but so what).

2. It is weight and windage aloft (this is quite true but minimal in my experience and well worth the small sacrifice; perhaps one gets only 14 knots instead of 15 for the untroubled night's sleep it affords.

3. It is unpleasant to look at—(this is surely a personal view—I like my racy little birdbath and find it most useful when picking out where she lies on a crowded trot after a jolly evening)

4. It will probably never be needed. (Nor the fire extinguisher, the first aid, the life raft, the emergency radio, the wire cutters, the spare water and the flares, but most prudent sailors carry them? It has another advantage which he has overlooked—it stops those seagulls splattering the deck.)

I believe that with a combination of good masthead buoyancy well stayed, as much buoyancy just at deck level as practical and a light aluminium ladder with its heel hinged to the underside of the bridge deck, say 12 foot long, with a pulley at the upper end for hauling out anchor and chain one man might well right a 4 ton cat? Or one might be able to get enough water ballast at the end of the ladder to achieve the same result.

Yours sincerely,

MIKE BUTTERFIELD.

P.S. A further advantage of masthead buoyancy arises in shallow water, namely you do not risk breaking your mast on the bottom or sticking it in the mud.

P.P.S. I agree with a lot of what Jock Burrough wrote in his article (pages 53-54) but providing one is prevented from a complete capsize a hatch in the underside of the bridge deck ought not to be necessary. It is surprising what a source of trouble a hatch in a part of the boat which in theory is above the water can give when out on the deep.

I do *not* agree with him that a 36 foot cat would not have adequate stability and on his own admission practically all his experience of multihulls has been in trimarans so are you qualified, Jock, to give such an opinion?

5, New Square, Lincoln's Inn, London, W.C.2.

WE HAVE YET TO BE EDUCATED

BY

JOCK BURROUGH

44, Bedford Gardens, London, W.8

Hedley Nicol and now Arthur Piver—no trace of Arthur since he left Sausalito on 17th March in his 36 foot *DART* trimaran for San Diego on his 500 mile qualifying trip for S.H.T.A.R. 1968.

Under the unknown circumstances monohulls might also have succumbed. These losses must be kept in perspective.

In general trimaran sailors are less experienced than monohull sailors. They are experimenting, they take chances unacceptable to the monohuller, in an effort to test their ideas—if necessary, to breaking point.

Designers with different ideas may claim that there were faults in the designs of those lost. Insufficient strength in the cross arms, no cross arms, insufficient buoyancy forward, insufficient beam. Lateral capsize, longitudinal capsize, diagonal capsize. Did *BANDERSNATCH* hit a whale with its starboard float, killing the large mammal with a slicing blow to its head—a flick of that enormous tail shearing off the float?

We do not know, we have yet to be educated. We are young in comparison to the decades of experience of monohull yachts which only started going off shore after decades of development.

Arthur Piver certainly opened up new horizons for those who were yearning to travel to those exotic distant islands of their dreams. A few sheets of marine ply—a few weekends work—and HEY PRESTO we are ocean sailors surfing down the faces of enormous waves at thrilling speeds, leaving the monohull sailors behind us—or, are we?

The sea is relentless—the sea is unforgiving—the sea is merciless. We are frail, our craft are frail.

The forces of wind and sea are immense. One cubic foot of sea water weighs 64 pounds—35 cubic feet one ton. A foot of water on the deck of a thirty footer could weigh upwards of four tons. We may like winds Force 4. Its force varies with the square of its speed. Force 8 is not just twice Force 4, but up to 9 times in terms of stresses on masts, sails and rigging. Force 10 is not just $2\frac{1}{2}$ times Force 4 but up to 25 times in terms of stress. Add to this the more violent motion of the sea, where then is the Safety Factor of 6. Six times what? Force 4 winds or Hurricane winds of Force 12.

Gales can come without warning—unexpectedly and those who go out to sea must be prepared for any eventuality—even *BANDERSNATCH*'s whale. We salute the pioneers who accepted the challenge and are now lost. They have extended the frontiers of knowledge, they have helped in our education. To Hedley Nicol and Arthur Piver, we owe an immense debt of gratitude.

Hedley Nicol was known to drive his boats hard. Typical was the *MORETON BAY* incident, when with cameraman and expensive equipment he was reaching at 27 knots in a 50 knot wind in shallow smooth waters. *VAGABOND* left the water and first touched on her mast. Hedley had all sail up and was testing to see which went first, mast or capsize (see A.Y.R.S. Publication No. 55 pages 22 and 23).

Leaving Queensland in early August 1966 in his 36 foot racing trimaran *PRIVATEER*, loaded with supplies, pamphlets and new designs to show to the U.S. public he set off across the Pacific at the worst possible time of the year—Typhoons, hurricanes and headwinds. It was his first ocean crossing, he had but two lessons in astro-navigation. He radioed his friends in Brisbane three days later that he was some 300 miles off-shore but gave no exact position.

It was his last message. Nothing further has been heard of Hedley. Typhoons had been reported in the area; a search was made but covering tens of thousands of thousands of square miles it was like looking for a needle in a haystack.

Before leaving, Hedley had been asked what he would do if he capsized. "Simply, saw off one float, right her and carry on, on one tack" he had replied.

In September 1967, the starboard float from *PRIVATEER* was discovered on the New Zealand coast. It had been sawn off close to the main hull along the starboard side. It is reported that under the barnacles were found messages indicating that all was well and that they were carrying on.

Where did the fault lie? Design? Seamanship?—or both?

So far as design is concerned, Walt Glaser writing in the June 1967 issue of RUDDER feels that ". . . rigs are growing disproportiately high, hull shapes are narrowing down to absurd fineness, and overall beam is growing wider and wider . . ."

Jim Brown writing in TRIMARAN of February 1968 can see no connection here with Walt Glaser's further proposition ". . . that there is a fixed point of no return in so far as excessive overall beam is concerned wherein the craft develops a built-in tendency to pitchpole or somersault at high speeds . . ."

Jim Brown considers—high aspect ratio helps windward performance—a vital requirement for a cruising yacht; narrow hull form reduces interplay wave-making between hulls, yielding, besides speeed, a quieter more seakindly boat; wide beam has no harmful effect, it leads only to the ability to carry the high sail plan when the wind is forward of the beam. Lateral stability factors have no bearing on the longitudinal capsize. If such has ever happened to a multihull—Jim Brown has no evidence of such. He says there is another axis for turning turtle—the diagonal one.

The cover picture in A.Y.R.S. Publication No. 63 shows the diagonal capsize actually occuring in a model.

To get the float bow forward enough and big enough was one of Arthur Piver's original axioms. Height of Centre of Effort, Sail Area, Weight and position of Centre of Gravity, position of Centre of

Buoyancy, overall beam and Centres of Buoyancy of the floats all have a bearing on stability be it lateral, longitudinal or diagonal.

Under running conditions, dead before, the sterns tends to lift under the couple of the Driving Force and the Resistance. The Centre of Buoyancy moves forward and the pitchpoling couple is resisted by the couple of the Buoyancy and the Weight. Our vessel retains her stability temporarily but at the expense of lifting out her rudder, losing directional control just at the time it is most needed as the Resistance now acts from a point further forward of the Centre of Effort and is thus directionally unstable.

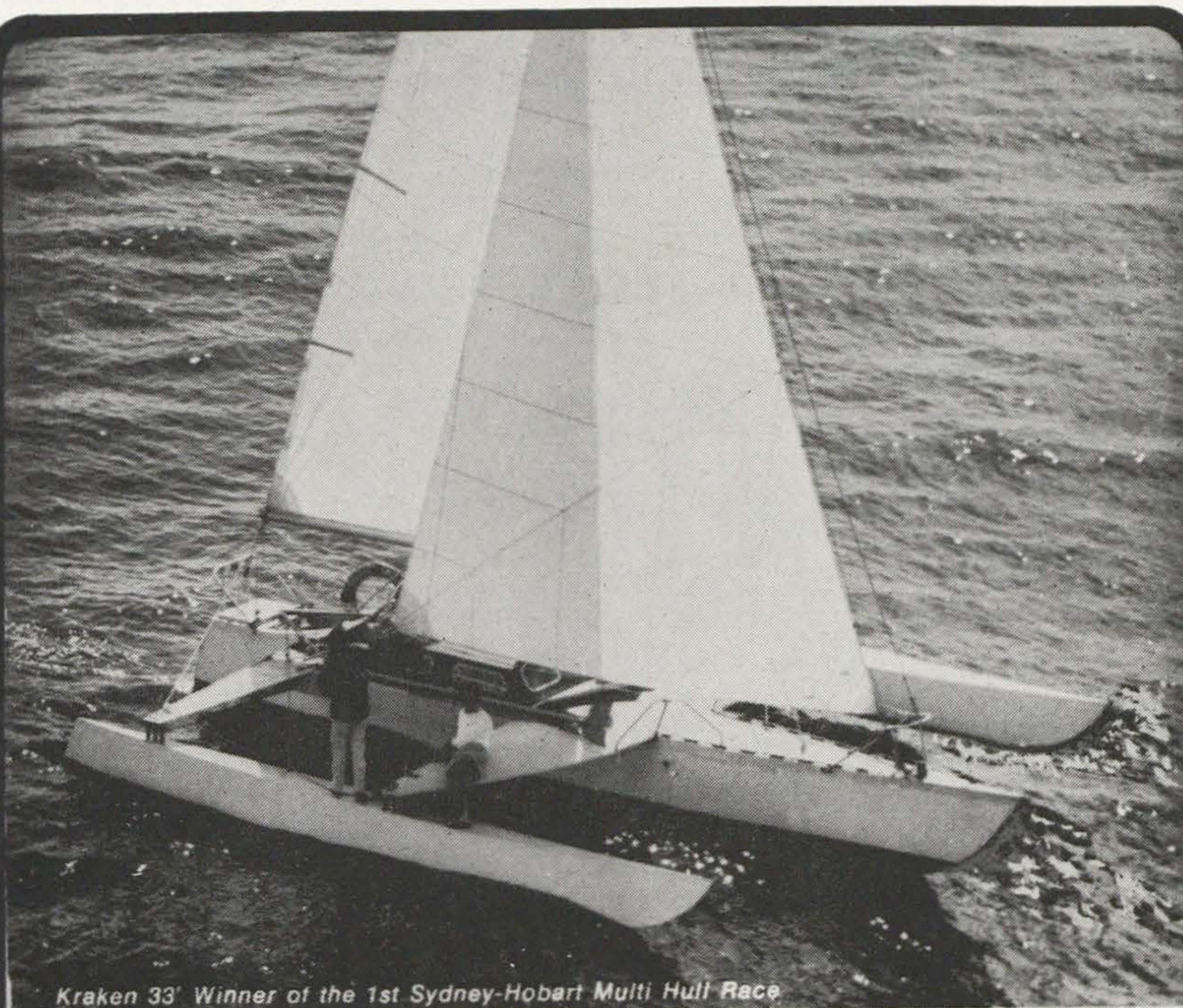
The tendency is to broach. In broaching, centrifugal forces swing the mast over and the lee float bow will dig in and trip the vessel unless that lee float is well forward and has sufficient buoyancy. A diagonal capsize is inevitable. So long as trimaran designers have their float bows aft of the main hull bow there will always be risks of the diagonal capsize particularly with high rigs.

Nicol's designs carried fine float bows well back from the main hull bow. As Jim Brown says—"it is crucial that there be live buoyancy where it is needed; far enough forward and far enough to leeward. Some catamarans could use it farther to leeward (because of limited beam) and some trimarans could use it further forward (because of limited float length). Nicol's hull form had a depth of less than half its breadth (waterline) and developed lift at speed. He noted the main hull lifted some 9 inches at speed. This sounds great—the speed increases, draft decreases and roominess inside is enhanced. However, if the main hull lifts by 9 inches the floats must lift 9 inches also, or else the vessel must heel enough to get the float back down to gain the initial stability. An increase in speed accompanied by a decrease in stability!

All multihulls surf to some extent. A fast trimaran can hang onto waves that are travelling at 20 knots. The wave peels, the boat surges down the face planes up 9 inches and begins flopping from float to float. Or, seas from the quarter find her knifing down their faces diagonally with the "small hull" (i.e. Lee Float, *Ed.*) burdened, the mainhull skimming and the comber exploding under the weather float."

As Jim Brown says "at that speed it only takes once".

JOCK BURROUGH.



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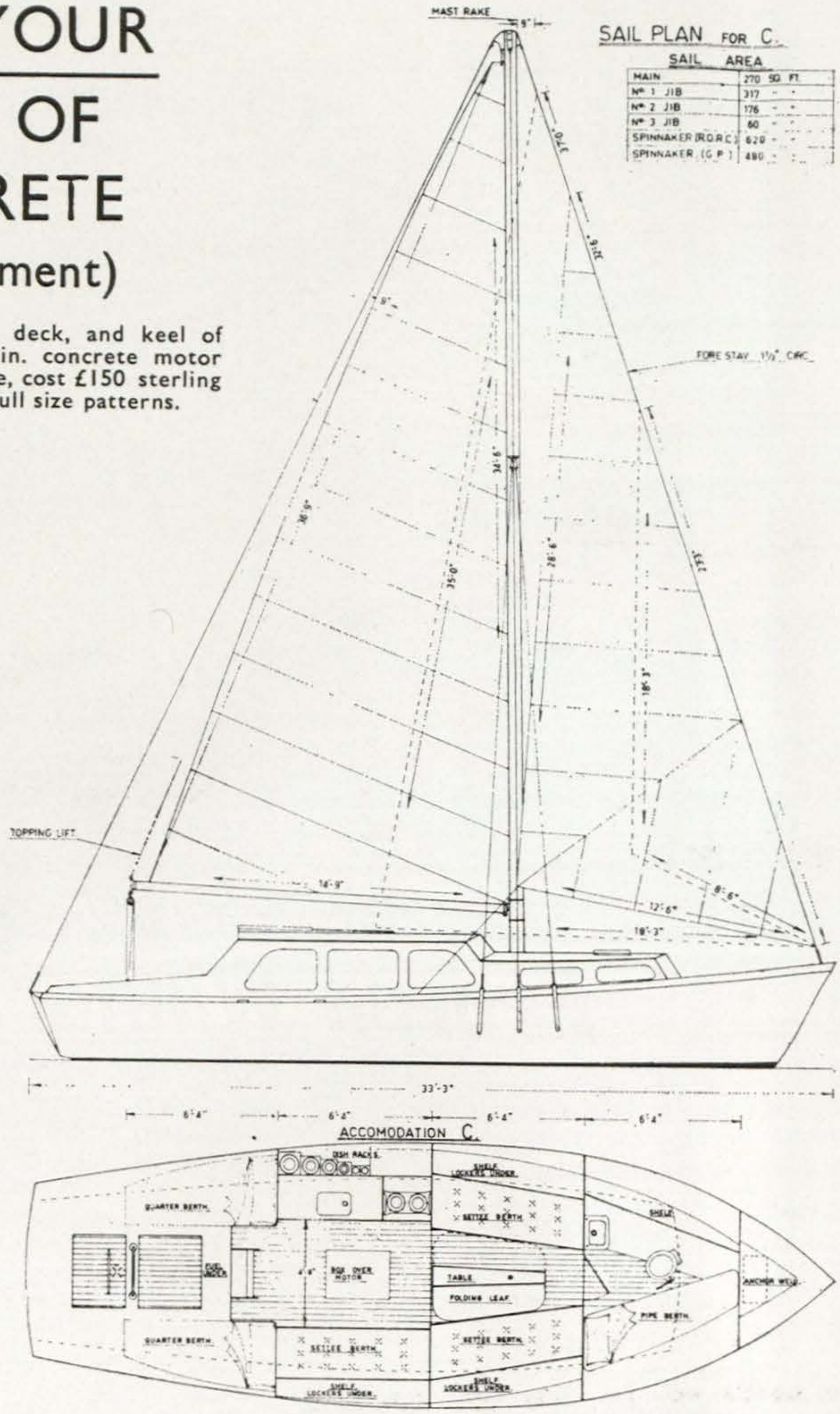

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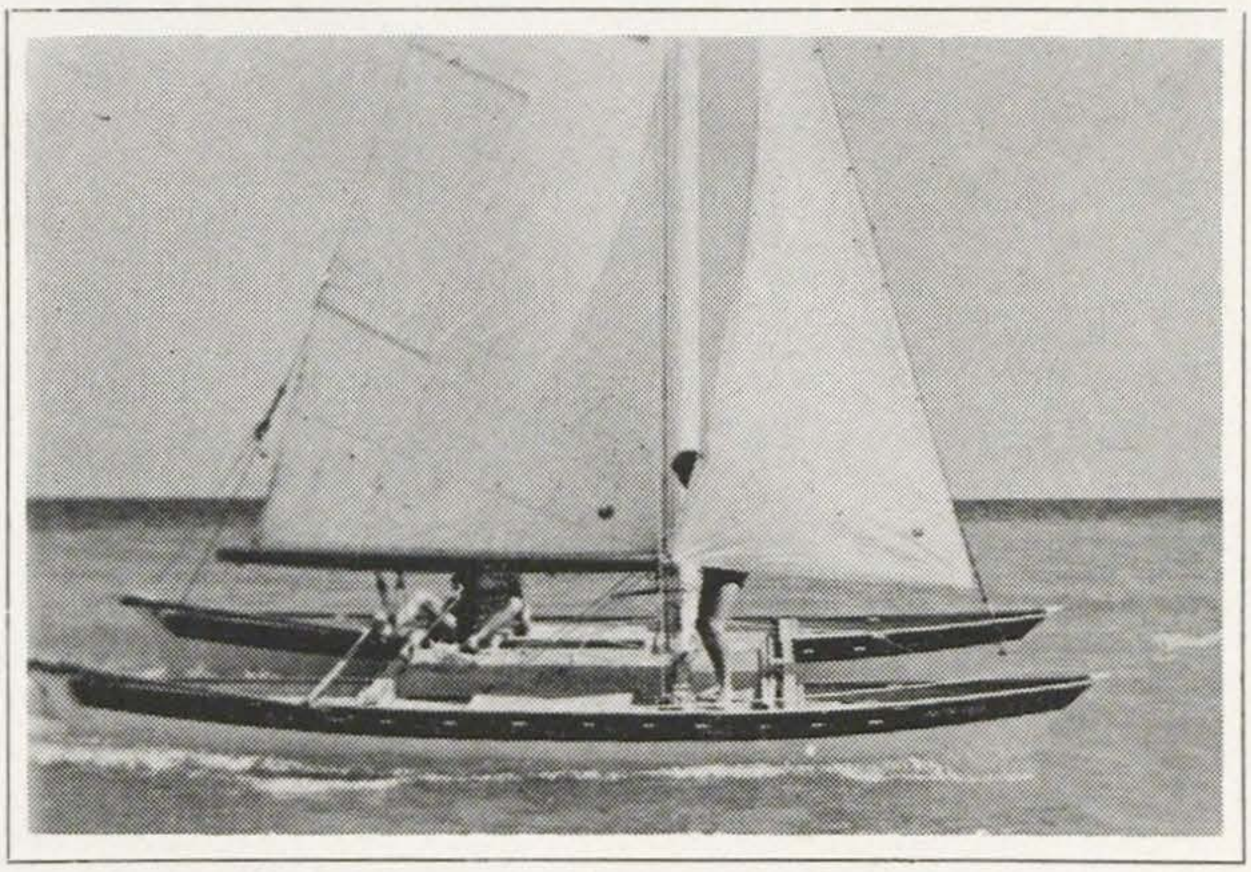

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