CATAMARANS 1967

A.Y.R.S. PUBLICATION No. 64

Photo: *Joyce Doughty*

QUEST III.

CONTENTS

THE AMATEUR YACHT RESEARCH SOCIETY

(Founded June, 1955)

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Sweden: Sveriges Catamaran Seglare, Mistelvagen 4, Lidingo.

Editorial Sub-Committee:

Michael Henderson,
34 Medina Road
Cowes,
I. of Wight.

John Hogg,
Parklands Cottage,
Curdridge,
Southampton, Hants.

Editor and Publisher:

John Morwood,
Woodacres,
Hythe,
Kent.

EDITORIAL

April, 1968.

MINUTES OF THE THIRD ANNUAL GENERAL MEETING OF THE AMATEUR YACHT RESEARCH SOCIETY HELD AT THE NAVAL AND MILITARY CLUB ON TUESDAY, 3rd JANUARY, 1967 at 7 p.m.

The Chairman stated that due to an error, the copies of the Accounts for the year ending September, 1966 had been delivered to the Boat Show Stand instead of to the Naval and Military Club for the Meeting. He asked whether any Member wished to move that the Meeting be adjourned and as there was no response he asked for a show of hands to the proposal that the Annual General Meeting should continue. This proposal was carried nem con.

(1) The Minutes of the previous A.G.M. were accepted as read and signed by the Chairman.

(2) Due to the absence in the North of England of the Treasurer, the Chairman and the Treasurer's Reports were given as one.

(3) The following Officers who presented themselves for re-election were re-elected unanimously:—

The President:	The Rt. Hon. Lord Riverdale, D.L., J.P.
Vice Presidents:	Austin Farrar, M.I.N.A.
	Beecher Moore.
The Editor:	John Morwood.
Vice Chairman:	Andre Kanssen.
Secretary:	Roger Waddington.

The following Ordinary Members who presented themselves for re-election were elected unanimously:—

Dennis Banham.
Peregrine Henniker-Heaton.
John Hogg.

(4) The Committee were instructed to appoint new Auditors.

(5) A vote of thanks to all those who helped the Society during 1966 was enthusiastically passed.

(6) No items had been received by the Secretary for discussion at this A.G.M. and the Chairman declared it closed at 8 p.m.

NOTICE OF THE FOURTH ANNUAL GENERAL MEETING

of the

AMATEUR YACHT RESEARCH SOCIETY

Limited

The Adjourned Annual General Meeting of the Amateur Yacht Research Society will be held on Tuesday, 10th September, 1968 at 7 p.m. at the Naval & Military Club, 94, Piccadilly, London, W.1.

AGENDA

(1) Minutes and matters arising therefrom.

(2) To receive the Chairman's Report.

(3) To receive the Treasurer's Report.

(4) Election of Officers.

The following Officers retire automatically and present themselves for re-election with the recommendation of the Committee.

The President:	The Rt. Hon. Lord Riverdale, D.L., J.P.
Vice Presidents:	R. Gresham-Cooke, C.B.E., M.P.
	Austin Farrar, M.I.N.A.
	Beecher Moore.
Chairman:	Lloyd Lamble.
Treasurer:	John Stitt.

The following Ordinary Members retire automatically and present themselves for re-election:

Jock Burrough.
Fred Benyon-Tinker.
Mike Henderson.

(5) To re-appoint the Honorary Auditors for 1968.

(6) Vote of thanks to helpers of the Society during 1967 and in particular to Hetty Tett and John Morwood.

(7) Discussion of items submitted to the Secretary and approved for this Agenda.

Late Publications. Herewith the April publication—in July. I hope we will now catch up and proceed more or less on time in future.

Increasing Membership. Once again, we have to thank all our members for increasing our membership still further. Our print order is now 3,000 which starts to bring the individual cost of publications down quite a bit, thus increasing the Society's profit. This may soon result in reprints of all back issues now out of print.

Members' Letters. We are only too happy to advise members on anything to do with yachting, if we know the answer. However, constructional details for all kinds of boats are not really within our province. Members must find out this kind of information from other sources or find out what a similar boat to their projected one has found successful.

Addresses on Letters. When members write us letters, would they please put their full addresses on them, even if we know them well. Our secretaries spend an extraordinary amount of time looking up addresses in the files—a singularly tedious operation.

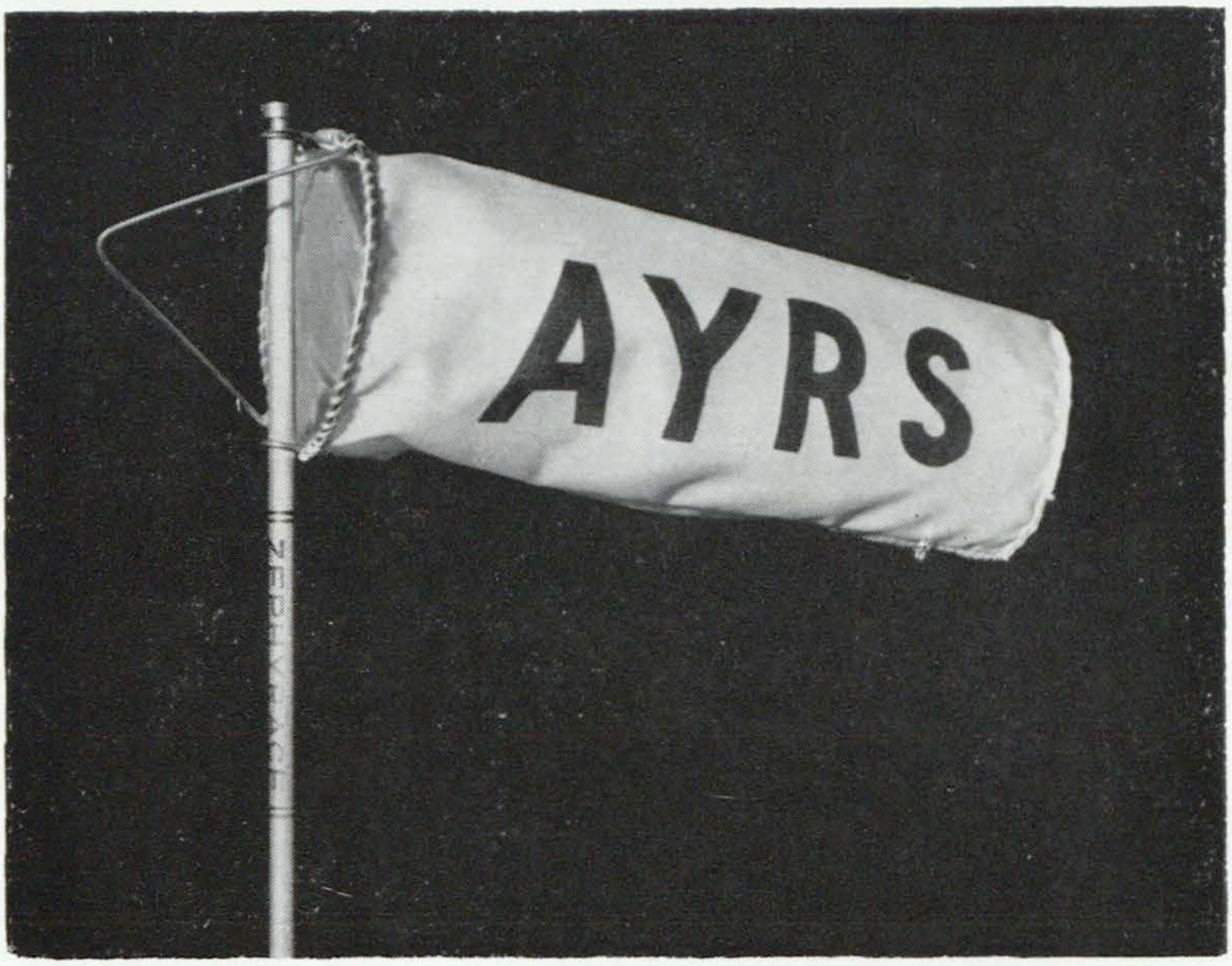
What we are mostly interested in is the boat of unusual kind which a member has designed or built or any catamaran or trimaran which has been built with an eye either to cheapness or outstanding performance. Model experiments are the initial phase of much outstanding development and we often recommend this, especially as such good fibreglass hulls can be bought from Raymond Blick, 23 Bray Road, Guildford, Surrey (£1 18s. 0d. for a cat or tri main hull 36 in. long). Hydrofoil experiments seem to offer the promise of another yachting "breakthrough" and we would like members to experiment in this field, where anyone has the chance of a real "scoop".

Self Steering. In this year of the Single-Handed Trans-Atlantic Race, self steering will flourish and the final "hardware" has yet to be developed. Multihulls will not self steer on a free wind course with an ordinary vane in a light wind. Replacing the vane with a wind-driven gyroscope seems to me to be the answer at the moment. Our hard-backed book on the subject sells for $4.00 or 22s. 6d. and should be recommended by members to their acquaintance, especially in the U.S.A., where self steering has yet to be seen in any great quantity.

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

The A.Y.R.S. Tie. A.Y.R.S. ties, with a single device of the letters A.Y.R.S. cost $3.00 or £1 1s. 0d. each. Colours are navy blue or black.

The A.Y.R.S. Burgee. The picture shows the A.Y.R.S. windsock burgee. The dinghy size is $5\frac{1}{2}$ in. long and costs 14s. or \$2.00. The cruiser size is 16 in. long and costs 28s. or \$4.00. We have been out of stock of these for a short while but now have them both again.



Subscriptions. Many members say that they cannot figure out when their subscription is due. This is, of course, on October 1st. We remind people of this in the October publication and it is clearly marked on the Membership Card.

New Editor Wanted. I have given my capacity for work a good deal of thought lately and now feel that I can no longer edit four publications each year. I can assemble the basic material from the yachting journals which come in here but just cannot put out the effort for the catamarans and trimarans issues, and they have to be ready when I am working hard in other ways.

Would anyone who has some experience of writing and an enthusiasm for cats or tris like to edit these two subjects for us? The summer and fall issues can still be done by me for the present.

Ferro-Cement Boats. This is a subject which has collected a good deal of interest amongst amateurs. We have collected about six long articles and brochures on the subject. Would anyone like to make these up into a publication for us?

150 YEARS AGO

From The Brighton and Hove Herald (October 25, 1817)

"A boat, of a singular and novel construction, called a catamaran, has recently been invented by a Gentleman of Arundel.—It has been tried, and found to answer all the purposes, either of a life-boat or pleasure yacht,—and is considered, by persons conversant in nautical architecture, to be the safest in tempestuous weather and a heavy sea, of any yet known.—It is also remarkable for fast sailing,—having, by far, outstripped four long galleys, celebrated for their swiftness. This curious vessel is formed of twin barrels, eighteen inches in diameter, placed parallel to each other at a distance of four feet, and terminating at each end, in a point;—on them is placed a stage, or bulwark capable of carrying from fourteen to twenty persons, into which the most turbulent sea can make no irruption.—Its length is twenty seven feet".

AN EXTRACT FROM THE I.Y.R.U. RULES FOR THE INTERNATIONAL CATAMARAN DIVISIONS

(Twin Hull Craft Only)

These rules incorporate the amendments approved in 1963, 1964 and 1965 to the original rules agreed by the I.Y.R.U. in 1962.

The purpose of these rules is to encourage racing and development within four divisions. It is hoped that international status will be granted to one or more classes within each of the divisions.

Divisions

A	*One-man boat*	
	Maximum sail area	150 sq. ft.
	Maximum extreme beam measurement	2.3 m.
	Maximum length excluding normal rudder fittings	18 ft.
B	*Two-man boat*	
	Maximum sail area	235 sq. ft.
	Maximum extreme beam measurement	10 ft.
	Maximum length excluding normal rudder fittings	20 ft.
C	*Two-man boat*	
	Maximum sail area	300 sq. ft.
	Maximum extreme beam measurement	14 ft.
	Maximum length excluding normal rudder fittings	25 ft.

D *Three-man boat*

Maximum sail area 500 sq. ft.

The above restrictions may be tightened or added to by the I.Y.R.U. permanent committee as development indicates.

Beam Measurement

Gunwales, sprayboards, rubbing strakes and all fixed parts are included in the extreme beam limits.

Length Measurement

If the rudder exceeds a maximum width of 3in. including its cheeks for any of the divisions, it shall be included in the overall length measurement.

Weight

The importance of light weight to a catamaran's performance is recognised but little is known about fatigue in new materials. No weight limits shall be imposed to control the strength of hulls until more information is available.

Masts

No limits shall be imposed to control the height of masts, although it is appreciated that excessively long masts cause catamarans to pitchpole downwind.

Unballasted Retractable Seats

Unballasted retractable seats are allowed for the helmsman in division "A". They are also allowed for divisions "B", "C" and "D" but only for the crew and not the helmsman. When the seat is in use, the crew or the helmsman shall at all times have at least one foot in contact with the boat.

Trapezes

Trapezes shall be allowed for members of the crew, but not for the helmsman.

Hydrofoils

Hydrofoils shall be permitted.

Insignia

Catamarans in the four I.Y.R.U. divisions shall carry the following insignia on their mainsails for identifications:-

The 150 sq. ft. boats to be identified as A
=
National letter.

The 235 sq. ft. boats to be identified as B
=
National letter.

The 300 sq. ft. boats to be identified as C
=
National letter.

The 500 sq. ft. boats to be identified as D
=
National letter.

Spinnakers

Spinnakers are not allowed for divisions "A". "B" and "C". Spinnakers are recommended in divisions "D" provided that:-

(a) The sail is set by three corners only, which may be attached to hull and spars by sheets and halliards of any length.

(b) The sail is symmetrical about a line from the head to the mid-point of the foot.

(c) Each edge is taped with a non-stretch tape.

(d) The area of the spinnaker does not exceed 800 sq. ft.

(e) The width at half length shall be greater than the foot.

Spinnaker Booms and Whisker Poles

Spinnaker booms and whisker poles shall not exceed 50 per cent of the square root of the maximum fore and aft sail area permitted for that division. The spinnaker boom or whisker pole may be attached to any part of the hull, spars or rigging on the windward side of the boat. Whisker poles shall be permitted for divisions "A", "B" and "C".

Sail Measurement Instructions

(a) *Mainsail and Foresail*

(1) The intention is to measure the whole driving area of the sail-plan and the whole effective area of sails and spars shall be measured.

THE FUTURE OF YACHTING

It seems a good thing to tell members each year what experiments are going on and where development is taking place. We only learn about the hydrofoil experiments in July and must have the information in the press by August 1st for the October issue but we always like to be told where and how each boat is performing, at any time.

(1) *The Flying Sailing Hydrofoil.* No known progress since Martin Sanderson's boat of last October's issue. This has not been made to "fly" yet.

(2) *The Foil-Stabilised Narrow Hull.* No known progress since the craft of Dr. Feldman, Paul Ashford and Mr. Bagnall (to be published next October). As I shall be sailing my *KINNEGOE CRUISER* (now called *TILICUM*, after Voss' canoe) at a delightful place called "Pluck's Gutter" on the narrow river Stour, I will not be fitting foils this year.

(3) *Sail Development.* I am going to try an ice yacht rig with a very bendy mast of 8 inches by 1 inch in section on my *TILIKUM* without a boom. Ice yacht masts bend as much as 10 inches with the concavity to windward. I hope my mast will bend enough to take out all twist from the sail. However, bent masts don't like compression strains and, doubtless my mast will smartly break. Roy Bacon tried this system a couple of years ago but didn't find it suitable for racing C Class catamarans. No other sail developments are known.

LITTLE AMERICA'S CUP, 1967

In 1967, the Australians challenged for the third time with *QUEST III*, designed by Charles and Lindsay Cunningham and sailed by Peter Bolton and Lindsay Rees of Melbourne. It was defended by *LADY HELMSMAN*, designed by Rod MacApline-Downie (bow knuckle added by Reg White) and sailed by Peter Schneidau and Bob Fisher.

LADY HELMSMAN won the series by four races to one. The race was lost when she broke a centreboard and holed her starboard hull, when she retired. In every race, the pattern was the same. In both light and strong winds, *LADY H.* pointed higher and footed faster close hauled while on a free course, the lesser wetted surface and lighter weight of *QUEST III* made her faster.

LADY HELMSMAN. This boat was fully described in our publication No. 59 but Rod MacAlpine Downie has now most generously published her basic lines which we publish by kindness of the Royal Institute of Naval Architects on page 12. She was unchanged from last year when she defended the cup against the American *GAMECOCK* and used the same mast which Austin Farrar developed to get rid of twist. The main cross beams were strengthened.

QUEST III. The hull was of the usual Cunningham type as seen in the other two *QUESTS*, a light, canoe-sterned type of low wetted surface, of full 25 foot length. She used dagger boards of high aspect ratio which are lighter than the swivelling boards of *LADY H*. and do not need rubbers to close the slot but they are cumbersome to adjust. *QUEST III* also had flaps above the bows to counteract plunging and used a net trampoline to prevent water-carrying and lifting windage when flying a hull. The hull weight of *QUEST III* was 500 lbs. to the 700 lbs. of *LADY H*.

QUEST III used a mast sock arrangement, giving a "pocket luff" effect around her alloy mast, instead of the wing masts with which the Cunninghams had been experimenting. Obviously, the Cunninghams are not well up with the A.Y.R.S. sail work or they would have realised that it is of more value to take the twist out of a sail than merely streamline the airflow into it. The secret with a wing mast with a straight luff line, as opposed to the *LADY H*. mast, is to have slack stays to allow the mast to bend with the concavity to windward. This has been shown at its best with the ice yacht rig.

Comparison of Boats. It is not yet known if canoe sterns are worth while in the C class, though to my way of thinking, the evidence is against it, if only to deminish pitching. However, the lighter weight of *QUEST III* and her less wetted surface seemed to have made her a faster hull than *LADY H*. in spite of or because of her canoe stern, as the case may be. This was evident in the off wind reaches where she was clearly faster but with an equally efficient sail, she might not have held this superiority to windward where weight and pitching become important.

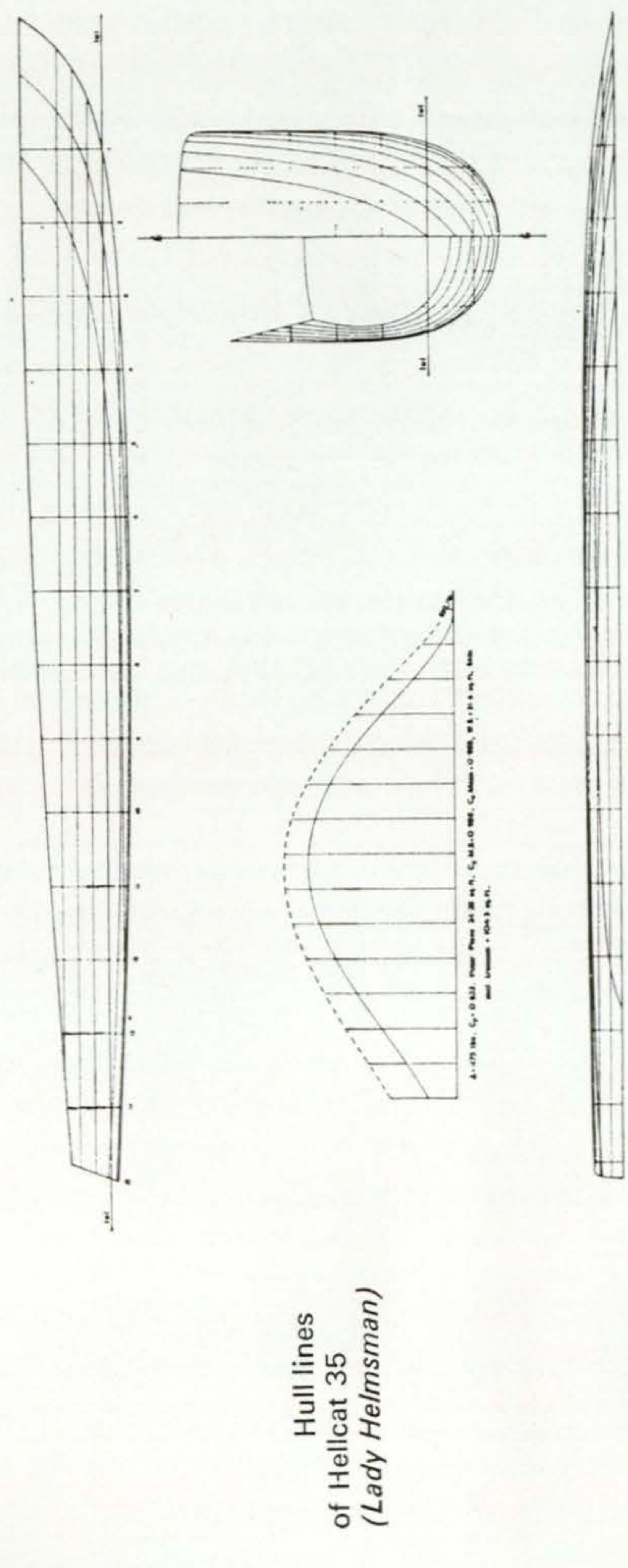
Undoubtedly the series was won by the twistless and highly efficient sail devised from the basic ideas of General Parham by Austin Farrar, of Seahorse Sails. This sail was fully described in our publication No. 59 and is apparently unbeatable except, in my opinion, by a pocket luff ice yacht rig of high aspect ratio.

CATAMARAN DESIGN

BY

JOHN MORWOOD

The lines, sections, profile and curves of sectional areas of Rod MacAlpine-Downie's *HELLCAT* 35 design are shown, by kind permission of the R.I.N.A. This is *LADY HELMSAN's* hull, though Reg White built in a bow knuckle as suggested in an A.Y.R.S. publication very many years ago, instead of having "stuck on" spray deflectors.



Hull lines of Hellcat 35 *(Lady Helmsman)*

According to Rod, if a canoe stern had been used with deminishing semi-circles, he would have saved $4\frac{1}{2}\%$ of wetted surface, which puts the matter of the canoe stern fully into perspective. Even at high speeds, the resistance of catamarans has been shown in the test tank to be due to 75% skin friction and 25% wave making so at ordinary racing speeds our contention that wetted surface is the only important criterion of design has been proved.

The immersed transom will be noted. This will give slightly more drag at low speeds, especially in pitching conditions but will deminish wetted surface and give a flatter run to the buttock lines.

The "midships section" is a high semi-circle which costs a bit of wetted surface both upright and heeled according to our calculations but gives flatter buttock lines.

The bow overhang looks pretty but, though very fine, it is still a pitching shape and loses waterline length.

The curve of sectional areas has the interesting feature that the maximum area lies forward of the mid-waterline length, a feature which is found in no other type of boat, despite the 19th Century aphorism "Cod's head and mackerel tail makes a ship that's sure to sail".

WILLSVENTURERS II & III. These two boats are of the same hull shape and are Rod MacAlpine-Downie's latest design. The A.Y.R.S. owns one but we have not had the finances to rig or race it so far. With vertical stem, deeply immersed, and a transom slightly more immersed than *LADY HELMSMAN*, the buttock lines are the flattest of any of Rod's designs so far. The wetted surface is slightly increased, but the shape and extra length damp out pitching better than on the other C Class cats and this appears to more than compensate for the extra resistance in dead flat water.

Conclusion. There appear to be two different types of C Class hull, both about equally fast. Both have the maximum section a semi-circle with the diameter on the L.W.L. Both are 25 feet on the L.W.L. and they could be called *THE VENTURER* and *THE QUEST* types.

The VENTURER Hull. This has a deeply immersed stem and transom with all sections aft of the maximum, semi-circles rising up to the transom. This hull will be slow in putting about and be fractionally slower in smooth water but will pitch less and hence get more drive from its sail.

The QUEST Hull. This has both stem and canoe stern only an inch or so below the surface and has semi-cricular sections based on the L.W.L. throughout, though a short piece of right angled V at bow and stern will damp some pitching. This hull will manoeuvre easily, have the minimum wetted surface and will weigh less. If it does pitch in light winds, the drag aft will also be less but this is a small consideration compared with the loss of sail drive in pitching.

Sail Development. To date, the Farrar wingsail has clearly shown its superiority to the previous wingsails and, of course, to the sloop. Its only real competitor at the moment is the pocket luff ice yacht rig with a mast bendy enough to untwist the sail. A final improvement might, however, lies in a semi-elliptical sail set, either as a squaresail of "fore-dipping" lugsail. This cannot be known until it is tried.

Centreboards. The boards at present used are the result of *aerodynamic* theory with few or no tank tests to back the shape up. They are high aspect ratio more or less vertical boards. The evidence from the tank, however, indicates:-

(1) That the leading edge should be sloped aft at about 65° from the vertical. (Southampton Tests).

(2) That the aspect ratio should 1:1 (Edmond Bruce).

(3) The boards should be large (Bruce).

There is no evidence on the shape of the leading edge of the board but it seems reasonable to have this slightly convex with a small concave "fairing" where it joins the hull (Smith: "Why Sailboats Win and Lose Races"). Nor is there much evidence as to whether or no boards should be thin or streamlined shaped.

Conclusion. On the evidence, the boards should be triangles, more or less, being twice as long at the hull as in draught. This at least is a traditional shape as found in the American sailing fishing boats which had no real thickness. Catamarans with the dinghy-type revolving boards could try this shape at little trouble. Those with dagger boards could try it by attaching it to the bottom of their dagger section and putting it into the slot from below.

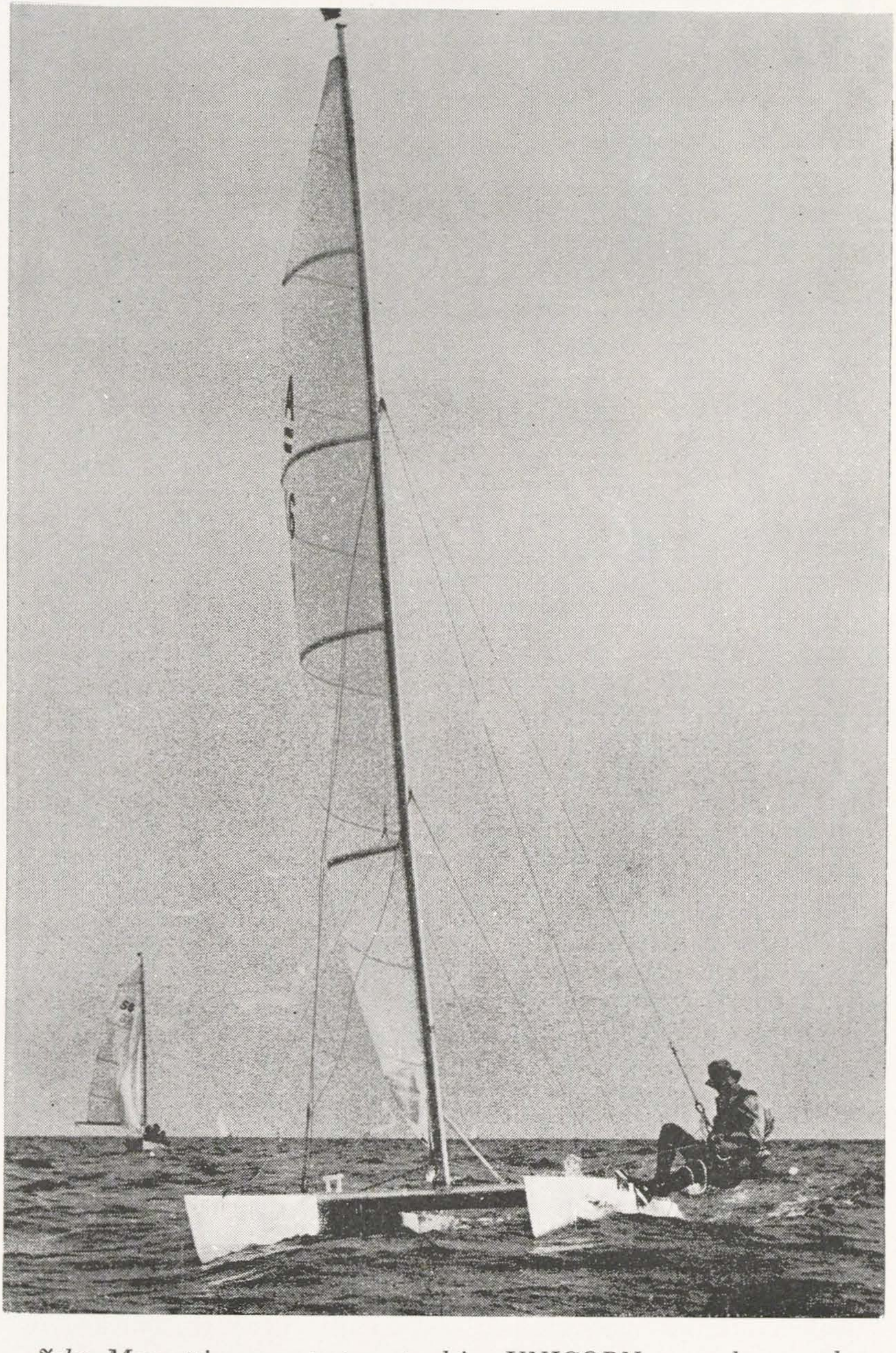
It is perhaps noteworthy that the shape suggested here is found in the fins of fish.

UNICORN

by Courtesy of the Editor, "Yachts and Yachting"

L.o.a. 18 *ft.* 0 *in.; beam* 7 *ft.* 6 *in.; Weight* 120 *lbs.*

Three years ago, cat designer John Mazzotti came up with a new method of hull construction. By using developed ply panels for either side of the hull and holding them together at the keel at a pre-



John Mazzotti uses a trapeze to drive UNICORN on a close reach. A sliding seat may be fitted if preferred.

determined angle with fibreglass tape, he found that he was able to fold the panels in towards each other to form a very good shape for a catamaran hull. Early experiments provided the ground-work for Mazzotti's successful "B" Class Manta design.

John Mazzotti has been folding plywood again and his latest design is the very easy to build and extremely quick *UNICORN* "A" Class cat. Once again the designer has produced a boat which is ideal for amateur construction. The building procedure is simplicity itself and no jig is required to produce the right hull shape.

UNICORN is 18 ft. overall and 7 ft. 6 in. maximum beam. These are the maximum length and beam dimensions allowed by the "A" Class rules. The boat carries 150 sq. ft. of sail in a simple una rig and this, coupled with the extremely low all-up weight of about 150 lb. ensures a very high turn of speed.

The "A" Class singlehanders are allowed to use either a trapeze or a sliding seat as a sitting out aid and *UNICORN* can be fitted with either. The designer himself prefers to use the trapeze because it is so simple and because a sliding seat increases the all-up weight by 10 pounds or so.

At first glance, an "A" Class cat might seem to be something of a problem to manhandle ashore. However, not only is *UNICORN* extremely light but she can be knocked down into her main components of hulls, cross beams and spars very quickly indeed once she has been brought ashore. Trailing is no problem and the boat is as easy and quick to assemble as it is to take to pieces.

The original method of stressed skin hull construction makes for great strength because localised stresses cannot build up but are dissipated throughout the skin. Only two bulkheads are used in the construction and these are glass taped into the hulls after they have been folded to shape. One is positioned just ahead of the main beam which is made from a length of standard mast section tubing and carries the mast. The other is fitted in way of the after beam which carries the mainsheet track.

Limber holes are provided in each bulkhead at the keel line so that any water finding its way into either hull is easily run out through the drain hole in the transom. No reserve foam buoyancy is needed because, in the event of a hull being holed below the waterline, sufficient water will flow into the hull to flood the compartments between the bulkheads above the level of the limber holes. Water will continue to flow into the damaged hull only against increasing air pressure and a balance will be reached while the hull still has plenty of buoyancy.

UNICORN's una rig carries a typical catamaran sheeting arrangement. A full width horse is fitted to the aft beam whilst a curved track is used for the kicking strap.

On hauling the boat ashore, the transom bung is removed and all the water is run out.

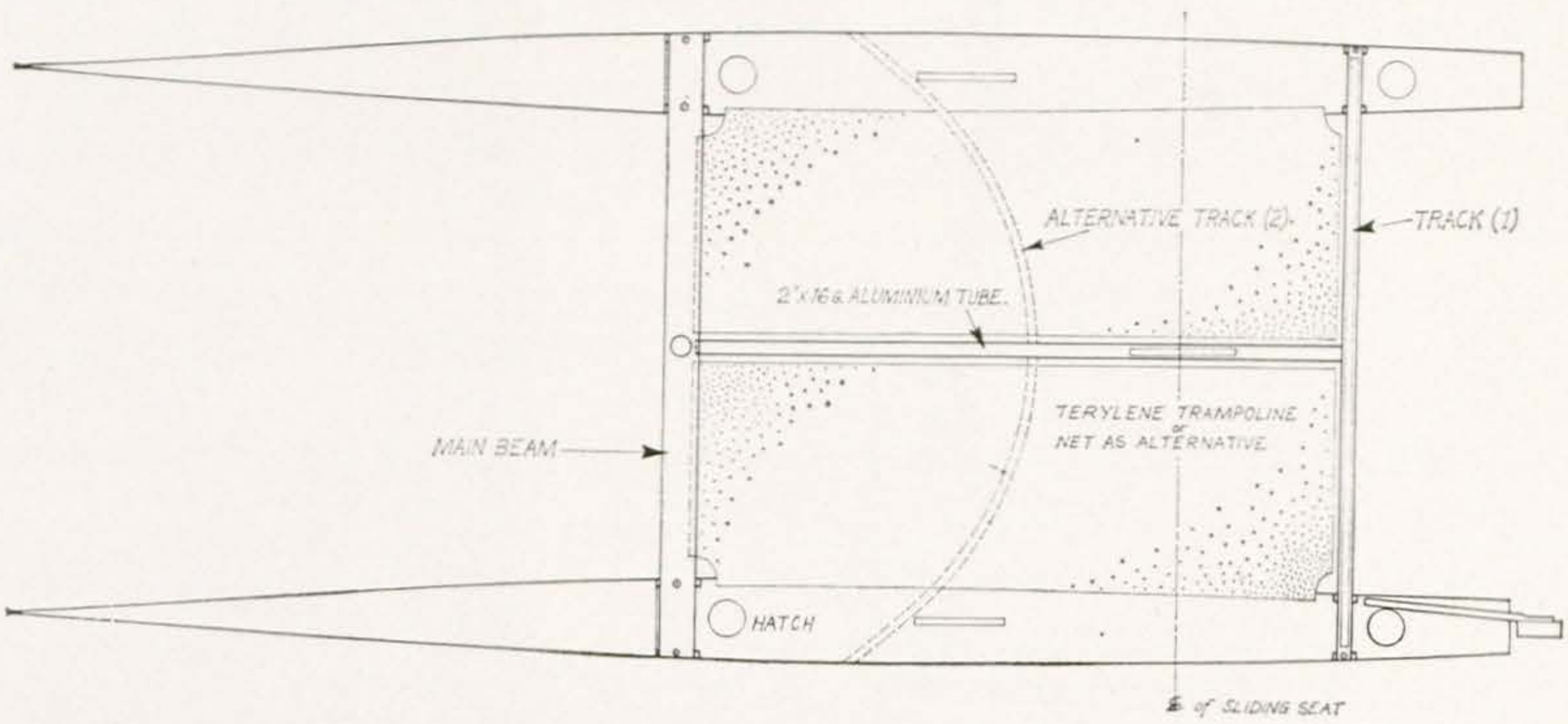
The materials list for *UNICORN* is short and the boat's performance does not depend on a number of expensive fittings. After buying his spars and sail and having built his boat from scratch, a home builder can be on the water for as little as £150. To date six

A una rig of 150 *sq. ft. is set on a rotating mast supported by one pair of shrouds and a divided forestay.*

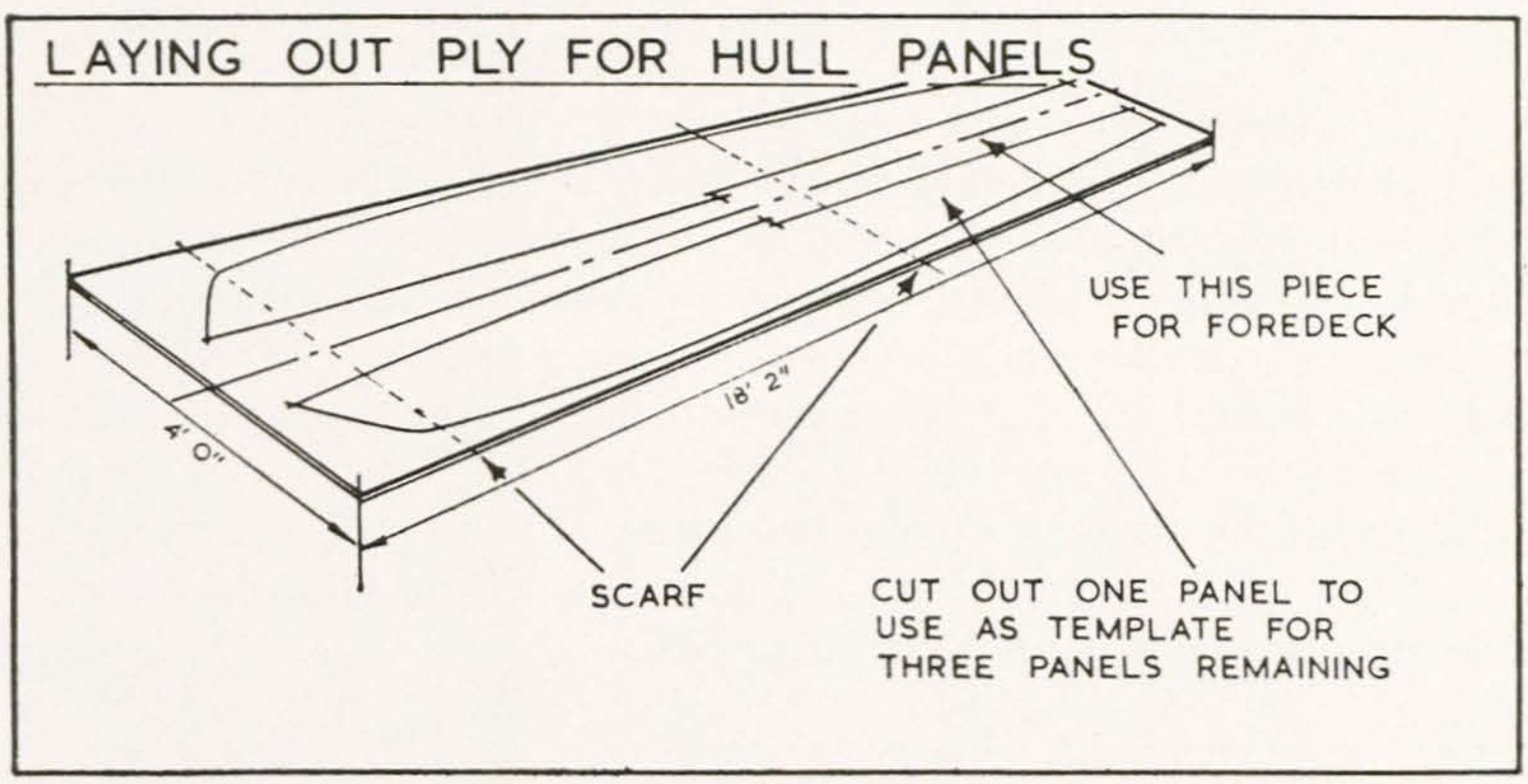
boats are racing in the class—four of these are home built—and the £150 figure has proved to be a very reasonable average cost.

At the moment *UNICORN* hulls are of all plywood construction, but work is in hand for a fibreglass hulled prototype. This should be an interesting experiment, for the intention is to build a *UNICORN* with one plywood and one fibreglass hull. The boat will then be tested to see which is the first to fail.

UNICORNS are built professionally by Trowbridge and Sons of Durnchurch, Winchester and the cost for a boat complete with sail is £300. Kits are available, of course, and either a complete basic set of



UNICORN's hulls are held apart by two beams, the centre area being filled with a Terylene trampoline supported down the middle by an aluminium tube. Access to the bolts which secure the beams to the hulls is obtained through inspection hatches in the deck.

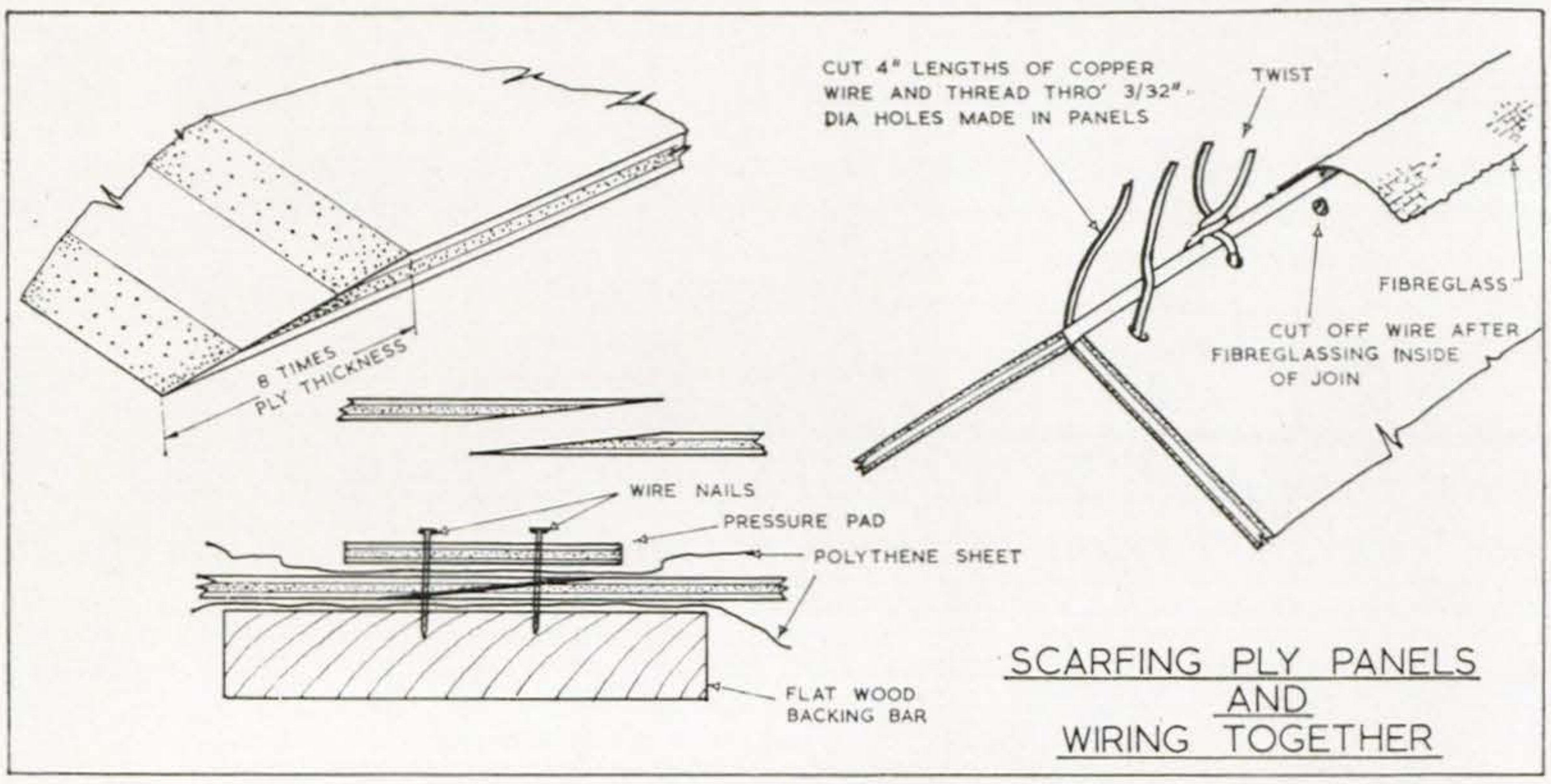


parts can be supplied or the boat can be ordered in any stage of completion. For the cat sailor who is good with his hands and wants to start from scratch, a complete set of working drawings and building instructions can be purchased from the designer for £8 0s. 0d.

Construction

The first job is to scarf together plywood sheets to form two panels 18 ft. 2 in. long x 4 ft. wide. One panel is sufficient for each hull. The width of the scarf should be eight times that of the thickness of the plywood, in this case 32 mm. or about $1\frac{3}{8}$ in. Pressure can be applied to the scarf while gluing by nailing through a strip of packing, through the panel being scarfed and into a wood backing batten.

When the glue has set, the nailed strip can be removed and the holes stopped up when painting. The sketch on the right shows the method of "stitching" the panels together with copper wire prior to fibreglassing the keel joint.

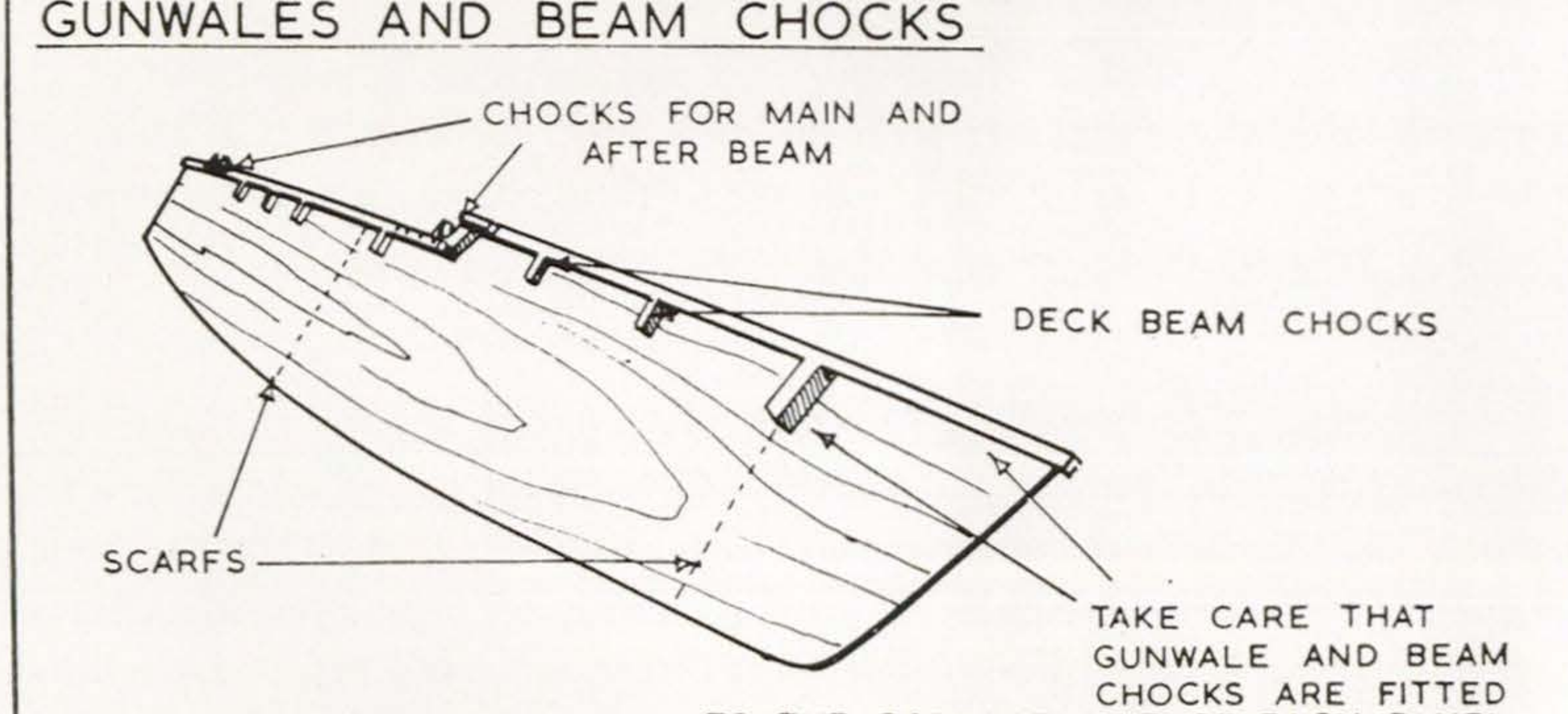


SCARFING PLY PANELS AND WIRING TOGETHER

(1) *Marking out*

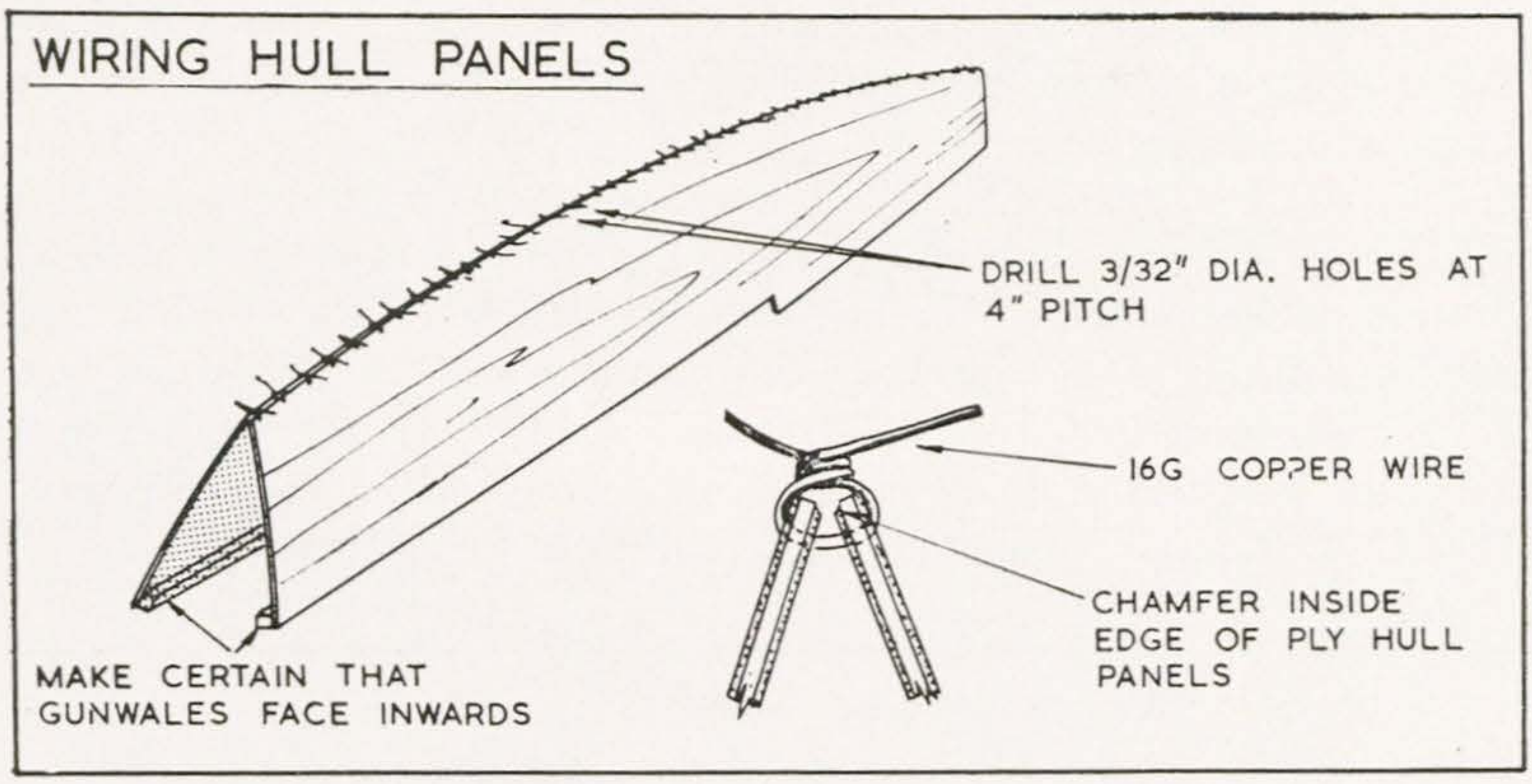
A datum line is marked on one panel and the offsets for the keel and deck line are marked off and the outline of the finished panel drawn in. One panel is cut out and carefully finished to shape. This is used as a template to mark out the other panels. Care must be taken to ensure that the face veneer of the plywood appears on the outside of the panel and that the scarf is trailing. That is with the join starting on the inside of the finished panel, forward and running to the outer face of the panel aft. A $10\frac{1}{2}$ in. wide offcut of plywood between the hull panels aft is used for the foredeck.

GUNWALES AND BEAM CHOCKS



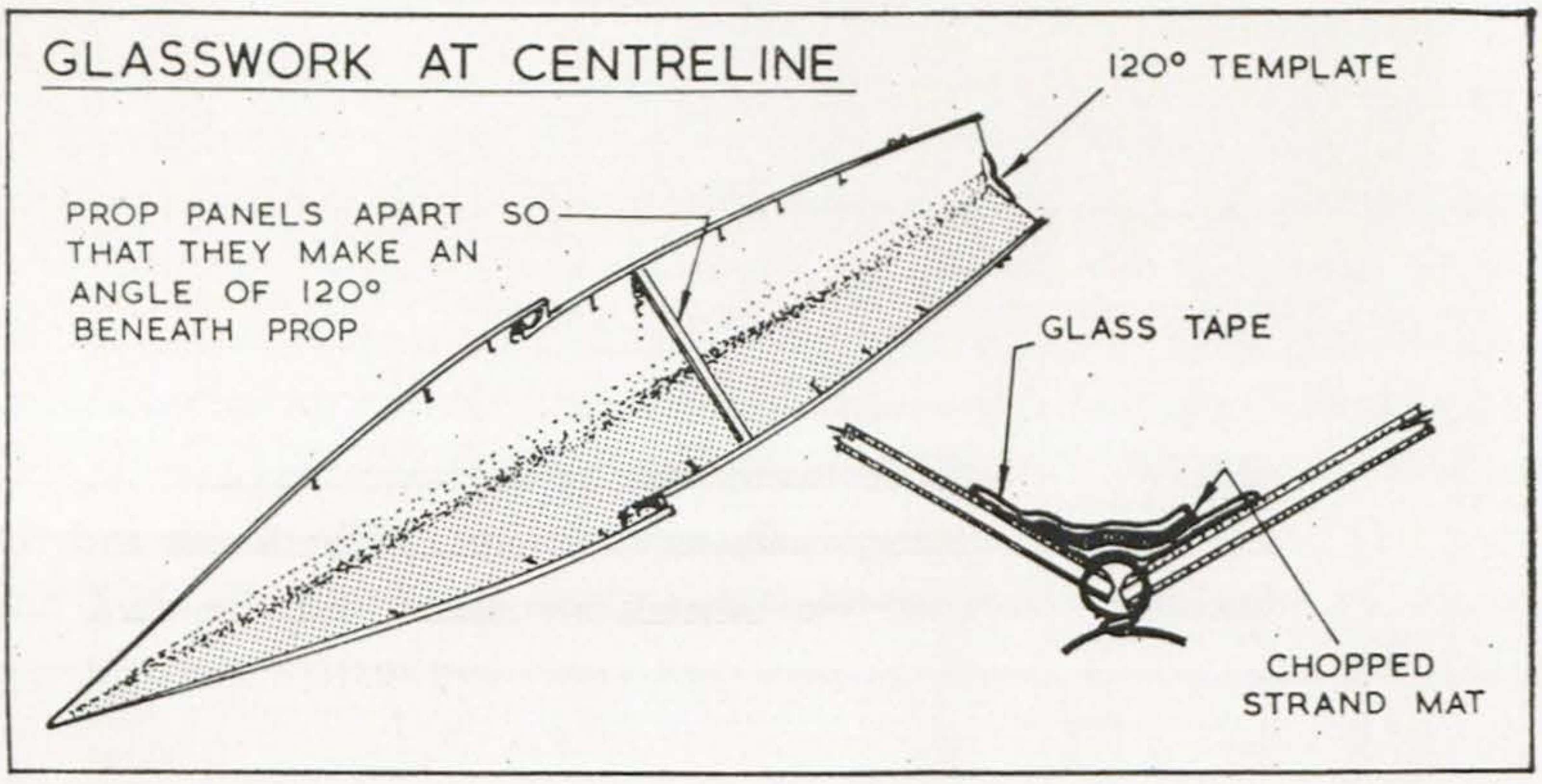
(2) *Hull Sides*

After the hull sides are cleaned up to shape the gunwhale assembly can be fitted. The $\frac{3}{4}$ in. square spruce gunwhales are fixed to the upper edge of each panel on the inner face and fastened with glue and barbed ring nails. It is important to make sure that two pairs of right sides and two pairs of left sides are assembled. When the glue has set, each sheet should be marked and cut out where the main beam and rear beam mounting blocks are to be fitted. The blocks and their doubling pieces are then fastened into place. Next, the deck beam chocks are fitted. These are nailed and glued to the panel just below the gunwhale.



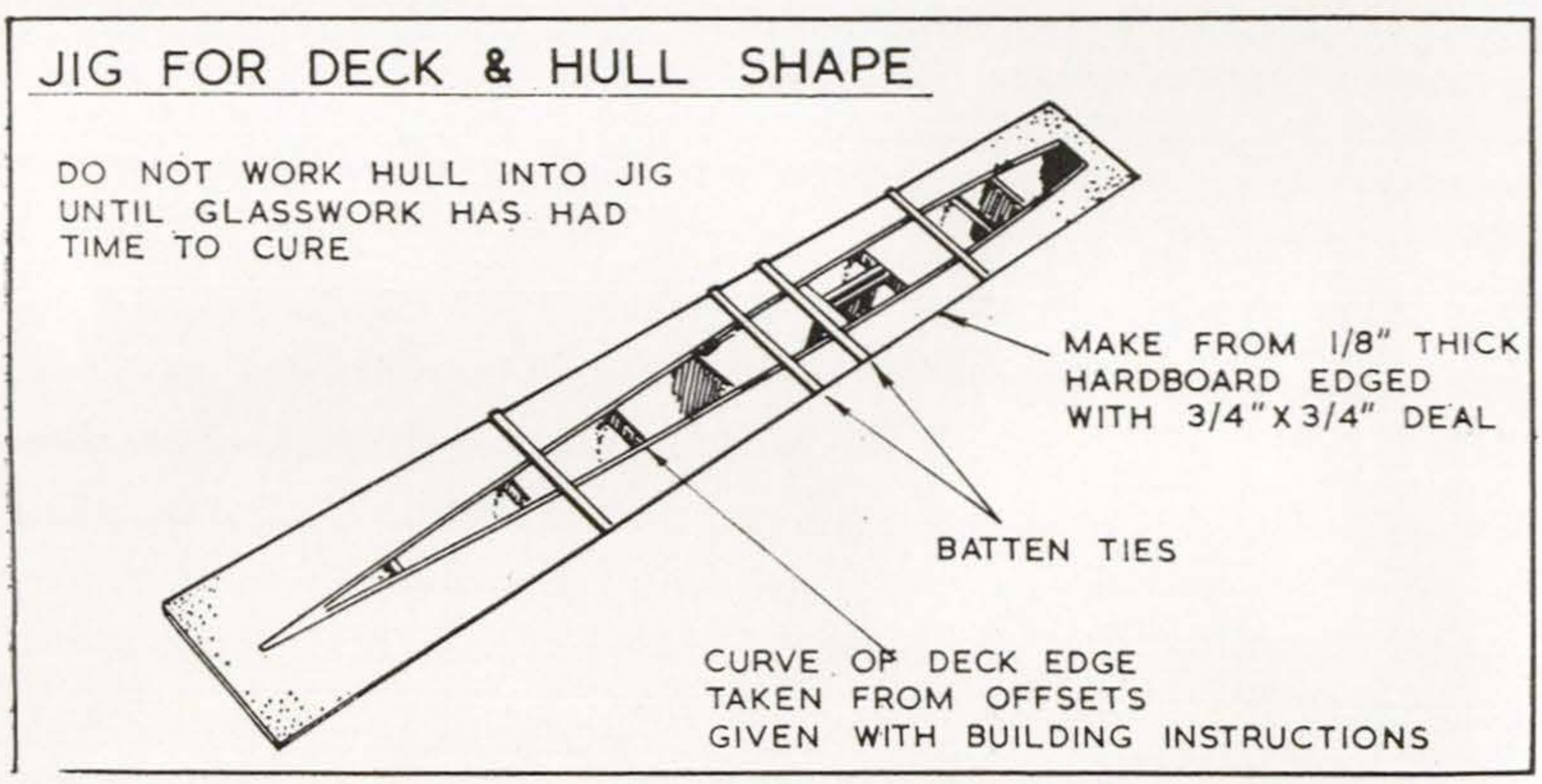
(3) *Wiring together*

When the glue holding the gunwhales and chocks has set, the gunwhales must be tapered for the forward 10 in. off to nothing at the bow. As this will expose the ends of a number of the fastenings, these will have to be punched back and removed to avoid blunting the plane or chisel. The sides are then paired off and marked so that they cannot be mixed later. Each pair is placed back to back and a row of holes, 3/32 in. in diameter, is drilled along the keel and up the stem. The holes should be about 3/16 in. from the edge of the plywood and spaced at about 4 in. centres. The sides are then reversed so that the gunwales are inwards and wired together using 3 in. lengths of 16 g. copper wire.



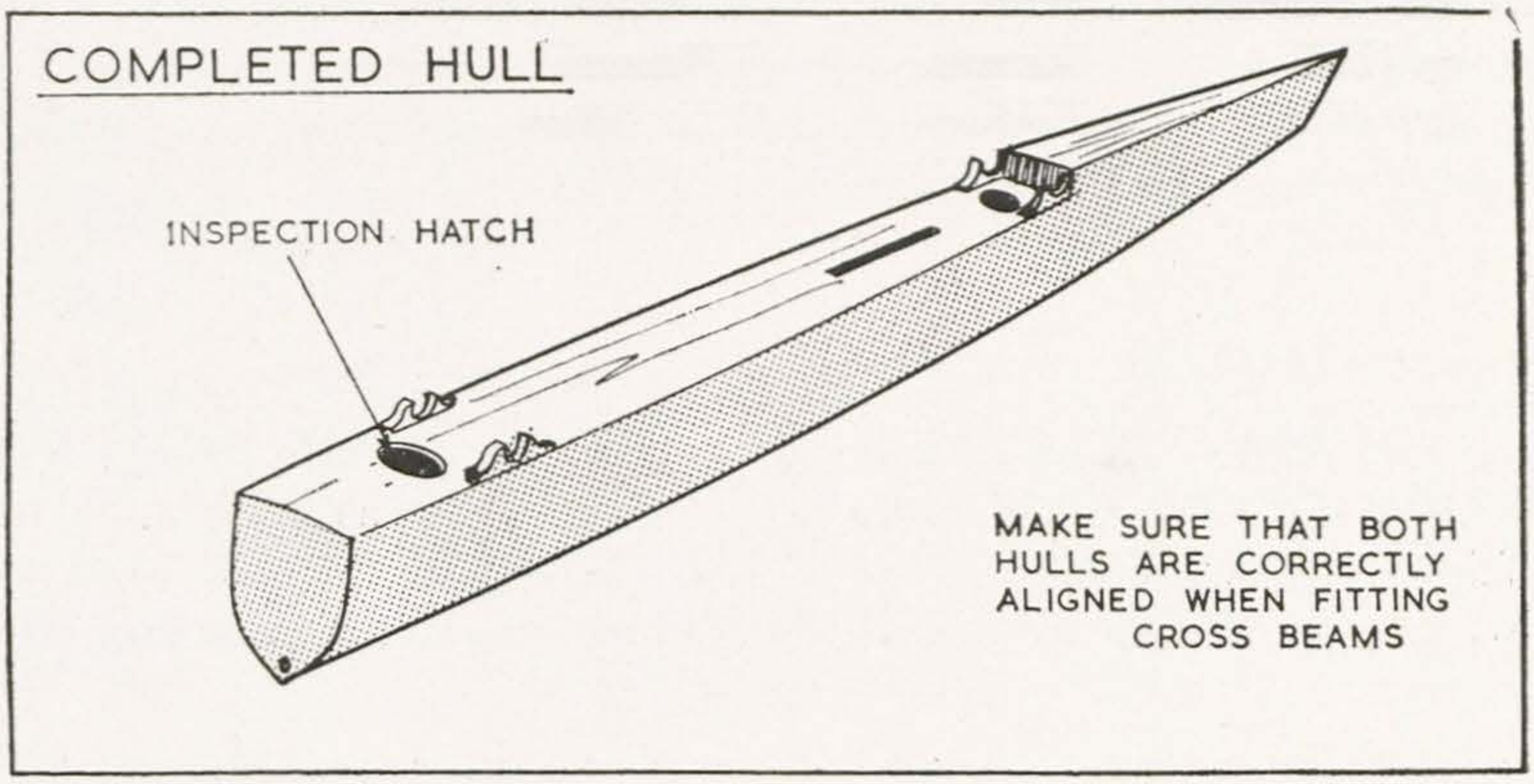
(4) *Glasswork at Keel*

When the sides have been wired together they are spread apart like opening a book to an angle of about 120° and held in place by a single shore fitted between the gunwales about 2 ft. aft of the main beam position. A template of plywood is cut to 120°and wired to the sides at the stern to maintain the angle right aft. Epoxy resin such as Araldite is recommended for use with the fibreglass for bonding the keel. A strip of 2 in. wide fibreglass tape is bonded to the joint offset $\frac{1}{2}$ in. one way, followed by a $1\frac{1}{2}$ in. wide strip of chopped strand mat down the middle and finally another strip of tape offset the other way. Two, 1 lb. mixes of resin should be sufficient for each hull.



(5) *Deck Jig*

Once the inside of the hull has been bonded along the keel and the epoxy resin has set the hull is turned over and the wire stitches are clipped off close to the surface of the panels and filed flush. The sharp corner where the panels meet is rounded over with a plane and two layers of glass tape are bonded over the outside of the join. When the resin has set hard the panels are ready for pulling to shape by fitting them into a jig specially made to dimensions shown on the drawings, or by driving a series of nails into the gunwales and pulling the sides together with line. The bulkheads, centreboard cases and deck beams can now be fitted.



(6) *Completing Hull*

Once the deck framework and bulkheads are in place the inside of the hull should be painted out with three coats of polyurethane paint. The decks are then marked and painted before being glued and nailed in place. Holes are cut in the deck just aft of each beam to take an inspection hatch and a ply doubler about $\frac{3}{4}$ in. wide should be fitted round the opening on the inside to take the fastening screws. $\frac{3}{8}$ in. x $\frac{1}{2}$ in. rubbing strips are fitted to the deck either side of each hull to take the chafe from the sliding seat and the hulls are ready for final sanding and painting. Finally, the hulls must be lined up carefully to eliminate twist and the cross beams fitted.

AUSTRALIS AND TORNADO NOW INTERNATIONAL CLASSES.

I.Y.R.U. CATAMARANS TRIALS AT SHEPPEY, 1967

It may be placed on record here that the R.Y.A., as an organisation, has never been anti-multihull but has followed the development of the racing multihull with interest and quite early set up a "Catamaran Committee". The I.Y.R.U. has followed and last year decided to select both an "A" Class and "B" Class catamaran for International status through a series of races at the Catamaran Yacht Club, Sheppey. *AUSTRALIS* and *TORNADO* were selected.

"A" Class Results

Name	*Designer*	*Helmsman*	*Points*
Australis (Australia)	Johnston	G. E. Johnston	20.7
Bambi (U.K.)	Prout/Coster	N. T. Coster	25.4
Catalina (Denmark)	Smitt	L. Wagner-Smitt	34.0
Unicorn (U.K.)	Mazzotti	J. Mazzotti	35.1
Sail Fast (U.K.)	Hubbard	R. J. Osborn	49.4
Miss Rothmans (N.Z.)	Stanton Cooke Bros.	G. B. Stanton	49.7
Lo-Ka (U.S.A.)	Karcher	R. F. Lostrom	68.4
Iolanthe II (U.K.)	Butcher	P. Butcher	78.7

AUSTRALIS won 3 races while *BAMBI*, *CATALINA*, *UNICORN* and *SAIL FAST* won a race each, so the boats can be said to be fairly evenly matched. *MISS ROTHMANS* dug her fore beam in waves and threw spray. *LO-KA* was fibreglass and therefore probably heavy.

Design-wise, the boats were very similar in shape. All had fine bows which experience shows go through waves without stopping so much. *AUSTRALIS*, however, had a sharp stern which did not seem to slow her at all. "A" Class cats pitch much more than larger catamarans and this fine stern might, under these circumstances, have more than made up for the extra (strong wind) resistance, while the lesser wetted surface helped in light winds.

"B" Class Results

Boat	*Designer*	*Helmsman*	*Points*
Tornado I (U.K.)	Rodney March	R. White	8.7
Mehitabel (Australia)	Cunningham Blaxland	P. Blaxland	25.7
Thai-Foon (U.K.)	MacAlpine-Downie	K. L. Sanger	69.1
Vivace (U.K.)	Mazzotti	A. G. J. Smith	70.7
Yankee B (*B-Lion*) U.S.A.	Hubbard	Mark Smith	76.7
Roton Pointer (U.S.A.)	G. W. Patterson	J. Bonney	82.4
Ready Steady Gone (U.K.)	Prout	R. G. Prout	83.1
Pacific Cat (U.S.A.)	Newport Boats	R. Baker	85.7

Boat	*Designer*	*Helmsman*	*Points*
Tornado II (U.K.)	Rodney March	T. K. Pearce	91.0
Centennial (Canada)	Perry/Carter	G. S. Percy	104.0
Yellow Bird (U.K.) (*Shearwater III*)	Prout	F. Prout	113.7

TORNADO and *MEHITABEL* had this series more or less between them. The older, beamier and heavier boats were out-classed. One could guess that the points obtained were almost in proportion to the weights of the boats concerned.

MEHITABEL is a more or less typical Cummingham (*QUEST*) type but sports a small transom about 3 in. in width. She is tremendously light with semicircular sections based upon the L.W.L. throughout, as compared with the sharper sections of the other boats forward.

Postscript. We have most certainly made some progress in catamaran design since 1955 but the *SHEARWATER IV* still acquitted herself well against the latest, longer, larger and leaner boats and, after all, the *TORNADO* is not very different in design from the dear old *SHEARWATER.*

TORNADO

A B Class catamaran for international racing designed by RODNEY MARCH

by courtesy of the Editor, Yachting World

L.O.A. 20.0 ft. Beam 10.0 ft. Sail Area 235 sq. ft.

TORNADO was designed with the requirements of the International Yacht Racing Union for a B Class catamaran well in mind, and to such good purpose that, following the trials at Sheppey in August, she is the boat that will be recommended to the I.Y.R.U. at its November meeting by the Observation Committee as a one-design class suitable for international racing. Rodney March set out to design a boat which would have an exceptional performance. This characteristic would necessarily stem partly from a light boat which in turn would make her easy to handle ashore. The third important factor is that *TORNADO* is especially suitable for amateur construction, using the "bent ply" method of forming the hulls.

TORNADO's construction is the same as the bent ply method employed for *THUNDER II*, which was a development of John Mazzotti's *MANTA* construction. By pre-setting the keel angle

Successful prototype TORNADO, international catamaran of the future.

when initially sewing and taping the keel together it is easily possible to maintain accurately a definite hull shape which can be repeated exactly. Three bulkheads and a piece of pre-shaped polystyrene foam for the forward stations assure perfect conformity to hull lines.

This method of construction lends itself well for amateur construction as only the minimum of jigging is required to hold the two 4.5 mm. ply halves of each hull at the correct angle while the epoxy bonded glass tape sets. A further simple jig is made to give the correct deck level plan. This jig can simply be made from hardboard with a piece of $\frac{7}{8}$ in. square screwed around the hole pre-cut to accept the hull.

The result is a hull with very soft lines which, in spite of the thin skin, is strong, rigid and very light.

The now familiar configuration of aluminium beams and Terylene "trampoline" are used to tie the two hulls together and plug the hole between hulls. Four stainless steel straps on each hull hold down the beams which correctly align the hulls on assembly. The bolt ropes of the trampoline fit into aluminium extrusions screwed to the hulls and into the after beam, which is a mast section complete with luff groove.

TORNADO promises to be a very popular boat; she is undoubtedly very exciting and for the first time brings in the added requirement of downwind tacking even in lighter winds, hitherto a waste of time with boats of her size except in special conditions.

Production boats from Sailcraft, Brightlingsea, Essex, cost £495, ex sails. Kit £338 including sails.

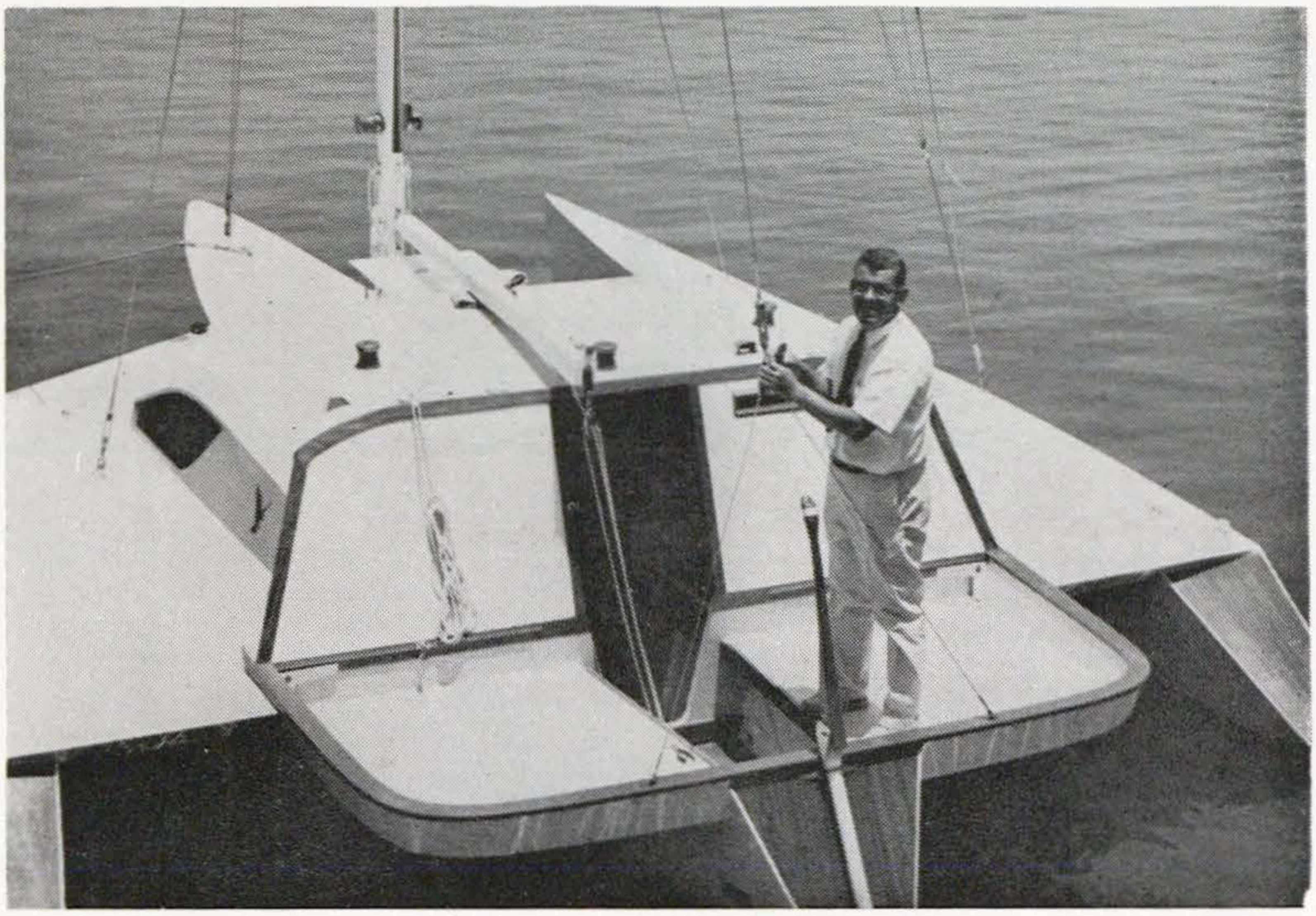
THE SAN DIEGO-ENSENADA RACE

BY

TONY ROSE

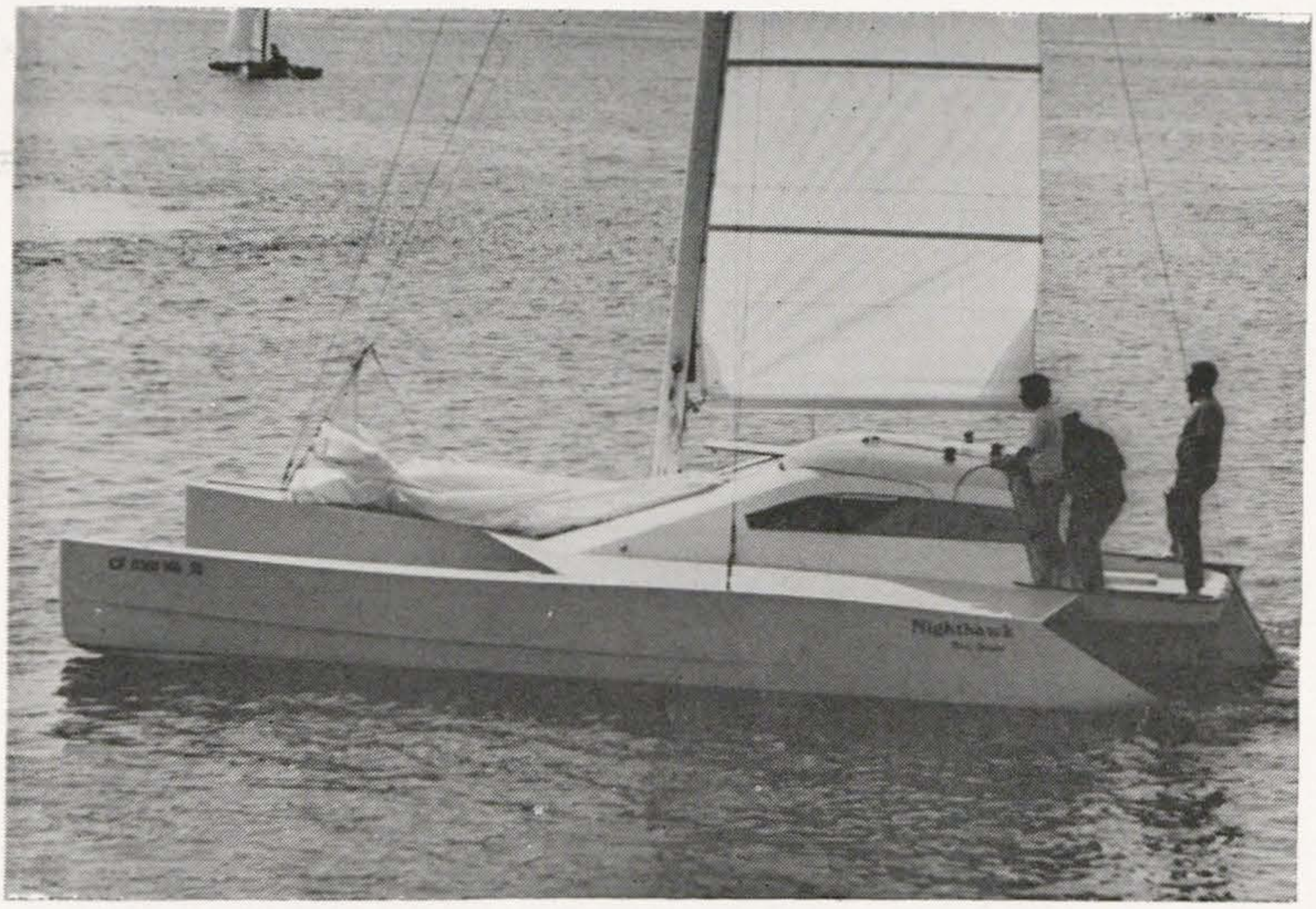
1046 LeRoy St., San Diego, California 92106.

This last weekend (30th September, 1967) was the San Diego-Ensenada (Mexico) race event and I was lucky enough to be invited on three boats as crew. I went on *NIGHTHAWK* (designed by "Skip" Johnson) which now apparently beats allcomers in the evening "beer can" races since her new dagger boards were fitted. The multihulls were last to start at 10.30 a.m. on Saturday—half an hour after the smaller classes started and 10 minutes after the biggest.

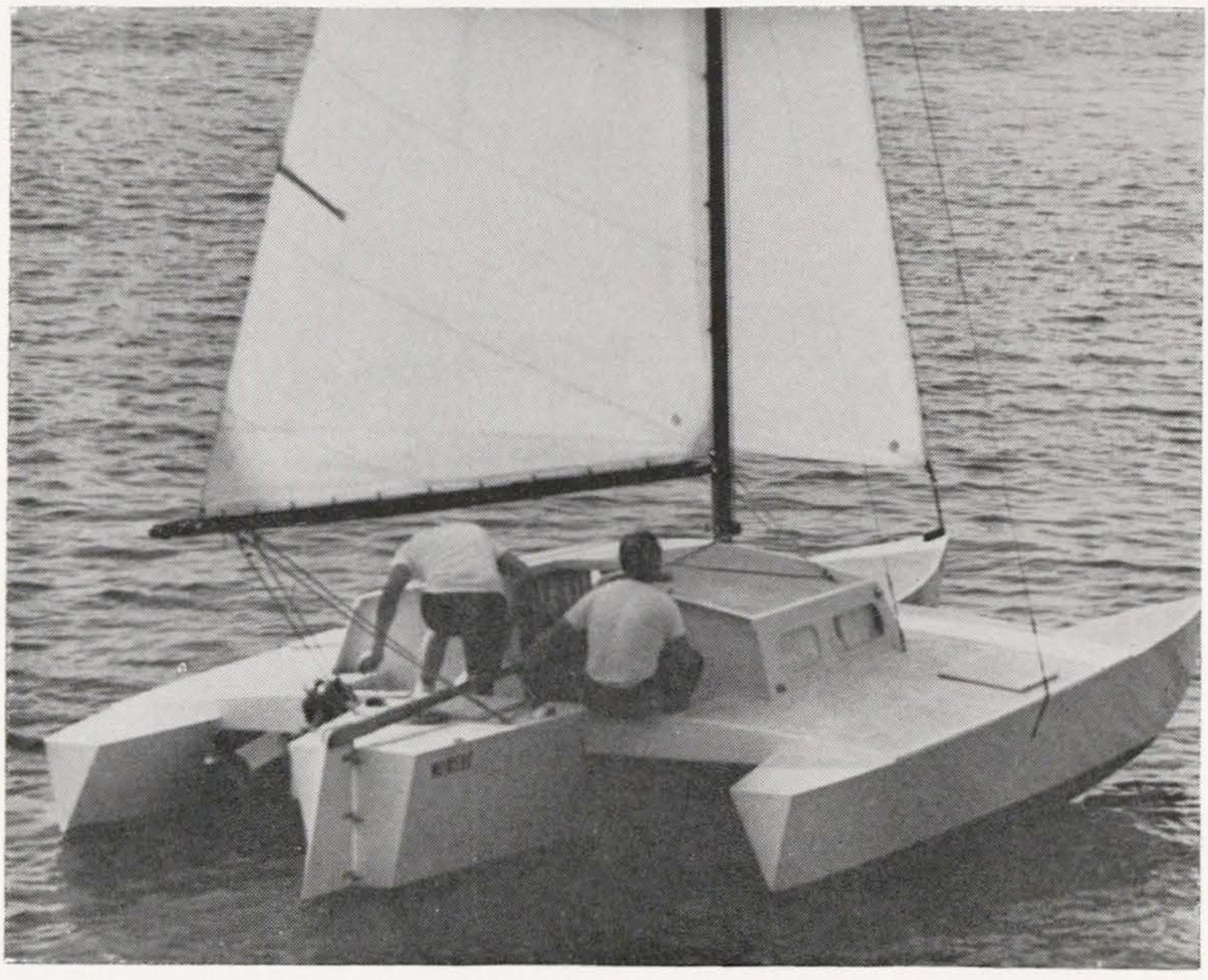


NIGHTHAWK and "Skip" Johnson after launching.

There were unfortunately only four trimarans—*NIGHTHAWK*, Norman Cross in *MALAHINE*, his 24 footer, a *GLOBEMASTER* (Piver design) and a 32 foot Piver derivative. A *PACIFIC CATAMARAN* also started with us, even though she was not allowed to enter officially. She arrived in Ensenada at 7.30 p.m., I believe about 1½ hours ahead of the whole fleet, sailed by the local dealer and fleet Captain and a real "character type" Joe Hawkins. His white spinnaker



NIGHTHAWK at Coronado Island Race.



NOMEKE—a 24 ft. Cross Trimaran.

has a caricature cartoon of Joe himself in the form of black sunglasses and moustache plus a bit of nose. The "P" cats always do this in this race.

It was downwind—spinnakers from the start—which, as usual, none of the tris owned.

The general opinion aboard *NIGHTHAWK* was that, by going out around the Coronado Islands, she would sail further but make up for it in speed, instead of following all the other boats "straight-lining it" for Ensanada, 70 miles down wind. This probably proved wrong. Only four other boats went our route and in time we passed them all,

"C" Class WHIRLWIND and OSPREY—a Cross 36.
Coronado Island Race.

despite their spinnakers. Two were "A" Class boats and one was an enormous motor-sailer from New York, at least 80 ft. long with sails all over the place. Unfortunately, when we moved in towards the finish in the dark we saw a lot of stern lights ahead which probably indicated that we too should have gone in a straight line. Really, we should have carried a spinnaker. All the same, our elapsed time of 11 hours, 13 minutes was not bad and, although we were 45th boat to finish, I believe we were about 25th on elapsed time.

Norm Cross followed us in 35 minutes later after going on a direct course. I think the finish order indicates how good the Pacific Multihull Association's rating rule must be because on corrected time

NIRVANA (*Proa*), *WHIRLWIND and WILDWIND*
Coronado Island Race.

Norm came in first, beating the *GLOBEMASTER* by 36 seconds while the *GLOBEMASTER* beat us by about 40 seconds. If a rating rule is meant to even out the boats and put the emphasis on seamanship or helmsmanship, then this must be a wonderful rule.

On the return trip, we had no engine and it took us 30 hours to get back due to calms and head winds, though *NIGHTHAWK* goes to weather well. At no time on the return trip or in the race, when we were within sight of another boat under sail only were they able to beat us. We always overhauled them. There is terrific potential in this boat, I think—but whether anyone is prepared to pay twice as much for a boat handcrafted as a trimaran as they would for a production fibreglass single hulled sloop with more accommodation is another matter. It was a very enjoyable weekend on a first rate boat.

SEA WOLF—a much modified Piver Nugget.

FIRST ANNUAL CORONADO ISLAND MULTIHULL RACE

This took place on July 23rd, 1967, the course being from San Diego, round Coronado Island and back—a distance of 26 miles in the Pacific. It was won by the fabulous *WILDWIND* of Norman Riise and Harry Bourgois, designed by Bob Reese. She was first on both elapsed and corrected time.

The fabulous WILDWIND—Bob Reese "D" Class design.
1st Elapsed and Corrected time Coronado Island Race.

The first trimaran to come in was *OSPREY* a Cross 36 while the first trimaran on corrected time was *SEA WUFF*, a *NUGGET* main hull without cabin and with cigar-shaped floats. *NIRVANA*, a *FLYING PROA* was hampered by lack of sail area.

Photographs are by A. A. Rose, 1046 LeRoy Street, San Diego, Calif. 92106.

WORLD'S MULTI-HULL CHAMPIONSHIPS, LONG BEACH, CALIFORNIA

BEOWULF III—S. Dashew's Whirlwind Cat.

Again, the photographs we show were taken by Tony Rose. The "C" Class *BEOWULF III*, a Whirlwind design, owned by S. Dashew is shown with the hulls apparently capable of pitching independently, while the "B" Class Delman *DOS EQUIS* owned by Alan Walti with box sections is going along nicely.

GALATEA, a Piver Globemaster, owned by D. McLean was the winning trimaran on elapsed time.

Ed.—I am sorry about the sketchy nature of these two reports. We really need members in all areas to describe the boats in noteworthy races.

DOS EQUIS—A. Walter's Delmar "B" Class, World's Multihull Championships, Long Beach, California.

GALATEA—a Piver Globemaster.

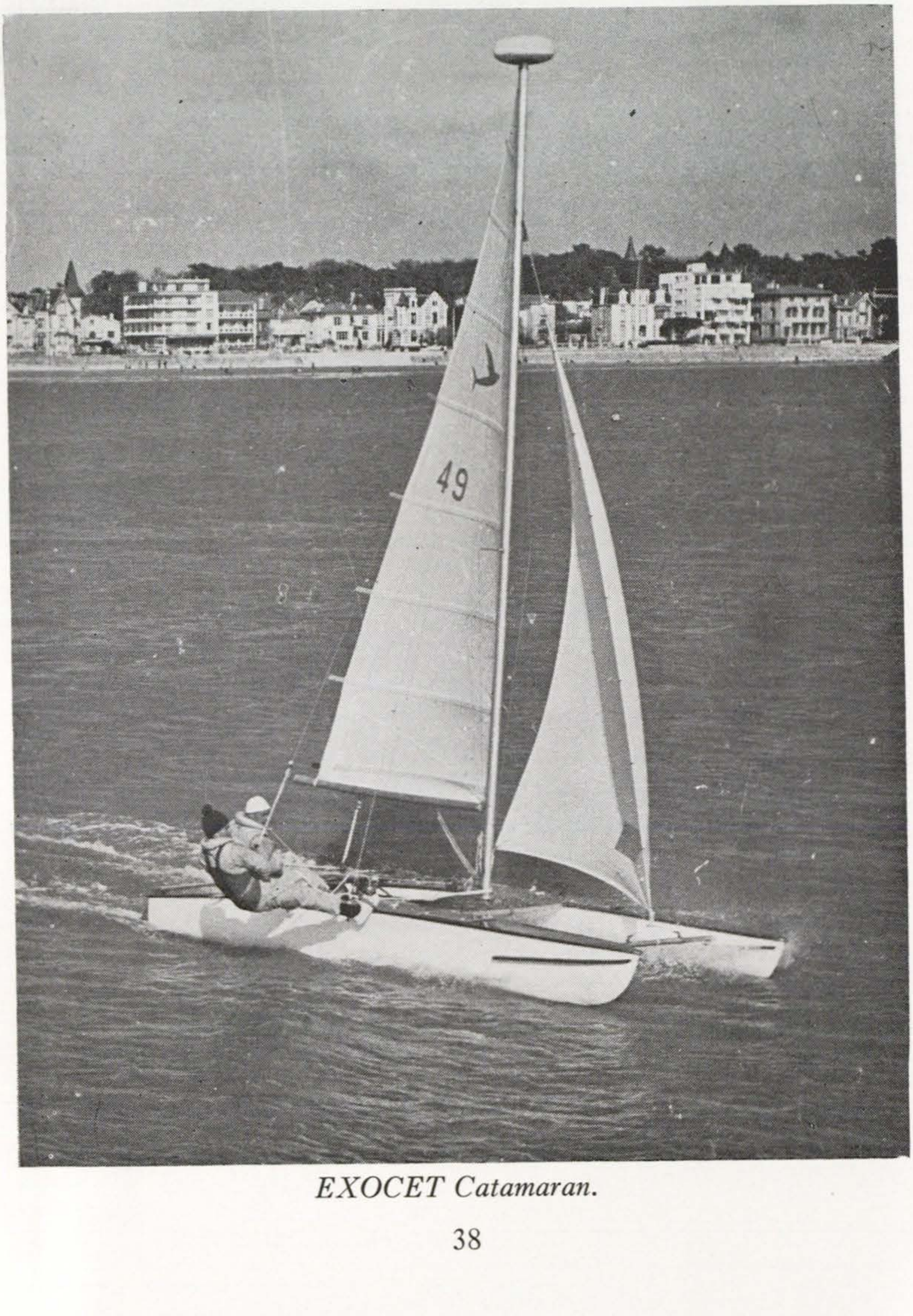
Another view of BEOWULF III Whirlwind design at World's Multihull Championships.

PUAHIO, J. Walt's Nugget and DOS EQUIS, A. Walt's Delmar World's Multihull Championships at Long Beach.

EXOCET CATAMARAN

L.O.A.	5,10 m.	Draft	0,13 m.
Beam	2,40 m.	Draft with C.B.	0,80 m.
Freeboard	0,60 m.[2]	Mast height	7,00 m.
Sail area	15,50 m.[2]	Weight	150 kg.

Builders: La Prairie, Ste MNC, Dpt. Nautism, 16 L'Isle d'Espagnac, France.



EXOCET Catamaran.

Eight years ago, we described *VELOCE* which may be thought of as the first of this series of catamarans. Since then, the craft has been redesigned and refined until this excellent boat has appeared which is second to none of its kind. There are now some 300 sailing in France due to series production in fibreglass reinforced polyester resin.

The Hull Design. This is quite normal and conventional, incorporating all the principles of design which have been shown to be necessary. The slight overhang forward makes the bows more pleasing to my eyes than the straighter kind and the plywood cockpit will be more suitable for the average sailor who is not interested in top speeds.

The Sail Rig. This also is absolutely normal—a fully battened rig with adequate boom downhauls. The mast and boom as well as the boards are of "duralinox"—a light alloy. The rigging is of stainless steel with Tergal sheets and halliards.

The Mast-head Buoyancy. I think this an excellent idea for light racing catamarans. They frequently capsize and, when this occurs in shallow water, the mast will usually become damaged if they turn upside down which they often do. With the mast-head buoyancy, at least the crews have a chance of righting them without outside help, thus relieving the rescue boat of a lot of anxiety when several boats go over together.

Summary. *EXOCET* is an excellent and well raced catamaran of excellent construction and design and an excellent class racing boat. She has won the catamaran championship of France every year since 1962.

EXOCET SENIOR

L.O.A.	6 m.	Boards, Duralinox, pivoting in each hull.
Beam	3 m.	Trampoline cockpit.
Freeboard	0,65 m.	Polyester resin-fibreglass hulls.
Max. Draft	1 m.	Four hatches.
Tergal sails	21,80 $m.^2$	Weight 180 kg.

Builders: LA PRAIRIE, Ste MNC, Dpt. Nautsime, 16 L'Isle d'Espagnac, France.

EXOCET SENIOR has been first three times in the French "B" Class and is of the same high standard of construction and rigging as the *EXOCET*. Her racing record is as follows:

EXOCET SENIOR

(1) Championship of Midi Atlantique. (Royan).
(2) One of a Kind at La Baule. Three times first in the "B" Class.
(3) First at Rochelle week.
(4) Won the French "B" Class Championship.
(5) First "100 miles Race" on Lac de Garde, Italy.

As can be imagined in view of this racing record, everything about this boat has been brought to the highest state of tuning and perfection. The pivoting and alloy boards and the mast-head buoyancy will detract very slightly from her performance but, in my humble opinion, she is the better boat for having them and I would like to see all of these features adopted for all racing catamarans.

SEA CAT 14

Manufactured by: "Hydrocraft", P.O. Box 3381, San Diego, California.

This firm sells construction plans and full sized patterns of sailing and power catamarans. Their full range is as follows, less the hydrofoil application described in our last publication HYDROFOIL VICTORY.

SEA CAT 14

SEA-CAT 8. Full size patterns $12.50. Material about $55.00. A nice little thing for sail or power.

SEA-CAT 14. Prices not available. See photograph. This catamaran has been built with bluff bows and submerged transom and obviously has the minimum of wetted surface for its length. The bluff bows seem to kick up some fuss, however, and it would be nice to know how this resistance compares with finer, slicing bows. One would suspect them of pounding a bit in a seaway. I would think this would be a very good craft for lakes and sheltered waters.

SEA-CAT 16. Construction plans $16.00. 2 man weeks to build. Material about $160.00. This is a more orthodox one-design class sailer of good performance. The cockpits in the hulls will be preferred by some, though they are likely to hold a good deal of water when the spray is flying—no matter how well drained.

Power Catamarans:

HYDROPLAY 9—A "Hot-rod" single-seater. Materials: $95.00

HYDROPLAY 12—A "Sports car of the sea". Materials: $130.00.

SEA-CAT 35—A power cruiser and motor sailer. 6 ft. 4 in. head room. 6 berth. Materials: $3,800.00.

SEA-CAT 45—A luxury sized deep sea yacht. Sleeps 8-12. Materials: $8.000.00. Takes about 14 man months to build.

THE *POLYNESIAN CATAMARANS*

DESIGNED BY

JAMES WHARRAM

Poste Restant, Deganwy, North Wales.

James Wharram was re-introduced to A.Y.R.S. in publication No. 59 where we showed his 34 foot *TANGAROA* design and explained his whole design philosophy which can be summed up as "producing safe, cheap-to-build, load carrying, shallow draft, fast catamarans". He now has sold plans *AND HAD BOATS BUILT* in such numbers that it appears his designs are exactly what very many people have been waiting for. The reasons for this are: (1) They allow a man to get sailing at the least possible expense in work and money; (2) They give him a little more speed than conventional yachts of the same length and fantastically greater cost; (3) James is still living with his family aboard his *RONGO* so that his designs will have had the benefit of female criticism and hence are likely to please the ladies. Of course, his ocean voyages with his family and his projected voyage around the world show people that Jim designs from the point of view of the deep sea and this gives confidence as nothing else can.

The Hull Design. This has the same shape for all James' catamarans within the constrictions of relatively differing desplacements. In other words, he has found a shape which is sea-kindly, has enough lateral resistance without appendages in the way of boards or low aspect ratio keels and is fast. Obviously, he would be unwise to change it, except to fit in more or less displacement as required for an individual design. The accommodation and constructional details of course vary with each design.

The Rigs. James favours the spritsail rig or, as with the *ORO* design, the native Polynesian sail. Both have brails which furl the sail quickly and easily and this must be a Godsend for an ocean cruiser, though useful any time. However, people will insist on the fractionally faster modern rig with which they are familiar, though the *ORO* rig must be excellent in view of our knowledge of the performance of the *WISHBONE* Rig.

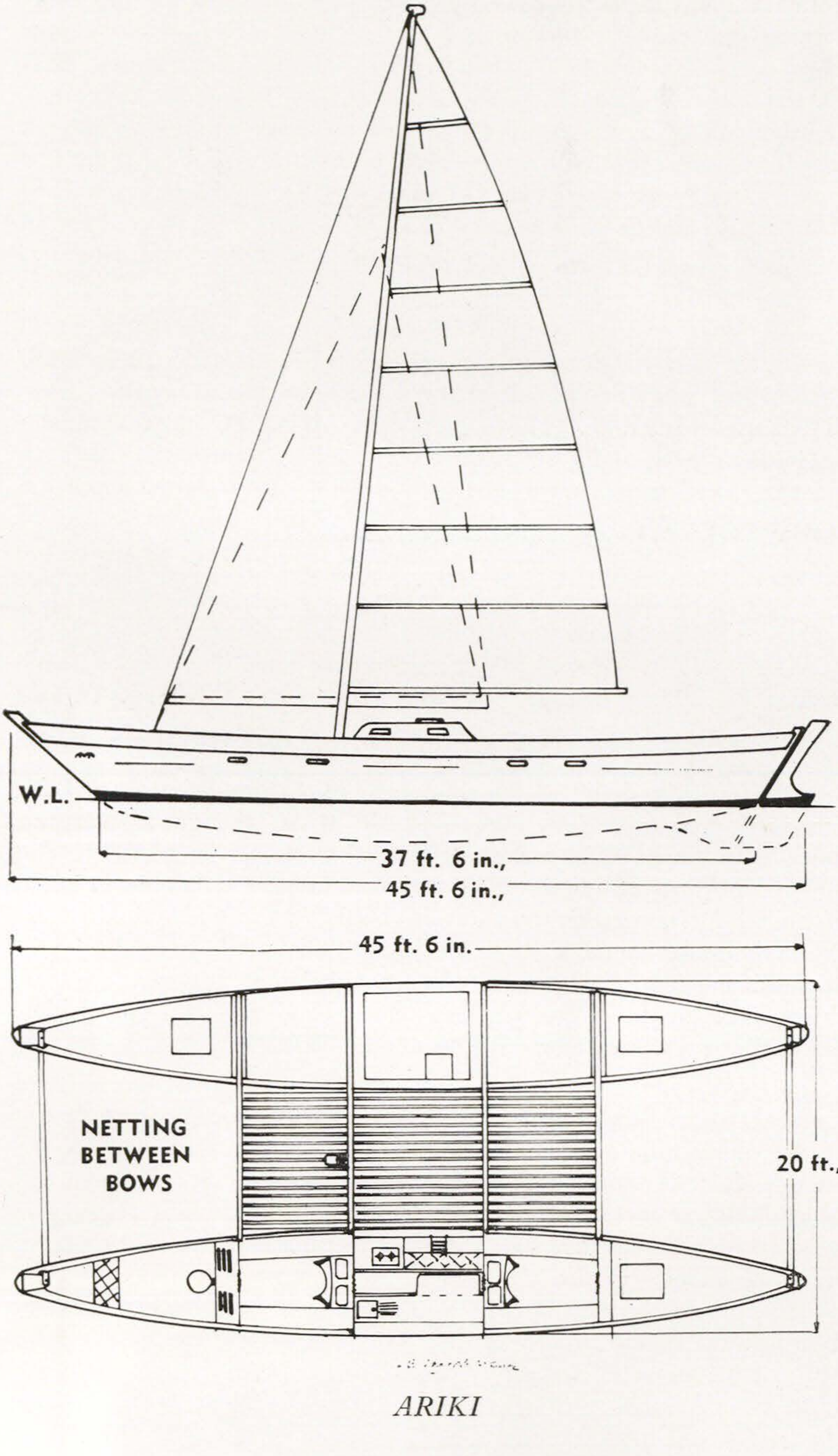
ARIKI

L.O.A.	45 ft. 6 ins.	Sail area, 700 sq. ft. (40 ft. mast).
L.W.L.	37 ft. 6 ins.	Displacement, $3\frac{1}{2}$ tons.
Beam	20 ft. 0 ins.	Sail area/weight ratio, 200 sq. ft./ton.

Designer: James Wharram, Deganwy, North Wales.

ARIKI was designed for an Australian to build for himself for the 1968 Single-handed Trans-Atlantic Race, though it was not finished in time. The expected cost of materials is £1,000. The builder has insisted on the high aspect ratio Bermudian rig in place of Jim's fully battened ketch and this should certainly give the boat an excellent performance, though I think a "Ghoster" would be badly missed if not used. There must be few things more aggravating than sitting alone in the middle of the Atlantic in a very light air wishing one had spent the extra money on such a sail.

ARIKI cannot expect to have a very high top speed owing (dare I say it?) to her canoe stern squatting though this doesn't show in any of the sailing photographs I have seen. Jim thinks she will do 15 knots at full tilt and he may well be right. Where she will score will be at the lower speed range (where her canoe sterns will help her) and this will help her average speed which Jim thinks will be in the region of 10-12 knots. If she averaged 10 knots across the Atlantic, she would cross in $12\frac{1}{2}$ days but she would not have been likely to do this to windward in the Single-handed Trans-Atlantic Race.



ARIKI

HINA

L.O.A.	22 ft. 0 ins.	Draft	1 ft. 0 ins.
L.W.L.	18 ft. 6 ins.	Weight	700 lbs.
Beam	10 ft. 0 ins.	Loading capacity	1,000 lbs.
Hull beam	2 ft. 6 ins.	Sail area	173 sq. ft.

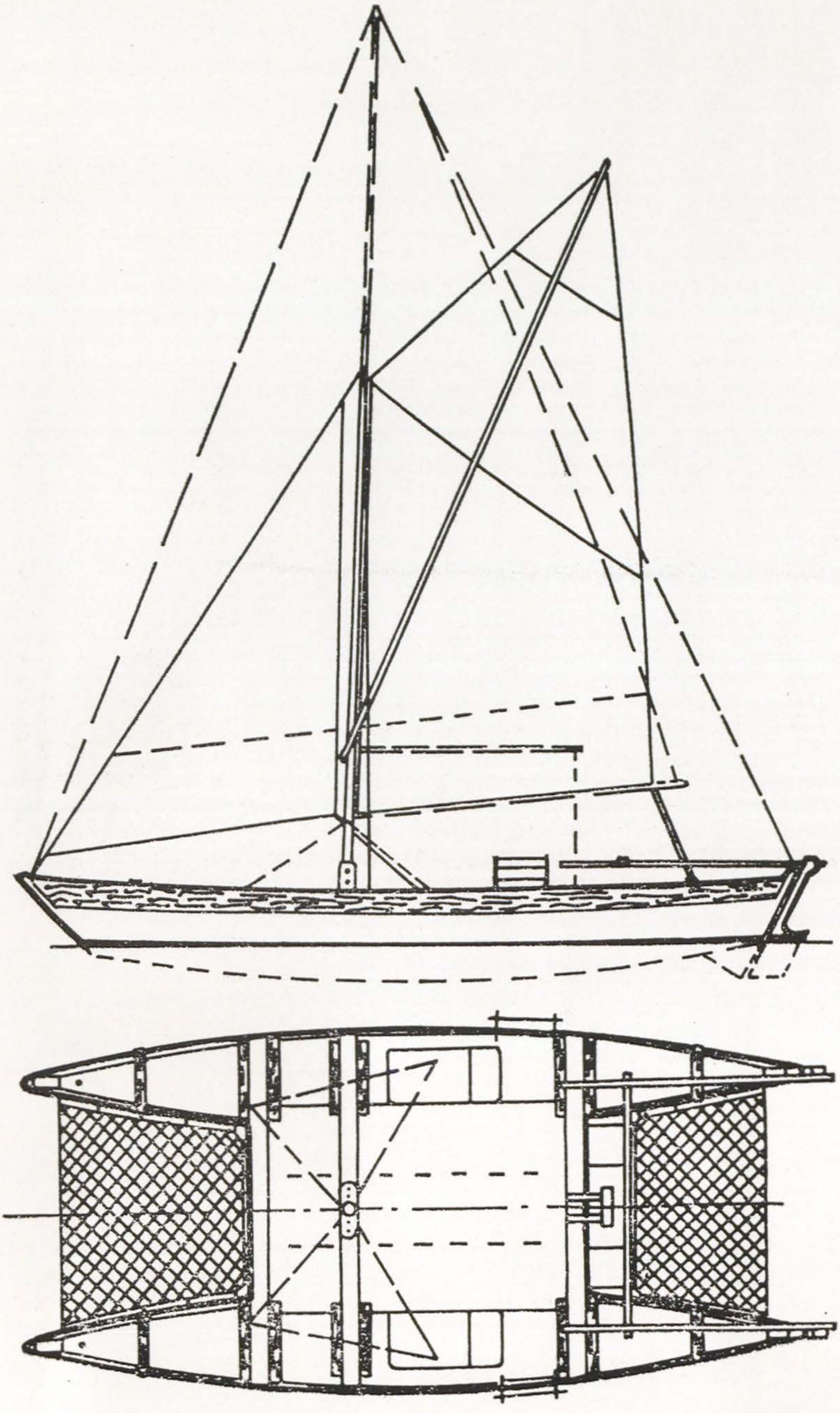
Designer: James Wharram, Deganwy, North Wales.

HINA is a day-sailer and "Overnighter" which can be taken to pieces for trailing. Bunks have been built into the hulls by some. though this is not recommended by the designer. Instead, a canvas

HINA—Bermudian rig.

or Terylene (Dacron) "cuddy" can provide shelter or a tent can be put up for sleeping. Designed for family sailing, coastal cruising or fishing, *HINA* is a boat which will be an ideal introduction to sailing for any youth or any youthful person of any age who has the capacity to use his hands to build her and thus learn the "feel" of the boat herself, as well as the "feel" of sailing.

Cost of materials, including sails: £120-£150. Building plans: 8 guineas. Study plans and photos: 10s.



HINA

HINA—Sprit rig.

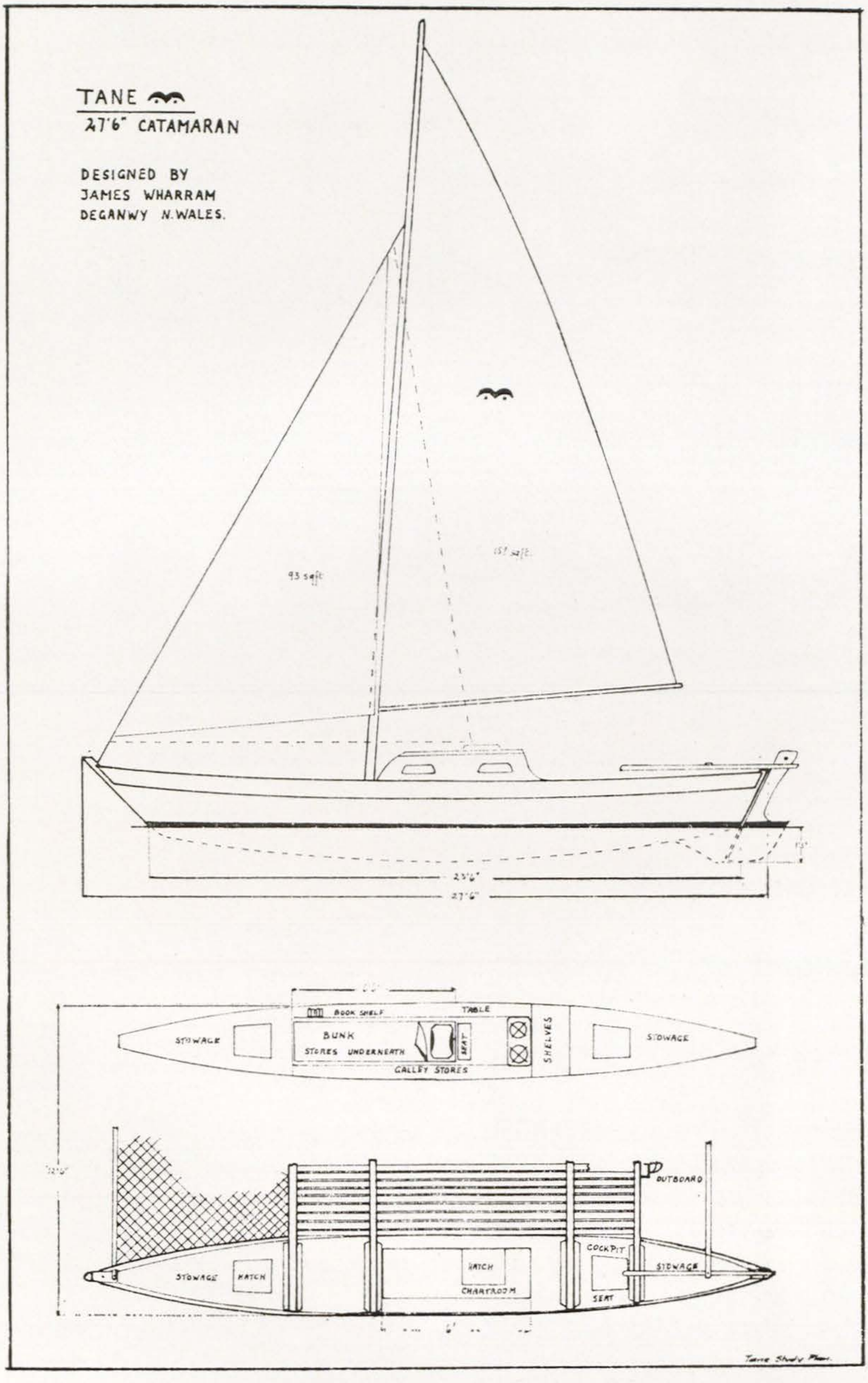
TANE

L.O.A.	27 ft. 6 ins.	Hull beam	3 ft. 0 ins.
L.W.L.	23 ft. 6 ins.	Draft	1 ft. 3 ins.
Beam	12 ft. 6 ins.	Sail area	227 sq. ft.

Designer: James Wharram, Deganwy, North Wales.

In the Thames Estuary and, I should think in many other places as well, there are several men who appear from nowhere during the Summer and sail small boats from anchorage to anchorage, meeting up in the public houses for company. *TANE* would make an ideal boat for such characters. The shallow draft, speed and seaworthiness with the simple accommodation is just what they need and one can easily imagine such a pipe-smoking man coming into the "hard" at some remote place and making his way to the "pub".

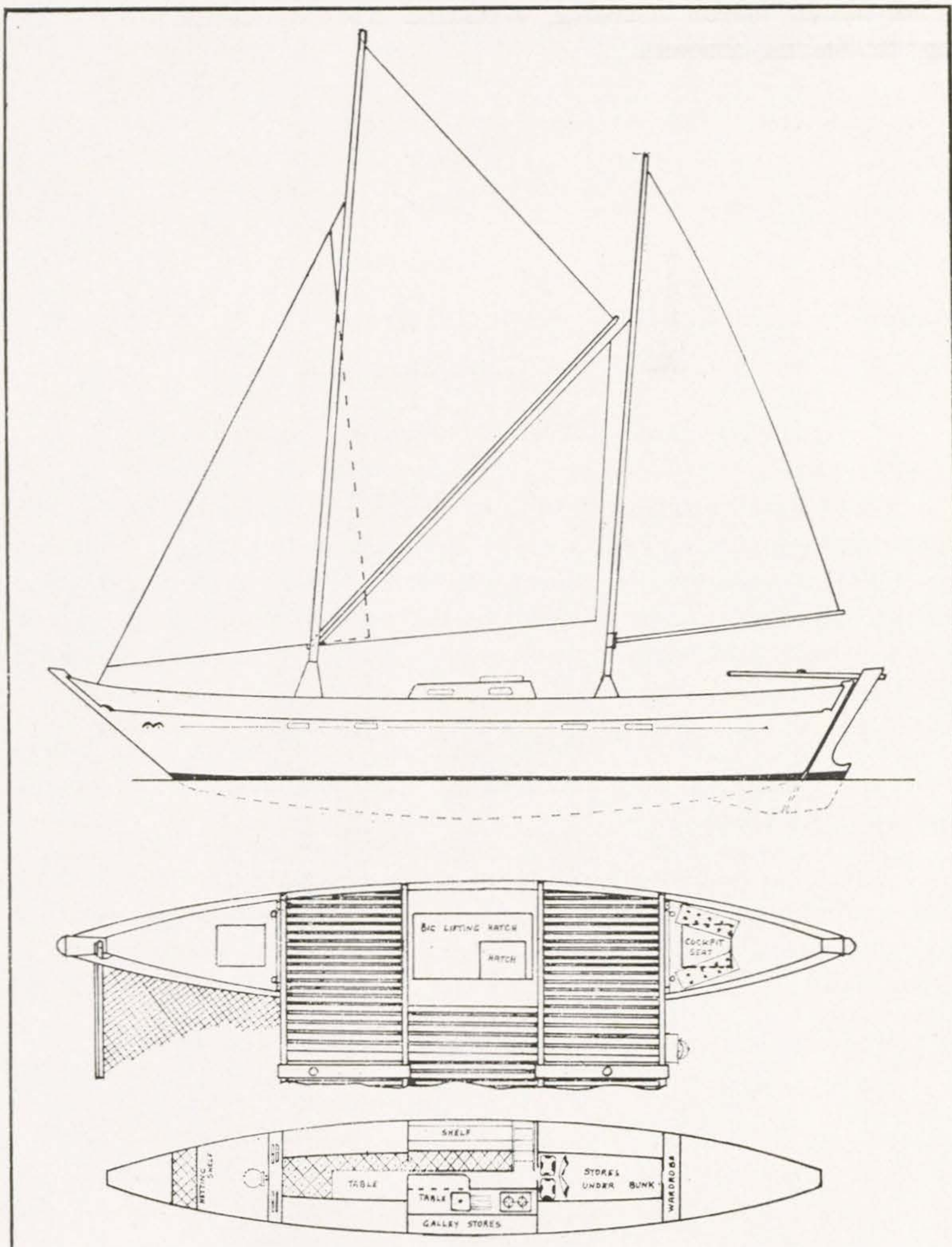
However, *TANE* could easily cruise far afield for the more adventurous and no doubt eventually someone will sail one across the Atlantic.



TANGOROA

L.O.A. 34 ft. L.W.L. 28 ft. 6 ins. Sail area 400 sq. ft.

This design was described in A.Y.R.S. No. 59 (alas, out of print). It is the smallest of his designs which Jim thinks suitable for ocean cruising.



NARAI

NARAI

L.O.A.	40 ft.	L.W.L.	32 ft.	Sail Area	600 sq. ft.

This design replaces the 40 ft. *RONGO*, being easier to build and faster to sail.

She is suitable for family ocean cruising, weekend cruising for 8 or racing, depending on the rig chosen.

ORO

L.O.A.	46 ft. 0 ins.	Draft	26 ins.
L.W.L.	35 ft. 3 ins.	Headroom	6ft. 7 ins.
Beam	20 ft. 0 ins.	Sail area	750 sq. ft.
Hull beam	7 ft. 0 ins.	Load capacity	3 tons.

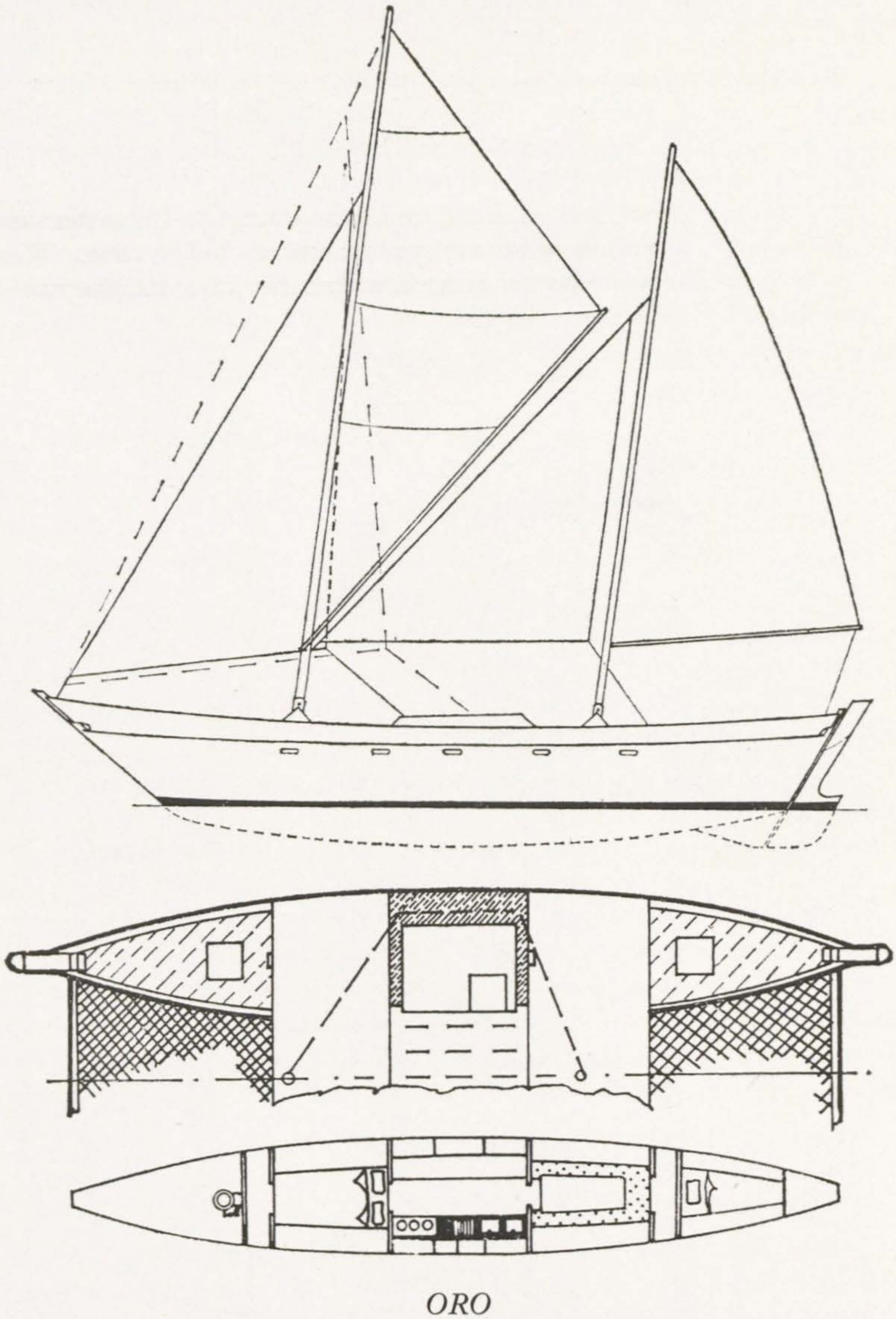
Designer: James Wharram, Deganwy, North Wales.

ORO is the cruising version of *ARIKI*, described above. The freeboard is higher and the rig will be far easier to manage. She can be built and equipped for about £1,000 in 1,000 working hours and should sail at an average speed of 8-10 knots across an ocean. There are 4 private bunk cabins, each with a double bunk and an 18 in. deep and 6 ft. wide wardrobe.

The two "working" cabins, with galley and chartroom/library/office are 7 ft. 6 ins. long and 7 ft. wide at deck level. Extra people may sleep in these.

The main hatches lift off as on a cargo ship, so that sun and air can enter the yacht in warm weather. Designed for fast all-weather weekend sailing for 6-8 people or 4-6 people during ocean voyaging, *ORO* could also be used for charter work or as a small expedition ship.

Building plans: 60 guineas. Study plan and photos: 30s.



ORO

Quotes from HINA Builders.

After his first sail on his *HINA*, (*KAIMILOA*), one Dutch builder, Mr. E. B. Lautier, wrote:

"She was just amazing. Her performance was even much better than we had dared her to be. She was faster, made less leeway, and was more manoeuvrable than we had expected. Her balance is perfect, and she can be steered with one finger.

"At low speeds, the boat is accompanied by a stern wave between the hulls, which can even turn over in shallow water. When speeding up, the boat is going faster than the wave, and the wave disappears. This clearly illustrates that a boat can really go faster than the wave she generates without surfing."

Later he said:

"Up till now, we have been beating Class II and III *RORC* racing on the Ysselmeer."

Then, on holiday in Spain, he wrote:

"Yesterday, we sailed from Miami Plays to Jarragona, about 17 N.M. in 2 hours, 5 min. in moderate winds. (4).

After the holiday:

"We have had four weeks of glorious sailing on the Mediterranean. *HINA* is just the craft to operate from a beach: the way in which she takes off across the surf is surprising."

"Our last sail of the season was a truly glorious one; from Durgerdam (Amsterdam) to Nijekerk on the Ysselmeer. In the harbour of Durgerdam we measured the wind: force 5-6. All other boats that left the harbour, (not dinghies, but cruisers from 7 m. to 10 m. o.a.) reefed down. So we too put one reef in the mainsail, but whereas the others kept their reefs, we found that we did not need it, so after ten minutes, we shook it out. The water was choppy, the sun was shining, it was a splendid day.

For the first time too, we were able to measure some speeds accurately:

Pampus to Muiden: 3.45 m., 19 min., 12.2 knots.
Muiden to Nijkerk: 13.68 m., 93 min., 8.95 knots.
Overall speed Pampus-Nijkerk, 9.35 knots.

"This, I think, means that the topspeed will have been around 15 knots. And during the second part of this run my son was quietly sitting in the lee hull, preparing ham and eggs! (We have installed a little galley in the port hull).

This builder's *HINA* has a Bermudan Rig and Wing Mast.

A builder in the South of England, Mr. David Buck, who launched his *HINA* during the summer, ran before half a gale in the Thames Estuary.

"I don't know how fast she went, but she seemed jet-propelled and manoeuvred very easily. We broke out the sails just after Greenwich and reached Hole Harbour by Canvey Island in a couple of hours. A yacht we passed came into the same anchorage four hours after us."

An Irish *HINA* builder, Mr. Tom Browne, was very pleased with his boat, as he sailed it all through last winter, and summer, often alone.

Another Irish *HINA* builder wrote saying:

"We have never sailed a catamaran before, and its stability even in rough seas, amazed us. I shall build one of your bigger designs after I have had a full season of sailing the "*HINA*.""

After the maiden trip in his *HINA*, another Dutch builder, Theo Gruter, wrote:

"Since our last communication, the *TIKI ROA* has been finished and made her maiden trip along the Dutch sandy coast with two fellows in her bunks. It was about 160 miles, and we sailed in every type of weather. We sailed in wind forces 2-7, without having to reef. Only by force 7 was there any water on the fore-deck. Our *HINA* is very strong, and the sprit rig made the trip very well.

"*HINA* made some very high speeds, about 15 knots during half an hour."

The *HINA* here in Deganwy, is owned by Martin Lowe, a schoolmaster at St. David's College, Llandudno. He uses it for sailing instruction for his pupils, saying that he "can teach 6 boys at once as against 1 boy in an Enterprise or similar dinghy".

(All the boats, except the first, are sprit rigged.)

One of our 27 ft. 6 ins. *TANE* builders, Mr. J. M. Gold of U.S.A. wrote:

"Your building method is the simplest and most easily done, I've ever seen!"

PELINDABA ex EBB AND FLO. Note jib on port hull.

PELINDABA ex *EB AND FLO*

BY

P. A. WOODS

Atherfold's Boatyard, Quay Lane, Gosport, Hants.

In the late winter of 1966 *EB AND FLO* came into my hands in very poor condition and trailing an unenviable reputation.

Working on hearsay of previous performance I decided that drastic changes were necessary apart from the work to "reconstitute" the structure.

Mr. Morwood confirmed the benefits of low aspect ratio keels and his suggested position, well forward, was the one in fact adopted. This has proved a happy choice, as, apart from sailing efficiency, harbour and anchorage problems are greatly simplified. Leeway is negligible both in a sea and in quieter water. Directional stability is excellent but in spite of this she turns like a dinghy when the helm is put down. Balancing the rudders has helped greatly in this. The only snag which appears insuperable and will have to be accepted is an insistence on shuttlecocking head to wind as soon as the way is off with no sail up. This trick, once realised, can be overcome by quick work with the stern line on those occasions when it is necessary to come alongside with an offshore wind.

The twin masts seemed unnecessary weight and windage so I dispensed with one and planned a rig giving a high headsail proportion. To take the new stresses a spar was made up of the discarded hollow box section booms which were glued either side of a solid beam. This formed a base on which to stand the mast and a spar to take the compression strains imposed by the four 10,000 lb. breaking strain rods completing a triangulation to support a 5 in. steel tube, transmitting the mast thrust through the bridge deck. The loading of this structure at the ends comes directly to the inboard gunwhales and is thence evenly dispersed in the hulls.

In this planning and that of the extra steel bracing which gives much needed ties between hulls and wing I was greatly helped by Mr. Marshall, of Marshall and Nicholson the original builders, who in a most delightful manner shot down my wilder flights of fancy and passed only ideas which would feasibly work. He really has to take the credit for the fact that the structure stays together and looks likely to do so for some years to come.

The interior had to be altered to suit the work of sail training and this was done with a total weight saving of 420 lbs. Mast, boards, cases, superfluous water tanks, pumps and piping account for a balance to make a total saving of 2,030 lbs. leaving a final weight of under five tons ex. stores, crew and baggage.

Sail area remained at 1,000 sq. ft. giving a very satisfactory power to weight ratio.

The dinghy type rudder blades were given a three inch leading tab so that when lowered they are in pivotal balance.

Performance

The first sail looked like disaster. The yard launch towed *PELINDABA* to clear water where she proceeded to sit sullenly—a lifeless collection of sticks, string and rag.

I was towed back ignominiously and replaced the patent steering system, which I had dreamt up, with her original rudders.

The second sail we pushed out to clear water with the rubber dinghy—repeat performance.

Desperate, I scooted her off with the dinghy and she suddenly came to life flying off at a huge rate and controlling like a thoroughbred—until we came about and had to start all over again.

This obviously wasn't going to do for sail training or any other kind of cruising.

Back to base again. This time I centralised the swinging bowsprit and fitted a strop and strut to carry the headsails 18 ins. further forward. This worked and she could be put about with exact attention to the foresheet handling.

Still not good enough for the purpose. Experimental tabs to balance the rudders was all I had time for before the first customers arrived.

Fortunately they were old hands from other cruises and they carried me through a very shaky first week. We consolidated the rudder experiment and changed the mast spreader arrangement. We then cleared out of Poole to make a 10 hour passage in light winds to Alderney.

From then on we never looked back and I dropped into the seasonal routine, crossing the channel once a fortnight and making my usual rounds of the islands and various ports of the Bay of St. Malo and the Cherbourg Peninsula. I covered some 2,000 miles in all conditions of sea and wind with crews of varying competence and strength.

Passage time were much the same as they had been in my 60 ft. monohull and occasionally there were bursts of high speed. I had obviously to "nurse" her because of the nature of the work.

Stability was fantastic and never once did she show the least tendency to lift a hull.

Once while surfing against a full spring ebb in the Alderney Race I pulled her away out of sheer funk at the chasm ahead. This was entirely unnecessary as I later proved she could ride these waves until they subsided.

In September the time had come to push her and while steaming past Calshot in a force 7, the bow strut—a beautiful hollow spar—disintegrated.

This forced me into trying a double headsail rig, unbalanced and of a very "lash up" nature.

The results were startling as she suddenly became a most good natured boat, tacking 90° with the sureness of a dinghy, sailing 10 knots to windward with no sense of strain and going very fast on all points of sailing.

I don't know why—it looks all wrong—but that is how she is going to be next season, without the "lash up".

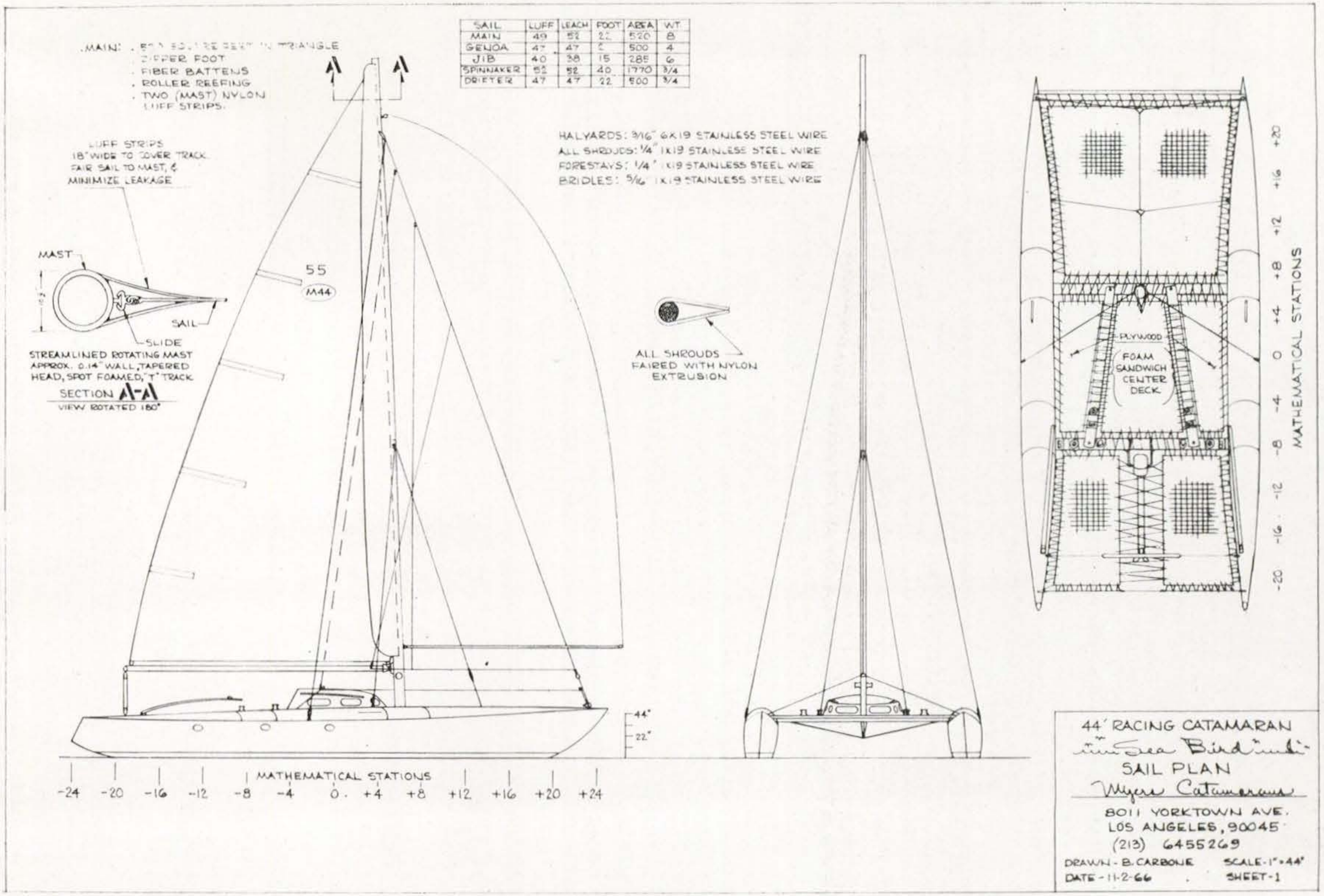
SEA BIRD

L.O.A. 44 ft. Sail area 1,020 sq. ft.

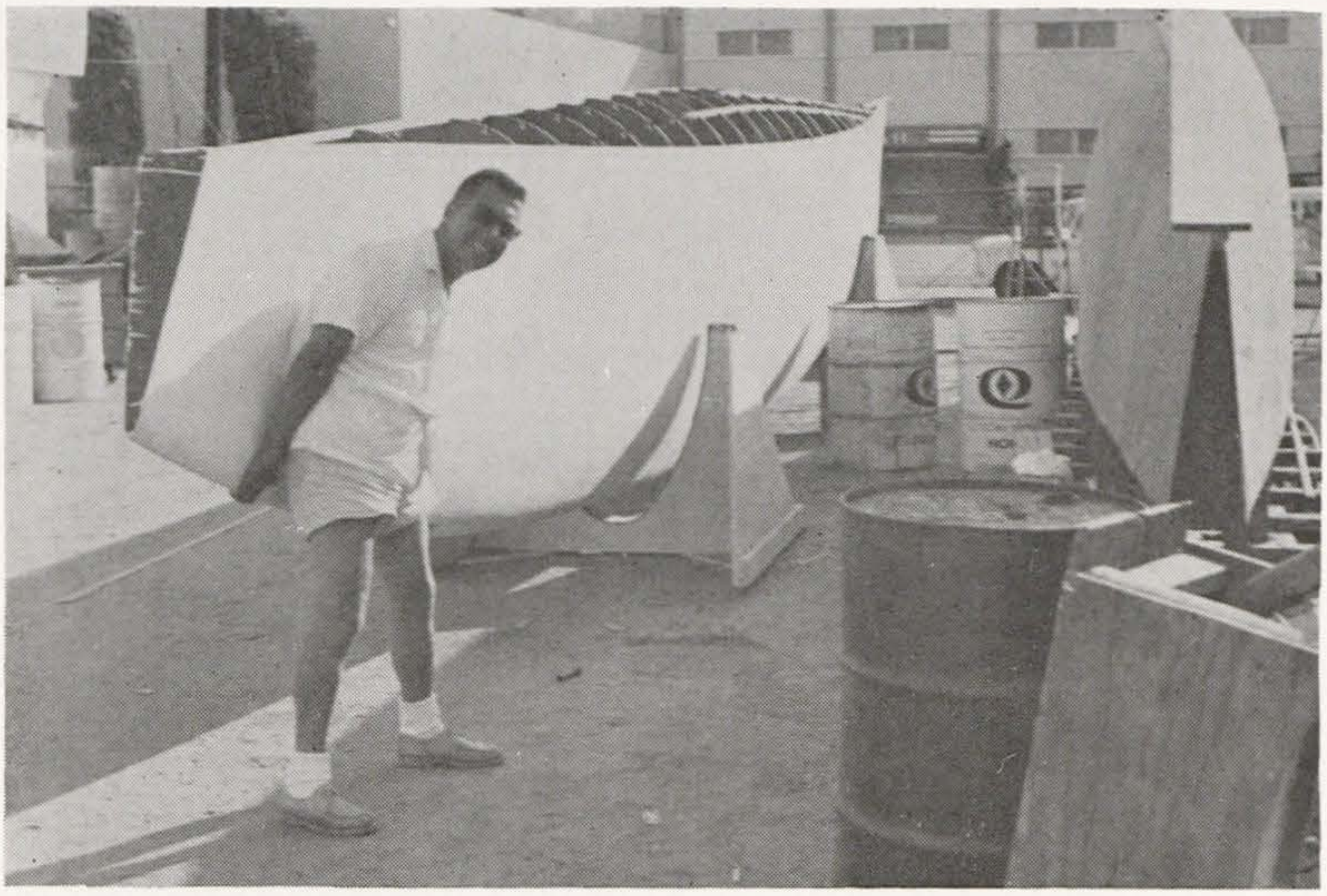
Designer: Hugo Myers, 8011 Yorktown Ave., Los Angeles, 90045, California.

I have before me two papers by Hugo Myers: "Tank Test Results for Fine Exit and Full Stern Light Displacement Hulls" and "Theory of Sailing—With Applications to Modern Catamarans". These are both excellent papers and, doubtless, members can get copies from Hugo if he has them. What they show, however, is that there is little to choose between various catamaran hull shapes, though this is discussed in greater detail later.

As a result of these tests, Hugo has designed *SEA BIRD* as an all out racing catamaran with the only accommodation a little cuddy amidships. The design is of the usual West Coast style which has been



MAIN: ZIPPER FOOT
FIBER BATTENS
ROLLER REEFING
TWO (MAST) NYLON LUFF STRIPS.
LUFF STRIPS 18" WIDE TO COVER TRACK FAIR SAIL TO MAST, & MINIMIZE LEAKAGE
MAST
SAIL
SLIDE
STREAMLINED ROTATING MAST APPROX. 0.14" WALL, TAPERED HEAD, SPOT FOAMED, "T" TRACK
SECTION A-A
VIEW ROTATED 180°
55
M44
SAIL | LUFF | LEACH | FOOT | AREA | WT.
MAIN | 49 | 52 | | 520 | 8
GENOA | | 47 | | 500 | 4
JIB | 40 | 38 | 15 | 285 | 6
SPINNAKER | | 52 | 40 | 1770 | 3/4
DRIFTER | 47 | 47 | 22 | 500 | 3/4
HALYARDS: 3/16" 6X19 STAINLESS STEEL WIRE
ALL SHROUDS: 1/4" 1X19 STAINLESS STEEL WIRE
FORESTAYS: 1/4" 1X19 STAINLESS STEEL WIRE
BRIDLES: 5/16" 1X19 STAINLESS STEEL WIRE
ALL SHROUDS FAIRED WITH NYLON EXTRUSION
44"
22"
MATHEMATICAL STATIONS
-24 -20 -16 -12 -8 -4 0 +4 +8 +12 +16 +20 +24
PLYWOOD
FOAM SANDWICH CENTER DECK
-20 -16 -12 -8 -4 0 +4 +8 +12 +16 +20
MATHEMATICAL STATIONS
44' RACING CATAMARAN
SAIL PLAN
Myers Catamarans
8011 YORKTOWN AVE.
LOS ANGELES, 90045
(213) 6455269
DRAWN - B. CARBONE
SCALE - 1" = 44'
DATE - 11-2-66
SHEET - 1



SEA BIRD hull being lifted to show light weight.

shown to be very fast indeed when built very lightly and raced hard. It is odd, however, that the British and American East Coast shape, which is very different, also seems to be very fast. It is a great pity that tank tests between the two hull forms have not yet been done.

COMMENTS ON THE MYERS TANK TESTS

BY

JOHN MORWOOD

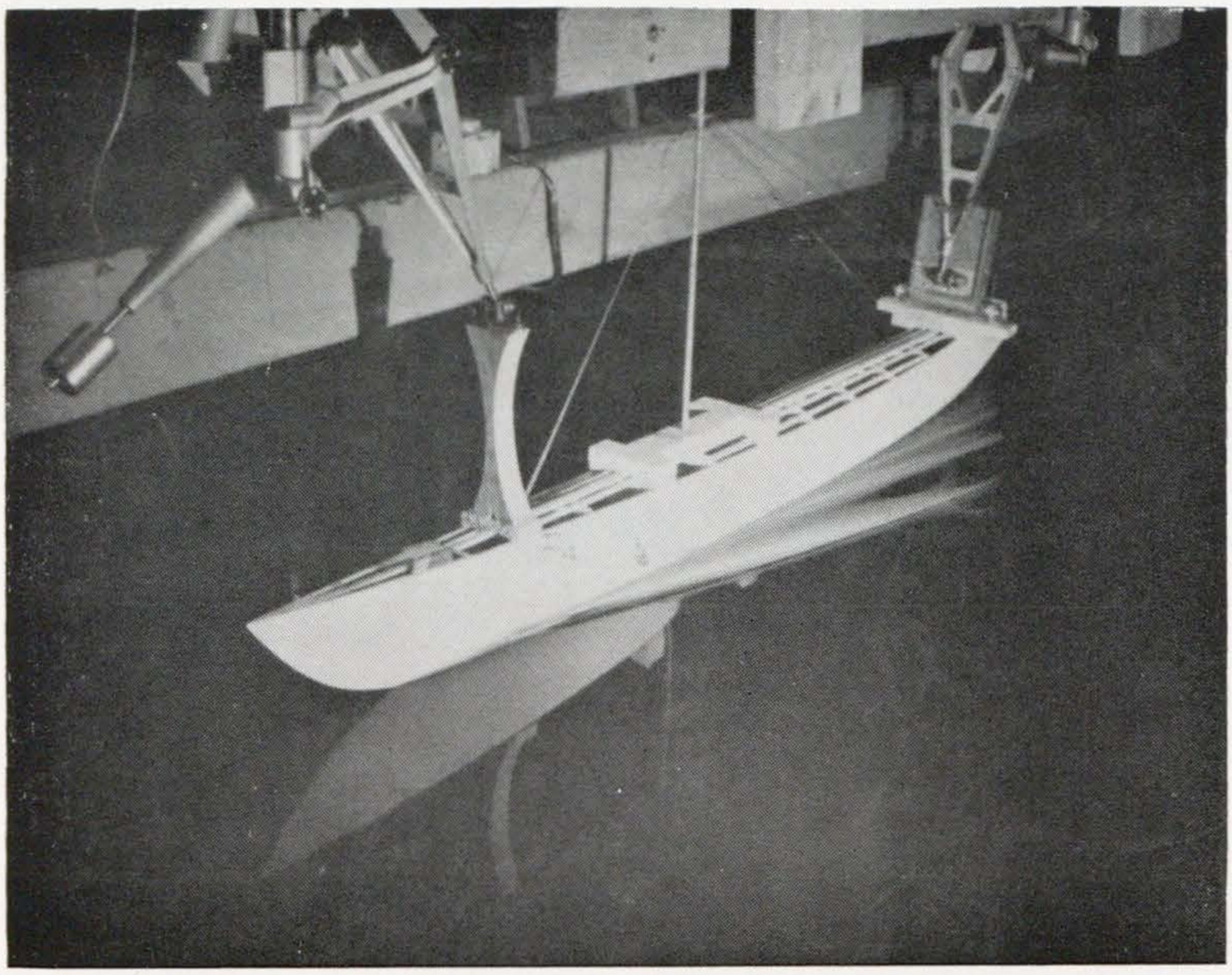
Hugo Myers paper is very interesting and what the present state of catamaran and trimaran design needs to get the last few per cent of perfection. The only other catamaran tank tests of which I know and are relevant to modern design are those of Michael Henderson so only a limited comparison can be made.

The Myers Testing Technique

Unfortunately the two models were not tested in the same tank and, while tank tests are pretty comparable between tanks, alas, there are variations. In my opinion the points which appear are as follows:

(1) The transom drag at low speeds is a serious cause of resistance. This in direct conflict with Mike Henderson's tests.

(2) Wetted surface is of the utmost importance up to 1.4 speed/length ratio which is 8.4 knots for a 36 foot waterline hull. In the tests, a rather high wetted surface hull was used for comparison from the *YEH* series at the David Taylor Model Basin, even though the beam/depth ratio was 2:1 which is, of course, the ratio of a semi-circle.



SEA BIRD hull being tank tested.

Conclusions

Within the confines of these tests i.e., not with leeway, my conclusions are the opposite of Hugo Myers. These are:

(1) Hulls should have semi-circular sections from the maximum to the bow, which, for best speeds should be a near vertical stem with its lower end immersed. This is a pitch-damping shape as shown so well in the *QUEST* designs by Cummingham. The buoyancy in the bow should be as far forward as one dares while still having a fairly fine bow.

(2) The stern sections should either be the main semi-circle raised up or they should be flat semi-ellipses—I don't know which. The question of the immersion of the transom I have no opinion on either. Mike Henderson's *PETANQUE*, with a 6 in. immersion on a 20 ft. catamaran seems extraordinarily fast, however.

Seakindliness. Transoms vs Fine Sterns

People get emotional about seakindliness because the evaluation of this feature is not precise. It is therefore often a matter of opinion. I will now try to be precise and will publish any arguments for or against my opinion, if couched in the same terms. I will only talk of pitch as roll characteristics of all cats are similar.

Stern Seas

Imagine a 36 ft. cylinder representing a transom-sterned boat, lying stern-on to the seas. Its maximum pitch angle will be that of the average waves slope of a 72 ft. wave, crest to crest. This angle is small and possibly 10°.

On the other hand, imagine a barrel with slightly buoyant planks extending out fore and aft representing a fine ended boat, to make a 36 ft. overall length. A stern wave here will not lift the stern plank until it is almost all immersed. It will then give the stern a big push up with a shorter lever arm i.e., the push up comes later. The motion should therefore be less violent. However, with fine bows and sterns, the damping of the pitch is less and, if the period of encounter with the waves is wrong, the total pitch may exceed the wave slope angle. Hugo Myers states that there is ". . . a greater pitch amplitude (but lower frequency)". From the foregoing argument, I guess that it is better expressed as "A greater pitch amplitude but lesser pitch acceleration".

Bow Seas

Let us assume that both transom-sterned and fine sterned cats have the same shape of bow but the maximum section is placed further aft with the former. The difference between them will then only lie in the fact that the transom-sterned boat will pitch around a point further aft in the hull. This will increase the period of pitch and lessen its amplitude. This means that the transom-sterned boat will be at its most uncomfortable state in a longer head sea that the fine-sterned boat. This comfort will be increased by the pitch centre being nearer where the crew are placed. The lesser pitch amplitude means that the bows will dig in less.

The Forward Movement of the C.L.R. on Heeling

I cannot see Hugo Myers' point here. I would have thought that, on heeling, far more forward movement of the C.L.R. was required (due to the lessened resistance on the weather hull) than could be obtained by the fore and aft asymmetry of a transom-sterned boat dipping by the bow on heeling.

The Case for the Deep Sectioned Hull

Bob Harris tried this section for his *OCELOT* as a racing catamaran early in the tide of modern development. It was a *pleasant boat* but not as fast as the rounded sections of his later *TIGER CAT*. And boards in each hull were necessary. Roland Prout's experiments with low aspect ratio keels on his "A" Class *BAMBI*, on the other hand indicate that a deeper hull shape than the semi-circle may be the best to windward. One conclusion which could be drawn is that catamaran hull sections for the best windward work could be the same as those of the conventional deep keeled yacht e.g. "wine glass" with a waterline beam to draft ratio of 2:1, but of course of the smaller size associated with the multihull.

Dear John,

Thanks for your letter of 20 August. I waited until now to answer it because I had an opportunity to get back to Mecca—the U.S. Naval Ship Research center in Washington, D.C.—and visit the five towing tanks and Mr. Hugh Y. H. Yeh in person.

Mr. Yeh and I went over your article. On the point of the shift of the center of buoyancy and the center of lateral resistance as the leeward hull is immersed, at least one of your English books on yacht design puts great stress on the importance of preserving as much as possible a symmetrical fore-and-aft underwater profile as the hull is heeled, to prevent such shifts. If the C.L.R. shifts, a great helm is required, which can be of overriding importance.

I'll get a copy of the paper off to Mike Henderson. In our discussions of rough water effects, about all the Navy was willing to say they really believed was that fine, fast ships, such as destroyers, suffer a lower percentage of speed degradation in rough water than do the tanker types. They have not tested stern effects, but are intrigued.

So, that's about all the news this time. We hope to launch the 44 ft. racer in November or December.

Hugo Myers.

8011 Yorktown Avenue, Los Angeles, California 90045.

ICONOCLAST

L.O.A. 42 ft. Beam 20 ft. Draft 3 ft.
Sail Area

Designer: Pat Patterson, Foss Quay, Millbrook, Plymouth.

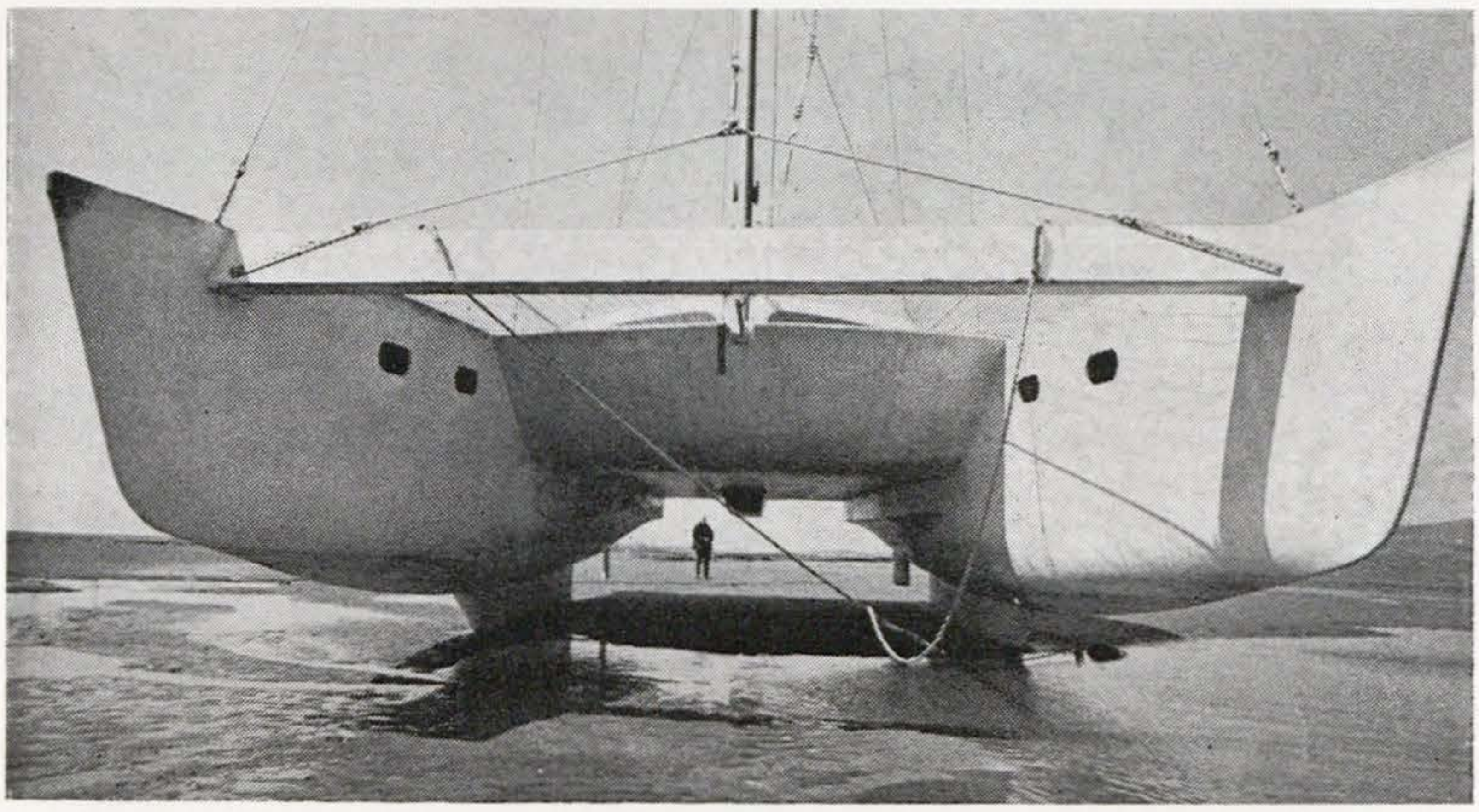
The original *ICONOCLAST* was built by Derek Kelsall of expanded P.V.C. foam sandwich with fibreglass to the *TORCAT* design with hulls similar to his *TORIA*. Actually, nowadays all hull shapes of this type are built to the suggestions given in our publications so they are all more or less alike with little room for originality. Pat Patterson writes:

"*ICONOCLAST* is a very successful cruising boat. Sailed against a good Class I Ocean Racer—9 foot draught, 56 feet long, she could hold her own in reaching conditions. Close hauled in light

ICONOCLAST—note keels.

going, the Ocean Racer was superior, possibly owing to the better sail wardrobe. In a force 4, on a 14 mile beat in a bit of a lop, up the loch to Stranraer, the Ocean Racer got in $1\frac{1}{4}$ miles ahead. She could just lay up the loch on the board, all the time on the verge of luffing. When I tried to lay the loch with *ICONOCLAST*, her leeway was too much. Paying her off and sailing much faster, she did better but obviously not as well as the other boat. I understand that that particular Ocean Racer cost something like 10 times as much as mine but I am so used to being as fast or faster than others that it was quite an eye-opener to sail against a boat of this class. As regards the 1968 Single-handed Trans-Atlantic Race, I have formed the opinion that, ignoring the human factor, it will have to be quite an exceptional multi-hull or exceptional wind conditions for a multi-hull to stand much chance against Tabarley's *PEN DUICK III* monohull.

"I am very pleased with the way *ICONOCLAST* handles. She is vastly superior to trimarans I have sailed and, as you know, they sail well. I was surprised to find that she would stay in a wind force 6 under main and mizzen (the jib block had broken). A trimaran normally has so much windage that it is usually necessary to back the jib in this strength of wind.



ICONOCLAST

"I am drawing the design out for amateurs to build of sheet ply. This is far less in cost than foam/sandwich, and I feel more practicable for an amateur to tackle. I also enclose a sketch of my *LOTUS* design. My correspondence has shown that there is a real need for a cat about this size suitable primarily for amateur builders. Personally, I would like to lower the sheer and the cabin. However, cruising people are more concerned with the accommodation than a spectacular performance, and rightly so.

"The *GOLDEN COCKEREL* capsize was rather a tragedy for cats. I notice that no mention was made of trying to gently luff her up as soon as she started to lift a hull. The only time I have been in this condition was in a Diamond 24 and this is what I did and she came down again very nicely. If one is over canvassed then, when on the helm, one can bear off to a run and loose the wind out of the jib if one has the wind fairly free. Otherwise, spill the wind by luffing. Once you start flying a hull, you have to act at once and this is quicker than trying to free the sheets.

"Cats make jolly good motor boats. In fact, I think they make better motor boats than sailing boats. I wonder how much longer it will be before this is generally recognised?"

Ed.—The vertical after ends of the low aspect ratio keels catch the mooring rope and Pat feels that they would have been better sloped up instead. My feeling is that they should also have been more sloped forward—about 20° *from the horizontal—and rather more pointed in longitudinal section.*

ICONOCLAST

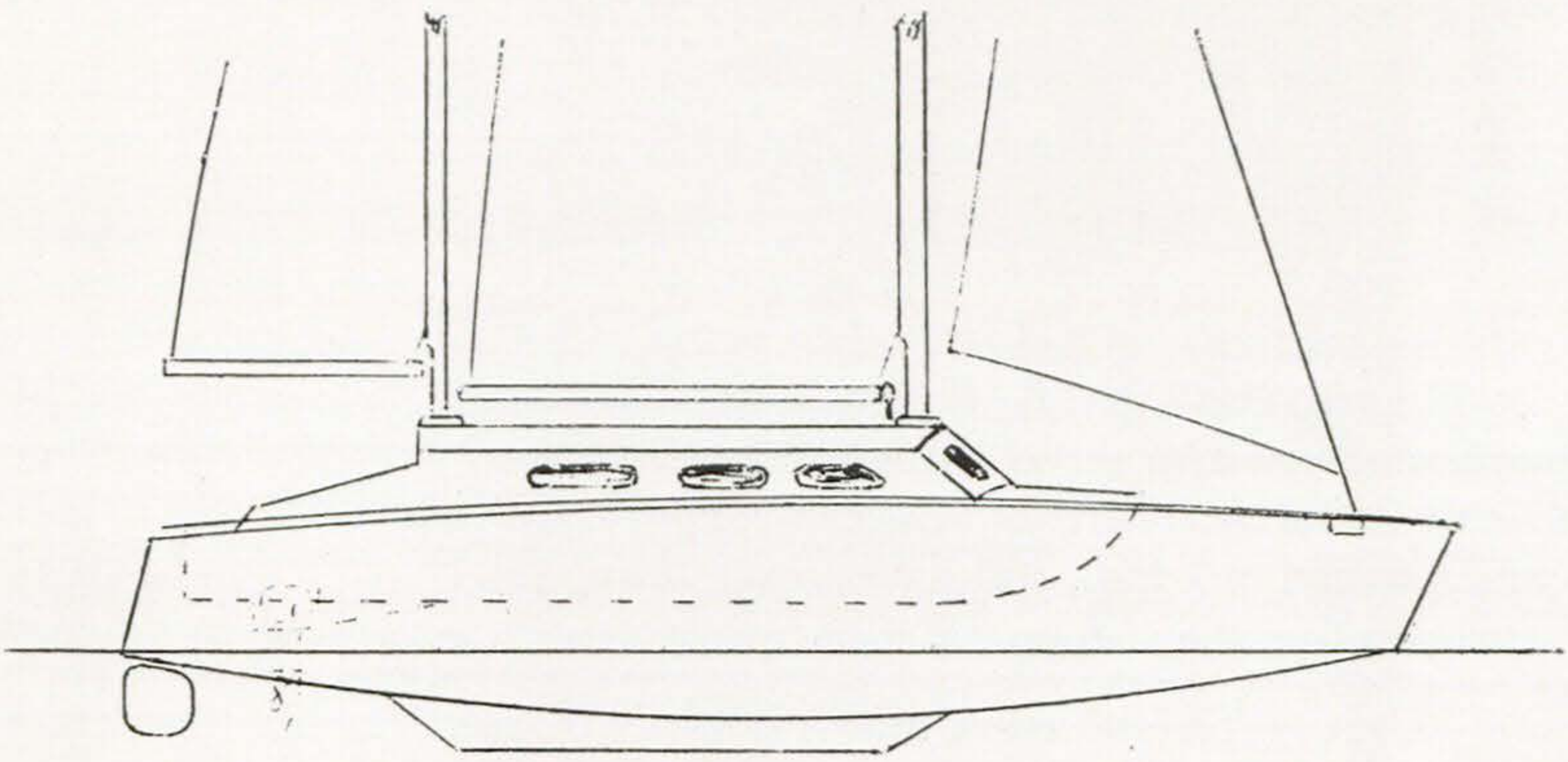
(Plywood version)

Plans copyright: P. & E. Patterson (Trimarans & Catamarans), Foss Quay, Millbrook, Plymouth.

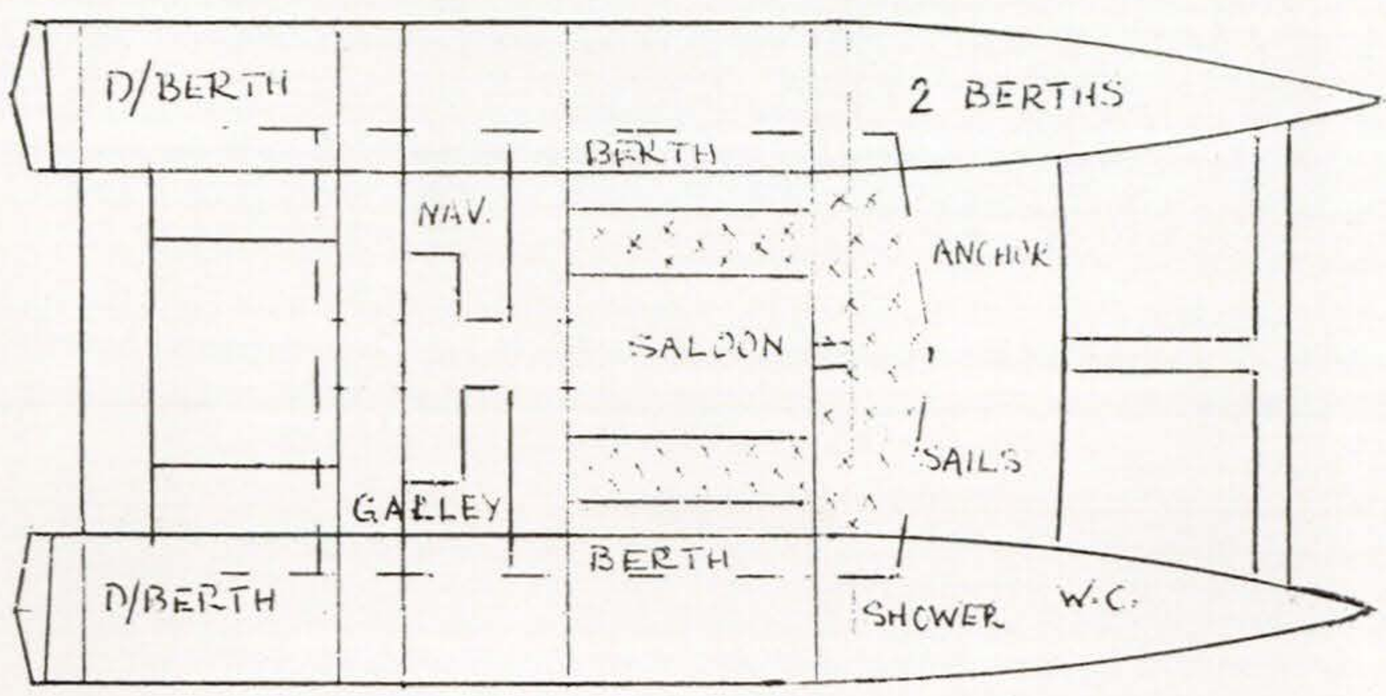
The prototype was launched in 1967. Plans drawn only after 1,000 miles of test sailing. The layout has been slightly improved. There is 6 ft. head-room in the hulls, and 5 ft. 6 in. in the bridge deck area. 8 berths are shown, and there is room to sleep 3 more in the saloon. Even though she is such a large boat, the designer has sailed her several hundred miles single-handed, and several hundred with just his wife and two young children. (On passage, the children played hide and seek!)

While performance is good on all points of sailing, she is rigged as a safe cruising boat, and is not intended to be an Ocean Racer. At some sacrifice to the accommodation in one hull an inboard engine could be fitted.

It is possible to build this boat using ply planking fibreglass sheathed, at a material cost of under £2,000.



"ICONOCLAST" L.O.A. 42' B.O.A. 20' DRAFT 3'



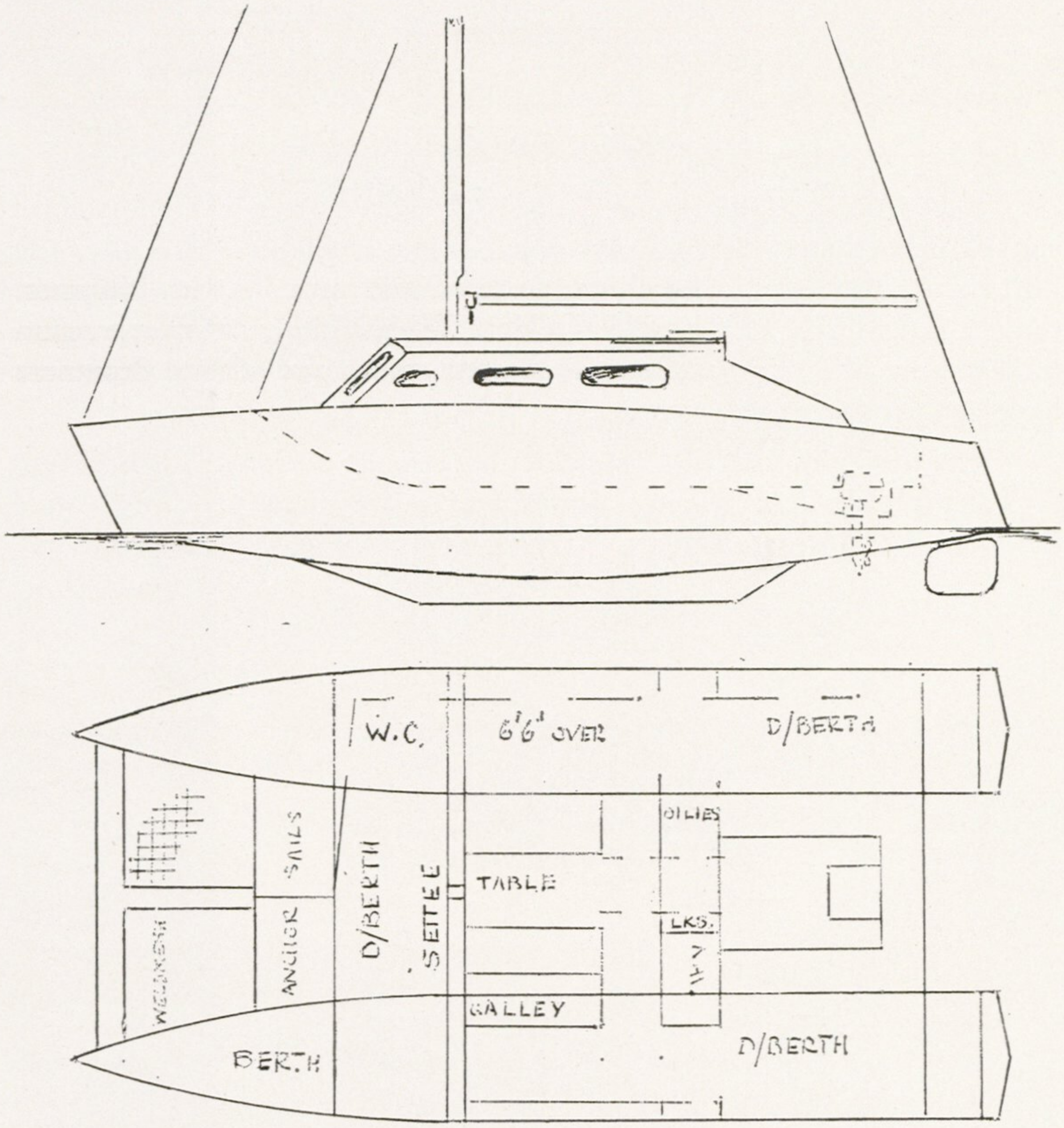
Derek Kelsall (of *TORIA* fame) helped considerably in the design and building of the prototype. Hull beam has now been increased to 4 ft. 6 in. Ketch rig is employed as it is felt that this is the best cruising rig, particularly when short handed or Ocean sailing.

LOTUS

L.O.A. 31 ft. 9 ins. Beam 16 ft. Draft 2 ft. 6 ins.

Plans copyright: P. & E. Patterson, (Trimarans & Catamarans) Foss Quay, Millbrook, Plymouth.

This is a cruising boat design. Emphasis has been placed upon good load carrying and a windward performance comparable with a modern 30 foot cruising sloop. As she has seven full size berths, she is designed to sit seven in the cock-pit and also around the saloon table.



LOTUS

The hulls can be built separately, upside down on a strong-back, righted, lined up by the keels, joined by through bulkheads and the underneath of the bridge-deck. The hulls are glass fibre sheathed with 6 oz. woven roving. The space forward of the bridge-deck is covered with "Weldmesh" galvanised steel wire net, and used as a working platform. Maximum head-room in the saloon is 5 ft. and 6 ft. 6 ins. in the hulls. Beam of the hulls is 4 ft.

There is more living room on a cruising cat than any other type of boat. Thought should be given to openness and space and NOT on filling up every available nook and cranny.

THE ACE—"A" CLASS CATAMARAN

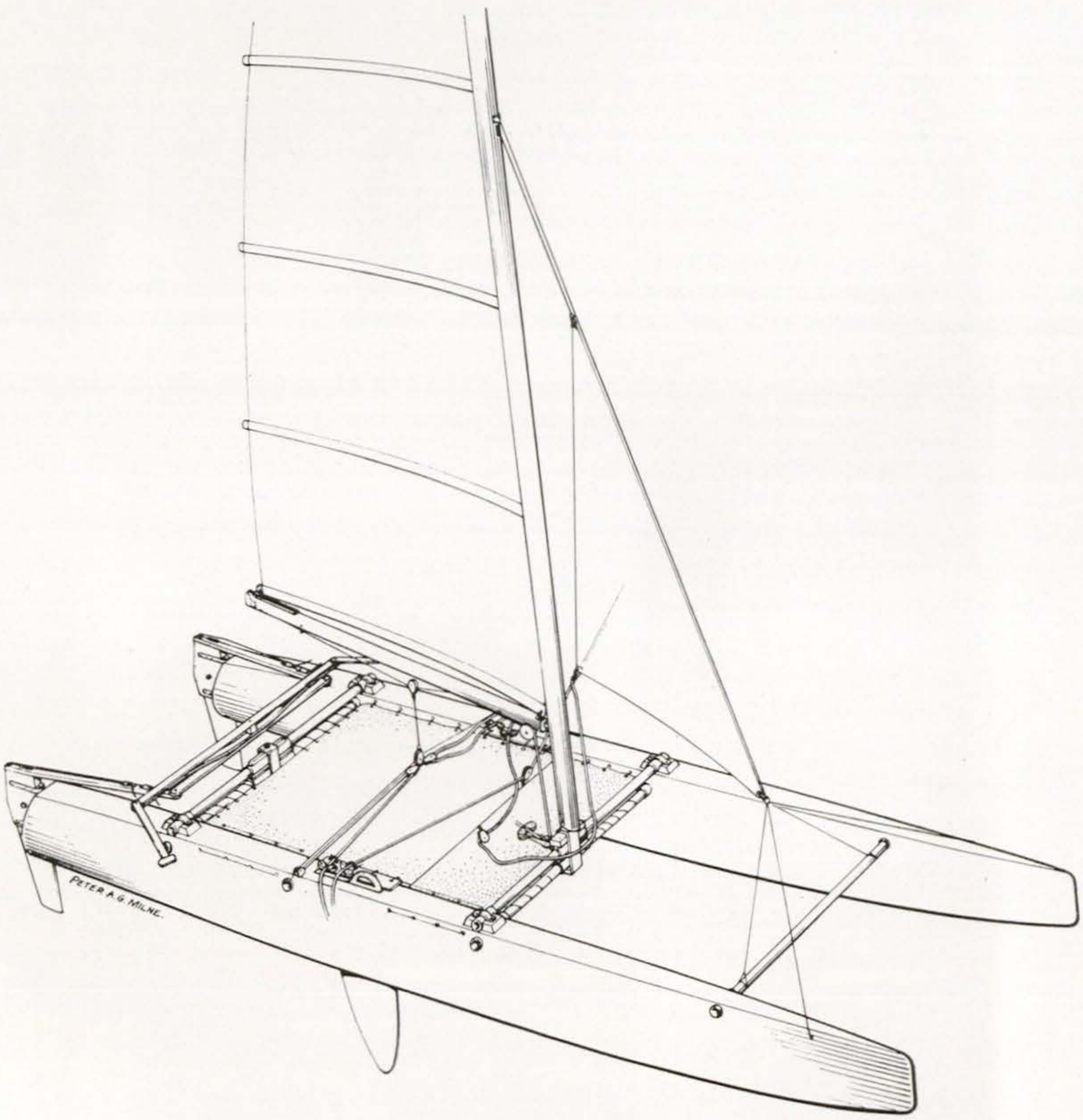
DESIGNED BY

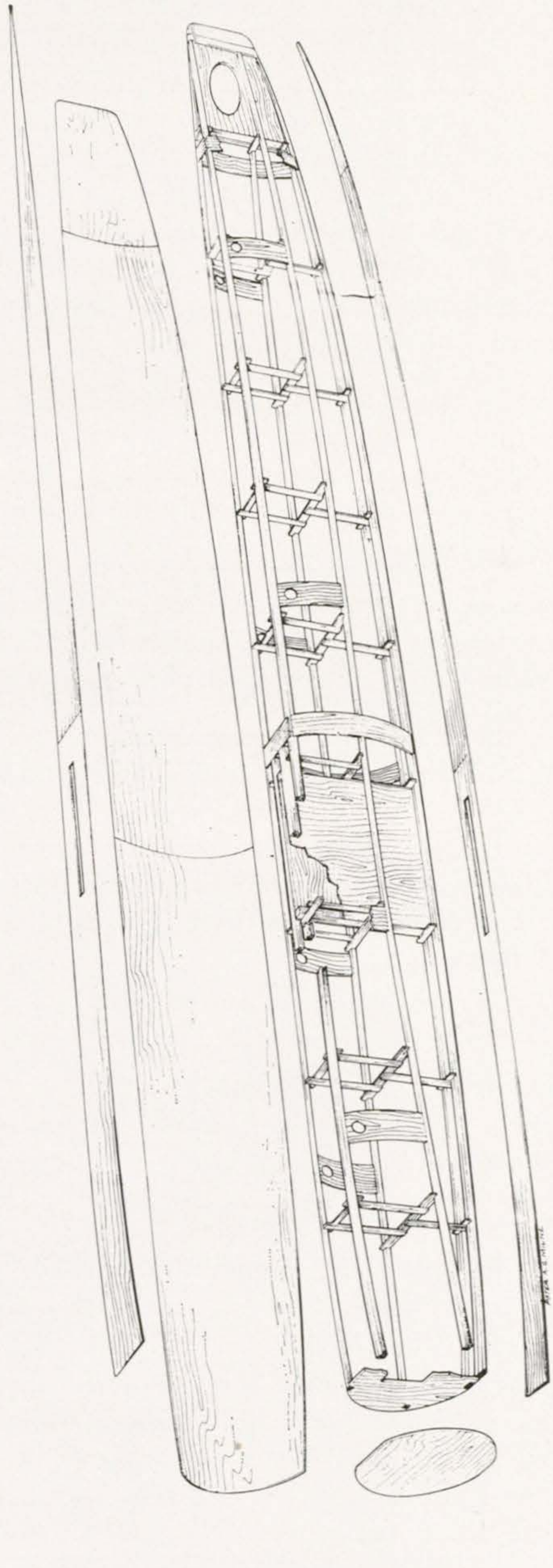
F. M. MONTGOMERY

77, Melvill Road, Falmouth, Cornwall.

The process of designing hulls to be made from sheet plywood started immediately marine plywood became available. Usually, the hull shapes produced were chined as they still must be with dinghies, though Uffa Fox's *PEGASUS* is a notable exception. However, slim hulls can be of a very good shape without chines and several designers have specialised in this type.

The first slim hull of a rounded shape to be designed for building of sheet plywood of which I know was a two-man paddling canoe designed by Norman Davies. This was a very good and completely





round bilge shape. About the same time, Erik Manners produced his 11 ft. *CAR CAT* which, by the use of a flat piece of the section at the keel line was able to improve the ease of construction and this is the design procedure used here. Two sheets of ply are used, one for the deck and one for the bottom, while the sides are made from curved plywood. However, "Andy" Anderson, with his *SHARK* trimaran produces the best hull shape of all from sheet plywood by bending a long sheet upwards and, by use of a press, he brings the bow and stern into shape. John Mazzotti's method has already been described which produces the lightest hull of all and this has been the source of his racing successes with his *MANTA* series.

The *ACE* "A" Class catamaran is shown in the drawings. The constructional method is well shown in the drawing of the unplanked boat with the shape of the ply sheets indicated. The mirror-shaped formers are removed after planking, leaving the longitudinal strength in the stringers and planking.

The hull shape is excellent and obviously capable of good speeds and the use of a wingsail mast and sail similar to that used by *LADY HELMSMAN* should give a very good performance.

To complete the picture of making catamarans from sheet plywood, we must mention that "Monty" Montgomery's series of catamarans *FLYING KITTEN*, *FLYING CAT* and *FLYING ROCKET* were of the same general pattern as are now used by John Mazzotti but by having greater beam and using frames and stringers, the weight and wetted surface was slightly greater and top racing successes eluded them.

OCEAN PRINCESS

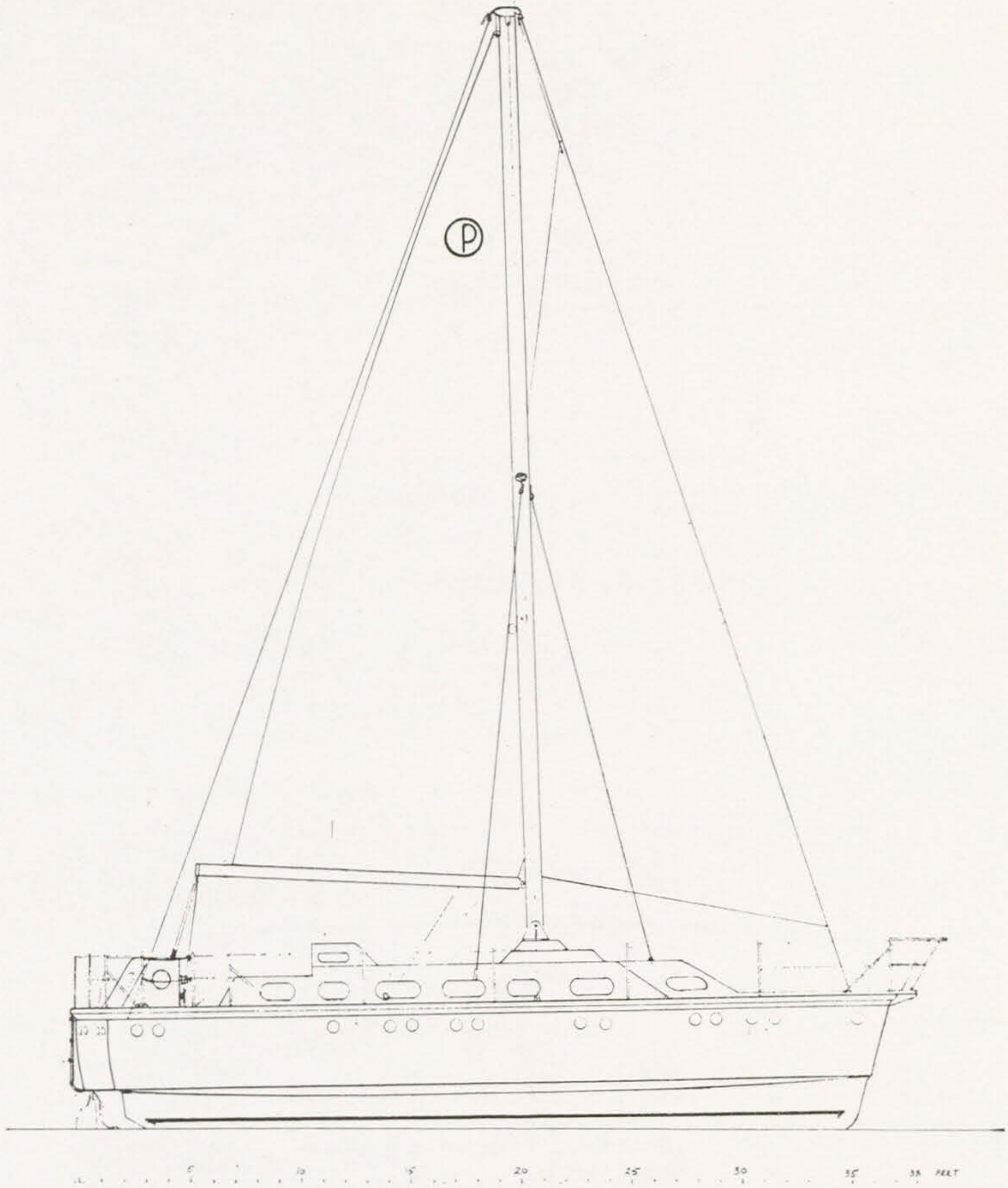
DESIGNED BY

F. M. MONTGOMERY

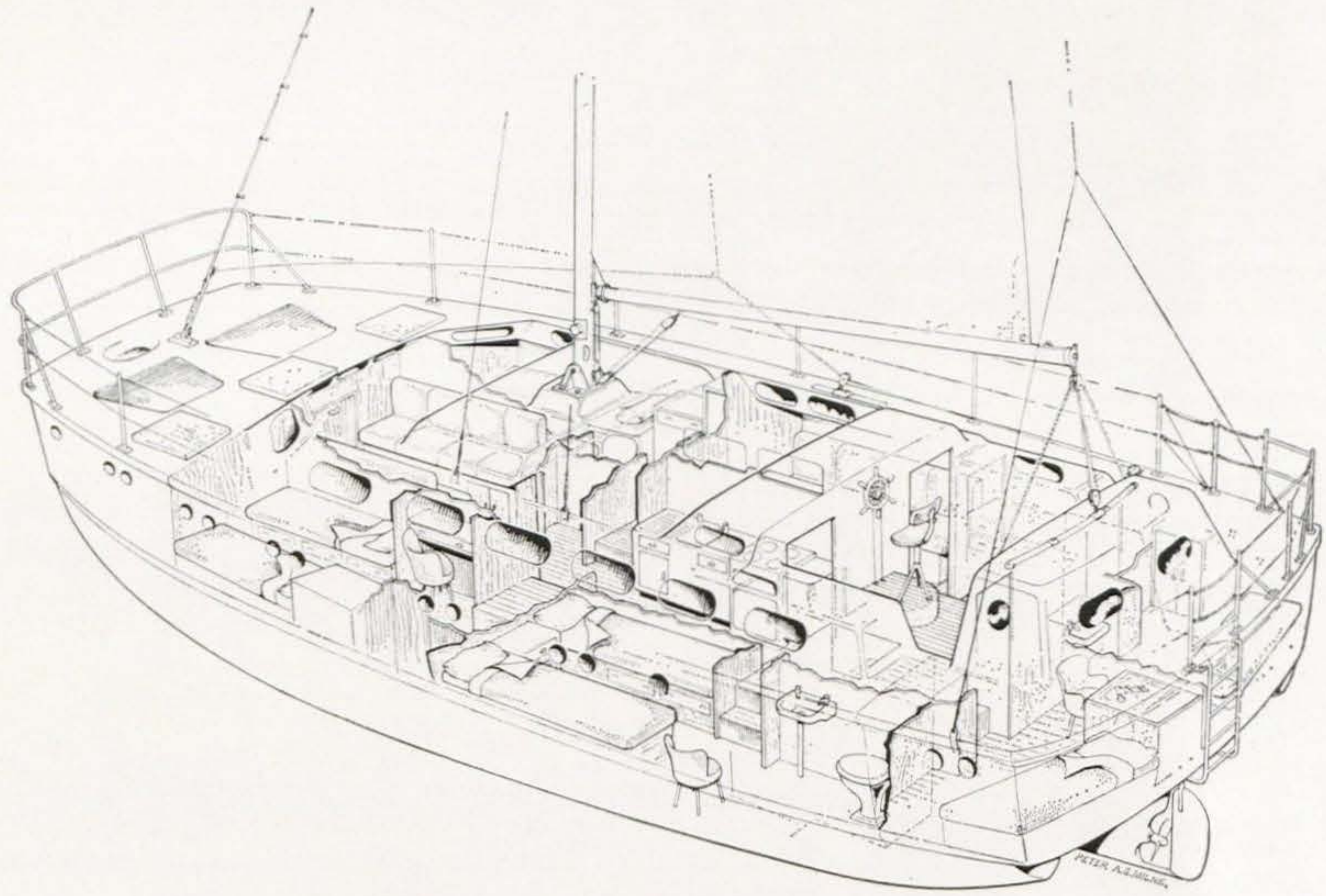
77, Melvill Road, Falmouth, Cornwall.

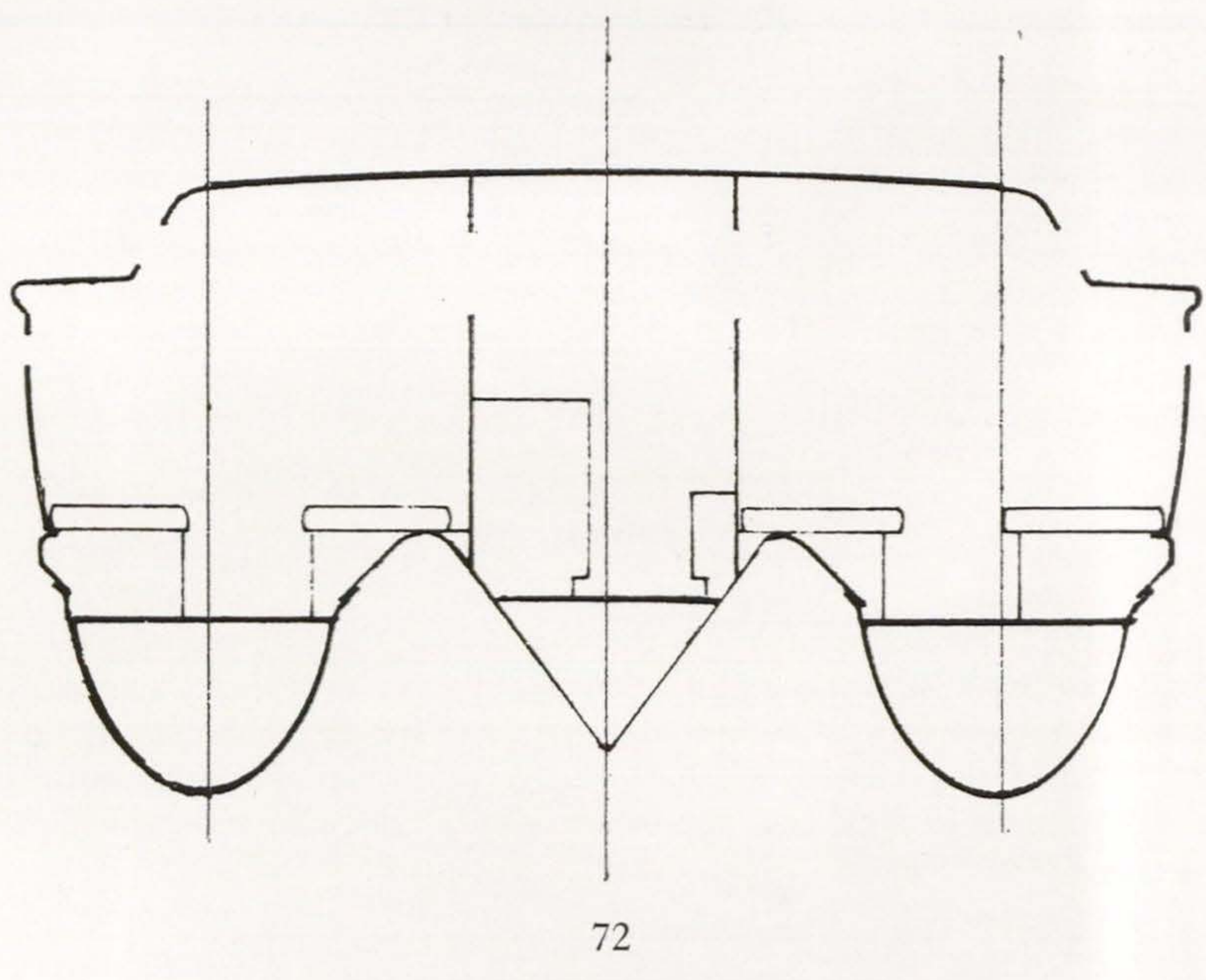
L.O.A. 36 ft. Sail area 443 sq. ft.

This is a great big palace of a boat, designed on the "Tri-catamaran" principle. The two outer hulls have a round bilge section while the centre hull between them has a broad V section. The middle hull has been put in to give lateral resistance and to house the engines below the accommodation.



This boat has been designed for permanent living as well as coastal cruising. It has everything needed for comfort and convenience. Obviously, owing to the weight resulting, the performance under sail will be modest but a powerful engine is intended. Many people seem to buy large fast cruising trimarans and catamarans and then insist upon powerful engines which ruin the sailing performance. One wonders if they had not better buy a boat like this which is designed for them.





BANANA-FISH, NEW MAST-WING, BRIDGE-DECK AND HULLS

BY

KAJ JORGENSEN,

Taarback, Strandvei 34A, Klampenborg, Denmark.

The reason that gaff and bermuda sails are set on the mast is undoubtedly because the mast unavoidably presents itself.

So far as I know no-one has ever yet devised a mastless yacht rig. But by fairing the mast and stepping it on a rotatable base a large drag component has been eliminated.

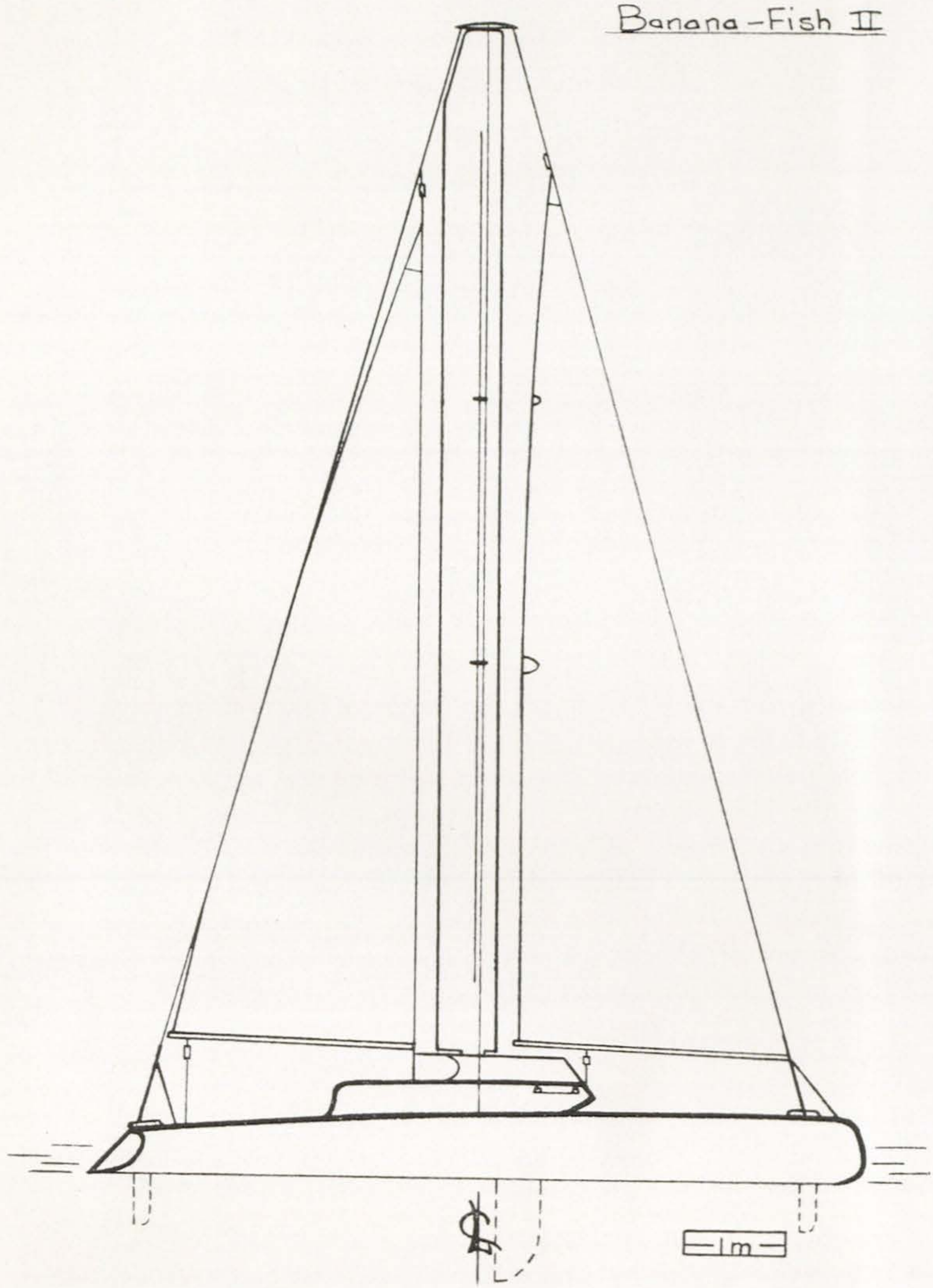
For centuries the mast has insinuated itself and, as any sail-sailor knows, a main sail is comparatively less efficient on the wind than is a head sail. And the reason that square sails are reputed to be slow on the wind is that they have low aspect ratio.

Today some very archaic rigs *make the scene* on multi-hull configurations, and among these are the two sails both set on stays. The mast only helps to present the sharp luffs to the wind. The efficiency and simplicitty is patent. From this sail plan it is not very fanciful to venture the idea of turning the necessary compression member—the mast—into an aerofoil of large aspect ratio, with a cord suited to the required thickness. This would obviate the mast and create one more leading edge. This foil, being stepped on a rotatable base with incidence control, affords the possibility of regulating the flow between the two sails and consolidating the downwash components.

The effect of this mast-foil will hardly be sensational but it will be a decisive improvement. In very strong winds the foil will drive the craft with the sails stowed. A large fin can be incorporated in the trailing edge, to be exposed when the craft is hove-to, or at moorings, so that the leading edge is compelled to always *face the wind*.

However, it can be generally assumed that for inherently slow craft the value of this proposed rig is somewhat doubtful, or, rather, limited.

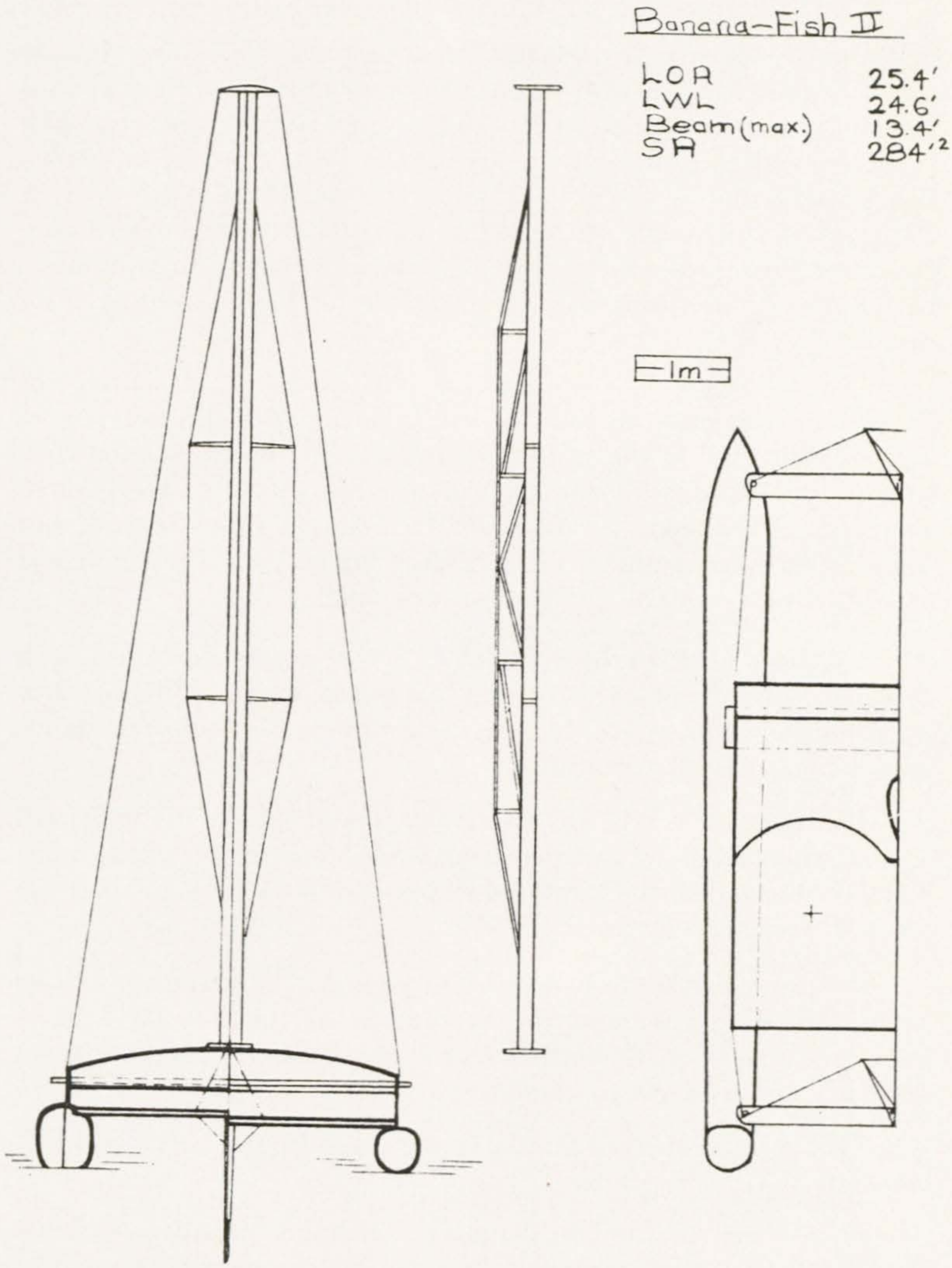
When a slow craft goes to windward in a gentle breeze the separation at the mast/sail is limited to about a mast-diameter abaft the mast, whereas the separation behind the sharp leading edge of the stayed sail can be amply 0.25 times the cord length. But, as the craft gathers speed relative to the wind the effective incidence decrease and the magnitudes of the respective separation areas change conversely.



BANANA FISH—Note wing mast and staysails.

Though, in the case of overlapping sails, it is ineluctable that the induced velocities modify the separation behind the leading edge of the overlapped sail.

This useful spar is made up of a compression member—a standard aluminium alloy pipe. At top and bottom it is reinforced to take the


Banana-Fish II
LOA 25.4'
LWL 24.6'
Beam (max.) 13.4'
SA 284'2
1m

circular plates on which it rotates. At the top plate the diameter is rather large, this is to clear the foil of the stays and distribute the stresses favourably. The canopy is exceedingly light and over it stretches stainless steel bands to take the stays. The drawing shows the webbing on the aft-side of the pipe. The transverse bending moments are taken up by the two struts on each side. The skeleton can be either covered with wooden veneer, or filled with expanded polyether to the required section and covered with a synthetic cloth like polypropylene, laid in polyester resin. Glass cloth is, of course, also suitable, but is about three times the weight of polypropylene cloth, and at this weight ratio has but a quarter the impact resistance. However, glass cloth may be expected to provide better initial stiffness. In the U.S.A. the price is about the same for these cloths in plain weave.

The foil section is a symmetrical NACA. It is, of course, not possible to calculate a section that will balance under all conditions at a given point, and at the same time produce lift; unless varying cord lengths, thickness ratios and moment coefficients were incorporated along the entire span. This might facilitate fingertip control, but would seem more destined for a modern art gallery than a practical exposition of a wondrous dynamical principle.

The lines of *BANANA-FISH II* are primarily developed with dynamical considerations; structural being secondary. Although they are stretched to the utmost for speed, they must, by catamaran standards, be considered seaworthy.

The calculated L.W.L., as shown, is that which the craft will assume when about 75% of the all-up weight is on either of the hulls. The 60° dihedral of the bow section comes at 0.15 L.W.L. abaft the forward perpendicular to the L.W.L.

It is a temptation to flare the bow sections. But this only looks better than it functions—throwing waves is no function for a pacemaker. But, rather, to demonstrate a fine balance between reserve buoyancy and dynamic moments.

The reversed sheer is largely configurated by the very high deck crown.

It has been the aim to maintain favourable pressure gradients theoretically, in order to promote laminar flow and smooth transition. Although the pressure gradients fluctuate wildly along the hull in a seaway, it seems that this has less influence on the boundary layer than the slope of the waterlines and buttock-lines.

Last summer I had a model built for a large hydrofoil concept and although it throws the most grotesque rooster-tails observed on the high seas, close study and much towing suggest that a disturbed wake is nature directly recuperating potentials; an exertion which the designer has spared the run for. It appears that the more tumultuous the water immediately abaft the stern, the less resistance has been encountered; the more laminar has been the flow and the less forward acceleration has been imparted to the boundary layer.

In contrast to this, most planing craft, boiling across the purple sea, turbulate the boundary layer almost at the leading edge due to too much squatting; the transverse components induced by V-section and engine vibrations, and they leave a smooth wake, raging with the fury of sheer horse power.

Mixing the induced fields of underwater objects vastly complicates the flow-pattern and pressure distributions. Therefore, appendages ought to be removed from the hull if this is at all possible. The catamaran configuration enables this without too much extra designing, for both rudders and centre-board. By placing a rudder each on the forward and the aft cross-board very rapid turning is facilitated.

Instead of the usual trapeze, *BANANA-FISH* incorporates a telescoping ladder, consisting of two aluminium pipes to which is glued a sheet of marineply. This is a few inches longer than the beam of the bridge and can be pulled about 2.65 m. out either side. Apart from the mechanical advantage of this it will provide a truely magnificent ride.

The purpose of building up the marineply bridge of *BANANA-FISH* is for the same reason that the web spreads the flanges. It does not increase the weight; it provides a snug shelter and, instead of increasing the windage, will probably decrease windage because it provides one large, smooth leading edge and shelters the many objects that would otherwise be exposed.

The bridge is fastened to the hulls by wing nuts and the bolts are fastened to the marineply reinforcement prior to casting.

It is proposed to make *BANANA-FISH* available for self-building; delivering plans for the bridge, etc., and the hulls cast in expanded polyethylene about a longitudinal marineply beam. Having the hull forms, it is a simple matter to lay up the polypropylene cloth in polyester resin combined with a wooden veneer. For those who prefer a fine wooden finish and have the skill and patience, an inner diagonal and an outer longitudinal in mahogany will be specified.

ANALYSIS OF VERICAL LOADING OF A CLASS "B" CATAMARAN MAIN BEAM DUE TO THE HEELING FORCE OF THE WIND

BY

JOE SIUDZINSKI

3367, Ramona St., Palo Alta, California 94306

Assumption/initial conditions

(1) Only the resultant wind force component tending to heel the boat will be considered in this analysis.

(2) Maximum steady-state loading of the main beam due to the heeling force will occur when the cat just starts to fly the weather hull. The boat is still horizontal (essentially), with no buoyant support to the weather hull. Consider the boat pivoting about the leeward hull.

(3) Ignore impact loading effects of any kind.

(4) Concentrate lee hull lateral resistance at the centreboard.

(5) Ignore any effect of the leeward stay, since it is hanging slack. The windward stay, for the purpose of this analysis, is assumed to be attached to the mast and boat at right angles to the boat centreline; another way of regarding the windward stay is to say that the fore-and-aft stay tension component is not considered.

(6) One crew member is on the windward hull; the other out on the trapeze.

(7) Ignore any effects the rudders or windward centreboard may have to produce a heeling moment.

(8) The point about which the boat pivots was chosen for convenience. The actual point is probably a couple of feet down from that shown.

Weights/dimensions/abbreviations

Refer to figure 1 for the boat dimensions and force locations.

W_H = hull weight (100# per hull)

W_c = crew weight (175# per person)

F_H = heeling force of the wind concentrated at the centre of effort (12 ft. above the main beam)

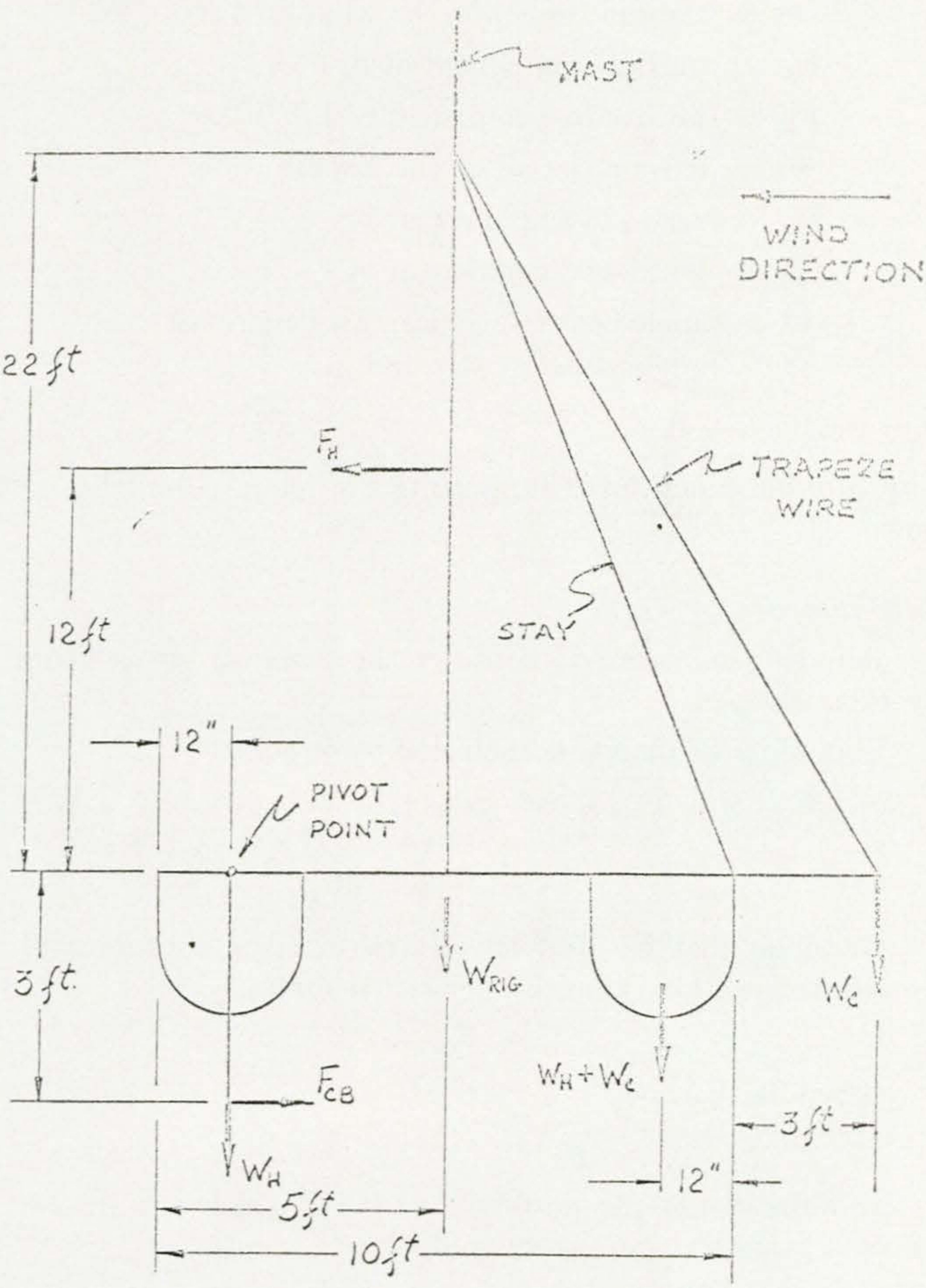


FIGURE 1 BASIC DIMENSIONS AND EXTERNAL FORCES

F_{CB} = centreboard "heeling" force (3 ft. below main beam)

W_{rig} = weight of the beams, rigging, mast, etc., concentrated at the middle of the boat (100 #)

F_s = tension (force) on the windward stay

F_{sv} = vertical component of F_s

F_{sh} = horizontal component of F_s

F_t = tension (force) on the trapeze wire

F_{tv} = vertical component of F_t

F_{th} = horizontal component of F_t

$\varnothing_t$ = angle between trapeze wire and mast

$\varnothing_s$ = angle between stay and mast

Mast weight = 30 #

Note: the buoyancy force supporting the leeward hull has not been shown.

Force analysis

Referring to figure 1, consider the external forces acting upon the catamaran.

Summing the moments about the pivot point:

$$\begin{aligned} F_H(12) + F_{CB}(3) &= W_{rig}(4) + (W_H+W_c)(8) + W_c(12) \\ &= 100(4) + 275(8) + 175(12) \\ &= 4700 \text{ ft.-lb.} \end{aligned}$$

Recalling that lee hull lateral resistance is concentrated at the centreboard, we may sum the horizontal forces:

$$\begin{aligned} \text{s.t.} \quad F_H &= F_{CB} \\ \text{therefore, } F_H(12+3) &= 4700 \\ F_H &= 313\,\# = F_{CB} \end{aligned}$$

In other words, the wind force is 313 # which acts at 12 ft. above the main beam trying to overturn the boat.

Incidentally, had both crewmen been on the windward hull instead of one being out on the trapeze, the following derivation would hold true:

$$\begin{aligned} F_H(12) + F_{CB}(3) &= W_{rig}(4) + (W_H+2W_c)(8) \\ \text{resulting in } F_H &= 213\,\# \end{aligned}$$

i.e., in this case, the ability to counteract the heeling force increases about 50% by using a man on the trapeze!

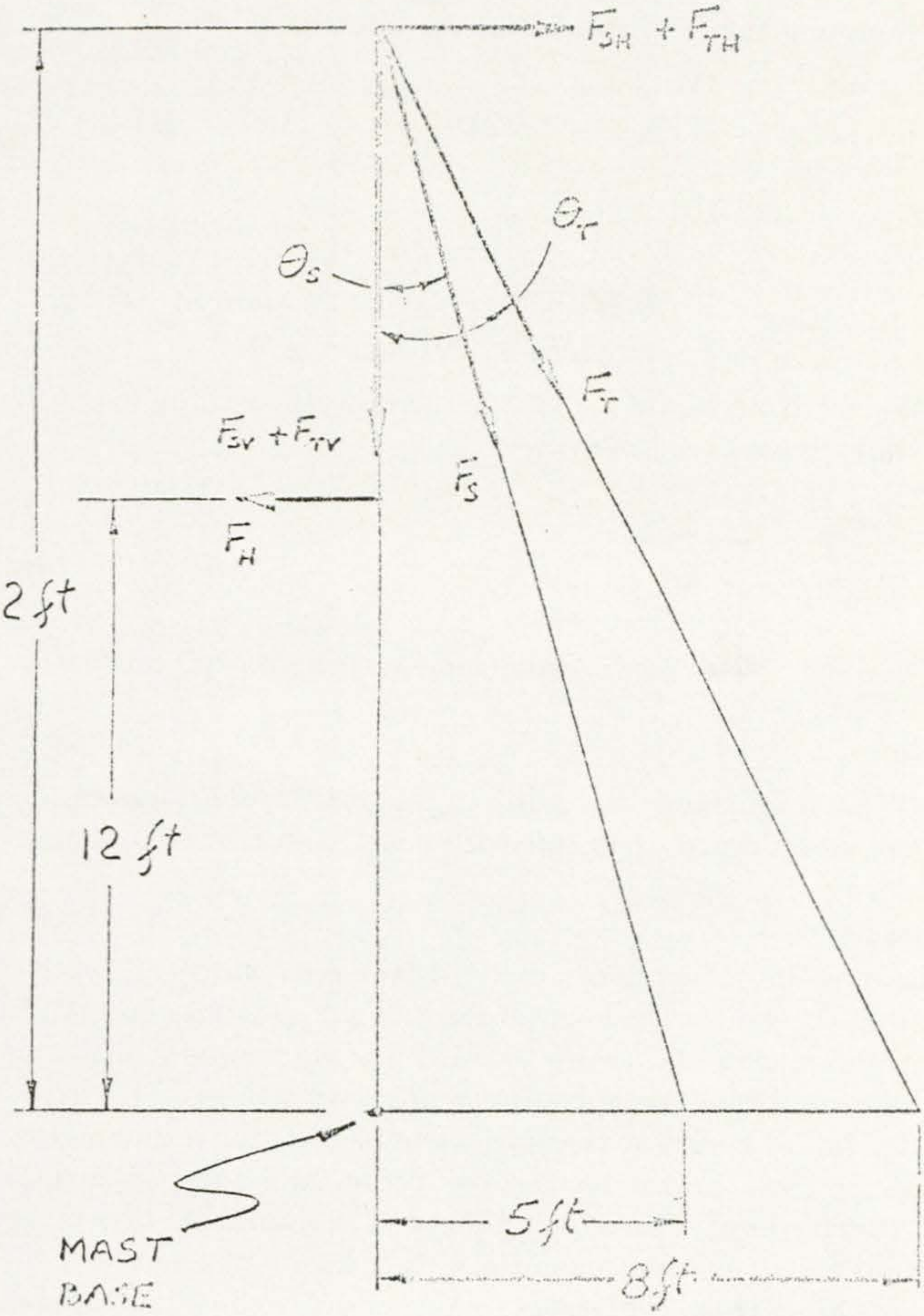


Fig. 2. Mast, Stay and Trapeze wire forces.

Referring to figure 2, consider the forces acting upon the mast through the stay and trapeze wire:

$\tan \O_t = 8/22 \equiv 0.363$ thus $\O_t \equiv 20°$
$\tan \O_s = 5/22 \equiv 0.227$ thus $\O_s \equiv 12.8°$

We know that $F_{tv} = 175\# = W_c$

Thus, $F_{th} = F_{tv}\tan\O_t \equiv 175(0.363)$
$F_{th} \equiv 63.5\#$

Summing the moments about the mast base:

$F_H(12) \quad = (F_{sh}+F_{th})(22)$

$313(12) \quad = 22F_{sh} + 63.5(22) \quad 3750 - 1400 = 22F_{sh}$

$F_{sh} \quad = 107\# \quad F_{sh} \quad = \dfrac{2350}{22}$

$F_s \quad = 107/0.222 \quad = 482\# =$ tension in stay

$F_{sv} \quad = F_{sh}/\tan Ø_s \quad = 107/0.227 \equiv 472\#$

We see from figure 2 that the main beam is being acted upon by the following vertical forces:

$F_{sv} = 472\#$

$F_{tv} = 175\#$

mast weight $= 30\#$

$677\# =$ total force bearing down onto beam

Conclusion

It has been shown that, due to the overturning force of the wind, the mast bears down upon the main beam with a force of about 700#.

Comments

(1) It must be remembered that only the resultant wind force coming from the side of the boat (at right angles to it) has been considered in this derivation. Any forward driving component of this force has not been taken into account. If we wish to expand the derivation and, for example, assume that the resultant force acts at an angle of 45° forward of abeam and that we maintain the "overturning" force component a constant (313#) then the resultant wind force increases by a factor of about 1.4 to 440# which, in turn, increases main beam loading considerably. I don't consider myself qualified to make three-dimensional analyses of all the force vectors acting upon the catamaran.

(2) Impact loading has been neglected. What happens when the boat "crashes" into a wave while travelling at, say, 10 knots, I don't know.

(3) Hull lateral resistance was lumped, for convenience, into one force acting on the centreboard 3 ft. below the main beam. This figure was a pure "guestimate", and the entire assumption might be invalid.

(4) I would be interested in pursuing the three-dimensional aspects of this derivation to find the total force acting upon the main beam.

"CRITICAL" (OVERTURNING) WIND VELOCITY

Rewriting the equation given by Mr. Edmond Bruce in A.Y.R.S. No. 61, Page 33, results in:

$$v^2 = \frac{F_s}{A_s C_s} \cdot \frac{2}{\frac{\rho}{2}}$$

where: v = apparent wind velocity in ft./sec.

F_s = total sail force in pounds

C_s = aeronautical coefficient

A_s = sail area in square feet (235 for "B" cat)

ρ = air density = 0.0024

The heeling force of the wind ($F_H = 313\#$) is only that vectorial component of the total wind force acting at right angles to the direction in which the boat is travelling. For a rough approximation only, therefore, consider $F_s = 313\#$.

After scratching my head for a while, I finally (almost arbitrarily) decided to use $C_s = 1.6$.

At this time the main interest (I believe) lies in obtaining a reasonable order of magnitude for "critical" wind velocity.

Plugging the above values into the equation results in:

$v^2 \equiv 695$

$v \equiv 26.4$ ft./sec.

$v \equiv 15.6$ knots.

Conclusion

Considering all the assumptions made, it is seen that a critical windspeed, above which the boat will tend to overturn, is about 16 knots. This is the windspeed component perpendicular to the direction of travel of the boat.

Dear Dr. Morwood,

I should like to comment on C. E. Bowden's article "Spoiler of Speed" in one respect. I think the Colonel's explanation of a boat's bow being lifted and thrown to windward by a wave ignores an observation which he makes in another connection: i.e.—the wave is moving . . . and moreover, it is moving to leeward! I read this article just after sailing in the first N.Y. to Bermuda Multihull Race. Pitching caused by waves and the resultant effects on sail performance must be of vital importance for light multihulls when going to windward. Angle of heel is much less of a problem. The use of "damping action of the asymmetric stern shapes" to control pitching may promise improvement. Significant also is the amount and distribution of weight in the craft. Although I have little competance in engineering, I would estimate that for multihulls the pitch region might be kept forward.

Multihulls which afford some real creature comforts (meaning displacement) and still perform well to windward in rougher wind and sea conditions will steadily be developed. I think there is considerable that can be done in this category.

Sincerely,

ALBERT SUNDERLAND.

831 Pearse Road, Swansea, Mass.

Dear Dr. Morwood,

The "Gunning" vane gear, described in your special number on self-steering gears, has now been further proved in practice. A German 29 footer sailed from Kiel, out through the Limfjord, to Utsire in Norway, across to the Shetlands and so back home. "We never touched the helm except when manoeuvring".

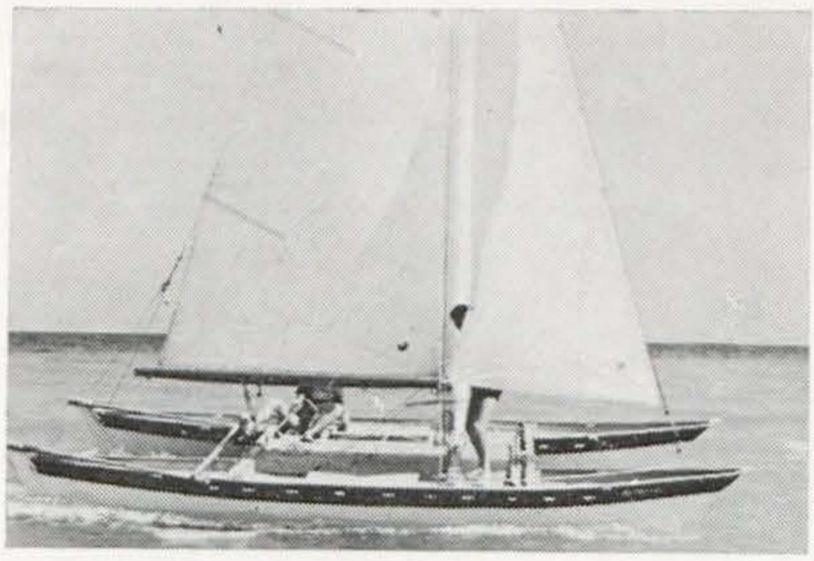
It was also fitted to *MYTH OF MALHAM*, built and originally owned by Captain Illingworth, an out and out racer, fast but quick and skittish on the helm. She was sailed single handed to Vigo, and back with the owner's wife, 7 year old son and a friend. They covered 1700 miles in three weeks, including 6 nights in port, and several days of calm.

They also ran into very heavy weather, force 8-10 in the Bay of Biscay, and ran before it 360 miles in 2 days, often doing 10 knots under storm-jib only. They had taken along, for experimental purposes, a "mini-vane" of 8 in. x 18 in., and decided to use this when they got a very bad forecast. (The vane can be taken off and replaced in about one minute). Now this miniature sheet of ply proved capable of steering the *MYTH* safely, putting the helm instantly hard-up when she tried to broach. The high quartering seas frequently pooped her, and it would have been difficult to remain on deck, but thanks to the reliability of the gear she was not forced to heave to, or lie a-hull.

Now the efficiency of a vane-steering gear may be defined as the ratio between the area of the vane, and that of the tab. A normal ratio seems to be about four or five to one. Here the vane-area was less than one half of the tab-area. I wonder whether this a record.

M. F. Gunning.

Little Hamstead, Steep, Petersfield, Hants.



J. Wharram

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★ Flexibly mounted beams joining the hulls together.
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