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# CATAMARAN, HYDROFOIL

AND BOAT DESIGNS  
BY ERICK J. MANNERS



*A 1959 Catamanner with fully battened sails, light alloy rotating mast and luff-spar. Designed by Erick J. Manners, M.I.E.I., A.M.B.I.M., A.M.I.W., Naval Architect*

*The contents of this popular priced book include a Foreword by the Countess of Leicester; The Principles of Design; Catamaran Evolution; Dinghies, Auxiliary Yachts and Motor Cruiser Designs; Racing, Cruising and Cabin Catamarans; How to Sail a Catamaran; Trimarans, Hydrofoil Boats and their Designs.*

Volume I.

# CATAMARAN,

## Hydrofoil and Boat Designs

by ERICK J. MANNERS



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PRICE 5/- (\$1.00)

Volume I.

## CATAMARAN, HYDROFOIL AND BOAT DESIGNS

### FOREWORD

By THE COUNTESS OF LEICESTER

FOR A LONG WHILE I have enjoyed sailing different classes of yachts and as soon as they became available I was intrigued to own a catamaran. Some of my family particularly enjoyed the 'big boat' feeling of stability provided by the 'cat' although only 14-ft. in length.

A great deal more information is required about these extraordinary new forms of yachts and I am delighted to hear one of the pioneers, Erick J. Manners, is publishing *Catamaran, Hydrofoil and Boat Designs*.

I have admired a number of the range of catamarans he has designed and built for various purposes including export markets. He has been professionally engaged in the development of marine equipment, boat design, building and sailing for over 20 years and is a qualified technical teacher.

Sailing and boating on the sea and inland waters is becoming increasingly popular. One can recommend nothing better for healthy exercise, the fulfilment of the spirit of adventure, the exercising of skill. All this can be enjoyed to the full in safety.

Holkham Hall, Norfolk.

1959.

### COVER PICTURE

*This photograph, taken by the author, shows an 18 ft. 6 in. 'Catamanner' class, introduced in 1957 going through her paces. The weather hull is just skimming the surface; this can be an ideal trim. Flying a hull looks spectacular but usually results in slower speed. The superficial 'stiff' coming up is only at the back when the rudders 'foam' at high speeds. Even this length of 'cat' can be trailed behind an ordinary car.*

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Volume I, 1959. 2nd Reprint, 1961.

ERICK J. MANNERS, A.M.B.I.M., Yacht Designer and Consultant

### OFFERS STOCK PLANS TO MAKE IT YOURSELF

Length, name & description of class	Details (see key)	Price of Plans
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11½-ft. Playcat (Sail, Paddle, Outboard) ..	AB. MP. A 1-2. . . . .	£4 4 0
11½-ft. CAR-TOP-CAT ..	SC. AB. A 1-2. MM. or GF. C. K. . . . .	£5 5 0
*14½-ft. POWER SKI-CAT SPEED-BOAT	AB. MP. A 1-4. S. . . . .	£6 6 0
*12-ft. Multi-purpose SAILING DINGHY ..	AB. MP. A 1-4. GF. S. . . . .	£4 4 0
12-ft. Hard-chine CATAMARAN	SC. AB. MP. A 1-3. S. . . . .	£4 4 0
*12-ft. Multi-purpose RUNABOUT (Outboard)	AB. MP. A 1-4. GF. S. . . . .	£4 4 0
14-ft. FAMILY CATAMANNER (Safe) ..	SC. AB. MP. or GF. A 1-4 S. C. or K. D. . . . .	£5 5 0
14-ft. SPORTS CATAMANNER (Fast) ..	SC. AB. MP. or GF. A 1-4 S. C. or K. D. . . . .	£5 5 0
15½-ft. G.P. CATAMARAN (Fast)	SC. MP. A 1-4. S. . . . .	£6 6 0
14-ft. RACER CATAMANNER ..	SC. A 1-2. MM. C. . . . .	
15-ft. TRIFOLD TRIMARAN ..	SC. AB. MP. A 1-2. D. S. . . . .	£5 5 0
*16-ft. CABIN YACHT or CRUISER	AB. MP. A 1-3. B2. S. . . . .	£5 5 0
16½-ft. LAKE CATAMANNER (Fast)	SC. AB. MP. A 1-4. S. . . . .	£6 6 0
18½-ft. RACER CATAMANNER	SC. A 1-5. MM. S. C. . . . .	
20-ft. TRIFOIL TRIMARAN (Super fast) HYDROFOIL ..	SC. A 1-3. B1. AB. MP. S. D. . . . .	£7 7 0
*20-ft. CABIN CRUISER ..	AB. MP. A 1-6. B 2-4. S. . . . .	£5 5 0
*24-ft. Auxiliary CABIN YACHT ..	A 1-5. B3. S. . . . .	£7 7 0
*25-ft. CABIN CRUISER ..	AB. MP. B 4-6. A6. S. . . . .	£6 6 0
*27-ft. CABIN CRUISING CATAMANNER (Fast) ..	SC. AB. MP. A 1-8. B5. S. . . . .	£10 10 0
*30-ft. TRIFORM CABIN TRIMARAN (Fast) ..	SC. AB. MP. A 1-5. B 4-6. S. . . . .	£10 10 0

*Key to Abbreviations:*—SC. Sailing Catamaran or Trimaran; AB. Specially suitable for amateur building; MP. Can be built in marine ply; A 1-2 Normally accommodates Max/min. persons 1 or 2, etc.; GF. Hulls available in reinforced glass fibre; K. Supplied as kit; MM. Moulded mahogany shell hulls; C. Supplied complete; B. Sleeps 1 or 2 persons, etc.; D. With detachable hulls; S. Safe.

The price of a set of plans includes royalty and International Certificate of Registration for one boat only together with official sail or racing number. Ten patents and registered designs are embodied. Over many years most of the designs listed have been fully proved afloat and some are already well established classes. Special designs can be drawn up to order and if required Erick Manners may be available to inspect or supervise new construction.

Plans available from the Designer

ERICK J. MANNERS, A.M.B.I.M.

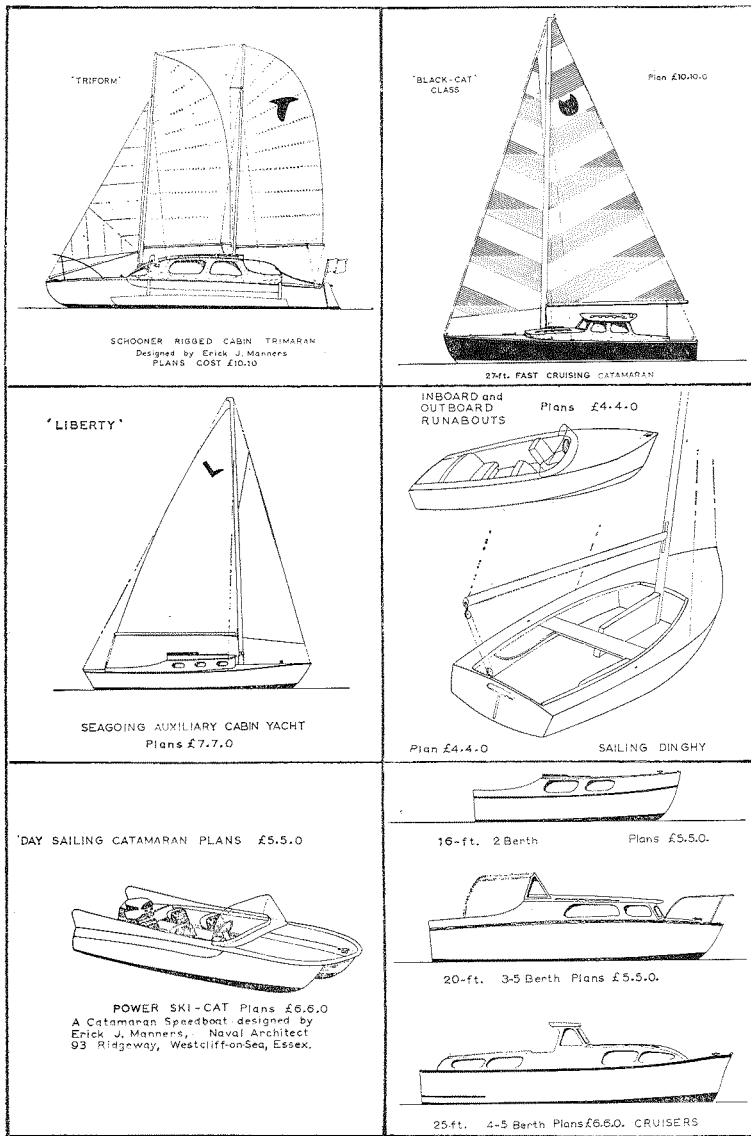
93 Ridgeway, Westcliff-on-Sea, Essex, England.

INTRODUCTION

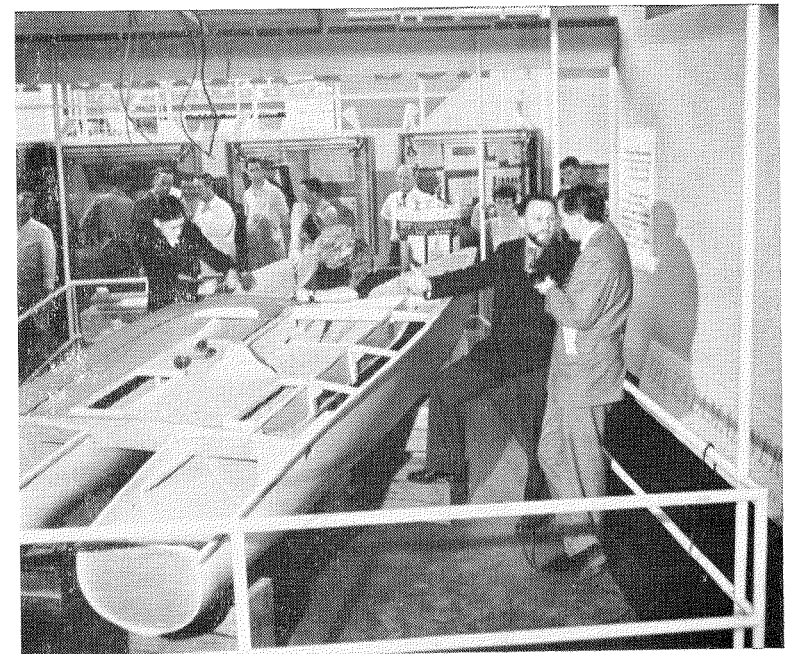
OVER TWENTY YEARS AGO I used to associate with another practical idealist, Major Max Manners-Spencer, A.F.R.Ae.S., about twenty-five years my senior. He was engaged on the stress side of aeroplane building and had been a keen pioneer balloonist. He lived all the year round in a cabin boat and I lived in another 35-footer I was building near by. Our most popular topics, discussion frequently going on far into the night, were boats of the future.

My favourite toys as a small child had been two long low foot benches because, when inverted, they became a canoe which I arranged in all manner of configurations with the vivid imagination held in childhood. Fortunately, my mother was fairly tolerant about some of the articles I used for sail plans and spars. In her wisdom she bought me a boat before I was very old.

Max was as interested in my outrigger sailing canoes as I was in his gigantic mechanical dream roller within a roller. The outer shallow bladed drum was intended to roll speeding over the water, while the inner



The designs illustrated above are described with an asterisk on the opposite list. A large General Arrangement plan (not building plans) together with specification particulars of these and other standard classes can be sent on receipt of 10s. This is not refundable but can be credited if constructional plans are purchased.



The author is interviewed on A.R. Television by Neville Barker about his catamaran designs.



*The Catamanner model was enthusiastically discussed by Cyril Lord, Sir Frederick Hooper, Jeanne Heal, and Sir Miles Thomas.*

*Before such boats became accepted by the public the advantages of catamarans were described to millions of viewers on B.B.C. Television during two sessions of the News Chronicle 'Be your own boss' competition some years ago.*

one hung stationary for the passengers' benefit, suspended on roller bearing races.

We also badly wanted to make what we thought at that time would have been a super speed boat. Airscrew driven with special underwater features. In the bows there was to be a twin plough-like device to deflect wave tops, leading on to a step under the bows well forward. High velocity air was to be compressed and forced through the open riser of this step where it would be transversely retained by twin fin-like bilge keels. The object was to have an ordinary floating boat statically, but one capable of minimum friction at speed, skating along on a pad of slightly compressed air over a partly pre-planned strip of water.

Looking back, I still think many of our novel boat ideas were quite practical, indeed several have now reached fruition. However at the time there were two obstacles. Firstly we could not afford to build them and secondly they were then far before their time.

A mutual friend of ours used to depress us with stories of how, prior to 1914, the very idea of aeroplanes being useful even in war was laughed to scorn by the worldly gentlemen who formed the Parliament of the day. He was there and should know, his name was Griffith Brewer, the first Englishman to fly as a passenger, with the Wright Brothers. He was later an aeronautical adviser to the Government and President of

## SUMMARY OF OTHER CRAFT DETAILED IN VOLUME II.

For other details see list on page 59. Those marked † are illustrated elsewhere in this volume.

- 8 ft. 6 in. **PEDALCAT.** A pleasure boat for hiring on amusement parks and lakes. Only requires foot pedalling so not handicapped if hirers cannot row or paddle. Suitable for two children or adults, a longer double hull version is recommended for sea-board use off beaches during calm weather. Plans £5 5s. 0d.
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- 12 ft. **SAILING CATAMARAN** with easy to make hard-chine symmetrical hulls built of plywood. Plans £5 5s. 0d.
- 12 ft. † **RUNABOUT.** Popular form of single hull launch for sports use with outboard motors although could be fitted with small inboard engine. Plans £4 4s. 0d.
- 15 ft. 6 in. **SAILING CATAMARAN G.P.** Embodying fast lines and easy to construct. Light weight, but stable and easily trailed. Plans £6 6s. 0d.
- 15 ft. † **TRIFOLD.** The smallest practical trimaran with detachable outriggers. Easy to build almost entirely from ply. Very fast. Plans £5 5s. 0d.
- 16 ft. **CABIN YACHT.** A tabloid single hull sailing yacht with attractive lines that can be made in ply at minimum cost with cruising accommodation for two adults. Plans £5 5s. 0d.
- 16 ft. † **CABIN CRUISER.** Outboard driven with roomy cockpit and sleeping accommodation for two adults and a child. A boat size with the minimum of upkeep and storing costs, excellent for beginners. Cheap to make. Plans £5 5s. 0d.
- 20 ft. † **'TRIFOIL'.** The first hydrofoil stabilized sailing boat. Super fast performance and good sea boat. Plans £7 7s. 0d.
- 20 ft. † **CABIN CRUISER.** Sleeps 3 to 5 persons including optional covered cockpit and windscreen bridge deck. Adequate space for double berth, galley and separate toilet. Simple build with attractive appearance. Plans £5 5s. 0d.
- 25 ft. † **CABIN CRUISER.** Central Bridge Deckhouse. 4 to 5 berth. Galley and separate toilet. The 20 and 25 footers may be kept on exposed seaside moorings and have full sitting headroom. Plans £6 6s. 0d.
- 27 ft. † **CRUISING CATAMARAN.** Sleeping 5 or 6. Full headroom. Watertight bulkheads. Dinghy in davits. Separate toilet. Self draining cockpits. Spacious decks. Plans can be adapted for passenger carrying or power use. Fast. Plans £10 10s. 0d.
- 30 ft. † **CRUISING TRIMARAN.** Sleeps 5 to 6. Full headroom. Separate toilet. Much cheaper than a Catamaran or single hull cruiser to make. Plans £10 10s. 0d.

★ Plan particulars of High Speed Wheeled Sand Yachts, Skate Ice Yachts and drawings for model catamarans and trimarans are available on request.

**OTHER PLANS.** If plans for the sort of vessel you wish to build yourself or get your local boatyard to build are not listed here, or on page 59, the Designer will be pleased to quote you for the supply of plans on receipt of general details of your specific requirements.

The Designer may also be available to supervise the building of new craft on behalf of clients or survey completed craft.

# TRIMARANS

## CATAMARANS & BOAT DESIGNS

The second companion volume entitled 'Trimarans, Catamarans & Boat Designs' should be available in the early part of 1961. Dealing with traditional single hull boats, as well as popular and controversial subjects; the new book also covers multi-hull craft in which Erick J. Manners is the only full-time specialist designer in Europe.

The new book is again written by Erick Manners with emphasis on the quickly approaching new and fastest form of boat the modern TRIMARAN of which the author is the professional pioneer in design, development and building.

The new publication includes the following Contents amongst other general interest features and building information:—

### Chapters

- |   |  |
|---|--|
| 1. Foreword by R. Gresham Cooke, C.B.E., M.P.                           | 7. Details of:—Three New Trimarans.    |
| 2. Introduction. Managerial Questions. Progress. Ergonomics.            | 8. Six Single Hull Designs.            |
| 3. Boats, Women and Industry. Quantity Reduction. Standards & Cruising. | 9. Three Cabin Cruisers.               |
| 4. Research and New Development. Duplication.                           | 10. Power Catamarans.                  |
| 5. Evolution of the 'Trifoil' and 'Hydro-wing'.                         | 11. New G.P. Catamaran.                |
| 6. Hydrofoils and Asymmetry.  | 12. Teaching Sailing and Tests.        |
|   | 13. How to Sail Trimarans.             |
|   | 14. Patents and Improvements.          |
|   | 15. Control Gear and Alarm Systems.    |
|   | 16. Cruising Catamarans and Trimarans. |

This fully illustrated book can be supplied price 5s. post free (or one U.S.A. Dollar or equivalent overseas, Surface paid) direct from:—

ERICK J. MANNERS, 93 RIDGEWAY, WESTCLIFF-ON-SEA  
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the Royal Aeronautical Society and of the Chartered Institute of Patent Agents.

Griffith Brewer did much to get the Wright Brothers early flying ideas accepted for the benefit of this country. Wilbur and Orville Wright were the first well-known Americans to at least try out a powered catamaran with hydrofoil-like appendages.

As Griffith, Max and I yarned about these things in a snug cabin lit by the soft glow of a swinging brass oil lamp, I used to burn to build new designs. But it was not until 50 years after the Wrights' work that I introduced what was probably the first commercial sailing hydrofoil boat. Such is progress and it will probably still be years before such boats are acclaimed.

Waterproof-glued plywood was at that time quite unheard of, but one thing that Max and I did about 1935 was to make a lightweight compound curved boat employing stressed skin multi-veneer methods. This was just as strong yet only a small fraction of the weight of traditional solid planks on heavy timbers. Rigid skin construction was at that time beginning to be applied to aeroplanes, although I remember flying in later planes which gave you at least a psychological feeling of insecurity as you looked down through a wide slot in the floor where the thin, doped cloth covering was casually laced across the inches wide draughty gap.



Lord Brabazon of Tara, former Minister of Aircraft Production and well-known sailor, christens a catamaran designed by Erick Manners especially for amateur construction.

During this particular period, I was appalled by the fact that all pleasure craft, with the exception of some very small dinghies, were each different and individually built by hand, piece by piece. At that time boat owners would have been just as peeved at duplication as is one woman on meeting another wearing an identical hat. Wrongly, at that time, I figured that every boat need not be different, particularly if the price could be vastly reduced. Consequently I set about designing, jiggling, tooling up and building 20-ft. Cabin boats. These were standardised so that a number of identical parts could be marked simultaneously from templates or built up in jigs for speed.

I made the youthful mistake of marketing the finished craft, to show a modest profit, at around half the price of comparative boats of other makes. Prospective buyers immediately smelt a rat. There must be something radically wrong with a boat priced so low.

During the intervening years, conditions have slowly but radically changed and to reach the average buyer's purse today, boats must be standardised. The first design (in current production) I am going to deal with is a 19 ft. scaled down version of this original 20-footer. Then I will go on to deal with a selection of a dozen other quite different craft, including catamarans, but first let's say something about development and design.

#### Reprint from an advertisement

<b>£55</b>	<p>PRIZE MONEY. Plus 5 Challenge Trophies offered in 1961 season to those winning important races in advanced designs by:—</p> <p><b>ERICK J. MANNERS, A.M.B.I.M.</b></p> <p>Yacht Designer &amp; Consultant, 93 Ridgeway, Westcliff-on-Sea, Essex. Send stamp for details and lists of boat plans.</p>
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#### PATENTS AVAILABLE

The boats listed in this publication are the subjects of E. J. Manners Patents, Copyright and Designs registered at the Patent Offices.

Any designers, professional boatbuilders or private builders who wish to use the features separately may do so by arrangement in writing with E. J. Manners. Only a very nominal royalty fee will be charged per boat.

If you purchase building plans the royalty fee is already included in the charge for the building plans together with the issue of an International Certificate of Registration and Approved Sail Number for one similar boat.

By prior arrangement if more than one boat is built from the original plans, additional plans need not be bought and only a small royalty becomes payable for each subsequent vessel produced.

numbers are air borne or simply chop through wavetops. These were tried on an asymmetrical hulled catamaran and have the advantage of being pivoted so that their axis are readily rotated to alter angle of attack. The boat can take the ground without any inconvenience to the hydrofoils.

Fig. 4 shows fore and aft foils in the form of a shallow Vee with the advantage that they could be hinged up to retract above the waterline out of the way when not needed leaving no underwater appendages. Small fences discourage air entrainment. A double row of foils biplane fashion facilitate quicker take off. My 16-ft. 6-in. 'Catafoil' of this description is shown in the film 'Sailing Catamarans', a lecture and this film may be arranged to approved yacht clubs. The film is 16 mm. silent colour and deals with the sailing of eleven of my catamarans and trimarans between 11 and 27 ft.

Fig. 5 was a Hydrofoil Trimaran. This craft has the minimum resistance of only one narrow central hull or fuselage stabilised by twin outrigger supported wing hydrofoils. For static stability the foils can be made partly buoyant. Various mechanical arrangements were made to lower the foils to change their dihedral and incidence as well as to fold them up after use. It should be pointed out to the unwary experimenter that the forces acting on the foils in a seaway even at anchor are very considerable indeed so that light lash-ups are useless.

The experiments showed that with an otherwise quite unstable single central hull the hydrofoils imparted adequate righting stability in use. Similar foils used on a catamaran or on an inherent stable single hulled boat need only have very short extension arms.

Apart from successful power driven hydrofoils, other modified hydrofoils I have used in sailing craft were described in chapter 9 and others are mentioned in *Trimarans, Catamarans & Boat Designs* Vol. II.

Although sailing catamaran, trimaran and hydrofoil configurations open the way to greatly increased speed performances, the propelling force remains the wind and this medium can only function through our present rather antiquated sail plan arrangements. Fully battened sails have reappeared again, they were very popular at the beginning of the century on sailing canoes, but they are hardly equal to the fastest hydrodynamic hull configurations. Let us hope that the science of aerodynamics may soon effect improvements so that better aerofoil arrangements will usefully absorb more energy to add even greater momentum to our boats.

## PRINCIPLES OF DESIGN AND DEVELOPMENT

THE SUBJECT MATTER of this chapter could occupy many volumes so let us pick out some of the most crucial factors. Some years ago I was tutor to a class of twenty-five boatbuilders taking a City and Guilds of London Institute course. About three-quarters of these students whose age averaged twenty were, at least at heart, intent upon becoming naval architects forthwith. Two points emerge. How very few such designers are necessary per ten million inhabitants even of a maritime minded nation. Secondly what a vast subject it is to study. In every available moment I have lapped up all the information I can on the subject and realise I have only discovered how very much more we have to learn.

Irrespective of what the particular designer may say, most contemporary design of household objects has taken many thousands of years to evolve slowly to its present perfection. The more complex built-up boat has only existed a few thousand years, so much remains to be learned. We have not progressed a great deal in line or sail since the fine Viking Long Ships or more recently the beautiful 'Cutty Sark'. The more we study the subject, the more technological problems arise at every juncture.

## MODIFIED SAILING HYDROFOILS

Thick line shows static waterline.

Dotted line operational waterlined heeled.

End Views.

Underneath Views.

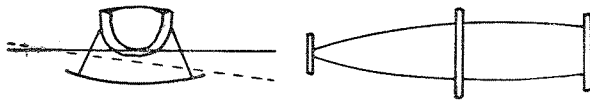


Fig. 1

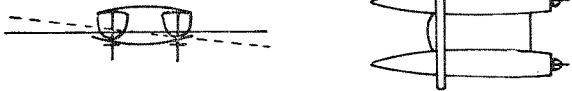


Fig. 2

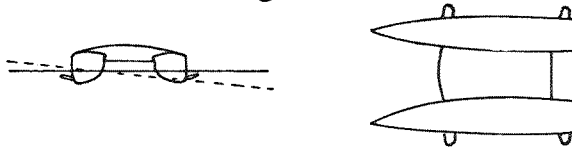


Fig. 3

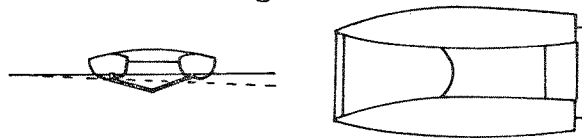


Fig. 4

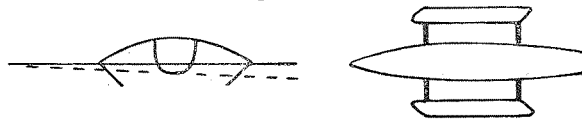
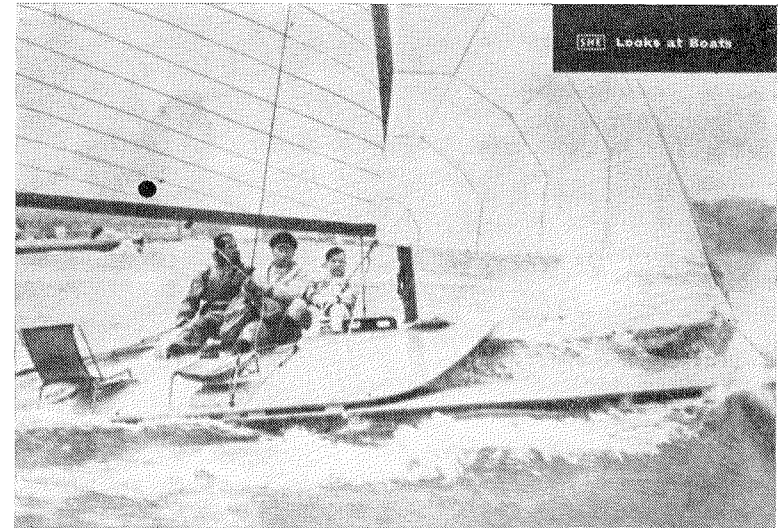


Fig. 5

## MANNERS HYDROFOIL CONFIGURATION

These illustrations, by courtesy of the 'Hydrofoil and Multihull Society', show some of the different hydrofoil configurations tried out by E. J. Manners on full-size sailing craft in the past.



H.R.H. Prince Philip sails in a gale of wind with K. Pearce in his prototype design, acclaimed by the yachting press to be the first successful high speed catamaran in the world.

(Photo by courtesy of "She" in an article featuring the Catamanner)

The few that research into these problems encounter yet more difficulties in the search for logic in analysis.

When Prince Philip opened the hydro-dynamics laboratory of the Department of Scientific and Industrial Research, he told the scientists: 'There are always two great problems which confront all scientific research establishments such as this. The first is to achieve a correct balance between fundamental work and the solution of practical problems. The second great problem is the liaison between researcher and the user'. This sums up the subject by a man who has a vast naval experience at first hand and who casually sailed 'Endeavour', the first modern Catamaran, in a gale.

Beyond the call for solving technological problems and attention to the qualities of safety even before performance, there remains the quality of aesthetic appeal. It is an overworked cliché to say that which is practical is the simplest and most attractive in appearance. Take as an example motor cars, when the earlier ones had become practical they were still an eyesore compared with the eye appeal of some concurrent design. How does one develop an aesthetic taste? How indeed, suffice that it exists as a rising tide while culture progresses. This philosophy of the beautiful is to despise the ugly, to retreat from the obscene, to progress towards satisfaction. Contemplate the Grecian Parthenon.

Summing up design and development principles, as applied to yachts, it is obvious that we must first master the mathematics conducive to the vessel floating on her correct marks fore and aft and even transversely to avoid a shocking list when launched, as had an earlier Royal yacht. For sound performance and economy we must study the principles of hydrodynamics and particularly aerodynamics as yacht sails are capable of much improvement. Then we need to meet up face to face with a variety of the practical problems met afloat and when sailing in order to further our hydro-mechanical study with an objective in view. In conjunction with these researches we ought never to forget that the sea tolerates no nonsense so the safety factor should predominate. Lastly let us add art to our draughtsmanship and look forward to cultivating perception of the aesthetic, which to the eye has the fulfilment as of fine music to the ear. It was the dignity of such music that Confucius contemplated in his King without and sage within thesis.

Exactly the same sort of thing happens in the water borne equivalent except that the water wings need only be comparatively small because water is hundreds of times denser than air. When the primary purpose of sustentation has made the boat airborne it does not become an aeroplane, it is a waterplane.

My sailing foil experiments have aimed chiefly at three targets only. (a) Partial lift; (b) Increased safety; (c) Less heel.

The first objective (a) sets about reducing wetted surface so that extra speed will result as the same force has less frictional drawback to overcome.

Object (b) increased safety, I consider to be an important requirement. Thin skinned modern dinghies are only a third or less the weight of their forebears so their inherent stability is poor. It is only the constant acrobatics of the crew that keep them upright. Stabilising foils can be fitted to reduce this hazard.

Target (c), the catamaran or trimaran configuration greatly increases the anti heeling moment so that the more upright boat makes extra effective use of her sail without spilling off wind.

### *Modified Saling Hydrofoils*

Fig. 1. A series of three or four foils, each of quite short chord but long span, divided up to share out the work so that if one becomes 'aerated' the others maintain a lamina flow with reasonable resultant equilibrium. These foils may be projected from a monohull, biscaph or triscaph configuration.

Fig. 2 shows a transverse rocker hydrofoil I fitted to a symmetrical hulled catamaran. The intention of this small section foil was to tend to resist heel and partly react in lifting the deeper forward chest with the vessel skating along on its flatter after sections or rudder foils. There is considerable drag at low speeds, although quick heave motion is reduced by the damping effect of the foils. If not provided to be adjusting it is prone to intermittent negative dive. Another big snag was weed ensnarlment. Although the weather end of this foil broke the surface at small heel, little air seemed to be drawn down on this particular configuration. Hydrofoils are far too small to react in air and this ventilation causes serious stalling, constituting a big problem to hydrofoil performance. What is awaited is a 'simple' gadget like a gyroscopic or photocell stabiliser brain, by perception anticipating wave heights ahead and through transistorised relays with mechanical amplification actuating small elevators on the main foils to avoid rotation around the transversal axis.

Fig. 3 shows quite a different concept. There are four trimming foils to improve stability. On a reasonable heel only the two that are wanted work because they are automatically submerged while their opposite



## 'MINETTE' CABIN CRUISER

L.O.A.	19 ft. 0 in.	Displacement	460 lb.
L.W.L.	17 ft. 6 in.	Engine power	from 4 h.p.
Beam	6 ft. 0 in.	Cabin Length	11 ft.
Draught	8 in.		

This boat did prove itself because the significant fact was that once the thing got moving, its hydrofoils went critical and would then support my weight. However I do not advocate the procedure involved in boarding such a boat. It meant going alongside in another moving vessel and, with gay Douglas Fairbanks abandon, leaping aboard. Later the even more perplexing prospect arose whether one would be able to leap off again, before the lift went negative.

*A Hydrofoil Express Cruiser*

In 1956 when I was elected, and have since remained, Vice-President of the Amateur Yacht Research Society an account of my Hydrocraft design appeared in the society's publication. In this I said catamarans were still displacement vessels and 'If we want to sail even faster, we must break the barrier we insist on creating by ploughing through the water. We should aim to avoid breaking the surface tension by sailing on top of the water'. The 1954 Hydrocraft is airscrew propelled with a well silenced self starting engine fitted above a streamlined saloon car like cruising body. This cabin with an all round vista is supported on twin catamaran hulls for static flotation when at rest. At speed pressure operated telescopic slides push down twin hydrofoils to either side forward with a more central one aft. Rams may be noted to adjust their angle of incidence. The foil wings remain under water while the main hulls lift up above the water and out of reach of short steep wavelets but accommodating a sort of phugoid oscillation in long seas or swells.

The Hydrocraft is capable of fast car speeds without difficulty yet using only half the horse power that would be necessary for an ordinary light displacement vessel and without sterngear complications.

At anchor the top of the coach roof lifts up boxed in by plastic surrounds to give full standing headroom providing a stable cabin cruiser with all the facilities of a super caravan.

*The Future*

For years I have submitted pictures and articles of possible boats of the future to numerous yachting magazines and papers, I have also contributed accounts of experimental work actually carried out and new boats built but the result is invariably the same—rejection.

In case it may help some reader make further improvements I will outline several fullscale-hydrofoil configurations I have tried out in the past particularly for sailing craft.

Generally speaking the actual profile of the hydrofoils is like diminutive aeroplane wings. Except in supersonic aircraft, wings have to be relatively large in order to generate enough lift to support a heavier than air machine. Gaining speed running over land, drawn by the thrust of the propeller, a velocity is reached where the machine becomes, in effect, weightless and air buoyant.

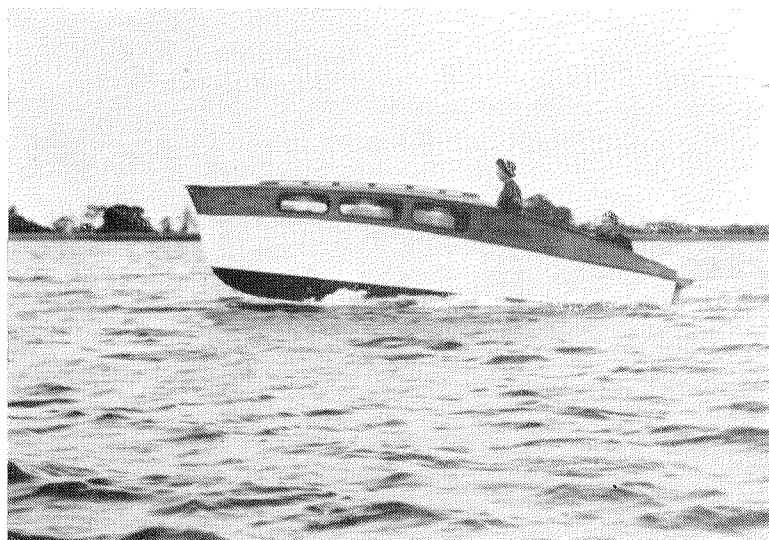
THE OBJECTS BEHIND this design are to offer the best possible value in a low priced cabin boat, particularly suitable for beginners, to provide a boat light enough for two adults and a child to put on a trailer and yet be capable of sleeping up to four persons. This accommodation can be used afloat or equally on dry land, caravan fashion, when it is being trailed from one water to another. Hotel bills thus saved, can go a long way to paying off the hire purchase terms.

'Minette' weighs 4 cwts. so within minutes the car driver almost forgets he has a tow. It is not true to say that it costs no more to tow. Even such a light boat will increase petrol consumption, but only perhaps by around 10 per cent. Even if you prefer to do your boating in one place it is economical to trail the boat to your garden for winter storage and convenient for spring fitting out.

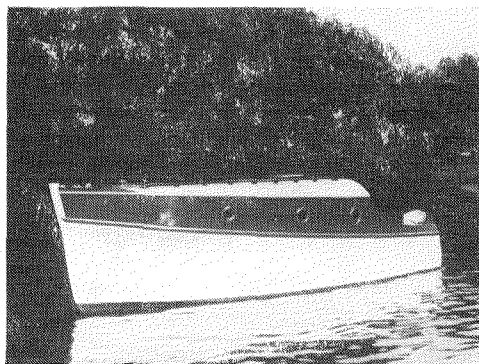
'Minette' is seaworthy enough to leave out during the season on exposed mooring in harbours or estuaries with wind-over-sea fetches of several miles. In saying this the designer does not mean to imply that the boat is intended for actual sea use in even moderately rough weather. All suchlike small cabin boats, even if they have no more than full sitting headroom, as in the case of 'Minette', should only cruise coastwise inshore in short hops and in settled weather. To go miles off shore skirting round sandbanks or to attempt long passages between ports on open seaboard is risky in any small vessel with tophammer, only one engine and no sail.

In most sound low sailing boats we usually reckon on going almost anywhere given time, but recently a young friend took me for a trip in his outboard engined boat so I could get some photographs. When we got no more than a half mile off shore he said, 'I would rather turn shorewise now'. For an instant, as a canvas engined sailor, I was rather taken aback. Then I quickly agreed — what does one do when the motor stops? Our weather can change alarmingly even in half an hour. A freshening wind can rapidly bring up a heavy short sea particularly in shoal water and worst of all with wind against strong tide. This is the first seamanship rule to remember. 'Minette' is intended only for sheltered use in estuaries, where, even if a strong wind develops, the water remains reasonably calm because it is land locked. She is ideal for rivers, lakes, creeks, canals, broads or inter-coastal waters. What delightful cruising can be achieved in such waterways and how welcome that cabin is when you are blissfully tired after a day's fresh air, absorbing new sights.

This 19-ft. Cabin Cruiser is built largely of weather- and boil-proof mahogany plywood and many members are of specially laminated construction of as many as thirty veneers. Ordinary flat plywood usually means a boat with deep Vee, hard chine and flat bottom construction, such boats as these are difficult to control in action, and usually have ugly, straight slab sides and square soap box-like transom sections. This plain box-like appearance is caused by the difficulty of getting compound curves in flat machine made plywood. This common type of flat bottomed boat is most difficult to control and manoeuvre.



The smaller insert shows the 20-ft. Cabin Cruiser designed and built by Erick Manners over twenty years ago. It is hardly outdated by today's standards. The larger illustration shows the 19-ft. version still being made of this well-tried design. Only the old-fashioned round ports and sheerline have been modernised. Neither of these design features would have been tolerated by the buying public in 1934. The picture shows the new, easily-driven 19-ft. 'Minette', racing along speed-boat fashion although fitted with an American rated outboard of only 10 h.p.



than most sailing conceptions. Abroad, the hulls of one or two sailing hydrofoils have become completely airborne but the snag is that they were also reputed to have been initially towed up and this is quite a different thing. A glider can gain altitude in rising thermal air currents but it cannot get airborne initially without being mechanically towed up.

I have towed boats up on their foils but the only sorts I am now talking about in this chapter are capable, if not of complete lift, of partial lift simply under the wind's influence. As I have outlined in another chapter, I feel that the electronic age must advance some more in order to prescience incidence control.

Until then we should be content with sailing hydrofoils arranged only to lessen partly the boat's dead weight. In reducing the apparent weight by half it is said that half as much speed again will be available. Immediately we enter controversy, how much faster can a boat sail above wind speed? Maybe not quite so fast in ordinary planing boats held up by water pressure only, but with the hydrofoil new potentials can be realised with the additional reduced pressure available on its upper surfaces.

### *Jet and Hydrofoil Experiments*

My early hydrofoil experimental boats have included both the slowest speed trials and at the other end of the scale high speeds. I came to the conclusion that jet drive was the ultimate for water speed. Some jet fuels certainly give a spectacular performance with the static part of the boat hardly contacting the water, it was a case of 'That's (something)—that was'.

The experiments I did not much like were when, years ago, I played with the old stove pipe jets. Because of the appalling noise the jet engine made I felt duty bound to get well away from civilisation for the process. This entailed lugging loads of paraphernalia over desolate marshes to tidal creeks. Such delightful places are best left in the serenity of quietness. Apart from the actual engine, the ancillary gear consisted of high octane fuel, compressed air apparatus and last but not least in weight, heavy lead low voltage accumulators from which to produce alternating current so as to step it up into the thousands of volts category. If the spark thus produced started the wretched jet motor, it seemed all hell was let loose. Already jaded from the exertions of cheating the marshes of the attendant gear I did not appreciate proceeding with that ear shattering noise on my tail. Let's stick to the music of silent sailing.

Perhaps no less hazardous but at least quieter was a multi-hull hydrofoil I made. For economy and carrying to water, it had to be as small as possible. Afloat at rest, this meant that if I stepped aboard (42-in. chest and heavy with it) the whole contraption and crew immediately sank beneath the wave, like a lift descending into a flooded basement.

## HYDROFOILS OFFER FASTER SAILING POTENTIALS

SEVERAL YEARS AGO I assisted with the building of what is, as far as I know, still the largest sailing hydrofoil form of boat ever to be attempted. In some respects it was similar to earlier work I had tried out.

New shapes are never immediately acceptable to the eye but this creation did look a little like a monoplane with a wing span of nearly 30 ft.

Unfortunately this boat was not to my design so I had to make it the way I was instructed. Some of the alterations I felt I really must advise were incorporated but I still thought that its performance was bound to be impeded in too many other ways. However, it was an interesting experiment if too complex.

At the tips of its streamlined outrigger wings there were hinged hydrofoils and these were fitted with adjustable apparatus so that their dihedrals and incidences could be tried at different angles. Naturally all these variables were not under remote control and consequently a great amount of time and energy needs to be devoted to evaluate the outcome properly. Another great obstacle to such work is the variability and suitability of weather conditions.

The working model, which we had made previously, showed that the capsizing moment of the huge machine was checked by the dynamic lift from the hydrofoils because they were themselves devoid of positive buoyancy.

A sailing boat with a beam of 30-ft. could hardly hope to be popular in crowded anchorages but at least its wings could fold back on high tensile hinges supplied by one of the leading aeroplane manufacturers. I used to work on aircraft and it may surprise some readers to know that only four bolts are used to hang on massive aeroplane wings. Mind you, they are good bolts, their alloy had to be just right and they are individually crack detected to reveal any defects that would be invisible to the unaided eye.

## SAIL VERSUS POWER HYDROFOILS

The sailing hydrofoil must not be confused with power driven hydrofoils of which a number of experimental boats both small and large have been built over 60 years. Experimental powered hydrofoils are invariably shown functioning in calm water. It is easy in these conditions but far and away more difficult for a sailing hydrofoil because a sufficient wind for fast sea sailing is always associated with broken water.

With level flight not heeled by sail plan influence a measure of success is assured with engine propelled hydrofoils and they are far more simple

The 'Minette' has much curvature applied to her vital statistics. For instance, the top of her transom has tumblehome and then curves in again to the waterline. There is a good flare, outward sweep, to the topsides and no ugly hard chine breaks the waterline forward. There is an attractive turtle deck but the main camber is applied to the edges only, so that the  $\frac{1}{2}$  in. thick 8-ply top is safe and comfortable for sunbathing. The important underwater section is rockered fore and aft and also curved transversely, providing very easily driven lines which make a boat responsive and easy to manoeuvre. Poor lines usually mean that twice the horse-power, and petrol, are required to get the boat along at a given speed. Her mahogany planking is  $\frac{1}{2}$ -in. thick below the waterline. The cabin is 11 ft. long by 4 ft. high, leaving a cockpit 7 ft. long with safe average freeboard of 3 ft.

The cheapest method of propulsion for 'Minette' is a 5 h.p. modern, self coiling starting cord, outboard motor for average 6 knot use. A clutch is a big advantage as also is remote bulkhead steering but this can always be fitted later. If speeds above 20 knots are desired a motor up to 25 h.p. can be fitted. Ideally, to cruise at quiet and steady engine revolutions, a 7 to 10 h.p. motor is very pleasant and gives speed-boat like performance. It has ample reserve of power to overcome adverse winds or normal water currents. The transom is  $1\frac{1}{8}$  in. thick to take heavy outboards.

'Minette' designs are built under licence to Thames Craft Manufacturing Co., established in 1934. They are obtainable from leading stores and suppliers at home and abroad. If preferred the 'Minette' can be supplied glass-fibre sheathed, at extra cost, in selected colours, to obviate the yearly repaint.

Because of standardization and quantity production methods this proved cruiser sells at a remarkably low figure.

## OTHER CABIN CRUISERS

Low priced Stock Boatbuilding plans are available for Cabin Cruisers of 16 ft., 20 ft. and 25 ft. in length, sleeping between 2 and 6 persons. These craft are of economic, carvel, hard-chine build utilising simple waterproof plywood. The 16 ft. and 20 ft. sizes can be easily trailed. See pages 57 to 59 for further details.

Reprint from advertisements

<b>NEW</b>	Well known hydrodynamic research worker has developed several advanced boat designs with
	proved potentials. Will those interested please write quoting Research:
<b>ERICK J. MANNERS, A.M.B.I.M.</b>	

CHAPTER 5

8-ft. DINGHY

A Dinghy the amateur can build with a professional look. Its eight features are: Low cost; High stability; High capacity; Low weight; Simple to build; Easy to tow; Easy to row; Simple to stow.

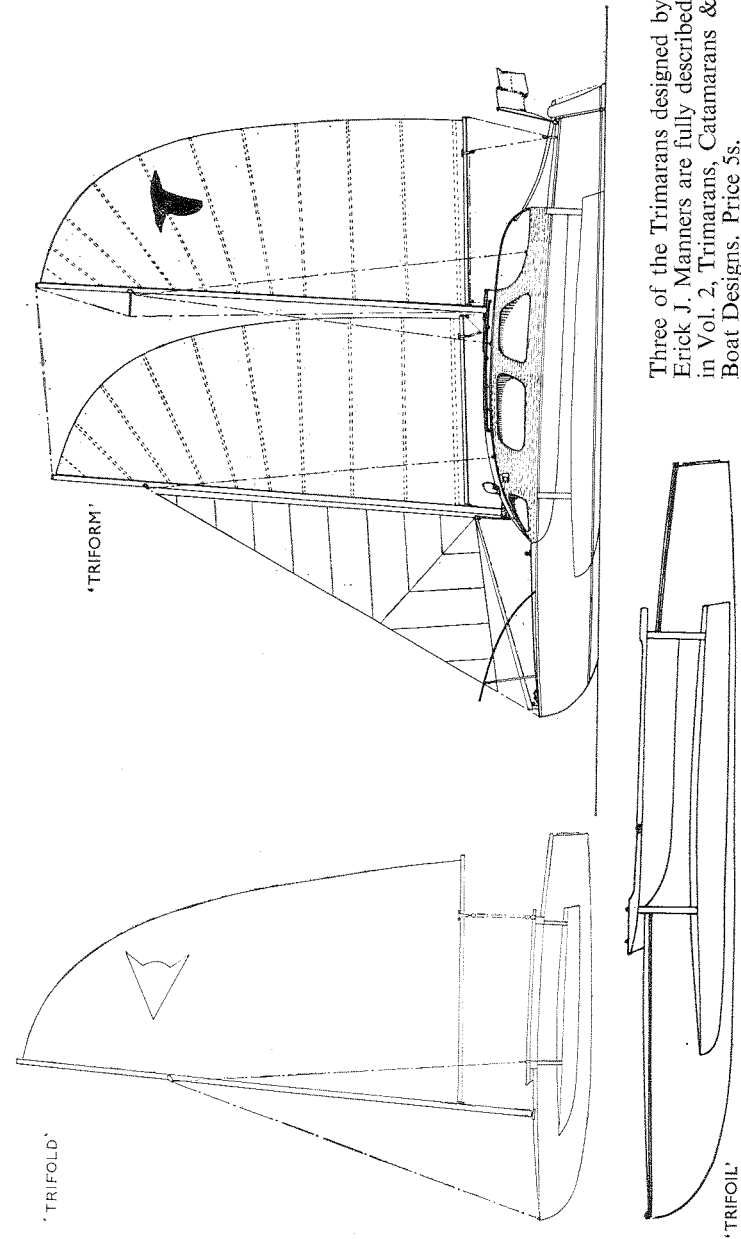
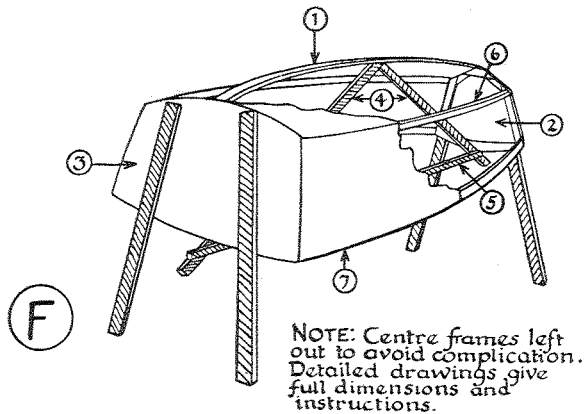
A DINGHY often has to be a general purpose boat as well as a Tender. The B.B.E. Dinghy is a useful boat for these purposes as it can be used for fishing, exploring streams and shallow creeks and on any exposed shore so long as the weather is reasonably calm. As a Tender to row out to larger sailing dinghies the B.B.E. dinghy is ideal as it is particularly easy to hoist aboard or it will tow with the minimum of resistance possible. The dinghy can be motorised by clamping on a small outboard.

The first most important quality to look for in a handy dinghy is obviously safety which means stability, allowing, if necessary, a man to stand up in it without fear of capsizing. Its design must not allow it to rock too suddenly. In many dinghy designs height calculation is from the top of the boat to normal sea level, rather than to passing wavetop height, and this means that when fully loaded, the wavecrests come aboard with unpleasant regularity. Consequently two sheerline heights are provided for in the drawings. (1) One for sea use with fairly heavy loads, and (2) For sheltered lake or river use.

Fore and aft balance is sometimes poor in small dinghies, the front being too far out of the water when one person sits aft and a second rows on the only other thwart. This dinghy design permits good balance under all states of loading.

It is important that a dinghy tender be light in weight. Some are so heavy that at least two people are needed to get them up the beach

*Stern view of one of many descriptive drawings supplied with the plans.*



jerks and unnecessary movement by the new weather skipper taking over at each turn. If you want to stop and lay-by for tea at sea just free the sheets and you have the most steady deck obtainable even on days when you could not take an ordinary dinghy out.

Fast and exciting as these boats are to sail, they are quite easy to trail. They are light, sit fair and square and one soon gets used to their 18 inches or so of extra beam.

Lift the cat sideways on sloping beach or hard, place a bit of cardboard or suchlike under each transom and then one person lifts each bow up while a child runs the trailer under to just past the C. of G. When trailing round very tight bends, take care not to let the lowered and now 'bowsprit' like mast get the wrong side of such things as lamp posts.

Of course, after sailing a catamaran you will find ordinary dinghies too slow or unsafe, but anyway here's to sailing galore with that extra sparkle that only good catamarans or trimarans can give.

## CHAPTER 11

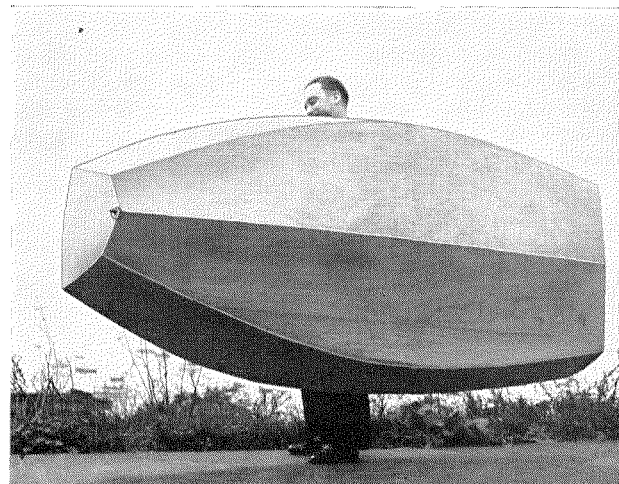
### TRIMARANS

I UNDERSTAND that as a professional I designed, built, sailed and developed the first fast and successful Trimaran in this country. A Trimaran is a multi-hulled boat. In this work I tried out a number of different float and hydrofoil configurations, interface and immersed, and came to the conclusion that the best arrangement was a central hull with a modified hydrofoil form on outriggers either side. If a balance can be struck a single main hull offers less resistance. It has the great advantage of a central cockpit with full legroom. This cuts down on physical exercise. For transportation the outriggers can fold up about their centre and detach from the hull.

In the photograph of one of my earlier Trimarans you may notice that it is actually heeling to windward, the opposite to the natural. This can give an aerodynamic lift component and with a little skill they can be balanced, cycle fashion, so that neither sponson is in the water. This can be seen in the film 'Sailing Catamarans'.

In my opinion suitably designed Trimarans have the highest sailing speed potential. In my seven year series of systematic research into Trimarans and Hydrofoils I have successfully developed the first fully engineered 'hydrofoil stabilised trimaran' in the world. This is named the 'Trifoil' and plans are available to build my 20-ft. 'Flying-Wing'. More orthodox, but improved float type Trimaran designs are also available with 'Hydro-wings' namely the 15-ft. Trifold and 30-ft. Triform a cruising Trimaran. These are fully described and illustrated in Volume 2 entitled 'TRIMARANS, Catamarans and Boat Designs'.

or to put them on to a trailer or beach rack. This heaviness often spoils the pleasure of boating. This 8-ft. light weight dinghy can be hauled up the beach by one man or easily put on to the top of a car by an average man and woman.



*Light Weight. One man can lift this dinghy. Bilge keels or a skeg can easily be fitted if the boat needs to be dragged over rough ground.*



*This 8-ft. dinghy is neither designed nor recommended to carry six persons—but this picture demonstrates its capacity and stability with such a load.*

Fully detailed building plans for the amateur cost 32/6.

### *Simplified Construction*

Most orthodox dinghies and boat constructions involve complex woodworking joints and it is therefore little wonder that the amateur woodworker often fights shy of building even small dinghies. This 8-ft. dinghy is specially designed with no complex joints other than the lap or butt joint which is simply one piece of wood laid on top of another and glued and screwed together. This design enables even the amateurs without any woodworking or carpentry knowledge whatsoever to readily build it with no more than seven commonplace tools. Sets of plans comprising six drawings, including full size patterns for frames, together with working instructions, costs 32s. 6d.

#### \* CATAMARAN MAKING

*A Legend by ERICK MANNERS*

This I witnessed on a desert island  
Amid outrigger canoes hauled up beachwards  
Sheltered beneath palm-frond serrated patterns  
Masking the full beauty of their curvaceous forms  
In the flickering, shifting light

They fetched Te Iho the wise old boatbuilder  
He did not use a pen nor any paper  
But composed a dance of catamaran making  
Symbolic of men's eternal striving  
To gain new clarity and light

Te Iho led the sailor dancers  
For a while he became once more young and energetic  
Amidst the ring of intense spectators  
Each held glowing lamps or torches  
Enclosed the dance floor of coral sand shimmering  
In the flickering, shifting light

As the hours passed the boatmen dancers  
Became more inspired, livelier, wilder  
The performers wore the wild hibiscus  
In crowns of the plaited leaf pandanus  
They looked as heathenish as their ancestors  
Their shadows leapt and danced among the palm trunks  
In the flickering, shifting light

Like ghosts, spirits from a past age  
Wakened to life by the primitive, exciting music  
Yet in time the dancers collapsed exhausted  
The drummers could no longer move a finger  
While in the background breakers rumbled dully  
Trade winds rustled in the tops of palm trees  
Came a quietness borne of tiredness  
I had seen the dance of catamaran making  
In the flickering, shifting light

*\* May be chanted with a lilt akin to Hiawatha*

and then with board down and sheets tight, get the 'cat' really sailing fast for a few moments no closer than 45 degrees nor wider than 55 degrees to the true wind. Then 'ready about' gently putting the helm down and immediately before or after, according to the balance of the craft, haul in the main sheet so that the boom hardens in to about amidships from where it was previously, probably over the lee inner transom quarter. Perhaps with or without further correction of the tiller, which will have swung back central or neutral while you were hauling in the main sheet, the 'cat's' jib luff in line with the mast centre, will now have swung so the wind direction is starting to come from the new side. This final process will be helped by the jib which has been left untouched until now and will be back winding and quickly forcing the bow head right round, particularly in the lighter cats which probably have lost way on by now due to their lack of mass momentum. As this happens and when the half-way mark is just passed the main sheet is purposely slacked off to take up the opposite but former close hauled setting and at the same time, or immediately after if there is no crew helping, the jib is brought across, gently but firmly and quickly but not in a 'crash bang' or flogging canvas style. At about this time the helmsman changes sides. When you have mastered this fast rhythmic movement you may be able to free and haul the jib much sooner. When you have developed a finesse there will just be time to pull the jib in really tight before the full weight of the wind becomes operative on the new tack. With a little practice the whole procedure only takes a few seconds, indeed it cannot be dragged out too long. Remember that unless there is way on a boat the rudders are useless for steering. A flapping or jerked across jib is bad practice. If at first you do muff it, miss stays and get into irons, put the rudders the opposite way and if you have gathered any sternway you may still get round.

Ordinary boats can be a menace to gybe turning with the wind but there is nothing to it in a cat. As you put the helm over haul in the sheet to lessen the inevitable rapid swing across of the boom. The whole process is much slower in a cat and its stability makes the customary dash across to the new weather side at just the right moment of time quite unnecessary.

Don't expect a light cat to manoeuvre very well if she is overloaded or towing a dinghy. For peak performance carry the absolute minimum of gear. Do not keep the jib sheeted in tight when you are close reaching, just the right amount of slackening can give you an additional 5 knot surge of speed and in this position of sailing you may need less centre board down or none at all if running. Best results come from correct sail trimming and fore and aft trim effected by the crew's weight together with fairly upright lateral balance.

Except in choppy water it is often best to sail a cat rather freer off the wind, you may have to go further but because faster you still arrive sooner. Short tacking against the wind in narrow rivers, keep her sharply close hauled and with dual helmsmen avoid waste of time,

## HOW TO SAIL CATAMARANS

THIS TITLE is rather a misnomer because to sixty or so adult students for many years I have spent 70 hours teaching them how to sail and know their boat, followed by a like time in seamanship and navigation tuition. Therefore it would be hard to adequately deal with the subject here. There are a great deal of interesting things to know about in these matters to be really competent and get the best out of sailing. So if you are keen, do give it some careful study in as many ways as you can, books, further education and actual crewing. The class room is the most conducive to learning.

All I have room for here is some mention of what you might best do differently in catamarans to traditional dinghies. If you are used to the latter it will be more difficult for you to change your habit than it will be for a beginner to grow up right with catamarans which are the easiest of any sort of boat to learn to sail in. A jammed sheet or a gybe lurch and you are deposited upside with the dinghy on top of you but this is not so with the mid-category B or C catamaran previously outlined in this paper.

In this connection I am in agreement with an original statement made by the former Minister of Aircraft Production, Lord Brabazon, when he said that small dinghies were not suitable for learners. During a special ceremony to give Londoners their first twin hulled boat demonstration, this well-known yachtsman told the crowds, press and TV crews that in these days, with the roads jammed, the water was the only place one could get on to. 'There is still room on the water and there we are, for once, more or less our own masters'. Commenting on ordinary small dinghies he said that although he had the greatest respect for small dinghy sailors no one could persuade him that conventional dinghies were at all suitable for beginners to sail in, on the other hand, he went on, the 'Catamanner' was excellent for all purposes.

Lord Brabazon said these twin hulled boats were safe and extremely difficult to capsize whilst still being remarkably fast. Regarding assembling 'Catamanners' from kits he said there was the added satisfaction of the actual building as well as the thrills of launching and sailing.

For making available such fast but safe boats for people's recreation, Lord Brabazon of Tara, G.B.E., M.C., P.C., congratulated both B.B.E., Twin Hulls Ltd., and the designer.

Perhaps the most important thing to do properly in a catamaran, depending on its design, is coming about. Remember that because a catamaran sails so much faster the apparent wind draws ahead far more, so until you have mastered the art don't expect to get right round if you are really on a reach to start with, that is with the true wind on the side of the boat. Instead determine, at rest, the true source of the wind's eye

## SCHOOLS M.P.

(12 ft. Multi-Purpose Dinghy for rowing, outboaring or sailing)

TO ENCOURAGE schoolchildren to take up boating I offer them plans at cost price to assist them to build a 12-ft. sailing boat for their own use. There are several reasons for this offer, they are rather far reaching but basically they are fourfold.

- (a) To encourage self motivation and the satisfactions that only stem from practical creation.
- (b) To provide, at the cheapest possible price, the safest, and most easily made dinghy.
- (c) To encourage teachers in many different subjects to enliven their teaching by maritime stimulation.
- (d) To advocate that suitable courses of classroom studies be made in sailing and sailing precautions prior to actually going afloat.

At 12-ft. long the M.P. dinghy is the shortest single hull boat I can conscientiously recommend. I think it quite absurd to push sailing dinghies of smaller sizes. Even toys of only 8- and 9-ft. are sold. They often put people off sailing for life. They are most inefficient to try and sail and lurch you overboard on the slightest provocation.

From personal observations I have been concerned about some of the rather dangerous and unsafe types of small boats youngsters are virtually being encouraged to go sailing in nowadays. If they were all confined to shallow boating ponds all might be well but you cannot expect this. Naturally some are going to be used in deep rivers, lakes and on the sea. The average modern dinghy is nothing like as safe as the pre-war dinghy of the same length. The length, beam and draught are just the same as previously so it is not that. The main reason is that modern dinghies have little inherent weight compared with the older sorts. Thus, the most important stability factor is insufficient, you need to skilfully balance the craft to keep it upright. The cause of this is that due to the introduction of waterproof synthetic resin glues, the build of dinghies is now very thin, indeed quite unlike the heavy solid planking riveted to timber ribs of the traditional dinghy. This former weight ratio gave the all important inherent stability with a sufficient safety factor that many light craft today are deficient in.

The principle of my special design is to provide the safest possible dinghy to have a fast performance yet be cheap and also particularly easy to construct with no complicated joints. Marine plywood is the main ingredient for simple building and because it is light, more round is put on the underwater section and the boat has a greater beam proportion. This is a characteristic of American boats and enhances the stability in much the same way as the beamy catamaran principle.

Apart from its inherent safety factor the Schools M.P. is well provided

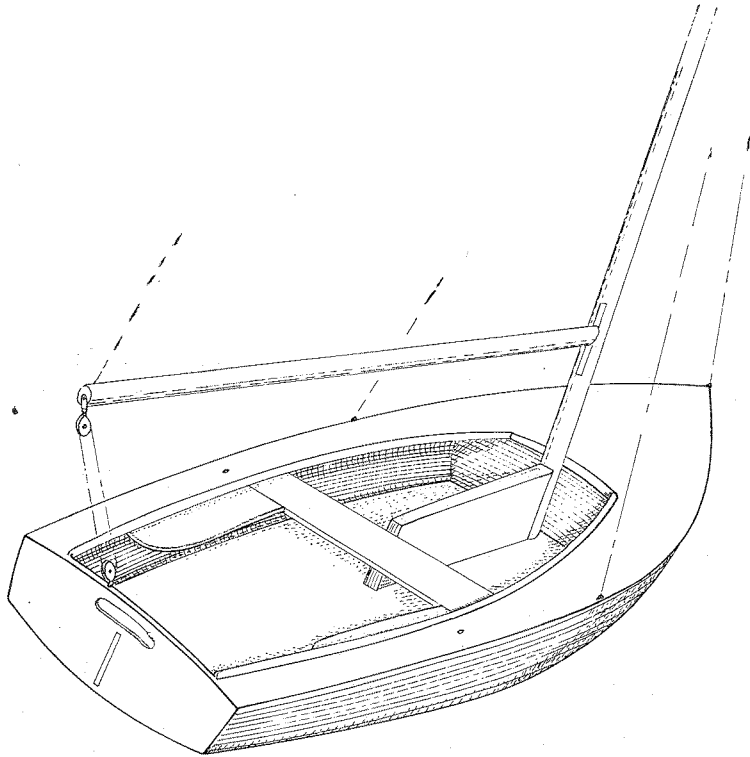
with built-in buoyancy so that in any event it cannot sink. She is light for launching and towing yet roomy and weight carrying. Her standard rig is not overcanvased but allows her to plane in a good sailing breeze.

Apart from her ease of sailing this Multi Purpose dinghy is readily rowed or driven with an outboard motor as a launch and she is not too big for car-top transportation.

Normally building plans cost £4 4s. 0d. for one boat. On receipt of a stamped addressed envelope further particulars of the cost price offer to schoolchildren may be obtained from the designer.

To provide Britain with technicians and craftsmen, Education should be realistic with really interesting subjects to get to grips with, as are all the many facets to do with boats.

*The designer offers a Challenge Trophy to schools racing this class.*



*Perspective drawing of the very safe and easy to build plywood Multi-Purpose Dinghy for rowing, sailing, fishing or outboard motor use. Building plans cost £4 4s. 0d. including registered sail number for racing or transfer purposes. This versatile boat is not too big for car-top transportation or may be easily trailed behind small cars.*

time. A snug and neat cover of waterproof plastic material can be quickly fitted over the boom for night use whilst one owner has a small permanent cabin built up.

### 'THE SHAPE OF THINGS TO COME'

*Another 1957 Ocean Cruiser Catamaran*

Thursday, January 23rd, 1958

## MANNERS DESIGNS A 40ft. CABIN 'CAT'

**Plenty of  
room, pace,  
stability**

**T**WIN HULLS LTD. have received many queries in the past year regarding cabin catamarans. We show here one of the designs produced by Erick Manners at their request.

Called the Cabinmanner, it is a 40 ft. cabin catamaran with full head room, including dressing space in the forward sleeping spaces.

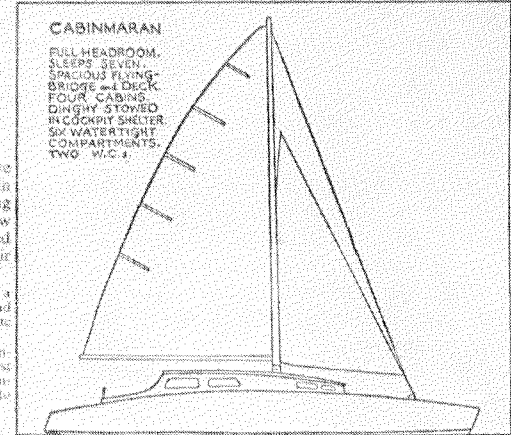
As may be expected with this entirely original conception of fast cruising yacht design, many completely new problems have had to be faced and solved.

#### EXTRA SPACE

The design cannot call on tradition or convention as do those of single-hulled cruisers. They bring new, stimulating ideas of speed, stability, roominess and comfort to the cabin boat.

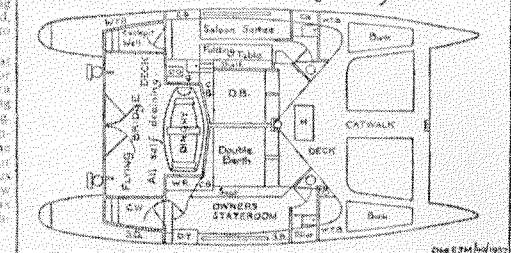
Inboard dinghy stowage in that part of the boat too shallow for accommodation makes for extra space and convenience, there being special facilities for easy launching.

There are two simple, non-mechanical outboard w.c.'s. The design readily sleeps seven in four separate cabins and gives generous locker space. It embodies the new familiar Catamaran principle of six watertight compartments for additional security.



**CABINMARAN**  
FULL HEADROOM,  
SLEEPS SEVEN,  
SPACIOUS FLYING  
BRIDGE and DECK,  
FOUR CABINS,  
DINGHY STOWED  
IN COCKPIT SHELTER,  
SIX WATERTIGHT  
COMPARTMENTS,  
TWO W.C.'s.

40ft. CABIN CATAMARAN designed by Erick J. MANNERS



**Roy (20) has**

THE SHAPE OF THINGS TO COME? THIS IS ONE OF CAPTAIN ERICK MANNERS' DESIGNS FOR A FAMILY CABIN CATAMARAN. IT IS DESIGNED TO SLEEP SEVEN AND BRINGS NEW, STIMULATING IDEAS OF SPEED, STABILITY AND COMFORT.

*A cutting taken from Yachting Weekly shows the plan and elevation of a 40-ft. Cabin Catamaran. She has been independently reviewed as capable of over 20 knots and more elegant looking than the Hawaiian catamarans.*





*The fully proved 27-ft. 'Black-Cat' Cruising Catamaran in action. This fine yacht, built by Twin Hulls Ltd., proved one of the outstanding highlights of the International Boat Show.*

*(Continued from page 41)*

The Catamanner 18-ft. 6-in. class was introduced three years before the next commercial competitor took up a length of this order which is, I feel, superior to combat the short seas of shoal water which unduly 'knock-back' shorter boats. In the film 'Sailing Catamarans' there are some action shots of the 18-ft. 6-in. Catamanner slowly lifting a hull and equally majestically lowering it back without any loss of speed. To watch or sail this larger size of 'cat' gliding across seas with its unretarded motion grips one with a sense of the graceful perfection of complete harmony. This vessel is shown at high speed on the cover page.

#### 18-FT. 6-IN. DE LUXE CRUISER CLASS CATAMANNER

This is very similar to the Racer Class just described excepting that the hulls are detachable. For cruising purposes a smaller sail area is preferred by some owners. Even so the boat is much faster than traditional craft and so enables greater cruising distances in the same period of

## CHAPTER 6

### 'LIBERTY' 24-ft. AUXILIARY SEAWORTHY YACHT

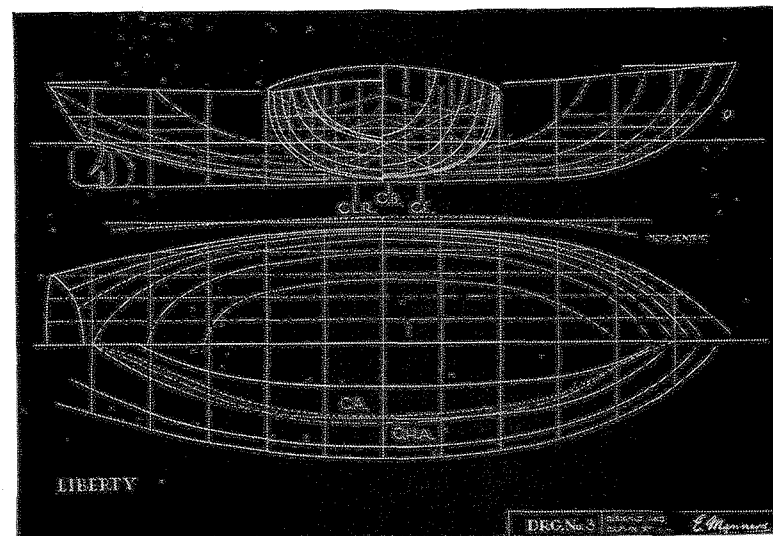
L.O.A. 23 ft. 8 in. Draught 1 ft. 7 in. with C/P 5 ft. 8 in.  
L.W.L. 20 ft. 0 in. Beam 7 ft. 10 in.

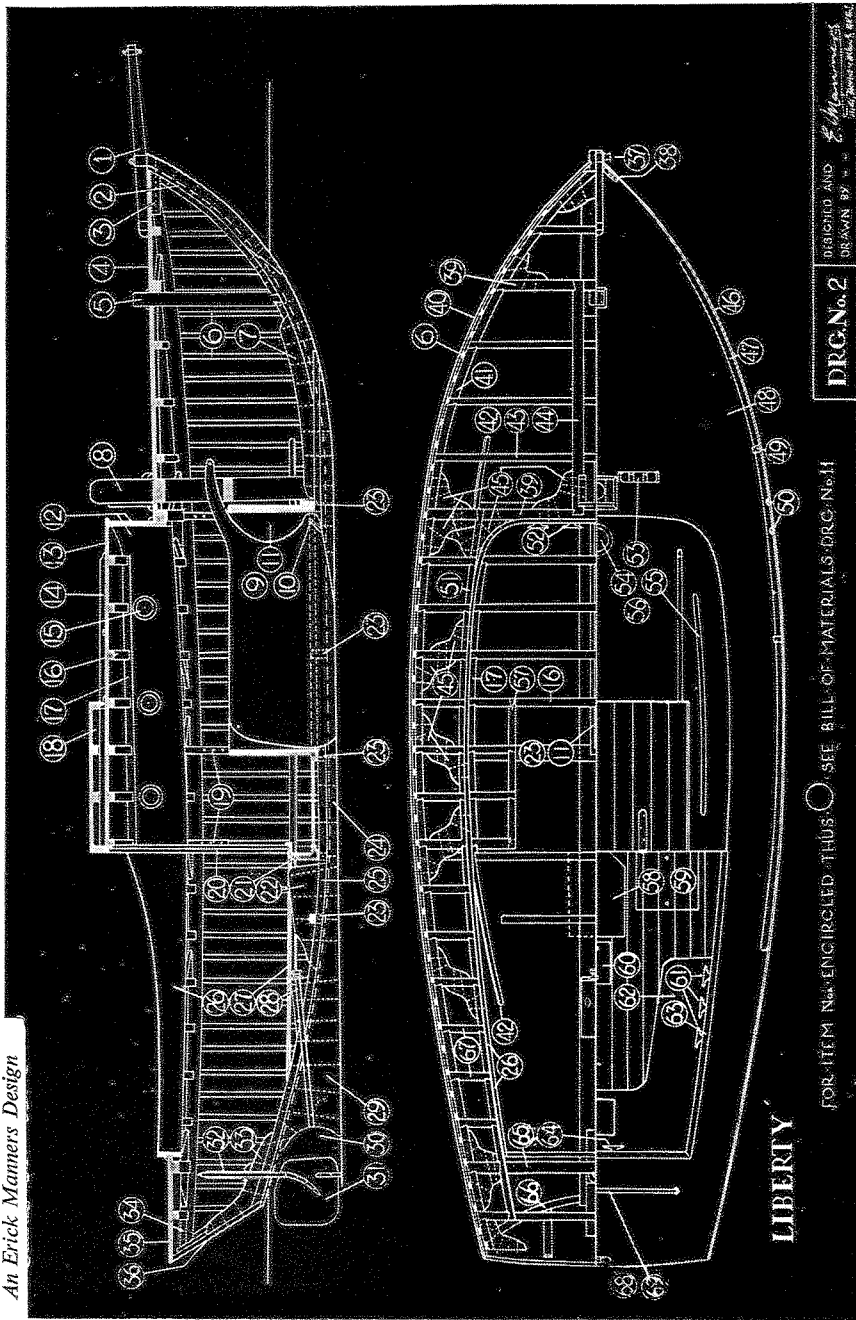
IN SPITE OF the trend towards smaller, lighter and more tabloid cruisers this 20-ft. waterline cabin sloop is generally considered by experts as about the minimum length and build for sound seagoing performance and at the same time providing full sitting headroom without unduly cramped cockpit or cabin accommodation.

This 2½ ton displacement sailing yacht is intended to be staunchly constructed in the traditional way of solid or ply planking on steamed timbers. In this design I have survived a force 7 to 8 gale for as many hours in the short steep waves of exposed shoal water, the most testing of all sea conditions. The cabin was good comfort as you cannot see against a gale of this strength in such sea conditions, because the wind blows the tops of the waves off in a horizontal blinding fury.

For sea keeping qualities 'Liberty' has a wonderfully lifting bow as a look at the drawings of her fine lines will show. To be really seaworthy a yacht cannot have a greater proportion of freeboard or superstructure. This design has in the past been commended by leading authorities and is so arranged as to be suitable for single handed sailing if need be.

Both saloon seats have upholstered backrests and these can, if required, lower to form a double berth one side with a single berth on the opposite side. Constructional plans cost £7 7s. 0d. A sail plan and profile of this seagoing vessel is shown in Volume 2.

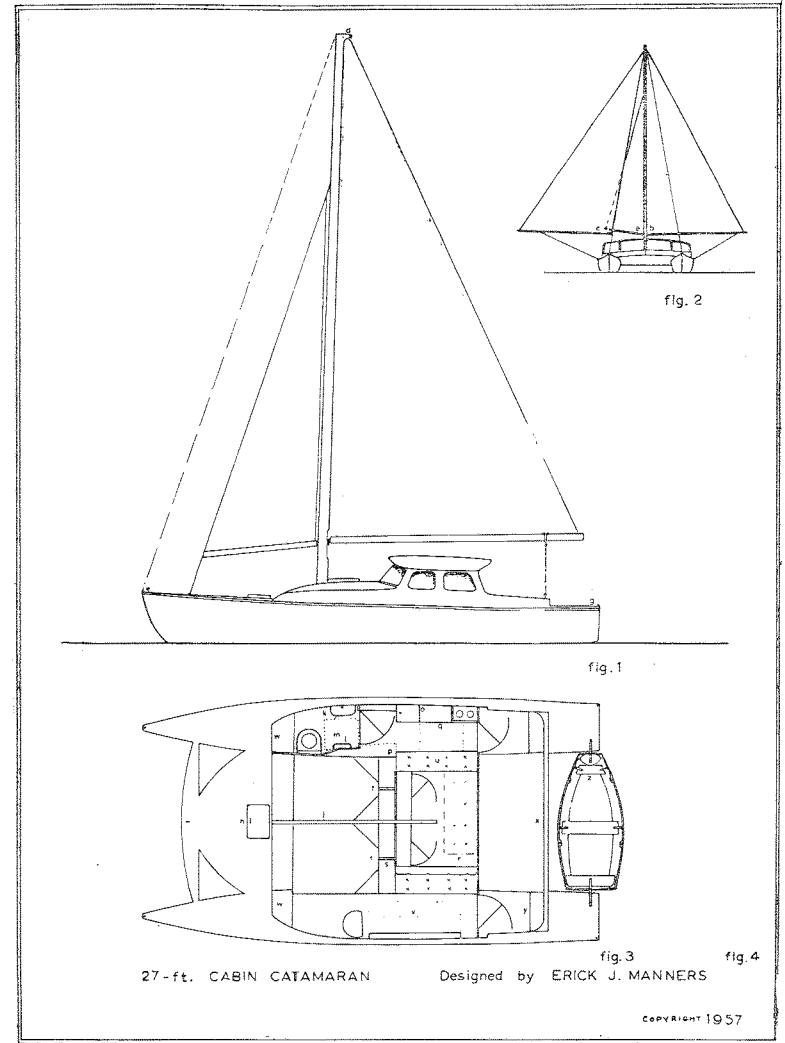




DESIGNED AND DRAWN BY *E. Manners*  
 DRC No. 2

FOR ITEM No. ENCIRCLED THIS O SEE BILL OF MATERIALS DRC No. 11

A 1957 Design of 'Black-Cat' Fast Cruising Catamaran With Many Novel Features  
 Designed by Erick Manners, M.I.E.I., A.M.B.I.M., A.M.I.W.



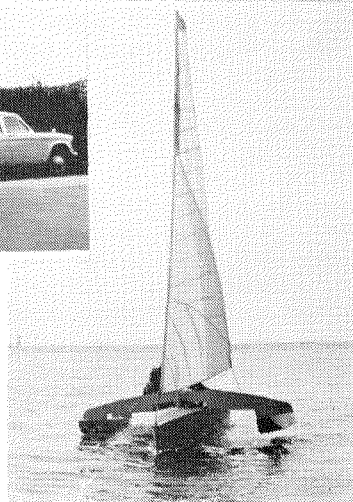
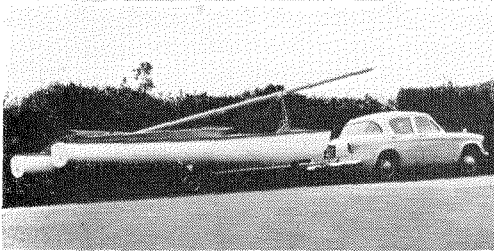
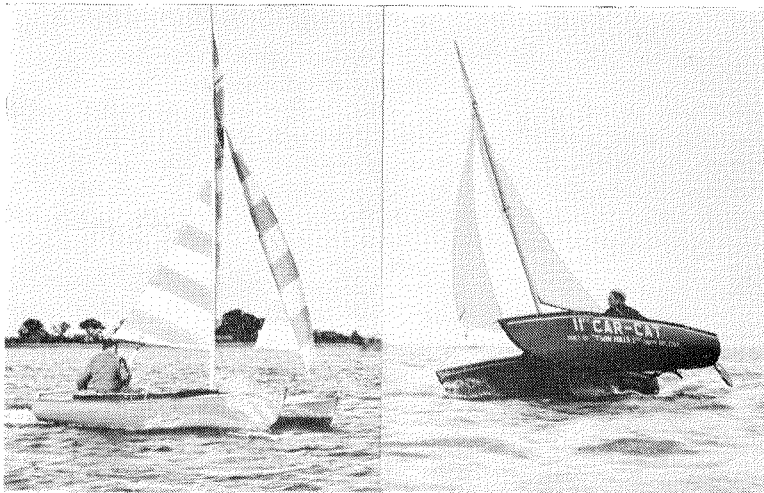
27-FT. CABIN CATAMARAN. The drawing shows a profile, a plan view of the accommodation and sail plans shown running goose-winged. The rig has the great advantage of standing backstays. Sets of building plans are available at £10 10s. 0d. and these describe other interesting features of this fast cruising vessel. An independently published account of the 27-footer refers to 'excellent features and it indeed appears to be about the best internal arrangement for the size'. This craft has proved to have a very fine open water performance. Photographs and trials of the 27-ft. Catamaran are described in Volume 2. Sets of 'Black-Cat' standardised class building plans have been sent to many parts of the world.

## THE FIRST POWER CATAMARAN

THE 'SKI-CAT' was the first British catamaran speedboat to be produced commercially. Why a twin hull arrangement for a motor runabout? There are a number of reasons. In an orthodox single hull launch, during forward motion, the stem has to separate the water and the bottom of the boat passes over it. Consequently the water is already in a disturbed turbulent state by the time it reaches the propeller, so that it cannot thrust against 'unspoiled' water. In the 'Ski-Cat' the propeller reacts in the 'clean' solid water flowing down between the twin hulls. In the 'Ski-Cat' the transom of the bridge deck on which the outboard motor clamps is forward of the hull transoms. This gives a well effect without leakage troubles, the tipping moment is less, while the motor can be tilted up without protruding and getting in the way of everything. It also has the hydrodynamic advantage of keeping the gravitational centre further forward as well as giving less fierce steering caused by the propeller slip-stream of a rotational outboard.

The double hulls giving improved directional stability, while in banking for quick turns skidding is almost obviated compared to the smooth single bottomed boat.

The divided hulls offer less bounce and slamming in a seaway while the central wing can tend to act as a shock absorber upon a resilient air cushion to provide a smoother ride. Except for strong, high powered installations I do not advocate the low central wing tunnel because it noisily slaps the wave tops. If an efficient separation pad of entrapped



The top left hand picture shows the popular 14-ft. Sports Class Catamaran built from a kit with beautiful glass-fibre hulls already moulded. These long lasting hulls are both rot-, worm- and leak-proof. They are easily maintained because painting is unnecessary. Although dearer than wood they are well worth the extra. This class has been exhibited at Earls Court, Olympia, Harrods, French, U.S.A., Hawaii, Swedish and other Boat Shows.

The top right picture of the 11-ft. Car-Cat with crew sat well inboard and flying a hull specially for Lawrence Hanley, John Bull's cameraman. Actually for her length this class is exceptionally stable, heeling much less than equivalent size dinghies. Kits are easily made up and cost from £64 with shell hulls.

Lower picture shows a 1957 18 ft. 6 in. Catamaran on a trailer ready for towing anywhere. This is the largest day catamaran commercially produced, and recommended for open shoal waters. These three standardised classes are exported in considerable quantities abroad.

The lower right picture shows one of Erick Manners' early experimental Trimaran designs described in Chapter 11. Silently cleaving through the water, notice how she is 'heeling' to windward.

(Photographs by E. J. Manners)



The 11 ft. 6 in. 'Ski-Cat' under way with a 7 h.p. outboard. For all-round use the 14 ft. 6 in. is the minimum length Power Cat recommended and constructional plans are available price £6 6s. 0d. See illustration on page 58.

air is required then there should be enforced air supplied as in the amphibious super speed boat with twin retaining sides I designed over twenty years ago, described on page 4.

Besides these advantages remains the extra lateral stability factor of the twin hull configuration giving a safer boat at rest. As in a sailing catamaran, quick and excess movement tends to be avoided by one hull partly cancelling out the different forces the other is experiencing. Besides reducing pitch and roll, in action the slender twin hulls produce less induced drag in the water rather as the twin blades of a sledge on hard ice offer less resistance than a flat bottomed toboggan on soft snow.

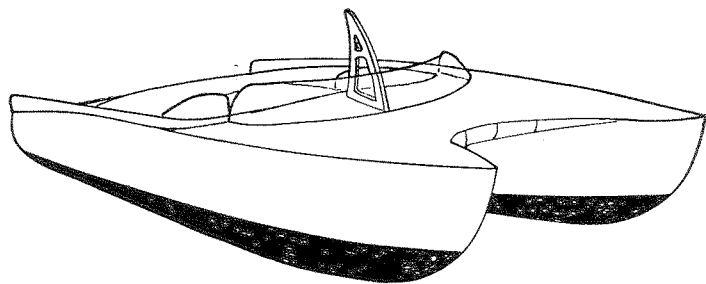
From these observations it is possible, subject to correct design, that the twin hull boat for power use will make as great a contribution to improved efficiency as has its sailing counterpart.

The 'Ski-Cat' design made its debut at Sir Edward Hulton's Olympia Exhibition in 1958. With all facilities freely provided, there were two boat displays. The principal attraction was that man with the iron nerve, Donald Campbell and his superb 'Bluebird', of world water-speed record fame. I was privileged to be invited to introduce the revolutionary new catamaran boats.

The 'Ski-Cat' gets along smartly with an engine of about 7 h.p. An engine of 10 h.p. upwards gives speed boat like results. This speed boat (pronounced Skee-Cat) gets its name from the angle of attack of its twin hulls being similar to the principle of someone planing on water skis. With high horse-power outboards the larger 'Ski-Cats' make a fine towing boat for water skiers with the advantage that they can safely come up to the boat out of the way of the recessed motor.

The seating accommodation of the new 'Ski-Cat' concept is sports car fashion, sides sheered in the latest fish-tail style.

A power catamaran of this sort was exhibited in the 1959 National Boat Show.



The first British power catamaran  
designed by Erick Manners

have been so easily holed the forward portion of the Catamanner, subject to collision impact, is of seven laminate thicknesses set on a 12 laminate beautifully curved stem. The side skinning laminate to at least 6 inches above the water line is  $1\frac{1}{16}$ -in. thick. This tough outer skin still retains all the advantages of timber resilience. There is a sandwich layer of foam plastic giving the boat built-in buoyancy without fear of puncturing. This unique composite sandwich construction of the Catamanner comprises mahogany veneers, foam plastic, glass fibre woven cloth and synthetic resins.

Adding very few pounds to overall weight, this plastic foam is expanded polystyrene containing millions of tiny sealed cells that cannot be punctured or damaged in the ordinary way. It is rot and rust proof giving permanent flotation. Since high-speed craft are much more susceptible to being damaged this positive buoyancy is a most valuable feature, and at present only available in the Catamanners.

The decks are of BSS 1088 marine ply and these are varnished to show up the beautiful grain of the mahogany. Comfortable 9-in. wide seating is arranged at average height of 8½-in. The after decks are attractively cambered and may have a hatch for stowage purposes. This has a built-in elasticated retainer. The decks around the cockpit are curved and streamlined. Apart from the covered side deck stowage space there are two separate cubby holes forward and two small hatches that can be used for additional buoyancy bags, or stowing sail battens, etc. Any water in the self draining cockpit is rapidly evacuated through the sideboard apertures which have a one way valve, side scuppers and also drains aft specially arranged so that they cannot splash back. There are no hatches in the cockpit floor to leak into the hulls. The same applies to hull centre-board case assemblies where the great stresses and strains often start subsequent leakage troubles. This unique feature is a Catamanner patent application.

As described in the particulars of the 14-ft. Racer, modified hydrofoils as well as the ordinary twin centre-boards are optional. I prefer to refer to the latter as 'side-boards'. Either of these fitments can be adjusted in use or instantly removed when not required as, for example, when running before the wind. Fixed keels are a tremendous drag in such conditions.

The rudders have light alloy hangings and are arranged with the Ackerman steering system. The fore tie compression strut is arranged as an 'Aquafoil' out of the water but set at an incidence in excess of negative dive so there is little chance of the bows porpoising under any circumstances.

The mast is the latest thing in engineered light alloy spars and may be had rotating according to the way the standing rigging is arranged. In the interests of saving time all rigging is reduced to the minimum of three shrouds, two halliards and two sheets.

(Continued on page 44)

## CATAMARAN EVOLUTION



*The 16 ft. 6 in. 'Lake Class' Catamanner streaks through the water without fuss or spray. This 'still' was taken from the  $\frac{3}{4}$  hour film on sailing catamarans directed by Erick Manners.*

## 18-FT. 6-IN. 'RACER CATAMANNER'

This 18-ft. 6-in. catamaran has been said to have aesthetic appeal from each angle, a thoroughbred in every sense, developed from twenty-five years' designing and building experience.

Let us consider the round moulded hulls first. They embody a number of patents. The forward entry is fine with a sharp cutwater on a straight line metacentric set with splayed dihedral, these generate into a wide flattened planing surface aft giving dynamic lift. The sterns are clear of the water line obviating drag at low speeds.

These high speed hulls are of composite construction with mahogany multi thickness veneer on the outside. Because other makes of catamarans

CATAMARAN IS HARDLY the best word to describe the sleek twin hulled sailing yachts that we have suddenly come to accept in the last few years, but it has come into popular use and will have to do now. These revolutionary new craft capable of sailing at two and three times the speed of orthodox single hull yachts are really only in the manner of a catamaran. The word being Tamil 'tied-wood' as are the raft-like logs strung together and called catamarans in some parts of the world.

The board principle of multi-hulled boats is very ancient, but a catamaran in the shape of a sailing boat with two separated but identical hulls was hardly known until recent times. What the modern catamaran principle more nearly derives from is the slim sailing canoe fitted with outrigger to keep it upright. These stemmed from Indonesia, Micronesia, Melonesia and other Pacific island chains. Modern western material techniques and constructional 'know-how' have been able to improve greatly even the good outrigger, particularly in relation to manoeuvrability. High power to weight ratio is the approach of modern methods.

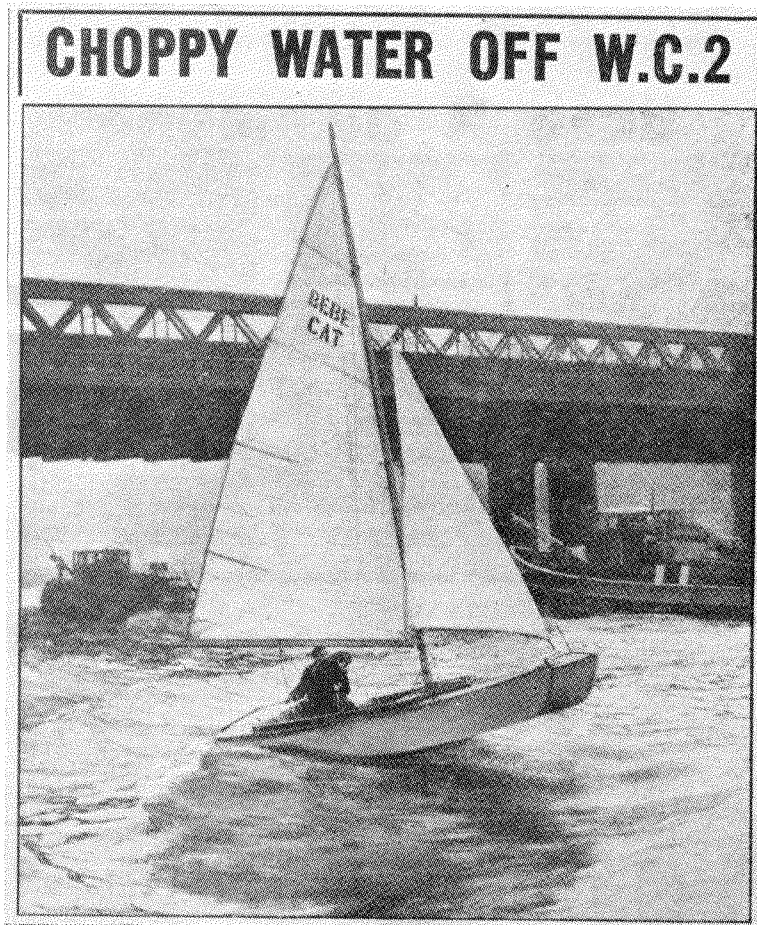
Although the odd catamaran of sorts appeared from time to time in the western world, none succeeded in popularising them until ace helmsman and precision engineer, Ken Pearce, designed and built his 18-ft. 'Endeavour'. This established a small nucleus of supporters in spite of very adverse comment elsewhere. His first successful hull form was subsequently used in the first British commercial racing catamarans.

At all periods grown men playing with model boats on ponds has unfortunately been somewhat suspect. I found that before catamarans even began to be accepted, experimenting with model twin hull boats on ponds caused the sightseer to relegate one immediately as definitely being on the 'fringe'. As a psychologist might insinuate, perhaps through lack of strength of character, I even went to the trouble of digging my own pond in backland for private research. Once, when one of my twin hulled experimental boats had to be erected on the foreshore, because it was of man carrying size, idle speculation led to a fierce argument breaking out amongst a gang of navvies working nearby. Before it ended in blows their foreman came along to enquire which of their devious contentions as to the nature of the curious object, might be correct. All their guesses were painfully wrong but peace was restored.

Only two commercial designs of catamarans were available in 1956 and by 1957 there was still immense opposition, they were waved aside as either having a hopeless beam, being ugly, unable to turn, unsafe, uncomfortable, soakingly wet to use, and dangerous.

The vital need was to get some enthusiasm over and acquaint the public as a whole about their real capabilities. Fads have come and fads have gone many times before and sometimes, more often than is generally supposed, not even the good thing catches on.

By chance, at the right moment in time, to condition the climate of opinion, millions of people became acquainted with the potentials of twin hulled yachts through the bubbling effervescence of Pam the Television catamaran girl. She got through three gruellings with the shrewd 'top brass' and succeeded right through to the four finalists. She wanted to 'be her own boss' by building my catamarans in this high stakes competition sponsored by the *News Chronicle* and specially featured by B.B.C. TV. Besides the television set viewers she introduced millions more to catamarans in general by her articles in leading newspapers.



Newspaper reproduction of a photograph in the *Evening Standard* showing a Catamanner flying between wave crests with Pam, and the author at the helm—amidst dense river traffic in the heart of London.

## Safety at Sea: Floatation

Many safeguards may not be needed for river and lake sailing, although it would depend upon the size of the lake, abroad many are exposed inland seas.

Catamarans are fine for sea sailing provided certain precautions are practiced. An owner can fit buoyancy bags, but they may chafe or puncture on internal hull nail or screw ends, or be otherwise deflated when their imperative need suddenly arises.

Consequently I have devised for this 14-ft. class and the 18-ft. 6 in. model a system of positive buoyancy that also serves an equally important and related function which I will try to describe in brief. When an orthodox relatively heavily planked single hull yacht sailing at say 6 knots, which is fast for such a boat, suddenly hits a substantial piece of flotsam, probably no real damage results and the vessel does not start or spring a leak. On the other hand when a relatively thin skinned catamaran hits a similar, or smaller, object at three times the speed, the outcome is likely to be a very different story. A wax candle fired from a gun barrel will pierce a tough shield. Accordingly I have developed a laminated external planking that is altogether tougher and stronger yet is resilient and weighs only a fraction of an ounce more per square foot treated. Combined with these advantages its own cellular construction is unpuncturable and retains positive buoyancy. The recommended ingredients for this sandwich construction are multi-veneers of wide mahogany, high density non-intercommunicating cellular plastic, with synthetic resin impregnated, woven glass fibre filament.

### 16-FT. 6-IN. 'LAKE CLASS' CATAMANNER

Length	16 ft. 6 in.	Draught	7 in.
Beam	8 ft. 0 in.	Sail area	200 sq. ft.

As the name implies this light weight catamaran was specifically designed for use on inland waters. Many countries abroad are well furnished with lakes. Light winds often rule in territories of this nature and the Lake model is intended to, and does, get along fast even in light conditions. She was the first modern catamaran with full leg room.

Because she is unlikely to encounter open sea wave conditions the Lake class is provided with full depth legroom, there is a great deal to be said for that. On either side in the cockpit area there is a well to the floor of the hull. At the front and at the after ends of this foot well there is a watertight bulkhead so that the boat will still sail even if the wells fill with water.

I know of few things more thrilling than silently 'creaming' along at high speed over the still, relatively calm waters of a lake in a strong wind, comfortably ensconced in this catamaran.

As the freeboard has not been cut away excessively and there is no reverse sheer to the bow, it is not so wet in use, nor with its greater buoyancy does it bury or submarine.

### *Metal Mast and Spar Development*

Instead of an ugly wide plank-like wooden mast, a properly rigged light alloy extrusion is recommended and these have been successfully used on the 'Racer' and other classes of Catamanner for some time past. They can be rotating but because of their slimness this is not always thought vital.

Physical mal-treatment excepted, metal masts carry much better during transportation, whereas spruce masts readily suffer damage in a variety of ways.

The light alloy mast has a far smaller weight leverage factor, when the boat heels, and offers very much less windage. The halliards are, of course, housed in the hollow interior. Compared with wooden masts, the metal Catamanner masts are a pleasure to handle because one person can lift them up and step or unstep them with the greatest of ease. This is a great advantage.

In 1957 I tried out balanced jib-booms on catamaran foresails and there is definitely something to be said for them in several ways. The manner in which they quietly tame an otherwise loudly flogging jib is a real joy. Theoretically there is also a lot to be said for a luff spar on the jib, but in practice, some already find this weight mass in a bad position. Both jib-booms and luff spars are an optional extra on Catamanners. On some Catamanners I have supplied, as an extra, a tackle to outhaul the jib from inboard, so there is no need to go out to fix tack or hank on the luff. A light alloy roller jib has a lot to commend it.

Before leaving masts and rigging I would like to warn the newcomer that, for maximum speed, the mainsail plan of some boats is increased in area by allowing the boom to be much lower than it should be for safety or comfort. It is no joke having to remember to fall flat on your face every time the boom swings over. Please do not ask unconversant friends to learn the hard way. This point is watched in all the Catamanner classes and in the larger boats the boom passes harmlessly over adults' heads without any uncomfortable stooping. This reminds me of a friend named Leo. Whilst learning to sail as a crew for the very first time, the skipper cried out 'Lee-oh' to warn he was coming around. 'Yes', cried Leo, springing to his feet to display his willingness to serve—prior to being swept overboard by the swinging boom.

At that time the original safe 'Family' class Catamanner had been introduced, together with the fast 14-ft. 'Sports' class and these were subsequently followed in 1957 by the establishment of the 11-ft. size Car-Cat and 18 ft. 6 in. class. In the next chapter these four popular sizes are each reviewed. These pioneer catamaran classes are still built and there were no other professional contenders in the 11 ft., 14 ft. or 18 ft. class lengths for the next two or three years.

With great foresight 'Boats & Boat Equipment' was the first yachting book to sponsor plans for the amateur to build his own catamaran from marine ply. This 14-ft. Catamanner can be built without a single complex joint by the entire novice as a result of comprehensive stage-by-stage plans. Over 600 of these plans have been sold and are still available from 93 Ridgeway, Westcliff-on-Sea, Essex, at £5 5s. 0d. a set of 22 sheets containing over 150 drawings with descriptions. This includes the royalty to the designer for one boat and a Certificate of Registration and official sail number is issued by the Catamaran Sailing Association, founded 1955. For those who do not wish to build entirely from scratch, glass-fibre shell hulls can be supplied for the amateur to finish off, saving him the hardest part of the work with all the other advantages of glass-fibre, such as obviating painting due to pigment colour going right through the plastic. This moulded hull has far better lines than would be possible with a ply hull but even with plywood hulls the 14-ft. Sports class will do over 15 knots without flying a hull.

An adventurous yachtsman, Capt. D. Brook-Hart, laid on a demonstration of catamarans for Londoners in the winter of 1957 showing three Catamanner classes. Various V.I.P.'s attended led by The Right Honourable Lord Brabazon of Tara, G.B.E. The weather was shocking. Consequently I understand the TV shots were poor and the newsreel film was useless. Pam and I demonstrated the 14-ft. Catamanner sailing in conditions that for an ordinary dinghy of similar size would have been suicidal. The shortest strip of Thames was chosen between the closest bridges, Hungerford and Waterloo, in the very heart of London. A winter gale was in progress up and down the country and the wind darted down on the boat in funnels, touching over 50 m.p.h. followed by complete pockets. At one time while we were sailing in this narrow confine of water I counted seven commercial vessels and tugs with their tows milling about us. In passing, several tug skippers intimated that, as it was obvious we wanted to die, we had succeeded in finding one of the quickest ways.

Without warning and in varied directions the fierce squalls smashed down on the boat crashing through the steep wakes raised within a few feet distance by heavy displacement vessels carried along in the surging cross and tidal currents.

Although the conditions were absurd for small craft they did effectively demonstrate the extraordinary safety of a suitably designed catamaran. At the start I sailed up near to a large launch piled solid with press and

cameramen—all doubtless hoping to witness a catastrophe. When within hailing distance I told them that I was going to use no centre-board, that without a keel I was going to sail tacking into the wind, reaching, turning and manoeuvring with a draft of only seven inches but no drop keel due to the patent design of the boat having asymmetrical hulls.

The demonstration was successful, we weaved between and in and out of the peak hour river traffic, tacking and turning right close up to oncoming vessels in a confused 'sea' with erratic winds. It would have been impossible in any orthodox light sailing boat. Afterwards I did not see a solitary report in any newspaper which brought to light the fact that for the first time a small boat had undergone arduous tests under sail without a keel.

#### BASIC LINES OF CATAMARANS



The seven basic sections for catamarans, usually aft of amidships, are illustrated above. In my opinion only the first four, A, B, C and D, are efficient, particularly the first three.

Probably the first shape alone was from natural evolution, this is the half circle underwater shape A. It naturally stems from the solid or hollowed out tree logs used in warmer seas by native islanders. As a seaworthy craft in single hullers it is obviously a very poor shape, given to rolling like a barrel, but this feature can be largely obviated by either a deep keel or by outriggers or double hulled craft. It is the hull shape chosen for 'Endeavour' and resulting boats copied from her. Although wet in use, it has the advantage of being easy to build with the minimum surface area. It works very well at speed in practice on the 'destroyer' hull principle. It is thought to lose dynamic lift in semi-planing as all the lines of force, except on the lowest point, tend to cancel each other out.

After considerable early experimentation I obtained a patent on the characteristic new section B. Obviously this strange asymmetrical shape had never before been possible to apply to orthodox monohull boats. Dual hulls presented the first opportunity of adapting advantageous hydrodynamic characteristics to the new catamaran boat, with oppositely 'handed' hulls.

to the dynamic lift also generated tending to lever or tip the narrow boat up on to its lee gunwale. In the balanced Foil-Cat arrangement, the extra righting moment of the widely spaced twin hulls greatly lessens the heeling attitude so that with the twin asymmetrical hydrofoils also widely spaced apart and if set at a dihedral, one is giving maximum lateral resistance to leeway even when partly heeled and the other is exerting maximum upward thrust. In other words two components most desired are obtained when required to help reduce the boat's displacement or leeway.

#### *For the First Time in History*

In addition to its removable hydrofoil fins the 14-ft. 'Racer' has another patent advantage in that like some of the other well proven Catamanner range of double hulled yachts, the actual hulls, particularly their after planing surfaces, are set at an equal outward dihedral opposite to each other. This means that at optimum heel, for the first time in yacht history, the main working hull is in fact sailing upright in the water and not lopsided on its ear as is unavoidable in orthodox craft. This disposition in itself gives a slightly asymmetrical hull which is the feature of another of my patents.

#### *14-ft. 'Racer' Features*

For high speed performances the 14-ft. 'Racer' is a logical development of the other Catamanners. Three of these are of glass fibre construction compared to the lighter 'Racer' with timber hulls. Regrettably in some other designs I have seen, this light weight advantage is overdone. Admittedly it results in speed increase and a cheaper selling price, but unfortunately it is also likely to mean a boat not strong enough structurally, and one that can only have a very short life.

This form of abuse has seldom affected single hull types of boat, but it would have done so except that class rules often imposed a sensible minimum weight consistent with adequate strength.

#### *Avoid Fatigue Failures*

I feel a catamaran should be strong enough not to fatigue from the niggling yet incessant stresses experienced when left on exposed moorings 24 hours a day each five month season afloat. A catamaran should have a life equivalent to comparative style dinghies. Consequently even the lightest of the Catamanner range has substantial connecting girders across the hulls and adequately braced to them.

#### *Comfort and Dryness*

Another special feature about even the Racer Catamanner is that it has sensible and comfortable raised seating accommodation as opposed to some designs where the occupants have to sit between battens on a flat floor which is usually swimming in water.





*The small inset shows a photograph taken in 1957 of the 18 ft. 6 in. De Luxe Cruising model. The larger picture shows a similar size Catamanner fitted with optional hydrofoils to provide partial lift. These modified hydrofoils may also be fitted as and when required to the 14-ft. Racer Class Catamanner described in Chapter 9. Unless driven by outboard motor the 'Mannerfoils', as they have already been called, are only intended to give partial lift to sailing boats by creating a combined force to windward to reduce leeway plus an upward lift component to increase speed and steadiness. The first two Hydrofoil assisted sailing catamarans ever to be exhibited were shown at the 1959 National Boat Show. Editors were informed but they excited no comment.*

For years designers have raved about the line drawings of a variety of symmetrical underwater shapes of different yachts. What so often seems to be lost sight of is the fact that the moment these yachts start to sail they invariably heel and instantly the underwater sections become asymmetrical and, what is more, usually in a way very much to their disadvantage.

This being so there is surely some advantage in a catamaran starting off with an asymmetrical shape that will be of subsequent benefit. In some circumstances the flatter side can be arranged inboard but principally this configuration is placed outboard. Unfortunately there is not space in this chapter to go into all the characteristics of the asymmetrical hull. At present it is principally used in its full form only in the 14-ft. 'Family' Catamanner. Apart from the advantage of being a more weight carrying shape, in profile, with its well rockered keel, it resembles a deep keel boat in proportions. As the reader will know the ordinary shallow draft sailing boat must have a centre or dagger board to provide enough lateral resistance to enable it to sail effectively, not to keep the boat upright as some people think. This asymmetrical hulled catamaran design provides the necessary lateral reaction to the water through her flatter outer side to leeward. Like a flat keel the flatter outer side does not readily cause the water to flow around to the opposite side as does the rounded hull. At the same time the design retains most of the advantages of the rounded hull in other respects and with better dynamic lifting component on the main part of her bottom.

I feel this shape may come into its own on the larger catamarans completely dispensing with ungainly moveable or fixed keels. This unique hull configuration sits down upright on the shore and even in the safe 14-ft. 'Family' class Catamanner hundreds of people have now sailed closehauled in as little as eight inches of water without the need or inconvenience of lifting keels.

Again after research I commercially introduced shape C early in 1957 and still use it. This has a somewhat flattened floor with a fairly quick turn to the round chines. At the time of writing, three seasons later, I cannot bring to mind any other professional catamaran builder who has so far adopted this shape. I feel sure many will in the future because last year and again at the back end of this year two amateurs have built boats that so far seem rather faster than the pure round or hard-chine bottomed boats. The shape has a disadvantage in that it is perhaps harder and thus more costly to build than the round or flat types.

Shape D is the common Vee bottom hard-chine type and generally regarded as the simplest for amateur construction. Although of boxy appearance, hard-chine construction is quite adequate for the slower speed general dinghy but I find that for the faster speeds of catamarans, which when sailing still side-slip, the water cannot get around the three corners quickly enough and therefore cavitates to the detriment of performance.

Sections E, F and G have all been tried on catamarans but I regret I cannot recommend any of them. I quite appreciate and have taken into account that they are easier and cheaper to make. However, in a variety of ways they are not thought suitable for fast or easily manoeuvrable catamarans.

Even if it looks logical and simple, shape F does not seem to be very much use. In his first effort at catamarans, Uffa Fox possibly made a mistake in selecting this steep sided Vee form. When sailing in one of my smaller and light draft shape C catamarans I passed a larger and deep draft but capsized F type of another designer who employed the same deep Vee shape.

Tantamount to the classic example of someone being able to sell refrigerators to the Eskimos, Richard Blomfield, M.A., sold one of my fast 14-ft. Catamanners to a resident of Hawaii, the home of the large catamarans. What is more he was invited to go out there and show them how to sail it. At that time he also had the opportunity of describing the merits of the rival 'Catamanner' breed on their television network. While he was there he went out in 'Manu Kai' and three times out of four she would not go about! She would not turn before the wind.

In those enchanted islands, Woody Brown is the reigning catamaran designer who believes in deep narrow hulls and his original 38-ft. 'Manu Kai' is the most famous example. Writing in this country John Morwood said, 'It is very obvious that all modern catamarans owe their design and existence to "Manu Kai"'. I cannot agree with this sweeping statement, probably along with others, I made successful catamarans before I ever heard of Brown's fine work some 9,000 miles away.

It would be inexact to relate my patent asymmetrical hull design, which, incidentally I use in only one out of nine different catamaran designs, to the 'Manu Kai' shape as shown in H of the accompanying illustrations. In appearance and practice this deep slicing knife edge type, which will draw even more water because it is related to a larger heavier cabin shelter form catamaran, is very different from my much shallower and three times broader section shown in drawing B. Furthermore in my design there is a very pronounced rocker to the keel side elevation almost leaving the water at the transom, whereas Brown's design is flat keeled right through to the after end, drawing 1 ft. 9 in. of water at its sternpost.

Even amateur built and sailed catamarans of my asymmetrical design can come about positively every time. Early witnessed tests were made in a 14 footer, with three up, repeatedly sailing on a reach to within about five feet of a rocky shelving lee shore and then rounding off before the wind on the new tack. This 'Family' class Catamanner will work to windward in under twelve inches of water, but provision is made in the design for a centre board for peak performance. Although many



*The 1956 14-ft. 'Sports' Class Catamanner shown sailing at 15 knots. In a John Bull editorial in 1958, Don Everitt said: 'Orthodox sailors claimed that catamarans are much less manoeuvrable than single-hulled boats. To disprove this point Erick Manners took a catamaran on the Thames between Hungerford and Waterloo bridges. Confining himself to this short stretch of water, he flung the catamaran back and forth across the river in blustery and crowded conditions'. Manners says: 'The tugboat men cursed us, called us suicidal maniacs, but we dodged them—and proved our point'.*

Accordingly, I have arrived at a modified hydrofoil arrangement that is more suitable for sailing boats. The lowest part of the hull or hulls does not leave the water. This patent sailing foil configuration can be used on single hull boats, trimarans or twin hulled craft. A catamaran arrangement is described here.

The hydrofoils themselves are of asymmetrical ogival section rather like a flatter wing form of a high speed aircraft. At least an opposing pair are fitted although twin pairs might advantageously be employed four square. Alternatively one twin pair can be used with a third double acting type mounted tricycle fashion to achieve the balance of a three-legged stool on an uneven base. The latter can be swivelled up when not required or else be arranged to turn partly to give directional rudder steerage. These hydrofoils are not fitted unless specially ordered for the standard 'Racer' Catamanner, although simple rudder foils can be interchanged when conditions warrant.

The whole essence of my 'Foil-Cat' sailing boats is that there need be nothing at all to distract from simple all round performance with no extra cost involved. The modified hydrofoil advantages can be applied as and when required befitting a sailing boat. The 14-ft. 'Racer' is at no time inconvenienced by its hydrofoil advantages.

With this objective I have arranged the twin asymmetrical hydrofoils not only to provide partial dynamic lift to neutralise some of the all up weight carried, but also to provide transverse reaction to sail side pressure for maximum lateral resistance to the leeway side drift suffered by all sailing yachts. In the orthodox yacht the centre-board helps counteract this in shoal draft vessels or the fixed fin in keel boats. The centre plate or fin keel tends to work against the usual boat as soon as it is heeled due

## THE FIRST SAILING HYDROFOIL CATAMARAN

### 14-FT. 'RACER' CATAMANNER

Length 14 ft      Draught with Foils 2 ft. 6 in.  
Beam 7 ft.      Sail area 160 sq. ft.

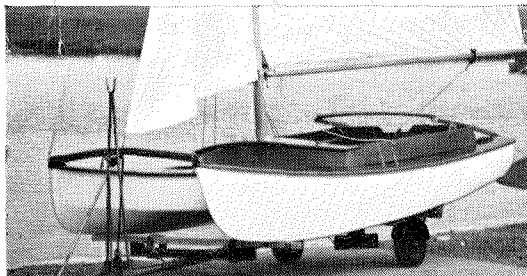
The 14-ft. 'Racer' Catamanner is believed to be one of the fastest boats of its type and size afloat today. When required it can be used with modified hydrofoils. Their use is entirely optional, they need not be used at all or the hydrofoils may be used as and when conditions dictate.

In the past I have experimented with a variety of small underwater wing hydrofoils on different sorts of power and sail boats. Some of these are described in the chapters on Trimarans and Hydrofoils and also in Volume 2.

Several of the configurations worked well on power driven craft, with the boat hull proper rising up in the water at quite low speeds, lifting higher as speed increases so that ultimately, the hull bottom can be a sufficient distance above the surface wave pattern to be unaffected by it. The underwater wings are placed on the lower ends of streamlined stilts planing just below the lowest trough level. Naturally it does not work out as simply as this in practice because the negative dive must be guarded against. The craft are apt to go into a nosedive.

Although successful on power driven craft, hydrofoils only work on sailing craft in certain maintained positions of sailing, and when there is a steady and spanking sailing breeze. If it gets foil borne during a short gust as soon as the breeze momentarily falls light again the sailing foil-boat flops back into the water in a disconcerting fashion, badly hampered, particularly in light breezes, by the serious drag of the usual sort of underwater foil appendages.

There is a similar sort of erratic occurrence every time the boat tacks. The wind is fickle, from minute to minute it is seldom steady in either direction or speed. Yachts need to frequently and radically change course as well as sailing as close to the wind's eye as possible. Consequently full foil application, successful for continuous and regulated power drive, does not seem very practical for sailing yachts.



*14-ft. Family class on a road trailer ready for pushing afloat. A time of 150 hours to construct from a kit is estimated by Kenneth Mason in his Bosun Book Boat-building from Kits. Introduced by Manners in 1956, this 'Family' Catamanner was the first one of its kind and the second catamaran to go into production in Britain.*

users have written to say they do not bother to use the board, in fact some people have not even installed one, I have never advocated this as general practice in such a short boat, particularly in confused seas.

Apparently the large Hawaiian catamaran is a fusion of the Polynesian and Micronesian cultures and perhaps stemming from the 'Manu Kai', Creger first designed more of a day sailing catamaran, the 16 ft. 'Lear Cat' with the less refined hulls shown in G and drawing over a foot of water which might be expected with a beam of only 7 inches. With all due respects this was not a good all round performer. It was subsequently improved upon by Tchetchet's hull shape similar to E if that can be called a development. The traditional hard chine shape D subsequently adopted by O'Brien is much better and other patterns of very similar shapes constitute the flatter floored form employed by most catamaran designers today, many of whom are amateurs.

It was not until fully engineered combinations of shallow draft sections A, B, C and D first came into being in England that easily controllable, thoroughbred catamarans arrived in the world.

## 'THREE TIMES AS FAST TWICE AS SAFE'

Once during a recording for 'steam radio' that experienced sailor and well-known commentator John Seymour, 'grilled' me with searching questions about what I meant by the above equation. It is not easy to adequately describe in a few words.

With thousands of words and countless diagrams, not allowed on the radio, I try to explain the reason why to my adult students. Some of these come in sufficient numbers, to form a 12-week terminal class for a subject that must be unique in these islands, if not in the world. This course of lectures is entitled 'Sailing Technology and Research'. During the course of deliberations I ask these staunch enthusiasts whether they have any questions. Often they have not. This can mean any one of several things to the lecturer. Either it has been too elementary, or they have not understood a word or have been 'lulled-off'.

Unfortunately there is not room here to go into all the reasons for the opening statement so I will simply crystallise them by saying that in general terms good catamarans can be had in three different ways: A, B or C. There can be all sorts of graduations in between but, in spite of what advertising blurbs and raves may say, not as A plus B, A plus C or other combination. It may be best to divide each section into 3rd. Badly designed catamarans are not good in any category.

Suitably designed the small day sailing catamaran in a strong breeze can be category A, which is an out and out racing machine. In this case it may give the ceiling speed. Because it will be exceptionally light it cannot be very strong, i.e. short lived. At its fastest extreme it will be very uncomfortable and frightfully wet to handle. It will be a thrill to keep upright but will easily capsize, not only sideways, but rear over tip also.

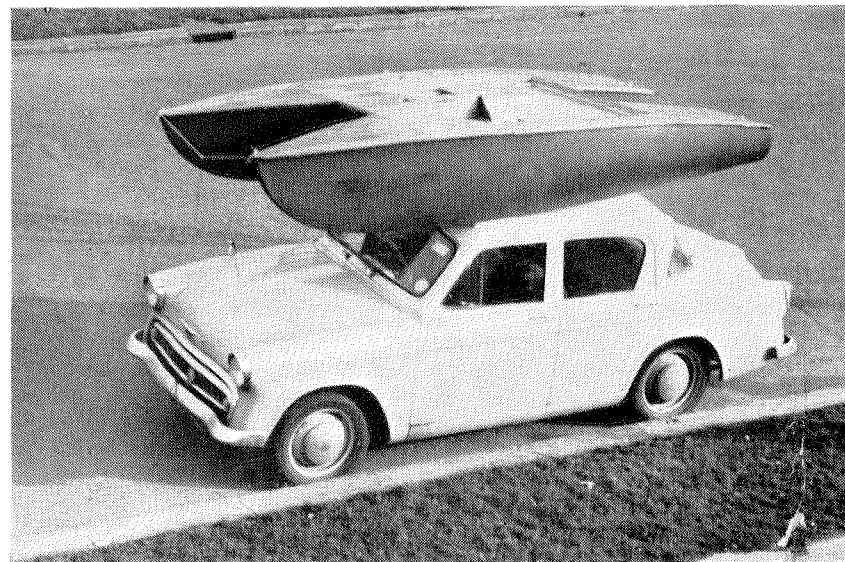
The half-way mark in category B will be the 50/50 type or compromise which usually appeals to most people. Here we include the real catamaran advantage because it can still be much faster and far safer than orthodox dinghies.

Finally in the C types we range amidst catamarans that can be twice as safe as ordinary dinghies but no faster on average. There is the advantage that they can go on sailing longer when others have to reef or capsize. They can be ideal for the older or younger element. They would be hard to better for the beginner to learn sailing in.

Having said that I can hear a typical reply: 'I know someone who's got a racing machine, on a calm day with the sails down it would be fine as a family picnic boat'. Jolly good, but mathematics are still an exact science. At the outset of catamarans most people thought, here is a safe sort of boat. With no one prepared to print any reasons otherwise, I think it has been a disservice to yachting generally that so many people in this country have been put off catamarans by seeing light ones break or capsize.

In America people were previously put off catamarans because they were poor to manoeuvre, good British designs have eradicated this snag and the Americans are being fast to copy. It remains to be seen whether they are going to be put off by our unduly light-weight trend. I understand that in Canada, for example, when its still only a bit bumpy by our standards afloat, the yachtsmen stick to golf. Who is going to enjoy ice cold water down the back of the neck?

Translating to boat terms from his original aerodynamic context, Sir Graham Sutton, C.B.E., D.Sc., F.R.S., a director of the Meteorological office, may have said: 'that the amount of dynamic stability which a catamaran exhibits can be varied according to the purpose of its use. In a racing machine, for example, the helmsman must be able to impose his will on the boat very easily and such catamarans have a relatively low degree of dynamic stability. They are lively on the sheets, helm and trim and consequently require greater skill in handling than would less specialised craft. Large inherent restoring forces, on the other hand, make a family class catamaran unsuited for peak speeds in racing but they can be particularly adapted to more sedate purposes such as carrying passengers in comfort and sailing for sailing's sake with maximum safety'. There is, of course, no reason why they still cannot race at their own level amidst similar classes.



11-ft. Car-Cats have been transported many thousands of miles in this way. Photo by courtesy of The Motor. In a 1958 editorial The Motor said: 'The construction is obviously strong and the design rigid. Nevertheless the 1 cwt. catamaran is an easy lift for two people on to a car roof-rack.'

The Sports Catamanner is completely manoeuvrable and puts up a very lively performance. Because her hulls are heavier than those of thin wooden racing machines she does not fly a hull very readily.

In the chapter on Catamaran Evolution I have tried to describe that whether we like it or not catamarans have to be divided up into three categories. Here is the rare example of practising what you preach. The 14-ft. size Catamanner is available as C, the Family boat no faster than similar size dinghies except when it's windy, but much more safe; B, the all round Sports model; and A, the Racer class for top speed.

The A.Y.R.S. Publication commented independently upon the 14-ft. Sports Catamanner as follows: 'This is a nicely shaped hull with a fine entrance developing into a rounded midships section and a flat run. The plastic hulls are symmetrical and their tops form seats at the side of the bridge deck so that when sailing, one does not sit in a 'saucer full of water' as happens with most designs. It is a handsome craft, nicely finished in the model I have seen'.

#### 14-FT. CLASS 'SPORTS' CATAMANNER

Length 14 ft.  
Beam 7 ft.

Draught 7 in.  
Sail area 145 sq. ft.

The Sports Catamanner has finely moulded reinforced fibre glass hulls with the pigment colour going right through obviating the need for painting besides being leak proof, worm and rot proof. (Alternatively ply hulls can be made as shown on page 35.)

There is a flare in the bow sides to deflect the water from a sharp cutwater and fine entry sections generating out in the flattened form of a semi-circle shown in profile C of chapter 8, the hulls being symmetrical. As well as easy dismantling, like the Family model the transom is already adapted to clamp on an outboard motor if desired. The Sports and Family class Catamanners have the characteristic upswept bows of their Polynesian ancestors and they never seem to get into a nosedive as can the reverse sheer type. Because it has less superstructure the Sports class is neater looking than the Family model yet as safe with the same sail area. Step by step detailed plans for amateur building cost £5 5s. 0d.,

Royalty paid and this 14-ft. Catamaran has been built for as little as £50 worth of materials.



*The Car-Cat will plane in quite light breezes. Test staff of The Motor tried her out and described the fun as tremendous. Catamanner classes are raced on the Rivers Blackwater, Medway, Crouch and Thames at various points as well as such places as Hickling Broad, Poole Harbour, and the Solent, etc. The Catamaran Sailing Association offers Challenge Trophies.*

Fast open sports cars appeal to many but they are only actively supported by a relatively small group of enthusiasts. I think in time catamaran sailing may follow the saloon car pattern. I'm sure more people will eventually settle for faster, safer, drier sailing without wanting to be soaked from the first minute on, just to get the last ounce of sailing speed. It is still really puny compared to speeds we prefer when we are really going somewhere.

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### *Sails and Masts*

Sail makers vary a great deal in price and also in perfection of cut of the sails, particularly when they are not used to the particular class concerned. Obviously to stand well, sail making for fast boats is a highly specialised job.

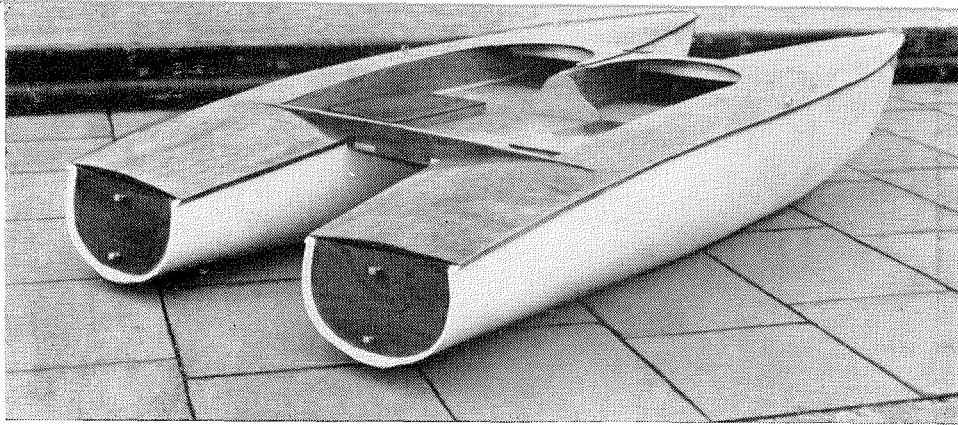
The Designer can usually supply builders or owners with suits of sails for his many different classes. This also applies to masts and booms. For practical use and efficiency light alloy metal masts with booms are recommended. Spruce so easily bruises and warps out of shape. These spars are supplied complete with pulleys for halliards, rigging attachment tangs and sliding gooseneck, etc.

Small fittings and rigging cannot be supplied separately but help can often be given to prospective builders, with suitable waterproof resin bonded plywood which is sometimes difficult to obtain, particularly abroad. For choice of designs see pages 58 and 59.

### *Do it Yourself*

The catamarans and trimarans about to be described can be built by the amateur as can the single hull boats previously described.

There is a great deal of personal satisfaction and confidence to be gained in building your own boat. Besides this you can make it yourself for under half normal prices and boats retain a good investment value. Usually if you think you could make one—then you can. Start now—get plans and prove yourself. A small boat can afford the finest recreation in our high pressure, trouble strewn world and you only live once.



*A stern view of the photogenic 11-ft. Catamanner introduced in 1957. If required, the 'hatches' may be removed to give full leg room. This was the first Car-Top Catamaran in the world.*

## CHAPTER 9

### NINE CATAMARAN DESIGNS

Length 11 ft. 3 in.	Weight 1 cwt.
Beam 5 ft. 6 in.	Sail area 75 sq. ft.
Draught 8 in.	or 100 sq. ft.

THE 'CAR-CAT' is the cadet of the Catamanner range but that does not mean she is toy-like. Because of the catamaran principle she has the safe stability factor of many single hulled boats of half as long again. One of the main objects of this versatile little boat is that she can be transported anywhere on the average car-top. On many ferries, steamers and toll bridges, etc., there is an extra charge for a boat on a trailer but not if it's on top of the car, nor does the trailer speed limit apply. This makes the Car-Cat an ideal companion for foreign touring holidays.

People who have owned Car-Cats have favourably commented that they give an exhilarating sail for adults yet are extremely safe for youngsters. They are low priced and get along well with a tiny outboard motor.

They are ideally a single handed boat but will readily carry two adults. One owner tells me he regularly carries four. The Car-Cat is quite easy to build at home because the hardest parts, the shell hulls, are supplied already made in moulded mahogany or reinforced glass fibre plastic as preferred. The only tools required to finish it cost under a fiver and comprise saw, drill, screwdriver, plane and clamps.

There is much to be said for a small light boat that makes you independent of boatyards and moorings and winter storage arrangements. Kept free in your garden she is ready 'for sea' at the week-ends and with the advantage that if the sea should be too rough you can proceed to the nearest inland waterway which will be calm by comparison.

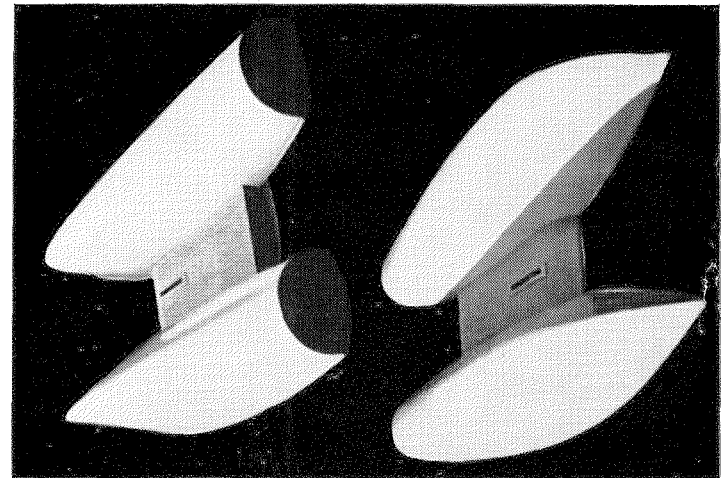
### 14-FT CLASS 'FAMILY' CATAMANNER

Length 14 ft.	Draught 7 in.
Beam 7 ft.	Sail area 100 sq. ft.
	or 145 sq. ft.

This Family class catamaran has already been commented upon in the last chapter, with special reference to its asymmetrical hulls. It was the first catamaran to be designed specifically for family use, and also the first in the world to have glass fibre hulls. With the 100 sq. ft. sail area I have had her in exceptionally fierce squalls with the canvas free but hoisted and she just sits there. There are four watertight bulkheads giving six compartments and for test purposes I have had the two forward ones both two-thirds full of water and still sailed her to windward with the foredecks aswirl. For a 14-ft. catamaran there is high seating with a coaming all round and double spray deflectors. People have commented that she is drier than an ordinary dinghy of the same length and that her gentle movement feels like that of a vessel twice her length.

The boom passes over passengers' heads without ducking. She is a very suitable boat for beginners to make their mistakes in. For the more experienced sailor desiring extra power the 145 sq. ft. sail area can be substituted.

Both the Family and the Sports model Catamanners are available as build-it-yourself kits with plans costing £5 5s. 0d. They have detachable hulls by undoing a dozen bolts, this is very handy for winter storage and long distance transportation. Illustration on page 34.



*Fishes' eye-view of the easily-driven hydrodynamic lines.*