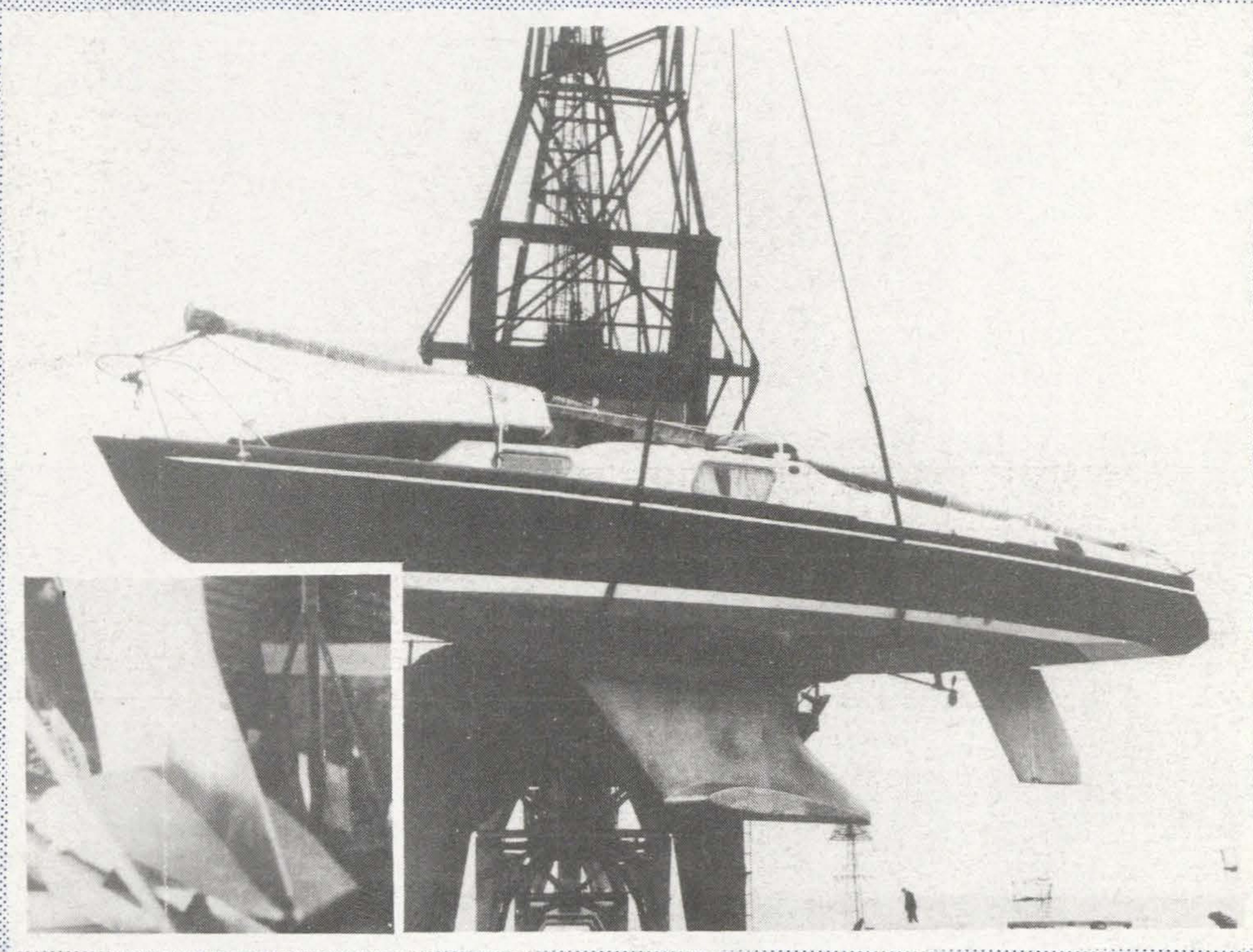
ISSN 0144 - 1396

AYRS 99

MARCH 1984



Bristol III Cruiser/Racer

Photo From J. Poslett.

CONTENTS

SUPRISE 45 From Holland Shown at Southampton by Ancasta Marine Ltd. This excellent stern design has liferaft stowage, boarding platform and a gangplank which hinges aft between the twin backstays.

MYSTIC 32 Aluminium fast sport fishing boat.

Stern shape of a 32' "Mystic" by Frank MacLear of 28 West 44th Street, New York, NY 10036. The relatively flat, gently arched oxbow sections permit the bow sections to be sharper, resulting in a softer ride at fisherman's transit speeds which can be 60% to 80% of ocean racing speed, but using only 30% to 40% of the horsepower.

THE AMATEUR YACHT RESEARCH SOCIETY

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

The Society (open membership) furthers the theory and practice of nautical science and related subjects. We are registered as an educational charity (No 234081) and a company (No 785326) without share capital, limited by guarantee. (VAT No 200 1168 38).

The Society has members in all countries of the world where sailing is a sport. Information for publication comes from members and people interested in sailing or building yachts. Funds come from members subscriptions, from the sale of books and from donations. The subscription for the present year is £ 10.00 or $ 20.00 U.S.A. . New ideas or details of problems are welcome. We try to pass these on to avoid duplication of research and to put people with similar interests in touch with each other.

Administration and Membership:
Michael Ellison, A.Y.R.S. Hermitage,
Newbury, Berkshire, England, RG16 9RW.

Editors Notes R.Michael Ellison. March 84

"Lateral Resistance" seems to cover a good portion of the contents of this number. We now have 113 titles only counting the various editions of 'Self Steering' as one. Your Committee are aware of the need to get information from the early numbers back into print or edited into new books. So far we have failed to find the cash.

The U.K. Sailboard litigation which was originally based on our publication 58 ended in January with the decision of the appeal court that the 'Windsurfer' patent is invalid. The judges upheld the decision on obviousness over the Darby board and also anticipation by Peter Chilvers who as a boy sailed a board with a 'free' sail and no rudder. The appeal court have to decide if the first judge made a correct decision on the information given to him so that no new evidence is used and witnesses are not called again.

Graeme Ward points out in his 'vortex' paper that in rough conditions the problems of making ground to windward are compounded by the drop in keel performance due to the confused water flow. Racing yachts also need maximum keel area in very light winds, conditions when a cruiser will usually start the engine, anchor or drift. A keel of about 4% sail area is said to be 'right' but 6% used by David Chinery and others for hydrofoil craft seems to allow for a "factor of ignorance" and saves using decimal points in the measurements and calculations. Hull windage can not be reduced by reefing but water ballast can be beneficial. As John Morwood pointed out after the 1979 Fastnet race water can easily be carried on a monohull so that she is always unstable when capsized.

Many members are looking for large improvements in performance against old equipment or designs that have been developed and tuned over many years of use. It is important not to be discouraged if first results are not up to expectations. A small modification will sometimes produce a dramatic change. I do often notice that features "known" to be bad are included in new designs. On an 'Ayrsfoil' at Portland the removal of a small strut from the upper side of one foil gave about a 15% speed increase measured against the other tack using a foil with its strut in place. The struts were streamlined but may not have been fair to the water flow. It is accepted that forcing water through a 'V' shape gap causes extra drag. Keels, foils and struts should be well faired and as nearly as possible at a right angle.

Ignorance was Bliss ! Enlightenment. From Reg Frank

Michael admits,(A.Y.R.S. 98), that at school he spent time sketching sails and windmills and other such things, rather than learning Latin verbs.

Had he applied himself more assiduously to 'Caesar's Gallic Wars', he would have come across information of great significance in marine history, and in his family too.

As readers of 'Caesar's Gallic Wars' will remember, Caesar was for ever complaining about the miserable sailors of Gaul. Indeed, everything in Gaul seems to have been miserable. Reason; they couldn't get his army to Britain. As our cruising members know only too well, either the tide was wrong or the wind was wrong. When they did have a go, ships would be set Eastwards, be grounded on the shallows there, and crews captured by the barbarians, and roasted for Sunday dinner to go with the Yorkshire pudding.

Another handicap was that Caesar's Nautical Almanac was published in Rome, where they didn't know about tides.

At that time, one of Caesar's advisers, Michelius Ellisonius, had a revolutionary concept. Had they listened to him, history would have been altered. He had the concept of 'Fore and Aft'. We will refer respectively to M.E.1, (not to be confused with micro multihull rating rules nomenclature), and F/A.

M.E.1. pressed his ideas on Caesar, who was inclined to listen. But the vested interest lobbies of the galley oar manufacturing industry, the slave traders, and the N.U.G.S., (National Union of Gaulish Sailors), prevailed.

M.E.1. was just as obstinate and persistent as some of his descendents, and he was holding up the war with the barbarians, so they packed him off to Rome and fed him to the lions.

These sad events remained in the consciousness of the M.E. family, and account for the charm and diplomacy of our editor, (who is about M.E.600).

But he can be obstinate sometimes.

And in A.Y.R.S. 98, after two thousand years or so, M.E.1's concept of F/A is once again being brought to the notice of a sceptical world.

Luckily, they don't throw people to lions any more.

A friend of the above member made a further comment:-

The commercial language in the Roman Empire was Greek, and that sailing terms would be in Greek. So if M.E.1. submitted his ideas in Latin, because the aristocratic Romans would not lower themselves to understand Greek, there would not be words to use. Nor would the oar makers and slave traders understand. As to the Gauls, it would be all Greek to them....

Horsepower - Displacement - Speed

Derek Kelsall gave a useful guide for finding the power needed for a required speed or the speed to expect from a given engine power. Not claimed to be exact but a guide which proved true for a number of different types of yacht owned by members present at our 'Cruising' meeting held in London.

$$\text{Speed in Knots} = \sqrt{\frac{\text{Waterline Length in Metres x Horsepower}}{\text{Displacement in tons}}}$$

Cruising Roland Prout spoke of 20 years continious building of cruising catamarans. He stressed that every business man must supply what the customer will take out a cheque book and pay for. This has not been the high performance "one off" craft with limited accommodation like "Wildgoose" or "Phantom Wake" which they have produced and enjoyed sailing themselves.

Roland agreed with Derek Kelsall on the advantages of wider hulls, especially above the waterline which can give a big increase in buoyancy as the hull heels. He listed some figures as a guide to the wind force to lift a hull with full sail set.

"Snowgoose"	5.8 lbs/sq.ft.	35' Cruising cat.
"Shearwater"	1.9 lbs	Day racer, 2 crew.
"Phantom Wake"	3.5 lbs	Prout racer/cruiser
"Wildgoose"	2.0 lbs	35' racer/cruiser
"Sirocco"	3.0 lbs	Prout 26' 15' beam.
"Comanche"	3.9 lbs	Macalpine-Downie Cr.
"Quasar"	7.0 lbs	Prout 49' cruiser

Rod Macalpine-Downie then spoke about his new 'Micro Multihull' which has a trailer built to fold out which makes launch and recovery quick and easy. The meeting then spent a long time on the old question of capsize, diverted by a question on the size of masthead floats. It was agreed that the yacht should be as stable on her side as when upright but it was not accepted by everyone that all multihulls should have a mast float. Roland and Derek can both supply and fit equipment to enable the crew to right any capsized multihull if the customer wants to buy it. Rod has tested sheet release gears which prevent capsize four out of five times - on the fith time inertia forces prevent it working until "too late".

Roland Prout summed up the feeling of the speakers - that a well designed catamaran of over 35 to 40 feet is very unlikely to capsize.

Speed Sailing Portland October 1983

'Speed Weeks' are held to give people the chance to use a measured course with official time keepers to break the established world sailing speed records.

Dates are chosen when strong winds are most probable but only the week at Portland from 10th to 16th October provided ideal conditions for breaking records.

The records were 36.0 knots by Tim Colman in the open class with "Crossbow 11", 25.03 by Ian Day with "Jacob's Ladder" in 'C' class (under 27.88sq m.), 24.47 knots by Andrew and James Grogono with "Icarus" in 'B' class (under 21.84sq m.), 23.0 knots by Ben Wynn with "Mayfly" in 'A' class (under 13.94sq m.) and 27.82 knots by Pascal Maka in under 10sq m. class. All the records were established at Portland harbour on the course along the beach.

The 1983 event at Portland was sponsored by Johnnie Walker Windsurfing and to encourage boards they put up a special prize of £ 10,000 for the first boardsailor to reach 60km per hour (32.28 knots) during the week. Rewards to the company making the fastest sailboard are high so competition is sharp and boardsailors are often well paid.

The wind from the open sea blows across the shingle beach which in section is like the upper part of an aerofoil. The timed runs are made along what would be the trailing edge. Although the tide rises and falls there is almost no tidal stream along or across the course. Boards usually run close to the shore often in very shallow water. There is some turbulance in the air from the beach and although there are three sets of transits people afloat seem unable to tell which direction the wind is blowing from or which course is most favourable. Boats and foil craft use deeper water further out and make their best speeds in much lower wind than sailboards so that with co-operation there is no need for separate events.

Fred Haywood made 30.82 knots on sailboard Maui. This big increase is perhaps partly due to the use of a rigid aerofoil mast. The 'A' class record was raised by Gordon Way and Glen McKinlay to 25.38 knots on a two man board called "Black and White 11". There was some discussion as to who is the helmsman, there is only supposed to be one skipper but the record was awarded jointly. The 'B' class record was raised to 26.59knots by A.Grogono and J.Fowler sailing "Icarus" using Tornado rig and foils as before.

The new records have been ratified by the International Speed Sailing Committee which has now grown from the original R.Y.A. organised group and has the approval of the I.Y.R.U. . It is no longer the organising Committee of the Portland Speed Week which is run by an R.Y.A. Committee. Sir Reginald is Chairman of both Committees.

The prize for outstanding design was awarded to "Gama" an entry in the 10sq m. class having a single inclined wing which stowed neatly onto the crossbeam. How to lower rigid sails is always a problem. This craft is also credited with an incredible run of 24.58 knots and therefore won the AYRS prize for the fastest non-sailboard in the class. "Icarus" and 26 different sailboard entries exceeded 25 knots on runs made during the week. "Jacob's Ladder" made a best run of 24.48 knots, Ian Day could not get any benefit from his new hydrofoils.

A sponsor makes the event more enjoyable and comfortable. In 1983 the entry fee for 50 entrants to cover the minimum costs of surveying and time keeping was £ 150. The sponsor reduced the fee to £ 50 and, having more staff and better equipment we were able to accept more entries. As the speed records are raised it will become more difficult to break them without 'ideal' conditions and some other sensation will be needed to bring the press for the publicity to keep the sponsors. It is certain that the Brest event could not be held without sponsors but their television and press coverage is so good that plenty of investors are willing to back the week.

<u>Brest Speed Week</u> 24th September - 4th October 1982

Mainly fine calm weather made record-breaking quite impossible. There was, however, from time to time enough wind, 20 - 25 knots, to dismast many of the development craft and even the great new deep-water catamaran "Royale".

The program has developed greatly, with fun Board Championships with slalom racing for sailboards, as well as general menagerie race for all the class leaders and a long race for the deep water multihulls. Eugene Rignidel in the great trimaran "William Saureu" did the best run on the outer course at over 23 knots.

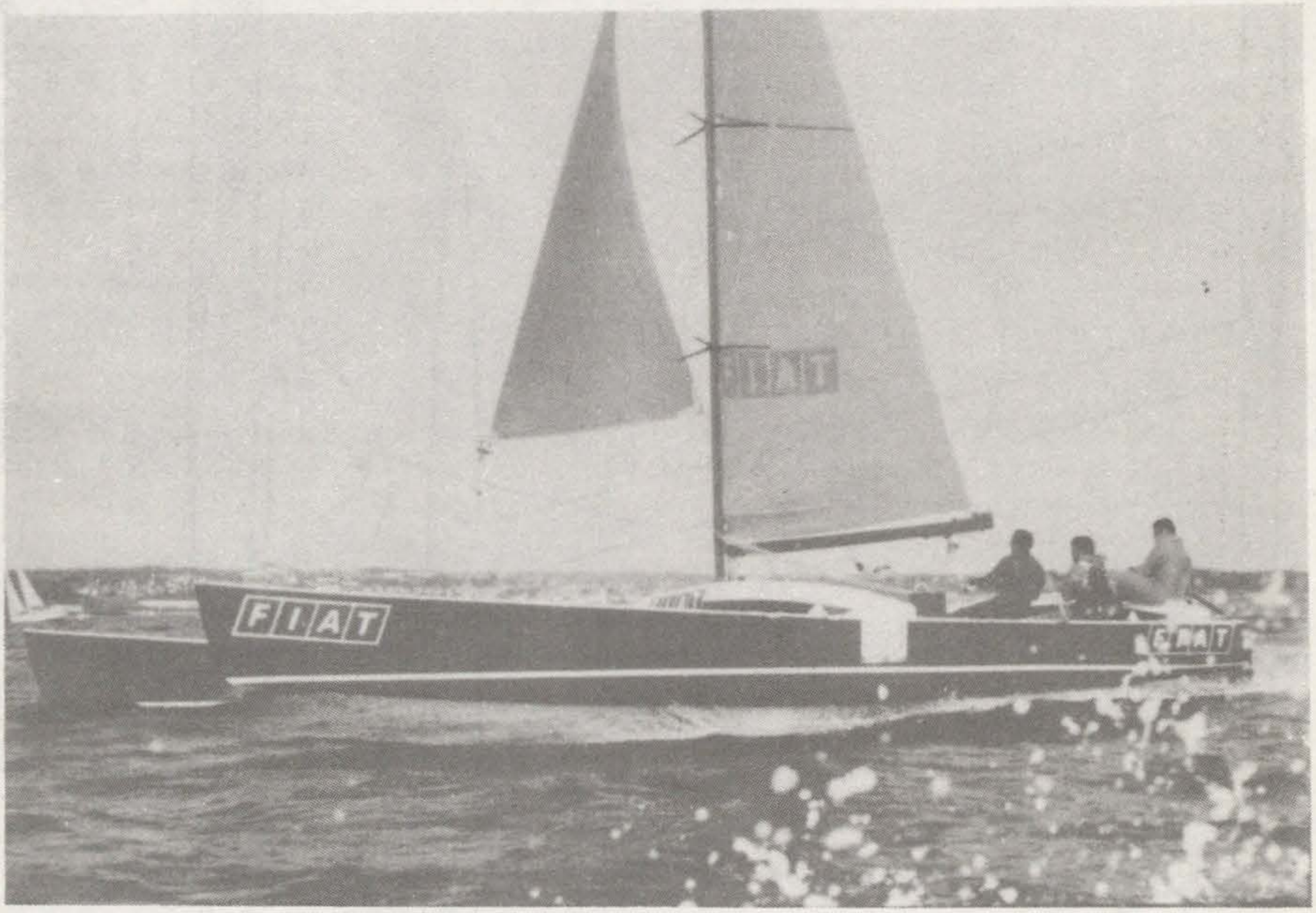
As might be expected, there were problems for the administration, notably with such a huge entry of sailboards who are not interested in less than force 6. However, order was maintained. A wonderful variety of "engines de vitesse" - contraptions for speed - were entered, and there were many casualties.

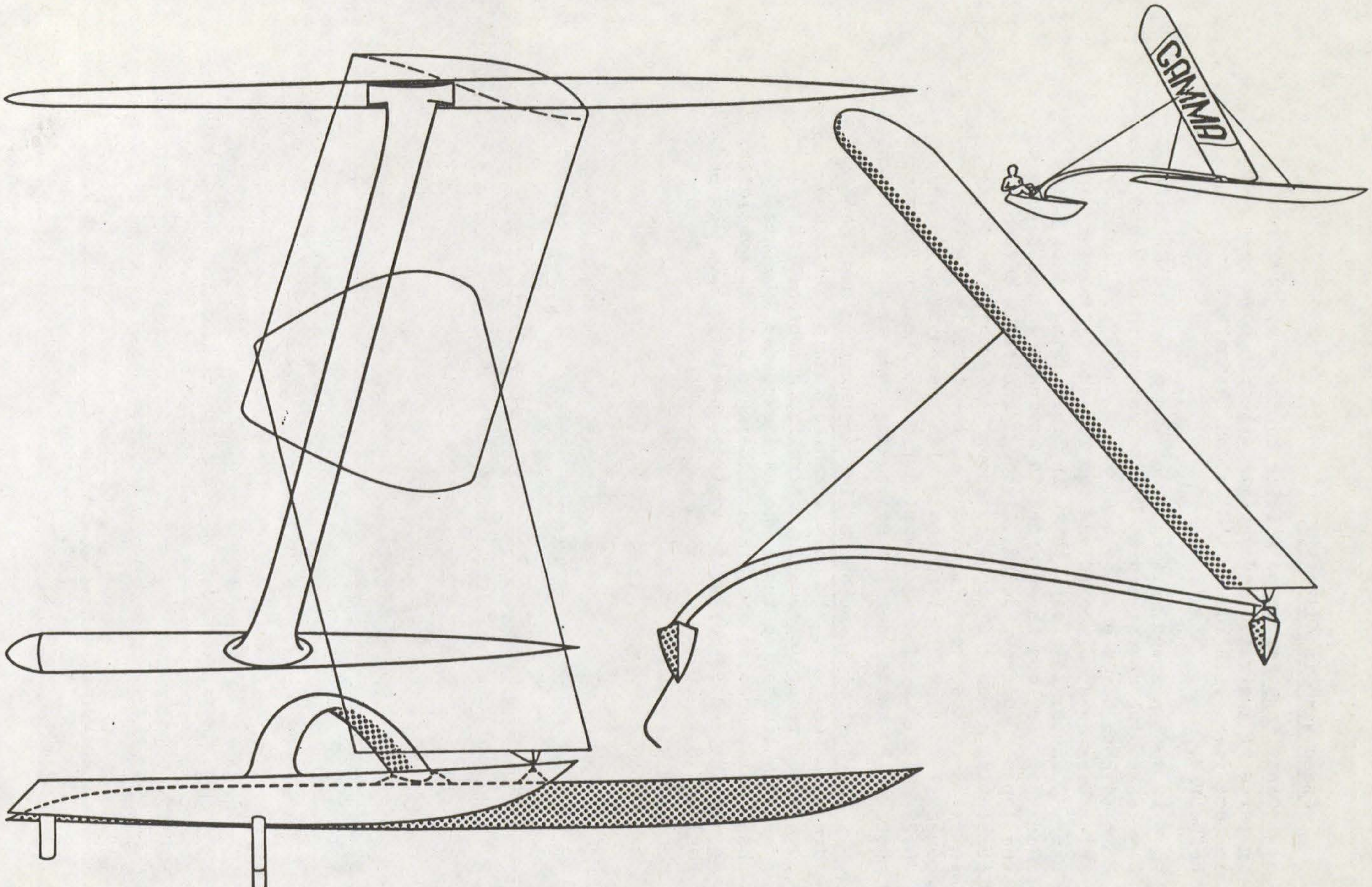
Speed Week in Australia

Conditions for speed sailing can be very favourable in parts of Australia and several attempts have been made in past years with runs by 'C' class catamarans near Melbourne.

In 1983 a speed sailing event was organised at Safety Bay Yacht Club on the Indian Ocean just south of Perth from 26th to 28th November. The best speed was 27.09 knots by Peter Dans on a sailboard and two Tornado catamarans made over 19 knots. A proa with an inclined 'wing' sail like "Gama" at Portland is regarded as having a chance to break the 'open' Crossbow record. Although she broke before completing a run she was good enough to greatly encourage interest in the event. Included in the results are two monohull 18ft skiff class boats with speeds of 17.95 and 16.27 knots. Wind speeds varied from 18 knots upwards to gusts of 29 knots when the sailboards made their best runs.

The Australian Speed Sailing Association has been formed to encourage and help organise future events and look after record speeds in Australia. Membership is presently limited to those who have exceeded 20 knots under sail, however associate membership will be available. Anyone interested may write to the secretary, P.O. Box 662, Manly, N.S.W. 2095.





GAMA

a contender for the speed sailing record, designed by Adrian Thompson, commissioned by

Gardiner Marshall Engineering Ltd.,
Hollywood Road, Bristol BS4 4LF.

"HARO" The Speed Machine.

From Eric Lerouge,
122 Rue Gambetta,
UrvilleNacqueville,
50460 Querqueville, France.

Back in 1979 I was planning with a few friends to build a 60' offshore racing catamaran. As the fastest sailboat at that time was a 'D' Class catamaran it was very clear to us that we wanted a huge D-Class.

Since finding the money to build the templates was a problem to us, we wisely decided to start with a real 'D' class as a half-scale model. "Haro", built by Yann and Armel at LeJeloux's yard in 'West system' was launched four years later.

Having no 'D' class yachts in France we increased the sail to 620 sq.ft., not bad for a 35'5" boat weighing 1150lbs. Jib is roller-furling and the aluminium rotating 41' mast needs triple diamonds. We were sponsored by Fiat for the Brest speed trials and the crew was Yann and Armel, Daniel Gilard, Halvard Mabire, Gilles Breteche and myself. I must say "Haro" is the most exhilarating boat I have ever sailed and with just 2 feet of freeboard speed is impressive ! Three crew are prefered in light weather and we trim the bow down and load the lee hull to to reach 13 knots in 8 knots of wind. In 12 knots of wind crew is to windward and aft and we did 19 knots. A fourth crew is needed for more weight and to trim the main traveller with more wind and we were paced once by a powerboat at 30 knots. Brave men are on the wire and we bless the U-shape bow and all the weight aft which prevents pitchpoling.

Lack of wind at Brest prevented us doing better than 21.5 knots. We were not helped by the race Committee who decided to close the "open" course the only day there was enough wind. Sharing the inshore course with 100 sailboards was a nightmare and we did not even have the distance needed to get the speed before the first mark. In the end only the sailboards were allowed to run. Brest looks more like a show than a sporting event.

"Haro" will get her maximum speed with more wind and a reduced rig. She seems able to beat "Beowulf V" best run (31 kts) We also have a 'C' class rig to improve "Jacob's Ladder" 25 kts record. We did very little beating but she seems powerful and the forestay is very tight. Jibing and tacking are easy but the crew must be synchronised to crawl 20 feet, tend the purchases on the sheets and free the jib from the diamonds. We still need to improve the fittings, solve rudder cavitation and most of all be fit enough and get used to the speed.

London 1984 Boat Show   Notes by Michael Ellison

Our display this year was confined to publications, an enlarged members notice board and a display of papers from other organisations. We were advised that the video display of the Brest speed week and the gas filled kites on our 1983 stand discouraged the public from buying books and asking questions. Sales and new members increased but this may be due to our new colour leaflet with a picture of trimaran "Hiley Payne" (ex Livery Dole and now Travacrest Seaway for 1984 OSTAR) Picture by your administrator at Portland 1983. We also had three new publications on sale and some copies of Design for Fast Sailing with stained covers which sold well at £ 4.00 each. (A few remain).

Around the show floors were covered with carpet tiles and the building had been cleaned and painted. There were not so many exhibitors nor so many people as in past years which made it all more pleasant for visitors and exhibitors. Still not one in 10,000 joined the Society - how do we improve ?

Exhibits that members reported as being of special note depended on their interest but the following lead the field :-

1. A "Moa". Only a small monohull proa. Perhaps a proa that is neither an 'Atlantic' (float to leeward) or 'Pacafic' (float to windward) should be a "Panama Proa". This very neat hard chine double ended boat is called "Leesailer" and marketed from Private Road 4, Colwick Estate, Nottingham. The boat has a flexible mast and daggerboard mounted midships and no rudder. A triangular sail is secured to the masthead with a sheet for the tack and clew which change according to the direction of travel. The hull is symetrical and the dagger board lifts out to become a seat when rowing. A marine ply D.I.Y. kit cost £ 258.75. LOA 3M (10') beam 1.17M (3'10") weight 23kg (50lb) Mast 4.57M (15') sail $4.9m^2$ ($53ft^2$) buoyancy 146kg (360lbs).

2. Tinker Inflatables. J.M.Henshaw (Marine) of Verrington Lodge, Wincanton, Somerset, BA9 8BN market the Tinker Tramp and Traveller inflatable tenders. An emergency cover has been made which converts the tender to a "lifeboat" and tank tests show that this combination with a sea anchor streamed from abeam is probably less likely to capsize than a liferaft. A report is available from the makers. A video film of the tests in winds up to 75 m.p.h. was impressive.

3. Gas Turbine engine. On stand UK40 Turbotech Marine Ltd. of Dodnor Lane, Newport, Isle of Wight, PO30 5XD had a power unit giving 250 shp @ 5,000 rpm with a weight of 67 kg that is only 158lbs with a fuel consumption of 0.65lb/shp/hour.

Fuel for this and a 1,000 shp model weighing 272kg (600lbs) is marine diesel. The units are complete and power take-off and accessory drives are provided from the gearbox hydraulic pump. For a racing powerboat the power to weight ratio seems unbeatable but turbines like to run at a constant speed with a steady load. With the 'Round Britain' in mind we found that a dispensation for an airscrew drive would probably be granted. Several firms making inflatable craft could build a large inflatable catamaran suitable for this purpose. Graham Benyon-Tinker of 20 Bolton Gardens, Teddington, Middx., was most interested and helpful even to the extent of giving a guide price for three hulls having safety 'inner tubes' and mountings for the platform to carry crew and power unit. In 1969 we looked at hydrofoils to use as 'shock absorbers' on "Iroquois GT" which cruised at 25 knots. We are now looking at 50 knots and a small ladder of foils to damp pitching would seem to offer useful advantages. Although not expensive by power boat standards funds to complete trials and a proper race entry are not available.

4. Wharram Catamaran. James moved his team to a larger stand and had on display a "Tikki 21" coastal trekker. This home built yacht was much admired for the detailed work in the design. Just one example of this is the mast step which makes it easy to raise and lower the (wood) mast. Full details from James Wharram, Greenbank Road, Devoran, Truro, Cornwall TR3

5. Sailboard Cruising Kit While James Wharram is angry that M.O.C.R.A. in general and Richard Woods especially should claim that a light weight 'Micro Multihull' designed for day racing and trailer-sailing is a "coastal cruiser" there was on display by J.D.Marine Sports Ltd a cruising kit for sailboards. This is a watertight box which can be secured to any board which carries tent pegs, gas cooker and clothes. The sail and mast become a tent. Size 41cm long, (16") width 29cm (11½") height 32cm (12½"). Address: Little Trevean, Lanarth, St.Keverne, Nr Helston, Cornwall.

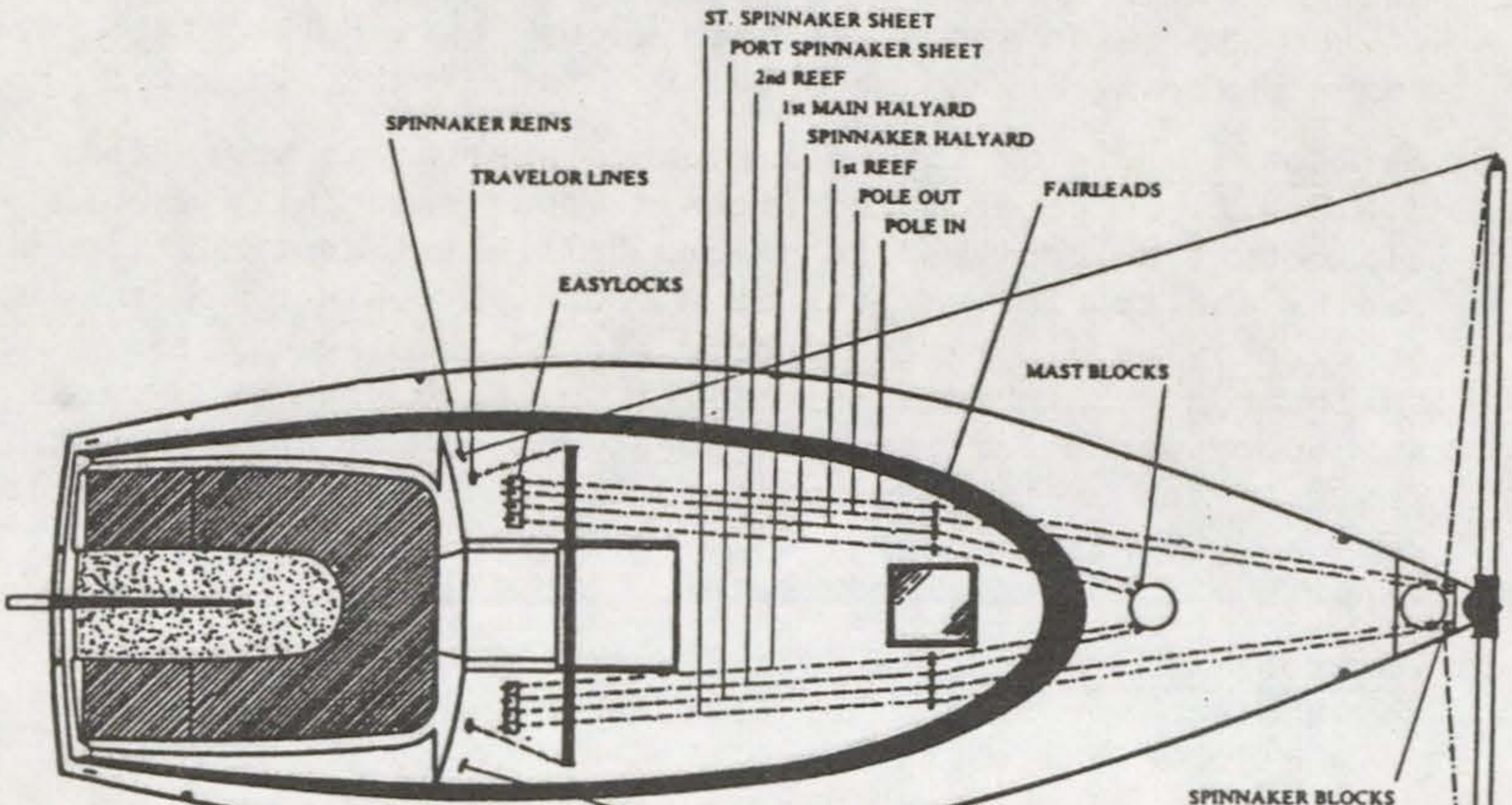
6. Bathtub Sailors. On stand J2 "Giltspur" at 7'9" long and Tom McClean who sailed her from Newfoundland to Portugal joined Tom McNally who was picked up in his 6' 10" 'yacht' after six weeks at sea. These craft had been carefully prepared for their record breaking voyages. Their 'success' is not welcomed by the Coastguard stand or the R.N.L.I. helpers who fear they may encourage others to venture out to sea in craft of similar size.

7. Freedom 21. This 'trailer/sailer' monohull has twin lifting keels each with a bulb and 'half a wing' for which a patent has been applied. The front of the bulbs are almost flat.

This yacht also has a spinnaker pole that slides in a patent "gun mount" on top of the pulpit. This very practical idea enables the crew to set, gybe, trim and stow the sail without leaving the cockpit. The pole shown on the plan slides in the mount to stow with only a stub projecting forward and the other end on the cabin top. The mast has no stays. The main has full length battens and slab reefs to a conventional boom. To quote from their leaflet :-"So the class rules of the Freedom 21 specify the boat must be sailed by one male and one female, entirely from the cockpit. This neutralizes the 'Gorilla' factor, and creates the pleasing prospect of a crew that might smell nice and be fun to sleep with - two qualities which your typical racing crew could never be accused of."

The yacht has four bunks and is available with fin keel draft 3'9", shoal keel 2'0" and twin lifting version 1'(3'6"). The basic price is £ 5,000. Before you sail add £ 2,000 for cooker, winches, compass plus £ 890 for road trailer plus dinghy, ropes, fenders and safety equipment and V.A.T. Full details from 49 America's Cup Avenue, Newport, R.I. 02840 or Portsmouth Road, Lowford, Southampton, England.

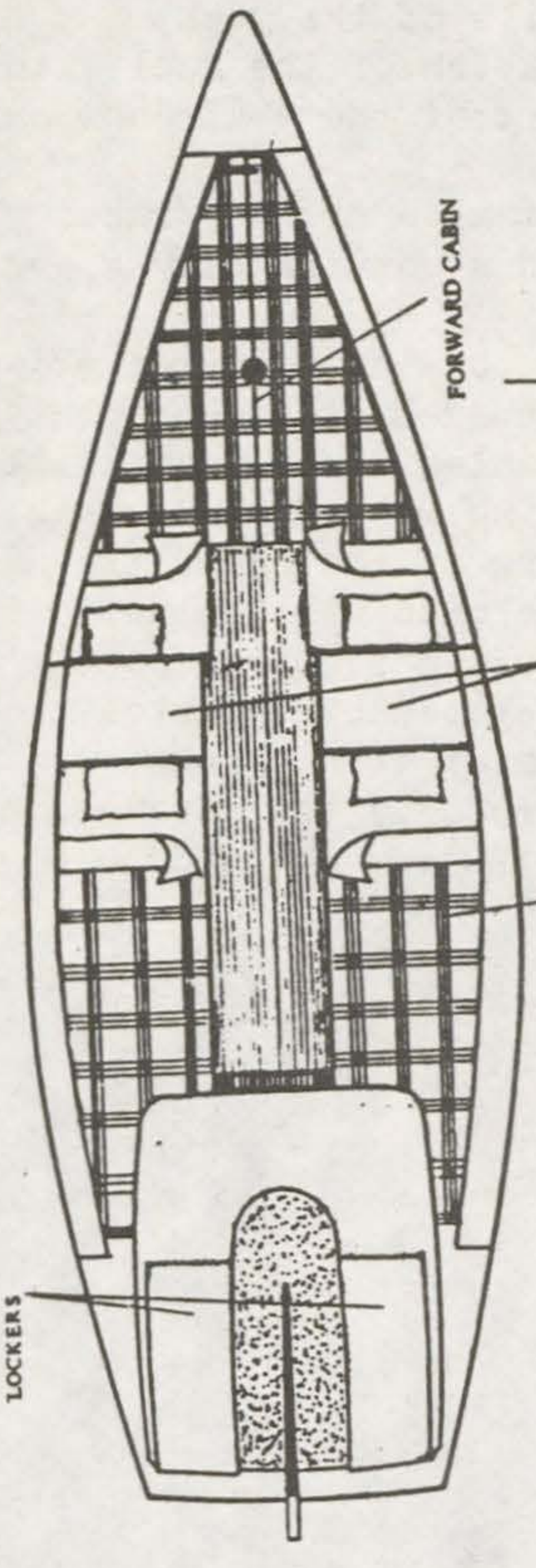
FREEDOM ★ 21



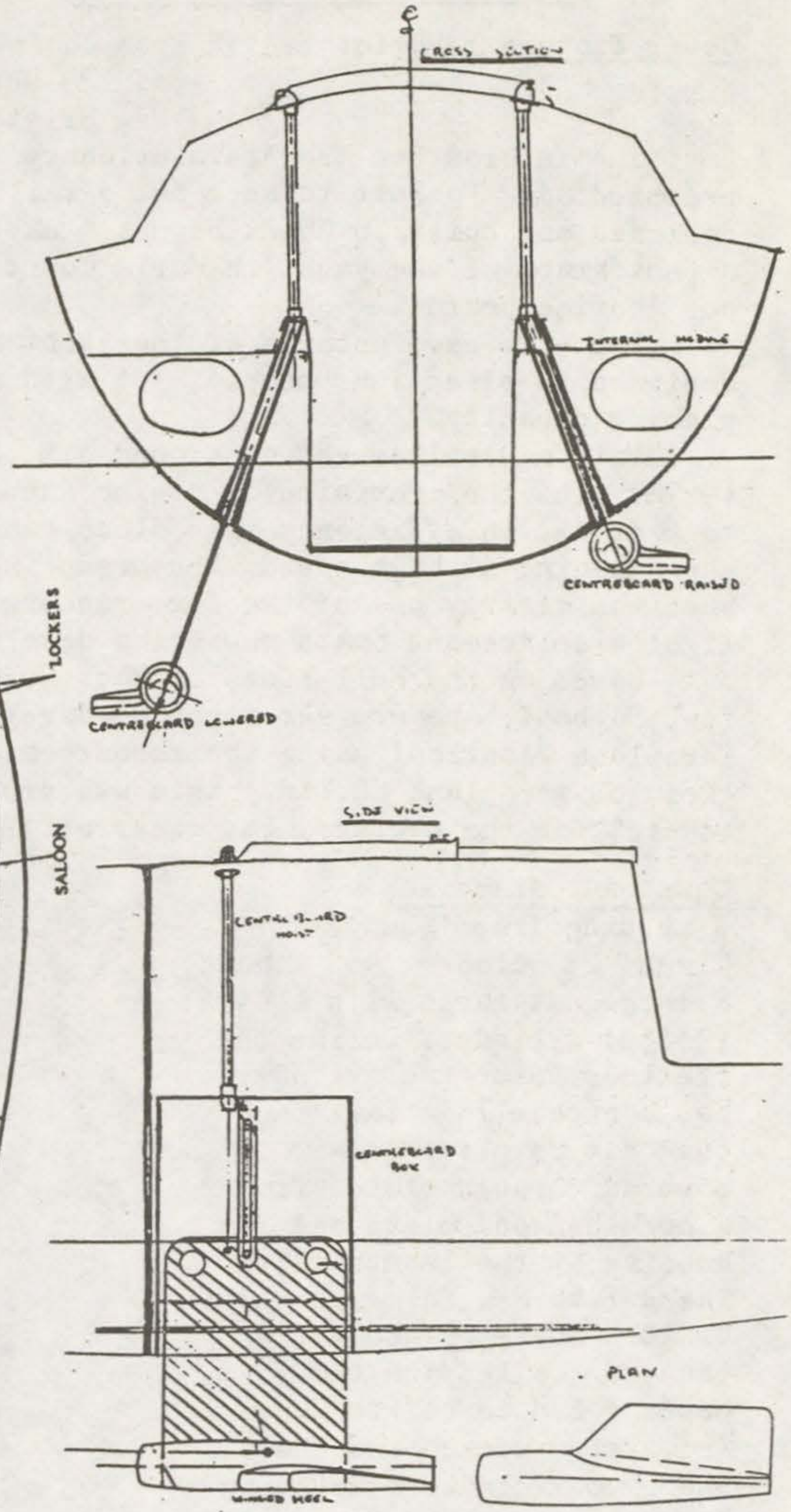
DECK PLAN

Sail Area	200 sq. ft	LOA	21'8"
Displacement, fin keel	1800 lbs.	LWL	17'8"
shoal keel	2050 lbs.	Beam	8'0"
Lead Ballast, fin keel	500 lbs.	Draft, fin keel	3'9"
shoal keel	750 lbs.	shoal keel	2'0"

FREEDOM 21



PLAN



TWIN LIFTING KEEL VERSION
Draft centreboard up - 12"
Centreboard lowered - 3'6"

Notes from the Notice Board.

Cover Picture :-"Bristol 111" From J. Poslett,
29 Devonshire Road,
Bristol BS6 7NG

The interest in the 'revolutionary' keel of "Australia 11" prompted Jack Poslett to seek out details of the yacht designed and built in 1962. He put a sketch of the keel with a photograph of the yacht in Earls Court at the 1963 Show on our 'notice board'.

The note gave details of the yacht as a cruiser/racer designed to sleep four people, yet with a genuine high speed planing capacity.

With a displacement of around 1.5 tons an a LOA of 32' (9.7m) plus the provision of a wing shaped ballast/end plate to provide fin efficiency when close hauled, and dynamic lift when planing at high speed, thus reducing wetted area. This boat was clearly one of the fore runners of the new ultra-light displacement boats now being developed world-wide.

Based on the hull lines of Jack Holt's forward-looking Y.W. Dayboat, the cruiser version, developed by 'Bristol Aeroplane Plastics' using the resources of it's parent 'Bristol Aeroplane Co.Ltd.' this was probably too advanced a concept for the average boat owner of 1963.

Cousteau Catamaran

A cutting from 'Sunday Times' 23 October 1983 shows a large catamaran with a 44' (13.5m) cylinder. Unlike the Flettner Rotor the cylinder has a streamline 'tail' and does not revolve but air is powered through slots from a combined end plate and fan housing at the 'masthead'. The E.T.A. New York was given as 10th November but sadly the gear failed and the passage had to be abandoned. The system worked and the energy savings were noted as "prodigious". In October 1979 the catamaran had a twin mast 'biplane' rig setting six roller reefing headsails and two mainsails rolling to the mast. The picture shows her ashore on Weymouth beach.

Commercial Sailing Ships. John W.Shortall 111 of Florida Sea Grant College sent copies of proceedings of May 1983 International Conference on Sail-Assisted Commercial Fishing Vessels and March 1983 paper 28 "Sail-Assisted Commercial Marine Vehicles". Copies available from:- Sea Grant Marine Advisory Program, G022 McCarty Hall, University of Florida, Gainesville, FL 32611.

Liverpool Polytechnic Department of Maritime Studies sent News Bulletin number 6, November 1983 on "Commercial Sailing Ships". Next issue about June 1984 costing £ 2.00. Address:- Byrom Street, Liverpool, L3 3AF.

British Wind Energy Association has set up a working party to examine wind assistance for ships. Anyone who wants to contribute should contact Air Comm.C.T. Nance OBE, Mornington, Cowes, Isle of Wight.

Multihulls. We displayed 'newsletters' from:- New Zealand, Auckland Multihull Sailing Association, Box 3337, Auckland.
England = MOCRA, Hon.Sec.Michael Fogarty, 91 Sterndale Road, Hammersmith, London W14.
France = Union Nationale des Multicoques. Sec. B.G.Morel, 7quater, r.de la Justice, 60200 Compiegne.
U.S.A. Northwest Multihull Association, P.O. Box 70413, Ballard Station, Seattle, Wa 98107
Denmark = Danske Flerskrogssejlere. c/o Lars Oudrup, Algade 46, 5500 Middelfart, Denmark

P.C.A. We started with copies of 'The Sailorman' on sale but from their A.G.M. held during the show James Wharram was elected editor and all papers were transfered to his stand.(Address 4 above). Presumably it will join with Jim's new journal "The Sea People" ending the owners association.
Holland. (No journal) Catamaran en Trimaran Club Nederland, c/o N.D. Boon, Groningerweg 46, 9738 AB GRONINGEN.
Iroquois Owners Association c/o Stuart Fisher, 157 Sackville Road, Hove, Sussex BN3 3HD. (Stuart is newsletter editor).

Seven Seas Cruising Association :- Newsletter from P.O. Box 2190, Covington, Louisiana 70434. Anyone may subscribe to their excellent journal, $ 18.00 in U.S.A. or $ 22.00 for overseas but to belong you must live on board your yacht.

Royal Institution of Naval Architects (RINA) Small Craft Group, 10 Upper Belgrave Street, London SW1X 8BQ. We had their papers from the conference "Advanced Rigs for Advanced Craft" on sale at £ 10 per copy. They plan another meeting for November 1984 to take place after the meetings of the International Yacht Racing Union which are held in London.

International Hydrofoil Society, 51 Welbeck St., London W1M. or Capt.J.W.King Jr., 4313 Granada Street, Alexandria, Virginia 22309, U.S.A. Subscription £ 9.00 for U.K..

Project Raft. The scrap timber raft previously mentioned as preparing for a 3 year round-the-world research voyage is still in Southampton, England. A bearing for the lifting propeller shaft was the only item which had to be ordered and paid for at full cost. It was the only part not ready and continued long delays ment that An and Ed were unable to sail during favourable weather. They plan to depart this spring as soon as the weather is suitable.

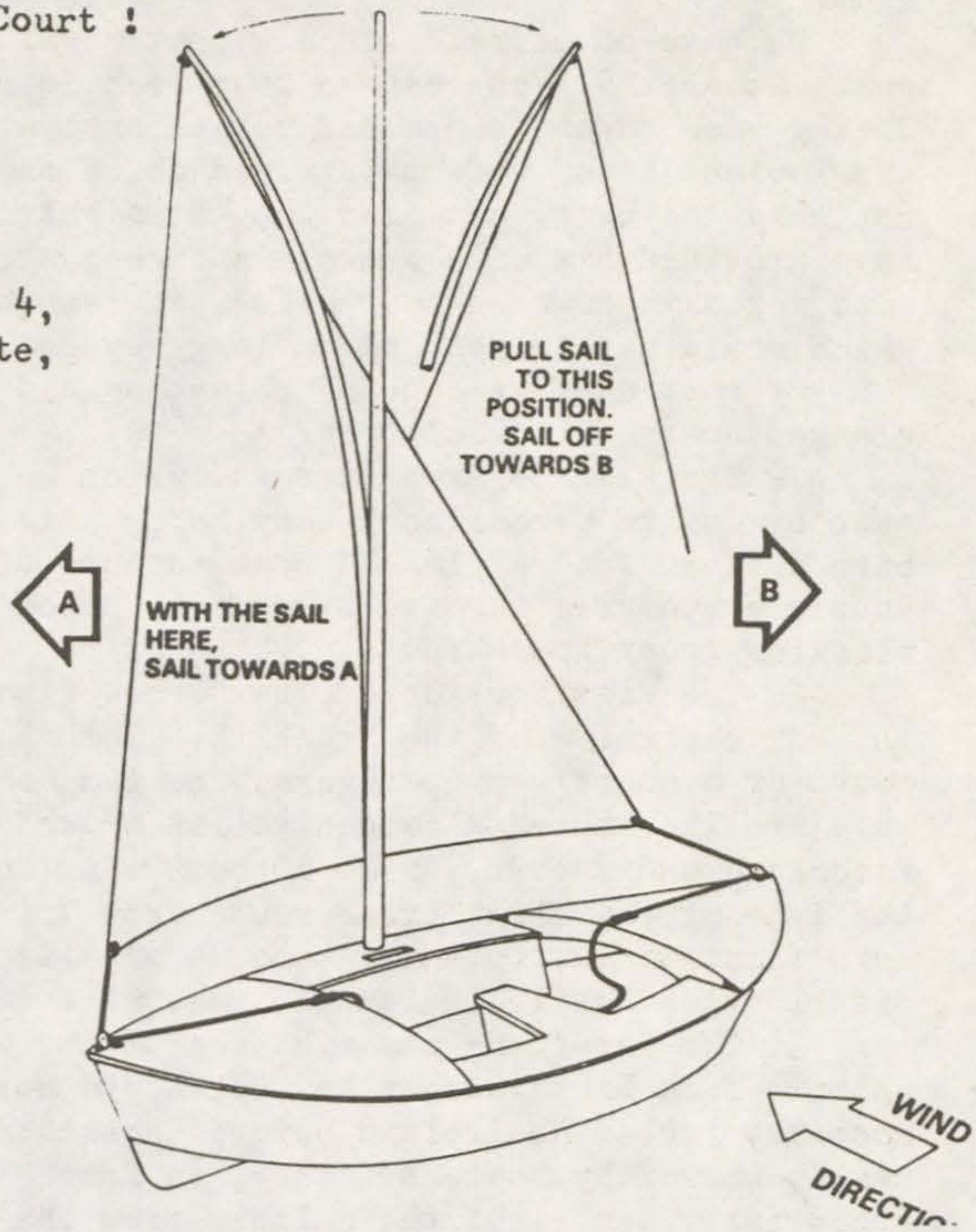
Product Addresses

The Kite Store, 69 Neal Street, Covent Garden, London WC2H. Catalogue of numerous types of kite including 'Flexifoil' Skysail at £ 33.50 and Super 10 at £ 77.50 (Dec 83 inc V.A.T)
Flexifoil International BV, Egbert Gorterstraat 3,PO Box 480, 7600 Al Almelo, The Netherlands.
Stewkie Aerodynamics Ltd., Manor Farm, Melbury Osmond, Dorset DT2 OLS, England for inflatable kites.
Multi Role Cruising Boat,(MCRB Developments) Walrow Trading Estate, Highbridge, Somerset. Monohull with retractable power unit and planing flaps giving 7½ knots to windward under sail and 18 knots under power. Certainly getting near to multihull performance. LOA 11.3m (37') Disp 4.2 tonnes.
Survival Suit. Meets new IYRU requirement for multihull yachts in lieu of liferaft (As well as numerous government and transport regulations) Cost £ 45 + VAT for single suits from G.R. Woodford Ltd., Group House, Fishers Lane, Norwich Norfolk NR2 1ET. (Contact R.M.Ellison who has a demonstration suit).
The Yacht Leg Company, 30 Crosier Road,Ickenham, Uxbridge, Middlesex,UB10 8RR make telescopic yacht supports for use while cruising. Adjustable from deck. Suitable for hard or soft ground but perhaps not under rough conditions.
Unsink Buoyancy. Heavy duty inflatable bags of various shapes for use as emergency floatation. Mountcracken Ltd., Brighton Marina, Sussex BN2 5UF. (Recommended by Geoff Hales).
Fixing for foam or balsa 'sandwich' construction yachts. A simple plastic moulding holds and fairs the bolt head and provides a solid core to take the compression load of the nut and fitting. From R.J.N. Marine, The Elms, Market Rasen, Lincolnshire.

"MOA" At Earls Court !

<u>LEESAILER</u>

Private Road 4,
Colwick Estate,
Nottingham
England



<u>Pivoting Mast to Spill Wind</u>. Letter from Gavin Byrne,
15 Faunce Cres., O'Connor,
A.C.T. 2601, Australia.

2nd February 1984

I am aware of the advantages of catamarans and own a small one. However, as a physicist, I am surprised that there have not been more efforts made to provide these boats with flexible or pivoting masts which presumably native built craft might have had. It should be possible to combine the wind spilling tendency of the monohull with the hull stability of the catamaran and thus produce a craft which is inherently safer. I realise that the engineering problems of such a design would not be trivial but they should not be insoluble.

How many boat designers and sailors realise that a cubic meter of air weighs over a kilogram ? When a stream of air many square meters in cross section is hurled at a boat at 30, 50 or more knots it is surprising that any boat survives.

Megalithic Boats by John Morwood.

We have no direct evidence that Megalithic man had any boats at all. Dug-out canoes have been found in peat bogs dating back to his times and pollen analysis has shown that hazel plantations were maintained which provided him with, not only the nuts, but also long straight poles which would have provided him with gunwale and keel strakes as well as ribs for skin covered 'Curraghs'. No remnants of planked boats which could put to sea and do long voyages have been found.

By contrast, we can infer that he did have a sea-going planked boat by the following :-

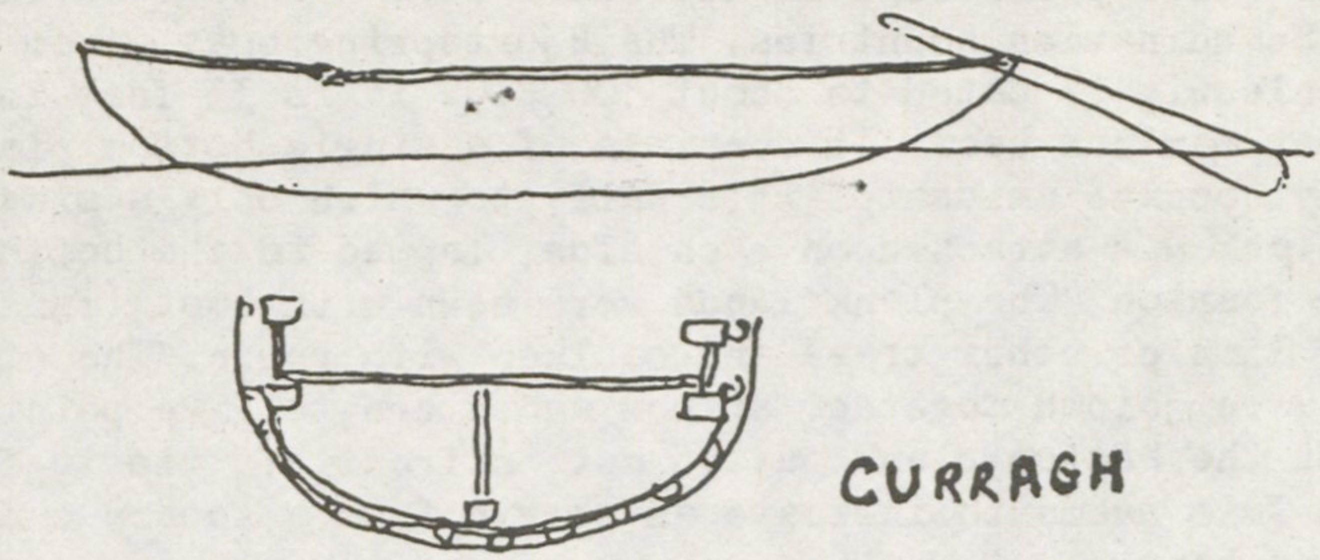
1. The skin covered curragh, which was the only boat seen by Julius Caesar in 55 and 54 B.C. is supposed to have been derived from a planked boat because of its keelson, double gunwales separated by some 6 inches (15mm) and residual planking under the skin.

2. The distribution of the "Grooved Ware" pottery which is characteristic of the Megalithic folk is either on the coast or a short way up rivers. The two main exceptions to this are the enormous concentration around Stonehenge, Woodhenge and Avebury, some 60 to 90 Km from the coast, and the line of the flint trade route from Grimes Graves, their main flint mines, to those same major sites. This coastal distribution surely indicates frequent communication by sea.

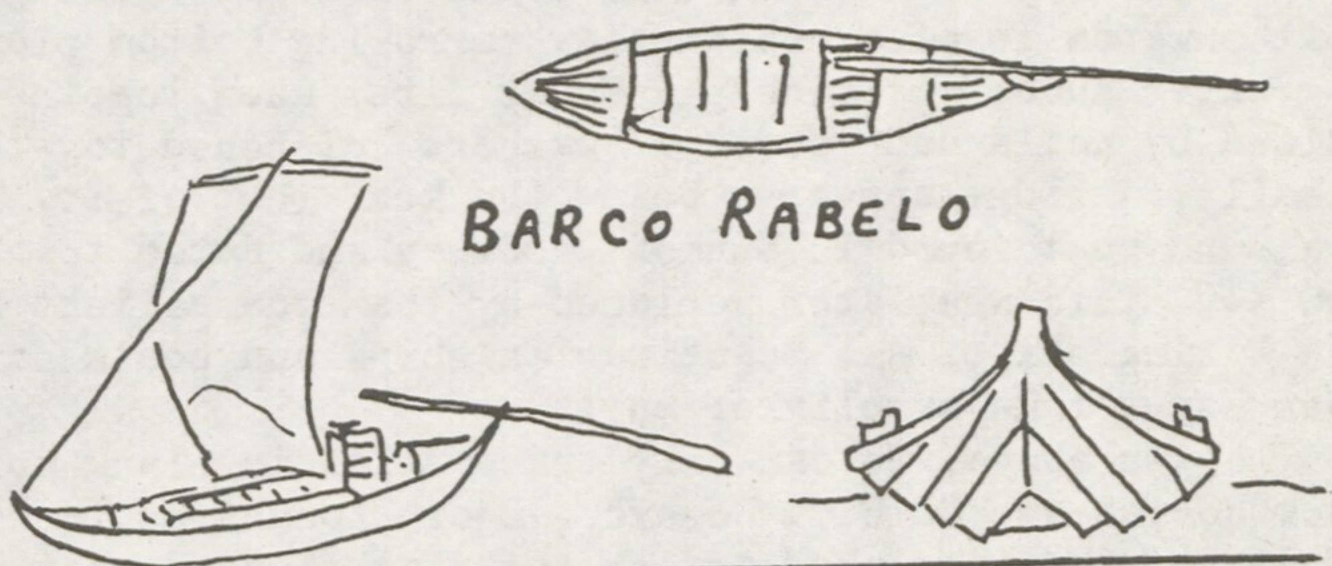
3. The far-flung distribution of the whole Megalithic culture from South Sweden and Poland to Morocco and Tunis and possibly including Ireland before England surely indicates a really seaworthy boat. Brittany, in France seems to have been the primary centre of the culture from where it spread much more inland than in Britain.

4. It has been shown by Professor Thom that the main pre-occupation of the Megalithic elite was the study of the sun, moon and stars. The prediction of eclipses must have been a great part of this process and, though eclipses might not be hard to forecast, one which would be seen in Sweden or Morocco would not be seen in England. Swift contact for news of eclipses would be very desirable.

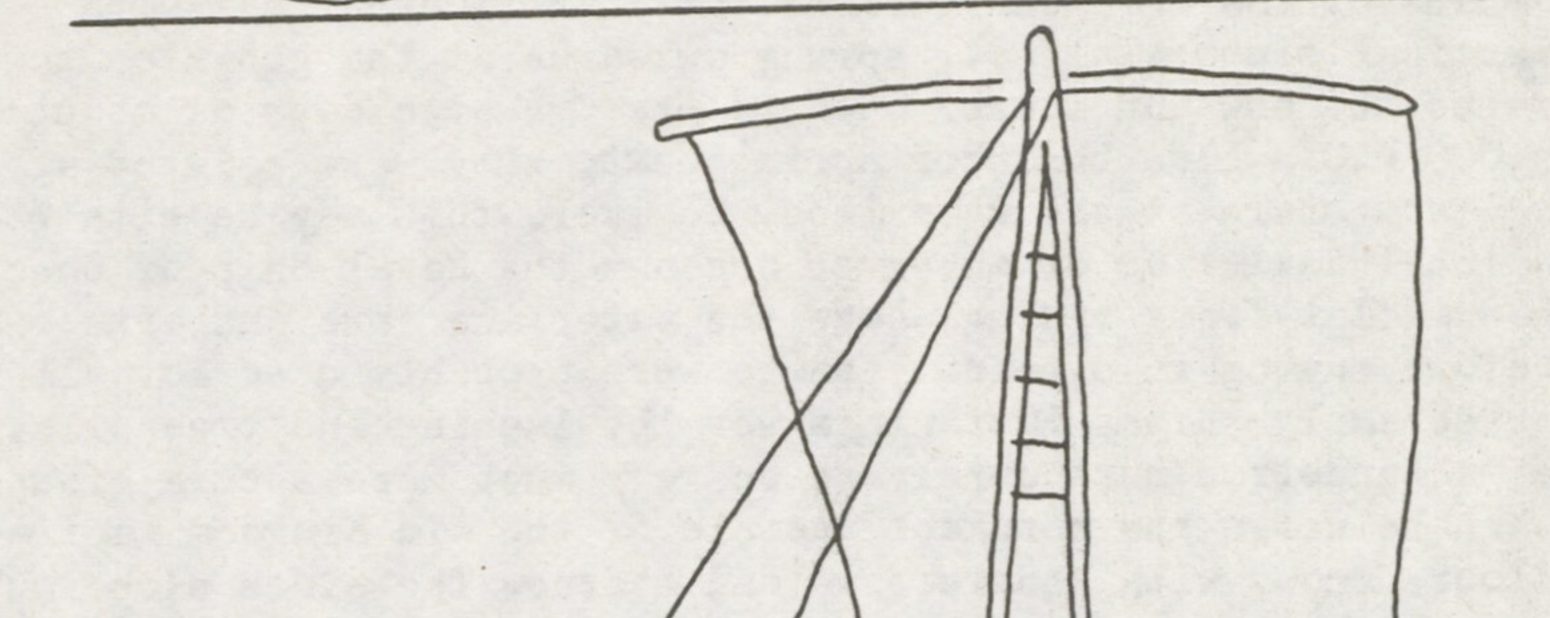
5. Perhaps, however, the best evidence for a pre-historic plank-built boat comes from two sources. Strabo, the Greek Geographer born about 63 B.C., quotes earlier accounts of a 'Magnis scaphis' or large boat from the river Douro, Portugal which was doubtless the ancestor of the clinker (lap strake) Barco Rabelo which used to bring wine down the Douro until the railway was built. The Barco Rabelo has a wide flat keel that indicates it was originally derived from a raft, the garboards and other planks being lapped on afterwards.



CURRAGH



BARCO RABELO



Old Kingdom Pharaoh's sailing scow after Landström

The other piece of evidence comes from the boat burials of the Scandinavian countries. The Hjortspring boat, from Als, Schleswig is dated to about 300 B.C. It is 33 feet long by 6 feet maximum beam. It consists of a single bottom plank, slightly concave amidships internally to which only a single broad plank was attached on each side, lapped to the bottom, clinker fashion. The plank lands were sewn with bast (inner bark of lime or other tree) and caulked with resin. The side planks were joined together at bow and stern to give pointed ends but the bottom plank jutted out in front of this to form "Rams". This seems to indicate an oregin from a square-ended punt-like boat.

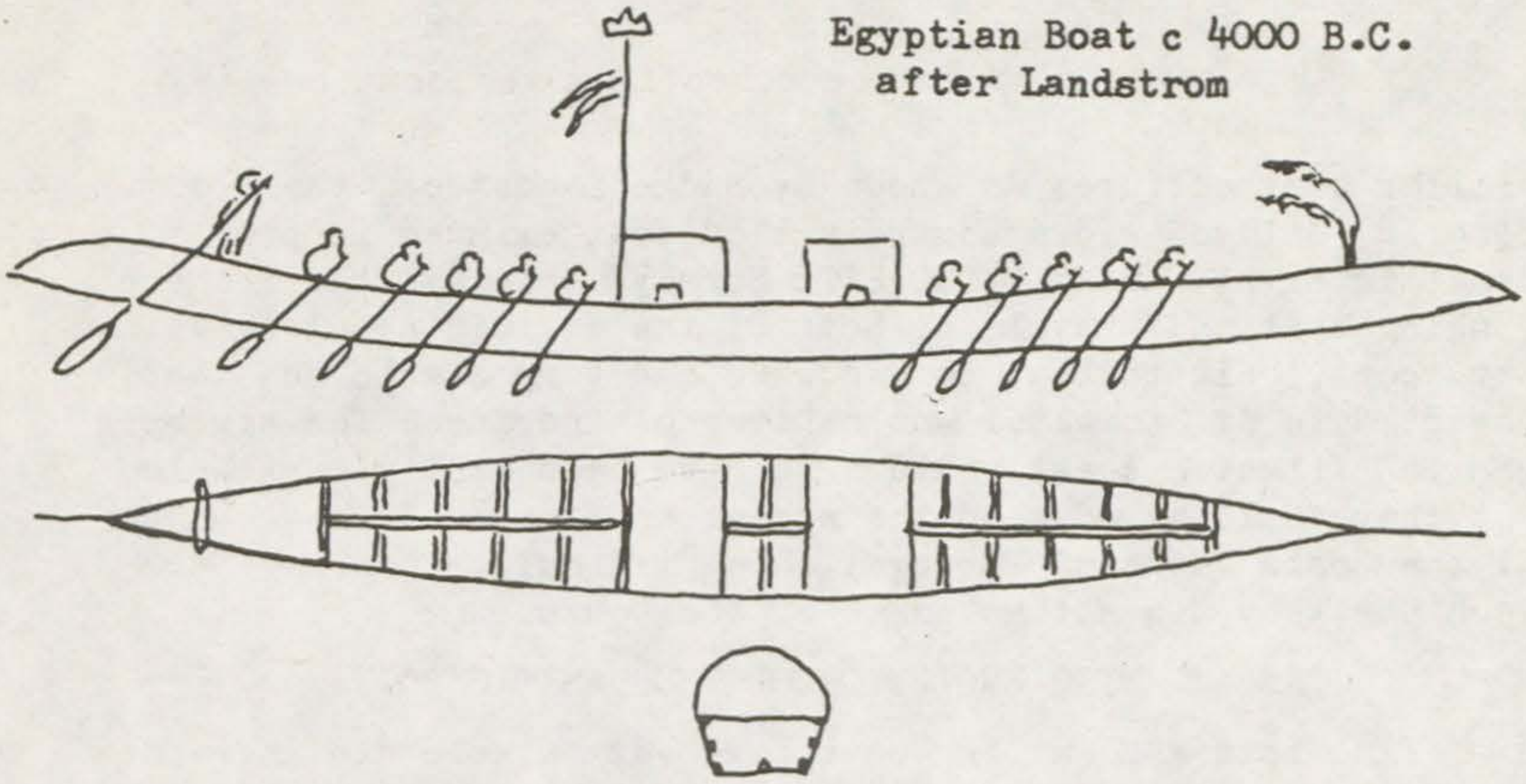
The story of Scandinavian boats from the Hjortspring boat onwards is of a continually narrowing bottom plank and a greater number of side planks at first sewn together, later joined by nails and rooves or washers, clenched together. Finally, a ridge appeared below the keel (but of it) in the Kvalsund boat found in Sunmore, Norway and dated to about 600 A.D. This was later replaced by the true salient keel of the Viking ships. All Scandinavian ships and boats have always been lap-strake or clinker built.

6. As above, we can only trace Atlantic plank-built boats back as far as 300 B.C. However, Bjorn Landstrom in his book, "Ships of the Pharaohs" traces the flat floored boat with vertical sides (in fact, sprung outwards at the gunwales to raise the bow and stern) back to pre-dynastic days of about 4,000 B.C. Like the Hjortspring boat, they were pointed at bow and stern at the waterline. However, this may be either a local deviation or an error because the Royal Ship of Cheops had a flat floor rising above the waterline fore and aft before ending in a point. Frames were probably used for all these early ships. Fastenings were by lashing and treenails.

Landstrom must surely be on very much more secure ground when he draws the merchant vessels of the Old Kingdom as flat floor scows with square bows and sterns. The sides slope out and the beam is relatively narrow. A high aspect ratio square-sail $1\frac{1}{2}$ times as high as it is wide would enable the boat to beat to windward, using the nearly vertical sides as lateral resistance.

The above hull and sail shape persisted throughout the Old Kingdom to vanish during the two centuries of chaos between the old and middle Kingdoms, when the central power seems to have disappeared. The hulls at this time became rounded in section and the sail aspect ratio dropped until the height was only half the bredth of the sail. Such a hull would not have any worth while lateral resistance while the sail could not point the boat to windward. This inaugurated the navigation of sailing up the Nile with the steady north wind

Egyptian Boat c 4000 B.C.
after Landstrom



and drifting down with the current with no sail set, as described by Herodotus. One can only assume that some dramatic catastrophe occurred at the end of the Old Kingdom such as the drowning of a Pharaoh when the sail was caught aback and capsizing the boat for the sacrifice for ever of windward ability.

Now, we know that, from the Western borders of Ancient Egypt along the north African shore, there lived a race of people who were called Libyans and they probably spread as far west as Morocco. They are shown in Egyptian tomb paintings as having golden hair, like some Moroccans of today. These may have been the original natives of 'Lower Egypt', i.e., the Nile Delta and may well have spread well into the middle east. They may have been the originators of the Neolithic revolution.

The following sequence of events happened :-

7,000 B.C. - 6,000 B.C. The first cultivation of grain and the domestication of animals.

6,000 B.C. - 5,000 B.C. Rapid spread along the whole north African shore, across the Straits of Gibraltar and Iberia to the Douro River. This spread must have largely occurred by land amongst probably Hamitic-speaking tribes.

A simultaneous but slower spread occurred into Anatolia by land; by sea to both shores of the Adriatic and also into the Balkans.

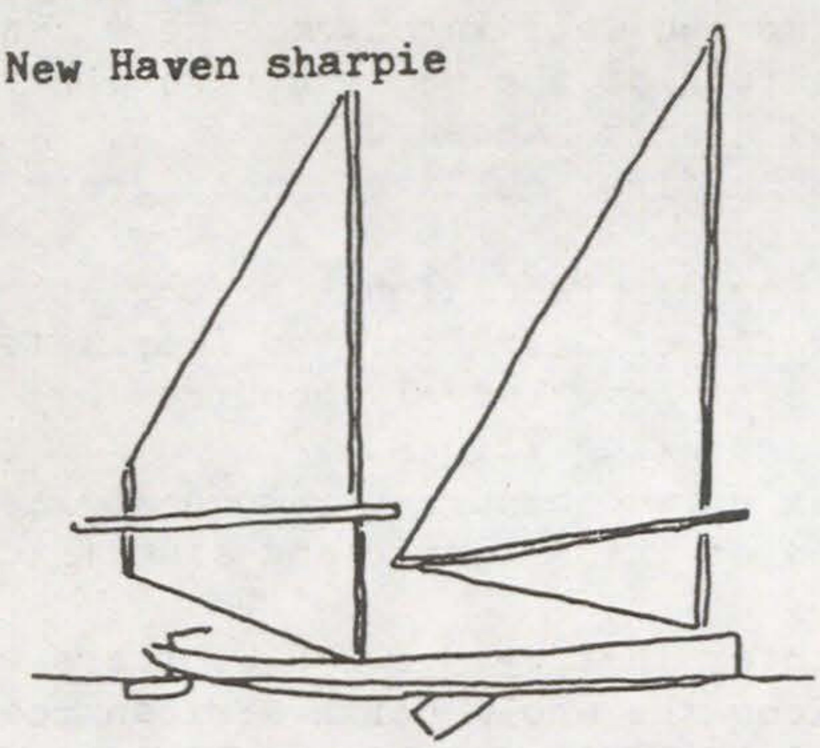
From the above, we can infer that by 5,000 B.C. there was a common Neolithic culture along the whole North African coast amongst what were predominately Hamitic-speaking golden haired people. These people and their language may well have spread well up the west coast of Iberia. Obviously, if all these peoples were prepared to learn the new Neolithic culture from each other, they would also have been prepared to adopt a similar boat culture. As shown by Bjorn Landstrom, the flat floored, splayed sided square sailed boat existed in pre-dynastic Egypt, about 4,000 B.C. Surely, this was the inshore fishing boat and travelling boat of the Hamitic peoples. With this boat, able to beat to windward and very stable and fast, the Straits of Gibraltar would have no hindrance. The southern Iberian Atlantic coast would also have been easily navigable but they would have found the strong and wet north-west winds of the Costa Verde of Portugal more difficult, this may have been why they did not go north of the Douro.

THE ATLANTIC EVOLUTION OF THE HAMITIC BOAT.

Flat bottomed sailing boats are very stable and therefore fast, the square ended scows, being faster than the ones with a pointed stem. The New Haven Sharpie of Connecticut, U.S.A. must be very similar to the Hamitic boat at one time, though it has a stem. A 35 foot one has been timed at 16 knots for three consecutive hours. A top speed of 19.4 knots was timed for 34 minutes.

The main fault of the scow and Sharpie is that they slap and pound in a head sea. This makes them very disagreeable to sail except when heeled or in light winds. They are also capsizeable. The cure for the pounding forward is either to make the forward sections V'd or rounded. Capsizing has always been regarded as an acceptable hazard of putting to sea in any small boat.

New Haven sharpie



The Atlantic, especially in in the North is not like the Mediterranean. Distant storms usually give a swell. The winds are fickle in direction and strength. The Hamitic boat was not comfortable. Quoting from the boats recently existing or known from examples found buried, the Saveiro of the Douro V'd its bottom, each side being made from three wide planks on both sides of a true keel. The Hjortspring boat developed a rounded bottom, as did the Barco Rabelo and the Irish Curragh. All originally used square-sails, if they sailed, though the Saveiro finally had a sprit-sail. The square scow ends were the first item to be changed and all primitive Atlantic boats are double ended. i.e. pointed fore and aft.

THE STEERING OARS.

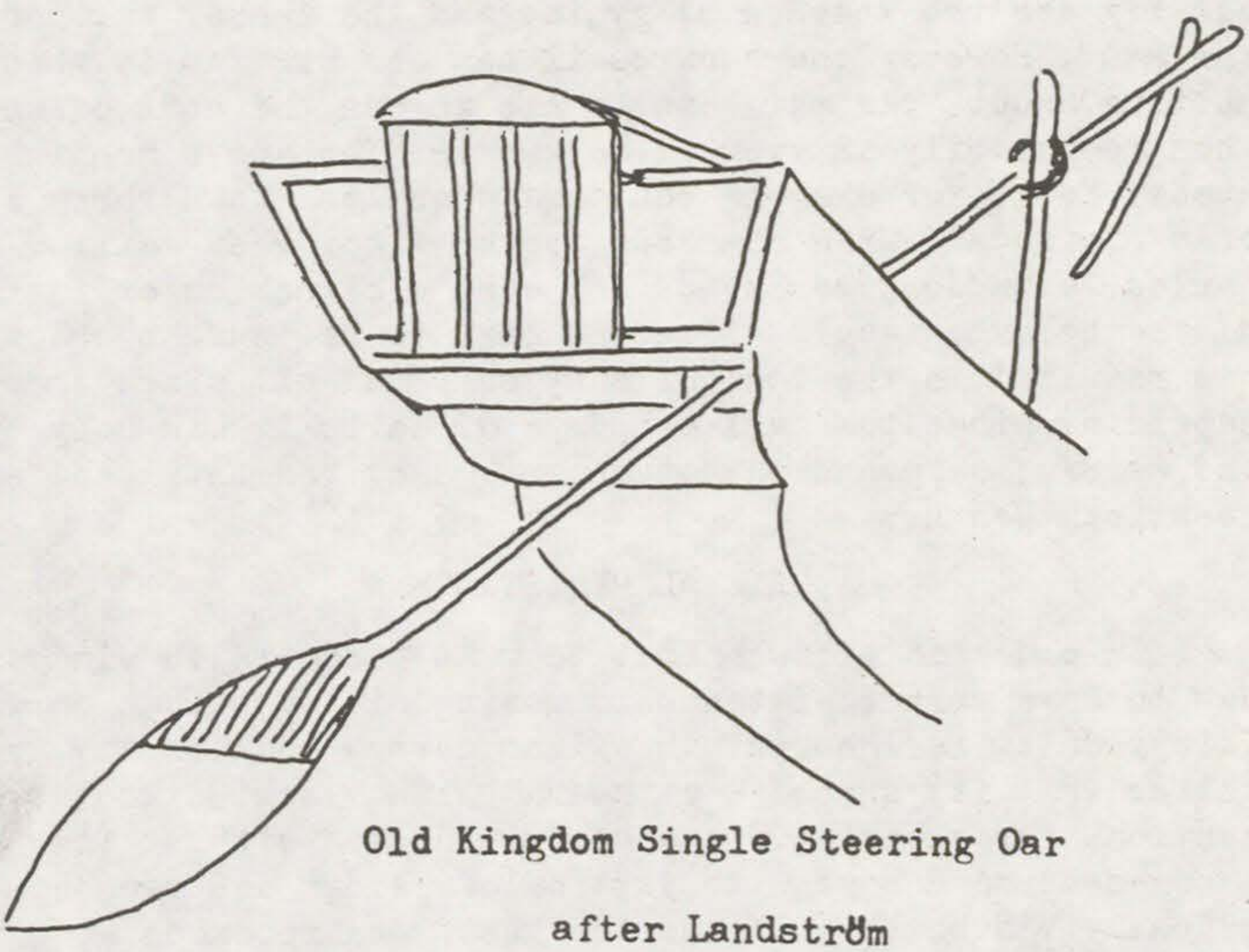
All steering oars, and indeed modern rudders, seem to be the most easily damaged parts of boats. Sooner or later, they will hit something or be hit by something. Being mere blades, they can break, or the attachment to the boat can come adrift. The boat is then more or less helpless.

The Ancient Egyptians at first used one steering oar in a notch at the stern, or transom. Later, they used up to three such oars on each side, in notches. Soon, the steering oars became loosely tied in their notches and a tiller was put in the loom. The oars now became more vertical, eventually being at some 20° from the vertical. This system eventually became the steering mechanism of the Phoenician, Greek, Roman and later Viking ships, the loom of the oar becoming more or less vertical.

The scow-like Ancient Egyptian merchantman tended to have but one steering oar which came to be placed through a hole in an aft sloping board at the top of the transom. Further forward, it was tied to a post high up so that its slope was about 45°. At its top end, a tiller came vertically down to the helmsman.

ATLANTIC STEERING OARS

The Atlantic has waves and tides vastly greater than the Mediterranean. A pitching boat will lift its rudder up often with loss of steering power. The Atlantic steering oar, thus



Old Kingdom Single Steering Oar

after Landström

became more horizontal than that of the Mediterranean. When boats became large, the increased force on the oar was simply solved by having a longer oar; the blade, being further back, needed less force to alter or keep course. The steering oar of the Barco Rabelo, Rabao and Saveiro are all exactly as long as the whole boat.

This steering oar also persisted in the English Channel until Medieval times despite the knowledge of the Roman and Viking systems. Cross Channel sailing was mostly from beach to beach and anyone who has sailed from a beach in an onshore wind and swell will know the trials of getting his rudder working. A steering oar is much more seaworthy. **In Boulogne a stained glass window shows a medieval saint, despite the size of the good lady, the steering oar is shown excellently.**

THE SQUARESAIL

Of all sails or sail rigs, not one develops as much sail force or is as close-winded as the squaresail as developed by the Ancient Egyptians in 3,000 B.C. The similarly rigged Humber Keel a square rigged, leeboard barge was alleged to look a whole point closer to the wind than the fore and aft rigged barges. It is no wonder, therefore, that the squaresail persisted from the earliest days of sail until its commercial extinction.

Other advantages of the square sail over the fore and aft rig are the absence of gybing and the lesser strains on the mast. However the squaresail has one big fault. When putting about, the sail has to lie across the boat or ship, thus temporarily driving it backwards. The above mentioned Humber Keel, for example could make no less than three lengths of a sternboard when changing tacks. Also, when sailing close-hauled, a sudden veering of the wind's direction or inattention of the helmsman could allow the sail to be 'caught aback'. This has resulted in the loss of many ships of all sizes from capsizing since the earliest days of sail. It was only by good and careful seamanship that the rig survived until the early twentieth Century.

LATERAL RESISTANCE

In order to allow a boat to make a course to windward, it has to have more resistance to moving sideways than forwards. This faculty is inherent in a long narrow boat of any type, no matter what its shape. A catamaran with a semi-circular hull section, for example will beat to windward without its boards. A box-sectioned boat with vertical topsides and even a modestly V'd bottom will be the best. Centreboards or weighted fin keels are not a necessity.

From the boat designer's point of view, the vital point is the ratio of sail area to the underwater profile area. A previous generation of yacht designers gave this proportion as from 25:1 to 35:1. A modern sailing scientist (Edmund Bruce) gives the formula as :-

$$\frac{\text{Sail area}}{\text{Board area}} = 257 \frac{V_B{}^2}{V_A} \qquad \begin{array}{l} V_B \text{ is Boat Speed} \\ V_A \text{ is Apparent wind speed.} \end{array}$$

This gives the same figures as before but indicates that fast boats need less lateral plane than slow ones.

From the foregoing writing, we can conclude that boats and ships without centreboards or fin keels must use less sail than those with these appendages. This accounts for the relatively tiny sail of the Viking longships. It also accounts for the persistance of the squaresail. The extra efficiency of the squaresail allows extra sail to be carried to windward.

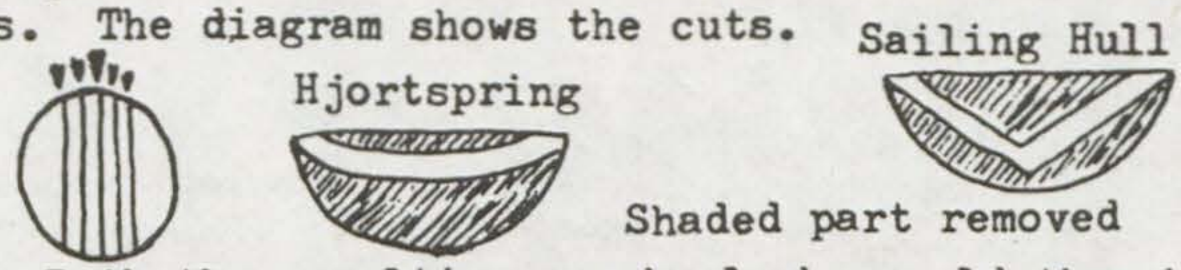
It may be pointed out here that extra sail area is not all important to sailing boats. Speed in light winds is proportional to the square of the sail area so that using only one quarter of one's sail area reduces the speed to half. More, the average Atlantic wind blows at 15 knots and boats such as we are considering travel as fast as they can easily go in winds of 10 knots.

MEGALITHIC BOAT BUILDING

Megalithic times were those of the virgin European forests. Pines, oaks, ash and beech grew to 60 meters in height with trunks 2 metres in diameter. Pollen analysis shows that the Scots pine was the main forest tree in Wales, Scotland and Northern Ireland. Megalithic dating shows that those were the areas of earliest British settlement. The main English and southern Irish tree was the beech on dry ground, oak or ash on clay. The pine is also likely to have been the main species in Brittany and northern Portugal. One can therefore guess that the people preferred to live in pine forests and probably used pine trees for boat building. During the copper and bronze ages, one can guess as to how the boats were built, as follows:-

A tall, straight forest giant would be selected with no side branches up to a height equivalent to the length of boat to be built. The children would then be given the task of keeping a fire of brushwood burning around its base. In some six to eight weeks, the tree would fall. The writer has found this process very tedious even to burn the base of a IO cm (4") hazel stool, which took many hours. The Megalithic folk might have preferred to 'ring' the base of the tree by taking off the bark all around to kill it a year or two before burning the base.

With the tree on the ground, five rows of wedges would next have been driven into the trunk to split it into two wide planks of the tree's diameter and two arc-of-a-circle logs. The diagram shows the cuts.



Both the resulting rough planks would then be smoothed by scraping, possibly being judiciously helped by fires. Oyster or similar sea shells would be the scrapers, in the absence of flint.

One of the arc of a circle sectioned logs would then be prepared for the bottom of the boat. For the Hjortspring boat, the bottom would be left rounded to make for a more easily paddled boat. For a sailing boat the bottom would be given a shallow V.

Finally, the two topsides would be joined to the bottom by thong or bast lashing, the seams being caulked with resin and moss. The topsides would mostly be splayed out to give extra gunwale beam for more efficient use of oars or paddles and this would result in overhangs fore and aft.

THE MEGALITHIC BOAT

From all the previous writings and arguments, it is possible to derive an estimate of what the Megalithic boat looked like. Firstly, we take the Saveiro, from Portugal which beats well to windward with its present spritsail. It is made from three planks on each side, making six in all. We then take this shape back in time to the Hjortspring boat from 300 B.C. in Denmark, made from one bottom plank and two side planks. However, we keep the shallow V (138°) in the midline. This will not detract from windward performance.

The topsides are well splayed forward, giving the long, overhanging bow which may well have derived from Ancient Egypt but which would give a sense of security when running before an Atlantic storm. They will also keep all but spray from coming over the bow when beating into a head sea. At the stern, the topsides are nearly vertical and fit in with the V'd bottom to give a handsome curved sternpost sweeping aft at about 45°.

A long steering oar is used, placed in a notch in the sternpost, instead of the thole pin of the Portuguese craft. The helmsman stands on an Apegadas which one thinks might have been used for navigational instruments and perishable stores. Its windage would help to balance that of the overhanging bow.

The fore and aft ends of the hull would be decked though the middle of the hull would be left open.

Finally, a squaresail of rectangular shape of at least a $1\frac{1}{2}$: 1 aspect ratio would be set with appropriate bow-lines to flatten the sail when going to windward. The braces and sheets would be those used by the Barco Rabelo. The mast would have three rope stays.

FURTHER THOUGHTS ON ATLANTIC PRIMITIVE BOATS.

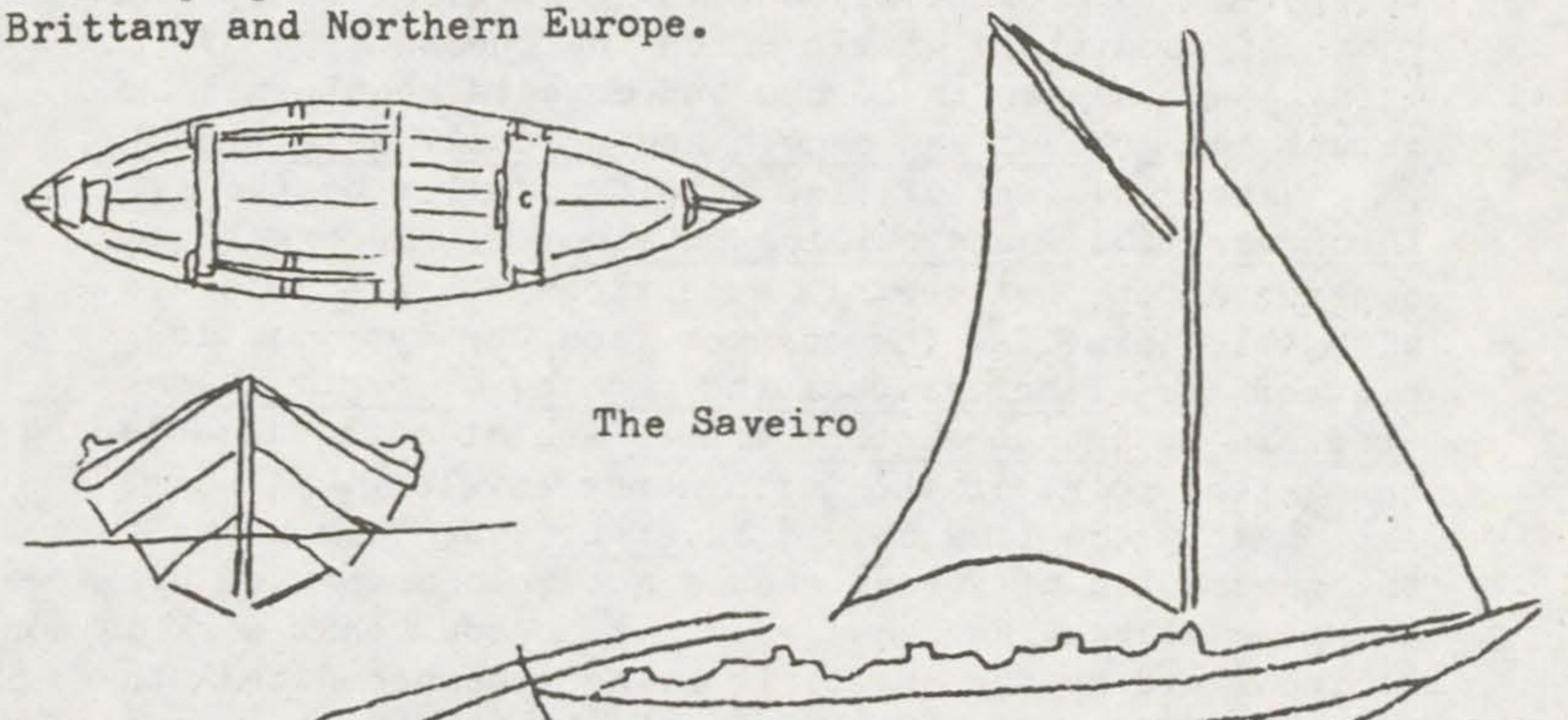
1. With a forest tree, possibly the pine, which can be split from side to side with wooden pegs driven into it in a row, it is less work to build two boats from a single trunk than in making a dug-out canoe. Moreover, the boats will have greater beam.

2. When two such sister ships are built and sailed together, small variations in hull shape which give either extra speed or extra windward ability will be noted. This makes for quick hull evolution.

3. In contrast to my thinking while writing the main text, the Saveiro has a virtually rounded, arc-of-a-circle hull bottom. Its lateral resistance probably comes from a V-ing of the fore and aft sections. The aft sections must be well V'd to give the stern profile.

4. It can be inferred that the Saveiro once had an Apegadas (wooden cage). The vestige of this can be seen in the planking just aft of the mast. When the conversion from the squaresail to the spritsail took place, the Apegadas was moved forward but could not be used because of the foot of the sail.

5. One can guess that the Megalithic boat was developed in Portugal by a Geodelic-speaking, golden or red crinkly haired people who later took their type and culture to Brittany and Northern Europe.



The Saveiro

Much of this article is based on, and some is reprinted from reference 1 with permission of Pergamon Press Ltd.

Vortex Generators

By Graeme Ward, 502 Wickham Rd., Shirley, Croydon, Surrey, Eng.

There has been much discussion in AYRS about vortex generators; what they are, what they are for, how they work (if indeed they do) and whether they are vortex generators or in reality vortex eliminators. The answers to the first two questions are not too difficult. They are supposed to substitute for a conventional keel, working as well but drawing rather less water. For the answers to the second two questions which are a bit more difficult, a fresh look at some basic fluid dynamics is a helpful beginning, with a look at "end plates", vortices, and how lift forces are generated.

Basic requirements of flows and flow systems

There are certain basic criteria which should be fulfilled for a flow system to be considered suitable for engineering applications. In the first instance the flow should be steady and stable. This means that flows that fluctuate with time are, in general, not suitable. Secondly the flow system should be well defined and insensitive to disturbances. Any disturbances should not upset the flow altogether, instead, it should be stable enough to revert to its initial state when the disturbance is removed. Thirdly the flow should be controlled. It should be possible to generate a range of forces and moments on a moving body sufficient to produce appropriate manoeuvreability over the range of conditions within which the chosen type of flow can exist. Any changes in forces and moments should not be abrupt but gradual and smooth and uniquely determinable.

Next; the type of flow should normally be the same throughout the whole sailing envelope of the craft under consideration, but certain exceptions to this rule are allowable, provided the changes from one type of flow to another are either gradual and smooth, or occur in a predictable and consistent manner and at a predictable and consistent point in the performance envelope.

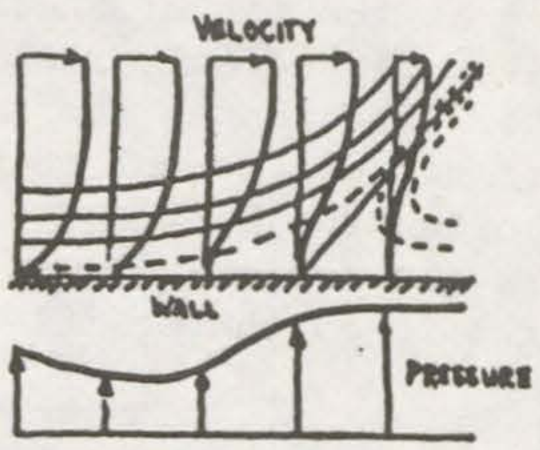
Lastly the flow should be efficient. This means that the generation of forces should not be accompanied by large energy wastage. The flows must all be such that work is done on the fluid by the craft. It being remembered that the energy needed to do this work is extracted from those forces otherwise used to drive the boat.

Flow Seperation

Perhaps the most important boundary-layer phenomenon is flow separation. It is fairly easy to see why flow separation may occur in a boundary layer when it is subjected to an adverse pressure gradient, under these conditions the slower fluid particles within the boundary layer have to flow against the same pressure rise as the faster particles in the outer stream. Both will be retarded but the particles within the boundary layer the more so because their kinetic energy is less, this is especially so for those particles nearer the wall where skin friction holds them back. The velocity profiles through the boundary layer will then deform as in diagram 1 and the flow will lift off the wall at a point where the skin friction becomes zero; the separation point, and the fluid will flow back behind it. It should be noted that whilst turbulent boundary layers can withstand larger pressure rises than laminar boundary layers, the latter would normally be thinner and produce less skin friction drag.

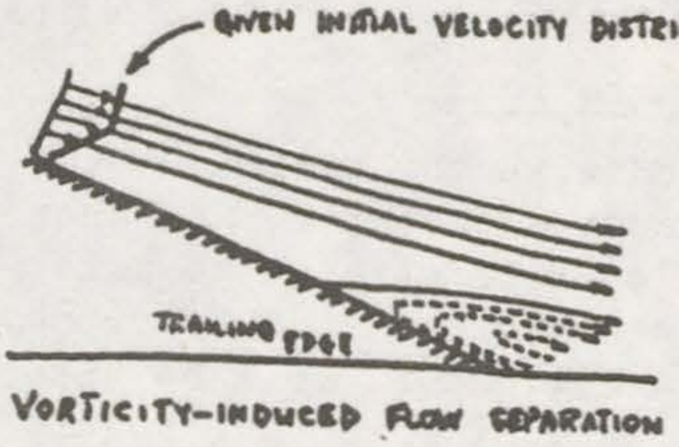
(i)

DIAGRAM 1



PRANDTL'S CONCEPT OF FLOW SEPARATION IN TWO-DIMENSIONAL FLOW

(ii)



VORTICITY-INDUCED FLOW SEPARATION

Lift and Span

It can be shown that a given value of actual lift is generated most efficiently (that is with the least induced drag) if the largest possible mass of fluid is captured (that is if the semi-span is as large as possible) and then subjected to the smallest possible change in angular momentum.

The air stream round the sail, the water stream round the keel, is deflected the minimum amount. This is because the rate at which kinetic energy is given to such fluid equals the rate at which work is done in producing the required vorticity to maintain the required lift. Apart from structural considerations, there are a number of reasons why very large semi-spans, or aspect ratios are not necessary and are in fact unhelpful.

Firstly whilst induced drag decreases as the square of the speed,profile drag (skin friction mostly plus a little form drag) increases as the square of the speed. So the minimum total drag or resistance occurs at a fairly low, fixed speed.

Another useful point that can be shown is that the drag induced from that deflection of fluid, the induced or vortex drag, is about the same whether the semi-span is extended by a certain amount "x", orwhether an end plate of width "x" is fitted at the tip of the foil or sail . Thus it can be said that end plates only really pay off if they can fulfil another function at the same time. In our case we have the additional desire not to have a deep keel in shallow water, so shorten the keel and fit an end plate and sail in places others can not go. Or, if you are already shallow enough of draught to go there; fit an end plate and point higher .

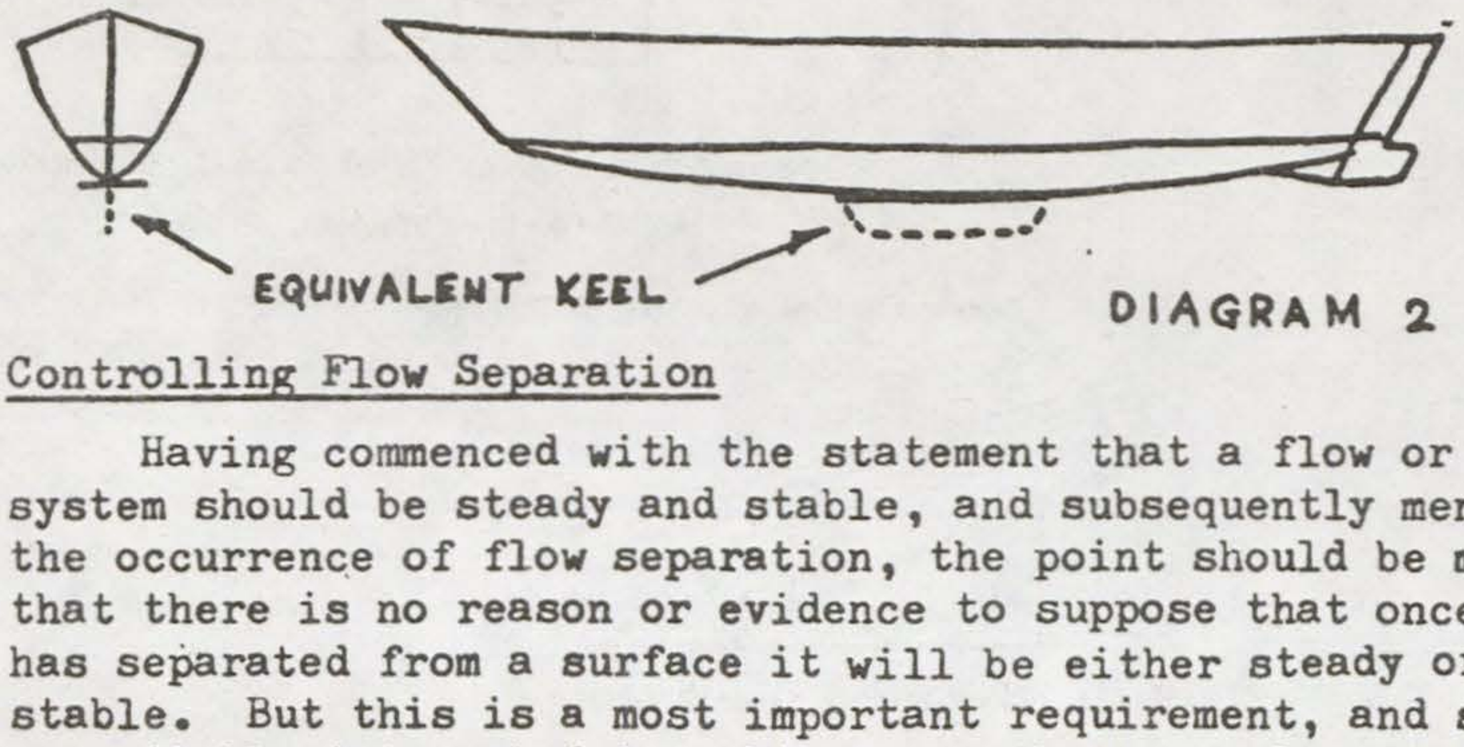


DIAGRAM 2

Controlling Flow Separation

Having commenced with the statement that a flow or flow system should be steady and stable, and subsequently mentioned the occurrence of flow separation, the point should be made that there is no reason or evidence to suppose that once flow has separated from a surface it will be either steady or stable. But this is a most important requirement, and so we are vitally interested in making sure that any places where flow separates are precisely fixed along well defined lines on the surface of the body. So far the only concept conceived which will fix flow-separation is a dynamically sharp edge; a geometric shape where the curvature is very high, or even infinite, so that a non-viscous flow should acquire a very high, or even infinite velocity and consequently a very high, or infinite pressure gradient. This is meant to make the separation of a real viscous flow around this shape inevitable at this place . the sharp edge. Because of these "infinites" it can be said that flow over sharp edges is not sensitive to Reynolds Number and thus small model tests are usually reliable .

Vortex Generators and The Generation of Lift Forces

With regard to the question of how lift forces can actually be generated, we are familiar with the classical streamline flow past and over foils. In a three dimensional foil this is associated with separation from the trailing edge only and the formation of a trailing vortex sheet which is nearly plane, at least initially. There are, however, other useful flows which can be utilised for the generation of lift forces. One such an alternative type of flow is where separation from side edges is an essential feature and where the trailing vortex sheet is essentially non-planar. Such a flow is shown in diagram 3 (i) where the vertical extent of the trailing vortex sheet is very pronounced because the side edges are much longer than the trailing edge on this foil of very small aspect ratio. Intuitively, one would expect that the extended non-planar vortex sheets should accelerate a greater mass of fluid downward and hence produce more lift than the plane vortex sheet from the trailing edge only, for the same span and angle of incidence. This turns out to be true, the lift being a non-linear function of the angle of incidence. The induced or vortex drag for a given span and overall lift may be smaller also. In principle this is another basic type of flow suitable for generating lift forces. In practice, the particular flow shown in diagram 3 (i) does not fulfil all the requirements which we originally specified to provide universal suitability for engineering applications. It should be observed that in a condition without yaw, the flow and the vortex system may be symmetrical with the attachment line running down the middle of the plate. With yaw as in diagram 3(ii), attachment is along a zig zag line which intersects first one edge, and then the other, and so on, and this leads to the formation of a new core at every intersection.

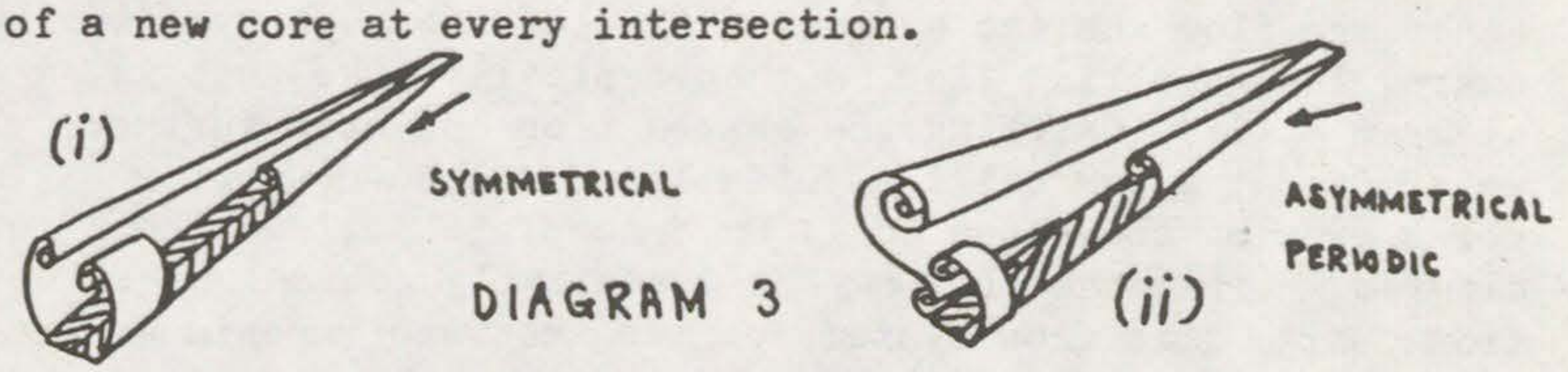


DIAGRAM 3

It should be noted that even without yaw the symmetry of a body placed symmetrically in a stream does not ensure the symmetry of the vortex pattern; a time periodicy in the wake is always a possible alternative, which is probably one reason why long shallow bilge keels perform especially poorly in heavy weather.

Therefore we are looking for flows which produce acceptable and stable arrangements of non-planar vortex sheets. There are fortunately many of this type, all associated with so-called slender shapes whose semi-spans 's' are significantly smaller than their overall lengths 'l'. It has been shown that a semi-span to length ratio $s/l = 0.25$ is about optimum; it should not be appreciably lower than 0.2 and values above 0.5 say, would imply a rather high semi-span and would make the application of this flow concept rather pointless.

(i)

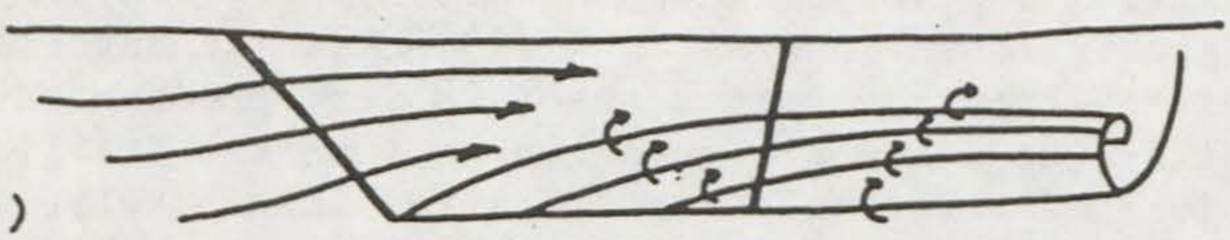


DIAGRAM 4

(ii)

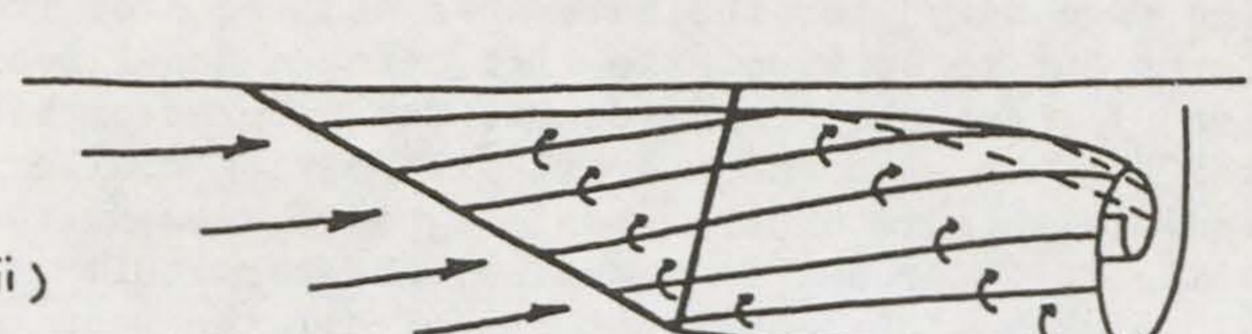


Diagram 4 (i) shows an example where separation occurs along the side and trailing edges of a tapered foil but where the flow remains attached over the leading edge. It turns out this is difficult to achieve when the angle of leading-edge sweep is, high as the separation line tends to creep round onto the leading edge; so we should design for a separated flow instead by making the leading edge dynamically sharp. The resulting flow is then typically like that in diagram 4 (ii). Carrying the abstraction one step further, we arrive at a conical flow with large rolled-up vortex cores growing above the foil. On a complete foil as shown in diagram 4 (ii), the flow may be essentially conical over the front part. This flow system fulfils the requirements we set out, and may be regarded as archetypal of a second basic type of flow suitable for the generation of lift forces.

A few points in Conclusion

1. It should be remembered when designing for a vortex flow system, be it a keel or a sail; the lines of flow separation must be fixed along salient and dynamically sharp edges.

2. At the design stage the pitch and roll characteristics of the boat should be estimated so that care can be taken to ensure the semi-span to length ratio is not set so low that in heavy weather the angle of incidence and the yaw rate, due respectively to roll and pitch of the bow are not so high that the over-edge vortex is made to burst or "roll off" as the leading edge becomes a trailing edge; causing the breakdown of the flow system. In such event a vortex flow system keel's performance could be expected to degrade to no better than that of a fin keel of equivalent length under similar conditions.

3. Some experimental work relating to angles of incidence and to the effects of the vortex pattern from a keel on the rudder characteristics might be advantageously undertaken using small models.

Bibliography

The conception of these radically different flow systems is in great part due to the work of Dr Dietrich Kuchemanns F.R.S. whose book (ref 1) is highly recommended reading even for the non mathematically minded.

1. The Aerodynamic Design of Aircraft 1978.
   Dr Dietrich Kuchemanns F.R.S. - Pergamon Press.

2. Aerodynamics.
   John E. Allen - Allen & Unwin 1979

3. The Science of Flight
   Sir O.G. Sutton F.R.S. - Penguin 1955

4. Fundamentals of Hydro & Aeromechanics
   L.Prandtl & O.G.Tietjens - McGraw Hill 1934/1947

5. Engineering Applications of Fluid Mechanics
   J.C.Hunsaker & B.G. Rightmire - McGraw Hill 1947.

6. Yachting Monthly - January 1981 P160 - 165
   "The Deep, the Shoal and the Upright" by Andrew Bray.

7. Yachting Monthly - September 1982 P1726/7 & October 1982
   P 2092/3 by Chuck Paine.

8. Rudder Design. A.Y.R.S. publication 79 by K.J. Olsen.

The Practicalities of Leeboards on a Y.M. Waterwitch

By Peter Tiney, 14 Matson Close,
Rothwell, Northants, NN14 2AY.

Background.

"SHELD" is a Yachting Monthly Waterwitch, Mk.1. The Mark 1 is the leeboard version and we chose to build this type because our cruising area is the Wash and N.W. Norfolk. With a draft of only two feet she is capable of extending the time of entry and exit into ports of the area from two hours either side of H.W. to three hours. The other advantage is that with a length of 30ft and despite a draught of two feet, the accomodation inside the craft is immense, because the usual shoal draft centreboard case is missing.

"Sheld" is ketch rigged; this has obvious disadvantages but as an ex-dinghy sailor, I wanted to keep the C. of E. as low as possible and we do not think we have suffered as a result. In fact going to windward we set the mizzen and make it pull by sheeting the mizzen sheet to windward on an adjustable traveller. The slight imbalance created by this can be trimmed out by moving the leeboard.

Leeboards.

The design called for two heavy galvanised flat steel plates through bolted to the hull. Having read about "Barneys Barge" in 'Swatchways & Little Ships' and her ability to break pivot bolts I wasn't terribly keen on that type of board and began to investigate the Dutch wooden leeboards. These ancient pieces of technology are extremely modern in many of their concepts.

All Dutch leeboards or swaards (swords) are aerofoil in shape with the convex area close to the hull. This does three things. 1) It pins the board into the boat and stops it from chattering about. 2) It helps to pull the boat up to windward or to cancel leeway. 3) Its shape allows a much thinner board.

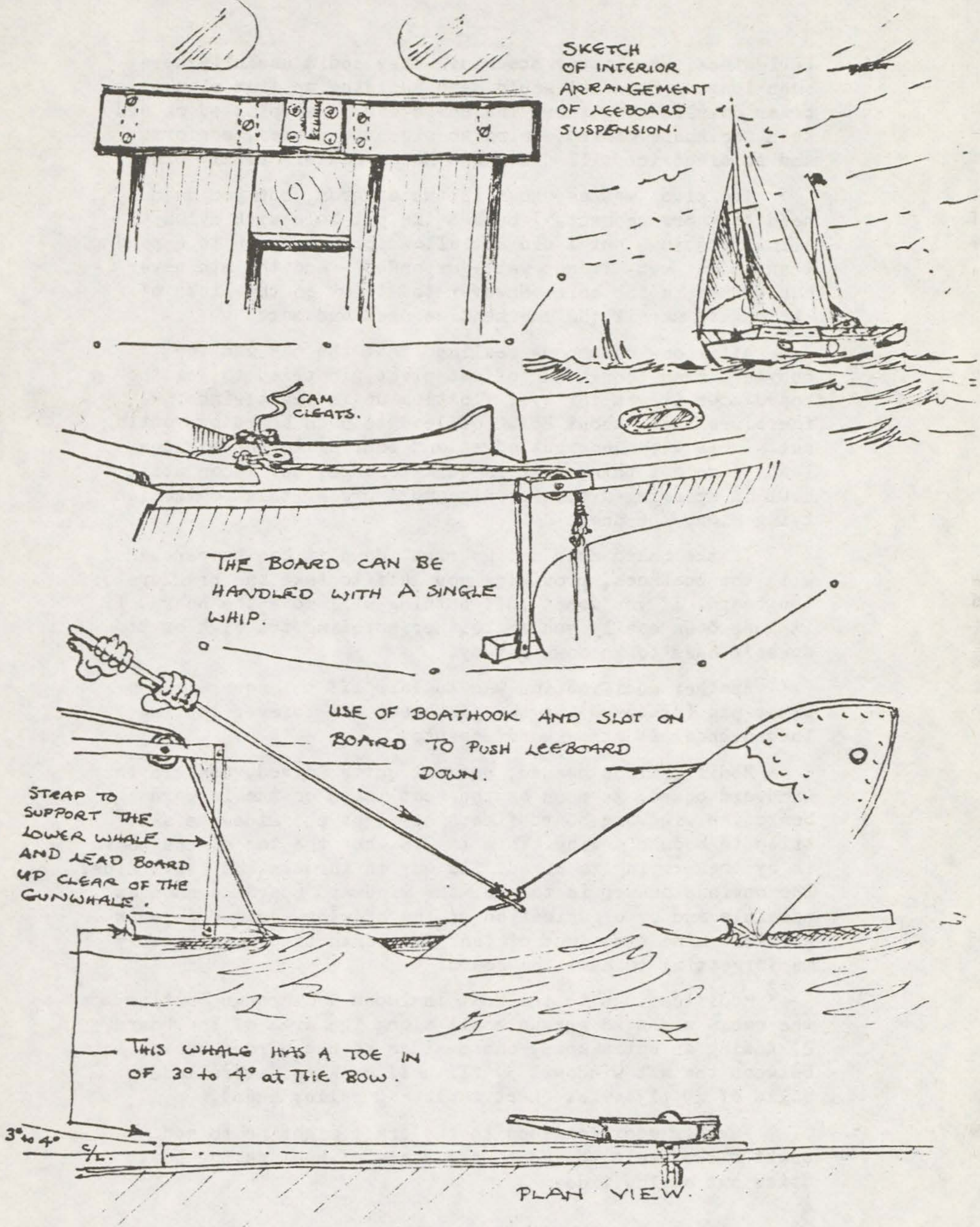
Dutch pivot points also allow universal movement so there is much less strain on the windward board if it is left down.

There is also a whale or strake along the outside of the craft to take and distribute the thrust of the board over several frames. This strake is parallel to the centre-line of the craft, but its outboard side is planed to slope it in towards the bow by $4^{\circ} - 5^{\circ}$. This has the added effect of giving the board in a vertical position a toe-in to windward, again helping to reduce leeway.

Sheld's Leeboards

These are from 7'6" x 2' x 2" timber, this being the largest slab of oak that'Spencers Timberyard',

SHELD. (Leeboard details)



A. TOE IN OF MORE THAN 3°-4° IS COUNTER PRODUCTIVE.

(Brigstock, Northants) stocked. They could usefully have been longer, but that would mean building up from planks brass dowelled together. The shape was first plotted on and then the shape carved, using an electric planer, surforms and an electric drill driving a Mason Master Grizzly Disc.

The pivot was as shown in the diagram, but you do not need that arrangement. I bushed the pit hole with nylon to allow rotation, but I did not allow for the nylon to expand when it got wet. It got wet - expanded - and the pin never has turned in the hole. However the twist in the links of chain give us all the movement we need and more.

After one season we realised that the oak was too buoyant. Even though the offset pivot pin tried to get the board down it was for ever floating up in light winds. We therefore added about 25lbs of lead to each board by routing out a hole with undercut edges and pouring in the moulten lead. I do not think that is quite enough, but I can still haul it up using a single whip and I prefer this to tackles lying along the deck.

If the board does not go right down it can be persuaded with the boathook, providing you luff to take the pressure off the board. If you don't luff nothing will move the board. If it goes down easily you are either pointing too high or it doesn't need to go down anyway.

Another modification was to fair off the square end of pivot pin (outboard) as the jib sheet was forever getting lodged under it at awkward moments.

Modifications needed, but not quite solved, concern the windward board. As soon as the boat leans on the leeward board the windward board floats straight out sideways and tries to become a wing. This is O.K. but the top of the board is by then trying to abrade its way in through the cabin side. The obvious answer is to haul the windward board as soon as possible and by organisation of the crewing system, this is possible nine times out of ten. The tenth time it's usually me forgetting to haul the board.

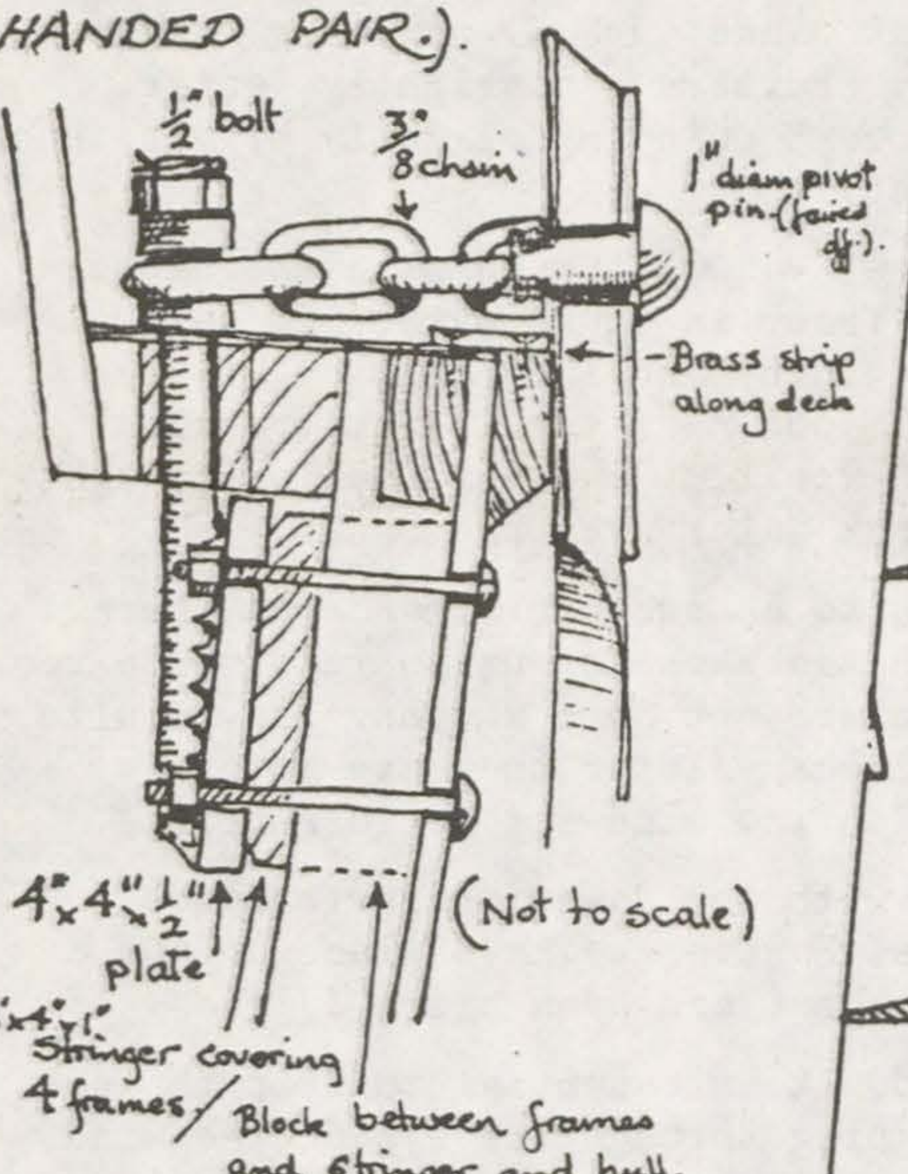
Modifications to the boat included 1) Through bolting the cabin sides to gunwhale all along the area of the board, 2) Adding an extra knee, cabin sides to coach roof beams between the aft windows. 3) All half bulkheads were made solid of $\frac{3}{4}$" ply (i.e. chart table and galley ends).

Further modifications to the craft might be to add short bilge keels to reduce the angle of heel as the boat dries out at low tide.

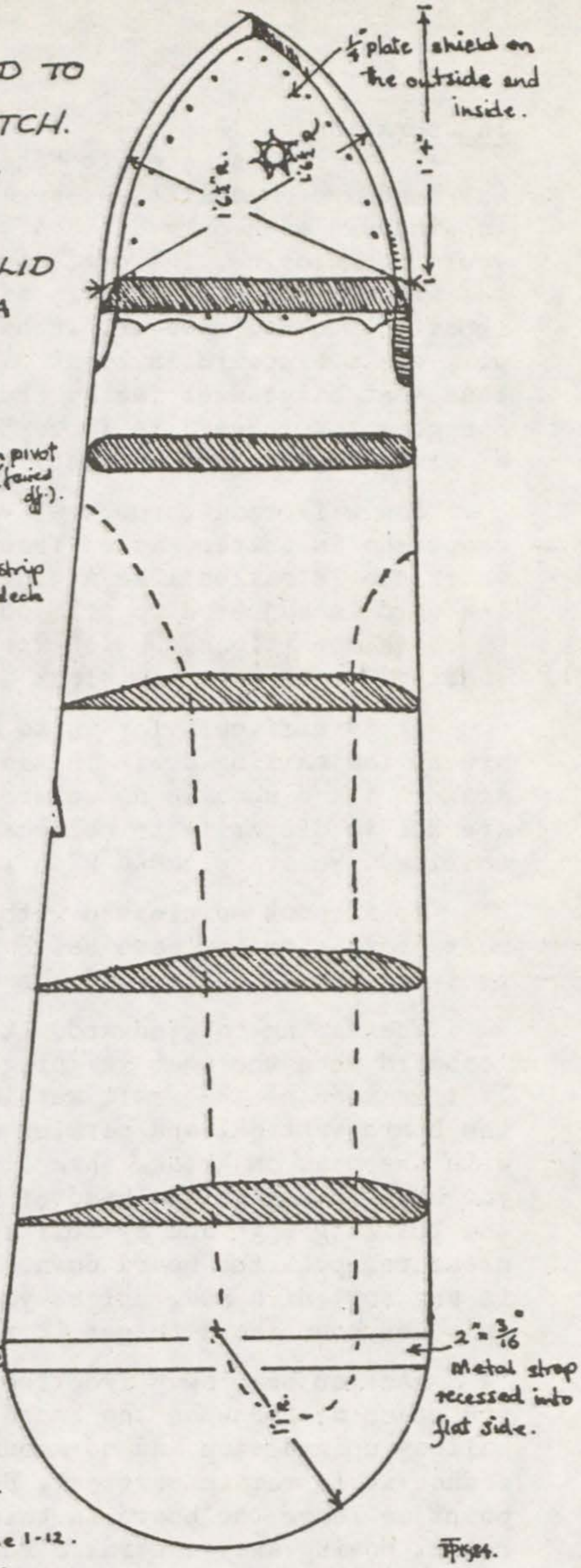
LEEBOARDS AS FITTED TO 'SHELD' A 'YM' WATERWITCH.

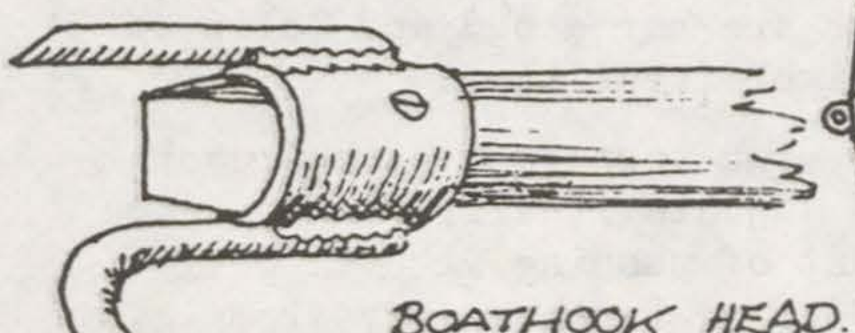
L.O.A. 30'. L.W.L 26'. D[ft] 2'

BOARDS CARVED FROM SOLID OAK BOARDS 7'6" x 2" (AS A HANDED PAIR.).



METHOD OF SUSPENSION OF BOARD.

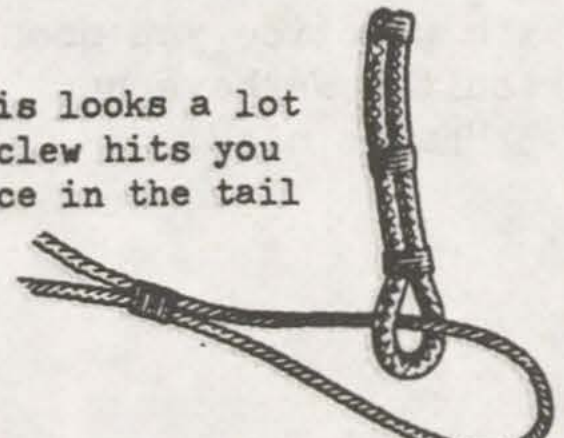




BOATHOOK HEAD.

Scale 1-12. Scale for Board only.

CULLED FROM A RUSSIAN MAGAZINE :- This looks a lot softer than a snap shackle when the clew hits you in the face. I might try a back splice in the tail to make it more secure.



In Operation

When we built "Sheld" we did not build her for her windward capabilities. We assumed that it would'nt turn to windward with only 2ft draft and that any windward work would be motoring. The craft's ability to cross the bar into the Wisbech Channel $1\frac{1}{2}$ hours after low water was much more important to us. However, we have been surprised. "Sheld" will go to windward in light winds (1 - 3) pointing higher than most bilge keel family cruisers and slightly faster. She goes to windward in force 5 pointing slightly higher than a Colvic 28 and just as fast.

She will tack through 95°- 100°, though with the barge shape she is better sailed freer in rough water. In calm water she is sailed like a dinghy and the position of the leeboard is adjusted to trim out nearly all weather helm. In these conditions she is excellent and her shallow draught enables her to seek the slack water over the banks.

It is difficult for us to assess performance as there are so few sailing craft in the Wash for us to rate ourselves against (and when we do we are not sure whether the results are due to disparity in helmsmanship or they are motor sailing). We are pleased with the windward performance.

We are not so pleased with the downwind performance, most craft seem to leave us. However we have plans to add a cruising chute to the wardrobe (and even kites !)

When going to windward, it is essential to drop the new leeboard when the boat is going through the eye of the wind. If this is done the craft settles on to the new tack with the board vertical and working well. If you drop the board with the boat on a tack then it will not go right down and you have to engage the head of the boathook in the slot on the trailing edge and by luffing the boat to take off the pressure, push the board down. This is not a safe procedure in any sort of a sea, unless you are harnessed and 'clipped on'. You soon learn to get it right first time.

As you bear away from the wind towards a close reach you reach a time when the board adjusts itself. It will come halfway up and stop and no amount of pushing it back will induce it to remain vertical. Bearing further away from this point we leave the board in this position until beyond a reach. Moving away towards a run the board will eventually birdswing out to the side and it is then hauled.

With practice you soon learn how to trim the board for best results. We have had "Sheld" going to windward in a force 3 "hands off".

To Summarize:-

ADVANTAGES:
1) Real shallow draught with, we think, very little reduction of performance.
2) Good uncluttered accomodation in the cabin.

DISADVANTAGES:
1) You need a crew to help when going to windward unless you are on a diet of Knorr soup.
2) If you anchor out in a short sea the waves get behind the boards and bang them against the hull (making sleep impossible).
3) The boards tend to catch on dock walls etc. as the tide rises and falls.

This article was written for the Eventide Owners Association newsletter. Anyone wishing to receive details of the class can write to Mrs C.McNaughton, Hon Editor at 8 Wootton Drive, Grovehill, Hemel Hempstead, Herts, HP2 6JZ, England.

"MOA" with a "MORSAIL" From John Morwood March 1981.

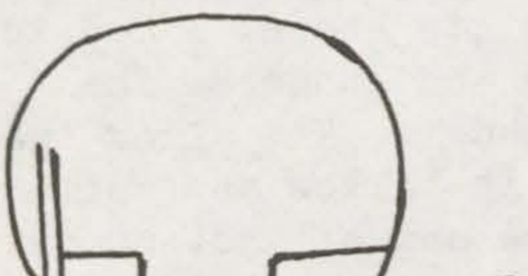
A "MOA" is a monohull proa and a "Morsail" is a balanced lug with bent yards or battens.

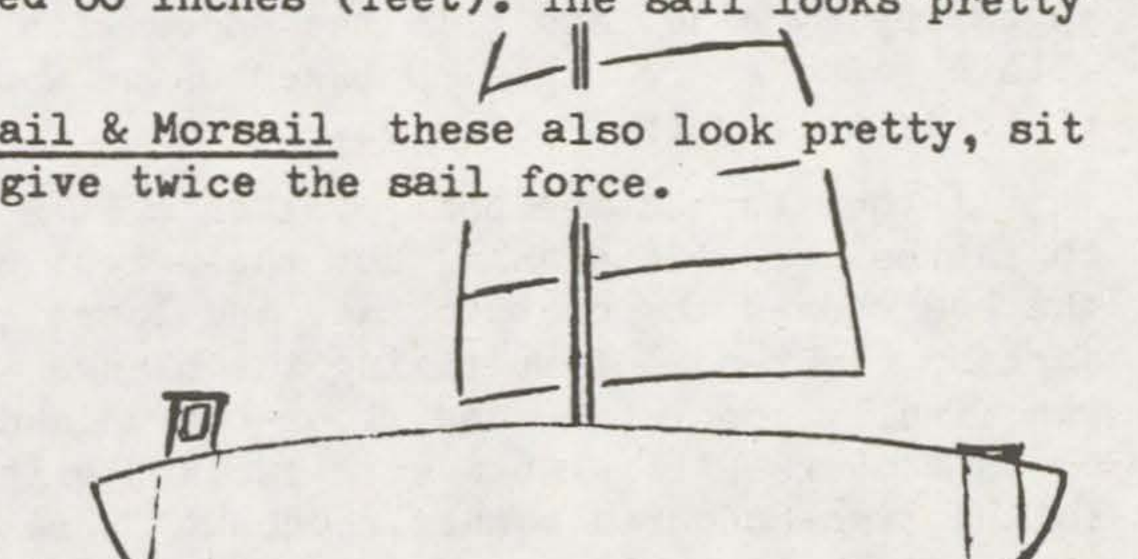
John was looking, as many members do, for an inexpensive, light weight, shallow draft, beachable fast yacht. It had to be safe and seaworthy, almost the same thing !

The Hull Derek Kelsall quoted £ 1,500 for a "Sidewinder" hull in 1979 (when it was being built). If the LOA was reduced from 51.5 feet to 45 feet, it might now be £ 4,000. A lifting ballasted keel should not increase the cost significantly and with two water tanks, the hull would be complete. The result would be a beachable boat of low weight. Probably lighter than a multihull.

Junk Rig. My model used 30 inches of sheet from close hauled to sail athwartships. To allow the sail to go right forward would need 60 inches (feet). The sail looks pretty and sits well.

The Squaresail & Morsail these also look pretty, sit well and should give twice the sail force.





Restoration of a Chinese Sampan

February 1984.

By Dennis Banham,
Greetwell, Bodinnick-by-Fowey, Cornwall.

Having seen a Sampan around Fowey Harbour a few years ago, I was interested to hear from a friend, that he had found one half buried in the mud of Mixtow Creek. This area is the graveyard of many old boats, which are left there to rot.

The next day I had a look at the craft, which was in a dreadful state. However, after washing off the mud, it was found that the keel, transom, and bow were in reasonable condition, with enough left to warrant it's restoration.

Enquiries via the harbour master lead eventually to the owner and on to the final location of sails and battens. The iron centreboard and the lovely curved rudder were found only one day before their removal with a load of rubbish.

With the hull upside down in my garage I found that it would be necessary to replace approximately 50% of the ribs, one complete side of planking, plus about 40% of the other side. Much of the damage to the original planking had been caused by iron nails used to fix the planks to the ribs, as well as joining each plank together edge to edge, using nails every 6 to 8 inches. The wood simply crumbled into powder next to each nail. With the high cost of mahogony planks I began to wonder if it really was worth while.

Fortunately, my step-son asked if I would like some mahogony planks (enough for the Sampan) for a Christmas present.

From then on it was a case of hard work, but very interesting. My previous boat building experience has been with 4 and 6mm marine plywood, never with 5/8" planks. Slow progress, but I was helped by a neighbour (a retired carpenter and builder) who, when I was struggling to bend a plank, would appear by my side, and trim the edges with a few deft strokes with a razor sharp plane. Between us we would be able to clamp it into the required position.

I then turned the boat over onto it's keel, and attempted to fasten the side planks, but the weight of the transom and the bow caused the boat to sag, and loose its shape. I had to jack up each end before fixing the planks and gunnels. This was finally completed, and floor-boards made to fit along the cross members. All planks were caulked with tallow and cotton in the time-honoured manner,(coconut fibre and oil not being readily available !)

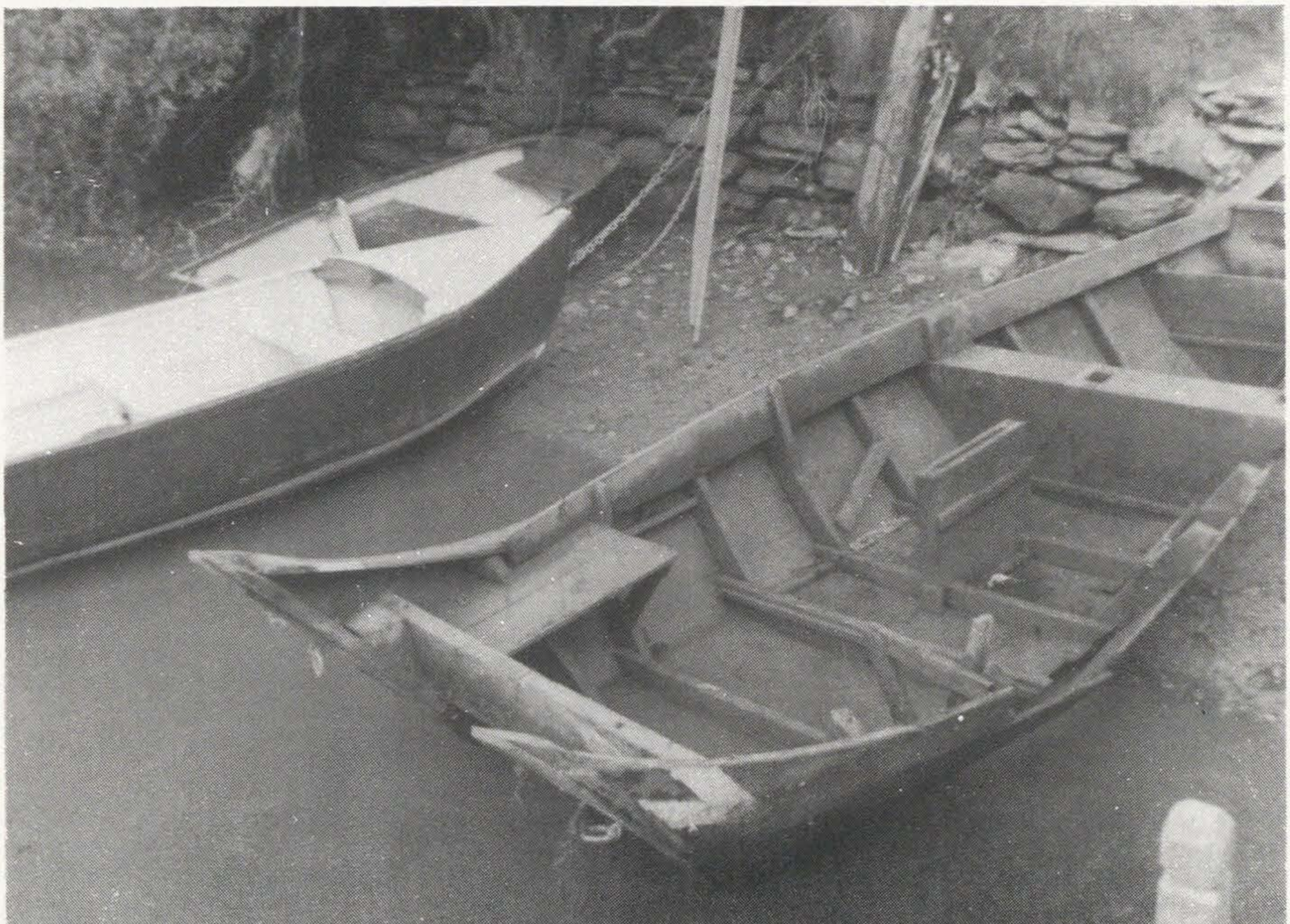
A new mast was made from a small tree. It fits into a keel block and is supported (unstayed) by the cross member just forward of the centreboard case.

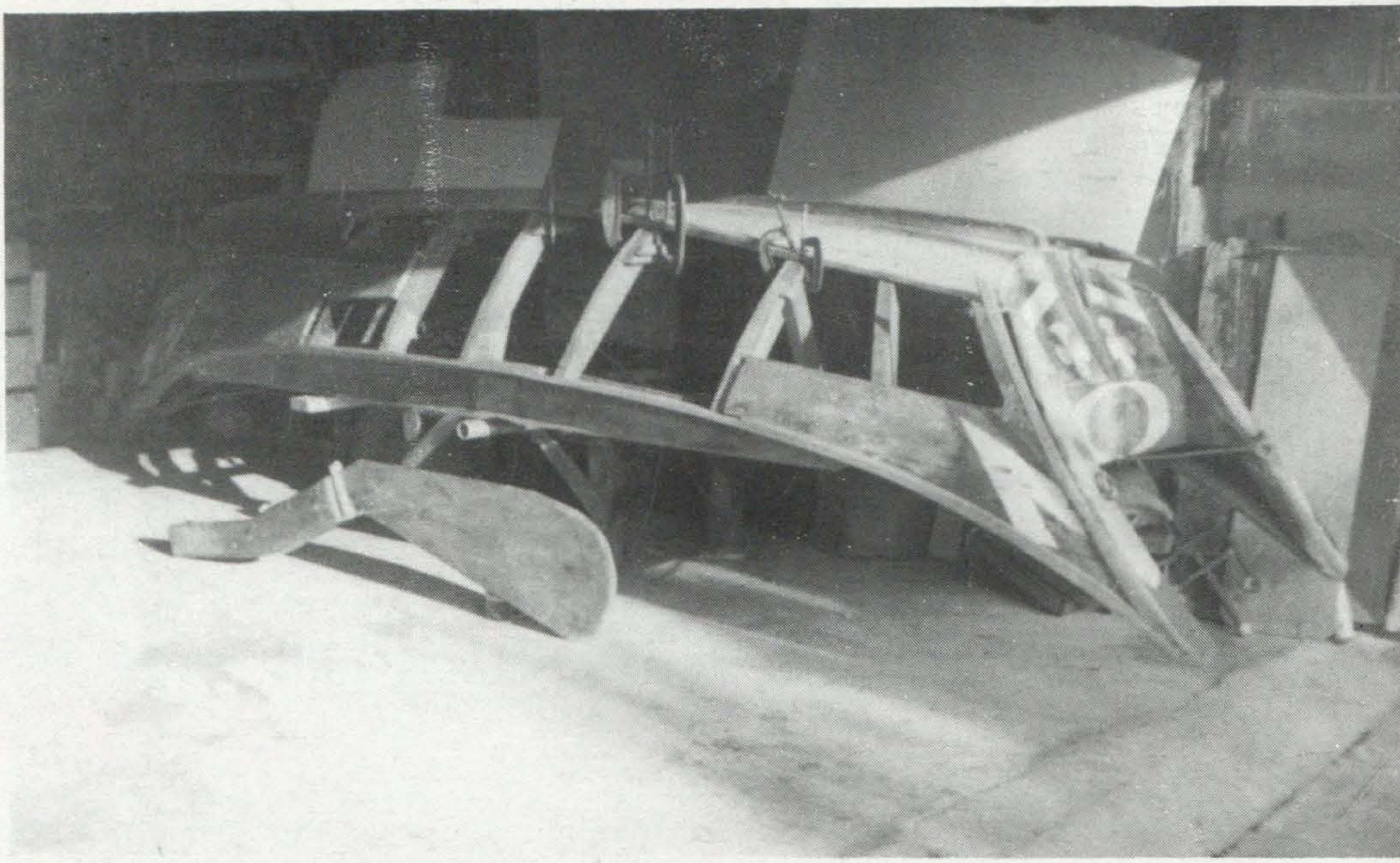
The junk rig took a while to sort out, but I was able to overcome this problem with the aid of Chinese craft, in various yachting magazines. Using the original sail as a pattern, a sail maker in Truro made me an excellent copy for a very modest sum.

The Sampan was finished, and painted in her original colours, ready for launching at the beginning of June. My wife suggested "New Life" as a name. This was translated for me as "FU HSING" by a friend.

This Sampan was built by Tan Chye Seng at 60b Weld Quay, Penang, Malaya as shown on the side planking which I was able to retain and restore. She was brought to this country about 30 years ago, and was sailed by the owner in Fowey Harbour. It was loaned to someone else, deteriorated, and was towed to Mixtow Creek, where I found it.

Finally, I had tremendous fun sailing "FU HSING" last summer. She caused a great deal of interest amongst the yachting types, and must be the most photographed boat in the harbour.





SAMPAN RESTORATION BY DENNIS BANHAM.