ROUND BRITAIN 1966

A.Y.R.S. PUBLICATION No. 57

TORIA, Winner Round Britain Race 1966

CONTENTS

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THE AMATEUR YACHT RESEARCH SOCIETY

(Founded June, 1955)

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EDITORIAL

October, 1966.

The Annual Subscription to the A.Y.R.S. is now due. It remains at £1 or $5.00 as before and should be sent to Woodacres, Hythe, Kent, England. We are thus taking over the distribution of publications for the South African Group completely, as well as the American and Canadian groups. Australian, French and New Zealand members may either subscribe to their " National Organiser " or to Woodacres, as they wish. If subscriptions are not paid by January 1st, 1967, No. 59 will not be sent. Again Bankers Orders are enclosed for the convenience of members so that subscriptions will be paid each year without effort.

If anyone has had a misbound or faulty copy of a publication or has not had his full five for this year, will he please let me know.

The British A.G.M. will take place on the first Saturday of the London Boat Show at 11.00 hours in a room at Earls Court. Members can join us at the A.Y.R.S. Stand at 10.45 hours.

The Weir Wood Meeting. As stated in the July publication, there will be a sailing meeting of the A.Y.R.S. at Weir Wood Reservoir, near Forest Row, Sussex on October 8th and 9th. Sailing will begin at 10 a.m. on both days. These meetings are tremendous fun with members bringing their experimental and conventional boats. It will help the organiser Dennis Banham, Highlands, Blackstone, Redhill, Surrey, to know what boats are coming. Please note, however, that no one may sleep aboard their boat or in the Reservoir area.

The London Boat Show. We have again taken a stand at next year's Boat Show. Will members with models or anything else which they think could be shown, please contact the Hon. Editor. The models of our model yacht competition will be on display with this year's winner but we may also show a full sized yacht. As usual, we need stand helpers. Anyone who would like to help in this interesting task by giving us a day or two, please write to the Hon. Editor.

A.Y.R.S. Ties and Windsocks. A.Y.R.S. ties with a single device cost £1 1s. 0d. or $3.00 each. Dinghy-sized windsocks are 5½ inches long and cost 14/- or $2.00. The Cruiser-size windsock is 16 inches long and costs 28/- or $4.00. The windsocks are lettered with A.Y.R.S. on each side.

A.Y.R.S. Winter Meetings. These have not been arranged so far. Members will be notified when this has been done.

Advertisements. A full page advertisement in our publications costs £5 for an inside page and £10 for a back page, which is only given to regular advertisers. These low prices only just cover the cost and matter for them is only accepted at the discretion of the Hon. Editor and must be in our hands at least two months before publication is due.

Multihull Insurance. We understand that several of our members have had trouble in getting reasonable rates for the insurance of their multihull craft. After exchanging letters with a Lloyd's broker, the following facts have emerged :

1. All Marine Insurance is on an individual basis and depends on the type of yacht insured and the past experience with the insurer.

2. Trimarans have a good reputation at Lloyds and the rates through Lloyd's Insurance brokers can be very reasonable but, as brokers are not allowed to advertise, I cannot publish any names. However, I can give names to members in private letters.

ROUND BRITAIN 1966.

Members will have realised that our publications have been getting larger. No. 55 *Trimarans* 1965, for example was 116 pages which was produced at a financial loss to us. This cannot continue, of course so this October, we are having two publications sinultaneously which allows us to break even financially. The trouble is, we get such an amount of interesting articles from our members that I cannot resist having it all. Even so, I still have unpublished good articles which I hope to have *sometime.* Members' views on this problem will be welcome.

The Round Britain Race of 1966 was a new departure in yacht racing and all the multihulled yachts did extremely well. Possibly as a result of this, the reporting of the race in the daily press was poor, I thought, and the reports in the yachting press may not be as full as our members would wish. We have therefore done our best to get as full a picture of the race as we can.

The rest of the publication deals with ocean cruising matters and semi-technical articles.

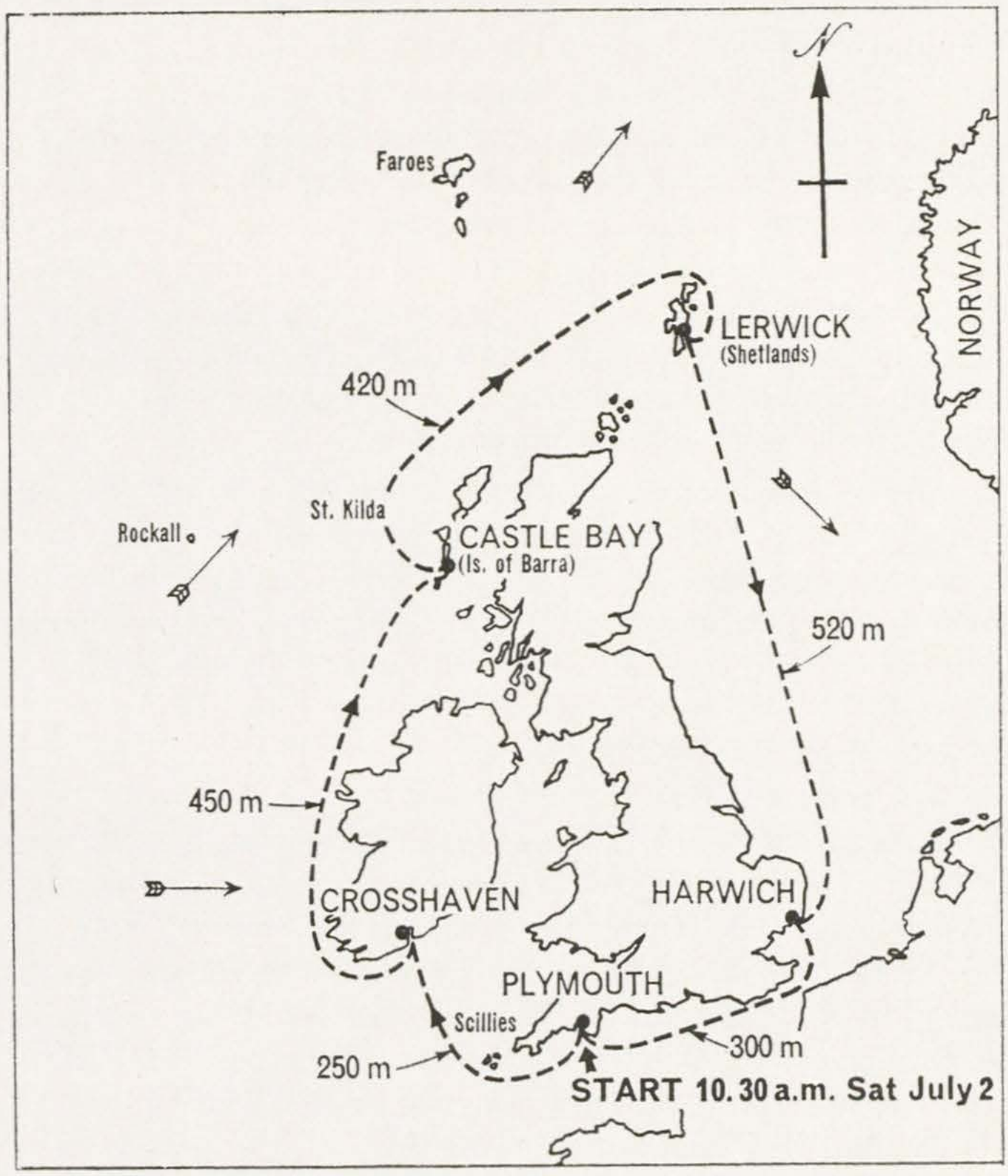
THE ROUND BRITAIN RACE 1966

ORGANISED BY

THE ROYAL WESTERN YACHT CLUB OF ENGLAND

On Saturday, 2nd July 1966, seventeen yachts started from Plymouth Sound in a race around Britain which may well become as famous in future as the Bermuda, Sydney-Hobart or Fastnet races, the single-handed Trans-Atlantic Race remaining in a class by itself.

The Round Britain Race was devised by Lt.-Col. "Blondie" Hasler, D.S.O. (who also devised the Single-handed Trans-Atlantic Race) as a race for seaworthy yachts of over 24 feet overall length of any rig, hull design, or nationality and crewed by a skipper and one other person. The object of this race is similar to that of the A.Y.R.S.



Cruising Yacht Design Competition namely, to develop seaworthy and fast short-handed cruising yachts so it fits in with the A.Y.R.S. policy most precisely.

The first yacht to cross the finishing line, having fulfilled the conditions of the race will receive the First Prize of £1,000 and the " Round-Britain " Trophy. The " Genesta " Trophy will be awarded to the handicap winner and each yacht completing the course within 6 weeks will receive a Plaque. A Token Award will be made to each crew.

The yachts started at Plymouth and made for Crosshaven, near Cork, in Ireland—a distance of 250 miles. Each yacht had to spend at least 48 hours at each stop to rest the crew so, after putting in the required waiting time, the yachts set off separately for Castle Bay, Isle of Barra off the West Coast of Scotland—a distance of 450 miles in the open Atlantic. From Castle Bay, after the required two day stop over, the yachts again set off, this time to Lerwick in the Shetland Isles—420 miles. From thence to Harwich, Essex (in East England) —520 miles and finally back to Plymouth—300 miles. Total mileage 1940 of open ocean and North Sea and English Channel. This does not take account of the distance actually sailed by the yachts.

The Round Britain Race was therefore a great test of both yachts and crews' capacity to withstand continued driving. The arch enemy was fatigue of materials and humans. This was in marked contrast to the present " classics " of the ocean racing fleets of the world where races only last 4 or 5 days and often less. Also, the limitation of the crew to two makes problems of temperament and the ease of handling of the yacht of vital importance.

The Single Hulled Boats. " Blondie " Hasler's *SUMNER* was the only single hulled boat especially designed and built for the race. This has box sections with a flat floor and vertical sides, extending into overhangs fore and aft. Twin ballasted bilge keels keep her upright but I would think she pounded rather a lot in a seaway. The other single hulled boats were more or less conventional. Though none were from the top flight ocean racing fleet, *SEVERN* which did so well is an 8 meter.

The Catamarans. The best known of these was Don Robertson's Prout-built *SNOW GOOSE*, which has 4 times beaten the British and American ocean racing fleet around the Isle of Wight in the last 6 years. *IROQUOIS* and *MANITO* are sister catamarans designed by Rod MacAlpine-Downie. *MANITO* is the boat sold to the public. *IROQUOIS* is more of a racing type. *MIRRORCAT* is, however, an out and out racer designed by Rod MacAlpine-Downie. She is composed of what appear to be two C Class hulls with cabins,

NO.	BOAT	TYPE	LENGTH	SKIPPER	CREW
1	**DINAH**	Bermuda Sloop	33 ft	A. Smith	W. H. Berry
2	**WHIPLASH**	Bermuda Sloop	31 ft	K. Pearce	J. Fenwick
3	**IROQUOIS**	Catamaran	30 ft	R. M. Ellison	C. P. Ellison
4	**MANITO**	Catamaran	30 ft	R. B. J. Gibbon	W. H. F. Gibbon
5	**SUMNER**	Bermuda Sloop	45½ ft	Lt-Col. H. G. Hasler	Mrs B. Hasler
6	**MATAMONA**	Trimaran	41 ft	Lt-Cdr L. G. Turner	G. Langwell Plum
7	**VICTRESS**	Trimaran	40 ft	Lt-Cdr N. C. W. Tetley	J. Field
8	**STARTLED FAUN**	Trimaran	33 ft	J. L. E. Willis	Tony Smith
9	**DELIGHT**	Yawl	39½ ft	W. Britton	Mrs Britton
10	**SEVERN**	Bermuda Sloop	47½ ft	A. Wheeler	Major A. M. Buchan
11	**TAO**	Trimaran Cutter	30 ft	H. R. A. Edwards	Wing-Cdr R. J. Burrough
12	**MABEL AMELIA**	Bermuda Sloop	41½ ft	B. C. McManus	J. A. Macadam
13	**TIKI ROA**	Double Outrigger	38 ft	J. Wharram	Helga Hempel
14	**TORIA**	Trimaran Sloop	42 ft	D. H. Kelsall	Capt. M. Minter-Kemp
15	**BLUE SALUKI**	Masthead Sloop	36½ ft	Sub-Lt J. L. R. Williams	D. D. Matthews
16	**MIRRORCAT**	Catamaran Sloop	40 ft	S. Fearon Wilson	R. Macalpine-Downie
17	**SNOW GOOSE**	Catamaran Sloop	36½ ft	D. R. Robertson	D. Cooksey

enlarged to 40 feet in length and connected, like the C's by light alloy poles and a trampoline deck. She should have been extremely light and extremely fast.

The Trimarans. *TORIA* (Derek Kelsall), *STARTLED FAUN* (Cox Marine—Skipper Eric Willis) and *TIKI-ROA* (James Wharran) were built especially for this race. *MATAMONA* (John Westell) was described in A.Y.R.S. 55. It will be remembered that she has floats which can be retracted to the sides of the hull when in harbour. The *VICTRESS* was the first built by Cox Marine to this Piver design. Her owner lives aboard all the year round. *TAO* (Musters Marine—skipper "Jumbo" Edwards. Owner and crew: Jock Burrough) is a production model trimaran.

Derek Kelsoll's TORIA

TORIA. The design and construction of *TORIA* are perfect for speed. She is made from expanded P.V.C. foam coated on both sides with a thin sheet of fibreglass and thus is extremely light. The central hull has a semi-circle master section and spreads fore and aft according to the principles which we have so carefully worked out. The floats are similar to the main hull and only slightly shorter. In harbour, one float is some 2 feet off the water giving a slight list which is not noticeable inside the boat. The two cross beams are not streamlined and there is no decking outside of the central hull, netting being used for security. We hope to describe the boat more fully next April, but, at 3 tons in weight and of perfect hull design, we at last have a trimaran to hold up as the best to date. We hope that

she will be a regular entrant in the Round the Isle of Wight races to convince the world of her value.

STARTLED FAUN'S design is the Piver *STILLETTO* (A.Y.R.S. No. 55). She was superbly rigged and sailed by Eric Willis.

TIKI ROA, designed and built by James Wharram for a cost of £600, (so it is said) is a delightful little boat of 38 feet in length which delights my heart for its ease of construction, though the accommodation is a little Spartan. He calls it a " Polynesian Double Outrigger " because he uses the Polynesian tied-on (but with one bolt) cross beams. To my calculations, he had a sail area to wetted surface of 5 : 1, which was the best ratio of all the yachts entered but his sails were in the spritsail ketch rig which would not have been quite so useful dead to windward. It was a great pity that he retired with a broken centreboard so early.

MATAMONA and *VICTRESS* were out and out cruisers, of great weight for multihulls but both plowed their way steadily around the course. *MATAMONA* eventually damaged a float hinge and had to retire but did well all the same.

TAO is also an out and our cruiser but is light enough to achieve good average speeds. During the race she averaged 10 knots for 4 hours on one occasion. She was beautifully built of fibreglass by Musters Marine with comfortable and orthodox saloon accommodation. We have reports on her sailing later in this issue.

The Winds. There was an anti-cyclone in the region of the British Isles for the early part of the race. Winds from Plymouth to Crosshaven were light and ahead. From there on, the leading boats had winds from astern all the way back to Plymouth but the later boats had south and south-west winds from Harwich back to Plymouth. We have accounts of the race as seen by three yachts following this introduction.

The Yachts Which Retired. Seven single hulled yachts started. Three retired, *DELIGHT* from illness, *WHIPLASH* and *SUMNER* from breakages. Four catamarans started. *MANITO* retired, no sure cause being known. Six trimarans started and two retired, *TIKI ROA* because of a broken centreboard, *MATAMONA* from a damaged float hinge. These numbers are not great enough to prove anything at all but at least they mean that these multihulls are fully as seaworthy as these single hulled boats.

Conclusion. The Round Britain Race of 1966 was a really great and truly ocean race which tested yachts and crews to their fullest. Those yachts which completed the course must have been truly sound with real seamen as crews. The race was sponsored by the *Daily Express* and *Observer*.

FINISHING LINE—PLYMOUTH.

Position—Yacht.	Time after firstarrival	Rig.	L.O.A.
1 *Toria*	arr. 0354 22.7.66	Tri. Slp.	42 ft. 0 in.
2 *Snow Goose*	15 52	Cat. Slp.	36 ft. 6 in.
3 *Iroquois*	31 26	Cat. Slp.	30 ft. 0 in.
4 *Startled Faun*	66 22	Tri. Slp.	33 ft. 0 in.
5 *Mirrorcat*	88 53	Cat. Slp.	40 ft. 0 in.
6 *Victress*	100 32	Tri. Ketch	40 ft. 0 in.
7 *Severn*	106 52	Mono. Slp.	47 ft. 6 in.
8 *Blue Saluki*	174 40	Mono. Slp.	36 ft. 7 in.
9 *Dinah*	216 12	Mono. Slp.	33 ft. 0 in.
10 *Mabel Amelia*	247 41	Mono. Slp.	41 ft. 5 in.
11 *Tao*	258 48	Tri. Cutter	30 ft. 0 in.

RETIREMENTS

1 *Delight*	Illness	Mono. Yawl	39 ft. 0 in.
2 *Tiki-Roa*	Broken centre-plate	Tri. Ketch	38 ft. 0 in.
3 *Whiplash*	Broken mast fitting	Mono. Slp.	31 ft. 5 in.
4 *Manito*	Cause unknown	Cat. Slp.	30 ft. 0 in.
5 *Sumner*	Broken rudder	Mono. Slp.	45 ft. 6 in.
6 *Matamona*	Damaged float hinge	Tri. Slp.	40 ft. 7 in.

HANDICAPS—COMPILED BY THE ROYAL WESTERN Y.C.

Toria	Scratch	*Mabel Amelia*	4 days
Mirrorcat	$\frac{1}{2}$ day	*Iroquois*	$4\frac{1}{4}$ days
Startled Faun	$1\frac{1}{2}$ days	*Victress*	5 days
Snow Goose	2 days	*Blue Saluki*	$5\frac{1}{4}$ days
Severn	3 days	*Dinah*	10 days
Tao	$3\frac{3}{4}$ days.		

FINISHING TIMES AND POSITIONS FOR GENESTA TROPHY BY YANDICAPS

		Corrected time		
		days	hrs.	mins.
1 *Iroquois*	Cat.	16	18	50
2 *Snow Goose*	Cat.	18	9	16
3 *Dinah*	Mono.	18	17	36
4 *Toria*	Tri.	19	17	23
5 *Victress*	Tri.	19	21	56
6 *Startled Faun*	Tri.	20	23	46
7 *Blue Saluki*	Mono.	21	18	4
8 *Severn*	Mono.	22	5	16
9 *Mirrorcat*	Cat.	23	6	27
10 *Mabel Amelia*	Mono.	26	1	5
11 *Tao*	Tri.	26	18	27

Information from : COX MARINE LIMITED, 131, Fore Street, Ipswich, Suffolk.

TORIA'S circumnavigation of Britain took 11 days, 17 hours and 24 minutes, beating the previous record set up by the (subsequently J Class) topsail cutter *GENESTA* by 23 hours, 31 minutes. *TORIA'S* time was arrived at by only taking off the 8 days spent in four ports. But putting into ports is a time consuming process in the approaches and if *GENESTA* had put into the same four ports, her time would have been a lot longer, for instance tacking through such places as Pabbay Sound. *GENESTA* was famous as one of Britain's most formidable challengers for the America's Cup and as the winner of the Jubilee Ocean Race round the British Isles held to celebrate Queen Victoria's golden Jubilee in 1887.

TORIA

TRIMARAN SLOOP

BY

DEREK KELSALL

42 ft. o.a. 22.4 beam Sail area—Main 320 sq. ft.
Draught central keel 1 ft. 10 ins. Jib 210 sq. ft.
rudder 2 ft. 6 ins. Genoa 360 sq. ft.
disp. approx 3 tons.
Designed by Derek H. Kelsall.
Build by Multihull Construction Co. Ltd., Wadebridge, Cornwall.
Winner of Round Britain Race.
Plus Lap Prizes Plymouth - Crosshaven
Crosshaven - Barra
Barra - Lerwick
Lerwick - Harwich
Skipper—Derek H. Kelsall. Crew—Captain Martin Minter-Kemp.

The method of construction chosen for *Toria's* hulls is one that has been used in Holland and in the United States but never before in the United Kingdom for a boat of any size.

One of its many advantages is that it imposes no restrictions on the designer. We can produce any shape required—at a reasonable cost even for " one-off ".

TORIA was completed as an ocean racer for a small crew but she was designed as either a cruiser or ocean racer and we shall be fitting quite spacious accommodation on our future models.

My design departs from general practice in most trimaran design on the following points :—

1. *Round Bilges* on all three hulls—this accounts for the ease with which she drives through the water. At the same time the

hulls are fine enough (particularly forward) to avoid pounding. She gives a very smooth ride, particularly at speed.

2. *Transom floats*—driving hard, close hauled or on a reach, the float transom just goes down to water level leaving only a ripple of a wake.

TORIA

3. The floats are *set high*. At rest one or other float is 2-6 ins. clear of the water. Only one float at a time is serving any useful purpose; therefore, I reason, that it must be wrong to drag both through the water. With plenty of wind, the windward float is 3 or 4 feet up in the air and it is only occasionally that a wave will slap up underneath. I have watched for hours, fascinated, as each wave comes along and passes clear of the keel for the length of the hull. In a sloppy swell and no wind, such as we encountered off Barra Head, we did get tossed from side to side, but so would every other boat.

From below one is never aware that one float is out of the water and there is never any sensation of falling from one to the other.

TORIA heels only slightly more than the more usual trimaran configuration.

4. Floats are very fine forward and set well forward—in fact when heeled the waterline of the float is ahead of the waterline on the main hull. The float stem is almost vertical and there is some tumblehome on the top-sides for the forward 10 feet or so. This gives a very narrow deck which does not pick up a green sea and the float will drive through a wave all the way back to the main beam without any noticeable slowing of the forward motion. We manage to avoid some of the pitching that one gets beating into a head sea, with floats with a lot of flare and overhand forward.

5. There are no decks outside of the main hull on the present model. They would not affect performance as long as any such decking is not carried too far forward. In future models I intend to use decking and accommodation between the main beams only, which will streamline this section and reduce the air drag. This will still leave 17 feet of clear space between the hulls forward.

TORIA was launched three weeks before the race and sailed on three brief occasions only prior to our taking her to Plymouth. There is not much to be said about these first trips except that everything went well and everyone who saw or sailed her passed very favourable comment.

We were then able to breath a sigh of relief on one or two scores. We had rather stuck our necks out on a number of points—particularly regarding the method of construction and radical departures in design. I must at this point mention Mr. Thomson who as the head of our company had shown great confidence in the project in spite of its experimental nature.

A S.W. force 7 gave us a much needed work-out on the way round Lands End. A few omissions and weaknesses such as, daggerboards too weak and carried too deep for the conditions, the overlooked taping of shrouds over spreader ends and lack of sufficient safety lines

round deck working area, all came to light and gave us a very full programme for the few days we were to spend in Millbay docks. We still managed to find time for the better part of ocean racing—the entertainment laid on by the Royal Western Yacht Club of England and the sponsors—*The Observer* and *Daily Express*. Most enjoyable it was too.

THE RACE

I won't bore you with the exact details of how and where we tacked to get from start to finish on each leg.

Plymouth to Barra

The start in Plymouth Sound was accompanied by the usual large spectator fleet, to see us on our way. Our start, in the very light headwinds was a very poor one. We were sailing *TORIA* very badly although I am not sure why. In fact *STARTLED FAUN* was the only one of the eventual leading group to show what she could do at the start. In fact it looked as though she was sailing away from everyone while boats of a potential speed like ourselves, such as *SNOW GOOSE* sagged away to leeward and *IROQUOIS* was even further astern.

BLUE SALUKI, *SEVERN*, *MANITO* and the curious *SUMNER* were others that I noticed getting along very nicely. This was one of several occasions when we chose to sail on our own on opposite tacks to the rest of the fleet. Our self-steering gear had charge of the helm for several hours that afternoon and for those conditions it proved a far better helmsman than either Martin or myself.

One thing that had immediately come obvious was that we had not spent nearly enough time tuning and experimenting to get the best speed. She proved to be very sensitive to even small changes in sheeting and heading. At this point we had our Electra Log in a somewhat inconvenient spot but when it was changed in Crosshaven to a position in front of the helmsman we found ourselves watching the instrument almost constantly—often sailing a course as much as 30 degrees off a direct course to gain a bonus of speed of as much as 4 knots. In average wind conditions *TORIA* sails exactly the same as any other boat, when the wind is astern or closehauled. However, with the apparent wind free and forward of the beam, if the sails are sheeted correctly, she comes alive.

This effect is comparable to sailing a day sailing Catamaran such as the C Class and it is the first time that I have noticed this effect on an ocean going yacht.

Apart from a few hours of rain and poor visibility during the early hours of the day of our arrival in Crosshaven the passage was one of light weather and pleasant sailing conditions. Not that there was any lack of excitement. Competition was obviously keen. The leading multihulls were very well matched and there was sufficient changing of position to keep everyone on their toes. We first sailed into the lead at the Lizard having overhauled *IROQUOISE*, flying an enormous masthead Genoa off her lee bow.

As the Lizard light dropped away in the distance several hours later, we ran into one of those situations where, do what we may, *TORIA* just would not " Go ". The wind was very light and just free—conditions which on later occasions sent us romping away from our rivals, and *IROQUOIS* took the lead from us again. Throughout the hours of darkness four sets of lights were visible in line astern of us. They were—*SNOW GOOSE*, *SEVERN*, *TAO* and *STARTLED FAUN*. In a vain attempt to improve our performance we allowed ourselves to drift to Leeward and we passed several miles to the S. of Bishop Rock. Again we sailed off on our own whilst the rest of the fleet tacked round the Scillies.

From here, one or two yachts sailed a direct line on one tack to Crosshaven whereas our course was a large " Z ". Calms and light headwings existed till the next morning when a very light South wind cleared the rain and fog and carried us very gently over the line. We had seen a number of sails during the afternoon and evening of the previous day but mostly unidentifiable and we did speculate during the early hours of the morning that some of our rivals might already be in harbour, however as the fog cleared the sea ahead proved to be void of sails but the horizon astern was dotted with at least six. It was not until the R.A.F. Shackleton flew overhead and appeared to be giving us special treatment that we dared to think that perhaps we were not such a long way behind after all.

The nearest of those sails astern eventually was identified as *STARTLED FAUN* and she seemed to be slowly creeping closer while the land ahead approached—oh so slowly. We tried out everything we knew—including our very long sweeps to keep that lead.

Crossing the line we were met by a conventional yacht that tacked very close to us and missed our starboard float by a hands span. The crew to quote " were so intrigued with this strange craft that they neglected to attend to their own ship ".

Being one of such a varied collection of yachts, one tends to forget what the normal ocean racing fleet looks like. An R.O.R.C. race from Beaumaris brought 25 such yachts into Crosshaven during our 48 hr. stay and this is how one after dinner speaker saw our fleet by comparison—" This bizarre circus resurrected from 3,000 years ago ".

One day the deep keel with its load of lead will be the oddity—but I wonder how far away that day is ?

Crosshaven-Barra

Getting round the Fastnet rock again brought us the light headwinds which we like least of all and 30 hours after leaving Crosshaven we were back amongst the fleet—*MANITO* this time, sailing remarkably well to windward, stole into the lead, *SNOW GOOSE*, *SEVERN* and ourselves were within a few hundred yards of each other and *IROQUOIS* and *STARTLED FAUN* none too far behind. At this point, the westernmost out islands of Ireland, it was just anyones race.

The wind fell away to calm for sometime while we wallowed in the gentle swell. It was a gentle North Westerly that filled our sails to set us sailing on a Northerly course with the wind just free. A smooth effortless 4-5 knots quickly carried us past *MANITO* and in what seemed like only minutes all those sails faded into the dusk astern. This was the last we were to see of our rivals at sea.

A S.W. 6 and 7 boosted up our average as we crossed the open sea to Barra to cross the line 6 hours ahead of *SNOW GOOSE*.

Barra-Lerwick

Those 6 hours proved to be most valuable. Leaving Barra, St. Kilda an unlighted outpost 66 miles N.W. is the next starboard mark. The last 40 miles of this leg was covered in 4 hours thanks to a force 6 from the S.W. Almost as the steep rocky cliff ominously appeared out of the murk just 1 mile ahead the wind veered to W. and strengthened. We romped round the corner, to head for Seven Hunters to the N.N.E. happily rolling down the main and exchanging the jib for a tiny storm sail. We did spare a though, occasionally, for *SNOW GOOSE* who must be still trying to make Westing as we eventually put 10 rolls in the main but still registered 8 knots in the wave troughs and 14 or more surfing.

A few hours after dawn the wind began to ease off but forecasts of force 7, 8 and even 9 kept us under much reduced canvas. None of this materialized and the rest of the journey was quite uneventful—cold, wet and boring as we approached the Shetlands.

It was calm, warm and very pleasant as we drifted round Muckle Flagga, the most northerly part of our course. The welcome given us at 3 a.m. by the people of Lerwick quickly dispelled the frustration of calms, rain and flukey winds encountered on the first 50 odd miles of our Southward course. We had increased our lead by a further 3 hours.

Lerwick-Harwich.

The longest leg of 520 miles to Harwich proved to be the least eventful of all in spite of the very high average speed we maintained. One or two members of the press who were following the race by more conventional methods had come in for some lighthearted leg pulling in Barra by arriving a day late—this they vowed would not happen again. No one could have anticipated the 10 knot average so it was two or three sheepish gentlemen who dashed out from London to record our arrival, after the event.

The course from Lerwick was 180 degrees and we maintained this heading until the lights of Great Yarmouth came into sight. The wind blew up to force 6-7 during the first day and our first 24 hour run was well over 260 miles. The second day seemed slow by comparison. We met another curious 3 hulled vessel, the enormous oil rig *SEA QUEST* being towed slowly North.

Harwich-Plymouth

Again there is little to be said about the last leg down channel. Our lead out of Harwich was 18 hours and barring accidents *SNOW GOOSE* did not have a chance of overtaking us.

She did in fact cover the distance in 2 hours less than we did to take the last lap prize.

TORIA covered the 2,000 miles in $11\frac{3}{4}$ days at an average of better than 7 knots. This is at least 2 days better than I ever expected. Yes the wind did rather follow us around—but would the result have been difference with more headwinds—not substantially—the fleet would not have been so strung out—but, not for the reason that the multihull will not go well to windward but because the conventional craft is such a slow, clumsy and uncomfortable vehicle in the conditions where the more enlightened sailor is enjoying the thrills of fast sailing in safety and comfort.

To sum up my feelings on the results, the well tried catamaran *SNOW GOOSE* and her fine crew, Don Robertson and David Cooksey are very worthy of their second placing. Mike and Peter Ellison earned their handicap trophy by driving *IROQUOIS*, such a small boat, and a catamaran at that, into third place.

I was very sorry to hear that Col. and Mrs. Hasler had retired from the race due to rudder breakage. *SUMNER*, his very curious but simple design was going very well compared to the other mono hulls. I hope he will not mind my suggesting that he tries *SUMNER* with a couple of outriggers.

MIRRORCAT, to all outward appearances, and in spite of her 12 hour time allowance over ourselves should have been the thoroughbred for the stable. She was dogged by ill-luck from the start but surely this does not account for her falling further behind the leaders on each and every lap of the race.

I attribute our success to *TORIA* and the effortless ease with which she gets over the water. The actual top speed may not be as spectacular as some other multihulls but I was continually being surprised to find out how far we had come in conditions where we were wishing for just a little more wind.

STARTLED FAUN'S RACE CONDITIONS

First Leg. Plymouth-Crosshaven.

Wind direction (on average) W. Force 0-3. Light variable. Course : mainly a close fetch. Yacht speed up to 5½ knots.

Second Leg. Crosshaven-Barra

Wind direction S.W., veering W. Fetch to S.W. tip of Ireland. Then reach to Barra with the wind increasing to force 5 with a large swell. (Perfect conditions for speed if one had the nerve). Yacht speed up to 13 knots.

Third Leg. Barra-Lerwick

Wind direction W, force 5-6 decreasing to 3. Fetch to St. Kilda. There was a gale warning on setting out so all boats were well reefed. The wind later increased to 6, gusting 7-8 which was met from St. Kilda to Lerwick with reaching to fetching winds. The yacht speeds were slow because of the reefs.

Fourth Leg. Lerwick-Harwich

Wind direction N-NW Force 6. Yachts speed 200 miles in 24 hours on a running course. Wind decreased on second day to force 2-3, then increasing to 5, direction N.

Fifth Leg. Harwich-Plymouth.

Wind direction N. Force 5 for 12 hours (covered 100 miles). This gave us a run to Ramsgate. Then light and variable for 24

hours with 6 hours of calm. Then a wind came, increasing to force 4 Westerly, causing a beat from the Isle of Wight to Plymouth.

COMMENTS ON THE ROUND BRITAIN RACE

BY

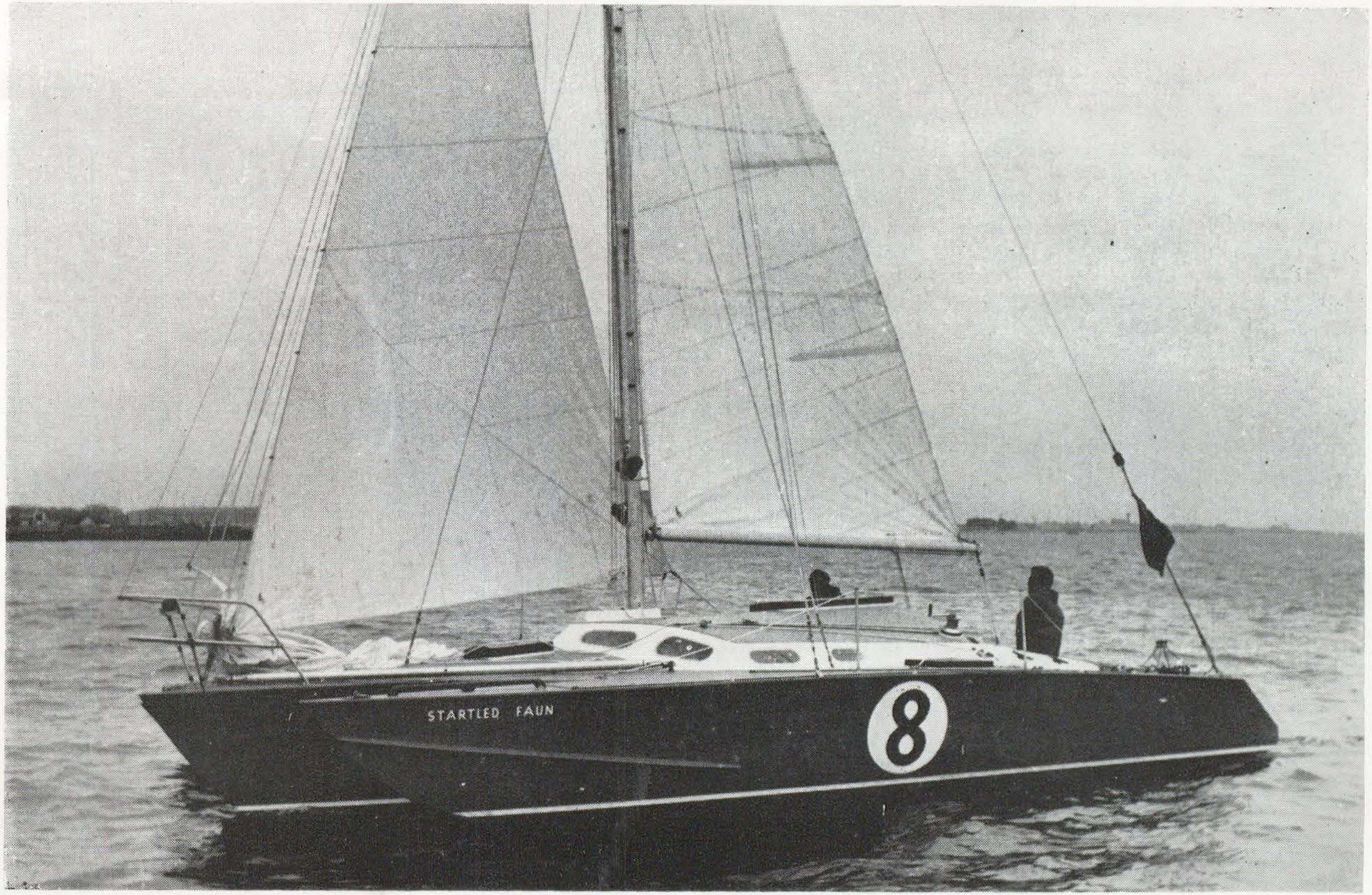
S/Ldr. Clarke (Cox Marine)

John Morwood has asked me to write some notes about how the Cox Marine entry, *STARTLED FAUN*, went round, but unfortunately, as this short article is being written, she has just crossed the finishing line (4th) at Plymouth. It will be several days before I hear the full details from skipper Eric Willis and his 22 year old crew, Tony Smith. In the meantime A.Y.R.S. has to go to press—so I can give only snippets of information, and a few personal impressions.

First and foremost it was a " clean " race. To the best of my knowledge there were no hates, moans, grumbles, sneaking, cheating, back-scratching or other evil of modern sports progress amongst the competitors, the organisers or anybody *immediately connected* with the actual race. As the ripples of interest spread outwards, the " experts " will begin to participate—and the whole event will no doubt become equivalent to World Cup " sportsmanship ". But remember : there was none of this sort of thing amongst the competitors and those immediately interested in the Race.

Next, the first six craft to cross the finishing line at Plymouth were all either 100% racing machines, or were designed specifically for the Round Britain Race. Apart from the unlucky pair *TIKI-ROA* and *SUMNER*, *none of the other yachts came into this class.* This is a very important point, because naturally one would expect to see the boats designed for the race, or for racing, come in before those which are just production cruisers. *SNOW GOOSE*, *STARTLED FAUN*, and *SEVERN* are racers ; *TORIA* and *MIRRORCAT* were presumably designed for the race ; *IROQUOIS* is a production model specially cleaned up and lightened for the race (it is significant that *MANITO* a standard production Iroquois class cat, retired at the second stop). *SUMNER* was built specially for the race by Blondie Haslar, as was Wharram's *TIKI-ROA*—theroetically a trimaran, but described by Jim as a Polynesian double outrigger. I really do wish that he had not had such lousy luck because Jim made the following crack to a yachting journal before the race and I did so want to prove that he was wrong. He said : " Neither *STARTLED FAUN* nor *IROQUOIS* worry me . . . ".

It is, perhaps, also significant that both *SUMNER* and *TIKI-ROA* were built " on the cheap "—the former because Blondie was



COX MARINE'S STARTLED FAUN—Skipper Eric Willis

trying to produce a low priced and fast monohull (impossible, say I) ; the latter because Jim has his theories about ocean-going cats and tris and I for one agree with him—and he knows I do.

The rest of the monohulls are too well known for me to comment : Ken Pearce was unlucky with his mast in *WHIPLASH ; BLUE SALUKI*, *MABEL AMELIA* and the slugging *DINAH* have done their best in a race that just *couldn't* be won by a two-man crew monohull (no matter which way the wind blows !).

This leaves *TAO*, *VICTRESS* and *MATAMONA*—all production models, all excellent trimarans. These are out-and-out cruisers—Cox Marine have had five of their Piver-designed 40 ft. *VICTRESS* trimarans cross oceans, and many others in this class, both amateur and professionally-built, have also made very long voyages with considerable success).

So we are now back to the first six to cross the line—remember that they are all built for racing or for the Round Britain Race.

STARTLED FAUN is a Piver-designed *STILETTO* class trimaran, and in her we incorporated everything we have learnt over five years of building Piver's trimarans. Since we are the biggest builders of trimarans in the world, we felt we had to produce a winner —although I must point out the first rule we made was that she *must be a commercal proposition.* We felt that it was no good producing a " one-off " out-and-out racer ; we are in business to make money, and we are only interested in saleable trimarans. Eric Willis gave us everything he knew about racing yachts (and he knows plenty) and we are still very proud of the result—after all, *STARTLED FAUN* was one of the few craft to go round the whole course without any damages or breakages whatsoever ! Complete with all racing gear (and it is plenty !) our version of the *STILETTO* class can be purchased for £8,000 or $22,000. When John Morwood and I saw her creep to windward and beat every other competitor out of Plymouth Harbour—well, I knew we had a winner ! We have, too—she is a joy to sail and will undoubtedly prove popular.

Possibly the only two boats in the whole race which must have been a bitter disappointment to their designers were *SUMNER* and *MIRRORCAT*. Both were over-publicised (always dangerous when you are trying to sell yachts), although in all fairness to Blondie she had always cautiously stated that he reckoned he only had a 50 : 50 change. The *Daily Mirror*, to quote a well-known politician, went stark staring bonkers with their propaganda—but even newspapers can cock thing up (have you ever had something which has happened to you personally reported in the Press ? Then you know what I mean !).

So, good luck to *TORIA*, which was designed to win the race, and did ! Good luck to *SNOW GOOSE* (the Round-the-Islanders must be getting fed up with her record—*please* don't become a Round-Britain-Islander, *SNOW GOOSE* !). Best wishes to *IROQUOIS* and the stalwarts who sailed her ; at least she helped the Rod Macalpine-Downie cat future more than the largely experimental *MIRROR-CAT*. A grand toast to the wonderful effort of *SEVERN* and her crew—busted ribs and all. In my opinion this was the finest effort of the lot (Cor ! and sh'e a monohull ! !).

STARTLED FAUN ? Well, you see we *knew* that all the monohulls would do best to windward, so we designed her specifically to do just this. And, she does ! Incredibly, she can head *comfortably* three points off the wind. The only trouble was that she only had one opportunity to prove her worth—at the start. As everyone now knows all the rest of the race was downhill !

TAO

30 FOOT MUSTERS MARINE TRIUNE TRIMARAN

BY

WING COMMDR. R. J. BURROUGH, D.F.C.

44, Bedford Gardens, London

TAO has been splendid. For a new boat launched 9 days before a race such as Round Britain 1966 she has shown no faults. For 2,000 miles racing under very rugged conditions this is a tremendous tribute to her first class design and building. We have broken one jib halliard twice. That is all, and even that can be put down to the jib halliard fraying its tail while in harbour or at moorings.

TAO is very fast and an excellent sea keeping boat. We were without our 420 square foot ghoster from Plymouth to Lerwick. We were only 1 hour 40 mins behind Toria to Crosshaven and only about 12 to Castle Bay, i.e over 700 or 6 days at sea—only 12 hours. Much of this with light airs less than Force 3 and on the wind and we would have used our ghoster for at least 48 hours. Experience so far shows that this gives us a good 2 knots extra in these conditions. We made an error which cost us 12 hours off N.W. Ireland, came hard on the wind and left the centreboard up and hit Ireland again instead of clearing it. Best run so far, 42 miles fix to fix in 4 hours.

She has behaved magnificently under rugged conditions. She has proved that trimarans can take the worst sea conditions. With 4 rolls in the main and our 65 square foot storm jib, she behaved wonderfully well on the Henderson self-steering throughout a very dirty night, if you can call it night, off Muckle Flagga, N.W. Shetlands, on 16th July. A very rough cross sea, wind just free on the part tack

Force 6 gusting 8, she took us comfortably through the night. Nothing inside the saloon had been lashed down, one thing that moved was one plastic wine glass on the draining board, fell over, bounced in the sink on to the cabin floor.

Jack Burrough's TAO—Musters Marine

The centreboard case is excellent. We did have a very stupid leak on the hinge pin due to a fibreglass face plate cracking and becoming a distance piece allowing some water in. I pumped bilges at their worst for 5 minutes every 4 hours which is nothing; in fact I was quite

glad to have the water in the bilges to give us extra stability and easier motion.

I find *TAO* a splendid sea boat, very comfortable for cruising, the family man's boat with a splendid turn of speed. After 4 days from Lerwick it was fun coming into Woolverstone under reduced sail and passing everything in sight.

On arrival at Plymouth, single handed from Boulogne, after three gales, one of which sank the ill fated *DARLWIN* all that was necessary before returning to our home port, Poole, was to charge the battery.

I would like to thank Mike Farrow of Cox Marine in helping all boats in the race and particularly *TAO*.

TAO—ROUND BRITAIN SAILING RACE 1966

BY

JACK BURROUGH AT HARWICH

The outstanding performance of trimarans in this rugged race has proven the basic design which has been fostered by A.Y.R.S. for the past eight years. Derek Kelsall's *TORIA* is so right in design concept—lightness ; long narrow hull shape both for floats and main hull ; floats of equal length with the main hull ; curved main beam to give water clearance and incidentally to improve accommodation below ; the greatest possible beam, because beam times weight equals stability and if we do not have weight we must have beam. Improvements which must come—spare rudders, better self-steering, easier reefing and unfurling of sails.

Before the race my skipper Jumbo Edwards, the well known Oxford Blue and Rowing coach had said that this was above all a test of crew endurance. How right he has proved to be. The fastest boat spends less time at sea. Some energy spent in making her fast, can thus reduce the overall strain, but may bring your crew temporarily nearer to the breaking point. To me the race has been a study in psychology. Jumbo is the skipper—appointed by me as entrant and owner. He owns a conventional 9 ton cutter, but does not know trimarans. He has heard that they capsize. He is a good seaman and an excellent navigator ; no risks are to be taken if they can be avoided whatever the cost in time. Jumbo has close experience of the sea—very close—he was the sole survivor in a liferaft from the crew of a Liberator in the Atlantic in 1943 !

As for me, I think I am cautious enough, but my wife thinks I am a member of the up-spinnaker and let's go, " press on regardless " brigade.

Be that as it may, the fact is that Burrough comes on watch and immediately suggests an increase in sail. Jumbo comes on watch and

immediately suggest a reduction in sail. I know I cannot win because I am not the skipper. The same two crew must finish the race and I cannot afford to have too much friction—God knows we have plenty. After three weeks the time has come when I know I will make the skipper happy if I suggest a reduction in sail as he comes on watch. He knows he can annoy me by reducing sail, or suggest a reduction in sail as I come on watch.

The psychological factors are there. Sailing is a form of madness. Ocean Racing is its more extreme form, and the Round Britain Sailing Race must be " The " Ocean Race. We must all be fairly mad to start with. Some friction between crew is inevitable. It has a vital bearing on endurance.

One of the best nights we had for comfort, except for the damp and cold, was in force 7 gusting 8 with a steep shortish sea on the beam, going to windward between Foula Island and Muckle Flagga on the extreme North West of the Shetlands. It was our fourth or fifth night at sea. We had the sails nicely balanced, with our 65 square foot jib and five rolls in the main. Our self steering took over and kept us on the way through two watches, eight hours. According to the sea and the amount of pitching, our extra crew member, George, the self steering, would stay out there in the cold and wet, noting every slight change in the wind and carefully applying just the right amount of helm to keep her on course. George would stay out there without food clothing or sleep. George was the most important man in the boat. One of the worst nights, was starry and warm with a calm sea and little wind, off Harwich, with low visibility in the shipping lanes and shallows. George cannot work without wind. No, George, no self-steering—DISCOMFORT.

Under all conditions she can be sailed much faster with a helmsman. In a reach in heavy seas, for example, the helmsman can choose his route through the waves and get that exhilarating surfing down the wave faces with your speed going up from 8 or 10 knots to 12, then 15, then 18 and then off the clock. Then you are off the wave and back again to normal but searching for the next chance. Or, running before a force 6 gusting 7, spinnaker up, everything else down—a heavy following sea—and she is trying to broach. Self steering cannot work as there is insufficient wind to drive her. It is an interesting sight to see the spinnaker taken aback as one's speed down the wave front increases above the wind speed. It is great fun, but an individual cannot keep it up for long, four hours is too much. What do you do ? Reduce sail, thus reduce speed, thus have an apparent wind on which

George can work. Now seas will overtake you, the motion becomes tiring, you are going slower and will be longer at sea, and you are using up your endurance. It really is all a question of human endurance.

THE NON-ACCEPTANCE OF MULTIHULLS

BY

JOHN MORWOOD

From time to time we get letters and hear comments from sad multihull enthusiasts who are amazed by the under-reporting of the speeds and racing successes of catamarans and trimarans. They feel that, now that multihulls have proved themselves faster and quite as seaworthy as single hulled boats, the whole yachting fraternity should immediately take to multihulls.

The reason why the ordinary yachtsman actually hates multihulls is that he has been brought up with single hulls ; he has invested a sizeable proportion of his wealth in his yacht (which his wife resents) which he must defend to himself (and his wife) at all times ; he has got into a routine of meeting men with similar yachts, racing with them and enjoying the discomfort and pleasures of the process. But finally, he just *loves* his yacht—possibly as a symbolic cradle with a love-hate relationship to the sea as his mother. This man is just *not* going to be converted and he must not even try. Admire his boat as you would his wife and bolster his personality. Don't say anything unflattering about his boat but ask him to sail with you and part saying how nice you think *his* boat is.

Catamaran sailors are emotionally against trimarans and both will doubtless hate the flying hydrofoils when they also come about. Usually, however, it is the people who are commercially involved with catamarans who are most against trimarans. The common catamaran sailor seldom makes this kind of remark and he will usually be delighted to try out a trimaran, while it is easier to get a conventional sailor of single hulled boats to like the trimaran—it is more like a cradle than a catamaran.

The whole matter is a storm in a tea-cup. Catamaran racing classes are springing up all over the world, though many yachting centres have yet to have one. Cruising trimarans are numbered in their thousands, though many people have yet to see one. There is room for all and only by the true merit of boats will they become the majority, which takes time.

Middle-aged fogies, like me, have an image of one particular yacht in our minds. It is that one in which we, for the first time had,

a sail in perhaps sunshine with a following breeze with, perhaps, a pleasant heave of sea. If that image is of a single hull, nothing will change it and we will carry it to our dotage. That is my own image, and while I don't mind sticking floats or hydrofoils out on either side, I cannot get away from the single hull. I am therefore more than glad that the trimaran has proved itself the equal of the catamaran for most purposes.

The really true catamaran and trimaran sailors are now just coming onto the yachting scene. They are the youngsters aged about 16 whose first real enjoyment of sailing has occurred on board a multihull so that they are emotionally attached to it for the rest of their lives. These youngsters will be buying large catamarans and trimarans in 20 years' time, when they are about 36 and the racing fleets of the world will perhaps all be multihulls.

It took 30 years for yachts to change from the gaff to the Bermudian rig. The first 10 years of this time was spent in proving that the Bermudian rig was the faster beyond all question and the other 20 years were spent in replacing the gaff-addicts by the young through the process of death and retirement from the scene. I believe that the acceptance of multihulls and flying hydrofoils will take much the same time.

Press Reporting. Let us not be upset by the non-acceptance of multihulls. We can sail them today but it will be 20 years before they form the majority of boats. It is, however, another matter when we find the yachting or general press ignoring the successes of multihulls. None of us must allow them to get away with it, without at least a letter of protest. We cannot and do not blame the middle aged Editors for being emotionally addicted to the yachts of their youth but, as Editors, we can blame them for allowing their reporters (who presumably are also middle-aged single hull addicts) to misrepresent facts. If reports of yachting events wilfully ignore the multihulls, the Editors MUST BE TOLD. The following letter from one of our Vice-Presidents to the *Daily Telegraph* is an example of what we all should do.

The Daily Telegraph. Monday, 11th July, 1966.

SUPREMACY OF THE CATAMARAN IN ISLAND RACE.

From :

Mr. R. Gresham Cooke, M.P.

Sir, I have been reading the full results of the Round the Island race which took place on June 25th, as organised by the Island Sailing Club. The overall winner under handicap, of course, was *ROUNDABOUT* and the first yacht to finish was the ex-12 meter *VANITY.*

No mention is made in the prize list of the fastest boat around the course, which was Mr. Don Robertson's *SNOW GOOSE* in the Cruising Catamaran Class. His elapsed time was 6 hours, 15 minutes, 34 seconds which was some $6\frac{1}{2}$ minutes faster than *VANITY*.

The reason why *VANITY* was the first yacht to finish was that Division I started 15 minutes before the Catamaran Class, and obviously if they had all started level *SNOW GOOSE* would have been the first boat to finish. I feel it is time that the Island Sailing Club now adjusted their prizes and results to bring out clearly which is the fasted boat round the Island, particularly as I believe *SNOW GOOSE* has held that proud position for four of the last six years.

There is some prejudice against catamarans on the grounds that it is not a mono-hull yacht. It is in fact one of the oldest sailing boats in the world, having operated in the Pacific for several thousand years. It is not entirely new to this country, because Sir William Petty designed and built one in the reign of Charles II and it was so successful that a larger one was then ordered. Admiral Anson saw catamarans in Polynesia in his voyage round the world in the 18th century.

The reason why they have only recently been developed in this country, after their very long use in Polynesia, is that lighter and stronger materials have now made their use in our waters possible for racing and cruising without the dangers which would have occurred in the time of Charles II.

As by any definition a catamaran must be a yacht (the Oxford Dictionary says a yacht is a light sailing vessel specially built and rigged for racing), I feel that the Island Sailing Club and other yacht-racing clubs should now recognise this fact and give catamarans, and indeed trimarans, equality of chances everywhere in proving themselves the fastest sailing boats in races such as the Round the Island race.

Yours faithfully,

ROGER GRESHAN COOKE.

London, S.W.1.

Ed. In the Round the Island Race of 1965 the fastest time was set by *CHIOMI*—a Nimble Plus made by Masters Marine of Poole. There was no mention in the press whatever of this achievement.

THE WIND AND THE SAILS

BY

JOHN MORWOOD.

THE WIND. Many studies have been published of the natural wind. That by John Hogg in A.Y.R.S. No. 56 is an excellent one, showing all the features of the usual study. But the one thing lacking in all the studies I have seen so far is a detailed description of the wind as it exists in fact and not merely as it is shown by the instruments concerned. The best that anyone has so far done is to describe it as a " Boundary layer ", leaving it to us to work out what is meant by a separate study of a " Boundary layer " as applied to an aircraft wing or sail.

In fact only at a height of about 200 feet does the wind blow in a steady stream similar to that found in a wind tunnel and even this is not always so. Below this height, we have the " Wind velocity gradient ", which is the layer of air in which we all sail and the fact that this diminution of windspeed exists indicates that the layers of air are moving on each other with quite a large friction. Let us now see how this movement takes place. The facts are these :

1. John Hogg's measurements showed whorls of air rotating at $3\frac{1}{2}$ miles per hour, thus giving the noted variations of windspeed of 7 miles per hour, depending on whether the whorl was increasing or decreasing the average speed.

2. The air in contact with the sea surface is stationary. Therefore the lowest whorls must be a " head over heels " tumbling in the direction of the windflow. However, the whole wind velocity gradient must also be a tumbling of the same nature. Therefore, we can say that the major vorticity in the wind velocity gradient is a series of whorls whose axis of rotation is horizontal and cross wind and the top of each vortex is moving in the direction of the main windflow. Because there is a change of the rate of wind velocity gradient at 10 feet in height, there may be a change in the nature of the vorticity at that height.

3. John Hogg's measurements also indicate sudden changes in wind direction and each change in one direction is followed by a change of almost equal amount in the opposite one. Looking closely at his graph of wind direction, one also finds batches of changes of wind direction, also followed by batches of change in the opposite direction. This indicates whorls of air of different sizes whose axes of rotation are vertical. Presumably, these vertical whorls are the horizontal ones whose axes have titled because of the general instability.

4. John Hogg's measurements and our inferences from them and from reason give us some idea of what is going on in the wind

which drives our yachts but it is as well to mention the minor vortices which rotates in the opposite direction to the major ones. Many of these will have been too small to be measured and some will be quite tiny.

Conclusion : The wind we sail in is irregularly irregular due to vortices of many sizes whose axes may be horizontal, vertical or oblique.

The Sails. Studies in the theory of sails (my own included) show diagrams of the wind striking the sails in a nice even flow such as is found in the wind tunnel. Polar and other diagrams are shown to explain how the sail force increases as the angle of attack of the wind on the sails increases until finally, the sail " Stalls " or there is a complete " breakaway " of flow over the leeside of the sails. This smooth flow is, of course, complete and utter nonsense. The wind is flicking around some 20° on either side of the average direction and is full of eddies even before it meets the sails. This explains why streamers tied to a single sail cannot be made to stream aft. They fly all over the place.

The Problem. The nature of the wind thus make nonsense of over-simplified yachting theory so some thought is called for to find out how to use such a tumbling mass of air to drive a boat. The first thought on the matter is to smooth the airflow and two ways to do this appear.

1. Make the boat go fast. This lessens the changes in direction very considerably. For instance, if a boat is travelling at the same speed as the wind, the changes of apparent wind direction are reduced from 20° on either side of the average direction to 10° on each side. The changes of direction experienced by an ice yacht going at three times the speed of the wind will be less still. It seems to me to be probable that it is this fact which make a single sail desirable for an ice yacht and just on the border line of desirable for a C Class catamaran.

2. The use of a jib or " Slat " ahead of the mainsail to smooth out the eddies. Practical tests show that a jib creates a smooth airflow over the leeside of the mainsail in front of which it is set. A small rigid or semi-rigid " Slat " placed just ahead of the mast would probably do the job with far less area.

The second way to deal with the rapidly changing wind direction is simply to use a sail combination which will get drive from a large range of angles of attack. This process has been called by John Hogg " Accepting the ' wind band ' ". Fortunately, the solution to this problem is the same as for that of smoothing the wind flow, namely, using a jib or " Slat ", both of which " Delay the ' stall ' ", thus allowing the sails to work at far greater angles of attack.

A third but rather conjectural way to deal with all these problems is to use a freely spinning mast not attached to the sail, which would be set on a stay behind it. The " Stagnation point " of the wind would be on the sail at the weather side and the wind would blow forwards and around the mast, keeping it spinning in the right direction. Such a mast would act as both a very good airflow steadier and also delay the stalling point exactly as does a jib or slat.

Conclusion. Except in an ice yacht, or possibly a C Class catamaran, some form of jib or " Slat " is necessary to smooth the eddies in the natural wind and to allow the sail to " Accept the ' wind band'". A spinning mast ahead of a single sail is suggested as a possible alternative.

Dear Dr. Morwood,

" The Wind and the Sails " is a timely alert before much wind tunnel work is done on cloth sails.

Under the section " The Problem ", one of the cures might be *low aspect ratio.* This reduces the stalling sensitivity as a function of the angle of attack. I have before me the Goettingen tests of thin plates which show this clearly.

I have personally investigated four dismal failures of thick air foils on ice boats with the help of smoke torches. Wind shifts caused a stall from which they did not recover when the wind direction returned. This is called " hysteresis ". I plan to study this next winter in the towing tank. The tank has been out of use for over a year due to my interest in full size measurements.

EDMOND BRUCE.
Lewis Cove, Hance Road, Fair Haven, New Jersey, U.S.A.

LEAVES, BIRDS' WINGS AND SAILS

BY

JOHN MORWOOD

Introduction. If we, in the A.Y.R.S., are ever going to produce an improvement over the conventional sloop rig, we must examine all the aerofoils of nature to see if any principles exist which we could take into account. This compels us to look at leaves and birds' wings and relate them to the airflows in which they occur.

Leaves. These come in such a bewildering variety that my mind boggles at the prospect of seeing much of an aerofoil purpose between their differences. In general, it seems to me that low lying plants and trees in places of frequent calms tend to be narrow blades except where the purpose is to blot out all the light as with the rhubarb and

coltsfoot. Plants like roses and cherries which are of medium height but growing in shaded places have a broader leaf of an aspect ratio of about 2 : 1 while the tallest trees, such as pine and American Sequoia Gigantica have needles which are obviously designed to have the greatest surface to weight and windage in gales and have no aerodynamic elegance at all.

Amongst all the leaves I know, only the ash frond with a series of leaflets on a stalk constitutes a mechanism for rhythmically accelerating the airflow about them. This formation is also found in ferns, weeds and wild plants but I do not think I know of any type which is so precisely made as to be of value to us. Perhaps the burbling and eddying nature of the wind amongst leaves makes aerodynamic efficiency of no value.

Birds' Wings. The leaves of plants and trees may not help us but it must be otherwise with the wings of birds. They are designed in many cases to create just those forces which we all want in our sailing boats. Their study may well give us the design we will find best.

Birds' wings are of three types as follows :

1. "*Propellor wings*" which are found on small birds. These flap at a high rate and drive the bird along. This kind of bird seldom glides with the wings outstretched. It flaps a bit, then folds its wings to its sides and shoots forwards under the momentum and then flaps a bit more. I think most insect flight is of the same type.
2. "*Gliding wings*" which are found on medium and large sea birds from the gull to the albatross. These wings are indeed elegant aerofoils of great lift to drag ratios. The albatross, for example, can spread out his wings when sitting on the sea surface and rise up on the wind without flapping his wings at all. Then by circling in the wind velocity gradient he can keep perpetually airborne. This is an aerodynamic efficiency which mankind has never achieved. But these "Gliding wings" have their drawback. If one watches gulls soaring near a cliff, one will often see them drop a wing as it enters an eddy or local downcurrent and a flap or two is then needed to resore even flight. In other words, such wings can and do get eddies over their upper surfaces and lose their lift. One can hardly call the process "Stalling" in the aeroplane sense as a bird can alter its angles of attack with the greatest of ease.
3. "*Soaring Wings*" of landbirds. These are found in rooks, hawks and eagles, for example. In general, all these birds fly in the wind velocity gradient over land or the sea coast where the wind is turbulent. Many of them fly amongst trees or just over their tops where the wind must be very turbulent indeed. The wings of these birds are all characterised by low aspect ratio of about 2 : 1 and about

5 discreet wing tip feathers placed in series, only overlapping each other about one third way in from the wing tip. As pointed out by Manfred Curry in his book *Yacht Racing*, the eagle also has a small fore wing in front of and above the main wing, thus constituting a "Slat" as a "High lift device". All these wings are therefore designed to accept a turbulent airflow of widely varying angle of of attack. This is the kind of windflow we have to use in our sailing boats.

Sails. In a previous article, it was pointed out that the faster a yacht goes the less the variability in the wind direction it meets. An ice yacht can therefore have a single sail. A C Class catamaran is at the point of transition while slower yachts will be better off with one or more fore sails.

Most birds' wings have a more or less elliptical plan form, except for the tip point which is used to control in many kinds. The low aspect ratio wings of rooks, hawks and eagles are more definitely elliptical and our sail plans should therefore be semi-elliptical and slats and slots should be tried out in the wind tunnel to find the best set up.

Conclusion. From a study of leaves, there does not appear to be anything of value in the design of sails.

From a study of birds' wings, it would appear that the rook, the hawk and the eagle have the most similarity to yacht sails in their windflows. This leads us to the conclusion that a semi-elliptical plan form of sail of aspect ratio of 2 : 1 with a "Slat" and possibly flaps may be the best type. Only practical study in the wind tunnel or at full scale will confirm or contradict this reasoning.

July 18, 1966.

Dear Dr. Morwood,

In reference to your proposed article, "Leaves, Birds' Wings and Sails", sailing craft employ two categories of fluid mechanisms. Our sails, keels, rudders, etc. strive for large reaction forces. On the other hand, our hulls attempt to avoid forces that act as parasitic resistances.

In examining nature for corresponding mechanisms, I would tend to view leaves as being in the same category as hulls as avoiders of resistance. Large areas absorb light, for photosynthesis, and gather carbon dioxide. To avoid tearing away, the leaves swivel and flutter to escape pressure resistance. There remains only the unavoidable frictional resistance.

Birds, insects and fish are like our sailing craft and airplanes in having useful propelling and control components which compete with load-carrying parasitic components.

Nature has been progressively performing " cut and try " experiments in small steps for millions of years with a " survival of the fittest." We would be foolish indeed if we did not try to study nature's results and apply them to our sailing craft.

I think you are stressing an important point, that of air-turbulence. Our sails must operate in this environment. They cannot employ high lift-drag ratio forms if that necessitates critical angles of attack. This probably means that the wind-tunnel air flow should not be too clean. Possibly a variable control of air turbulence should be provided.

Sincerely,

EDMOND BRUCE.
Lewis Cove, Hance Road, Fair Haven, New Jersey, U.S.A. 07701.

THE HORSE POWER OF SAILS

BY

JOHN MORWOOD

One horse power is, by definition, 550 foot pounds per second. 13 knots is approximately 22 feet per second. Therefore, a boat travelling at 13 knots is being pulled by 25 lbs. per horse power.

A sail stretched athwartships develops a coefficient of sail force of about 1.2 for its projected area. A spinnaker produces more from air friction down the sides of the sail.

A coefficient of 1 produces in a windspeed of 17 knots a force of 1 lb. per square foot of area on a stationary object.

Down-Wind Horse Power. 21 sq. feet of projected sail area at a coefficient of 1.2 will produce 1 horse power running dead down-wind at 13 knots in an apparent windspeed of 17 knots. The true windspeed will be $13 + 17 = 30$ knots.

Broad Reaching Horse Power. With the apparent wind about 20° aft of the beam, with a sail placed athwartships, the sail coefficient increases from 1.2 to a higher figure which is not known. The highest value given for this is about 1.7 but I think that if 1.5 is achieved, we would be lucky. Taking the figure of 1.5, the sail area per horse power would then drop to 17 sq. ft. Again, the boat speed would be 13 knots and the apparent windspeed 17 knots. The true windspeed would be about 20 knots.

Close Hauled Horse Power. Here the sail force is the same as for broad reaching (more or less) but about two thirds of it press the boat sideways and only one third is available for driving the boat. The sail area now becomes 51 sq. ft. per horse power, with the boat travelling 13 knots and the apparent windspeed again 17 knots. The true windspeed would be about 10 knots.

Summary. The horse power of sails depends on the apparent speed of the wind and the speed of the boat. When, however, the boat is going at 13 knots and the apparent wind is blowing at 17 knots the horse power developed by sails is as follows :

Down wind : 21 sq. ft. per h.p.

Broad reaching : 17 sq. ft. per h.p.

Close hauled : 51 sq. ft. per h.p.

Because the true wind is not the same for these three courses, these calculations are not thought to be of interest. The only valid state is to calculate the horse power in a constant true windspeed.

August 5, 1966.

Dear Dr. Morwood :

May I suggest an additional approach for your studies of the horse-power of sails. It is one that uses no coefficients or assumptions. It may amuse interested A.Y.R.S. readers and provoke thought and and debate.

Horse-power from sails is proportional to the product of the boat speed and the sail force when on a running course. A tethered boat will have a high sail force, but since there is no boat speed, there is no horse-power. On the other hand, if a boat, by some means, is running at the speed of the true wind, there is no sail force and again no horse-power from the wind. In between these two boat speeds, in respect to the true wind, is the maximum value of horse-power.

The proportional equation is :

$$H.P. = k \cdot V_b (V_t - V_b)^2.$$

where V_t is the true wind speed.

V_b is the boat speed.

$V_t - V_b$ is the apparent wind speed.

The sail force is proportional to the apparent wind squared. Elementary calculus tells me that the maximum horse-power, in this equation, ocurs when the boat speed is one-third of the true wind speed.

Some A.Y.R.S. readers, who know algebra, may like to see if this is true by solving with a series of assumed values for the boat speed as a ratio of the true wind speed. Then the relative magnitudes of the horse-power proportionalities can be compared to determine the optimum.

Sincerely,

EDMOND BRUCE.

Lewis Cove, Hance Road, Fair Haven, New Jersey, U.S.A.

END PLATES AND ASPECT RATIO

BY

HOWARD K. MORGAN

1442 Inwoods Circle, Bloomfield Hill, Michelyn, U.S.A.

The effect of end plates at the tips of an aircraft wing which are at right angles to the wing surface is like the effect of the deck on a sail when the sail touches the deck at its foot. When the sail foot clears the deck, as is usual, there is much leakage of air under it from windward to leeward. The aspect ratio of the usual triangular sail if touching the surface of the water would be twice the luff to average chord. But, as a result of the usual gap under the boom, its aspect ratio is only about 50% greater than the luff length to average chord ratio.

When dealing with a wing or sail there are two important causes of drag. The part that does not vary with change in aspect ratio is the profile drag. It is based on the shape of the wing or sail. The other part is the induced drag which does change with aspect ratio. Now, the aspect ratio is proportional to the lift squared over the induced drag and, the performance of a wing or sail is directly related to the ratio of lift over total drag, induced plus profile drag. If this L/D ratio can be improved, the aircraft can glide further and the sailboat can sail closer to the wind.

The reason a wing tip or sail end (foot or head) gives losses is not immediately obvious. In addition to the air flow over the top and aft under the bottom of a wing, there is a circular flow completely around the wing too. Since the air beneath a wing is at higher pressure, some of it flows forward and up over the leading edge of the wing passing aft over the top and forward under the wing again. This means the total air flow is a combination of this circulation plus the larger, generally aft, flow. There is no actual separate air flow forward under the wing as such but rather an equivalent reduction in volune of air passing aft under the wing and also an increase in that flowing aft along the top. The same is true for a sail.

The circulating " hoops " of air are like flywheels which store energy all along the wing. Each is a little tornado or vortex of air requiring little energy to keep it going. But when a vortex of air spins off the wingtip or sail end, it carries valuable energy with it. An end plate forms a dam causing some of this energy to be conserved. A very large plate would prevent all such loss since it is a more perfect dam.

The increase in the wing lift curve slope (change of lift with angle of attack) with tip-located double end plates is dependent upon the square root of the area of the end plate divided by the airfoil span.

If the foot of a sail had a horizontal, round end-plate (like a canvas drumhead) placed symmetrically beneath it of a diameter equal to once and a half the foot (boom) length, the induced drag due to vortex loss could be reduced to 60% of that with a completely free foot. If the round end plate was two thirds this diameter or equal in diameter to the foot length, the drag might be 70% of the free foot drag. The drag referred to here is the induced drag and not the profile drag which might be equal, more or less depending on conditions.

While the increase in lift slope is desirable, a clearer answer exists in the change in total L/D ratio which is so important to close hauled performance to windward. The L/D ratios can improve up to 60% and 45% correspondingly with the round plates given which is a lot. Now this full increase is not realized since the deck beneath a sail has already improved the aspect ratio roughly 50% over that with a free foot. So it might be said that the overall improvement of an end plate is something like 25% in L/D ratio very approximately and under the best conditions. Any "hat" on the masthead, such as the catamaran float to prevent full overturn after capsize, will also retard the flow upward off the main and improve the main's aspect ratio.

The "Park Avenue Boom" prevented a little of the air from slipping under the boom, its main use being to keep the arch in the sail all the way to its foot. With such limited horizontal boom area there would be little measurable increase in aspect ratio. On the other hand the use of an end plate of boom length proportions is too big. Keeping the foot near or on a deck or use of an awning, especially forward under a sail is beneficial.

To examine the above matter for smaller amounts of leakage, consider the following: If a horizontal slot were cut fore and aft along a sail, drag would increase as this slot was widened. This is the same effect found with a sail actually touching the deck when the gap beneath it is increased by raising the foot allowing leakage under the boom. Experiments with fore and aft slots cut in a wing show that for an aspect ratio of 6, the drag increased by some 6% for a slot only 1% of the chord (sail foot) width. For a 5% gap there is 18% more drag than with no gap, for 10% some 23% drag an increase and for a 20% slot some 27% drag increase, most of the damage having now been done. A sail with a foot of 10 ft. could easily be three feet above the deck of a small boat. This 30% gap would reduce the aspect ratio considerably and increase the induced drag 30%—perhaps increasing the total sail drag by 15% or so.

Another situation is of interest since it is like the above. One would expect that when an aircraft comes in low over the ground that the wing end vortex losses might be modified due, in this case, to

ground effect and this is certainly the case. While a true " fence " has not been placed on the wing or an end plate at its end, the increased friction of air between wing and ground for flow toward wingtips will actually reduce the vortex losses at both wing tips. This effect is not noticeable when the aircraft is well over one quarter wing span length expressed as height above ground but becomes very noticeable if lower. At 10% of the span in height above the ground and at lowest flying speeds, this can reduce induced drag to 60% of that in high flight. Total drag might then be 80% of the usual inflight drag at that speed. Higher speed, greater height and longer wings reduce the effect so that at high speed and $\frac{1}{4}$ wing span height, the induced drag has only dropped to 95% of that if higher, a mere 5%. Thus a jib can effect the mainsail likewise by its proximity, increasing the lift of that mainsail through reduction of wasteful air flow up or down the mainsail.

The so-called slot effect of the jib and the mainsail in combination can be expressed as an effect resulting from the proximity of the jib to the main which retards vertical flow on the main thus reducing vortex losses. The same can be said of the effect of a mast-head jib on the head of the mainsail which can reduce vortex losses. Usually the explanation of slot effect involves the effect of increasing the leeward air flow on the main thus reducing pressure, hence more drive. But this hardly explains the effect since the jib would be damaged in its higher pressure area on its windward side and provides less drive. A biplane aircraft suffers over a monoplane because of the two wing proximity. So, in effect, the jib causes increase of air flow across the leeward side of the main, thus acting as a force to reduce somewhat the damaging flow otherwise down around the foot or up over the headboard.

Dr. J. Morwood,
A.Y.R.S. Editor and Publisher,
" Woodacres ",
Hythe, Kent, England.

Milan, September 18, 1965.

Dear Sir,

My auxiliary sail is intended to operate without a proper centerboard or fin keel of any sort, I now learn from publication No. 50 that Mr. Fin Utne of Stavanger is experimenting along the same lines on his *TWING* cat, but has problems from stalling. My guess is that his twin rudders arrangement may be just " overbalanced ", thus losing rapidly its turning power and enhancing its braking effect when speed drops and the angle of optimum " lift " becomes smaller.

If such is the case, my suggestion is to move the rudder line of pressure aft by either modifying the sections or shifting the pivot points.

My scale experiments and full-size observations in traditional Venetian craft confirm that it can be made to work—though perfect balance is difficult to achieve as the forces involved are of a dynamic nature and very much affected by sailing speed.

My own idea is instead that of a self-contained collapsible unit, easy to carry around and extremely simple to use, and is primarily conceived as a standby means of propulsion for outboard dinghies, prams, and above all the inflatable outboard runabouts that are growing so popular in this country. As a marine service engineer, I am naturally concerned about the seemingly light-hearted way some people take their families on extensive coastal trips in small outboard outfits, often with little or no regard for the fact that any powerplant is apt to fail critically, especially when operated and serviced by partly competent owners. If full-scale trials prove successful, I may even apply for patent rights, and surely will report to A.Y.R.S. if anything of interest shows up.

With the occasion, I would like to express my enthusiastic acceptance of the model cruising yacht contest announced in publication No. 51. It is indeed this kind of unprejudiced and independent creative thinking that lead me to join A.Y.R.S. back in 1955 ! But appreciation alone may be of no avail, unless supported by constructive remarks. In my school days I built and raced sailing models to the " M " International Class (50 in. L.O.A., 800 sq. in. S.A.) Rule, and had thus the opportunity to make a few factual observations on working models in general.

First and foremost, racing models are sailed in out-of-scale conditions and at above-scale speeds. Their general similarity with the full-size object is therefore purely nominal, excepting for what can be learned by overdriving a model beyond the actual limitations of its full-size counterpart, and even so, it is admitted that only a few single elements of its design can be evaluated at a time and never the machine as a whole. However, a trained eye can always discern points of full-size interest in the behaviour of a model in true-to-scale wind and wave formation. In this latter case, since ambient density and viscosity cannot be scaled down, at least three things become apparent :—

1. The deciding factors in *scale* model racing—arranged in decreasing order of importance—are the following :
   a) *Skipper* (i.e. ability of the human to foresee and preset the model for the *average* condition to be met on the racing course)

b) *Sail(s)* (i.e. cut, shape, workmanship, material)

c) *Hull(s)* (i.e. ability to sail upright and on a straight course, appendages, finish—the influence of wetted area and displacement is over emphasized to the detriment of volume distribution and other hydrodynamic refinements).

2. Unless the model sail(s) and rudder(s) be remote-controlled without any mechanical connections between boat and skipper, nothing can be learned about manoeuvrability and steering balance (vane steering can take care of many faults), and a model would differ from its full-size counterpart in that it would be designed with straight running in mind, the only limitation to fore-and-aft spreading of the lateral plane being the necessity to keep ballast as low down as possible.

3. A model with a divided sail plan (schooner, ketch, etc.) would invariably loose on a mono-sail one.
Moreover, the choice of Captain Slocum's *SPRAY* as the reference design rather surprises me for the following reasons :

a) 36 feet is a large size by modern standards ; unsuitable for economical mass production ; more than a single-handed crew can manage comfortably.

b) The cost of a *SPRAY* replica would be prohibitive nowadays : with wood planking, beam costs proportionately more than length.

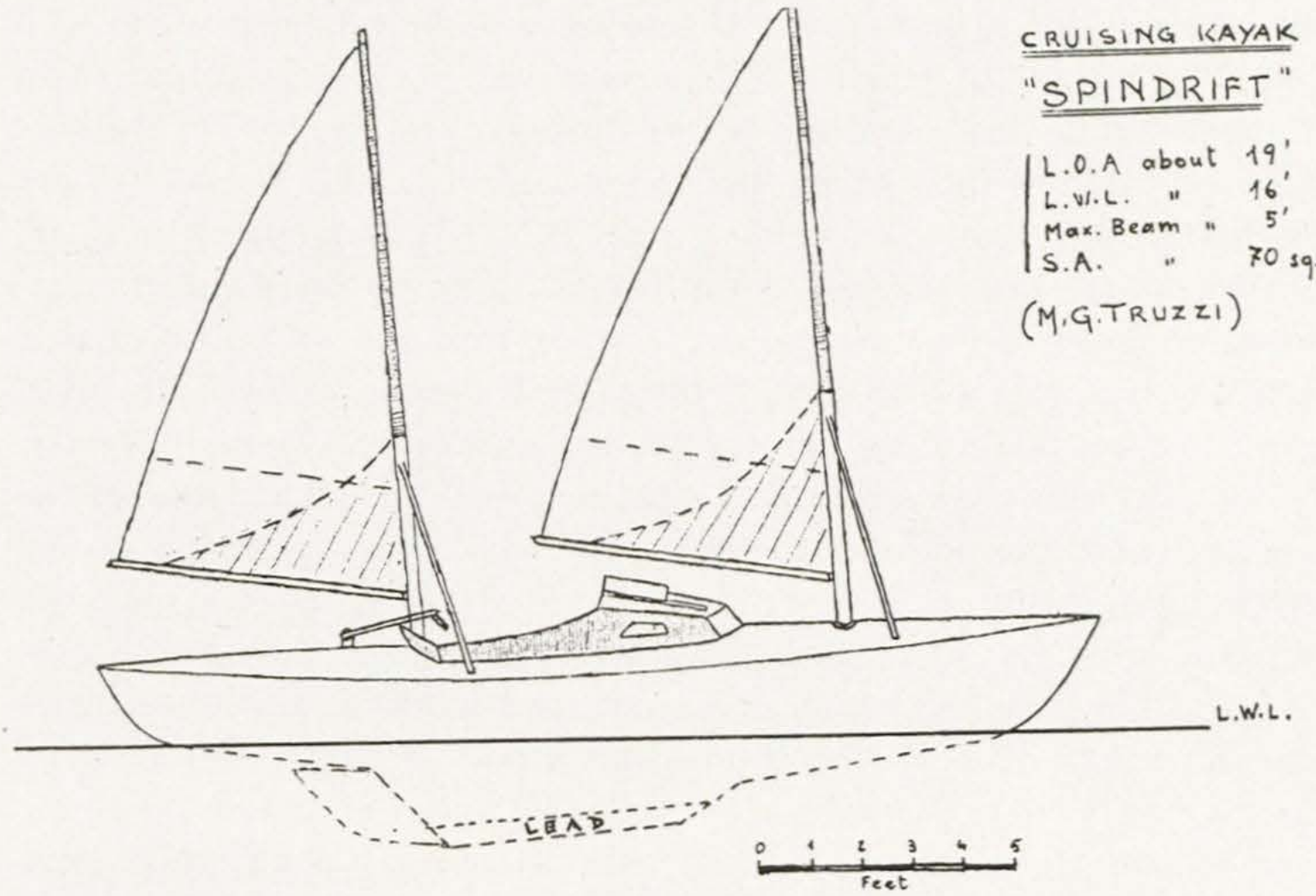
c) *SPRAY'S* hull is that of a commercial fishing vessel, to be sailed by professionals and designed to carry as much useful cargo as it could take, to provide a steady platform for the handling of the same and related gear, to withstand rough abuse, and for (them) cheap construction materials and methods. She would require a good power auxiliary in modern crowded anchorages.

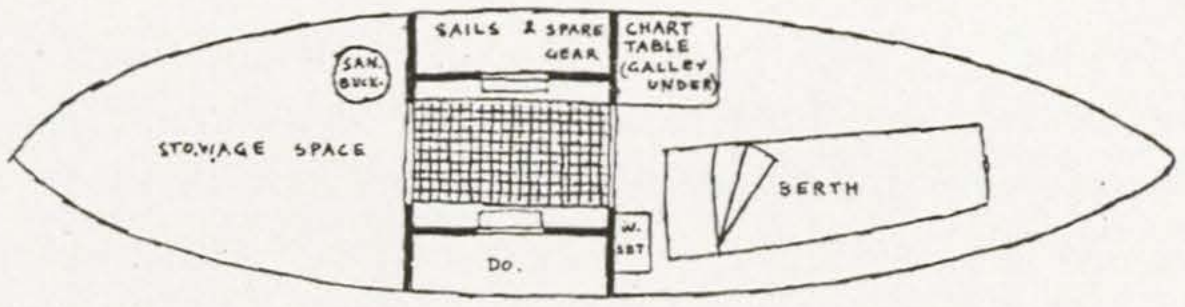
d) *SPRAY'S* ultimate stability is poor : she *can* be capsized, and possibly did. Her successful voyage around the world is a tribute to the superlative seamanship of her Skipper, more than to inherent virtues of her design. *IGGDRASIL* was just lucky !

e) Length for length, it is not at all difficult to design something much faster than *SPRAY*. The only excuses for duplicating her are, in my personal opinion, romance, plenty of room below, and a spacious unclattered deck.

Nevertheless, I look forward to reading about the outcome of these trials with the utmost interest and open-minded attitude, and would welcome a future subdivision of the contest into classes, to

include small cruisers of say 20 feet or so (with some emphasis on simplicity of design and low cost realization, rather than on performance alone). I hope to enter a design from my board next year, if advised in good time and provided a British fellow member agrees to sail it for me ; prizes of course would be shared in equal parts.





Incidentally, I take the liberty to enclose a sketch of a cruising kayak 19 ft. overall, which I designed six years ago to sail across the Atlantic single-handed. After much talking and dreaming, the project same to an end when a little blond decided to dry-dock me for

good with her smile. It is therefore merely an exercise in design, but includes features that may arise interest.

The hull is of the round bottom type, designed for mahogany strip planking. Later on, however, I discovered that a suitable corrosion-resistant aluminium alloy was available in cold-rolled sheets of large size. Lines were modified accordingly to a hard chine type with developable surfaces ; the sheets were to be cut into plates and fastened by means of small stainless steel bolts set in a sealing resin compound (akin to " Araldite ", for instance). The turtle deck is marine plywood with a small mahogany cuddy. The two masts are composite : the lower part being a steel tube tripod stepped on deck, and the upper part stayless solid wood. The topmasts are interchangeable and can be unshipped ; a spare topmast would be carried lashed on deck (shown in dotted lines) and a removable blade fitted onto it to form a sculling oar for general conveniences in harbours. Sails are also interchangeable and can be spread on either sides of the foremast when running dead before the wind ; a jib and a trysail (interchangeable) might be included. In extremely bad weather, the topsmasts could be unshipped and lashed down, and two diminutive semirigid triangular sails (leech re-inforced with a taut steel wire —shown in dotted lines) rigged onto the tripod uprights for steadying purposes. The tripods also act as mooring posts and their uprights (lower masts) communicate at will with the hull interior through a water trap to provide ventilation. The rudder spindle includes, of course, a universal joint.

A steering compass and the pertinent charts would be secured to the chart table and a Perspex window in the fore bulkhead would make them visible from the cockpit.

Drinking water would be carried in a plurality of plastic bottles to provide reserve buoyancy when emptied, and provisions in inflated plastic bags for the same reason.

I believe this type of hull could be built economically of sheet plywood to provide a smart, watertight, self-righting and very easy to handle cruiser for an adventurous youth with limited funds and a very Spartan turn of mind. An enlarged version could make an ideal low-cost world cruiser for any yachtsman favouring light displacement.

And so I end a lengthy letter, for which you will possibly excuse me, renewing my sincere appreciation for providing us with delightful reading through one of the best publications I have come across so far.

With my best personal regards.

M. G. Truzzi.

Via Oltrocchi, 8, Milan, Italy.

29th September, 1965.

Dear Mr. Truzzi,

I long remember your name, having written it on many an envelope in my time since 1955, till all my friends joined in taking this work away from me, and I have seen your letters in the English Yachting Papers and was very much impressed. It is nice, therefore, to receive your most interesting and informative letter, which I would like to publish for the benefit of all our members.

It see that both you and Fin Utne are experimenting with the *BRAGANZA OF VENICE* type of sail and rudder. As it works for the Venetians and, indeed, the Chinese, we also should make it work—a kind of " outboard sail ", and I think your idea of using it as an auxilliary is fine.

I am glad to have your remarks on our Model Cruising Yacht Competition, and this must undoubtedly increase our understanding of what we are doing. I do think, however, that spreading the lateral plane fore and aft would increase wetted surface and thus be its own restriction.

You are quite right, of course, that two-masted rigs would lose to a one-masted one if the sail height were unrestricted. However, as we have pushed the mast height so low, we hope that the two-masted rigs will be tried.

Your remarks about the choice of Captain Slocum's *SPRAY* are, of course, true, but she was a fast boat all the same. In the fullness of time, if we run this Contest every year, we will have the Winner of the previous year as our standard of top performance with our model *SPRAY* (if we get one) as a good average type. We chose 36 ft. as being the shortest length in which 6 ft. of headroom could be usefully achieved. Small cruisers of 20 ft. would have relatively less headroom, and, apart from the length of bunks, could be scaled up to 36 ft.

I, personally, am therefore against future sub-division of the Contest into Classes, as I doubt if it would achieve anything.

I like your ocean cruising kayak very much as it reminds me of a boat I once owned, but that, with 100 sq. ft. of sail on one mast. was none too great. The mast system you suggest is very appropriate to the job, and, indeed, many of the other features could well be used with success.

JOHN MORWOOD.

Dear Sir,

The article in *Yachting Monthly* which referred to the A.Y.R.S. interested me immensely as I have built a sloop to Maurice Griffiths *LONE GULL II* design and am planning a solo cruise in her in the near future.

In the short cruises I have been able to make in the last two years, she has proved very suitable, being seakindly and easy to work, though not fast (which does not worry me). She is capable of being left to look after herself while close hauled with the tiller pegged. I am, however, intending to fit some form of vane steering gear so that I can turn in or do a bit of cooking whilst she is sailing off the wind or broad reaching.

I repeat, that she is not fast, although from her lines, compared with other boats I have owned and sailed, she should be, I feel a little faster. It may well be that the bilge keels do slow her down as you suggest ; it had occurred to me that the turmoil about them, at low speeds anyway, was having a bad effect.

My boat is planked with 1 inch Pitch Pine, which is a little heavier than the mahogany the designer specified. She draws 3 ft. 9 ins. which is quite a lot more than the designed draught. From the published photograph of the original *LONE GULL II*, I would say that she is much deeper in the water than she was designed to be, as well.

All in all, this vessel suits me admirably. Although I am not interested in speed, it would be interesting to see the effect of replacing the bilge keels with hydrofoils but it is unlikely that I shall make the alteration now.

H. J. KIMBER.

The Point, Highbridge, Somerset.

SEAKINDLINESS
CORRESPONDENCE ON A.Y.R.S. PUBLICATION No. 53
SOLO CRUISING

To : Peter Tangvald and John Morwood.

Dear Sirs,

I read with great interest your correspondence on ocean cruising and would be pleased to add a bit to the conversation.

L. F. Herreshoff lives nearby and I have asked him about ocean cruising boats. As you may know, he has designed several boats expressly for this purpose. They are all long, narrow and with ballast rations less than about 40%. The best known of them is *MARCO POLO*, 55 ft. by about 10 ft. beam and $5\frac{1}{2}$ ft. draught,

outside ballast, double ended, three masted ketch. Another beautiful one is *DIDIKAI* (design No. 74), 36½ ft., by 31 ft. by 8 ft. 8 ins. beam and 4 ft. 9 ins. draught. 17,800 lbs. displacement and 5,500 lb. ballast, double ended two masted ketch, 510 sq. ft. sail area. I strongly recommend his book *The Commonsense of Yacht Design*, 2 vols., available from the *Rudder* magazine. He and his father are two of the most talented designers that our country has produced. I consider L.F. an artist. His formal aerodynamic knowledge is not great and he rather scorns " higher mathematics " but his instincts are exceptionally good.

The problem of high average speed at sea seems to me to impose two requirements on a boat. She must go well in light weather and she must be able to go to windward in nearly any condition. Any tub can do reasonably well in good weather and reaching.

The light weather condition can only be met by having enough sail area compared to wetted surface. The ratio of sail area to wetted surface should be well in excess of 2.0. William Gordem says a boat, to be a good drifter, should have three times more sail than wetted surface. Herreshoff's *ROSSINANTE* has about 2.2 and goes well, but is very narrow. My little sloop is 1.7 and is clearly underrigged. I think 2.5 is a good ratio to aim at. It appears to require considerably more sail than is currently fashionable. It is clear that a larger than normal sail area will have to be reduced somehow as the wind gets heavier before a smaller rig requires reefing. A well designed ketch is a pleasure in this respect. If the boat becomes too burdened, handing the mainsail solves the problem and still leaves a satisfactory rig.

Going to windward in heavy weather requires stability, low drag and a well designed hull, keel or centreboard. A long narrow boat is much easier to propel into a head wind and sea than a short fat one. Adequate stability can be obtained with length and moderate ballast. Of course, it is a great help if the centre of effort of the sail is low. Going to windward in light weather, again, requires adequate sail area to wetted surface.

In addition to meeting the two major requirements for high average speed mentioned above, a long narrow boat is very much faster off the wind than a fat one. Edmond Bruce has done an elegant job of demonstrating this in A.Y.R.S. Publication No. 45. *MARCO POLO* length to beam ratio is about 5.5 : 1 ; *DIDIKAI* about 4 : 1.

Regarding rigs and aspect ratio of sails, the best reference I know is Marchaj's *Sailing Theory and Practice.* It seems clear that, if a racing boat is being considered to be built to a rule that encourages beam and lots of ballast, the stability is adequate to hold up a very

high aspect ratio rig of limited area. But if you are building an ocean cruiser and want a narrow boat for a number of reasons, it makes sense to go out of your way to make a low rig to minimize the stability problem, provided no real sacrifice is made in other areas. Marchaj has shown results of tests on pages 149 and 150 of his book that indicate to me that there is something to be said for going lower. (The maximum driving force is higher, but at a somewhat freer angle). I feel that the top 15% of most Bermudan mainsails is almost entirely useless due to two effects : 1. The interference effect of the mast which becomes relatively larger as the sail gets narrower near the top and 2. the almost unavoidable twist which allows the peak to go along very lightly loaded. So, for ocean cruising, I feel it pays to keep the rig low, perhaps using short gaffs, or wide head boards and battens or some other device for getting the sail wider at the top of a short mast.

While we are on the subject of rigs, I want to tell you about one good quality of a big ketch I once owned named *PANDORA*. She was the quietest boat in a seaway I have ever been aboard. I've been aboard several boats that banged their gear about dreadfully if the wind was light and there was sea enough to rock the boat, *PANDORA'S* masts were raked to quite an extra-ordinary angle, Chesapeak Bay fashion, and the weight of the booms tending to swing amidships was enough generally to prevent the irritating bangs that usually occur under the circumstances, yet did not adversely affect the light weather sailing qualities of the boat noticeably. I don't generally sleep very well on a sail boat under way, but *PANDORA* was the best I've met in this respect.

Quite a lot of your correspondence is about motion in a seaway and the requirements for a comfortable motion. This is a complicated problem, and I don't think you have been precise enough in stating the various aspects of the problem.

What weather conditions generally cause uncomfortable motion ? No wind : lumpy sea and storm conditions with consequent seas are doubtless the most demanding conditions. What motions are objectionable ? Pitching and rolling are the only ones of consequence and rolling is generally the worst.

If there is any wind at all, a large sail plan will quieten the motion much more effectively than a small one, especially going to windward, when the apparent wind is stronger. If the sails can draw, the more sail the better.

If there is no wind at all, or it is too light to keep the sails drawing, the problem has more variables. The conventional round bilge boat is seriously under-damped in the roll axis, especially if the ballast is

low and the boat heavy. The amount of energy in the roll is too great to be controlled by the sails acting as dampers. Herreshoff says that the only way to ease the roll is to reduce the stability, and thus the sail carrying power. Reducing beam accomplishes this and of course improves the boat in other ways.

I think that quick rolling is the effect to be avoided, especially if the centre of rotation is low and the boat appears to be pushing and pulling you sideways some distance with each roll in addition to the rotation. This is what makes me hold on for dear life and wish I were somewhere else. If the centre of rotation were only higher, and I could go and sit at it, or below it, I'm sure it would be relatively comfortable. It would be similar to a swing where the acceleration appears to be vertical, or nearly so. I don't really know the answer to this problem. Clearly damping is required and lots of it. All I can say is that if a boat is shallow and wide, it will have a quick motion ; if it is heavily ballasted, very low, it will have both a quick motion and a low centre of rotation which I know is distressing. However, a narrow boat without too much ballast and with whatever flat surfaces and other damping effects can otherwise be worked in is what appears to be best at present knowledge. I strongly suspect that a hard chined boat is better in this respect than an equivalent round bilge boat.

In a storm, when it is impossible to set any sail or to stay on deck and tend it if you could, a condition exists which requires reasonable motion, and whatever safety is possible. The problem is that of the large breaking wave. No other situation is nearly so dangerous. I believe the safety of the boat is seriously and adversely affected by having a deep keel. If the boat can be pushed very hard without having a sharp upsetting tendency, the chance of survival without major damage is much improved. A keel clearly holds a boat to the lower unbroken waters, while the topsides catch hell from the crest. I have tried several models in model sized seas off our coast and the effect is clearly demonstrable. A shallow draft with the centreboard up or nearly so is noticeably less apt to be upset by a breaking sea.

There is a persistent belief in this country that relatively narrow, shoal draft centreboard boats are more comfortable and safer in a seaway than ballasted keel boats. Commodore Ralph M. Monroe developed a type of modified sharpie that he called *PRESTO* boats, named after the first of the type, built, I think, around 1885. They varied considerably in size, but none of them drew more than about one inch for each foot of L.W.L. with boards up. They had round bilges, flat bottoms, flaring sides. Vincent Gilpin has written a very persuasive little book about these boats called *The Good Little Ship*. I have never sailed in one of these, but everybody I had read or talked

to, who had, was clear about their comfort and apparent safety at sea. They are inside ballasted and are of about the normal displacement for their length and beam.

I am sure you are aware of the beneficial effects of making a boat as large as you can. The relative stability of any particular design increases with length linearly. Also, the roll period is longer due to the increased mass, and moment of inertia. This helps the comfort problem. Also, due to the longer waterline length, the boat is potentially faster. Cost and physical strength are, I suppose, the chief limiting factors.

Balancing these factors to make a good boat or one to fit a certain set of conditions requires considerable persistence. It is essentially an iterative problem in optimisation. The route is : from specifications to assumed hull dimensions, to wetted surface, to sail area for light airs, to stability, drag and windward ability, running speed, and back to the beginning again, altering dimensions (or specifications if necessary), and back through the numbers again. Most of the information to do these numbers is in the A.Y.R.S. books, Marchaj, and Hoerner's *Fluid Dynamic Drag*. The most important missing piece of information that I am aware of is the effect of seas on hull drag, specifically head seas. For the rest, adequate data is available to enable approximate solutions to be obtained.

The exact route through the optimization process of course cannot be specified because of differing requirements for different boats, and each designer doubtless follows his own inclinations on the importance of particular aspects. But except for some important designs, (perhaps the racing 12's) I'm sure this procedure is not widely used. It is a powerful line of reasoning, and deserves some thought.

To summarise this long letter, I believe the best boat for ocean cruising is long, narrow, not too stable, shallow, a large low rig and and as long as you think you can manage. She will go faster in any direction than a fat one (except possibly in a strong wind to windward with no sea, which is not a useful condition for you) and she will have an easier motion.

I like your proposed boat, Peter Tangvald, very much 45 ft. x 40 ft. x 11 ft. 10 in., and I like the rig also, I think that maybe she is a trifle wider than she needs to be. I recommend that thought be given to the sail plan so that if the centre sail is taken in, the remaining sail area is around half the original, and that the original balance be approximately maintained.

Any strong opinions that you have formed from your nautical experience are likely to be nearer right than anything I could recommend. My thoughts are based on nowhere near so much experience

as you have had, but rather on a technical inclination and training, reading extensively, related aerodynamic experimental work, and lots of rumination.

Kindest regards and best of luck.

JOHN H. THOMSON.

16 Juniper Road, Swampscott, Mass., U.S.A.

Peter Tangvald's Comments : This is a very interesting letter and I agree with everything he says but strangely enough, despite my agreement with his theories, I do not reach the same choice of boat as he does. *DIDIKAI* and *MARCO POLO* of almost the same section have both the reputation to be terrific rollers with a sharp snap at the end of the roll, probably due to too much weight-stability and too little form stability. Of course, the advantage of such cross sections on a very narrow beam is to give good headroom. By the way, Wild, the owner of *DIDIKAI*, told me that the designed $2\frac{1}{2}$ tons keel was not giving the boat sufficient stability and he has had to add another ton of inside ballast, thus bringing the total ballast to $3\frac{1}{2}$ tons which in any case, sounds more normal for such a cross section (very steep floors and slack bilges). However, I greatly admire the way Thomson has studied the problem of ease of motion.

John Morwood Comments : We have here the classical yachting theory and practice situation. We all are agreed on the theory of what makes a sea-kindly yacht. L. F. Herreshoff, with two generations of yacht designing of the very top quality behind him, designs such a yacht. But, in order for the yacht to be seakindly, it has to be lightly ballasted and thus heels readily so the owner puts in extra ballast which no doubt is the cause of the motion complained of. This merely goes to show how difficult is the lot of the designer. One feature of sea motion which we have not discussed is the effect of the " rate of encounter " of the seas. Obviously, when the natural frequency of roll corresponds with the " rate of encounter " of the seas, the rolling will be far worse and this can be improved by hoisting a heavy weight up the mast to alter the yacht's roll frequency.

Dear Sir,

My fifty-third A.Y.R.S. publication came today and to show that every word is read, I send you some comments on the difficult question raised by Peter Tangvald on page 18 : what makes a sweet-motioned ship ? Rolling and pitching comprise the motion and we have to take them separately.

For myself—but not perhaps for others—your words on page 34 give a satisfactory general answer to the rolling problem : " the problem . . . is . . . concerned with . . . the Metacentric height."

The pitching problem is more complex and one gets different answers from different people. Some years ago, I visited the Royal Netherlands Ship Design Experimental Tanks at Wageningen and was told they were investigating the pitching of empty tankers when the machinery was situated aft. Captains had been complaining of the excessive pitch as compared with the amidships machinery types. Note that, when loaded, both types behave quite well.

I was asked what I would do to diminish the pitching. Without a moment's thought, I replied, " Flood some of the forward tanks." This is in accordance with your remark on page 20 : "if violence of pitching is a problem, placing the weights more at the ends is a help."

But I was wrong and had fallen into a deliberate trap. I was then shown that ballasting the bow tanks set up a " dynamic moment " tending to increase rather than diminish pitching : and the only way to some improvement was by way of a far less extreme distribution of weight. You can see this " new thinking " in the shorter ballast keels of modern sailing yachts.

Preferring comfort nowadays, I avoid the light displacement, high ballast ratio sailing yachts and curiously enough, when it gets rough, the heavier, less extreme craft do not do so badly.

" Avoid extremes " seems to be the motto for *comfort :* but I admit that does not take the argument very far. I am talking of mono-hulls only, of course.

CDR. G. H. GANDY.

c/o Drummonds Bank, 49, Charing Cross Road, London, S.W.1.

Ed.—Tankers are usually designed to sail with a wave crest amidships and another over the propellors. Thus, they have a much fuller bow, relatively, than a yacht. This gives them different dynamic characteristics. Racing yachts should concentrate weights amidships to " keep the ends lively " but, with overhangs, fore and aft, such a yacht will respond to every reasonably size wave. However, the slope of such waves is usually surprisingly gentle. What one wants to avoid is the development of too much moment in the pitch so that the motion can be stopped more easily. This applied to Commander Gandy's tankers and would also, as he says, apply to yachts. However, if a " period of encounter " of seas should so coincide with a yacht's frequency of pitch, the motion will be especially violent and this could be reduced by putting more weight at the ends of the yacht to reduce the period of the pitching.

SOME TRIALS OF A.Y.R.S. SUGGESTIONS

BY

R. S. SALE

Prior's Hold, Wantage, Berks, England.

Polystyrene Foam "Wood". A small quantity was made experimentally from $\frac{1}{4}$ inch polystyrene and calico, glued with Cascamite. It proved unsatisfactory for the following reasons :—

1. A tendency to warp, for undisclosed reasons.
2. Low tortional rigidity.
3. It was almost impossible to shape or finish the "wood" due to the contrast between the foam and the very hard "grain" of the glued calico.

Nevertheless, it was evident that the material might have applications due to its lightness (about half the weight of cedar) and strength in some directions.

Ed. I made my samples with much thinner polystyrene and used paper for the "grain." There were 12 *laminations to the inch. My samples also tended to warp violently when drying but, if cut into boards and held rigidly, they "seasoned" perfectly. As Mr. Sale says, there is very low tortional rigidity, but this can easily be cured by glueing sheets of paper or cloth to the "boards". I find paper better than cloth. My samples sanded perfectly smooth probably due to the greater number of laminations. The density of my samples when dry is* 11 *lbs. per cubic foot. I have tried but so far failed to get the material manufactured commercially.*

Net Trampoline. Although this has advantages, such a boat is very wet indeed, and could cause excessive crew fatigue (there is more water moving at a higher velocity than in a dinghy !).

Slotted Mast. The problem of the "wingsail" and the Editor's suggestions are very interesting. I have devoted some thought and experiment in this area, but not, however, with the wing sail in mind. The object was to delay the stall characteristic on a broad reach. It appeared that to design slats on the Handley Page principle (extending automatically at a critical incidence) would mean excessive weight and complication. A slat would therefore have to remain open on each tack. This would not necessarily be a disadvantage as it might be possible to design the windward slat to act as a fore flap.

Flow experiments with a model built on this principle showed that the flow could be maintained for another 12° to 15° but the effect was adverse at other angles of incidence i.e., the incidence became *more*, not less critical. Although no definite result could be claimed,

the indications suggested that any solution on these lines would possibly only be good for a fairly narrow range of wind speeds—perhaps these C Class catamarans would need two or three masts for differing conditions.

A limited experiment was also made with a slot, but the results were not encouraging, producing some peculiar reverse flows and this was not pursued.

Catamarans respond very quickly to changes in wind strength and the ability to make rapid and correct adjustments of incidence is most important in order to gain maximum advantage from variations in the apparent wind. Sheeting and other gear must, for practical purposes, be kept simple and efficient and possibly this aspect of high speed sailing craft is worth more attention and research.

THE "QUARTERMASTER" GEAR

BY

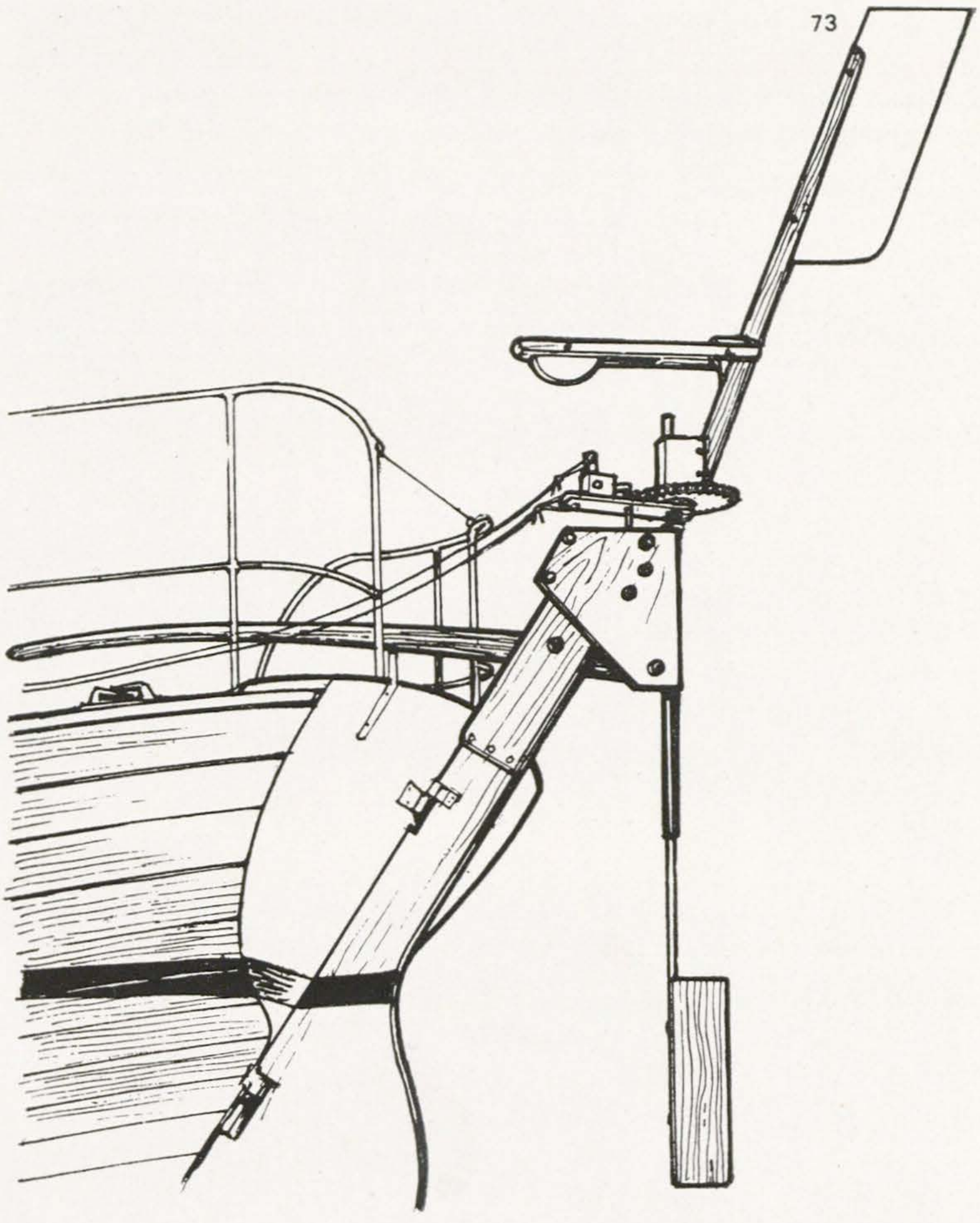
H. K. WILKES

Firlawn, Dene Close, Chilworth, Southampton.

When I designed the "Quartermaster"* self-steering gear for my *FOLKBOAT* I set out to produce one which would be efficient, but which would not require any modifications to the yacht, which could be easily removed for racing, and could readily be fitted again, either at moorings or even under way, when required.

Initial trials in 1965 using various "feed-back" linkages, though theoretically sound, were disappointing. Eventually I finished up with a very simple arrangement which works most satisfactorily in all conditions, is easy to fix and operate, and is relatively inexpensive. The gear works on the trim-tab principle, the wind vane being directly linked to the trim tab. Turning the trim tab causes the water flow to exert a lateral pressure on the tab, which being directly mounted on the rudder stock, moves the rudder. Setting the wind vane to the wind for the course required, or alteration of course or tack is made by operating from the cockpit a light lanyard attached to a latch engaging notches in a dial on the wind vane staff. The secret of holding a steady course on any point of sailing is the use of light shock cord on the tiller, and (in a following wind) in using loose tiller lines to limit the swing of the tiller. Practice is required to obtain optimum results.

The gear steers a remarkable windward course. Trials in 1965 with recording instruments showed that the "Quartermaster" brought the yacht better to windward than I could, steering manually. On the 1966 Round the Isle of Wight Race we set the "Quartermaster" and



crossed the starting line exactly ten minutes behind the main fleet of over 300 yachts. The first 13 miles to the Needles was a long-and-short tack beat in force 3-4. Except to tack, neither the gear nor tiller was touched. At the Needles buoy we hove to and counted 22 boats, including six *FOLKBOATS*, rounding behind us. On several occasions we had had to bear away to give room to a yacht sagging down to leeward and it was clear that the " Quartermaster " scored by pointing up better and sailing at a smaller angle of heel.

Any efficient gear shows to best advantage when sailing on the wind. With the wind aft, some yawing must be expected since the

gear reacts to the apparent wind. Few realise how much a change in the speed of the true wind, even when constant in direction, alters the direction of the apparent wind. Yawing so caused may be appreciable in sheltered waters, but is seldom a problem in the open sea.

Anyone who has used one will agree that an efficient gear, even for day-sailing, adds greatly to the pleasure, and the benefits are still more marked when passage-making. Single-handed or short-handed cruising is infinitely easier, and sail changing, including setting a spinnaker, presents no problem. We shall see many more boats with self-steering as time goes by.

* manufactured by Bingley Son & Follit Ltd., Minerva Road, N.W.10.

Dear Sir,

It may interest you to know that I was the builder and owner of the famous yacht on the Thames, The *GUILDFORD BELLE* Mississippi Sternwheel Steam Yacht, that has been on television, in film, newspapers, etc., here and abroad. I don't have it now as for the time being I have turned my interest into a 6-ton sloop, and am fitting and planning for an extended single-handed cruise to the West Indies and cruising the Out Islands of the Bahamas. Later I plan to design and build a seagoing 48 foot model of the *P.S. SIRIUS*, the first steamer (paddler) to cross the Atlantic under sustained power.

I only give this information as you may have members with similar interest with whom I could correspond, or swop knowledge.

Thanking you,

Yours sincerely,

F. C. MITCHELL.

61 West Street, Dorking, Surrey.

Dear Sir,

The A.Y.R.S. publications always contain choice items for digesting.

The No. 53 issue proved no exception. Your running commentary with Peter Tangvald made very interesting reading. So much so that I've enclosed, for interest sake, a profile of a recent effort for a local client who intends to build soon.

He was very definite in his wants . . . including headroom throughout below decks for his 6 ft. 3 in. frame.

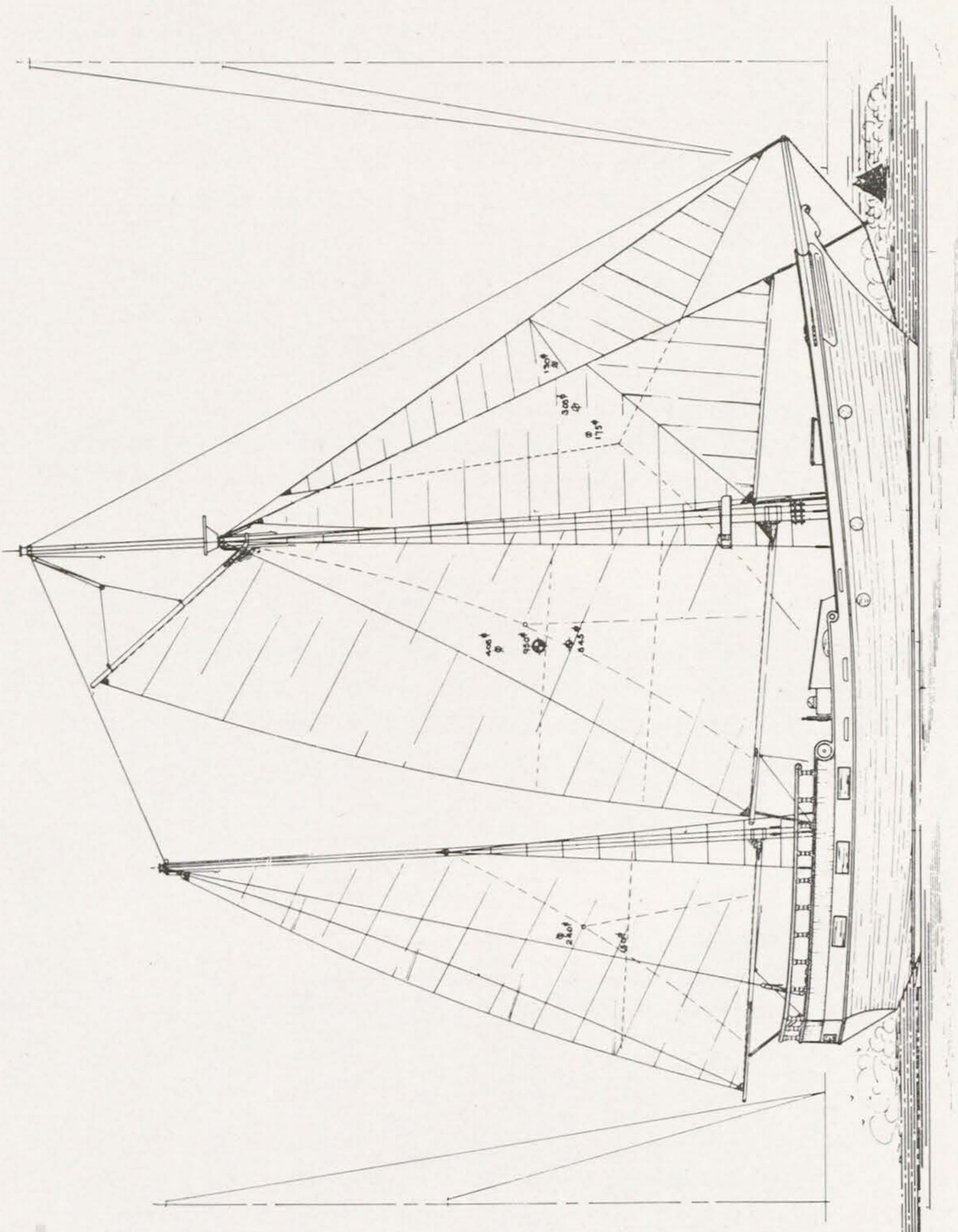
Multi-hulls intrigue me. I'm sufficiently convinced of their merits that should I ever become fortunate enough to own an ocean

cruiser a multi-hull it will be. Cat or Tri I have not decided.

Best regards.

RALPH C-GODSON.

Members of Society of Small Craft Designers
6520 Leibley Avenue
Burnaby 1,
British Columbia, Canada.



THE DOWNHEARTED BOAT-BUILDER.

This poem is dedicated to all amateur trimaran builders but especially to John Norton, for whose encouragement it was written.

There's a broken-hearted Norton to the West of Hythe, in Kent.
His spirit's nearly fractured and his soul is badly bent,
For he's making of a trimaran only thirty pedes long
But his eye has lost its lustre and his lips have lost their song.

. . . .

He blames it all on Morwood, the A.Y.R.S. and all that lot.
He says we shouldn't do it. He says we should be shot.
" But trimarans are efficient—the shape of yachts to be.
" So when I read about them, I said ' that's the yacht for me '."

. . . .

He was misled by Piver, out in the U.S.A.
Who could knock the things together—in two months, did he say ?
But the details were so fiddly and the " Styling " took so long,
And he thought so much about it that three years now have gone.

. . . .

In his shed, she looks near finished. Her skin is on ; and true.
She's pretty but unpainted, with spots of blood-red glue.
But there's lots of little panels and ports and lockers still
To cut and fit and offer and little seams to fill.

. . . .

The dreams of tropic waters and skies so ever blue
Are fading from his vision and almost lost to view.
He drags himself to joiner with laxidaisy mien
And tries to work so swiftly but no result is seen.

. . . .

But when he turns the corner and gets her painted white,
His spirits will assemble and he'll quite forget his blight.
He'll think of Ocean Crossings and Trade Winds blowing free.
Skin diving will absorb him and he'll take his curse off me.

JOHN MORWOOD, 9th May, 1966.

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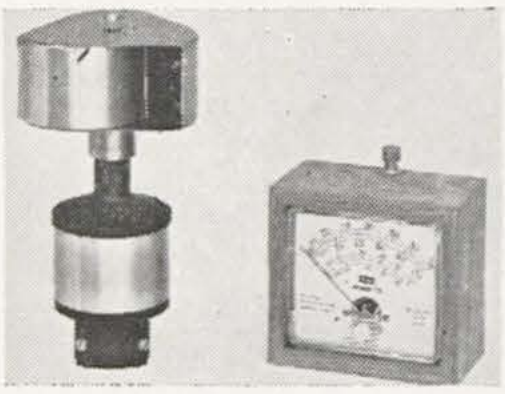
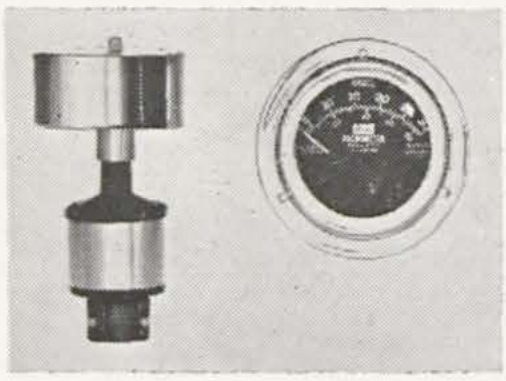


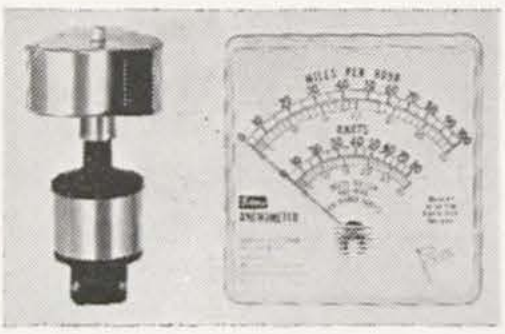
MODEL RK $65.00

Ranges 0-35 and 0-100 miles per hour and 0-30 and 0-80 knots. For Yacht, home, or office. Install sender in any outdoor location and read meter in cabin, home, or office. Meter supplied in teak case. Deduct $5 if case is not required. Meter is not waterproof.



MODEL R-4 $80.00

Ranges 0-30 and 0-80 knots. Meter is waterproof and may be mounted in cockpit. Meter supplied with 12 volt lamp and chrome mounting ring. Requires 3-5/16″ mounting hole. Know your wind velocity as you sail. A valuable aid for obtaining maximum boat performance.



MODEL R-7 $80.00

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