ISSN 0144 - 1396

AYRS 100

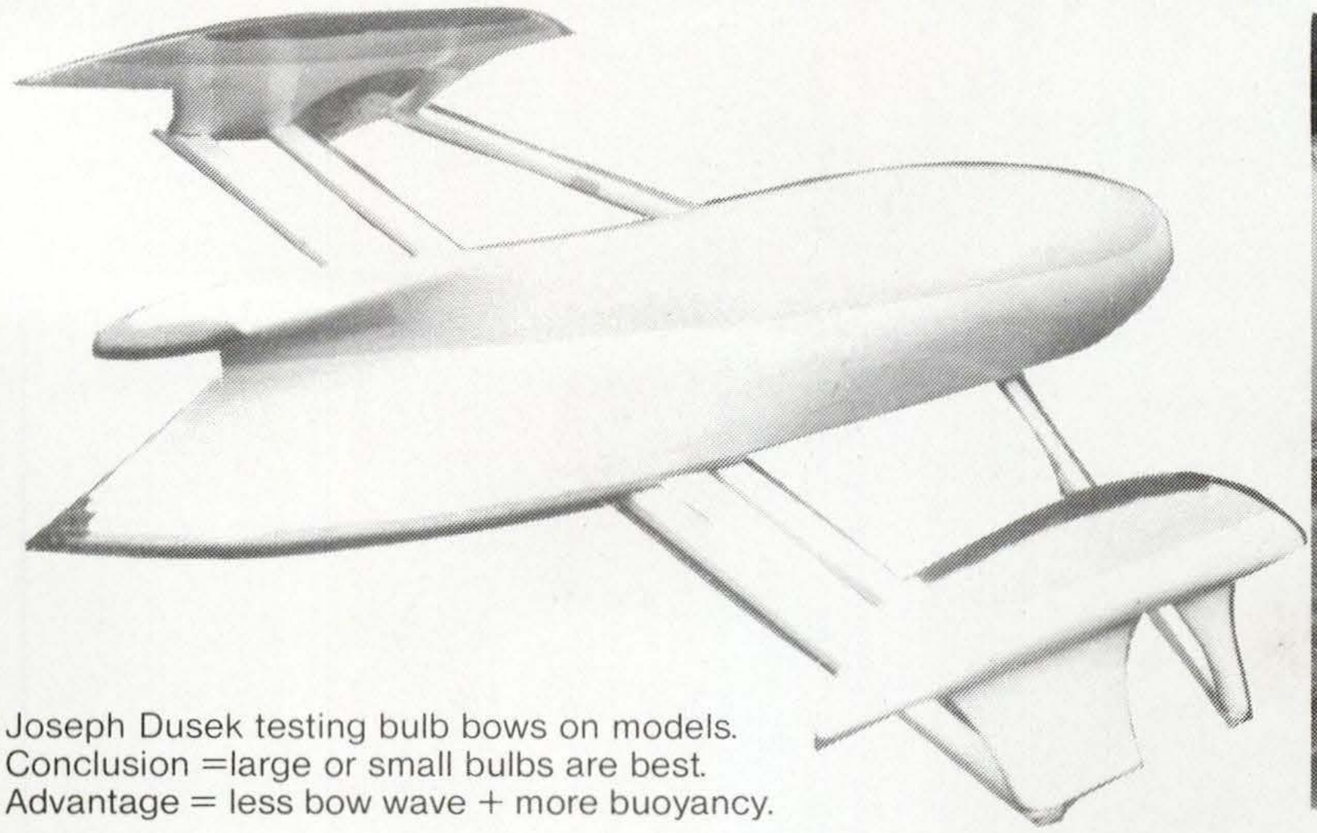
DECEMBER 1984

EFFICIENT PERFORMANCE

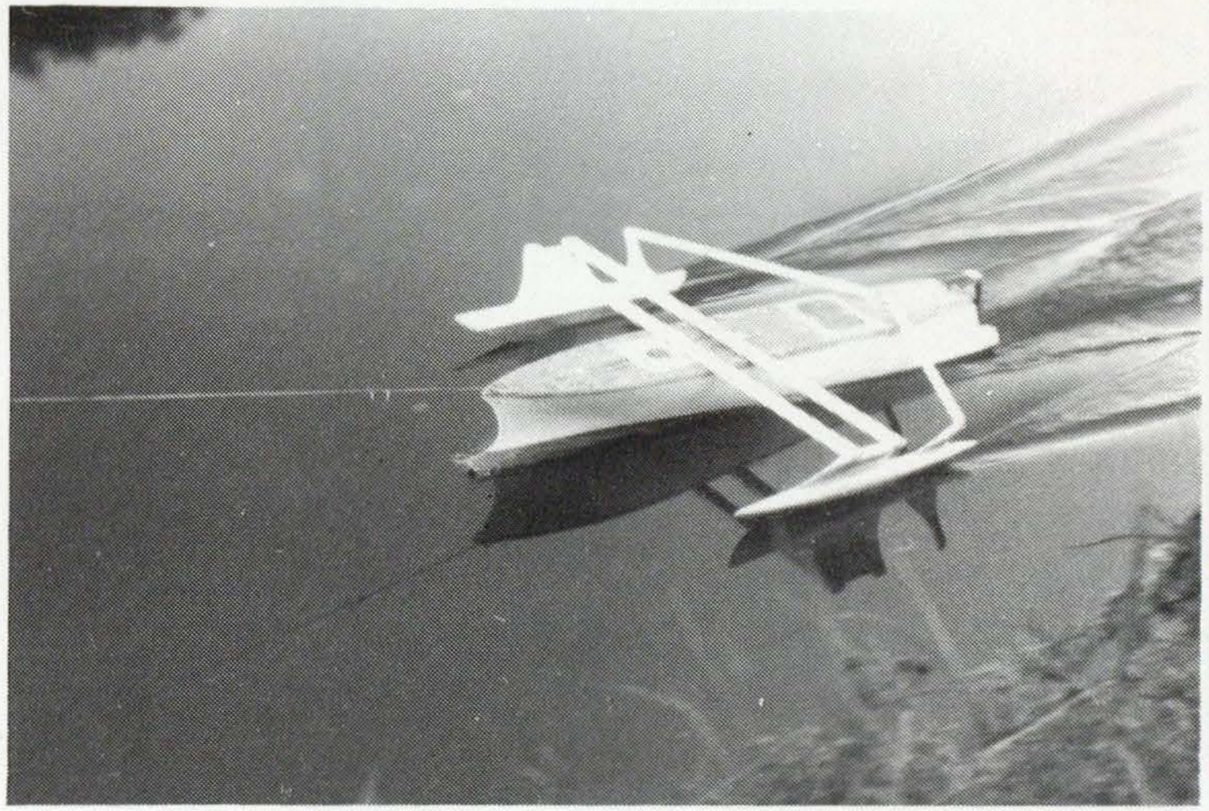
Theo Schmidt

Photo by Norman Champ

CONTENTS



Joseph Dusek testing bulb bows on models.
Conclusion =large or small bulbs are best.
Advantage = less bow wave + more buoyancy.



THE AMATEUR YACHT RESEARCH SOCIETY

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

President:
HIS ROYAL HIGHNESS
THE PRINCE PHILIP, DUKE OF EDINBURGH,
K.G., P.C., K.T., G.B.E., F.R.S.

Vice Presidents:
Austin Farrar, F.R.I.N.A.
Beecher Moore

Founder and Consultant Editor: **Dr. John Morwood**

Committee

Chairman : Sir Reginald Bennett V.R.D.
Vice Chairman : Shaun M. Coleman Malden
Hon. Secretary : Jane E. Ellison
Hon. Treasurer : Graeme W. Ward

Fred C. Ball, Michael Butterfield, Norman Champ
Tom Herbert, Andre Kanssen, Mrs Pat Morwood.

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

The Society has members in all countries of the world where sailing is a sport. Information for publication comes from members and people interested in sailing or building yachts. Funds come from members subscriptions, from the sale of books and from donations. The subscription for the present year is £ 12.50 or $ 20.00 U.S.A. . New ideas or details of problems are welcome. We try to pass these on to avoid duplication of research and to put people with similar interests in touch with each other.

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

Editors Notes by Michael Ellison

Number 100 at last but you have also had eleven of the 'Airs' series, two editions of 'Cruising Catamarans' and three editions and numerous reprints of number 13, the original 'Self Steering' publication of 1957.

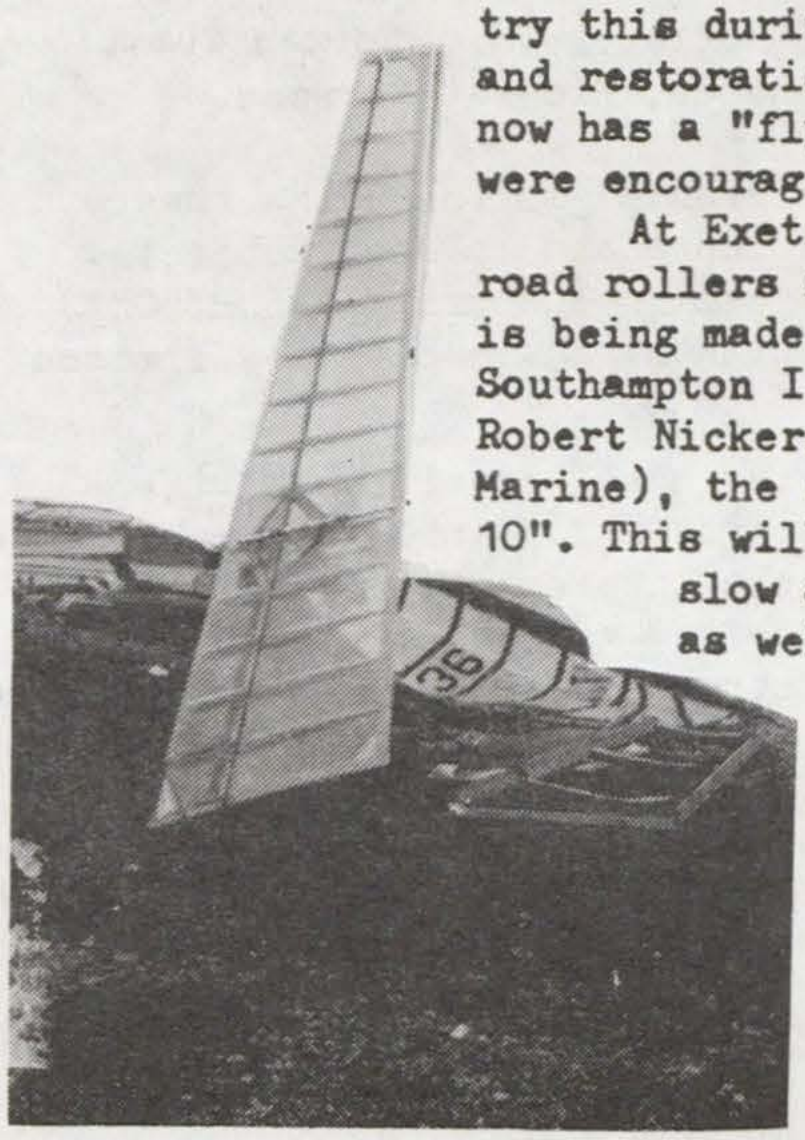
The number on 'Multihull Safety' is not "dead" but it is taking the member much longer than expected to complete the work involved. Steady progress is being made and we hope that book shops and libraries will stock it so that our work and objectives can again be visible to the yachting public most of whom have never heard of us even if they have walked past our show stands and use a wind vane self steering gear.

This number has been typed by me using two fingers so that the spelling and mistakes are mine and copyright. Our need for better equipment and more funds are as great as ever. 1985 will bring changes as I have moved house and am looking for a base for the Society.

Reg Frank in his article notes that we need drag figures for our yachts. I understand that in the 1930's these were provided by the builder - perhaps measured on sea trials before the owner accepted his new yacht ? It should be easy to tow yachts at a range of speeds measuring the load on a spring balance. For heavy loads a pully would half the weight or a larger tackle could be used. I did hope to try this during 1984 but "Sabu" was wrecked and restoration is not quite complete. She now has a "flying gaff" rig, first sea trials were encouraging. Full report in a future issue.

At Exeter we were reminded that "only road rollers nead weight" and great progress is being made with light strong yachts. At Southampton I found that Westerly are to build Robert Nickerson's "Panic" design (Ref RJN Marine), the class will be called "Storm Force 10". This will make a lot of multihulls look slow as cruising yachts if they sail as well as the prototype.

There seems to be an increase in the amount of research needed. Old ideas can now be practical due to new materials. How about a simple instrument like an off course alarm which should be sold with every self steering gear ?



Rigid aerofoil sail for sailboard with handle flush on windward side. Simon Sanderson brought it to Portland 1984.

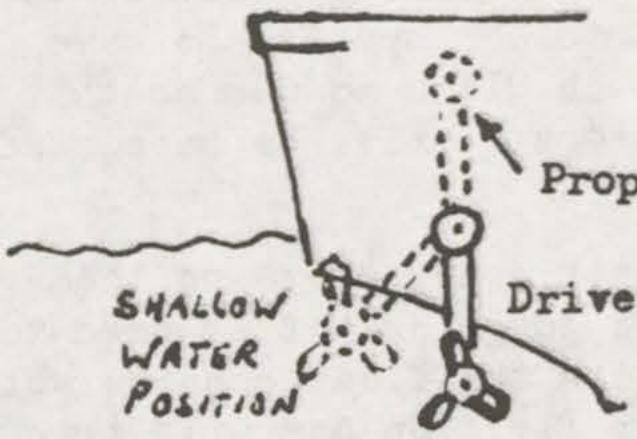
Southampton Boat Show 1984

The 1984 Show was wet. We again had a stand in the dinghy arena. This year the show was extended from September 14th to 22nd which gave more days for people to look round and consider new yachts or to visit used craft advertised by various brokers and moored locally for inspection. This is a "boat" show, equipment and services are displayed but not on the scale of the London show and interest in the Society has never come near to the London level. Perhaps due to having a prime position near a main footpath we had our best ever result from a Southampton show with new members and considerable interest at times.

New Outdrive Unit For me the most interesting new idea on show was an engine/outdrive unit shown by E.F. Roberts whose ARC Drive Products of Waterside, Little Shurdington, Cheltenham. The unit was shown and for sale as a complete package with a 'fibre-glass' dinghy and 3h.p. four stroke petrol engine priced at £ 640.

The engine is mounted amidships under a seat and can be quickly lifted out of the boat by removing a pin. Drive to the transome is by a double shaft - the inner one drives the propellor and the outer steers the boat by turning (steering) the outdrive leg which can rotate through 360 degrees to give side thrust or reverse as required. By lifting a catch the outdrive 'leg' can be lifted from the transome to clear weed, run ashore or sail. On larger units now being developed for cruisers the engine can be mounted low down amidships but there need be no propellor drag when sailing and the unit can be lifted to clear a foul up. As the unit can drive in any direction it could be mounted on the side of a hull or through a well in the hull.

Plywood Butt Joint Against our stand Chippendale Craft Ltd. of Norwich showed a rowing skiff available as a kit. It was notable it had an excellent clear finish to the wood inside but very few people, even "experts" noticed that the plywood 'planks' were butt jointed without any doublers. Using epoxy and one layer of tape (not countersunk) there was no sign at all of a join when looking along the side of the hull or rubbing with a finger. Construction uses the 'West' system. The boat 4.65m (15'3") beam is 0.9m (2'11") weight about 25kg (55lbs). As a stage 1 kit the cost is £ 265 or complete boat £ 680 ex works including tax.



Twin Drive Cruiser showing
180 degree side swing of leg.

Smoother Sailing by Bernard Rhodes

One of Prof. Sodde's laws states that whenever you want to sail to Auckland the wind will be in the S.W. "Ten to fifteen" the radio D.J. smoothly announces; but we know better. By the time we float off at 1300 it's a steady 20 gusting 25, and every wave has a white cap.

Klis 11 was just a bit small for plugging 15 miles into that lot - she could do it but the crew were left a bit shattered by the ordeal - until, that is, Denny Reid and I put our heads together on the problem.

SHOCK ABSORBERS

The criterion for our sort of cruising is that hot cups of tea must be feasible without too much strain in the galley.

No tea and life is hard indeed! So, how to smooth out the motion of a little boat, and thus make her like a "big boat" in a seaway ? The inverted T - foils as fitted to Duet cats have proved dramatically successful in damping out pitching and also in reducing nose diving on a reach.

We fitted a T - foil to KLIS's rudder with epoxy fillets and glass tape (marvellous stuff). Proof that it worked was that we had to fix the rudder so that it would not slam up and down on its pintles in a head sea, and the motion was much easier. Denny likes to take a scientific approach and designed the foil to have the optimum shape, aspect ratio and hydrofoil profile. But still the kettle didn't always stay put on the stove. Many yachties would just add fiddles to restrain the kettle, but Denny gets seasick.

L SHAPED FOILS

The Mark 111 KLIS has her daggerboards in the floats angled in at the bottom to counteract rolling - how can we achieve the same effect using the existing vertical cases on KLIS 11 ? Some more putting together produced our L - shaped boards, which are arguably an improvement over the sloping ones, and will form part of the development of KLIS 1V.

Again, the engineering of the angle in the boards which I would have rubbished as impossible, presented little trouble to Denny, who went into a corner with his micro-computer. He came back a couple of hours later with how much glass to use so that the entire weight of the boat could (theoretically) be supported on the tip of one foil.

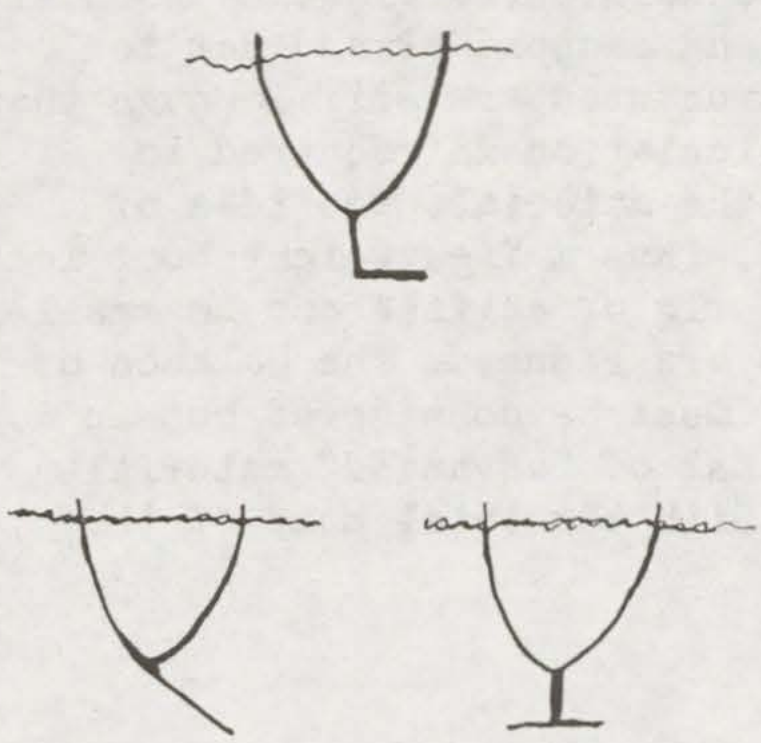
The foils are fantastic !! The kettle now stays on the stove and pouring out the tea is not the juggling act it used to be; with the wind free, the lee foil lifts the float considerably, reducing its drag and really letting her fly. On one wild trip

to Auckland, Denny did in a nor'easter (Prof. Sodde was on holiday), he found it beneficial to leave the windward board full down. When reaching, it "hooks into" the water at times when the lee float encounters a trough and stedies out the motion even more.

To windward we found ourselves driving KLIS considerably harder in comfort, to the point where the mast started making horrible "S" shapes. We now rig an inner forestay and a mast head backstay when reefed down.

The most exciting aspect, which we have recently discovered, is that the up and down motion of the foils relative to the water flow actually produces a forward thrust, somewhat like a whale's flukes. Denny has done calculations which show that the bigger the head sea, the more power is available to push through it ! Perhaps that answers the query of a keeler sailor in the local boating club after a race in light winds and a bit of a slop : "How the... do you guys manage to sail straight into the wind ?!" And of course, less pitching and rolling means a smoother air flow over the rig, which has to be good.

Just how do you measure ease of motion or seakindliness ? Whether or not it makes a particular person seasick would seem to depend as much on the state of mind, how much drunk the night before, sexual satisfaction...etc, as on the boat. To do it scientifically would need something like a three dimensional load-cell dynometer interfaced with a digital read-out LCD log, windspeed, heading, sea state (?) indicator, all hitched up to a computer with print-out. Loosely translated, this means time and money. So I reckon if we can stand a mug of tea on the galley-top without it sliding across and capsising over the fiddle, that's good enough.



The Angled L Tea factor

MULTIHULLS - A British View.

MOCRA/AYRS Multihull Symposium Exeter 17th November 84.

One hundred and thirty people attended a full day symposium at Exeter Maritime Museum on Saturday 17th November, the meeting was organised by David Millner helped by Heather Heard

The Speakers by program were:-

Peter Phillips on Multihull Racing. 23 Quarry Park Rd., Exeter, Devon.

Tom Lack on Cruising. Tom Lack Catamarans Ltd., The Quay, Christchurch, Dorset.

Dick Trafford on Cruising in the Mediterranean. 1 Mount Howe, Topsham, Exeter.

Michael Ellison on Speed Sailing and Multihull Safety.(AYRS)

Chris Knox-Johnson on Multihull Insurance. Knox-Johnston Insurance Brokers Ltd., 14 Fenchurch Ave., London EC3.

Pat Boyd on Secondhand Multihulls. Patrick Boyd Multihulls, Inholms Farm, Horley, Surrey.

Don Wood Film of 1984 'Round The Island Race' and Recovery of "Colt Cars G.B." 91 Heath Road, Weybridge, Surrey.

Stuart Fisher on Cruising Boat Design & Seaworthiness M.O.C.R.A. Hon. Editor, 157 Sackville Rd., Hove, Sussex.

Chris Knox-Johnson was to cover the problems of insuring trimarans because of the record of accidents in the top racing boats. He could not attend due to his son having an accident on the previous day. He is trying to establish sensible rates for both racing and cruising multihulls, perhaps by a degree of self underwriting.

Paul Rudling of S.P.S. (Structural Polymer Systems Ltd) of Cowes, Isle of Wight. PO31 7EU gave the first paper on the uses and working of advanced technological materials in production line and home boat building.

Paul spoke about F.R.P. (Fibre Reinforced Plastic) composites including combinations of polyester and chopped strand mat to carbon epoxy composites. If these structures are stiff enough they will be strong enough so detailed calculation is required to establish the required thickness of the material. The idea of adding a bit more for safety is past. Thus a lightweight boat is produced which is easily driven. The rig or engines can be smaller and less expensive and running costs are reduced. The balance of this against increased material cost must be considered but in production boats the proportionate cost of "advanced" materials required can be small in comparison with the total cost of the boat.

The wrong blend of materials can eliminate potential advantages so the correct mix for tensile, compressive and impact strength is required. The materials must also be resistant to fatigue and weathering in a marine environment. "Advanced" materials include composites of R + S glass, aramid (known commercially as Kevlar) and carbon fibres encapsulated in an epoxy resin matrix. Epoxy systems have many advantages but increase the cost. In certain circumstances more material thickness is required for strength if epoxy is not used so additional costs must be considered. Carbon fibres have considerable strength but strength is related here with brittleness. Again a composite of of materials gives the best result.

For the production or home boat builder the heat curing of, for example, polyester or epoxy adds significantly to the strength so should be undertaken if possible.

For marine core materials Nomex honeycombs are ideal but if cost does not permit balsa and foam are quite acceptable. Future developments include 'Pre-pregs', fabric impregnated with resin (or resin/hardener mix in the case of epoxies) under controlled conditions. It becomes theoretically possible to lay up a complete hull in a single operation.

"Colt Cars GB" was abandoned in mid-Atlantic by Jeff Houlgrave during the 1984 O.S.T.A.R. after rig failure and with a holed hull. Don Wood described his negotiations to buy the trimarn (unseen) after she had been lifted onto a German freighter. He showed a video of her delivery to him in the English Channel as she was lowered from the cargo ship on passage back to Germany. A team of divers and a tow boat brought her ashore and she has now been refitted with her original mast. There was further film of her tuning up under her new name "Red Star, Night Star". She has been fitted with an escape hatch and some bright paint.

Peter Phillips talked about his 1984 O.S.T.A.R. race and enthused about the young willing workforce who built "Travacrest Seaway" (999 -cover of AYRS leaflet) and who keenly race her when the opportunity arises. He told how in the early hours of OSTAR he found the yacht slowing down and then discovered the escape hatch had come open. Apart from the delay while he pumped the boat dry there was a problem with the Travacrest navigation system which was partly immersed. However he dried off the relevant socket and the set has travelled thousands of miles since without problem. Peter has his own views on multihull insurance and regretted not having the opportunity to discuss this with Chris Knox-Johnston.

Peter went on to show slides taken in Quebec at the start of the Transat Tag race to St Malo which he felt was the best organised race he had ever been involved in. The dock area was once unsightly like Plymouth but Quebec had made a wonderful job of creating a place to hold prestigous events by utilising the labour of temporarily unemployed young people. Security was kept by giving each skipper and crew member a plastic disc to wear at

all times until the end of the race with a different colour for skippers, crew and support teams all marked with name and name of yacht so that positive identity checks were always possible.

The Phillips team have started, against another tight deadline, a new 80' Shuttleworth catamaran which he hopes to race next year if he can find a major sponsor.

During the lunch break participants had the oppertunity to see some of the exhibits of the Exeter Maritime Museum including "Cheers" and a number of native Pacific multihulls. The museum won an award last year for being one of the best three museums in the world. Also Theo Schmidt pedalled his ingenious bicycle around the canal basin demonstrating his efficient propeller.

After lunch Dick Trafford, one time Bobcat sailor and recently Rear Commodore of the Royal Cruising Club, gave an illustrated talk on cruising in the Mediterranean, focusing mostly on the once deserted coast of Turkey. His slides showed wonderful views of the idyllic coastline of Turkey, enticing us from a cold November day to catch the first charter boat to warmer climes.

Stuart Fisher is secreatary of the Iroquois owners association. He spoke of his ideas for a fast cruising catamaran and Rod McAlpine-Downie is drawing up a 35' yacht to his ideas. Stewart hopes to form a group with others so that five or more yachts can be built to spread the cost of making moulds and to gain the advantages of production run price for sails and rig.

Don Wood took line honours in the Round the Island race with his Kelsall racing catamarn "Source" in the multihull 'A' division complete with a T.V. camera crew on board. There were 1,200 yachts in the race so the film proved most interesting.

Tom Lack Catamarans Limited make the famous Catalacs, they have sold over 600 family cruising catamarans over 25 years. Tom believes in sale by non-salesmanship, the boat if right will sell itself. It is sailing wives who choose the Catalac designs which are not the fastest but do offer family comfort, spaciousness and value for money which is not often matched. Tom believes strongly in after sales service. He declared his main interest as people, and not boats. He gave a few hints on compatibility of crew as well as urging us to take great care of sailing wives and girl friends.

The secondhand multihull market was the subject of Pat Boyd who gave an entertaining talk interspersed with very sound advice for people who wish to sell. A boat should be maintained and presented in good condition which regretably many are not. Also the boat should be conveniently situated so that it can be easily inspected. He advised a small colour photograph be given with full sale particulars, including a note of items of equipment

not functioning. He added some amusing anecdotes of his experiences which kept his topic lighthearted.

Michael Ellison described developments in 'speed sailing' seen at Portland and some comments on multihull safety led to final question time.

Safety was high on the list of questions and included Bill Bailey's comment that for U.K. waters his first choice of safety equipment is a survival suit. Mike Butterfield stated that even away from daylight and sea air the rubber seals at hands and neck of these suits perish within two years. Regular maintenance is required. He also felt that cheap survival suits were cold to be in. Michael Ellison reminded the meeting of the need to have a suit which a person can get into without help. On the question of cold he stated that the board sailors at the Portland speed week became extremely stupid after 20 minutes in the water and could no longer conform with the requirements of timekeeping. He assumed that multihull sailors would also become stupid after 20 minutes in the cold water and act accordingly. Moving on to the subject of man overboard, Mike Butterfield had undertaken trials with a net, weighed down with a pole and hung from an aft crossbeam to pick up a person from the water. The yacht can maintain steerage way and the person is recovered in the net. There is a risk of the person being hit against the underside of the boat by waves while being dragged through the water but the yacht does not have to stop near the casualty. Still on the subject of safety another participant reported that he had purchased from America and fitted but not tried a parachute sea anchor, unfortunately (or fortunately) no-one else present had any experience of one. Geoff Hales reported his trials of a Tinker Tramp inflatable dinghy with canopy as an alternative form of "liferaft". His comments were encouraging, particularly as it did not seem prone to capsize. Peter Phillips is also to assess one having spent a miserable few hours capsizing in a conventional liferaft in 1980.

Keith Bennett, catamaran builder from South Hill, Bryher, Isles of Scilly described his interest in powered catamarans, many of which in sizes from about 16' to 30' are used in the shallow water around the islands, and the larger ones in the rough Atlantic swell around the group. He was able to answer a question about one of his very practical sailing cruising boats which had been seen in Gibraltar during August.

The meeting was brought to a close by its organiser David Millner. This was the second symposium David has organised the first being in March at Starcross Yacht Club where yachting activities are documented from 14th August 1775 making it the oldest in the U.K. South West England now has a winter multihull meeting program and David encouraged members from other areas to establish their own local groups.

Book Review by R.M.Ellison.

FASTER FASTER by David Pelly (Macmillan) ISBN 0 333 322703 £ 9.95

This is a book about speed under sail. Half is devoted to the recent world sailing speed records and the event at Portland.

David Pelly has written a very readable account which people involved with the event have enjoyed and agree that it is useful to have an account written by a journalist who has been involved with the event from the start.

A lot of historical research went into the first half of the book covering a subject which has interested me from the time I learnt to read. Lots of interesting facts but sadly a few errors lead me to question their reliability. These are the open boat which challenged the schooner "America" to a race used a dipping lug and not a standing lug as mentioned. These were reputed to be the fastest craft in our waters being developed for rescue and salvage work off the Suffolk coast. The first 'Round Britain' 'two crew' race was 1966 not 1967. There is mention of sail thrust being half way up the mast but due to sail shape and twist it is lower than a third on most craft.

The AYRS gets no credit for pioneering and encouraging the development of multihulls or for our October Weir Wood sailing meetings from which members transferred directly to Portland when the classes for smaller sail areas were introduced. Our 285 page book "Sailing Hydrofoils" was published in 1970 and had almost sold out by the second Portland Speed Week. The conclusion "kite yachts and hydrofoils have come to fruition largly because of speed week while others such as inclined rigs have yet to do so" must be hurtful to our early contributors. There can be no doubt that development is being encouraged by these events and we are doing all we can to help.

David Pelly being a journalist sees a side of 'Speed Week' unknown to me as one of the observers. He talks of the event going into "decline" and "lowest ebb" in 1982. Each year we have increased the number of timed runs without ever lowering the standard of time keeping. If any run is in doubt it is discarded. Sailboards - professionals or otherwise - who do not have visible numbers do not have "runs" timed. Without a sponsor there is no free telephone or free drink for the press so it may feel like a decline. The purpose of the event is to provide an independent accurate measurement of yacht speeds and to ratify the fastest as records. There has been a constant improvement. The Royal Yachting Association have put huge amounts of effort into the organisation and running of this event always keeping within budget and yet receive no credit for its success.

The book is written in a style that is easy to read and hard to put down. A great deal of work has gone into producing it.

Speed Sailing Events in 1984

Although the establishment of world sailing speed records is not in any way racing the International Yacht Racing Union is the only meeting at which national matters concerned with yachting can be discussed. From the start the I.Y.R.U. had been "informed" of the speed records and agreed that the R.Y.A. should control the records through an international committee.

In 1983 Russian yachtsmen wanted to establish a world record but 'the powers that be' refused to accept the R.Y.A. committee. As a result in November 1983 the I.Y.R.U. accepted the speed record committee but passed the office work and administration back to the R.Y.A.. The Committee now has to pay its own expenses which it will do by a levy on events held to establish records, on people who wish to set records and a charge for ratification of new records. This Committee will approve or appoint official observers for speed record runs.

The Portland Speed Sailing run by the R.Y.A. is now quite apart from the World Sailing Speed Record Committee, it just happens that our Chairman is also Chairman of both of them.

During 1984 events were officially held at Camargue, Sete, Brest and Portland. These events provide the chance for speeds to be accurately measured but they are sponsored and a sponsor needs publicity. This is obtained by providing prizes for the fastest times during the event which becomes a competition.

Portland 1984 was sponsored by Johnnie Walker and they provided the funds to make this the best organised event so far. They were also lucky because the wind came from the 'right' direction at all speeds from light to storm during the event. None of the previous class records were broken but Baroness Jenna De Rosnay became the fastest woman boardsailor. There are also numerous 'fastest national' records claimed by entrants from several countries but all the WSSR Committee can do is to issue a 'certificate' to confirm that a craft was observed at a certain measured speed.

For the first time video cameras recorded all the runs and the time at start and finish, they were set in line with the transit posts on the shore and connected by wire to the time control cabin. It was very interesting to 'play back' the film and find that the time is almost exactly the same as the visual and verbal time recorded by radio as it has been in past years and as used on the circular course afloat. Within 1/100 second.

The new "Jacobs Ladder" failed to better the speed of the previous craft. In part this was due to the flooding of the hull by spray from the foils pouring into the aft cockpit. When this was cured the wind was not strong enough. New inverted 'T' foils have hydraulic incidence control from the aft cockpit. Kite control is from another midship cockpit.

The rules for 1985 do not allow the use of stored power but the Committee will consider electric controls for future years. This would allow radio control and kites could be flown with a single control line saving weiht and windage. Stored power can be used for instruments ir required.

It is interesting to note that "Stalker" a Bruce foil stabilised craft and "Icarus" a flying hydrofil Tornado were dismasted before they reached the limit of stability and capsized. From my experience with "Sabu" (Bruce foils) if both foils are immersed it is hard to imagine a limit to stability, the windward foils pull downwards due to leeway.

Vertical Axis Windmill

Invention & Patent by J. Dusek
p.o. Box 404, Potts Point,
N.S.W., Australia 2011.

Joseph Dusek failed to get "Dalibor" to 'Speed Week' at Portland in October but he came over from France to watch before returning to Sydney via Hawaii. He left us with details of a vertical axis windmill which gains power output from the "blade" (sail ?) when moving to windward being lifted by its airfoil shape and and working a pump. The blades are moved by the drag of the blade being moved downwind on the other side.

The patent reads :- The device consists of windmill mounted on vertical shaft helicopter fashion and unlike similar windmills that produce power by using drag of reclining blades off the wind, the device stated uses aerodynamic force of advancing blades into the wind which flip upwards.

In order that the invention may be better understood and put into practice preferred forms therefore are described by way of example with reference to the diagram. Fig 1 is a view of existing windmills and Fig 2 describes the invention.

The device consists of windmill mounted on hollow vertical shaft (1) helicopter fashion. The windmill operates on principle that exposed area of reclining blades is pushed off the wind while advancing blades into wind rotate 90° and project small front section of the edge of the blade into the wind.

Blades of windmill (2) are attached to the hub (3) of the rotor by hinged bearings (4) which enable blades not only rotate alongtheir horizontal axis 90° but also flip upwards producing additional aerodynamic force which is extracted by means of pneumatic pumps (5) or any other mechanical, electrical or hydraulic systems. The power from systems is transmitted through hollow shaft (1). Plate (6) under the rotor connected by the rods (7) with the blades permits changing rotating angles of blades by moving plate up or down to regulate output of windmill or shut down windmill in high winds or when not in use.

FIG-1

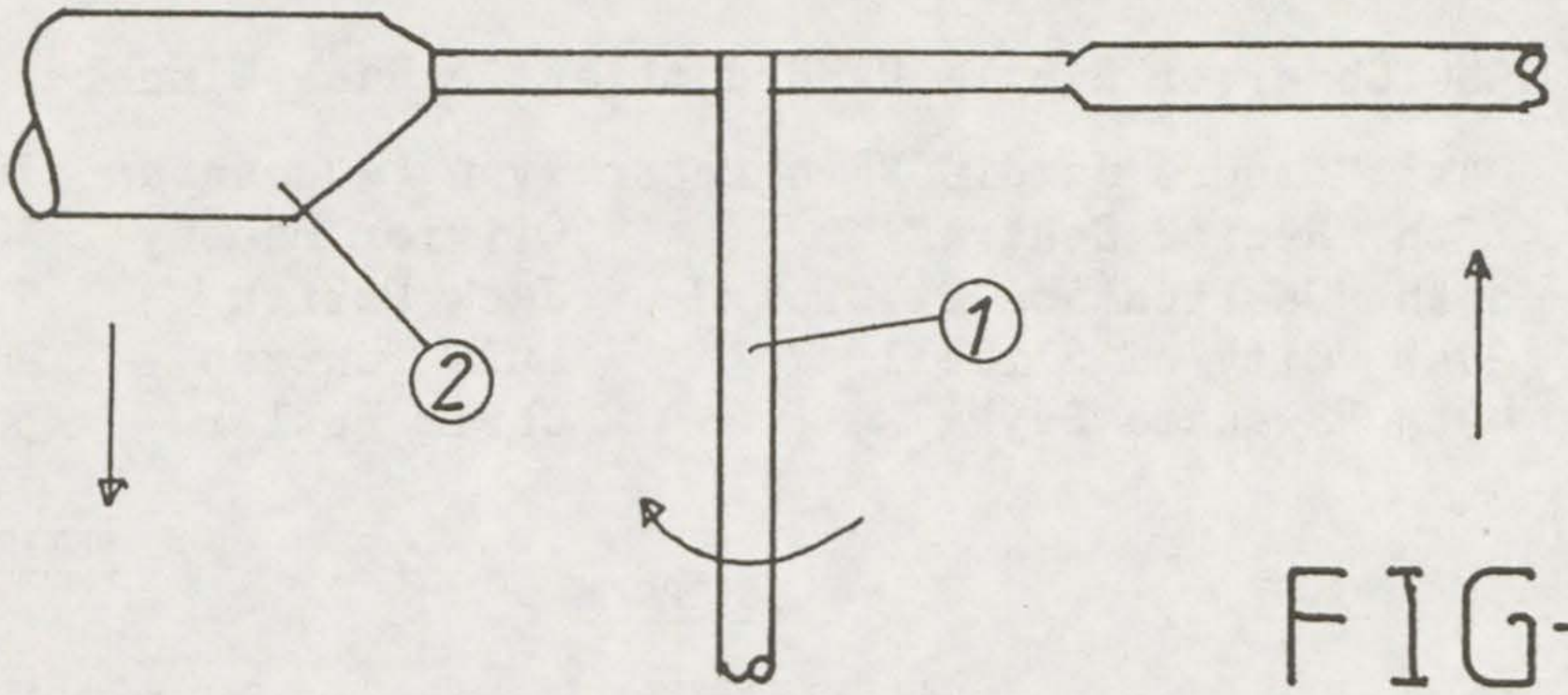
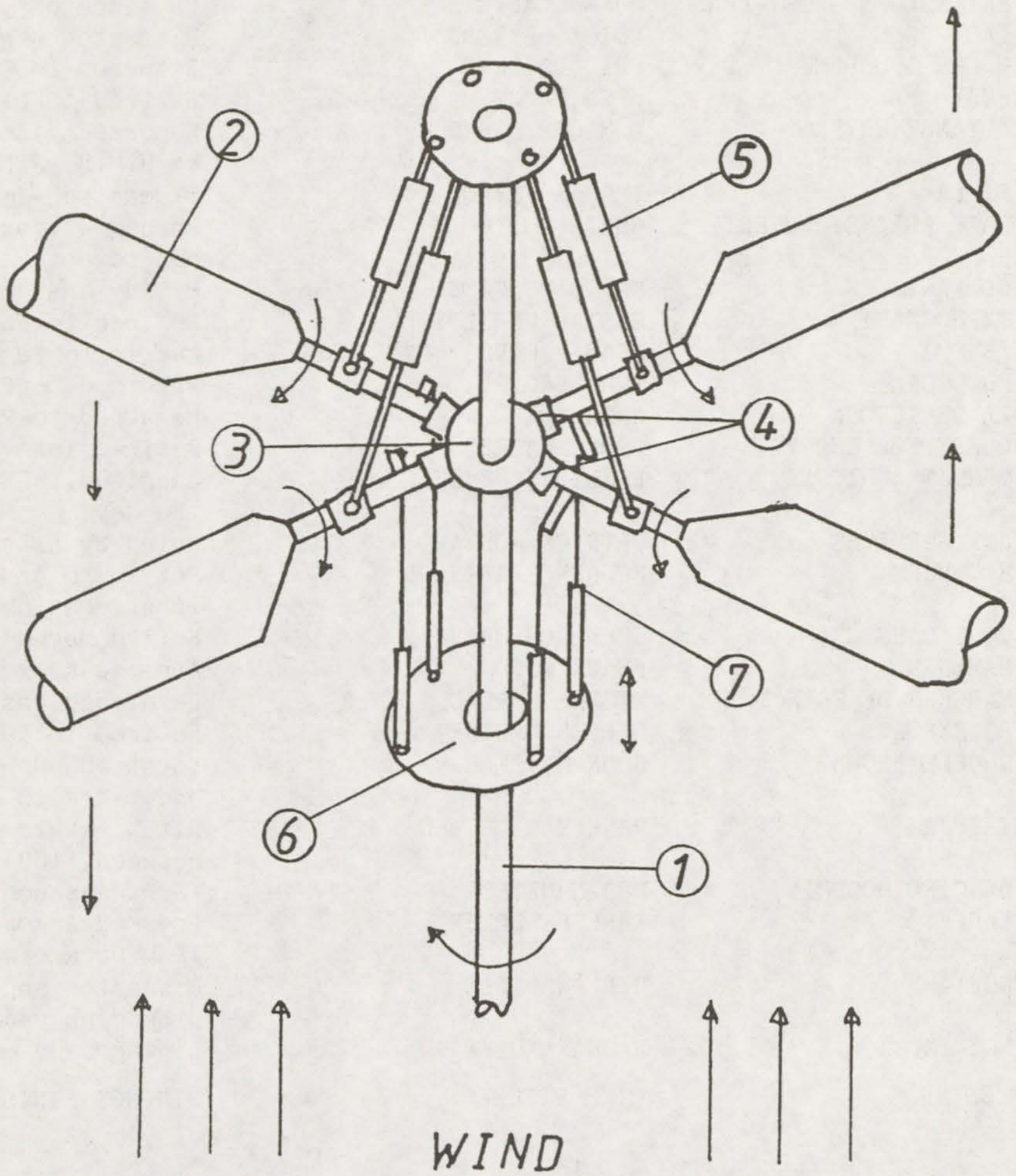


FIG-2



1984 Observer Single Handed Atlantic Race Winners.

Class 1	1st	"Umupro Jardin V"	skipper Yvon Fauconnier	16d06h25m
2	7th	"Region Centre"	Olivier Moussy	16 19 16
3	14th	"Destination St.Croix"	Jack Petith	18 12 31
4	21st	"City of Slidell"	Luis Tonizzo	20 23 40
5	49th	"Swansea Bay"	Chris Butler	30 14 48

DATE	YACHT	SKIPPER	RETIREMENTS &
JUNE			
2nd	REFUGEE	DOUGLAS PARKER	Retired at the star
2nd	BATCHELORS SWEET PEA	JUNE CLARKE	Capsized off Cornis
2nd	LADA POCH	LOICK PEYRON	Dismasted - retired
3rd	ROGER & GALLET	ERIC LOIZEAU	Returned to Plymout
4th	FURY	HUGH McCOY	Retired to Plymouth
5th	ALIANCE KAYPRO	MONIQUE BRAND	Reported dismasted by H.M.S. JERSEY to
5th	RIZLA +	THOMAS VEYRON	Dismasted - made ow
6th	RACE AGAINST POVERTY	CHRIS SMITH	Sprung a leak - pre own power.
6th	GO KART	DAVID DUNCOMBE	Hit by whale - reti
6th	TYPHOON VI	GUSTAV VERSLUYS	Retired to Falmouth
7th	JEREMI V	JEAN-JACQUES VUYLSTEKER	Put in to Perros-Gu
7th	PRODIGAL	BOB LENGYEL	Returned to Plymout
7th	LA PELIGROSA	ANDRE DE JONG	Returned to Plymout
7th	QUEST FOR CHARITY	GEOFF HALES	Retired into Penzan
7th	CREDIT AGRICOLE	PHILIPPE JEANTOT	Capsized. UMUPRO J the way.
9th	JET SERVICES	PATRICK MORVAN	Holed by hitting tr
9th	BIOTHERM	FLORENCE ARTHAUD	Put in to Azores wi later continued wit
11th	COLT CARS GB	JEFF HOULGRAVE	Hull damaged during
14th	MARSDEN	FRANK WOOD	Arrived Leixeos (Nr
15th	MARCHES DE FRANCE	MICHEL HOREAU	Developed mast trou
17th	33 EXPORT	GILLES GAHINET	Retired in La Trini
17th	DOUBLE BROWN	JOHN MANSELL	Yacht abandoned wit and taken to Newpor
24th	TJISJE	HENK VAN DE WEG	Hit by whale and pr between 1100 and 15
26th	DANCING DOLPHIN	BOB MENZIES	Yacht abandoned in
28th	KARPETZ	KARL PETERZEN	Pressed Argos emerg leak became worse.
JULY			
4th	NOVIA	BILL WALLACE	Dismasted and press picked up yacht and
6th	LOIWING	RACHAEL HAYWARD	Ran aground on U.S.
	JESTER	MIKE RICHEY	DID NOT FINISH

Tri. Fr.		
Tri Fr.	CLASS I	Over 45 ft. (13.72 m.) to 60 ft. (18.29 m.)
Tri USA	CLASS II	Over 40 ft. (12.19 m.) to 45 ft. (13.72 m.)
Mono USA	CLASS III	Over 35 ft. (10.67 m.) to 40 ft. (12.19 m.)
Mono GB.	CLASS IV	Over 30 ft. (9.42 m.) to 35 ft. (10.67 m.)
	CLASS V	Over 25 ft. (7.63 m.) to 30 ft. (9.14 m.)

CASUALTIES

DETAILS

t. Medically unfit.
n coast. Rescued by Lifeboat - yacht towed to port by fishing boat.
to Dartmouth - own way.
n - sail and centreboard problems.
with rudder damage. Arrived in Plymouth 0630/05.
- believe boom only. Located by helicopter from R.F.A. ENGADINE - towed
Scillies.
n way to Port Navalo.
ssed Argos emergency push but later reported he was able to make port under

red to Plymouth unassisted on 9th June. Retired on 12th June.
with steering problems.
irec - sails damaged. Retired 10th June.
n and then retired to Falmouth with steering problems.
n and then retired to Falmouth with steering problems.
ce with leaking hull.
ARDIN stood by - rescued skipper and then put him back onboard when help on

ee trunk. Ship directed to pick up skipper.
th rigging problem - found she had structural problem as well and retired -
n crew to Newport.
dismasting - yacht abandoned and crew rescued by ship after R.C.A.F. location
. OPORTO) and retired there. He was dismasted on 6th June.
ble and returned to France arriving 21st June.
te with mast problems.
h structural problems - crew rescued by another competitor, JEMIMA NICHOLAS,
t.
essed Argos emergency push. Located by A/C and rescued by helicopter all
00 G.M.T.
sinking condition. Skipper rescued by merchant ship. (Argos alarm).
ency push. Skipper rescued by merchant ship. Hit drifting buoy. Resulting

ed Argos alarm button. A/C located yacht and directed ship to scene who
skipper.
coast after mistaking the signal from Pt. Judith for that of Brenton Tower.

O.S.T.A.R. Notes

We wrote to all the competitors who failed to complete the 1984 O.S.T.A.R.. Thomas Veyron and June Clarke were the only two who replied. In the early races all the entrants with problems were happy to pass on details so that others could avoid making the same mistake. This has always been declared as the main object of the race - to encourage the development of yachts suitable for cruising with a small crew.

Norman Champ took a week off work to help man a stall for AYRS on the side of Millbay dock, Plymouth, before the start of the race and we had a look at all the yachts and craft. They were in my opinion better prepared and presented than ever before but several of the largest craft showed very little respect for the ocean and had the weather been as rough for as long as on some past races there would have been more failures. As it was eight out of fifteen multihulls were 'lost' but this is almost a meaningless figure - these are highly tuned racing machines with weight reduced to or beyond the limit of our knowledge of the loads involved and the crews try desparately to gain every word of publicity for their sponsor.Only a satisfied sponsor and happy shareholders will pay up for a more expensive craft for the next race.

Please forgive me for the delay , I have been sailing my brothers yacht back to France from Newport. I wish it was my boat, as you know Rizla+ failed to complete the OSTAR.

What happened is that the articulation of the for turnbuckle failed to work, beating in 25-30 kts of wind. I was with storm jib and the solent jib furled on deck, the battens kept me from putting it somewhere else, when the articulation went wrong, the turnbuckle bent and the pin that holds the turnbuckle to the chainplate broke. The forestay went slack and the mast fell back until the furled jib got caught in the mooring cleat. This was lucky and it was not a big problem to restep the mast from a 45° to a 90° angle with a halyard and the help of the swell. I had to give up racing because I did not trust the bent turnbuckle with 2500 miles left to sail. For the future I will try to be more lucky, though it had been OK for 5000 miles, and change pins for nuts and bolts.

Thank you and your friends for the help you gave me in Plymouth. I hope to see you soon, maybe for the Round Britain Race. Rizla+ is for sale now. I hope to have another boat someday.

Thomas Veyron.

129 BIS Rue St Charles, 75015 France.

PHILIP THIEL, N. A.
JULY 16, 1981

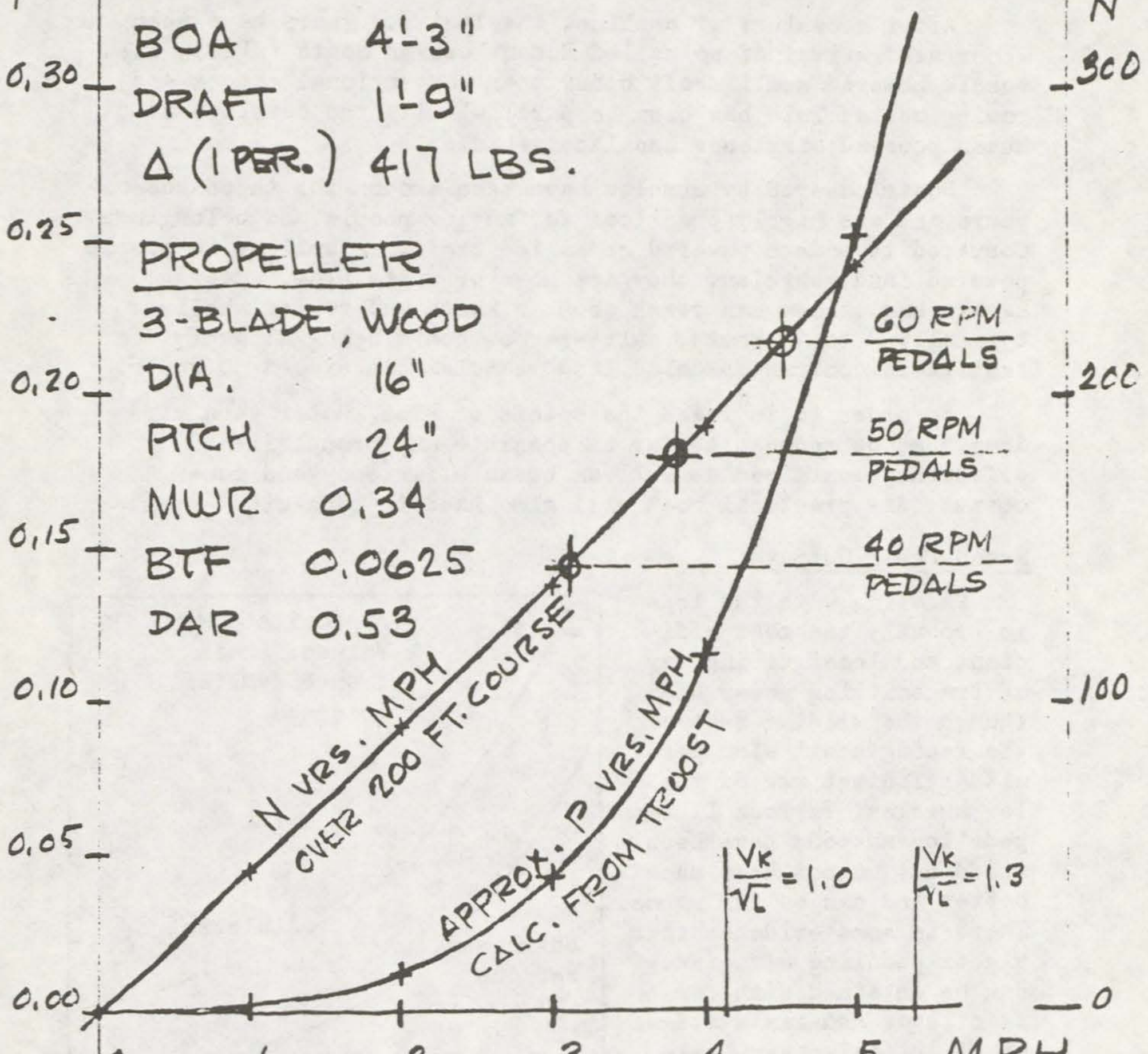
DORYCYCLE

LOA	16'-0"
LWL	13'-0"
BOA	4'-3"
DRAFT	1'-9"
Δ (1 PER.)	417 LBS.

PROPELLER

3-BLADE, WOOD

DIA.	16"
PITCH	24"
MWR	0.34
BTF	0.0625
DAR	0.53



N = PROP. RPM (= 3.6 × PEDAL RPM)

P = HP @ PROPELLER, CALCULATED FROM TROOST FOR $B_{3.50}$ WITH 0.05 WAKE FRACTION ASSUMED

PERFORMANCE WITH "LO-TECH" V-BELT DRIVE

Human Powered Boats

by Theodor Schmidt BSc.,
26 Fore Street, Evershot,
Dorset, DT2 0JW, England.

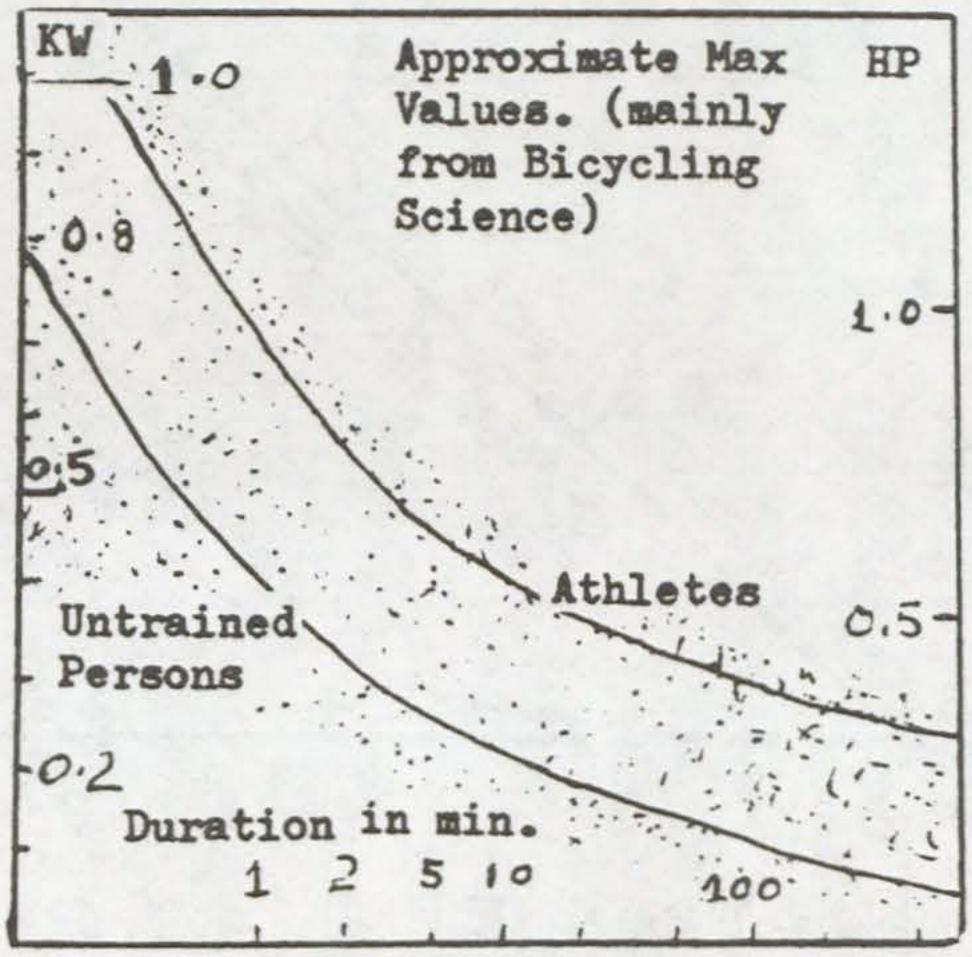
After a century of decline, the last few years have seen a certain revival of so called Human Powered Boats (HPBs), i.e. muscle powered small craft other than conventional canoes and rowing boats. This has been in parallel with the development of human powered airplanes and land vehicles.

Boats powered by muscles have been around for thousands of years and are highly practical for moving people and belongings. Compared to modern powered or sailed craft, as well as to muscle powered land vehicles, they are however quite slow. Racing kayaks and canoes can reach about 8 knots and rowing shells typically 9 to 11 knots, multi-person boats being slightly faster. In contrast pedaled land vehicles can exceed 50 knots.

In order to increase the speeds of HPBs, water (and air) drag must be reduced as far as possible and propulsive efficiency maximised as well as human efficiency and power output. Any practical boat will also have to cope with waves.

Human Power Output

Pedaling with the legs is probably the most efficient and least tiring way of transmitting power although the sliding seat of the racing shell also permits efficient use of the leg muscles. Various linear pedaling methods have been tried but do not seem much better and can be far worse. There is some evidence that higher pedaling efficiency can be obtained with certain lever and cam systems or elliptical chainwheels, all of which modify the pedaling action at the dead centers. A difficulty with water (and air) vehicles : one must pedal against constant torque, unlike a bicycle. In order to avoid excessive speed variations one must learn and practise advanced pedaling techniques such as "ankling" and using toe clips, or have a tandem arrangement with the pairs of pedal cranks offset 90 degrees.



Propulsion

All vehicles propel themselves by imparting momentum to some medium, this being water for most boats. It is easy to see that the less the water is disturbed after the passage of a boat, the less energy has been wasted both in driving the hull through the water and in producing the thrust to do so.

The thrust of a propulsion device is equal to the mass of water acted on per unit time, times the amount it is speeded up by. At the same boat speed and the same thrust, a small propulsor must therefore accelerate the water going through it to a higher speed than a large one, which speeds up a large mass of water only slightly. As the energy loss in the wake is proportional to the square of the speed increase, a large propulsor is intrinsically more efficient.

If V is the boat speed and v the speed increase at an ideal propulsor, the theoretical limiting efficiency is $1/(1+v/V)$. This is called the Froude efficiency and approaches 100% for a very large mass speeded up only slightly, as is the case for vehicles acting directly against the earth without slipping. The table gives ideal and total conversion efficiencies for some devices, all relating to a small craft with V = 3m/s and virtual drag area:—

$l\,(c_d \cdot a) = 0.01m$ $\quad (F=\frac{1}{2}\rho c_d \cdot a \cdot V = 45N,\ P=F \cdot V = 135W).$

Froude efficiencies of propellers with diameters:

10cm	80%
20cm	93%
30cm	96½%
40cm	98%
50cm	98½%

$$\eta_F = \frac{1}{1+\frac{v}{V}}$$

Total conversion efficiency of Larrabee propeller:

50cm	88%

Total efficiency of some drag devices, both with $C_D = 1$:

oars with	A=	$0.1m^2$	76%
parachute with	A=	$20\ m^2$	98%

$$\eta = \frac{1}{1+\sqrt{\frac{\rho \cdot C_d}{A \cdot C_D}}}$$

It is seen that drag devices must be very large for high efficiency. This is because pure drag coefficients do not exceed about 1.5 in water. Lift devices such as propellers can be smaller as they simulate drag coefficients of up to several hundred.

The size of practical paddles and oars is obviously limited (and hence their efficiencies) and so are the practical sizes of propellers and paddle wheels. Propeller designs are compromises

taking into account maximum draught, strength of blades, and cavitation and other hydrodynamic losses. Propellers for HPBs are so lightly loaded that they can be designed for higher efficiencies than motor boat propellers which are typically 70% efficient (at speed).

Professor Larrabee of the department of Aeronautics at MIT has designed propellers having minimum induced drag and exceeding total efficiencies of 90%. These usually have two blades with aspect ratios of around 20. I made one like it, which proved considerably more efficient than a slightly smaller t-bladed one of conventional design. Even more efficiency could be eked out using a contra-rotating pair.

Many other propulsors are possible, such as Voigt-Schneider propellers and similar, linear paddle mechanisms, and "fish-tail" propulsion used so sucessfully by marine creatures, but all of these are mechanically complex and prone to mechanical losses if not superbly made.

Hull resistance

This is made up of skin friction drag, which depends on the amount and quality of the wetted surface area, pressure drag, which depends on the shape of the hull, wave drag due to the formation of surface waves, induced drag if planing surfaces or hydrofoils are used, and other minor drag sources e.g. struts and rudders. These are all more or less interdependent and increase at different rates with speed.

Ordinary displacement hulls are very efficient at low speeds (a man can pull at walking speed a barge weighing many tons) but at higher speeds the wave drag rises sharply. Deeply submerged hulls are not thus limited and the same is true for hulls with very high length to beam ratios, but these have more wetted area than beamier hulls. Racing shells and multihulls are of this type. At higher speeds skin friction becomes so great that it pays to raise the hull out of the water by letting it plane or using hydrofoils.

Laminar flow sections and clever methods of boundary layer control, such as porous hulls and slimey chemicals, can reduce drag at certain Reynolds numbers up to four times, but a method which can potentially do even more would be to eliminate skin friction completely by moving the skin like a conveyor belt or caterpillar track, but this would require very high quality engineering. Many inventors have tried something along these lines with various types of boats on rollers, but none seem to have been sucessful.

Practical Boats

The Victorians had propeller driven multihulls which were faster than the racing shells of the time. All that is left of this heritage are the slow pedalos seen at seaside resorts.

But the inventors are out again: in the U.S.A. and Europe a

number of HPBs have appeared and competed in races organised by the International Human Powered Vehicle Association (IHPVA). This was founded originaly in California to promote development and racing of advanced bicycles and other land vehicles which are banned from racing within the traditional cycling organisations with old-fashioned ideas, a situation not unlike that of multihulls, and now air and water vehicles are promoted as well.

In spite of limited practical use, pedaled airplanes have been developed more intensively and sucessfully than boats because of their appeal and the very substantial Kremer prizes. On land, there is now also a large prize by Du Pont for the first single HPV to reach 65 mph, and there are competitions for electrically assisted vehicles and annual "mileage marathons" where fuel economies of up to 2000 mpg are recorded, and there is about one HPV event every month during the summer in Europe.

Interest in HPBs is still slight, except for traditional boat races, when Peter Selby and the Greater London Council organised the Festival of Human Transport near London in July, they were lucky to get ten aquatic entries.

In sprints over 200m, James Grogono set a reference speed of 8.6 knots in his standard single sculler, easily the most refined and ecpensive craft there. He is also the first person to have achieved complete liftout on hydrofoils under oars, although he maintains that the brief flights did not seem any faster than without foils.

David Ower's recumbent canoe with bevel gearbox and propeller achieved 6.7 kts. This boat was the basis of his MSc thesis and also nearly managed to lift out when used with hydrofoils. Both these hydrofoil projects were hindered by not extremely efficient propulsion; oars in Grogono's case and Owers by a propeller designed for motor boats.

From the Netherlands, the Huppes brothers and two friends brought a delightful tandem catamaran with the cyclists sitting sideways to facilitate the drive to the home-made 4- bladed steel propeller. This managed 6.2 knots.

Two other sideways catamarans brought by the Hancock family were slightly slower, using propellers for outboard motors. Mr Quinn brought a terrific looking monohull equipped with two paddle wheels worked by up to 3 people on a large lever system. Colin Stanwell-Smith had a not quite complete catamaran with an ingenious surface-piercing sculling propeller which could cope with weeds and shallows better than the other craft. Also in the slow brigade was a "Heath Robinson" scout project and some commercially available buoyant water skis.

My own boat was not finished in time. It is a fully submerged hull with a large Sanderson designed propeller and the cyclist perched above on a central strut, kept upright by four inclined buoyant hydrofoils. This general configuration has been proposed by John Morwood in 1961, Brad Brewster in 1979, and

Simon Sanderson in 1982. Huppes in Holland also made a similar boat years ago. Mine has proved too flimsy for hard pedaling and several miscalculations during construction have resulted in only 3-4 knots rather than the hoped-for 10-12, but wait till next year !

I have since made a totally different boat, designed to be practical rather than fast. It is an inflatable catamaran onto which an ordinary bicycle is placed. An outdrive with propeller connects to the bike's chainwheel and a rudder is attached to the front wheel. This boat goes comfortably at 3 - 4 knots, maximum speed 5 - 6 knots, and it is very manoeverable. It disassembles and packs small enough to go on the bike for riding on land. The whole boat (without bike) only weighs 7 kg.

Its maiden voyage was at the MOCRA meeting near Plymouth from Cawsands across to Plymouth (5km) and later down the Fal from near Truro to Falmouth in two stages (14km), also carrying my baggage and travelling on the road a good deal as well as by train.

Curiosity on the water was high, sometimes too high, as motorboats would often come too close for comfort. These people do not seem to realise the agravation caused by their wash (quite apart from the noise), and unfortunately speedboats on confined waters seem to be the same dangerous nuisance to HPBs as motor vehicles to cyclists on most roads, as the ability to command the power of many horses is not often combined with the necessary circumspection and thoughtfulness.

References

"Bicycling Science" By F.R. Whitt and D.G. Wilson MIT Press 1982.

"Human Power" Magazine of the International Human Powered Vehicle Association. Membership $ 15/20 per year. P.O. Box 2068, Seal Beach, California 90740.

1. and 2. Symposium of Human Power. These contain descriptions of most American HPBs. IHPVA (see above)

"The design and development of a man-powered hydrofoil" by B. Brewster. MEBS thesis, MIT 1979

"The design and development of a human-powered hydrofoil racing boat" by D.Owers. MSc thesis, Cranfield 1983.

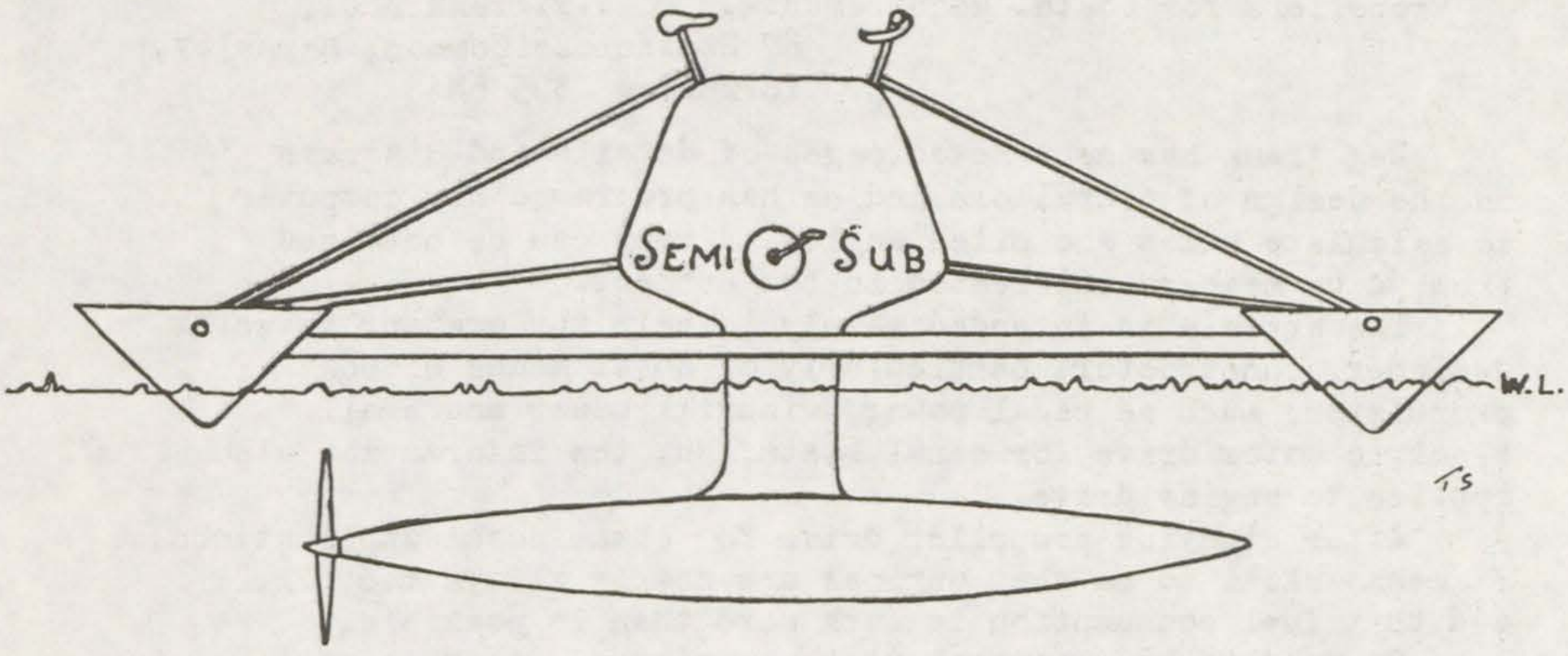
"A sculling hydrofoil development by J. Grogono. RINA.

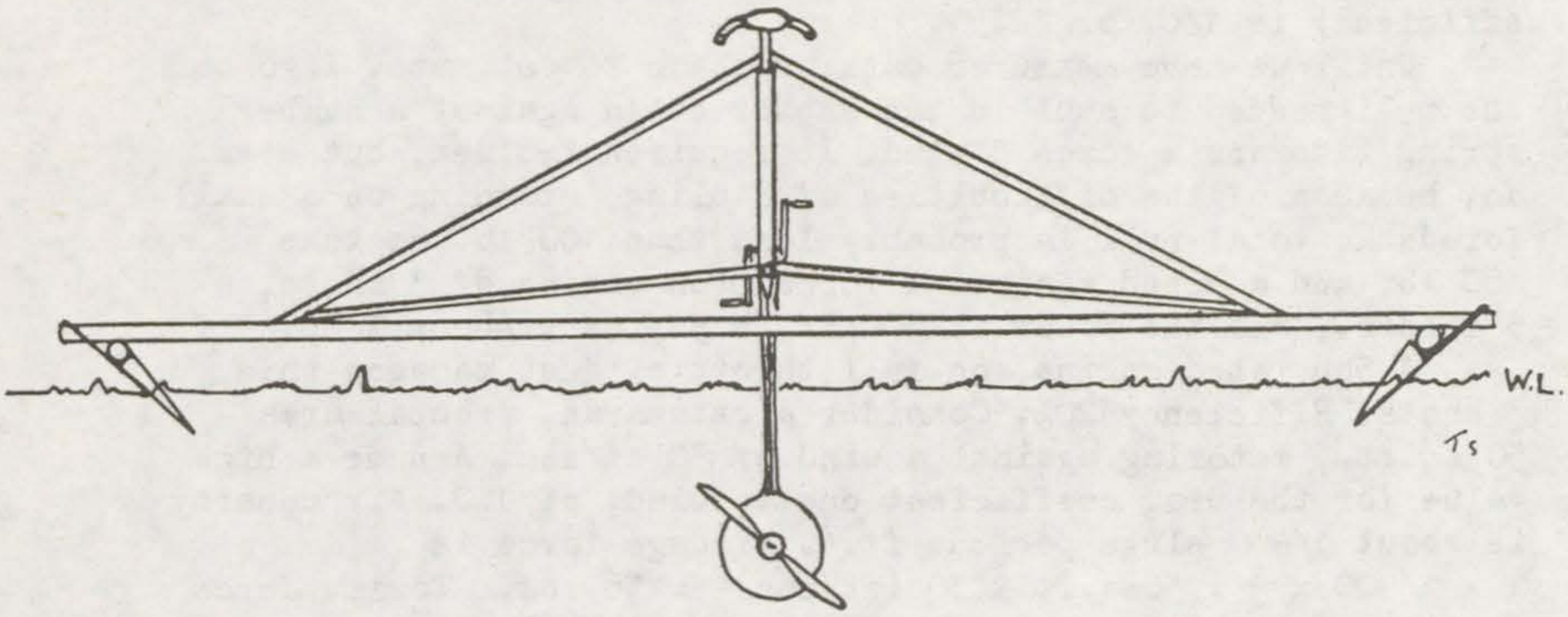
"Pedal Power Boating" by Philip Thiel. AYRS No 98.

Water Bicycle Plans, sold by Henry Cox in Fareham, Hants.

Symposium on Human Powered Vehicles. RINA London November 1984.

"The screw propeller" by E.E. Larrabee. Scientific American 243.


SEMI SUB
W.L.
TS


W.L.
TS

Propellers for boats. Requirements.

W.R.Frank BSc.,
87 Staincross Common, Barnsley,
Yorkshire S75 6NA

Reg Frank has sent seven pages of details and diagrams on the design of propellers and he has programed his computer to calculate sizes and pitch angles. A copy can be obtained from us by members interested in the subject.

The article is intended mainly to help the amateur inventor, designer, constructor, particularly of novel means of boat propulsion; such as pedal power, windmill power and small electric motor drive for canal boats; but the information also applies to engine drive.

After studying propeller drive for these novel applications, it seems clear to me that engines are nearly always too big, and that fuel consumption is much more than is possible.

We need to know more about the resistance to boat motion, and if anyone could do a few towing tests for publication in AYRS, this would be most valuable research. We then need to specify clearly exactly what we require, which can vary from a canal boat moving at slow speed, restricted by regulations, to using the engine at sea against strong headwinds. Since one horse used to pull a heavy barge easily, it seems likely that only about one quarter horsepower is needed, and that if a canal boat is using 2 hp from a 5 hp rated engine, that the efficiency is 1/8, or 12.5%.

Until we have measured data, we have to estimate. I go on the pull needed to haul in the anchor chain against a Humber spring tide and a force 5 wind. It requires two men, but even so, because of the difficulties of hauling, standing on a small foredeck, total pull is probably less than 100 lb. So take 100 lb, and a speed against a force 5 on engine of 3 knots, 5 ft/sec., and the power is 500 ft lb per sec. About 1 hp.

A 5hp rated engine, on full throttle, just manages this 3 knots. Efficiency 20%. Consider a catamaran, frontal area 50 sq.ft., motoring against a wind of 30 ft/sec. Assume a high value for the drag coefficient due to wind, of 1.0. Air density is about 1/400 slugs per cu. ft. . Windage force is $1 \times 1/400 \times \frac{1}{2} \times 50\text{sq.ft} \times 30^2(\text{ft/sec})^2 = 56$ lbs. Towing force not including windage might be 30 lb. Total 86lbs. Power, at speed through the water of 5 ft/sec, $86 \times 5 = 430$ ft lb per sec = 0.78 hp. At 10 ft per sec, apparent wind increases to 35ft/sec Hull drag increases to $(10/5)^2 \times 30\text{lb} = 120$ lb.
Windage resistance increases to 76 lbs giving a total now 196 lb.
Power = 196lb x 10ft/sec = 1960 ft lb per sec or about 3.6 hp.
Typical engine, 25hp.

Pushing against wind consumes less power than higher speeds through water. An engine giving 6 knots in calm reduced to 4 liberates a lot more power if engine and propeller speeds are correctly matched for different boat speeds by variable pitch or two forward speed gear ratios.

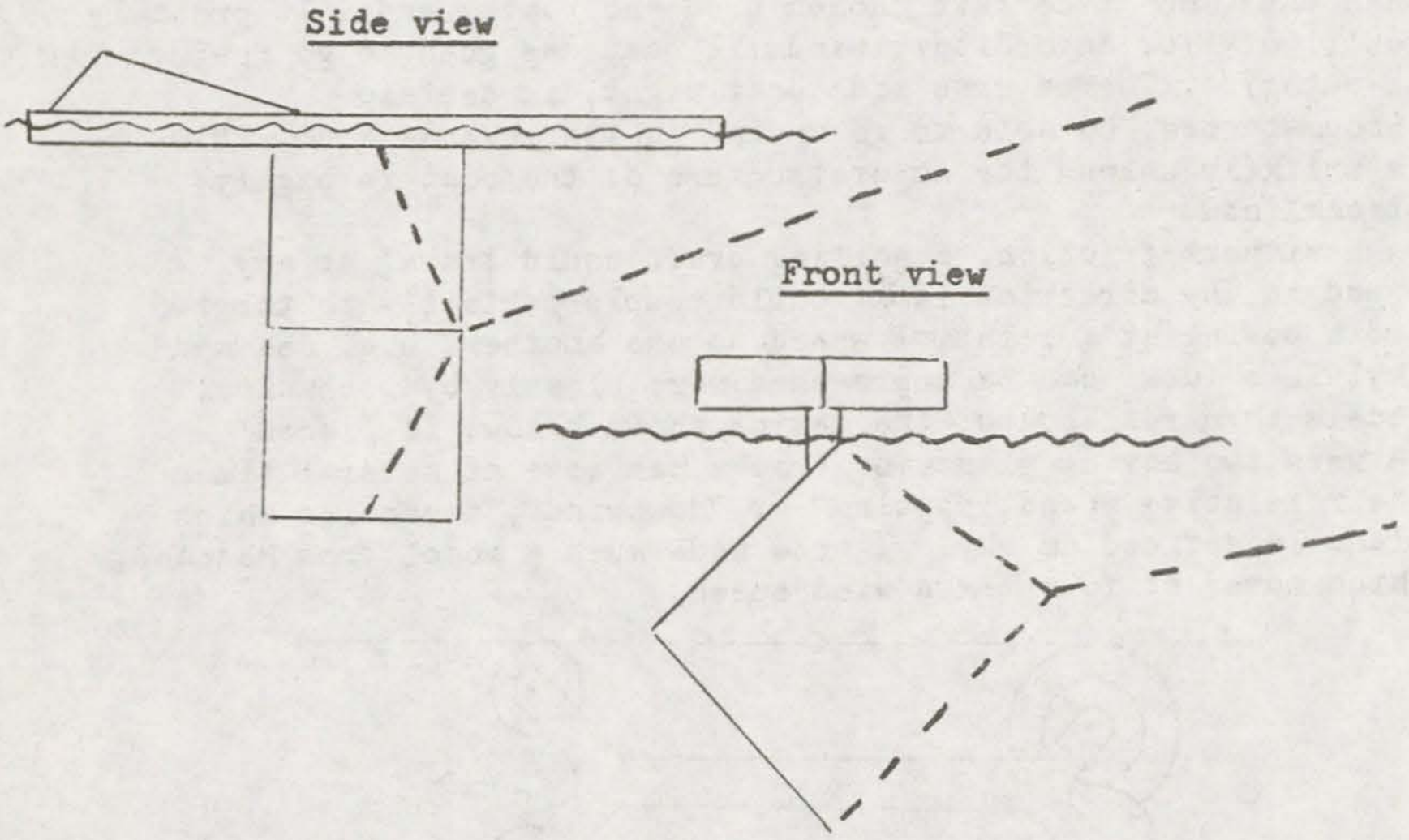
Hapa Design by Roger E. Glencross

6 Melville Av., London SW20 ONS

My hobby is building a windpowered seaplane. The aerofoil is a hangglider and the keelforce comes from a paravane called a "hapa", towed by the glider. This article describes the hapa.

The hapa has to be compatible with the glider I already have, that is, it must be able to sail on the same course as the glider in minimum winds, and use optimum L/D ratios of both elements. The glider is suitable for slow upwind journeys so the hapa must be also. This dictated the area of 5 square feet. The glider L/D is 3 and towing tests show the same for the hapa. Minimum flight speed is 12 m.p.h. and V_t (minimum) permitting flight is $7\frac{1}{2}$ m.p.h.. Foil section is a flat plate and planform is rectangular, since this simple layout achieves the required L/D of 3. For the same reason aspect ratio is only 2. This has a wide range of operation, a good C_L and is stable. It has slight positive buoyancy and stability is ensured by the hapa's shape of two rectangular flat plates set at 90 degrees to each other. A surface-breaking stabliser prevents diving at speed and rolling is prevented by a two-leg bridle. Stalling and oscillating is prevented by the correct positioning of the towpoint. Control is automatic on a single towrope, but a second towrope can be used if angle of attack control is needed. It can not tack but I am modifying it to shunt non-automatically.

(Reduced from a much longer report)
September 1984.



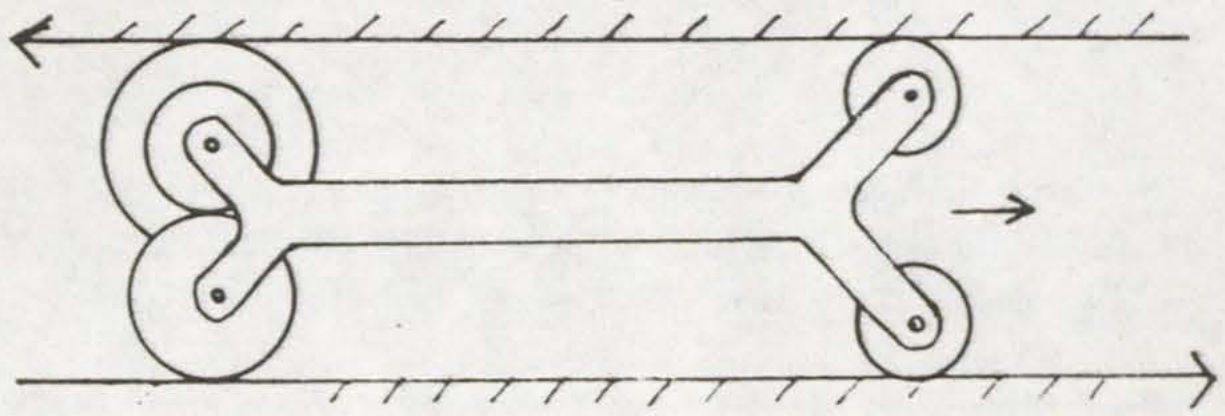
Downwind Faster Than The Wind from Theo Schmidt

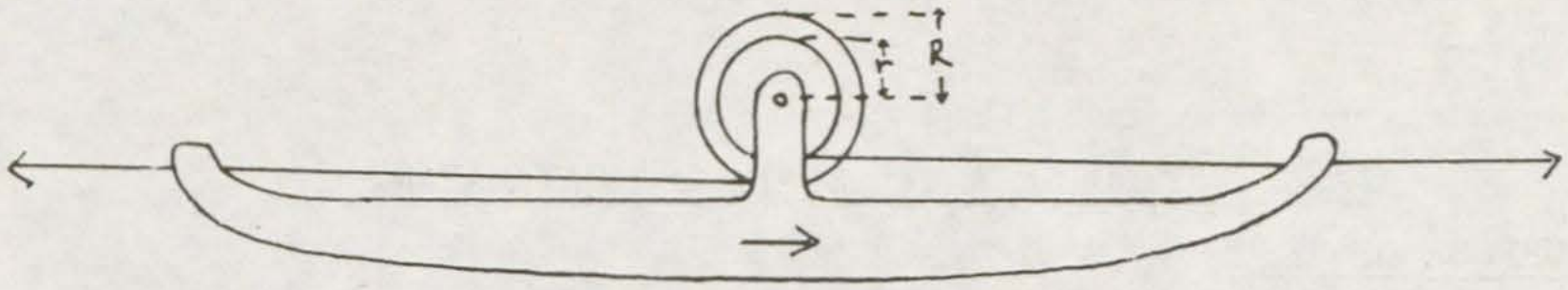
There seems to be a revival of the old argument whether or not the speed of a sailing boat can exceed the true wind speed while going directly downwind. This is obviously not possible for an ordinary craft using sails, but the fastest of these (iceboats and racing catamarans) can make good a speed to leeward in excess of the windspeed by tacking down wind.

Several sailing articles make a case for windmill and propeller boats being able to go down wind faster than the wind by adopting a mode where the windmill is used as a propeller and the propeller as a water turbine. At least one manned windmill boat is reported to have reached this condition briefly. The sceptics argument that this is not possible without going through "a no wind barrier" by using auxilary power, is not valid because this reverse mode can be adopted before the boatspeed exceeds the true windspeed, and the boat could quite happily sail at exactly wind velocity with not a breath of air over the deck, but with the air propeller pushing the boat along using power derived from the water screw.

It is difficult to achieve this in practice, as propeller gearing and turbine efficiencies must be very high and the hull of very low drag. A special set of blades would be needed for this reverse mode as the blades used in normal mode (upwind and autogyro) are cambered the opposite way. Propeller and inverse propeller efficiencies can however reach 90% at their design points if carefully designed. So it should be possible to drive a specially constructed low drag windmill boat downwind faster than the wind at certain chosen wind and boat speeds. It probably won't work for an ordinary windmill boat designed to go upwind or autogyro. The reverse mode boat might, in certain circumstances, be able to go upwind in its reverse mode. This is unlikely unless the superstructure of the boat is highly streamlined.

Without friction, a sailing craft could travel at any speed in any direction if it could couple perfectly to the two media moving at a relative speed to one another, e.g. sea and sky. This ideal can be approached more closely by mechanical models than real boats; the device shown below, if placed between two moving planes or tracks can move at several times their relative speed, "upwind" or "downwind", depending which plane is defined as sky. I once made such a model from Meccano, which moved at four times wind speed.

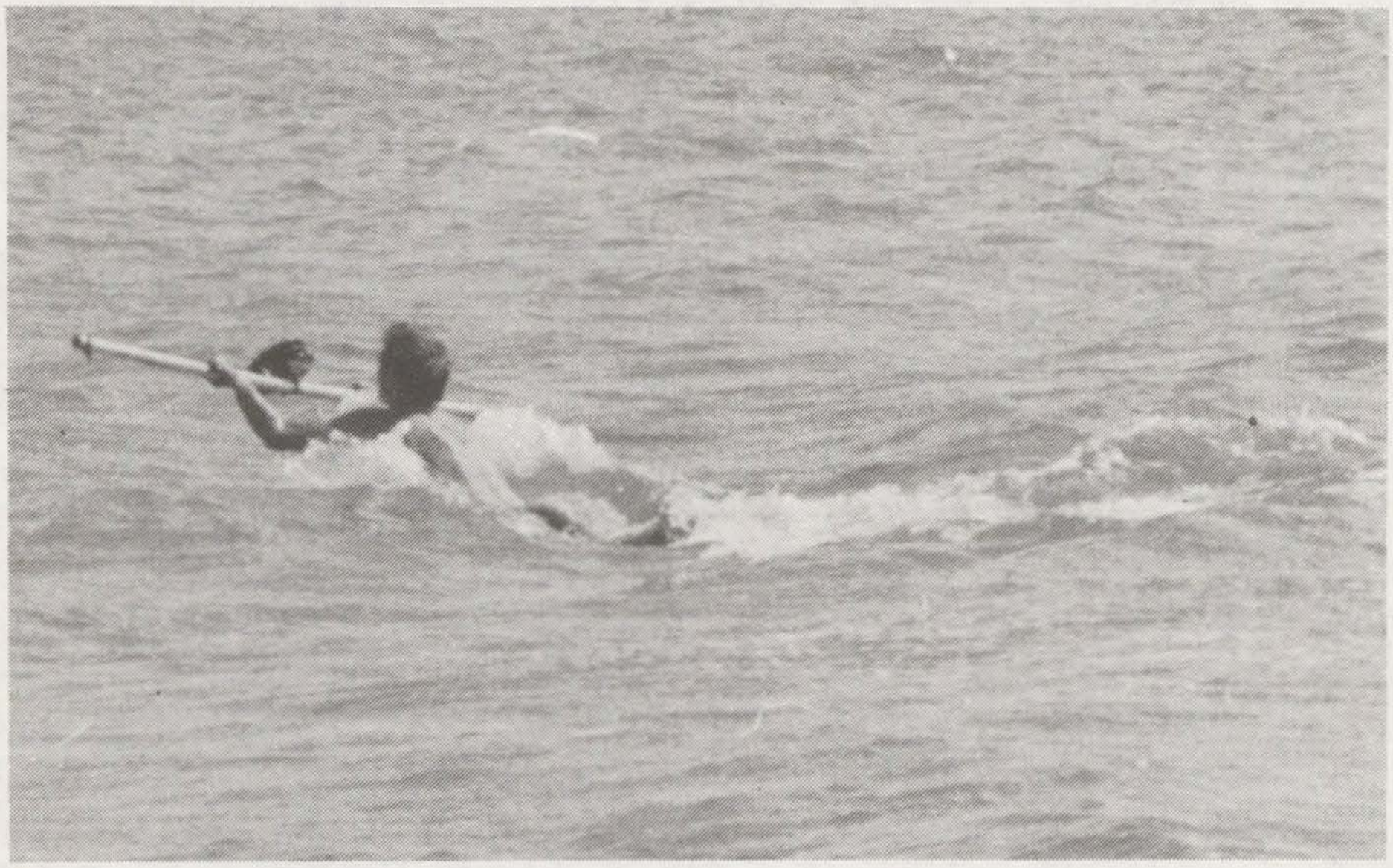




This shows an even simpler model, which can actually be used on the water. It is simply an opened-up differential pully and will move at 1/(1 - r/R) times the speed the strings are being pulled apart. I made such a model which travels at 4.4 times relative string speed and attached one line to a parachute drogue in the water and the other line to a kite in the air, and it was indeed able to go downwind or upwind faster than the wind. Unfortunately, when the model reaches the kite or drogue, the trip is over and it has to be wound back.

Thus there is no difficulty in making a kite-powered roller boat go up or down wind faster than the wind, albeit for a limited distance !

References : "Downwind faster than the wind" H.M. Barkla (AYRS 98) and RINA Advanced Sail Symposium, November 1983.



The inventor Theo Schmidt body planing at around 5 knots pulled by a kite. Next time he will wear braces on his swimming shorts.

TANK TESTING OF A 1/5 Scale 26' CATAMARAN.

PURPOSE OF TEST

Test different stern shapes and study the effect of trim and displacement. Hull similar to a 'C' class with half-circle sections.

5 shapes were tested :

1) Narrow transom and aft overhang such as a "Seabird".
2) Medium and slightly immersed transome such as "Aquarius V".
3) Immersed transom same section as the main section. "Hellcat".
4) Flatter transom with elliptical section such as "Petanque"
5) Flat transom with hard chine.

PICTURE STUDY Shape 3 at 14 knots.
Half-circle sections at the bow give an interesting dynamic lift.

RESULTS STUDY

Up to 3 knots : Shape 1 is very slightly faster than 2. Very near are 3, 4 and 5. Shape 1 is not as good as one might think due to water licking the overhang. Transom drag at that speed is purely psychological, all drag is due to friction.

3 to 6 knots : All the models are about the same.

Above 6 knots : Shape 5 has the edge, hard chines seems to do its job. The fuller the transom- the flatter the wake, the smaller the drag.

CHANGE OF TRIM

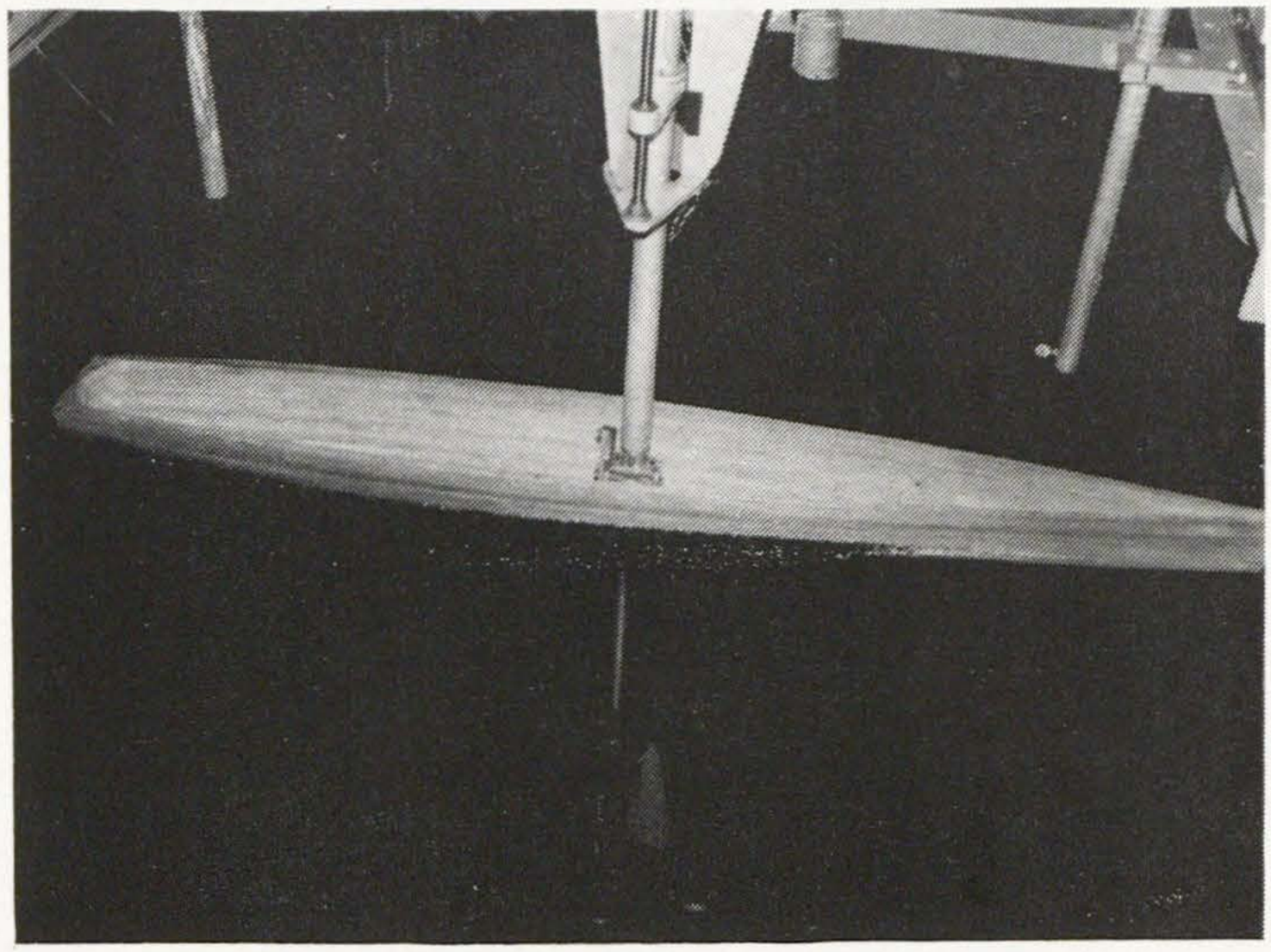
This was to see if it was good to change trim in light winds. The answer is no, a hull designed with half-circle sections increases its wetted surface area when trim is changed. In strong winds a change of trim leads to excessive bow wave or transom drag.

CHANGE OF DISPLACEMENT

This was to see if flying a hull reduces drag. The answer is yes. This is proved in practice : Steve Dashew even puts his crew on the lee wire on his 'D' class in light weather.

CONCLUSION

It seems that the half-circle section right to the bow with a flat transom and a hard chine is best for a cat. However one may have to compromise to simplify construction or increase accomodation.



Model test by Eric Lerouge, France.

"Liferaft" conversion of a Tinker Tramp inflatable investigated by Geoff Hales and to be tested by Peter Phillips.

"Thursday's Child" sailed by Warren Luhrs took 16 days 22 hours 27 minutes from Plymouth to Newport.

Photo at the start by Norman Champ.