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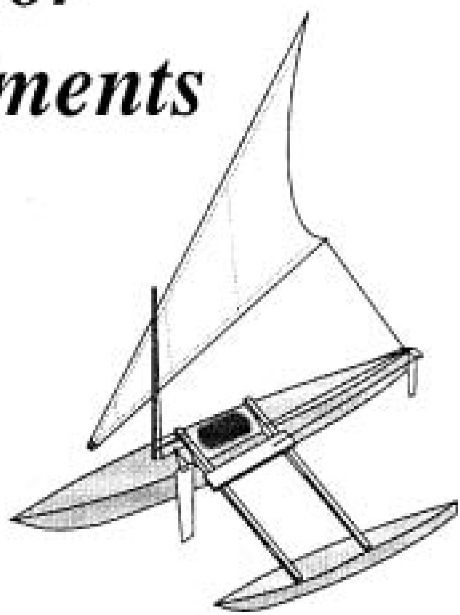
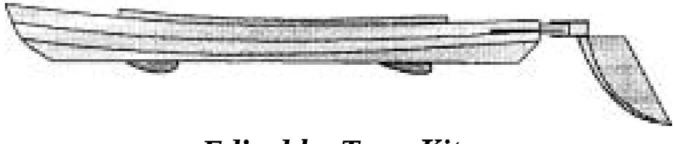
Canoes for Experiments

Sail and Human Power





Edited by Tony Kitson

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Canoes for Experiments

Sail and Human Power

Edited by Tony Kitson

Amateur Yacht Research Society

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Preface

Last year, 1995, was the 40th anniversary of the founding of the Amateur Yacht Research Society and I had planned to mark the occasion with a tribute to our founder the late Dr John Monvood. This publication is late, but, I hope, can still serve as that tribute.

It is common to say at such times, I wonder if he realised what he was starting and what the society would be like today? In this case I do not think that he would be too surprised. He realised that there were many people with an interest in the science and technology of sailing but without a professional involvement and that they needed a forum in which to share their ideas and results. He might be a little surprised at some of the ideas shared. But maybe not. Much of the progress that has been made in these forty years is not so much in those ideas as in the materials and techniques with which to realise those ideas.

Dr Monvood was a great advocate of the use of canoes as ideal platforms for low cost experimentation, so it seemed logical to produce a publication to illustrate this. That was my original intention but, when I approached John Bull, our 'sailing canoe' co-ordinator, he gave me so much information on the history of sailing canoes that this became a major part of the issue. I hope that Dr Morwood would forgive me, his own interests certainly spread to the early development of sailing craft. Also I am convinced that some of these pioneers of the recreational use of canoes, John MacGregor, the brothers Baden-Powell, George Holmes and Albert Strange would have been ideal AYRS members if only Dr Morwood had been around to get things started a few years earlier.

Introduction

Today most people, indeed most canoeists, are surprised to hear that canoes can be sailed and think that you are either referring to the International 10 square metre or to some crazy experiments carried out by AYRS. In fact the early pioneers of recreational canoeing regarded their craft primarily as sailing craft, with paddles as 'auxiliary power'. Our sailing canoe co-ordinator, John Bull, is also a founder member of the Open Canoe Sailing Group which was established to revive this approach. Hence their motto, "sail when you can, paddle when you must".

My original plan was a publication covering recent experiments using canoes and I have not been totally diverted from this plan. The second part contains crab claws, dorado tails, Bruce foils and forward pedal-rowing, surely enough to keep the experimentalists happy.

Acknowledgements

Thanks are due, of course, to all the contributors without whom no AYRS publication could be produced.

For this publication we are especially indebted to John Bull, who has written and researched much of the information that is presented here. John Bull has provided us with some fascinating information on the early pioneers of canoeing and their exploits, and some more recent exploits. He also directed me to some of the developments from sailing canoes, particularly by the members of the Humber Yawl Club, which were instrumental in the emergence of the small cruising yacht.

We are equally indebted to Walter Giger of the AYRS New England Group who has provided us with access to the writings of Gail Ferris, Ron Rantilla and Harry Bryan.

Gail Ferris has written in the AYRS New England Newsletter of her exploits kayak cruising in Greenland. I hope that we can expand on this in a future publication on small/open boat cruising. In this issue she reports some developments to improve safety when kayaking in open sea conditions.

What is a Proper Canoe?

by John Bull (February 1994)

When boats like the Newman brothers' Trans-Atlantic canoe The Spirit of Cleveland' or Philip Bolger's 'His and Hers' appear cries of 'foul' and 'but its not a proper canoe' can be heard from numerous watersides. Just what is a 'proper canoe'?

Canoe design has varied so much since John MacGregor in the 1860's that one would be hard put to make a single definition. Even today there is a very wide variety of boats that call themselves canoes from the almost elliptical stunt boats to the needle like K Fours, or from the thigh hugging sea kayak to comparatively wide bodied open canoes. In a world view of canoes one has to take note of the very long and wide bodied, often ballasted, Baidarkas of the Aleuts to the multi-hulled craft of the Pacific peoples that ranged the Pacific Ocean. Such a diversity of parameters, yet all are classified as canoes.

It is sometimes claimed that the unifying factor in all these cases is that they are propelled by paddle, with the paddler facing forward. This is certainly true when the canoes are paddled but quite a few canoes were sailed. The Pacific islanders have always sailed as well as paddled canoes, at least for the last thousand years or so. There is also quite a lot of evidence to suggest that simple sails on canoes were in use among many Indian sub groups in the North and South of the Americas. The Caribbean people were observed sailing their canoes in the sixteenth century when the first Europeans arrived. Certainly after the European invasion of the Americas the use of sail became widespread, but it would be arrogant indeed to imagine that ours was the only influence. One can only say that by the middle of the seventeenth century sails were in use from the Mic Macs in the north east to the Nootcan in the north west and from the Eskimos in the Arctic to the Peruvians on the southern continent. The best one can say about paddles is that they are commonly used for propulsion but not always.

Neither can size or portability be considered as a serious parameter, for our historical antecedents vary from the Eskimo kayaks that can be carried under the arm to the great Nootacan canoes that were fifty or sixty feet long with a beam of sixty or so inches, carved from a cedar log and which must have weighed several hundred pounds. The quality of these canoes can be gauged from Jon Voss's account of his round the world voyage in 'Tilikum'. Again, the best one can say is that canoes **are** commonly of a size that can be carried, but not always.

Nor were canoes always unballasted. The Aleuts frequently carried a hundred pounds or so of stone in the bottom of their big Baidarkas and these were wonderful sea going canoes, often staying at sea for several days at a time. Similarly with the configuration of the canoe, multihulled canoes are to be found all over the Pacific Ocean from small ten foot fishing canoes to the huge sixty foot proas and trimarans that made very extensive voyages to and fro over immense distances. Even a cursory examination of the Pacific canoes would confirm that it would be to fly in the face of reason not to classify them as canoes.

Perhaps the only definition that is supportable is the length to beam ratio which is usually in the order of at least 5.5 or 6:1, they are very narrow bodied. In most other small craft, dinghies, small yachts, the beam to length ratio is in the order of 2 or 3:1. Generally speaking a canoe is pointed at both ends, but be careful because the Valley Aleut sea double and the Reynard Turbo immediately spring to mind with their little transoms, although one could hardly argue that these disqualified them Pedantry is a dangerous stance to take in canoe matters.

Sure 'The Spirit of Cleveland' was a canoe. Chris Hare built her from the Trapper mould in some fancy materials. Yes she was extensively prepared, including an outrigger. Yes she was paddled for considerable distances as well as sailed under her Solway Dory rig which was a much modified canoe rig. As with all traditional types we have considered earlier she was developed for the job she was to do. It is very much a question of horses for courses. Let us just enjoy the variety our sport offers and rejoice that we are prepared to welcome all sorts of odd-balls into the family.

This article was first published by "Canoeist" magazine February 1994, and is reprinted here with the permission of the author.

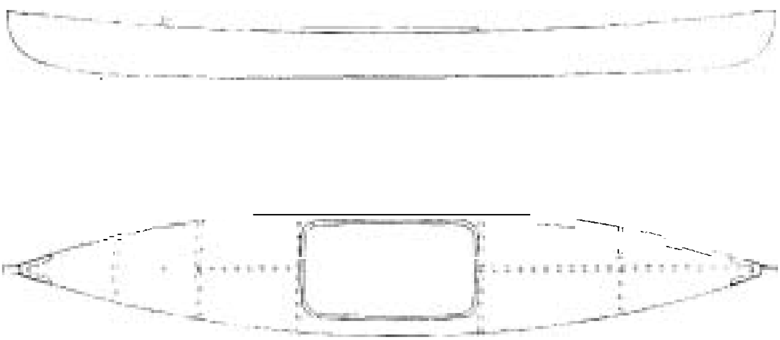
Sailing Canoes

by John Bull and Tony Kitson

Beginnings

The beginnings of the sport of canoeing are generally attributed to John MacGregor and certainly his first book, 'A Thousand Miles in the Rob Roy Canoe', aroused great interest among the young men of Victorian England. The book was an account of his travels via lake and river through Europe in a small paddling and sailing canoe.

MacGregor conceived the idea of a craft able to carry him over lake, river and estuary but small enough to be easily transported to and from his cruising grounds. The Rob Roy canoe, designed by him, was based upon the shape of the "Esquimaux" canoe (or Kayak), and built for him by Searl and Son of Lambeth, rowing shell builders. This first Rob Roy was 15' long with a beam of 28" and a draught of 3" (including the 1" keel). She was built using the lightweight clinker planking which had been perfected for the rowing shells, with oak planking and a cedar deck. Her weight was 80 pounds.



The 'Rob Roy' Canoe

Rob Roy was launched onto the Thames at Putney, and from there proceeded under paddle power, and with the benefit of the tide, to Greenwich. Here MacGregor first tried setting his sail. He sailed to Gravesend and then on to Shoeburyness. Based at the National Artillery Association camp, he spent the next a few days experimenting with his new craft. Rob Roy performed well and, even in a gale, he was able to step the mast and rig her sail at sea.

After this shake down MacGregor proceeded by steamer to Sheerness, rail to Dover and steamer to Ostend to begin his summer cruise. Throughout the summer of 1865 he sailed and paddled Rub Roy extensively on the rivers arid lakes of Belgium, Holland, Austria, Germany, Switzerland and France

The following year MacGregor designed and had built a second Rob Roy He had decided that the original was too large and this year's model was reduced to 14' with a beam of 26" and weighing only 71 pounds. She was rigged with standing lug sail on a 5 foot mast. In the summer of 1866 he cruised from Christiana (now Oslo) to Stockholm, again publishing his exploits in or 'The Rob Roy on the Baltic'.

In the same year the interest generated by MacGregor's exploits lead to a group of enthusiasts setting up the Canoe Club The club flourished and eventually became the Royal Canoe Club, with the Prince of Wales as Commodore

Racing

Initially all canoes followed the Rob Roy pattern, a craft equally able to be propelled by paddle or sail. But things were set to change and some members of the club were developing canoes specifically for speed under sail. Gradually the requirements for such a craft resulted in canoes which could not easily be paddled.

There followed a division of interest between those who stayed with MacGregor's original concept of the 'travelling boat' and those who wished to develop the 'speed sailing' approach. This divide in the canoe club was also reflected by two of its famous members, the brothers Badcn-Powell Robert felt that the canoe was essentially a travelling boat, light in weight and propelled by sail and paddle and able to make long and often arduous journeys on rivers and around coasts. By its very nature such a craft would have to be a compromise able to survive in all sorts of conditions. Warrington Baden-Powell had the 'go fast bug' and became deeply involved in the design and competition of sailing canoes, indeed he was a major force in British canoe sailing. These craft piled on enormous amounts of sail and counterbalanced its effect by carrying lead ballast inside the canoe and a heavy iron keel outside. A sixteen foot by thirty inch canoe could have over a hundred square feet of sail and carry as much as one hundred and fifty pounds of ballast. They became, in effect, miniature racing yachts.

The lines of one of Warrington Baden-Powell's early boats, Nautilus, were taken to the United States in 1870 and within months the idea of sailing a canoe had captured the imagination of many young American gentlemen. In 1872 the New York Canoe Club was formed and, following its English counterpart, supported both cruising and racing.

Many of these early boats were exquisitely built, they were so light and delicate, and they were being built for gentlemen who could afford to pay for the best. The outcome was a craft with almost the same qualities as a musical instrument or fine piece of furniture.

In 1886 Warrington Baden-Powell and Walter Stewart challenged the Americans to an international match. A cup was put up by the New York Canoe Club and the racing took place at Grindstone in New York State.

The diverging lines of development that had been taking place became apparent during the competition. The British had continued to add more ballast and sail their boats from within the cockpit. The Americans had realised that by dispensing with the ballast and compensating for its loss by sitting out on the side decks they could retain the same sail area and have a boat that was perhaps one hundred and fifty pounds lighter. This bold and unconventional step won the day for them.

It is interesting to compare these differences with those of the Americas Cup boats of the same period, where narrow beam and low slung lead wrrc also losing combinations for the British challengers. In 1885 Ganesta (beam 15', draught 13'6'1) was beaten by Puritan (beam 22'7", draught 8'8'1) and in 1886 Galatea (draught 13'6") was beaten by Mayflower (draught 9'9", beam one third greater than Galatea). With these craft it was the centreboard of the Americans, which allowed variable lateral resistance (and wetted area) to be optimised for on and off the wind, that won the day. In both cases the Americans optedfor subtlety of control versus brute force.

It was not until 1933 that the British team was to be victorious, this time with very different boats, designed and lead by Uffa Fox.

Uffa set out to challenge for the New York Canoe Club's International Trophy but also to compete in tlie American Canoe Association's National Championships. At that time the rules governing canoe racing in England and America were different, so a craft conforming to two sets of rules was designed.

The Americans had developed the sliding seat for their craft, to allow tlie maximum use of crew weight for countering the heeling force of the sails. This is reputed to have been developed by Paul Butler, who was a small man unable to rival his heavier opponents when sitting out. He adopted the old Indian idea of a plank across the canoe to assist in getting out further to windward.

Uffa had learnt the lessons of the earlier British mistakes. He took the game one stage further and designed canoes with planing hulls. The 'East Anglian' was sailed by Uffa and the 'Valiant' by Roger de Quincy.

They attended the American Canoe Association meeting at Sugar Island where Uffa won two of the National Championships of America, the Sailing Championship and the Paddling and Sailing Championship Roger de Quincy won the Paul Butler Trophy Then at the New York Canoe Club meeting at Long Island Sound they won the club's International Trophy The first time in nearly 50 years that it had left America

After their success the British challengers met with the American authorities and agreed a set of rules to combine the best aspects of the national rules from both countries On their return these were approved by the Royal Canoe Club and the Humber Yawl Club This agreement formed the basis for tlie International Canoe Rule, now the International 10 sq m Canoe

The following twenty years proved that our cousins were no more able than us to learn from their mistakes in international competition. They continued to contest the trophy in non-planing hulls and allowed us a brief period of glory.

Cruising

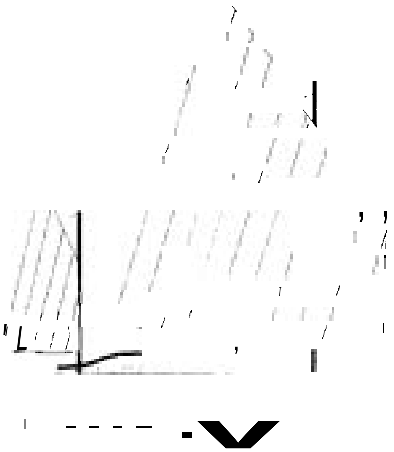
During the 1860's and early 70's the Royal Canoe Club was developing rapidly and groups were set up and events held all around Britain. Through the books of John MacGregor and the activities of the club many young men were introduced to the new sport. One such was George Foster Holmes, born in 1861 and brought up in Hornsea in the East Riding of Yorkshire.

In 1876 the Royal Canoe Club held a regatta at Homsea Mere and it is likely that this may have introduced the young Holmes to the travelling canoe. At that time he owned and sailed a traditional Yorkshire Coble, but these craft required a gang of helpers to launch from the beach and he was attracted to the idea of a craft which offered him greater independence.

'Cassy' **1883 (14' x 3'6")**

His first design for a sailing canoe was the Brownie, built for him, as were most of his subsequent designs, by J A Akester of Hornsea Brownie was 14' long with a beam of 2'6" Her narrow beam and light brass centreplate made her a somewhat tender craft for sailing in the Humber In 1883 Holmes designed the Cassy, agam 14' long and agam built by Akester However, with a beam of 3'6", a 60 lb ıron centreplate and a 3/4" thick keel shoe, Cassy was altogether a more stable boat She was ngged with a standing lug maın and spnt mızzen and was rowed rather than paddled, presumably her beam prompted this change ın 'auxiliary power'

At the same time as Holmes was designing Cassy the local branch of the Royal Canoe Club was in decline. Like Holmes, other members sought craft more seaworthy than the Rob Roy type but still able to be transported to distant cruising grounds. They formed the Humber Yawl Club, which did much to foster the design of such craft for both cruising and racing, through a series of competitions. In 1888 it initiated a racing class for 1 or 2 crew with a maximum length of 15', for which Holmes designed the very successful Ethel. She was 13' x 4'6", a size which would still fit in a railway van for easy transportation. For this design he reverted to the lighter (22 pound) brass centreplate, but carried 112 pounds of removable lead ballast. Ethel proved to be a capable cruiser and was successful in the club's races.



'Daisy' 1890 (18' x 5'3" x 1'4")

Holmes was a prolific designer and during the next few years he produced a number of boats in the 13' to 18' range Daisy (1890) was 18' long by 5'3" bean with a draught of 1'4" (3'6" with plate lowered) and had a 336 lb iron keel She proved to be a good cruiser and Holmes kept her until 1897

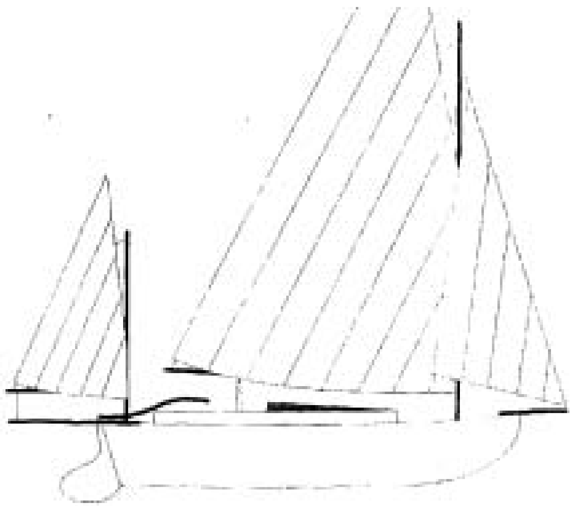
In 1897 Holmes designed and had built the Eel, this was a larger yawl and was a result of the influence of Albert Strange and his boat Cherub. Strange had moved up to the North East and joined the Humber Yawl club where he met Holmes and they became friends

Albert Strange was an artist and art teacher, born a Gravesend in 1855. In 1888 he designed the Cherub, a 20 ft canoe yawl. He joined the Humber Yawl Club in 1892.

The Eel was 21' long by 7' beam, had a displacement of 1.5 tons and a draught of 2' (4'6" with board down). She had an iron ballast keel of 1,364 lb and an iron centreplate weighing 280 lb. The rig comprised a 200 sqft, high peaked, loose footed gaff main, a foresail set to a bowsprit and a gunter mizzen sheeted to bumkin.

Eel became Holmes cruising boat and was retained for many years. She was finally replaced in 1913 by the larger Snippet. She was 28' long (22' waterline length) with a beam of 8'6" and draught of 2'6". She carried a main of 250 sqft, foresail of 93 sqft and mizzen 64 sqft, giving her a total of 407 sqft of sail.

Holrnes cruised extensively in Snippet right up to his death in 1940. He also continued to design the smaller craft, his last being Ripple (1938), a 20' canoe built for sailing on Hornsea Mere.



'Eel' 1897 (21' x 7' x 2')

Strange also continued to design craft for himself and others, though graduating to larger craft than Holmes. Between them they represent the beginnings of the design of small craft for purely leisure purposes. In the early days of the Humber Yawl Club there were very few options open to anyone wanting a small cruising craft, you either converted a small working boat or designed a craft for yourself. While still at school Holmes had owned a 20' Yorkshire Coble. Strange, at age 17 (1872), had cruised France in a converted Thames Peter Boat, the 'Stella'.

Holmes is credited with developing the sailing canoe into a useful coastal cruiser. Strange is associated with the development of this into the seaworthy cruising boat up to 70', eventually producing around 150 designs.

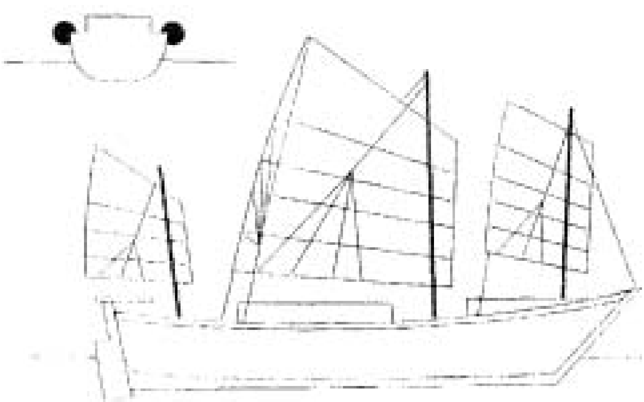
Voyaging

If the cruising exploits of the early canoeists and members of the Humber Yawl Club are impressive then the exploits of the 'canoe voyagers' are astonishing.

Joshua Slocum, now more famous for his single-handed circumnavigation in the 'Spray', had earlier completed a remarkable voyage in his 'canoe' Liberdade. He had lost the Aquidneck, a 326 ton trading clipper from Baltimore, in 1888, whilst returning from Montevideo. He and his family were stranded at Paranagua, south of Rio de Janeiro with no passage home.

He built the Liberdade using available local timber and 'pure copper nails' procured from the natives for which he paid in copper coins at a rate of two kilo of coin for one kilo of nails. *It seems that chandlers were always thus!* The vessel, which he called a canoe, was based on his recollections of Cape Ann dories and a photograph of a 'very elegant Japanese sampan'. She was 35' x 7.5' x 3' and carried a three-masted junk rig, and bamboo sponsons for reserve stability in the event of a knock down..

Liberdade carried the Slocum family safely from South America to South Carolina, including one passage from Pernambuco (Recife) to Barbados, a distance of 2,150 nautical miles in 19 days.



The 'Liberdade' 1888

The voyage of the Tilikum was a very different affair. Norman Kenny Luxton, journalist and John Claus Voss, master mariner set out deliberately to test the writing skill of the former and the sailing skill of the latter.

They planned a circumnavigation in a vessel built up from a dugout canoe. The sides were raised by 7.5" and decked over, stability was provided by a large keel timber, lead ballast shoe and 1,000 lbs of internal ballast. Additionally four 100 lb sacks of sand were used for trimming. Tilikum was 38ft x 33ft x 6'9" x draft 2', and carried a three-masted schooner rig 252 sq ft.

They set out from Oak Bay, Victoria, British Columbia in 1901 and aimed for Pitcairn Island and the Marquesas but they passed too far west, and eventually hit Samoa and Tonga. After a knock down, Luxton suffered coral poisoning, and went to Australia by ship. Voss took on crew, lost him (and compass), and eventually reached Sydney Harbour, Australia.

After some time in Australia Voss, now single-handed, left Auckland, New Zealand, stopped at Thursday Island, he sighted Cocos Keeling Islands on 8th November, but was swept past on the current, and eventually reached the coast of South Africa. From Cape Town he crossed the Atlantic to Brazil, Pernambuco Harbour. He recrossed to Ponta Delgada in the Azores and left for England on 13th August arriving in Margate, England, 3 years, 3 months and 12 days after leaving British Columbia.

If you don't consider a 35 foot vessel may be classed as a canoe, you may be more impressed by Frederick 'Frits' Fenger who, in 1911, cruised the Windward and Leeward Isles in his 17 foot by 39 inch canoe Yakaboo.

Fenger left Grenada on the 9th February 1911 and 'island hopped' through windward and leeward isles up to Saba. This may not quite be ocean crossing but he was regularly crossing 30 miles of open sea, often 40-50 miles, and always with the nearest land to leeward 1500 miles away.

And if this was not enough, Fenger accomplished this in a canoe with no rudder, Yakaboo was steered by moving the centreboard fore and aft. *This pre-dates Henry Gilfillan by eighty years, see AYRS 112. Sorry Henry.*

And if 35 foot canoes do not impress you and Fenger did not cross oceans, then consider Dr Hannes Lindemann. In 1955 he emulated Captain Voss, but smaller, crossing the Atlantic single-handed in his 23.5 foot by 30 inch dugout canoe, Liberia II. *Liberia I had been destroyed by fire in an effort to smoke out burrowing insects.* After several failed attempts, he successfully crossed from the Canary Isles to St Croix in sixty five days.

The following year he emulated Captain Franz Romer who, in 1928, crossed Atlantic in specially built Klepper faltboot. Romer crossed from the Canary

Isles to St Thomas in W Indies, taking 58 days of unbelievable hardship and finally having to be lifted from his canoe.

Liberia III, 17' x 34" x 10.5", was a standard Klepper folding canoe, into which were crammed 202 lb spare parts, 176 lb canned food and 198 lb crew. This crossing from Las Palmas, Canary Isles - St Martin, W Indies took 72 days

Recent Voyagers *(from John Bull 1994)*

In the last year or so we have seen the sailing canoe performing on the open sea, vindicating Alan Byde's statement that 'if we are to emulate the performance (at sea) of our forefathers then we must use their techniques', particularly the use of sail.

In November 1992 Chris and Stewart Newman sailed their outrigger canoe, the Spirit of Cleveland from Lisbon to Jamaica. A distance of 4,600 mile in 59 days. An average of 3.25 knots, 78 miles per day. Their best day's run was 101 miles, a performance that many small yacht sailors would be pleased with. It was undertaken in an Atlantic Trapper, a standard canoe but modified for the job in hand. Any canoe undertaking a long voyage is modified to a greater or lesser extent, we would be foolish not to.

Closer to home, there has been considerable activity by sea going canoes. At the end of May a classic cruise was repeated, for the first time for a great many years by sailing canoes. It starts from Loch Lomond via the River Leven into the Clyde and then northwards up Loch Long with a short portage at Arrochar back into the north end of Loch Lomond. Keith Morris, Andy Sallabank, John Tompkins and Walter Green completed the trip in 34 hours, including an overnight stop at Ardentinny.

The prevailing light conditions meant that considerable parts of the course were done under paddle, an ample demonstration of the old adage 'sail when you can and paddle when you must' and one of the reasons to keep alive the tradition of the sailing/paddling canoe.

This trip was almost overshadowed by Roland Denereaz who, starting some 24 hours later, sailed and paddled the same route, against adverse wind and tide, to arrive at Luss on Loch Lomond in 25 hours, non-stop. A tremendous feat of skill and endurance. It is worth noting that all these people have outstanding abilities both as canoeists and sailors.

At the end of June, Keith Morris was in action again. This time in the able company of Andy Sallabank and Tony Ball. They sailed from Crinan at the north end of the Crinan Canal via Oban and Fort William to Portree in the Isle of Skye. Something approaching 200 miles in seven days sailing with two days lost to the weather. Making allowance for tacking and local diversions this would give a daily average of around 29 miles, and an average speed of 2.5 knots. Their longest day's run was 33 miles. For most of the journey they camped on beaches and some careful thought had gone into keeping boat loads down to a minimum. Keith carried a VHF marine radio and kept contact with the local coastguards, a well worthwhile practice for small craft at sea, particularly as their course included several exposed crossings.

At the end of August Ray Goodwin and Dave Howie sailed a seventeen foot Dagger Venture from Dunlaoghaire (Dublin) to Holyhead in 21 hours. The course is some 70 miles direct and they averaged 3.5 knots. They crossed in fairly choppy conditions, a force 4 to 5 w to SW wind and the only water that came onboard was removed with a sponge. He found that steering with a paddle for such a long time in the boisterous conditions was very tiring but that he could not imagine doing a long sea trip in the future without a sail.

References

The majority of information for this article came from John Bull, some previously published in the magazines Canoeist (ISSN 0269 9982) and Afloat! (ISSN 0968 9109). These two are essential reading. Additional material has been gleaned other books and magazine articles, all of which are well worth reading.

Sail and Oar - John Leather, 1982, Conway Maritime Press, London, ISBN 0 85177 218 8.

Sail Your Canoe - John Bull, 1989, Cordee, Leicester, ISBN 0 904405 94 X.

Alone at Sea - Dr Hannes Lindemann, 1993, Pollner Verlag, Oberschleisheim, Germany, ISBN 3 925660 27 5.

A thousand miles **in** the Rob **Roy** canoe; on rivers and lakes **of** Europe (15th edition), 1885, London, Sampson Low, Marston, Searle & Rivington.

The Voyage of the Liberdade, Captain Joshua Slocum, (1894), reprinted 1949, Hazel Watson and Viney, London.

From 'Classic Boat', ISSN 0950 3315
George Holmes and the Development of the Humber Yawl, Howard Crowther, No 1, Jan 1987
The History of the Yawl, Mark Fishwick, No 11, Jan/Feb 1989
John MacGregor, John Leather, No 27, September 1990
Building the Canoe Yawl Ethel, Dick Phillips, Nos 31-41, Jan-Nov 1991.
The Canoe Yawl, John Leather, No 40, Oct 1991.

From 'The Boatman', ISSN 0966 1514
The Yacht and Boat Designs of George Holmes, John Leather, Nos 22-23, Mar-Apr 1995

From 'WoodenBoat', ISSN 0095 067X
A Canoe called Yakaboo, Joe Youcha, No 119, Aug 1994.
Tilikum: A dugout canoe for venturesome voyaging, Nicol Warn, No 121, Nov 1994.

The following books I have not read (because I have not yet acquired copies) but have been highly recommended to me;

Canoes of Oceania, Haddon and Homell, University of Hawaii Press

Canoe and Boat Building - A Complete Guide for Amateurs, W P Stephens, (1885).
This is out of print but the illustrations and text are available (separately).

> 'Fifty Plates from William Picard Stephens Canoe and Boat Building - A Complete Guide for Amateurs', Mystic Seaport Museum, Mystic, CT 06355.
> Text photostat of 'Canoe and Boat Building - A Complete Guide for Amateurs', WP Stephens from;
> Earl G Doan, Island Canoe, 3556 W Blakely Avenue NE, Bainbridge Island, Washington 98110-2205, USA

Alone in the Caribbean, Frederic A Fenger, (1917)

The Open Canoe Sailing Group

by John Bull

The Open Canoe Sailing Group was formed in the middle of 1990, one hundred and thirty years after sailing canoes first appeared in Britain. In the intervening years the sport had risen from its zenith at the turn of the century and declined to almost zero by the outbreak of the second world war in 1939.

There had been great times in this period, from the heady days of the 1870's and 80's when canoeing activities were regularly reported in the Times and other papers to a culmination in 1934 when Uffa Fox designed and built the International Canoes 'Valiant' and 'East Anglia' which successfully challenged for the America Cup, the first time that the British had won it.

After the second world war the International Canoe continued to develop becoming the International Ten Square Metre Sailing Canoe and indeed the class has continued to develop to this day, becoming more and more sophisticated, very expensive and very difficult to sail well. It is perhaps this very sophistication which holds back the class and to a great extent has lead to the decline in sailing canoes.

Sailing canoes, that is *proper canoes* that can be paddled as well as sailed, survived by dint of the efforts of a few eccentrics. It was not until 1989 that the first ad hoc race for open canoes was held at the IC 10's national meeting at the Clyde Canoe Club on Loch Lomond.

Subsequently John Bull of Solway Dory, one of the eccentrics, was invited to become an ex officio member of the British Canoe Union's sailing committee and class rules were drawn up which are the guiding principles today. The marriage between the open canoes and the international canoes was not a fruitful one, their interests were too diverse in spite of the tenuous link of history. The following year, at the IC 10's national meeting at Stone on the Blackwater Estuary, their ways parted by mutual agreement and the Open Canoe Sailing Group came into being. The OCSG has but one objective, to further the interest in canoe sailing. The season starts in April with the Ullswater meeting and runs through with monthly events at different venues around the country to the final meeting in October. The racing is serious, in spite of what they may tell you. 'Oh yes' they say 'its just a bit of fun', 'I only do it for relaxation' they say, but don't you believe it. As soon as the race starts they've all got their heads down and are trying hard. They'd cut your ears off for half a length advantage. Mercifully, Rule 8 controls our worst excesses; 'Before any protest can be considered by the committee (which doesn't exist) a round of drinks must be bought for the assembled fleet'.

Today there are about seventy registered boats racing and another hundred or so unregistered, they are scattered around the country although there is a sizeable contingent around the Lake District. The membership of the OCSG stands at around eighty and is growing. There are a further fifty or so individuals who are showing more than a passing interest in canoe sailing and may swell our ranks in due course. The OCSG is now affiliated to the Open Canoe Association which is perhaps a more appropriate sheet anchor for it.

Open Canoe Sailing Group - Race Rules.

1. Starhoard tack has right of way.
2. Overtaking boats must keep clear.
3. If two boats are on the same tack the windward boat must give way.
4. Paddles may only be used to steer or assist tacking unless otherwise stated.
5. Crews may be single or douhle handed.
6. Race control must he informed as soon as possible of a withdrawal.
7. Competitors are expected to render assistance in an emergency.
8. Protests will only be considered after the protester has bought a round of drinks for the assembled fleet.

For those who have never seen a sailing canoe it is an open canoe of about sixteen feet or so, fitted with a sailing rig, often a Solway Dory Voyager which is a sleeved lateen sail of 40 square feet. Gunter and Lugsails are also represented in the fleet and some owners build their own rigs, but to be successful you do need to know what you are about. 44 square feet is the maximum allowed under the current rules, it is a good working size for cruising, seldom causing the boat to be overpowered. The boats themselves are quite capable of carrying *50%* more sail but of course they would become more demanding. Leeboards are the usual device for resisting leeway, centreboards are not allowed and rudders are optional.

Open canoes can be sailed solo or double handed, it doesn't seem to make a great deal of difference to the speed. Crews generally sit in the bottom of the canoe to keep the centre of gravity as low as possible, although the more competitive crews sit out on the gunwale to allow them to drive the boat that bit harder. Given the right conditions, the top end of a force three wind and reasonably flat water, an open canoe can be induced to plane. The hull and leeboard begin to vibrate and hum quite loudly as the boat accelerates, an experience likened by one OCSG member to 'riding a pig without stirrups'.

Speed is always a difficult thing to estimate when you are as close to the water as you are in a sailing canoe. Its a bit like the fisherman's story of the one that got away and perhaps you shouldn't spoil a good story for the sake of pedantry, but certainly speeds up to seven or eight knots can easily be attained. More importantly for the cruising canoeist quite high averages can be maintained for extended periods.

Open Canoe Sailing Group racing has played an important part in the development of an understanding of the sailing canoe and we are now seeing some very long sea voyages undertaken. In 1993 a sailing canoe crossed the Atlantic from Lisbon to Jamaica in sixty three days, an average of around three and a half knots. In 1994 three sailing canoes sailed from Crinan to Portree in Skye, two hundred miles in seven days, averaging again some three and a half knots.

Generally canoe sailors already have their boat and a rig will cost around three hundred pounds. This usually includes everything and of course what you buy is a guarantee that it will work first time as designed. They take about an hour to fit. You can design and build your own a great deal more cheaply and I would recommend that you read my little book 'Sail Your Canoe' unless you already have a working knowledge of sail rig design. You can also buy plans for a forty square foot rig from Solway Dory. *(And see plans for the Crab Claw rig later in this publication.)* The cost of the rig will depend on how much scrounging you do but it will be in the order of one hundred pounds. A complete sailing canoe ready fitted out for the water will cost around the thousand pound mark from any of the main dealers in open canoes.

Of equal importance to the boat and the rig is the sailor himself. A good sailor will make a poor boat go fast whereas a poor sailor is not likely to do much better in a good boat. Sailing canoes are very sensitive to their setting up and it is easy to lose speed by inattention or clumsy handling. Surprisingly they are not as liable to capsize as many people would expect and we quite often have water coming over the gunwales without the imminent danger of capsize.

Membership of the Open Canoe Sailing group is free but there is a five pound per annum charge for the monthly newsletter, the Gossip, which carries the general crack and information about forthcoming events.

British Canoe Union Open Canoe Class (1990) Regulations

1. Length
   a) Any length of single hulled canoe is permitted.
2. Beam
   a) Any beam is permitted.
3. Sail
   a) Area Not greater than 44 square feet including the roach area.
   b) Design Any design of sail rig is permitted.
   c) Height The maximum height of the rig shall no exceed 15 feet
4. Deck
   a) Deck The canoe shall not be decked for more than two thirds of its length, ie one third of the boat must be open.
   b) Gunwale The gunwale must be more than 3" wide.
5. Buoyancy
   a) The canoe shall float if submerged. Extra buoyancy may be added but shall not substitute for additional decking or increased beam.
   b) Personal buoyancy MUST be worn when racing.
6. Keel
   a) Keel A fixed keel is optional but shall not exceed $1^1/_2$" in depth.
   b) Centreboard Centre boards are not allowed.
7. Steering
   a) Steering by paddle or rudder is optional.
8. Aids
   a) Sliding seats or trapeze are not permitted but toe straps are permitted.
   b) Any bailer may be used.

i) *These regulations apply ,from January 1st 1990.*
ii) *Canoes outside these regulations may be admitted at the race officer's discretion.*

The Personal Trimaran

by Gail Ferris (April 1994)

During the fall of 1991 as I was making paddling plans for kayaking in the Upernavik Greenland area, I realised that I should take into account the fact that not always would I necessarily be able to conveniently find places within a reasonable distance to land at in this area. The kayaker is unable to carry out some essential necessities while on the water unless there is some extra stabilising device at the kayaker's disposal. For those moments during epic long distance crossings by Hans Lindernann, Ed Gillet and others made use of outriggered floatation when the paddler felt the necessity.

As a kayak paddler I often have felt that it would be nice to have auxiliary floatation. 1 compared types of floatation systems on the market which required that the paddler pass straps beneath the hull of the kayak to install the air bladders. I thought about the awkward and unstable situation for the paddler is when the paddler has to install these strapped on air bladders on the water in threatening conditions. The paddling resistance of these flexible and unreinforced air bladders would considerably slow the hull speed. Thus these air bladders are best used for temporary and emergency situations, but are too difficult to install under such circumstances. The straps which require that the paddler pass beneath the hull the straps from one side to the other in order to secure the air bladders. It is of necessity that the air bladders be centred so that the kayak is not canted to one side, then they must be secured tightly to have the air bladders function as auxiliary stabilisers of the kayak. During the installation on the water the accidental twisting of a strap which has been passed beneath the hull would severely compromise hull speed and the kayak paddler would on a wide hull, be unable to determine or prevent this from happening.

With the increased interest in kayak sailing the development of outriggers which attach to the forward cockpit section where normally leeboards are installed. There are may kayaks which lack sufficient stability to be sailed without additional stabilisation. The stabilisation for sailing kayaks has been developed to optimise sailing of unstable kayaks by placing pointed ended air bladders at the end of aluminium outrigger structures. The double leeboards are about 18 inches long and about ½ an inch thick and the single leeboard is longer than 18 inches is thicker than the double leeboards.

There are several qualities of these devices which make them unsuitable for Arctic travel. These devices are for what they are designed to accomplish, too difficult to stow when broken down, weigh too much and are difficult to install when on the water. Some of these devices require special precision installation and they are attached only to the coaming of the folding kayak. The coaming on a folding kayak is not designed to absorb this amount of stress. Any outrigger device placed at the forward section of the cockpit makes paddling very difficult at best.

I concluded from my past experiences in Arctic travel that I needed a light weight and easy to not only stow but install outrigger. The outrigger extends equally out from both sides of the kayak thus converting the monohull to a trihull. The outrigger was as Lindemann's was out of an extra paddle. I consulted with Werner Paddle Company about the relative strength of their paddle shafts. I was informed that the shaft was of a composite structure of wrapped fibreglass which was pole vaulting material, thus it could take extensive stress without failure. Through the years I have, on necessity, brutally chopped holes in the ice with Werner paddles and never have experienced any failure of shaft or paddle blades.

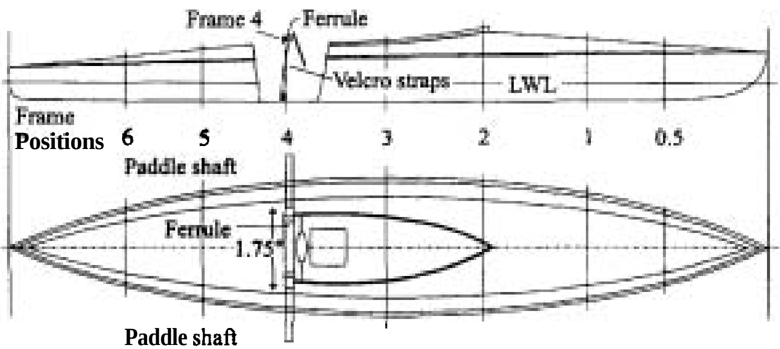


Figure 1. Additions to Klepper "Aerius" Kayak

The attachment in my folding kayak was accomplished with two nylon straps with nylon Velcro available at standard sewing and fabric stores. In retrospect the Velcro I should have used is polyester industrial strength which is manufactured by Velcro USA, 406 Brown Avenue, Manchester, New Hampshire. 03108. Telephone (603) 669-4892. Polyester Velcro is more ultra violet resistant and stronger than nylon Velcro. Velcro when it becomes wet loses 50% of its strength. Nylon strap stretches considerably when wet. The inherent advantage to using Velcro strapping is that when threaded through a loop and doubled back upon itself, the shear strength is doubled. Diving and medical equipment is often attached to a person's body with this type of strap loop device because of it's great versatility and strength. I attached the Velcro to the nylon webbing by stitching with a sewing machine and nylon thread. The hook part of the Velcro is best sewn on from the back side of the strap because the hooks tend to cut or badly foul the thread when sewing is attempted on top of the hook surface.

The paddle shaft was to be positioned across the cockpit with a ferule that was to be in place at all times when the kayak was on the water. The ferule upon advice from Rayan Hanegan of Werner Paddle Company was specially made and match fitted to the paddle intended to serve as the outrigger arms.

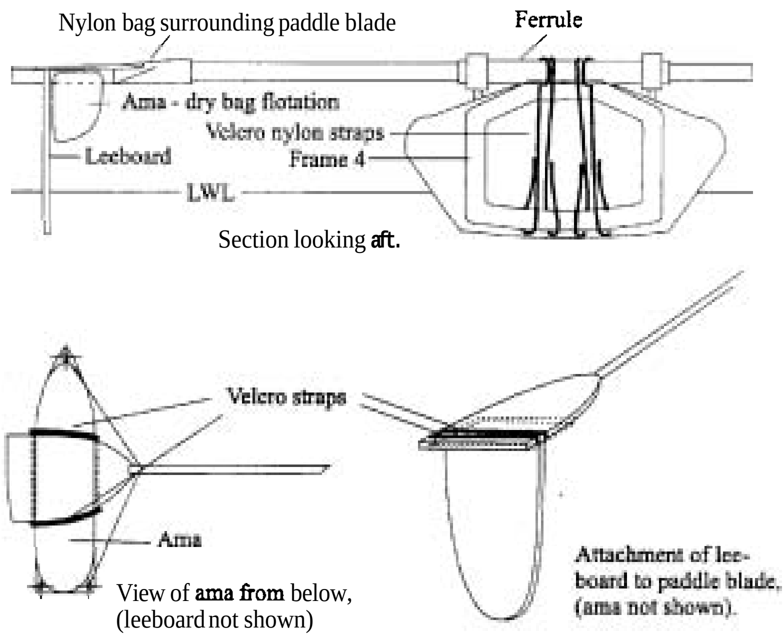


Figure 2. Detail of Additions to Klepper "Aerius" Kayak

Each of the two Velcro nylon straps is wrapped once completely around the ferrule which is resting behind the seat across the top of the coaming and against the rear coaming piece. Each end of the nylon velcro strap is passed around the bottom of the rib just behind the seat and the strap is pulled tight and the velcro is attached hook to loop sections by pressure to itself. To compensate for wet stretching in the nylon strap, the strap can be dipped in water and then used to attach the ferule to the kayak.

The 17.5 inch ferrule which just extends across the width of the cockpit has blocks of wood epoxied to it to act as spacers for the coaming on the stem and spacers to maintain a shallow less than 5 degree climbing angle on the outrigger arm paddle blades and to retain the lateral position of the outriggers.

It was through the sage advice of Jon Persson of Old Saybrook, Connecticut, that a climbing angle of less than 5 degrees on the outrigger paddle blades be maintained so as to prevent the yawing angle from driving the paddle below the surface of the water rather to create the all important lift needed.

Attached to the outrigger paddle blades were nylon Oxford cloth bags which had nylon velcro straps sewn to them. The choice of cloth bags for attachment points on paddle blades was because the bag could neither slip up or down the paddle blade once it was strapped on. In the interest of things being designed for temporary use these bags can be easily attached or detached as needed. To these bags the sewn on nylon straps serve as attachment points for the floatation bags or amas.

The floatation bags or amas are made of expedition weight dry bags which have grommeted ends and fold over Fastex clip closures. Within each of the two dry bags is placed a loosely rolled, partially inflated Thermarest pad. These Thermarest pads serve not only to hold air in addition to amount of air the dry bag would retain but to provide increased structural rigidity. The traveller also gets to rest on two pads not just one when sleeping on the cold hard ground. The dry bag is attached to the paddle blade with nylon velcro overlapping strap in a U configuration. The forward and stem end of the dry bag or ama is tied from the inner grommet and the closure clip to the paddle shaft. This will maintain parallel with the hull orientation. I hope.

Next to the floatation bag can be strapped the leeboards. The leeboards which Jon Persson made of marine 4 mm mahogany plywood, fibreglass cloth, nylon strap, velcro, and marine epoxy. These leeboards are 10" long and 5" by 5.5" wide attached to the paddle blades with epoxied velcro nylon straps threaded back over on themselves through Delrin loops.

The paddler can put into position the outrigger arms which are two halves of a kayak paddle by slipping them onto the male and female fittings on the ferrule behind the seat. These are anchored with spring steel push pins.

The sail and its mast are stowed on deck in a canvas sailbag for my folding kayak which is a Klepper is the Klepper M-l Driftsail. I modified the M-l Driftsail by adding reef points. The reef points were made by sewing extra mast sleeves of shorter lengths to the original mast sleeve and adding extra points. The jibsheet was sewn to duplicate at about 1/3 the size of the S-4 Klepper jibsheet. This smaller jib, Jon Persson pointed out, can be set in such a way as to move aft the centre of effort sufficiently to permit efficient use of the leeboards which are positioned farther aft than normal being behind the seat rather than just behind the mast as in other designs.

I hope that this design is flexible and versatile enough to extend my safety margins and horizons.

I, Gail Ferris and Jon Persson designed this personal trimaran with the most valuable help of Geoffrey Conklin in April 1992.

This article was first published in the AYRS New England Newsletter, April 1994.

The Solway Dory Delta Sail

A Crab Claw for the Sailing Canoe

by John Bull

Professor Marchaj's surprising analysis of the Pacific Islander's Crab Claw sail (see AYRS 111) came at just the right time for us. We were looking for a rig for a sailing canoe that was being prepared for racing. The prospect of a ten or twelve percent increase in thrust from a given sail area was too good to pass up, and design work was immediately put in hand.

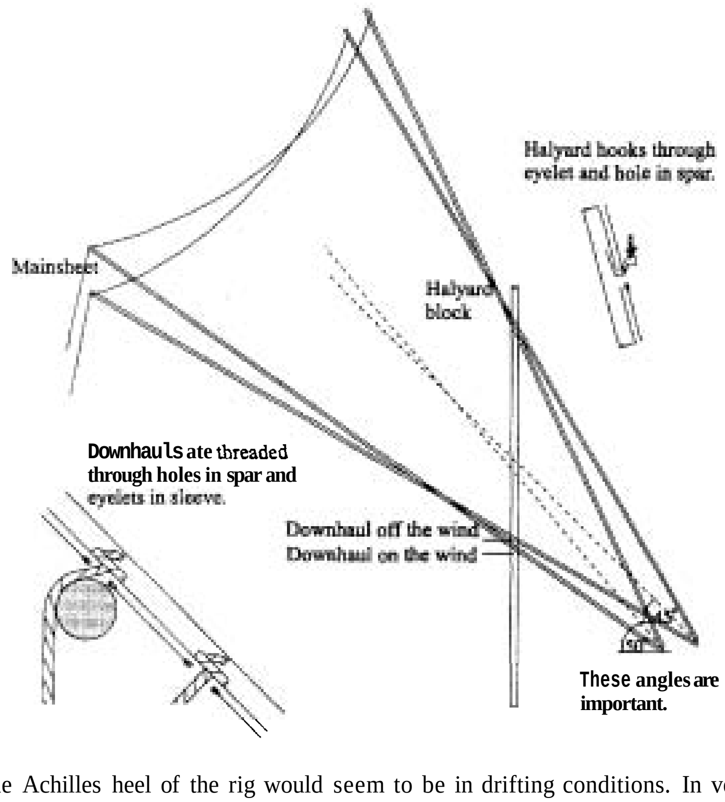
Our sail maker viewed the project with more than a little mistrust. The idea of a flat sail, let alone one of such a peculiar shape, was more than any self respecting craftsman should be expected to bear, but he was as good as his word however and in due course the sail arrived, minus, we noted, his usual logo.

Our Crab Claw, called the Solway Dory Delta sail, was to be of forty square feet, set on thirteen and a half foot aluminium spars and carried on a mast of some eight feet. The rigging was simple, a halyard, two downhauls and a sheet.

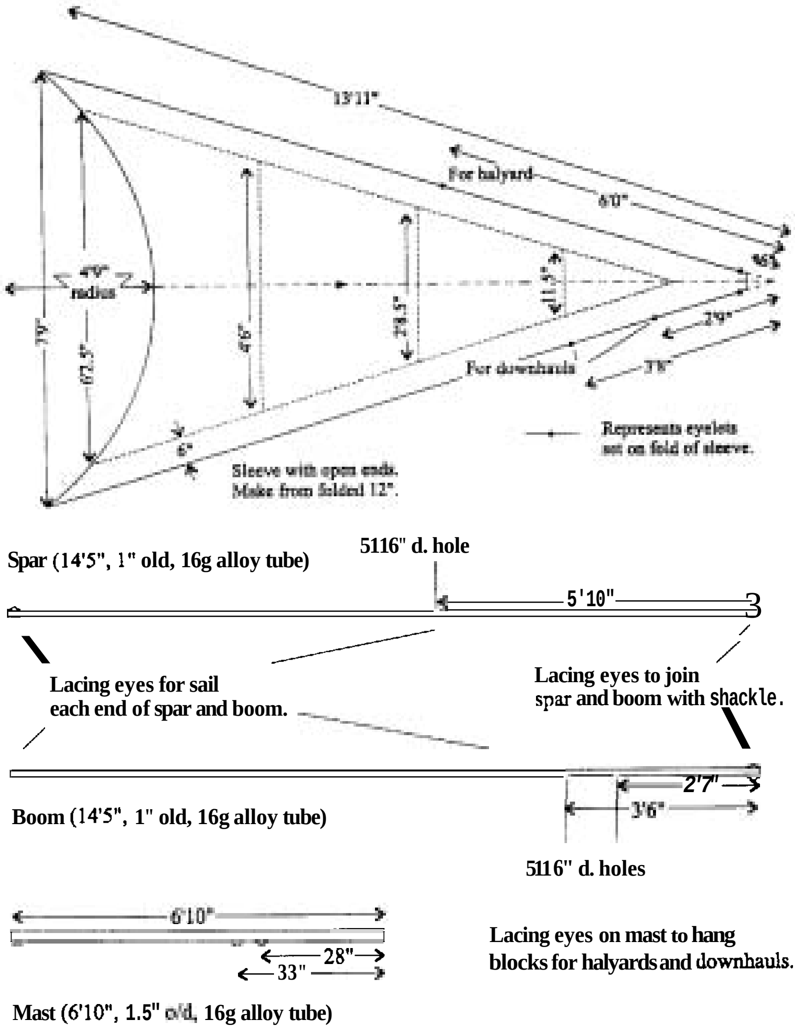
On the water the rig has been all that we hoped for in terms of performance and, if one ignores the ribald remarks of the hoi polloi, 'look a low flying hang glider', 'turn right at Folkstone for Hawaii' and the like, a very well mannered rig in spite of its lofty stature. Anyone with a streak of exhibitionism in their persona will enjoy it and one of its incidental advantages is that it is set well above head level, even for tall people or very large heads.

The Delta sail is cut flat and lends itself to home manufacture on this score, it is also set flat and being so restrained by spars and tension it does not flog. Reefing is carried out by slackening the halyard or downhaul and allowing a curve or belly to develop in the sail, thus reducing the projected area. Two downhauls are needed in order that the sail may be carried in different attitudes for use on or off the wind (peaked up high for windward) and this adjustment does make a difference to the performance. The sail is permanently rigged on one side of the mast and is not changed with the change of tack.

Surprisingly, for such a high set sail and long spars, gybing is a fairly gentle event, without the usual heart stopping flailing of rig or ducking of heads. The initial trials of the Delta were carried out on the Solway Firth on a seventeen and a half foot by three foot open canoe which was regularly sailed in winds of force four and five and the choppy seas that one gets in estuaries. Its very low aspect ratio means that it has a relatively low heeling component and is comparatively easy to hold up. In practice it points well and is good to windward in spite of Tony Marchaj's rather pessimistic wind tunnel results on this point. It is altogether a good rig for a small boat.



The Achilles heel of the rig would seem to be in drifting conditions. In very light weather the crab claw will not compete with conventional rigs, presumably because adequate vortices do not develop along its edges and hence there is little if any differential pressure across the sail.



John Bull has generously allowed us to publish his plans for the Solway Dory Delta Sail. If your eyes are up to it you can probably make a Crab Claw from the details on this page. If not, or if you feel that you should pay a royalty to the designer, you can obtain plans from John.

Crab Claw Sail for Pacific Proa

by Pierre-Yves Corre de Dufau de Maluquer

Ed. I received two letters from Pierre-Yves, and many photographs. Here are extracts from the letters and a selection of photographs.

6'' November 1994 - St Martins, Indes Occidentales Francaises

Here are a few photographs and some details of my, just launched, Pacific Proa. I can say that in Force 2-3 I can reach a speed of 15 kts

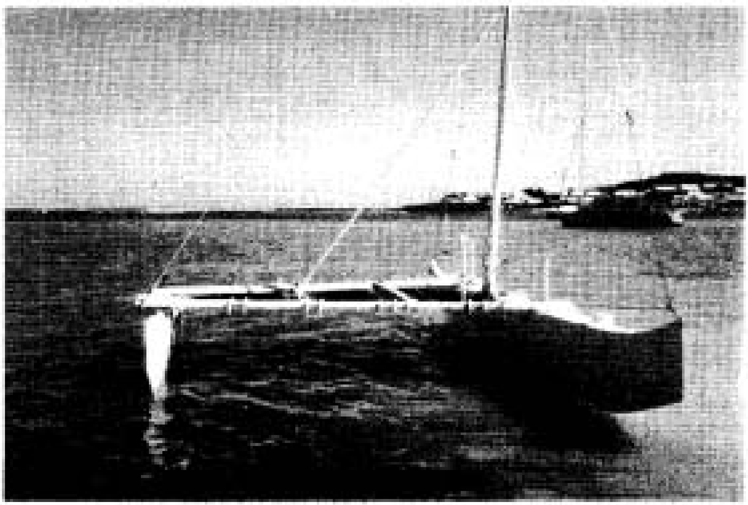
- Main hull, length 8m,
- Outrigger length 4m,
- Overall beam 4m,
- Sail area 22 sq m

Performance to windward is very good, close reaching superb, down-wave is bad and risky. I cannot be more explicit because I have, as yet, only sailed her twice.

Pacific Proa with Crab Claw in action in Caribbean

I canted the outrigger by some 30 degrees against the waves, this is good, but down-wave the outrigger meets the wave with an inevitable negative incidence, bringing the float downwards, stopping the boat and eventually starting a beautiful diagonal capsize. Consequently I am busy putting the outrigger vertical, with higher beams. From memory it seems to me that Mantis IV had 'floils' I guess that the boat had the same problems?

Muntis IV had two 'floils' (foils which also provide some buoyancy), a trimaran. I reported a dramatic drop in speed on face of wave when running - I thought due to beam twisting. (Michael Ellison)



Pacific Proa - with outrigger now vertical.

For starting a new tack a pole is necessary to push the boom outwards, if not then the boat will never lay across the wind but will come into a close reaching position, making a start in my case is impossible, because the boat will come in front of the wind instead of moving ahead. I must say that my rudders are small and close to centre position

23rd May 1995 - Trinidad

Now I am sailing (I quit working) in these waters of Trinidad, and later Venezuela, aboard my proa Walkyrie, an Atlantic proa of 68ft.

The 'big one', Atlantic Proa Walkyrie.

The little one, Pacific type, with a kind of crab claw sail is 8m long by 4m beam of 350 lb and 22 sq m sail. The main hull is only 1 ft wide, the float 10" and 4 m long. My hulls are both asymmetrical, no dagger boards - two rudders in trunks, they can turn 360 degrees.

About performance;

The proa is very good to windward but not as good as a Prindle 19. I tried to sail on one hull even by very light winds. It appears that it is in these conditions that the boat is best.

Tacking in the Caribbean seas is a bit dangerous for the rig; The mast is held by a rope (tension) and a strut (compression) and it is the strut that can be a problem, bending too much because of the weight of the spars (with the waves on the beam. My conclusion is that the strut system is good for lagoons only.

The fun for me is to repeat the gestures of the Micronesian people. I did not have real ambition for outright performance

I don't think I have added new ideas to Kia Kia by Chris Hughes.

Details of Rig for Pacific Proa.

Pierre-Yves modestly claims that he has made no advances, merely applied the ideas printed earlier in the pages of AYRS publications. He quotes the following references as being influential in his design.

References

AYRS 1	Sir W Acklands canoe
AYRS 7	A micronesian canoe by Sandy Watson
AYRS 68	Kia Kia by Chris Hughes
AYRS 47	the Prout proa and Botje III by JS Taylor
AYRS 71	Flying proa by JS Taylor
AYRS 111	Rig Efficiency - the crab claw sail

Bruce Foil for Canoes

Produced by Solway Dory and Chris Hare Marine

Reviewed by Tony Kitson

The K-Wing and C-Wing stabilisers for kayaks and open canoes respectively have been developed by John Bull and Chris Hare. They are a development of the stabilising foil pioneered by Edmond Bruce and described in previous AYRS publications. One example of the ideas explored in our pages being turned into a successful commercial product.

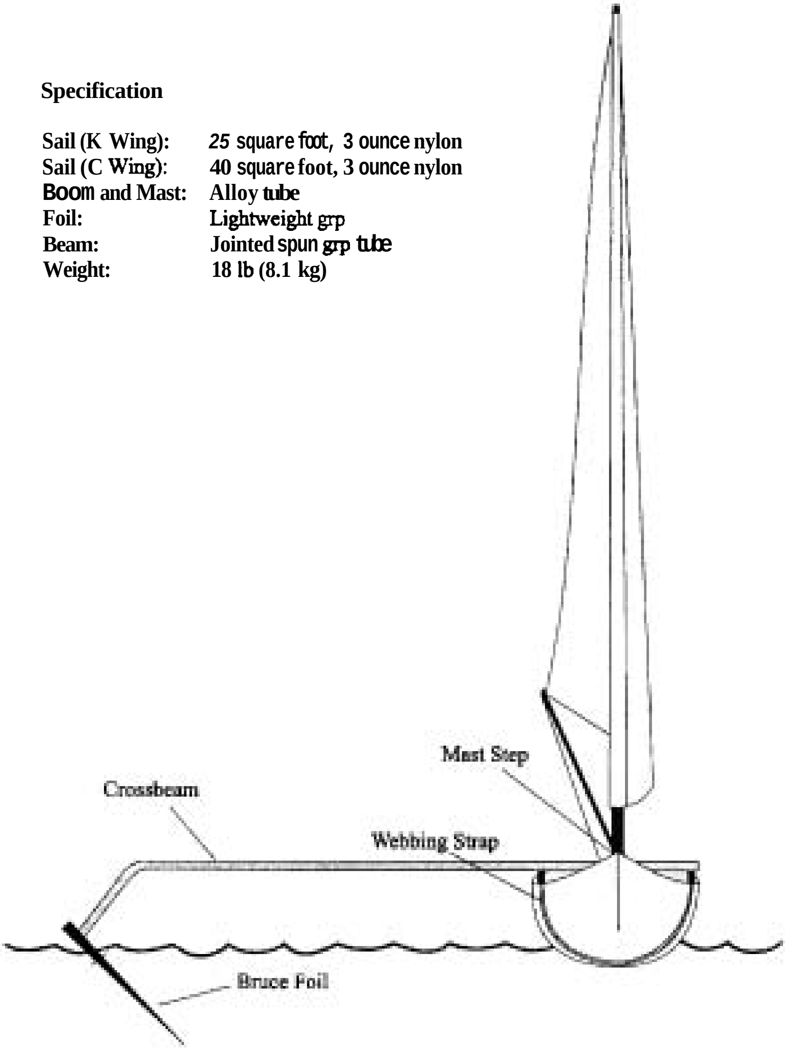
The Bruce foil provides stability by the use of dynamic forces. The foil is mounted on an outrigger, but does not provide significant buoyancy. It is canted, with the lower edge closer to the main hull, and acts simultaneously as a leeboard (or weatherboard) and stabiliser. When the foil is to lee of the main hull it provides an upward, as well as lateral, thrust, when to weather it provides downwards and lateral thrust. Thus a craft looking like a proa is able to sail on both tacks, an Atlantic and Pacific proa combined!

The K wing combines both the foil, the outrigger beam and the mast step and is fitted to a standard kayak by means of web straps which are tightened down around the hull with stainless steel ratchets. This allows the sailing rig to be fitted without permanent modification to any kayak. When the wind drops or you really want to start using your energy paddling again the rig can be simply removed.

Disclaimer: I have no connection with Solway Dory or Chris Hare Marine. Neither have I sailed a canoefitted with the K-Wing. This review is based upon literature read and seeing the product at the Canoe Show.

Specification

Sail (K Wing):	25 square foot, 3 ounce nylon
Sail (C Wing):	40 square foot, 3 ounce nylon
Boom and Mast:	Alloy tube
Foil:	Lightweight grp
Beam:	Jointed spun grp tube
Weight:	18 lb (8.1 kg)



Fin Power

Success Comes From Copying Nature

by Harry Bryan (Winter 1994)

Summary

The fin-powered concept described here was developed with almost no knowledge of other experiments with pedal-powered craft. My only model was the paddle-wheel boats that can be rented at vacation beaches and that show vast room for improvement. The drive system and boat we now build were conceived on a sailing voyage where time to think was the greatest gift.

The major inputs to the design process were:

1. fish caught and studied,
2. close observation of swimming fish at aquariums in Auckland, N.Z. and Monterey, California,
3. the book "How Animals Move" which I studied at the public library in Honolulu, Hawaii. Unfortunately I neglected to copy down the author and publisher of this work.

When problems developed in the design process solutions were usually found by returning to the study of fish anatomy.

Speed through the water has been important only if it contributes to efficiency at cruising speed. Reliability, relaxation and ease of pedalling have been the guidelines.

Previous Human Powered Fin Boats

Early in the evolution of this design we used whales and dolphins (with their horizontal tails) as models. Einar Jakobsen has worked with this concept (Human Power vol 5, no 3, Fall 1986) as has Trond Oritsland (letters to the editor, Human Power vol 9, no 2, 1991). **A** horizontal-foil boat was built by Parker MacCready (Human Power vol 5, no 3). Although this approach has proven to have potential, several problems exist which cease to exist or are easier to compensate for with the vertical fin which we have chosen.

Advantages of Vertical Fins

For the horizontal fin, the centre of oscillation must be at least half the distance the fin will sweep below the water's surface if the fin is to remain submerged. This means that some of the drive mechanism must be at this depth. This makes it susceptible to damage. Also this drive mechanism (any underwater part which is not the fin) will contribute drag.

Optimum Stroke

We have found also that with a displacement hull (canoe or kayak form) there is greater efficiency in a slower oscillation of the fin sweeping a large area than in a shorter and quicker stroke. This motion seems best at 1:1 with the pedal stroke, which greatly simplifies the drive system **A** large swept area means greater depth of stroke with the horizontal fin which we see as limiting the area the boat can be used in. Our fin will kick up as does a small sailboat rudder when it encounters an obstacle or shallow water. It will swim over a shoal or through a patch of seaweed.

One other great advantage to the single vertical fin is that steering as well as propulsion is achieved with no additional mechanism. Once this last advantage was seen we concentrated completely on the vertical fin.

Double Versus Single Fins

Calvin Gongwer has experimented with double vertical fins (also Human Power vol 5, no 3). This may reduce the fin-induced rolling if the fins oppose each other, but steering would then be much more complicated. I will return to steering below.

Use of Flexible Fin

The fin we use is quite flexible as we have made a conscious effort to match the characteristics of a fish. There appear to be definite advantages to this over a rigid foil. As the fin swings to the side it bends and twists in reaction to the water pressure. The more it can bend, the longer the stroke can be and still produce forward motion. The best construction seems to have a narrow but stiff leading edge and a quick change to the main area of the fin which is quite flexible. This is similar to a fish.

Even with the flexible fin, you cannot swing past 30 degrees from the centre line of the boat and still maintain a favourable angle of attack. A more flexible fin would allow this, but when the fin is too flexible sufficient power cannot be transmitted to the water. We can increase the length of the arm to sweep a larger area with the same 30 degrees, but this gets clumsy and begins to make the boat look odd.

Use of **a** Fish Joint

Our solution to delivering more power without increasing fin area or arm length was to (once again) copy the fish. Just in front of the actual fish's fins we studied is a joint that is controlled by muscles and has a limit of bend at about **25** degrees from the centre line. We introduced this joint between the oscillating arm and the fin at its end, added a muscle in the form of a spring (which tries to keep the fin in line with the arm) and a stop in the form of a nylon cord within the spring which limits the joint to a **25** degree deflection.

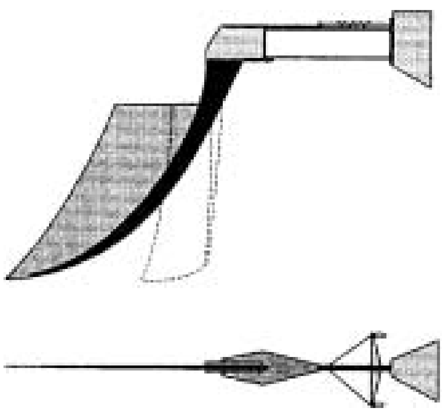


Figure **1.** Fin and Fish-joint

Because the fin is now allowed to pivot **25** degrees as well as to flex, the arm can be oscillated back and forth about **45** degrees and still provide thrust at its extremes. The spring performs three functions. First it makes smooth transition from the end of one stroke to the beginning of the next. Without the spring, part of the pedal stroke is lost as the fin shifts from stop to stop. The spring and the flex of the material both store energy which is released at this, otherwise inefficient, part of the stroke cycle. The second function of the spring is to allow for light shallow strokes. If there were no spring and the arm were oscillated less than **25** degrees from centre, the fin would just swing on its pivot and provide no thrust. The third contribution of the spring is to hold the fin far to one side if a tight turn is being made.

Spring Tension

The correct spring tension seems to be that which allows a cushioning effect as the spring is extended against its stop during moderate pedalling. Light tension is good for light pedalling but feels sloppy in a sprint. Heavy tension allows greater speed but is inefficient at slow and moderate pedalling speeds. Our present 'cruising' spring is 75 mm at rest and 150 mm extended. At this length the tension is 58 N (13 lbf).

Fin Shapes

Six fin shapes have been med so far. All have been able to push the boat at hull speed (about 2.2 m/s, 5 mph). The improvements have been in reaching this speed with less effort, and in designing to eliminate stress points and consequent material failure.

The leading edge of the fin, which engages the cheeks at the pivot, extends nearly the whole distance to its tip. It is cut from two pieces of General Electric Lexan polycarbonate plastic. These are each 6 mm thick. Sandwiched between these is a single piece of 1.5 mm (116") Lexan, forming the bulk of the fin. Early structural failure was partially attributed to the effect of the solvent glue (methylene chloride) used to bond the pieces together. Present practice is to use 3M 5200 polyurethane adhesive backed up by copper rivets.

Given a fixed area of fin needed to load the leg muscles efficiently, the choice of fin shapes goes from narrow and vertical to a shallow shape extending aft. The fish equivalent is from tuna to trout. The deep narrow blade will require a stiff leading edge. We use hardwood on this style of blades as it is stiffer than Lexan. It is the fastest shape. Its drawback is 150 mm (6") more draft, 600 mm (24") rather than 450 mm (18"). Also, as mentioned, there is a bit more rolling with a deep fin.

As the fin design angles back more and more its leading edge must become more flexible in order to provide forward thrust at the end of each stroke. Spring tension must also increase to counteract the leverage of the fin area as it moves aft of the pivot. The two fin shapes illustrated represent what we have found to be the practical limits given the present fin drive mechanism and fin material.

Prototype Hull

The hull of the prototype, "Thistle", was designed to meet the needs and potential of the drive system. Its length is 4 m (12'6"). Beam is 750 mm (30").

Two fixed fins are fastened to the hull. They correspond to the anal and pelvic fins of the fish. The anal or further aft fin opposes the tendency of the fin action to make the boat roll. More importantly it keeps the stem from wiggling due to the sideways force generated by the fin.

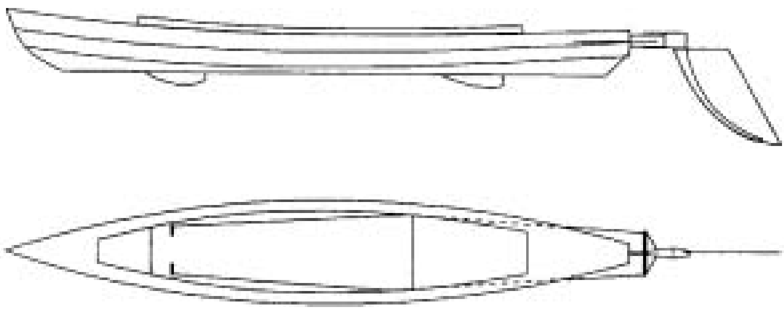


Figure 2. The 'Thistle' hull.

The forward fin aids greatly in manoeuvring. It gives a point to turn around when steering and keeps the bow from blowing away when the wind is on the beam.

Pedals and Ropes

Low-stretch polyester ropes transmit the pedal motion to the fin-drive mechanism through plastic tubing built into the hull. The pedals are reciprocating (rather than rotary). They pivot upon bearings fastened to the inside bottom of the cockpit.

Steering is achieved by either coasting with one foot depressed or pedalling with the fin to one side or the other.

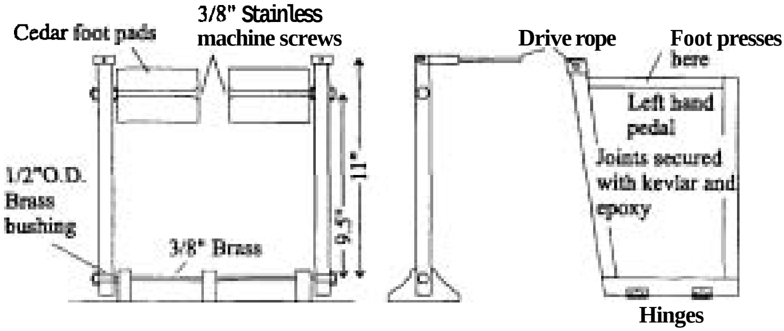


Figure 3. Two alternative pedal types.

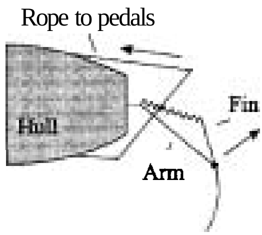
This boat has proved to be easy to pedal for long distances and extremely easy to learn to steer. The feeling of control (both propulsion and steering) being all in the legs, gives a natural feeling of walking to water travel while freeing the hands for photography, binoculars or fishing.

"Thistle" was designed to match the thrust and steering characteristics of the fin-drive unit with a suitable hull form She is small enough to be modestly light in weight and easy to carry on top of a car. Her layout allows for the semi-recumbent position best for pedalling, stability and windage. The hatches at either end provide storage and flotation.

The drive unit itself has changed little at all since its building. To mimic its motion wave your arm from side to side in a slow horizontal handshake. Let your hand be like a fish's tail. Thus the pivot joint becomes the elbow joint, the second pivot just in front of the fin becomes the wrist joint. The solid piece between the hinge joints is the forearm. The tilt-up 'rudder' cheeks and the fin itself are referred to as the fin.

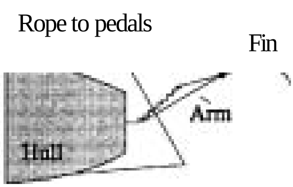
Look at the drawing of the boat from above. Imagine pressure applied by the right foot. The drive rope (which passes through a polyethylene tube from the cockpit then out through the hull near the stem) pulls the forearm to starboard. The fin does not want to be moved sideways so there is a twisting at the wrist joint. This causes the arm extending forward from the fin cheeks to move off centre, which movement is resisted by the spring connected from this forward fin arm to the elbow joint pin. The harder you push on the pedal, the more deflection there is until a doubled nylon starter-cord stop inside the spring becomes taut. This stop is at approximately *25* degrees. **A** fish's tail (a dorado's) seems to come up solid at the same point.

1.



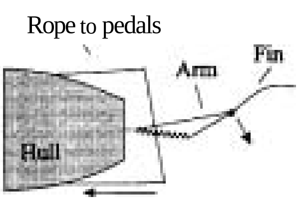
Start of stroke by right foot pressure. Spring is fully extended against its stop. Fin/arm joint is at maximum angle.

2.



End of right stroke.
Note that fin is still providing forward thrust.

3.



Shifting to start the **left foot** stroke. The **spring** is just starting to be reten**sioned** after the **fin** swings past centre. The fin is releasing its stored energy.

Figure 4. Stroke/Drive diagrams.

The fin itself is now in the best position to impart forward motion, and it now moves to starboard following the **forearm**. The flexible parts of the fin bend which makes a more efficient shape. This bending also stores energy.

At the end of the stroke, the energy in the flexed fin is released while the left foot causes the forearm to start back to port. Without the spring this motion reversal is sloppy. Also, the spring makes light, shallow possible where the stop angle is not reached. Steering also is crude without the spring.

Spring tension with the fin shapes illustrated seems best around 10 and 20 **lbf** measured with the spring extended to its stopped length.

The unit will go through heavy weed or over floating rope without fouling.

I believe this concept **will** be at its best for fishing, bird watching, photography or just as a pleasant way to get some exercise. It is a complicated oar but a very simple outboard motor.

Fin-Drive Details

1. Forearm - 314" oak with 1/8" x 1" stainless steel screwed to the top and bottom Bearings made from drilled-out 112" s.s. rod are welded to the front of the flat stainless steel while the other end is drilled for the 114" wrist bolt.

2. 1/8" x 1" stainless steel.

3. Spring and nylon stop. Collapsed length is 5". Extended length is that which allows an angle of 20 to 30 degrees between fin and forearm. Spring tension is between 10 and 20 lbf at full tension.

4. Fin cheeks. Made of 1/2" good quality plywood glued and sealed with epoxy. There 5 pieces to this assembly, two side pieces (cheeks), a filler in between the cheeks, a lower piece designed to resist the spreading of the cheeks, and an upper piece similar to the lower but extending forward of the wrist joint to engage the spring. The upper and lower pieces have bearings for the wrist joint made from drilled out 1/2" s.s. rod, these bearings are epoxied into oversize holes.

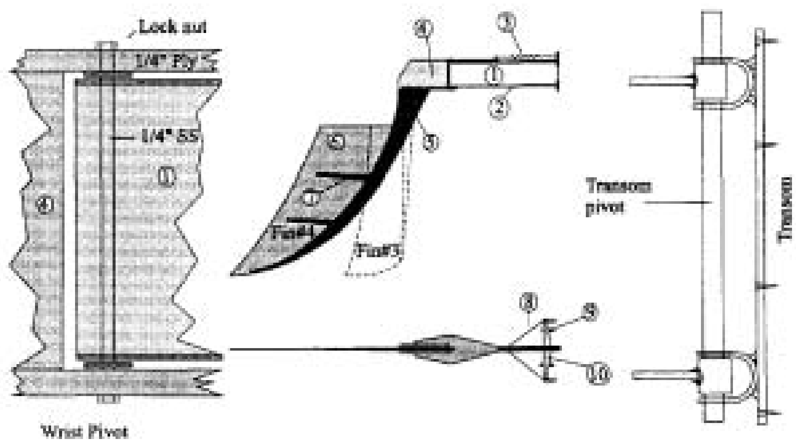


Figure 5. Fin details

5,6,7. These references describe the parts of fin number 4.

Fin number 1 was much too stiff and consequently very inefficient. Fin number 2 was much better, but its leading edge was too wide. Fin number 3 has a leading edge of ash. It is 318" thick. This ash is split with a band saw from its tip and 1/16" Lexan plastic is laminated between, using polyurethane caulk and rivets. This fin works well and is capable of pushing "Thistle" at 5.3 mph. Because the ash is quite stiff, it should be used on a nearly vertical fin.

Fin number 4 is laminated totally from Lexan. Its leading edge is two layers of Lexan, with 1116" Lexan laminated between to form the back of the fin. The number 7 on this fin refers to stiffeners as this fin was too flexible when first built. The shape and number of the stiffeners customise the flex of the fin. The stiffeners on the lower edge are on both sides and overlap the leading edge to form a continuous reinforcement.

A sharp, lightly-set block plane will shape Lexan. The glue used is methylene chloride. Work fast with spring clamps. I understand that this is nasty stuff. Use gloves and excellent ventilation at a minimum.

Fin number 4 draws less water than number 3 for the same area. So far it seems very strong and can tale scraping on a rocky bottom.

8. 5/16" low-stretch braided yacht rope. The power transmission ropes are the same size as these short ropes on the forearm. They have snap hooks seized to their ends to engage the seized eyes at the end of the yoke (10).

9. 1/4" carriage bolts come up against rubber pads on the hull serving as stops to prevent damage to the elbow joint from over pedalling.

10. 3/4" tapered oak or ash. This sits in a notch in the forearm and is itself notched out 3116" on its lower edge so that it is keyed in place.

Dedication to "Human Power"

The fin-powered concept has been great fun to develop. There is a unique feeling of oneness and control between operator and boat. We offer this design knowing that it works well in its present form, but knowing that tinkerers and experimenters will be able to make steady improvements in materials and design.

Please feel free to copy any part of this concept. We hope you will give us credit where it is due and share your experiences with us.

Harn Bryan is a professional boatbuilder and instructor in boatbuilding. His goal is to compete in the market-place while steadily decreasing dependence on fossil furls. A hand-cranked drill press, pedal jig saw and grinder, treadle hand saw, and a heavy dependence on traditional hand tools are steps along this path.

This article first appeared in 'Human Power' the technical journal of the Inter-national Human-Powered Vehicle Association. We are grateful to the author for permission to reprint it here.

Pedal Rowing Explained

by Ron Rantilla (1994)

A person who can row a boat at 6 MPH with a sliding seat rowing system can row that same boat at 6.7 MPH with my front facing rowing system This fact has been established by repeated elapsed time tests over a known distance.

Many people have asked me how this can be, since the pedal rowing system uses shorter oars. I used to think that long oars were necessary for speed too. This comes from the fact that sliding seat rowing systems use long oars and they were the fastest rowing systems around. But after experimenting I found that long oars are not at all necessary and that there are other factors that are much more important than oar length.

What follows is offered is an explanation of why the pedal rowing system goes faster.

Two Reasons.

There are two possible reasons for the increase in speed

- One possible reason is that the pedal rower operator is working harder and producing more power with his muscles.
- The other possible reason is that the pedal rowing system is more efficient and makes better use of the muscle power delivered to it.

Both of the above reasons are true. The pedal rower allows you to develop more power and it is a lot more efficient than sliding seat rowing.

Before we get into the analysis part, a brief description of the two systems under comparison is helpful.

Traditional Sliding Seat Rowing.

The traditional rear facing sliding seat rowing that we are talking about is for a sitting operator in a narrow boat using oars about 9.5 feet long. Outriggers are used to support the oar locks out over the sides of the boat. The oars pivot in the middle, with the handle portion being about **32**" long. The operator sits on a small wooden seat with rollers which slides forward and rearward in the boat. He has his feet bound to stationary footrests, which enable him to slide his torso back and forward relative to the boat. The purpose of the sliding seat is to allow the use of the legs in driving the boat forward. The power is transmitted to the oars through the hands. The oars are operated in unison, with a power stroke and a recovery stroke. The system is sometimes referred to as sculling. We will refer to it here as sliding seat rowing.

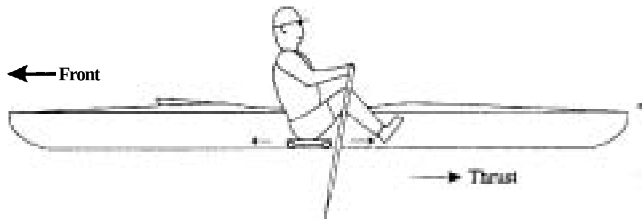


Figure **1.** Traditional sliding seat rowing

Front Facing Pedal Rowing.

The front facing pedal rowing system is for a single operator in a narrow boat and uses oars about 6.2 feet long. The oarlocks are supported on an uprigger, above the operator's knees in the centre of the boat. The oars pivot on the innermost ends, with the handle grips about 18" outward from the pivots. The operator sits in a stationary seat. His feet rest upon two independent pedals suspended from the uprigger. The pedals are connected to the oars by ropes guided through pulleys and are attached at a point about 22" from the pivot. The power is transmitted to the oars through both the hands and ropes. The oars may be operated in unison, but the preferred method is an alternating stroke so that the left power stroke and the right recovery stroke are done at the same time, similar to a kayak stroke. The oars feather into a flat position for the recovery stroke. This system will be referred to as pedal rowing.

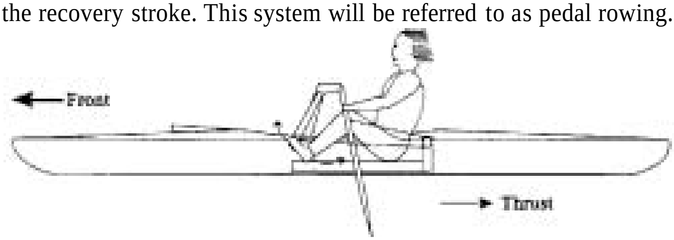


Figure **2.** Front facing pedal rowing.

Power Analysis.

Human power output studies show that a fit human rowing can generate about 0.6 HP for a short period of time. A bicyclist can generate about 1.2 HP and bicycling combined with hand cranking can generate about 1.7 HP Although a bicyclist can generate twice a much power as a rower, he cannot sustain the difference, because the human body can generate only so much power. Long term power output for rowing is about 0.25 HP and for bicycling about 0.33 HP.

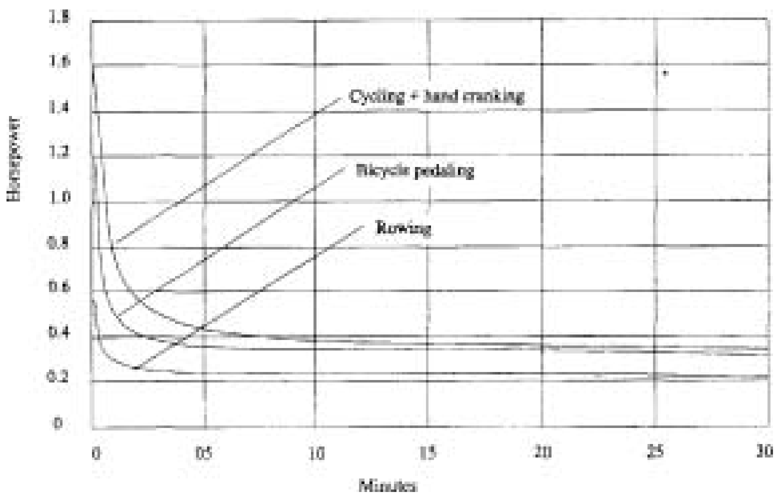


Figure **3.** Human power output.

Pedalling combined with hand cranking increases the power because the hand cranking power is added to the leg pedalling power rather than substituted for it. The power is delivered simultaneously rathcr than sequentially.

Why is pedal rowing more powerful than sliding seat rowing ?

No studies exist in which pedal rowing power has been measured. but by analysis we can see possible power producing advantages.

Sliding Seat Rowing Power Stroke.

In order to understand the mechanics of sliding seat rowing, a brief description of the power stroke, or drive, is useful. Susan Lozetto does this very well in her book "Rowing- Power and Endurance"

> "**The drive/legs:** Seventy-five percent of the power of the sculling stroke is provided by your legs, which begin the drive ...
>
> **The drive/back:** When your legs are almost fully extended, your back takes over ....
>
> **The drive/arms:** When the back has almost completed its lean into the bow, bend your elbows and arms forcefully, and smoothly pull the handles into your body ....
>
> The drive is a smooth continuous motion in which the movements of your legs, back and arms overlap to provide constant power."

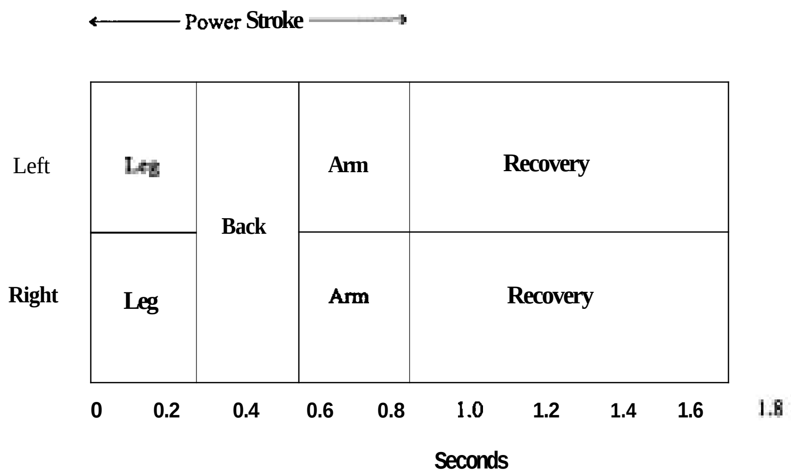


Figure 4. Sliding seat rowing power stroke.

Pedal Rowing Power Stroke

In order to understand the mechanics of pedal rowing a brief description of the power stroke is useful. The pedal rower uses pedals to transmit leg power to the oars via ropes and pulleys. The connection point and leverage ratio is such that a complete extension of the leg pulls the oar through a full stroke of the oar or about 90 degrees or arc. Like cycling combined with hand cranking, the power in the arms is added to the leg power, rather than substituted for it. The handles are positioned such that pulling the arm from the extended position to close to the body moves the oars a full stroke of the oar or about 90 degrees of arc. The power paths are independent and the operator may use any degree of upper body and lower body power desired.

The drive/back component is eliminated in the pedal rowing stroke.

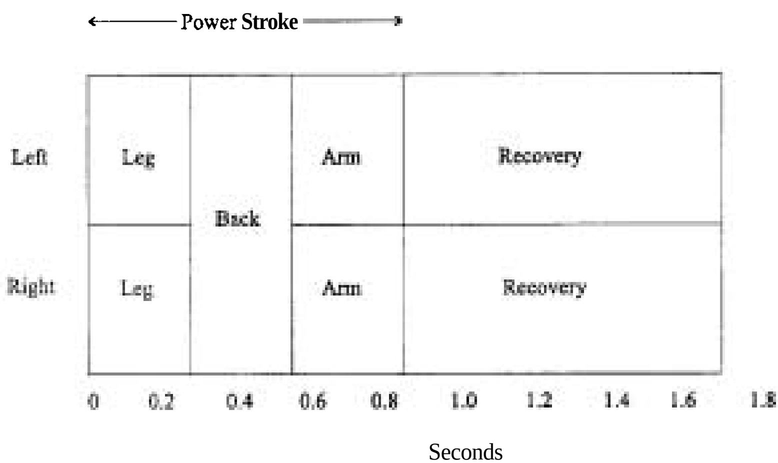


Figure **5.** Pedal rowing power stroke.

Diminished Power

There are three factors which diminish the power producing capability of sliding seat rowing as compared with pedal rowing.

The first factor is dilution. Pedalling uses the powerful leg muscles for driving force throughout the entire power stroke. Sliding seat rowing uses first the leg muscles, then the lower back, then the arms for the driving force during the power stroke. The back and the arms being weaker, produce less power during that portion of the stroke.

The second factor is **limiting.** The legs are capable of generating much more force than the arms or lower back, but since this force must pass through the arms and back before it reaches the oars, the amount of force is limited by the weakest link (the lower back). So even during the leg drive portion of the stroke, the power from the leg is limited.

The third factor is **stroke rate.** Power is the number of units of work performed in a unit of time. The higher the stroke rate, the more power generated. At the same hull speed, a sliding seat rower strokes at 35 strokes per minute while a pedal rower strokes at 40.

Mechanical power is the conversion of energy into motion. If you took measurements of all the forces generated by the different muscles in the above analysis and calculated it all out you would end up with ***input*** power. But what we are really interested in is output power, or the power available for moving the boat forward. For that we have to take into account the efficiency of the system.

Efficiency Analysis.

In the 1981 world rowing championships in Munich, Peter Kolbe won, rowing a boat with a fixed seat and a sliding rigger. In the 1982 championships, five of the six finalists had fixed seats and sliding riggers. In 1983 all six finalists used boats with sliding riggers. Then sliding riggers were ruled ineligible for competition. The sliding riggers did not increase the power generating capability, nor were they forward facing, but they dominated the competition because they were more efficient.

My system does not use a sliding rigger but gets the same effect with greater efficiency by using a fixed seat and pedals.

Any machine transforms energy into useful and useless work. Efficiency is the ratio of useful work divided by the sum of useful and useless work.

$$\text{Efficiency} = \frac{\text{Useful Work}}{\text{Useful Work} + \text{Useless Work}}$$

From the above equation we see that by eliminating useless work we automatically increase efficiency.

What useless work is there in rowing ?

The useless work is that which does not move the boat forward.

Friction is one form of useless work. There is friction in the oar pivots of both systems. There is friction in the sliding seat rollers. I'd say the friction is about equal in both systems.

The oar slips in the water. The oars don't slip as much as people might think, only a few inches per stroke once you are up to speed. The primary factors are pressure per square inch and time in the water, which (at equal hull speeds) are the same in both examples. I don't see where there would be any significant differences here.

The oars reciprocate in both systems. The mass and distance of the sliding seat rowing is greater, but the frequency is less, so I'd say the useless work here is about equal.

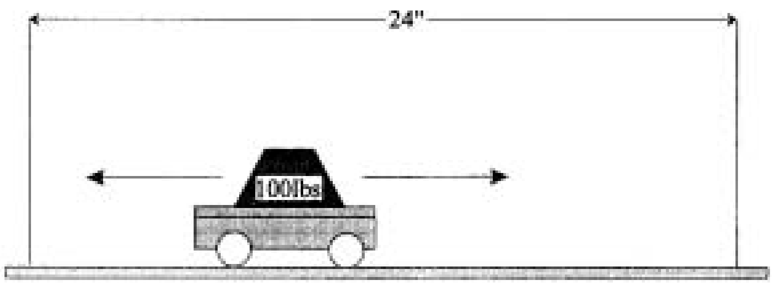


Figure ***6.*** Reciprocating mass.

In the sliding seat rowing system the bulk of the operator's body slides back and forth about 24" during each stroke. The mass being reciprocated is actually the dead weight of the boat, since this is usually less than the live weight of the operator's body. If the boat weighs 40 pounds and the sliding seat/outrigger unit weighs 30 pounds and the reciprocating mass of his hands and feet is 30 pounds, the total mass is 100 pounds. To move a 100 pound mass back and forth 24" 35 times a minute takes 0.143 HP (disregarding friction).

For the pedal rowing system, the reciprocating mass of the hands and feet is about 30 pounds. To move this mass back and forth 24" 40 times a minute takes 0.064 HP

The difference in work for reciprocating motion between the sliding seat system and the pedal rowing system is 0.08 HP, a significant amount considering that the total sustainable output power of sliding seat rowing is only 0.25 HP

If other useless work is equal in both systems and totals say 10 percent of the output power, the sliding seat system is 59% efficient and the pedal rowing system 74% efficient.

However there is another source of useless work, drag in the water. Shifting the centre of gravity messes up the flow of water past the hull. This problem is minimised with the pedal rowing system when using the preferred alternating stroke.

Speed.

How do you get any speed with short oars ?

Leverage and Speed.

One reason the pedal rower's oars are shorter is that the effort arm is folded back and is part of the load arm. This cuts 32" off the length of the oar.

The radius of the arc which the pedal rowing oar swings is 10" shorter than the radius of the arc of the sliding seat oars.

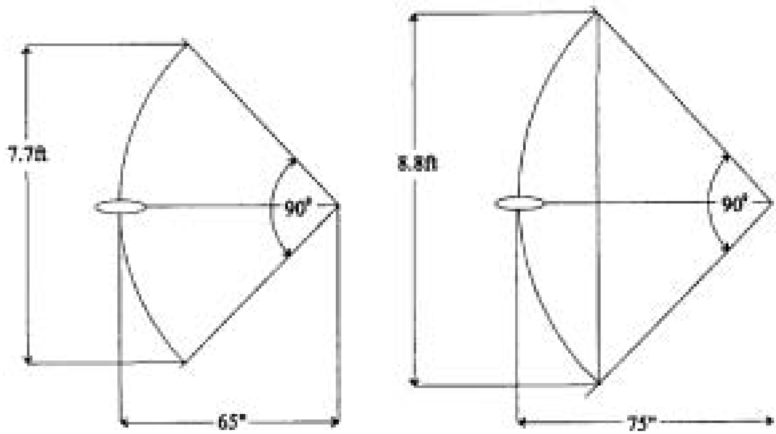
With short radius oars, you stroke at a higher rate to maintain the same speed. This is an advantage, because it allows you to develop more power with less stress. The ratio is 75/65 or 1.15 to one.

35 strokes (long oars) times 1.15 = 40 strokes (short oars).

Example:

Here is a comparison of stroke rate and speed of two different oars. Speed of the boat in the water is determined by the chord of the arc through which the centre of the oar blade swings and the time it takes to swing the arc, less slippage.

The arc radius to the centre of the blade for a sliding seat oar is *75"*. The arc radius for the pedal rower oar is *65"*. Assuming a 90 degree arc in both cases, the sliding seat rower moves 8.8 ft. (the chord of the arc) per power stroke and the pedal rower moves 7.7 ft. per power stroke (less slippage).



Pedal rowing oar **Sliding seat oar**

Figure 7. Distance traveled per stroke, less slippage.

Assuming that the recovery stroke is equal in time to the power stroke and that the boat/operator combination travels at the same speed during the recovery stroke, the sliding seat boat travels 17.6 ft. per complete stroke cycle. At 35 strokes per minute and allowing for 5% slippage this is;

17.6 times 35 times 0.95 = 585 feet per minute or *6.6* MPH.

For the pedal rower (using non-preferred symmetrical stroke for similarity of example) and assuming equal time for the recovery stroke and the boat/operator combination travels at the same speed during the recovery stroke, the boat travels 15.4 ft. per complete stroke cycle. At 40 strokes per minute and allowing for 5% slippage this is;

15.4 times 40 times 0.95 = 585 feet per minute or 6.6 MPH.

Using an alternating stroke, the results would be the same, although one must assume that the boatloperator combination would slow down during the recovery stroke for the symmetrical strokes illustrated while for the alternating stroke there is no recovery stroke and therefore would be no slowing down.

Alternating Stroke

Although the pedal rowing system is faster than sliding seat rowing the real beauty of the system is that you can use the alternating stroke. With it you can maintain the same speed as a symmetrical stroke with what seems to like half the effort. Many things we do are easier if we use our limbs alternately. Walking. Swimming. Bicycling. Leg Raises. Climbing. Running. These things are much harder if we try to do them with our limbs in unison. It's the same with rowing. Once you try it you won't want to do it any other way.

Why would anyone want more power and efficiency ?

Personally I am not looking for speed. I row for fun. Extra power and efficiency are just a by-product of a rowing system that is a lot more comfortable and sensible to me, and lets you get a good workout. I've entered a lot of races and completed lots of cruises and have had a lot of fun that I could not have had with a sliding system.

Important Note:

The pedal rowing system described above is not intended for competition in US Rowing sanctioned events where the rules specify that the rower must face the rear of the boat. US Rowing officials have informed me that the purpose is not to restrict rowing, but to have uniformity within the classes, and if there is sufficient interest in forward facing rowing they will consider opening a new class. However, there are many "open" races in which front facing rowing systems are welcome to participate.

Conclusion

I hope that this issue has shown that the recommendation of John Morwood to use canoes as a cost effective platform for experiments is still valid today. I am currently building one of John Bull's designs for a 'sailing and paddling' canoe. This is intended to become a sailing, paddling ***and experimenting*** canoe.

My only regret for this publication is that we did not find anyone using our founder's other great 'experimental tool', the lightweight aluminium ladder, as cross beam. As one who has spent time swimming in the 'invigorating' waters of Portland Harbour after the failure of a cross beam during Speedweek, I am still tempted to try John's solution.

If you are using canoes for research please let me know. Once I get a theme I am pleased to exploit it!

If you are interested in canoe sailing then get in touch with John Bull. John is not only an active AYRS member, and our 'Sailing Canoe' co-ordinator, he is also a founder member of the Open Canoe Sailing Group. He will tell you about their current program of events.

If you are an active canoeist, then introduce the idea of canoe sailing in your club. If it catches on you could be introducing a new group of people to the experimental approach and the AYRS community. In doing so you will be continuing the work which John Morwood started 41 years ago.

Postscript

Since concluding this publication it has occurred to me there is much in common between the AYRS and the Open Canoe Sailing Group. The OCSG members seem to be insatiable experimenters, and their rules certainly give scope for this.

AYRS provides a good forum for the exchange of ideas but, apart from once a year at Weymouth, it studiously avoids the wet stuff. OCSG organises a series of events throughout the sailing season and at various venues throughout the UK.

How about an additional 'class' in these events with a relaxation of the rule 1a (see page 24) relating to 'single hull'. I assume that this would currently outlaw foil stabilised canoes, the foil being regarded as an additional 'hull'. With this relaxed we could then race foil stabilised canoes.

A requirement that all entries must be capable of being paddled round the course *with stabilisers removed* would ensure that competitors did not stray too far from the concept of low cost modifications to standard canoes.

If anyone would be interested in this idea, get in touch with me or pester the OCSG, or do both. If the idea catches on we might even be able to persuade someone to put up a Morwood Trophy, but only for competitors who use aluminium ladders.