

DBSC Mermaid

Tuning, Handling and Boat Preparation Guide

Prepared by Roger Bannon and the crew of
Endeavour no. 102

September 1999

Introduction

In response to a number of requests I have put together this boat preparation and tuning guide, which is based on the settings used in “Endeavour” and “MyDi”.

Following extensive two-boat testing the view has emerged that there is very little difference in performance between these two boats, which is surprising given the *almost* 40 years disparity in their age.

Over the last 3 years we have worked extensively on attempting to refine the “fixed-spreader” rig and finally, after some miss-steps, we feel it is now working quite well.

The advent of watertight bulkheads and the availability of modern epoxy adhesives and coating systems have facilitated immense improvements without diminishing the traditional characteristics of the Mermaid.

I am sure a few will not wholeheartedly agree with some of what is outlined in this guide, but we believe the techniques described not only improve the boat’s performance, but enhance the safety and ease with which it can be sailed.

In Wexford in 1997, “Endeavour” weighed in at 437 Kgs (almost 80 lbs overweight). Last year we decided to refurbish her with a view to making her lighter, stiffer and to cure the multitude of small leaks which had defied our best efforts to remedy.

We also wanted to establish whether it was possible to upgrade an older boat to match the perceived performance of the newer ones, notably “MyDi” which had been built the previous year.

We also wanted to do this at reasonable cost, so much effort went into recycling existing equipment and most of the work was carried out by ourselves with professional assistance provided by Peter Dunne.

The advent of dry-sailing encouraged us to look at more extensive use of epoxy based techniques which might have proven risky to a boat which spent most of its time on a mooring.

Mermaids are easy boats to sail but extremely difficult to race at their optimum all the time. This is largely because of the inefficiency of the rudder and centreboard. They do not give a lot of feedback through the rudder. Unless you are very sensitive, it can be difficult sometimes to diagnose why you are going slowly.

The best sailors in the fleet constantly compare and monitor their speed against their closest competitors and try to match performance with boats who are in the groove or as the Americans would say in the “zone”.

We believe the changes we made to “Endeavour” have been beneficial in finding the “Zone” more easily and we hope that you find the following pages interesting and helpful in realising the potential of your Mermaid.

How successful was the weight reduction?

We were surprised at how well we did. If we had used a minimum weight centreboard and rudder the boat could have been sailed to 394 Kgs before any lead correctors were fitted.

We know where a further 10 Kgs can be easily reduced in the future if the boat puts on weight.

Basic Weight Statistics	Endeavour		MyDi
	(before)	(after)	
Bare Hull weight with floorboards And fittings	329	297	298
Mast and Boom	28	25	26
Centre-board	67	67	60
Rudder	13	17	14
Lead correctors	0	8	18
	<hr/> 437	<hr/> 415	<hr/> 415
	<hr/>	<hr/>	<hr/>

It is very striking that the bare-hull weights are so similar despite the addition of bulkheads to “Endeavour”.

The effective weight reduction was 32Kgs because in Wexford we used a much lighter rudder than we use now.

We also use a heavy centreboard instead of adding lead correctors, as this is much more efficient use of weight. The older mild steel centreboards (imperially measured) tend to be 7-10 Kgs heavier than their modern metrically denominated equivalent.

The key elements in the weight reduction process can be attributed to the following:

- Use of 6mm 5ply gaboon cored plywood for the decks and bulkheads
- Use of 9mm 6ply gaboon plywood for the floorboards.
- Complete replacement of all deck beams, gunwales, seats and knees.
- We had replaced the centre-board casing and mast-step in 1993 which resulted then in a weight saving of 9 Kgs.
- Stripping and recoating the hull.

Some Structural Issues

Deck

The decks were fitted using epoxy glues with no fastenings. The gunwales were fitted before the deck was laid to provide a wider glue area at the edges, where deck strength is most needed. In general the deck beams and carlins were lightly, though very carefully engineered to provide maximum structural integrity, particularly around the mast and near the main thwart at the back of the casing.

The decks are made to maximum width near the chainplates to assist narrowing the jib sheeting angles and to minimum width near the back of the boat to improve Skipper mobility.

Floor-Boards

These are fitted in 2 full-length pieces, on either side of the casing and fastened to supports, which are themselves through- fastened from the outside of the hull. This creates a massively strong box-girder structure, which stiffens the boat considerably and also helps in preventing leaks from the planks working. It is important to appreciate that the front bulkheads need removable panels in order to fit the floorboards in this manner.

Mast

The mast is fabricated from Sitka Spruce. It is as a 4 piece laminated structure with a pencil scarf 8 feet from the tenon.

It is stiff, light and made to the minimum dimensions. It weighs 14 Kgs before fittings are attached.

Watertight Bulkheads

The bulkheads were very carefully fitted to be strong, waterproof and provide easy access for maintenance.

- The faces to the inside were glass taped with 3inch tape and SPS epoxy.
- The outside faces were epoxy filleted with SPS and 407 fillers.
- This approach provides a strong bond and wide waterproof glue area, whilst also having an attractive finish in the cockpit area.
- Removable covers made of the same plywood were bolted on at 3inch intervals to the front bulkheads, effectively doubling the thickness of the ring-frame.

Planking

“MyDi” was constructed using conventional waterproof glue to bond the plank lands together. This provides enormous hull rigidity, which can be demonstrated by removing all the moulds before the frames are fitted. In this state it is impossible to flex or twist the hull in any manner which is in complete contrast to the conventional “nails only” hull in the same state.

The downside is a tendency for planks to split but repairs are easy to do, if not always cosmetically attractive, using epoxy filleting techniques.

“Endeavour” is a conventionally nailed hull that suffered from the land nails stretching and breaking. As a consequence she had developed a chronic number of small leaks which proved very difficult to trace and fix. In 1993 we replaced over 70% of the frames and fitted a new centreboard casing with very little effect on stopping the leaks.

We had two alternatives;

- Refasten all the land nails
- Epoxy fillet the lands and garboards

We decided that refastening was not an option because it was likely we would do more harm than good because the land nails were small and difficult to remove, a feature of Brennan built boats.

The epoxy filleting approach proved to be an unqualified success but it was incredibly laborious and tedious requiring endless patience and a lot of ingenuity.

- The entire outside of the hull was stripped thoroughly to bare timber using a mixture of paint stripper, mechanical and hand sanding.
- All caulking and filler was removed.
- Obviously broken nails were replaced
- Split planks were either epoxy filleted or replaced
- All the lands below the waterline were cleaned out using a wide variety of improvised tools
- The lands were then opened up to a vee shaped groove using a modified chisel and an electric router
- The hull was then coated with 4 coats of SPS eposeal
- The underwater parts got an additional 2 coats of raw SPS epoxy
- The garboards and lands were then injected with epoxy paste, made up from 407 fillers, using syringes
- The resulting fillets were faired off using 3M sanding boards
- The bottom was then coated with SPS high-build epoxy and faired down with the 3M sanding boards
- Finally the topsides got 7 coats of 2 can polyurethane varnish with the bottom getting 4 coats of Gelshield.
- The Gelshield was then burnished with 400-wet/dry sandpaper to a satin finish.

The entire process took 160 hours but it was very well worthwhile.
The boat has a beautiful low maintenance finish, does not leak a single drop of water and is much stiffer than before.
However it is a difficult job requiring help from friends or crew. Shortcuts cannot be taken without the risk of ruining the entire job.

Crew Weight

It is surprising that with all the discussion about hull weights, little focus has been directed to crew weights.

I believe a consensus has emerged over the last few seasons regarding the optimum weight of crews in a Mermaid.

This year I sailed in different boats in a variety of conditions with a range of different crew weights and have come to the conclusion that the optimum weight ranges between 33 and 36 stones.

This is also reflected in the typical all-up crew weights of the leading boats in the championships this year, except for us who were sailing with 40 stone!

We definitely had a pace disadvantage downwind in the marginal surfing conditions. In previous years, when we had good results, we typically sailed with 33-35 stone in the boat.

Subsequent to the championships we have sailed with 34 stone and found the boat very much quicker.

The boat does not need a lot of weight to perform well in breeze upwind and it is definitely better to be lightly crewed downwind in all conditions.

I hope this does not result in the breakup of long standing heavyweight partnerships in the fleet but the empirical evidence is there for all to see.

Essential Equipment

We all have our ideas on equipment layouts and frankly it does not matter what you use so long as it works.

However I have strong views on a small number of key controls that must work easily whilst sitting out.

- It must be possible to adjust the kicker
- The rig tension must be adjustable
- The mainsheet must have the lowest purchase you can live with (to assist effective pumping downwind)
- You must be able to pull up the centreboard

In addition it is crucial that you can easily adjust the lower shrouds before each race and that one of the crew can easily and quickly alter the outhaul under load.

Other desirable, though not essential, equipment includes;

- adjustable jib leads from the weather side
- Compass
- Adjustable spi pole height
- Mainsail luff tensioner or cunningham hole adjuster
- Use of low stretch dyneema/spectra ropes, which are incredibly strong and do not absorb water.

Rig Setup

The attached schedule sets out the key measurements for both “Endeavour” and “MyDi”.

These measurements are specifically for a “Fixed Spreader” rig which would not be comparable to existing free-swinging spreader rigs.

Basically what we are trying to achieve is a straight rig with good gust response.

The Mermaid rig is underpowered in all but the most robust conditions, so depowering capabilities are low on the priority list.

The principal objective of the fixed spreader rig is to stiffen up the mast and make it more resilient to inversion under spinnaker in windy conditions.

The “design” position for many of the mast fittings cannot be used on a fixed spreader rig so the tolerances have to be exploited to gain the best effect.

In theory if a fixed spreader rig works properly there should be very little to adjust between different conditions and after much experimentation, we now find this to be the case.

Except for the spinnaker hoist, all the mast fittings need to be placed at the minimum height permitted by the rules. This to provide support to the relatively weaker lower section of the mast.

Because fixed spreaders support the top of the mast so much more efficiently compared to free swinging spreaders, lowering the height of the top shrouds gives good gust response flexibility to the top section whilst improving control over the lower section. The geometry of the shrouds is materially improved by these changes and it is much easier to set up the rig on a reliable and consistent basis.

We have found spreader length and deflection to be extremely critical to optimising the rig and I would suggest that anyone converting to this rig should start with the attached measurements.

Basically longer spreaders stiffen the mast sideways, however be careful that your spreaders are not too long causing the mast to sag to leeward in the middle under extreme load.

Swinging the spreaders aft induces fore and aft bend and swinging them forward has the opposite effect.

Depending on the inherent bending characteristics of your mast, spreader length may need to be varied or the deflection adjusted.

Our settings are for a fairly stiff mast. A softer mast may benefit from spreaders 1” longer with deflection set at 8 ½ “

Be careful! Small adjustments of the spreaders have a large effect.

Rig Adjustments

We tend to sail the boat with the same mast rake in all conditions, except perhaps in heavy airs, when we might rake the mast further back by an additional 3-4 inches.

The approach we adopt is to adjust the rig before every race via the jib halyard and the lower shrouds.

The fuller the leading entry required the tighter we haul the jib.

We then adjust the lowers until the middle of the mast is not sagging to leeward.

This is done on the water by adjusting the leeward lower shroud and then tacking to see the effect. This repeated until it is right.

In contrast to the old rigs it is surprising how much tighter the lowers have to be on the fixed spreader rig.

Shrouds can only be adjusted before a race, so once started, the only way of changing things is by altering the jib halyard tension, which has a dramatic impact.

If the rig is a bit overpowered or we need to foot we slacken the halyard.

If underpowered we tighten the halyard. In light airs we let the jib luff sag by up to 3 inches and let the rig move around quite loosely.

Very small adjustments make a huge difference!

Because of the rig stability, the kicker becomes a crucial fine tune, needing to be constantly adjusted in response to changing conditions.

If overpowered, ease the kicker or if underpowered tighten it, however do not overdo it to any extreme.

Usually we sail with the top 2 telltales on the main flicking behind the leech 50% of the time in light to moderate winds.

In heavier airs we slacken the kicker a little to induce twist whilst keeping the main as close to the Centre line as possible.

Jib Sheeting

Jib Sheeting is also very critical. We constantly play the jib sheet upwind in response to velocity variations and waves.

An oversheeted jib is a real speed killer and makes the boat hard to steer.

If there is one thing we do that gives us a speed edge is the attention we give to jib sheet trim.

We now use a window in the mainsail to watch the jib leech on which there is a telltale.

We never allow this telltale to stall out by flicking behind the leech.

We also never pull the jib in bar tight. If a line appears between the tack and the clew with the foot trembling, the jib is too tight.

In waves regardless of wind strength, we sheet the jib an inch looser than normal and move the jib cars forward 1.5 or 2 inches.

In flat water with windy conditions, we move the cars back an inch and sheet a little tighter. However in these conditions it is important to ease the jib in lulls and when bearing off to duck boats or negotiate a difficult wave or series of awkward waves. If you have windward adjustable cars it helps to pull these forward temporarily at the same time.

Boat Trim

I am always surprised at the amount of heel many Mermaid sailors tolerate.

The boat must be sailed bolt upright on all points of sail, upwind and downwind.

To prove the point here is a little experiment you can try.

Get one of your crew to sit on the side of the boat with no sails and the centreboard half down. Then push the boat from the transom and see what happens when compared to doing this with the boat upright. It will travel twice the distance for the same effort when upright.

I guarantee you will never let the boat heel again when you see the contrast. As the boat heels it's underwater shape changes dramatically and becomes hopelessly inefficient.

If you find it difficult to keep the boat flat try easing the jib an inch, tighten the kicker and ease the main. You will not believe the difference this makes. Alternatively if it is lumpy, ease the kicker and the jib and tighten the main a little.

It also helps if the boat is sat out properly with the crew weight well forward including the skipper. The skipper should be sitting in front of the thwart most of the time and if it is very windy, he should be positioned exactly on the thwart.

Downwind the crew must be very sensitive to weight location and smooth movements even in heavy airs. Most of the steering on runs should come from sheeting and crew weight adjustments.

Try sailing without a rudder to accentuate the differing effects of trim.

Finally to succeed in large fleets on start lines it is important to practice the technique of holding the boat stationary. Never use the jib in this situation, just the main.

Downwind

If there is one thing that has changed dramatically in recent years it is the pace with which Mermaids are being driven downwind.

The fixed spreader rig provides huge additional strength to withstand the loads of the spinnaker, making the boat more powered and safer.

Handling techniques have improved and the boats are planning in lower wind strengths.

Much of this is due to the significant improvement in Spinnaker design and improved equipment being used.

However there are always new tricks to learn.

Remember to adjust your pole height to suit the conditions.

Keep the clews level. In lighter airs drop the pole height until spinnaker becomes easy to fill and then raise it back up slightly.

On reaches dropping the pole makes the luff fuller, raising it makes the luff flatter.

On windy runs pull down the leeward tweeker to give more control and eliminate rolling.

If the boat is rolling uncontrollably sheet in hard and bear off a little, yes bear off!

On a tight first reach when you are not quite laying the mark and you are near it, try this.

Sheet in hard and release the spinnaker halyard 10 feet. Keep the sheet in hard and the spinnaker will flutter harmlessly while you luff up to get around the mark and you can quickly rehoist it as you do the rounding.

To speed up late drops take the pole off early and free fly the spinnaker until you are at the mark and then pull it quickly in from the windward side. Do not be preoccupied with trying to get the spinnaker down on the correct side for the next hoist. Windward hoists are almost as fast, just bear off briefly when doing them.

We use an "one- to- one" split mainsheet with two ratchets to reduce the purchase on the mainsheet in order to be able to pump more aggressively downwind. This is really effective on runs with waves because if you can plane you will be able to sail up to 10 degrees by the lee which is very fast because of the super VMG (velocity made good). Another very fast technique is to heel the boat to windward just before a gust strikes. The boat straightens up as the gust hits and with maximum power, a good pump with the boat dead upright makes it is easy for the boat to jump up on a plane or accelerate even faster.

We sail the boat on runs with a small heel to windward all the time because it balances the boat perfectly and makes it extremely easy to steer precisely.

Centre-board Position

We have our centreboard casing capping at the minimum height permitted by the rules in order to sail upwind with the plate as upright as we can get it.

Only if the boat is proving hard to steer in big seas will we raise the plate a little.

As soon as we free off from a windward course we always raise the centreboard until the helm feels light.

On reaches it will usually be more than half up and on runs we raise it almost completely, even in heavy airs.

I like to sail a boat with a light helm and I believe that if you have to fight the tiller you are doing something wrong, usually by being oversheeted or by having too much centreboard down.

Considerable turbulence is generated around the slot, which has a very detrimental impact on the centreboard's effectiveness. The flat profile of the centreboard is very susceptible to stalling. Consequently we put a large effort into having a perfect finish on the centreboard and fitting efficient slot gaskets.

We use folded sailcloth on each side of the gasket which is fitted under tension to keep it firm and maintain a tight seal against the centreboard. We also fair the keel bands into the keel as smoothly as possible using 407 epoxy fillers.

Generally we prefer to use a mild steel centreboard because it is the stiffest material available, easy to coat with epoxy to get a good finish and is the cheapest and easiest material to cut and shape.

Other Thoughts

----Sitting Out

Mermaids are not the most comfortable boats to sit out. Anything, which can be done to encourage the crew to sit out harder and for longer, will improve performance.

Most recent new or refurbished boats have fitted doublers to the coamings and installed deeper and wider gunwales.

These not only provide enhanced comfort but also greatly add to the stiffness of the boat without incurring a weight penalty of any significance.

The toe strap arrangements adopted by Zuleka and Innocence also represent a big improvement on typical arrangements in other boats. Obviously each boat needs to tailor their arrangements to suit the crew but for many, too much is asked of crew who have to put up with insecure and uncomfortable sitting out positions which probably will do harm to their physiques.

----Boat Covers

Some boats are starting to use boat covers. With the increased use of epoxy in the construction and coating of boats it is almost essential to use a cover.

Epoxy is very susceptible to UV degradation and discoloration. It is a small investment to make after spending so much time and effort on your boat and in my view the most cost-effective item you will acquire for your Mermaid.

It will also substantially reduce the cost of maintenance in future years and preserve the boat and it's equipment in much better condition. Be sure to use a breathable acrylic material.

Summary

The key to success is preparation, practice and intelligent experimentation. We sail wooden boats with the inherent variations associated with natural materials. No two boats are ever going to be the same but every boat can be optimised by careful and methodical experimentation.

If the boat is 90% set up correctly there is more to be gained by getting basic handling and crewing techniques sorted out than by fiddling with the boat to get the last 10% from it.

Having said this, I strongly recommend switching to a fixed spreader rig because it is stronger, safer and easier to set up on a consistent basis.

Future Developments

The constant evolution and improvements to the boat over the last 15 years has provided a great opportunity for convergence of performance and closer racing.

The proposed adoption of wooden rudders will have an enormously positive impact on the Mermaid's handling characteristics and make the boat easier and more responsive to sail.

Unfortunately I believe we will have to revisit the possibility of using aluminum spars in the not too distant future.

The cost of wooden spars is becoming prohibitive and obtaining timber of appropriate quality is virtually impossible.

Another development we should look at is the cloth permitted in sails. Many so-called exotic materials are now as cost effective as conventional Dacron.

The current design of the jib is not very durable with leeches becoming destroyed after a few races.

Should we look at slightly changing its design to improve its longevity? Since we nearly all replace our jibs every year it would not be a big deal to make a change.

The boat would also benefit from a slightly larger spinnaker. The current design is flown too high on the mast for its size. A version 15% larger would be easier to fly and would improve the boat's light airs performance dramatically.

I believe the success of the Mermaid class over the last 15 years has been largely attributable to the steady improvements introduced over the period. We need to continue this if the class is to thrive in the future.

We also need to rewrite our rules and regulations to make them clearer and more consistent. The current version is an incomprehensible mess, which is extremely difficult to police because of the inherent conflicts between rules, drawings, amendments, etc, on a wide range of issues. The Mermaid class deserves better if for no other reason than to protect the investment in our boats and to ensure a level playing pitch for all of us.

Acknowledgements

I would like to take the opportunity of thanking my crew, Peter and Emily Bannon together with my good friend Peter Dunne for all their help over the last 18 months in refining our collective ideas and putting them into what we believe was good practical effect. In particular Peter Dunne was prepared to spend endless hours painstakingly working out how to implement some of our more demanding ideas in a display of outstanding craftsmanship. This added immeasurably to the enjoyment of reviving "Endeavour" to her former elegant and beautiful best.

MERMAID TUNING MEASUREMENTS

FIXED SPREADER RIG

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<u>Measured from Transom</u>	Imperial
1. Chainplates (middle)	9' 7"
2. Jib Leads fore/aft	9' 9"
3. Spinnaker Sheet Leads	3' 3"
4. Aft Mainsheet Attachments	1' 2"
<u>Other Measurements</u>	
5. Mast Heel from middle of Centre Plate Pin	1' 6"
6. Distance between Jib Leads	3' 8"
<u>Mast Measurements</u>	
7. Mast Rake (Tensioned with Jib Halyard) - From edge of Transom to bottom edge of Top Mast Band	25' 10"
8. Length of Spreaders (from side of mast to shroud)	1' 9"
9. Spreader Deflection - From straight edge across spreader tips to mast track	9"
<u>Measured from Mast Tenon</u>	
10. Spinnaker Hoist	21' 8"
11. Upper Shrouds	21' 10"
12. Jib Halyard	17' 10"
13. Spreader Brackets (to middle of bracket)	14' 1"
14. Lower Shrouds	13' 11"
15. Spinnaker Pole Ring	6' 2"

Other Points on Set-up

- 1 to 1 ½ inches or less of pre-bend with maximum rig tension.
- Mast choked firmly, including the sides under maximum rig tension.
- Mainsail Leach Tension controlled by Kicker.
- Main and Lower shrouds attached to same chainplate.
- Lowers are set-up on the water to suit prevailing conditions:
 - i.e. - Tighten or slacken to keep mast straight sideways.
 - If mast is straight sideways it will automatically be set-up with correct fore/aft bend for conditions and selected jib halyard tension.