

THE CASE FOR THE DISPLANING POWER CAT AS A LONG-RANGE OCEAN CRUISER



| story **PETER BRADY**

I was halfway through the second part of my series on Staying One Step Ahead and was going to include some sections of an article I wrote earlier this year for *Pacific Passagemaker Annual* when I realised that it made more sense to publish the article pretty much as it was originally written as it had a very significant message. For years I had compared my displaning power cats to predominantly planing hulls, however having had people constantly question the accuracy of my fuel figures (I am putting this in polite terms) I decided to do a more comprehensive study of a diverse range of boats and how they performed as long-range cruisers and I have to admit I was genuinely surprised by the results and I think a lot of readers will be as well.

Long-range or trans-ocean powerboat cruising is a relatively modern pastime and evolved during the early 1960's in slightly different ways either side of the Atlantic. In the USA, Arthur DeFever a respected designer of long-range tuna and sardine boats was asked by some fellow members of the Offshore Cruising Society to design a cruising powerboat that was capable of long-range cruising based on his fishing boat designs. What he came up with was the basis for what is now known as the 'trawler style' cruiser that has influenced a great

many designers since. At the same time across Europe and Britain large numbers of fishing boats were being mothballed so a ready and cheap supply of ruggedly built power boats that were perfectly suited to long-range cruising, excellent sea boats and economical by necessity became available. A great many of these boats were also brought to New Zealand during the fishing boom of the 1960's and I was lucky enough to both work on them and study their lines while starting out in boatbuilding in the early 1970's.

In 1975, Robert P. Beebe's book *Voyaging Under Power* was

published defining what he believed were absolute rules and formulas for long-range power boat design based on a displacement hull. This book was considered by many as the bible at the time (and still is by some) although he was not a fan of the trend in the 1980's to try and increase cruising speeds by moving towards a semi-displacement hull form even if Arthur DeFever was one of those involved. He didn't believe that any non-displacement boat could carry the load required for long-range cruising and thought that the figures being quoted for range at faster speeds were inaccurate.

He was probably right that some of the figures were rubbery particularly when faster boats were loaded, but he had not taken into account the advances in boatbuilding technology that allowed lighter yet stronger construction, considerably higher power to weight ratio diesels and the availability of watermakers that removed the need to carry thousands of litres of water on passages.

In the early 90's we saw the first step of another change in direction with the development of the non planing power catamaran as a viable long-range powerboat cruising alternative. As with all multihulls, their narrow hulls breach most conventions of naval architecture that define displacement and planing and so a number of Robert P Beebe's absolute rules became irrelevant. Malcolm Tennant was one the first to seriously push the concept of a faster yet economical long-range offshore cruiser in the mid-90's, culminating with the 78ft *Pacific Harmony*, the epitome of what he termed 'high speed displacement' CS type hull in the early 2000's. At the same time that Malcolm was designing his CS type, I was developing my displaning type and

although we went slightly different ways about it, we were both chasing the same goals of fuel efficiency combined with load carrying ability and therefore range with a number of my designs built between 50 and 65ft that have clocked up huge numbers of sea miles to date, one reportedly having been around Australia two and a half times.

Post GFC we are seeing a resurgence of interest in long-range powerboat cruising with well know yacht designer and writer Steve Dashew introducing a new type to the market in the form a narrower version of the type defined in *Voyaging Under Power* as his way of raising the cruising speed a little. New custom and production semi-displacement monohulls are still being developed along the path that Arthur DeFever started, with planing and hard chine semi-displacement power catamarans still moving forward in the hands of designers such as Roger Hill and of course I am still developing and flying the flag for the displaning type since Malcolm Tennant passed away.

With this greater diversity of designs now aimed at the long-range cruising market and others jumping on the

bandwagon to claim their boats are long-range cruisers, I thought it was a good time to have a look at not only what defines a long-range cruiser but also how the displaning catamaran stacks up against others.

To start the discussion, I think we need to define what quantifies a powerboat as a long-range ocean capable power boat cruiser or Passagemaker. I believe a range of 2,000nm at displacement speed is a reasonable bench mark (Robert P Beebe defined 2,400nm at 7.5kts) and surprisingly this knocks out quite a number of designs that are marketed as Passagemakers, plus the carrying capacity and facilities to be self-sufficient for at least two weeks. This range will get you comfortably from New Zealand or Australia out into the Pacific Basin or across the top end of Australia to the Kimberley with time on the cruising grounds without having to carry fuel on deck or stop at rough, dangerously out of the way or extremely expensive places to refuel. Using 8kts as a reasonable average displacement speed for a boat in the 55-65ft range, I have chosen a number of well-known designs in this part of the world that reflect the

different types on the market and that have published their fuel figures to use as a comparison. I know there are other boats out there including other power cats that probably meet the criteria, but as I cannot find published fuel usage figures, I cannot include them. I also cannot tell exactly how heavily the boats were loaded when these figures were taken so some leeway must be allowed and range predictions are usually calculated on a 10% residual and calm conditions, so tides, currents, waves and winds may also have some effect when actually cruising. In some cases the lowest speed with fuel figures published was slightly over 8kts but we can still get a very clear picture of how each boat compares. There are also both smaller and larger powerboats out there that meet the criteria, however I had to choose a size range where there was a good representation of all the types. There are also quite a number (and increasing every day) of boats that claim to be long-range capable however they do not even come half way to meeting the criteria Robert P Beebe set and so as usual buyers need to do their research thoroughly.

THE BOATS INCLUDED ARE:

Fleming 55

Respected production semi-displacement monohull. 2 x 500hp engines, 3,785lt fuel capacity, 2,000nm range at 8kts. Fuel figures were collected from the Fleming website which shows a 2,000nm range at 8kts, but my calculations show no residual left or allowance for genset use.

Nordhavn 57

Considered by many as the quintessential heavy displacement type monohull. 1 x 325hp engine, 8,000lt fuel capacity, 2,057nm range at 8kts. Fuel figures were collected from Nordhavn website with 10% allowed for residual and genset use. This model is no longer in production and Nordhavn have modified their hull shape slightly to increase top end performance, however it looks to me like the newer Nordhavn 55 is delivering much the same figures.

Steve Dashew 64

Custom monohull, narrow and more yacht like in its hull form. 1 x 236hp engine, 12,800lt fuel capacity, 9,083nm range at 8.2kts. Fuel figures collected from SetSail website and owners web sites with 10% allowed for residual and genset use

Bill Upfold 20m (65ft) Highlander

Custom New Zealand designed and built semi-displacement monohull. 2 x 750hp engines, 6,000lt fuel capacity, 2,430nm range at 9kts. Fuel figures published in *Pacific PowerBoat Magazine*.

Pathfinder Pilothouse 17.4 (57ft) Rehab

Custom Australian designed and built displaning power catamaran. 2 x 440hp engines, 5,200lt fuel capacity, 4,622nm range at 8kts. Fuel figures recorded by Yanmar's representatives on sea trials.

Roger Hill 20m (65ft) Tenacity

Custom New Zealand designed and built semi-displacement power catamaran. 2 x 500hp engines, 8,000lt fuel capacity, 2,781nm range at 8.3kts. Fuel figures provided by Roger Hill.

So what are the key features we are trying to compare of long-range cruising powerboats?

1: PERFORMANCE

Whilst performance is generally thought of as top speed or acceleration, its real meaning in relation to machinery is 'manner or quality of functioning' which is a far more wide ranging definition and in this case is a combination of speed, range and fuel economy. How well does the displaning power cat perform in comparison to monohulls and other power catamarans designed and built for the same function?

Speed – higher with less horsepower is an understatement, *Rehab* achieves the highest speed one and a half knots faster than *Highlander* using 620 less horsepower and this is not a one off achievement. In 2001 we achieved 21kts from 2 x 225hp engines in a 58ft scientific research boat and two other

displanning power cats built around the same time at 61 and 64ft achieved 23-24kts from 2 x 330hp engines.

Range and fuel economy – These two requirements go hand in hand when creating the ideal long-range powerboat cruiser and all boats compared have good to exceptional range at our chosen displacement speed of 8kts. *Rehab* was the best at 8.5ltph (litres per hour) by a whisker from the Dashew 64 at 10.4ltph (data started at 8.2kts) with the next best being the Fleming 55 at 18ltph and *Highlander* at 20ltph (data started at 9kts, so may be around 15ltph at 8kts) then *Tenacity*, (data started at 8.3kts) the Nordhavn 57 at 28ltph the least economical. It may surprise some people to see the Nordhavn last, however when you look at their beam, draft, weight and windage, they are a very big bodied boat and their top speed is only 9.7kts, so even at 8kts they are being pushed hard.

The Dashew 64 being the narrowest monohull on the waterline is neck and neck with *Rehab* up to 9.7kts, then it starts to rise more sharply up to its top speed of 11kts and at the Nordhavn's top speed of 9.7kts, it's using more than three times the fuel of *Rehab* and the Dashew 64. *Tenacity's* fuel burn rate only rises slowly up to 10.8kts where it is only using slightly more fuel than *Rehab*, however it then starts to rise sharply as it transits over its natural displacement speed, with *Highlander* surprisingly more economical than the Fleming 55. However, above 11kts is where the real differences in fuel economy between the displaning cat and the others start to show with *Rehab* exhibiting a small bump on the graph as it moves into its displaning mode, but is still ahead of the pack as it transits from displacement to displaning when it is more economical at 14.5kts than it is at 12.9kts. At this 14.5kt sweet spot, *Rehab* is using half the fuel of *Tenacity* and *Highlander* and less than a third of the Fleming 55. At 18kts *Rehab* is still using just under half the fuel of *Tenacity* and *Highlander* and just under a third the fuel of the Fleming 55 as it hits

its top speed. As we move into the 20's, there are only three boats still in the race with *Tenacity* dropping out at just over 22kts, *Highlander* at 24.8 with *Rehab* going on to 26.5kts. From this information we can see that the displacement hulls act as per the text books, so in reality do the semi-displacement designs, even the catamaran, with their fuel use curves climbing steeply as soon as they move above their natural displacement speed. This is demonstrated by the fact that the shorter Fleming 55 starts its rise first at 10kts and the 65ft boats are using exactly the same fuel at 11.7kts where they start to rise more sharply.

I do not believe this type of comparison has ever been made before and I have mostly compared my designs to planing hulls in the past and I must admit I was genuinely surprised at how the results illustrated the displaning power catamarans ability to perform over a very wide speed range, most especially in the mid-teens which the

design is optimised for. I cannot find Malcolm Tennent's original published figures, but I am pretty sure from memory that his results were much the same as *Rehab's* for his power catamarans of this size.

2: STRENGTH AND DURABILITY

This is very important as not only will the long-range cruiser have to occasionally deal with heavy conditions, but it will also have to dock at commercial facilities in remote places which can be very hard on a light unprotected construction. All the boats compared would be considered robust and although the long-range offshore power catamarans history is relatively short in boating terms, it has not taken long to work out where it needs to be stronger than first thought, particularly in regards to torsional rigidity, wingdeck connections plus panel stiffness and strength. So although the power catamaran throws up some different

engineering challenges compared to a monohull, now that this learning curve has been mastered there is no logical reason why a long-range cruising catamaran should not be as strong as a monohull.

3: LOAD CARRYING ABILITY

This is still a key requirement of long-range cruising with more 'water toys' being carried and equipment such as air-conditioning, refrigeration, plus comprehensive electrics and electronics considered standard these days. Some of this extra weight has been offset by the development of realistically sized watermakers that have taken away the requirement to carry and store large amounts of fresh water and minimised the risk of getting sick from bad water picked up in remote places. What still has to be carried when long-range cruising are greater fuel quantities, food, personal belongings, tools and spares on top of more machinery to ensure back-ups for the boat systems, usually

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a larger, more open water capable tender plus heavier anchors and chain.

The large bodied pure displacement monohull in the form of the Nordhavn will be the least affected by extra weight, as they are not trying to push through the mathematical displacement barrier. The Steve Dashew type can carry a large payload as indicated by its fuel capacity, however being narrow on its waterline, heavy weights will need to be carried low down so as not to affect stability. The three semi-displacement examples will carry a load, however extra weight will affect their ability to reach their top speed, increasing their fuel consumption as they push into planing speeds. The displaning hull form is a very good weight carrier with neither performance or fuel economy particularly affected by weight (3 tonnes = increase of 8lph more fuel at 16.5kts and a 1kt reduction in top speed) however as with all narrower hulls, you have to be careful where extra weights are placed fore and aft as they are more sensitive to this.

4: SEAWORTHINESS

Firstly let's get the question of capsize out of the way as this is the criticism that is always levelled at catamarans even if they are power not sail. All power boats except specialist craft like lifeboats could capsize or get rolled by a large wave so catamarans are not any different, however I cannot find any recorded instances in the world of a non-trailerable power catamaran capsizing. There was mention of a self-righting ability in regards to the Dashew designs, however I could not find any hard evidence of testing. Lock Crowther had tank testing done very early on for his ferry designs and found that it was virtually impossible to capsize a power catamaran, as the wave passed under the first narrow hull so quickly, it picked up the other hull before the boats angle was large enough to cause a capsize. I have had two owners tell me of very steep large seas coming side on standing their boats up at what they thought was an extreme angle, but they came down without

any problems confirming Lock's test results. So taking away the argument that has dogged the multihull v monohull in the sailing world should remove any doubts about the power cat's ability to long-range power cruise. My own and my clients experience is that a well-designed displaning power catamaran is a very fine sea boat with no tiring roll or corkscrew motion and is very soft on its occupants. *Rehab*, the 57ft power cat I have used in the comparison steamed around the top end from Brisbane to Mandurah in Western Australia, a distance of 4,500nm as its delivery trip. I was on the first 1,000nm leg to Cairns and kept in regular touch with the owner as the trip progressed. They encountered a variety of conditions and not one of his 15 guests that joined him for different legs, including some with very little previous sea time was seasick, which is pretty rare over this length of journey. The fact that the majority of fast ferries in the world now are now catamarans says a lot about how good a sea boat they are and how comfortable their motion is.

Head seas have in the power catamarans short history been considered their weakness with too finer bowed designs driving through waves until they slammed under the wingdeck unless the wingdeck clearance was very high. Fuller bowed semi-displacement or planing type powercats inclined to feel like they were head butting waves if they slowed below planing speeds creating a jerky motion. The reason I developed my CVD (Controlled Vapour Dampening) features of multiple chines on the inside topsides and multiple V-pods with chines was to overcome this perceived weakness, keeping the bows finer lower down to cut through seas while providing graduated increases in buoyancy and lift, as well as turning the solid water into vapour to create a dramatically softer ride.

Handling at sea – direction stability and predictable tracking in following seas is an important attribute which is why all the compared boats have at least a large skeg if not a full keel. Power catamarans are particularly good in a following sea as they will

surf on their wingdeck rather than bury their bows and broach when hard pressed and when this ability is combined with full length keels with drag (deeper aft than forward) as it is on all my displaning power catamarans, it makes them a very fine sea boat in following seas. If there was a criticism levelled at Malcolm Tennant's CS type hulls, it was the combination of deep fine bows and a less defined keel without drag which meant that they steered by the bow in a following sea. So with the right features, there is no reason why a power catamaran should be inferior as a sea boat when compared to a monohull.

5: SAFETY

The vulnerability of all boats at sea is fire, collision, running aground or mechanical breakdown. With modern lining materials, fire sensors, alarms and fire-fighting systems, all these boats are equal in their ability to deal with this possibility. Whilst the catamarans have two hulls to run into something like a container, they also have, if built with multiple water tight sections in each hull, the best chance of surviving this type of damage or flooding. Less draft means less chance of running aground, although in my experience when you know you have less draft you tend to push your luck a little more. However if you do hit bottom, the cats ability to dry out without falling over and having the protection for their stern gear of full length keels is a big advantage.

All the boats compared either have two engines or are usually fitted with a wing motor to be able to get home should the main engine break down, albeit slowly. The cats however have a huge advantage in that not only do they have two engines, but they are also located in different hulls and usually with separate fuel tanks. This gives them the added advantage that a flooded engine room or small fire wouldn't take out all systems.

6: HANDLING

Handling or maneuverability at low speeds – the widely spaced counter-rotating propellers of the

power cat provide 'turn in their own length' manoeuvrability and with the addition of a bow thruster, docking can be done so precisely and easily that it makes what can be a very stressful operation simple. Full length keels with an underwater profile that is matched to the boats windage provide very predictable handling in side winds for either cats or monohulls with the boat neither wanting to peel off by the bow or stern as many planing hulls do. The Nordhavn, Fleming and *Rehab* would be easiest to handle when docking short-handed with their trawler style doors opening directly onto the side decks allowing quick access from the helm to help with lines.

7: ACCOMMODATION AND LAYOUT

The greater beam of the catamaran does provide more space for the same overall length than a monohull and it does allow more freedom when designing different layouts

in the saloon-dining-lounging-drive station and accommodation areas, as the overall floor plan is squarer rather than a monohulls long rectangle. This creates less of a bus or caravan type of feel, where everything is arranged in rows. It also allows the aft deck to be better utilised as loose outdoor dining furniture can be shifted around to either shelter from the wind or sun. All the compared boats except the Dashew 64 are basically raised pilothouse designs with either covered or fully enclosed flybridges which gives them a very usable upper level. I will also mention at this point that *Rehab* has an additional feature on its flybridge in the form of a lowering hardtop that lets it pass under two bridges on the way to its owner's waterfront house. This upper deck area gives all of them a huge advantage over the Dashew 64 in that they can store the tender up out of the way, freeing up the aft deck for entertaining. The Dashew 64 is

the most tube like in its layout due to both its narrow waterline beam and its low freeboard when compared to the others. The Fleming 55 and the Nordhavn 57 are the most traditional in their layouts, but this suits many people as it provides a cosy 'small ship' feel. The Highlander, *Tenacity* and *Rehab* are more open plan with *Tenacity* being the beamiest at 22ft to *Rehab*'s 20ft, although *Rehab* gains back some of its over 6ft less length and 2ft less beam by carrying the aft deck right to the end of the hulls with a duckboard for fishing. Where the catamarans extra beam really makes a difference however is at the bow, as this width is carried right forward allowing a totally different style of foredeck, easily large enough to use as another entertaining area. This beam right forward on the cats also allows either a bridgedeck level full-width owners ensuite like *Tenacity*'s, or a smaller owner's ensuite and guest queen cabin on the other side like



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Rehab. These single level cabins with domestic sized walk around beds are a huge leap forward in user-friendliness particularly for older or less able boaties. *Tenacity* with its wider hulls and greater overall beam has greater floor width in the hulls than *Rehab* and its berths are set athwartships over the wingdeck making this floor space seem even larger. Both cats however benefit from the extra privacy in their mid-cabins housed in two individual hulls when compared to the monohulls layouts. I will add however that the power catamarans tunnel can be noisy as it acts a bit like an amplifying tube to small wavelets, so soundproofing may be needed in this area to create a boat as quiet as the composite monohulls, as would the Dashew 64 require more sound and thermal insulation with its aluminium construction.

8: LIFESTYLE

Lifestyle in long-range powerboat cruising is not just about time at sea, as a great deal of time will still be spent at anchorages or on a berth in port and this is where the catamarans inherent stability really shows its worth. Stabilizers reduce roll when the boat is under power, flopper-stoppers do the same and work at anchor providing there is room to deploy them, however neither work as well as the catamarans beam at a pontoon or a wharf. This lack of roll is what makes catamarans so easy to live on both at sea and at the dock, particularly for less physically able people. When you combine this lack of roll with large shaded deck areas, this user-friendliness is why catamarans - either sail or power, have become so popular in the charter fleets and why everyone meets on board them to socialise at anchorages.

With modern weather forecasting and routing the ability of the three faster boats (the Flemings range would be reduced to around 350nm at 13kts making its extra speed virtually useless on any long passages) to either make passages in less time or dodge unfavourable weather patterns would be a very reassuring feature. The two cats would still have a range

of 1,400nm at 13kts (*Tenacity* by its larger fuel capacity and *Rehab* by its fuel economy) and *Highlander* would have a range of 1,100nm.

9: COST

None of these boats are budget boats in that they are solidly build with high equipment levels demanded by their owners. The cats will be more expensive to berth in a marina with their extra beam, but newer marinas are putting wider berths in shallower areas which reduces their dredging costs, so this cost should even up in the future. The cats by their larger beam and therefore increased square meterage are going to cost more to build in materials and labour for the same length, however in the case of *Rehab*, her smaller engines and drive trains pull some of this back as will her superior fuel economy over the whole operating range in time. As a designer-builder I am more aware than most of the cost of building power catamarans and have been working since 1998 with my P.A.C.K. boatbuilding system to reduce this cost by modularising components, so I think that this aspect will again even up in the future.

CONCLUSION

The Dashew style of long-range cruisers are at one end of the spectrum of the types by almost being a yacht without a rig, which is not surprising given Steve Dashew's background. They would provide a very safe and seaworthy cruising platform, however with their narrow beam they will be tender at rest and as demonstrated by their owner's photos and footage, will be wet on deck. They do have limited accommodation for their length and are not as versatile as some of the other boats, but they have an almost cult following.

The Nordhavn 57 is the type of boat that Robert P Beebe would have approved of - big and heavy it would promote a feeling of 'little ship' confidence and you could load it without having to think about how much you put on board or where you put it. However, its fuel economy was

surprisingly disappointing at 8kts and was the worst of any of the boats at its top speed where its range would drop off dramatically. As with the Dashew 64 there would be no choice but to cruise at a leisurely pace and around the top end of Australia where the tides run strongly, it would be even slower going.

The Fleming 55 was a surprise in that it only just (on Fleming's figures not mine) makes into the class and you could not use any of its speed potential on anything other than coastal hops. It would however make a good coastal cruiser with a solid feel, lots of accommodation and the ability to long-range cruise at strictly displacement speeds. This is the boat that the public always asks me how we compare with at boat shows as it is seen as the leading production boat in its field.

Both *Highlander* and *Tenacity* are good examples of well designed and built New Zealand custom semi-displacement cruisers. They meet all the criteria for a long-range cruiser being more fuel efficient than the Dashew around 10kts, but with that extra advantage of speed to outrun unfavourable weather or to shorten passage times. They achieve this extra speed more efficiently than the Fleming and retain a useful range at low teen speeds by carrying lots of fuel rather than by exceptional fuel efficiency and so they would cost more to run than the displaning power cat if you used this speed. They are both versatile boats, being good weekenders with their 20kts plus sprint speed, excellent coastal cruisers yet have the ability to cruise the Pacific Basin in comfort.

So how does the displaning power cat rate as a long-range cruiser? The figures speak for themselves but explaining how in naval architectural terms is more difficult as it does not fall into any text book category and yet commercial operators understand its economic and motion benefits completely which is why so many fast ferries are effectively displaning. A cruising boat that has equal or better fuel efficiency than the Dashew type at displacement speeds plus better performance and

economy right through the range than the semi-displacement type and is less affected by loads has got to be on the right track. Throw in plenty of comfortable and user-friendly accommodation, large usable deck areas, excellent seakeeping qualities and ride along with predictable and easy handling, the safety of two hulls, shallow draft and the ability to take the hard on its keels and you have a type that ticks all the boxes and some.

A displaning catamaran like *Rehab* is also a great day boat with its ability to carry 50 plus guests without them tripping over each other, has the ability to coastal cruise with its combination of high sprint speed and range if required, yet is a very capable long-range cruiser as its range could easily be extended even further by fitting larger tanks.

Steve Dashew states in his writing about power boat cruising "We know from long experience that 9.5-9.75kts is a magic number. If you can average this, day in and day out, you can avoid really dangerous, if not unpleasant conditions, with a dose of luck, and judicious timing. And faster is even better. Speed reduces passage time, allows more flexibility in weather tactics, makes stabilizer systems more

effective, and is more fun." He is right about speed and its advantages and the displaning power cat doesn't even need stabilisers.

There has been an underlying prejudice against catamarans that at times is hard to understand, however when you look down the rows in the marinas and see how many sailing cats there are now in proportion to monohulls compared to thirty years

ago things are changing. In the genuine long-range cruising market the displaning power cat's has an absolute advantage with its high cruising speed combined with range which clearly sets it apart from the pack. This unique factor plus the other lifestyle features outlined in this article should and will make it the market leader in ability, if not in pure numbers.

