DISPLACEMENT POWER CATAMARANS

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Displacement Power Cats

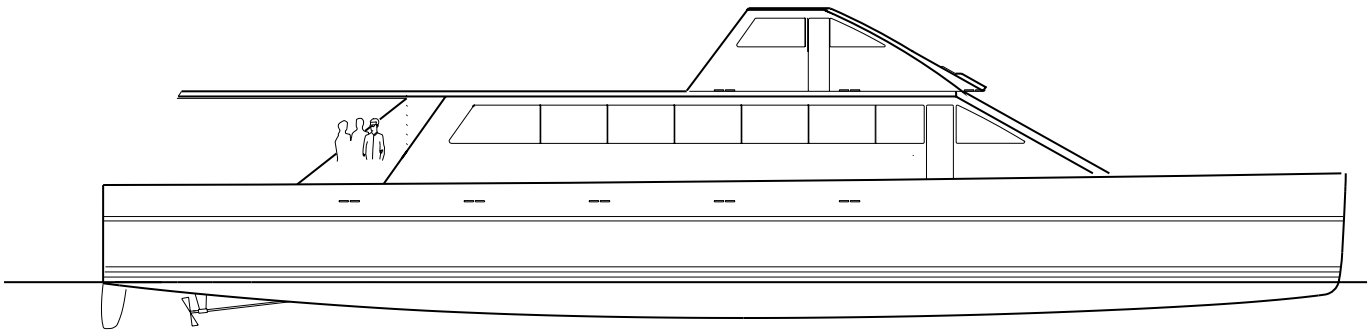
Most of the large power catamarans that I see are designed by large design offices, and in my opinion, designed badly. They have poor efficiency, and a relatively unpleasant ride, compared to what they could deliver. There are significant reasons for those shortcomings. Those reasons have to do with the decision makers who order the plans and the vessels.
I have been designing power catamarans for about 20 years now. Most of my clients have been owner-operators; people who knew firsthand what constituted a good design.
Designs for larger organizations need something else. Because I usually deal usually with experienced watermen, I have been shielded from inexperienced decision-makers. Larger organizations will often have decision makers who are not watermen. They do not know what makes up a good design. They depend on heavily accredited experts. The accredited experts have credentials, but the wrong experience to do good catamarans. They cannot yet design great power catamarans. And I need to do a better job of explaining what I do to make the best designs.

The mainstream design office catamarans that I see look that way because those gold plate offices are most familiar with designing single hull vessels. They come from a very conservative design place. They know what works for a single hull boat, and the cats they design are even better boats. Their cat designs resemble their single hull designs. Why change that?

I come from a racing sailing multihull background. The goal in designing those was to reduce vessel drag in every way possible. Usually that meant creating easily driven hulls, and elegant engineering to keep weight down. If I had adopted the mainstream design office paradigm of just-add-more-power, it meant I was doing something wrong, and was a mistake.
From the vantage point of 2008, it looks like these big design offices with figure this out in about 5 years, with the impetus coming from new, younger designers they hire. At that point people will note that I am doing displacement hull designs like, Nigel Gee for example, which will be a huge irony. This is how I think it happened. Lets look at some 65' passenger boats as examples.

Displacement Single Hull.

These boats have a top speed of about 10 and a half knots, are very efficient up to that speed, and are seen as very traditional. To go 10 knots as a 65' vessel they might need as little as 120 hp. Waterline length determines the top speed. The longer the waterline, the faster the top speed will be, up to the hull-speed wall of about ten knots. They are never seen as fast. My picture is a fishboat, but the hull would be the same as on a passenger vessel.

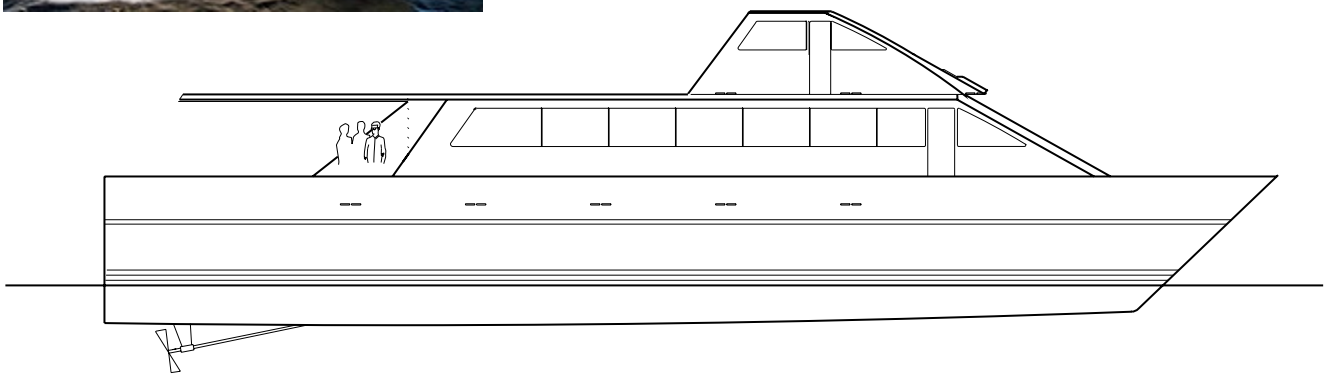


DISPLACEMENT SINGLE HULL

PLANING SINGLE HULL

Planing Single Hull

This configuration is the only way to get a single hulled craft up above hull speed. The top speed is only dependant on power applied. To do 30 knots it would take some 1500 hp or more depending on weight.
The ride is rough in waves. Below planing speed, they are very inefficient. The look of these craft implies a modern, fast boat and is very popular. The long, overhanging bows convey the look of speed. A fast single-hull powerboat must look this way.

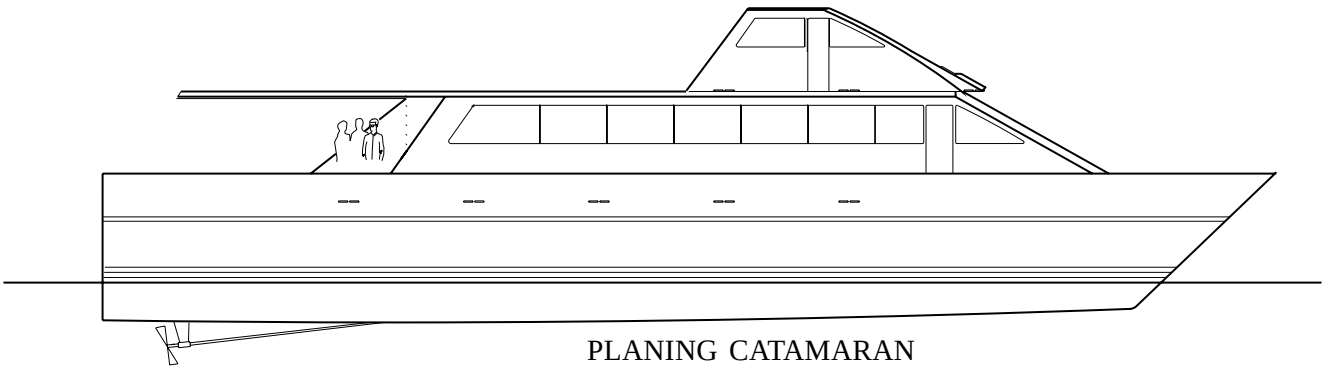


PLANING SINGLE HULL

PLANING CATAMARAN

Planing Catamaran

The planing cat's ride is still rough compared to displacement cats, but better than on a planing single hull boat. The top speed of these craft again are only dependant on the amount of power applied. Oddly, power needed, and efficiency are not much better than single hull planing craft, at planing speeds. Below planing speed, they are more efficient than single hull boats, but much less efficient than displacement catamarans. They will require some 1500 hp to do 30 knots, depending on weight.



PLANING CATAMARAN

Being capable of 30 knots is not always an advantage however. It can be a disadvantage if less speed is needed.

As charter operator Rob Bryan relates about planing cats, *"Again the weather or seas. When the seas are 3' to 4' you can't do 30 kts. I ran a Bellcraft planing cat in the Keys. We could only run on plane about half the time.*
30k is great the limited amount of time you can run that fast. but usually it will be too rough to run that fast. I like the wave piercer idea but don't really have the room for the extra length on these boats. I estimate that the boats can run 30kts 10% of the time, 20kts 40% of the time and 12 to 15 the balance. Hence my aversion to planing hulls."

Displacement Catamaran

Designed to Look Like a Planing Catamaran

An odd permutation of the types of catamarans available has actually been around for a few years. In fact we are awash in them. It is a displacement catamaran that looks like a planing catamaran. It does not have enough power to get up on a plane, but since it typically has deep transoms and long bow overhangs, it is an inefficient displacement catamaran also. Typically they are metal and controlling weight is of no importance to their designers. To the corporate decision makers, it looks fast, so what more can one want? I have recently been asked if I would change my efficient displacement catamaran designs to look like one of these; to look fast. That is quite an irony to evolve a design approach that optimizes a vessel type and be asked to design one like a corporate monohull design office would do. This configuration has the worst of both spheres.

A DISPLACEMENT CATAMARAN MADE TO LOOK LIKE A PLANING CATAMARAN

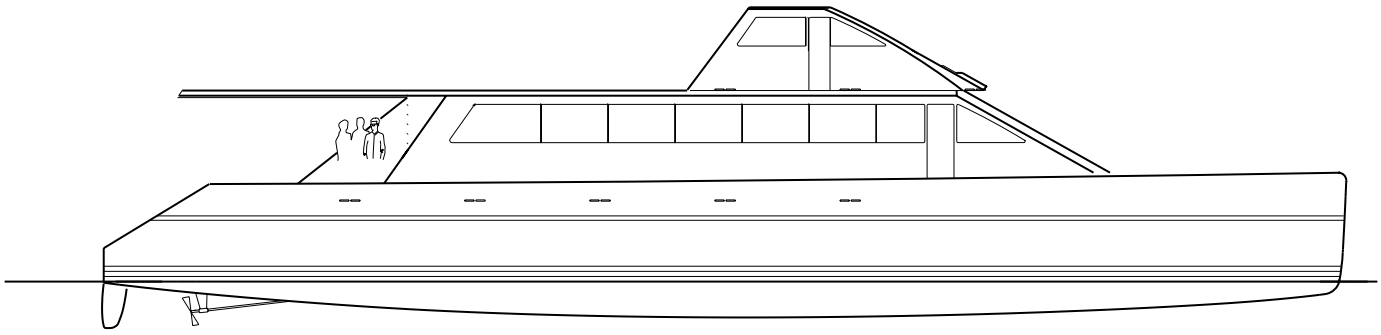
This is an interesting example of a displacement catamaran designed to look fast no doubt. It has the planing cat look. That however gives it less speed ability plus a worse ride and worse economy. The famous design offices with little catamaran experince mimic each other in the old paradigm.

If speeds under about 3 times hull speed are acceptable, (which for our 65, is about 32 knots) a displacement catamaran delivers the best ride and best economy.

DISPLACEMENT CATAMARAN

Displacement Catamaran

The top speed for our 65 displacement cat is about 30 knots. The ride is the best of any of the other types in this list. It is significantly better than any of the other design types due to the “soft” hull sections and the relatively long waterline length, combined with slender hulls. .
Fuel efficiency is also the best of any of the types in the list. Again, it is significantly better, especially at speeds just down from top speed. And again with displacement hulls, waterline length determines the top speed, so longer is better. The power needed to do 30 knots is about (2) 450 hp or 900 hp.
One live example of a displacement catamaran is the HoloHolo on Kauai. See www.holoholocharters.com
Its 62’ long, weighs about 25,000 lbs, has a pair of 440 hp engines and operates in some of the most severe



DISPLACEMENT CATAMARAN

waters in the US. When I was on it we were going 28 knots
most of the way according to my GPS. Both ways. About 40 people were along with us that day.
As a displacement cat, that speed is not pounding the passengers like a planing cat would.

So what is the catch? Why don’t those large, gold plate design offices do slender hulled, efficient displacement power catamarans?

I say that the problem is that displacement cats don't look fast to corporate, less-experienced decision makers. In profile, to most people in the old paradigm, any fast boat has to have big bow overhang. A vertical bow looks slow to them. The idea that a vertical bow makes a longer waterline, and thus higher speed, has not yet percolated down to corporate owners. The idea that a longer waterline gives a better ride has even farther to percolate down. I also recognize the visual comfort of the overhanging bow pushing back the water. Despite being inefficient in a catamaran, it feels comforting.
It does make sense. They don't have time to take a Westlawn class, so they ask large, corporate design firms for advice. These are the same offices who have been doing power single hull vessels for years. It's the only language they speak. The only advice these offices can give is to design heavy planing catamarans with overhanging bows.
Displacement cats do require more care to design and more rigorous engineering to perform as well as they do. Weight and clearance are more important than with heavy, overpowered cats.

Weight
A displacement hull powercat will have the longest and narrowest possible hulls for the size of boat. Naturally it will strive have the longest possible waterline. That waterline length gives a higher top speed and a smoother ride. It will also try to keep its transom from running under water. That will save a lot of drag. The narrow length/beam ratio helps the hull keep going in horrible weather without being thrown around as much as a fuller hull would be.
Slender, shallow hulls are only possible if the weight is kept off of the vessel as much as possible. That requires the rigorous engineering that I do. Foam cores and proper laminate design and fiber orientation must be used throughout the vessel. My designs will meet ABS, or DNV structural classing society requirements, though they are a minimum. A good composite multihull designer goes far past the classing society requirements. Large corporate design offices that are used to designing metal single hull vessels are not much concerned about weight, and would probably not be very knowledgeable about how to keep weight out of a catamaran anyway.

Bridgedeck
A high bridgedeck lets a fast catamaran keep moving through big waves much better than a low bridgedeck does. In the old design office paradigm, they make the bridgedeck low and then add more structure, which is weight, to it to keep the wave slamming from damaging the boat. Those wave slams slow the boat down though, besides making the ride rough. Good designs reduce drag in every way possible.

Notice how all these design features are interrelated.

In conclusion, people who want smooth riding, economical and long range ocean powerboats will do best to choose displacement catamaran hulls, by designers experienced in catamarans. Hulls that are as narrow as possible to carry the weight will reward operators with great economy and a great ride.

I had just about finished this article, when the then latest issue of Professional Boatbuilder arrived. The April/May 2007 issue has a textbook case of what I am writing about here. Again, a world famous monohull design office tries their hand at designing a charter catamaran. Almost every feature of the featured 82' catamarans are like a pair of relatively thin monohull hulls welded together. It has what looks like two hard chine planing hulls, but ones that have a top speed of just 20 knots. That was the targeted speed; the actual speed was less. They have the classic monohull speedboat overhanging bows, hard chines, and deeply dragging transoms. That 20 knot speed is well back into the middle displacement speed range. The displacement speed range for that size catamaran could top out at about 38 knots. There is no reason to make that configuration of catamaran hull a planing design. Except that designers who don't know catamarans look to the work of large, famous design offices for those cues when they finally get a fat comission to design a cat. And being famous, they probably get fees many times bigger than experienced catamaran designers. It makes me cranky.
Instead of form following function, it becomes form follows myth.

It occurs to me that small design offices who design efficient catamarans must become some kind of crusaders.

We must try to show clients how to get the best possible boat for the use. Educating clients about options has to become a big part of the design process.
My sense of the large corporate design offices is that they will design anything the client wants with very little striving for excellence. Maybe they have no time nor motivation to educate clients. How else can I explain popularity of the fuel sucking corporate power catamarans? It's like we experienced catamaran designers have to do this kind of intervention.

The very efficient wave piercers and SWATH craft are a variation on displacement catamarans, but that is another article.