Pedigree Cats Inc.

Frequently Asked Questions

Why is it so many catamaran builders that started building a few years back are no longer in business??

This question keeps coming up and I think one reason is because most of them wanted to build one female catamaran mold and hope everyone wanted it. Stamp them out and make a fortune. People now have the tools to research boats and builders; and we highly recommend everyone do so. In 1994, about 50 builders surfaced, claiming to be the biggest and best. I think there are a few still left, but most of their web sites no longer come up.

Pedigree Catamarans, Inc. has been building catamarans in the Pacific Northwest for over 11 years and Gary has been building multi-hulls on the West Coast since 1975. “In my thirty-one years of building composite multi-hulls, I have never built the same boat twice”. The era of production boats is OUT! Custom boats, especially cats, are IN!

Building your boat is a big investment. When carefully done by the right builder using the right materials, the experience can be fun and rewarding.

CAT OR TRI?

Taken from ***The Design File*, Tony Grainger Yacht Design.**

CATS have become more popular for cruising mainly because of the accommodation space and privacy they provide and because for a given length they are faster and cheaper to build than a trimaran. TRIS, on the other hand, provide good performance through a wider range of conditions than catamarans, and can also be effective for cruising by utilizing flare above the waterline in the main hull, and by fitting aft cabins where additional privacy is required in the accommodation layout. Apart from the accommodation, the trimaran provides a more forgiving motion in a sea way and better resistance to pitching if the hull shapes are well designed, and the wide beam allows it to carry more sail in fresh conditions. Against these advantages is the fact that a cat will require less berthing space and is likely to be more maneuverable in close quarters if twin diesels are fitted. Also, the cat will have a more steady motion than a tri while sailing downwind.

How much does a custom catamaran cost?

The cost of a custom Pedigree catamaran, constructed with foam core, composite construction is very close to that of a production built yacht. The advantage is, you will have exactly what you want and the disadvantage is, it will take a little while to build.

Charter cats are generally a lot less expensive. They do not need the big ticket luxury items, such as water makers, A/C, big gen. sets, fancy interiors, etc.

When production space is available, you can have just the hulls built and finish the catamaran yourself at a considerable savings. If you wish, we can provide you with a cat at what ever stage you like. For example, we can fit the engines and aid in completion and when you are ready to launch, we can arrange that as well.

Most of our catamarans are fully loaded and ready for cruising. We have listed the average cost clients have spent on our amenities and pricing page. For a list of some of amenities included in a Pedigree Cat and the average prices, go to our Amenities & Pricing page or click on the "Amenities & Pricing" button available from most pages on our site.

All and all, we can provide just about anything you and your budget can imagine. Our goal is to get you out there to enjoy the fun with the exact Catamaran you have always wanted.

O.K. - I am interested in a Catamaran.
What do I do next?

Step 1 - What type and length do I need?

Common Questions: Sail or Power?
Ocean Cruising or Coastal cruising?
Personal Use or Charter? Day Charter or Term Charter?
Approximate Length?
Additional requirements?
Accommodations for how many?
Budget $?
Speed and range desired?

Visit the **Designer's Showcase** and look at a few different yacht profiles and floor plans. We can help direct you to boats that will suit your needs based on the answers to the questions listed above, plus we have others not shown. Keep in mind that floor plans and non-structural minor changes can be modified before construction begins to **ensure that this is the yacht you have in mind.**

Ultimately, you will need to determine the approximate length, and select the profile and floor plan to start working toward what you have in mind. Our stylist can also help put your dreams on paper.

Dick Newick, multihull designer for forty years is famous for saying **"You can have two of three factors in a multihull - speed, comfort, and economy. You cannot have all three."** That is true, but could depend on how fast you expect to go.

While true for sailing cats, the new displacement power cats are able to do quite well, reaching speeds of 20 knots with very little horsepower. Cats must also be balanced and not over loaded, to perform as the designer has projected. Extra weight to be carried must be disclosed to the designer before adding and before building.
Range is proportional to speed, if you go fast you burn all the fuel you have loaded and if you travel at the speed the designer states for cruising your range increases accordingly. Most of the designs now will cruise at 15 knots while total burn is 13 gph and top speed will be in the 20 knot range.

Step 2 - What is included and how much is it going to cost?

Visit our **Amenities and Pricing** page to get a list of items included on a Cruise Ready, Pedigree Cat. You can sail away knowing you have all the necessary safety gear and amenities onboard.

We have been able to determine an average Pricing Guideline for your information. These are an average price for a Pedigree Cat power or sail, with all the amenities listed as an ocean ready yacht. Of course, pricing may change depending on if you want gold plated faucets or require additional equipment onboard. Also, charter yachts are generally less than the price

listed, while trimarans generally cost more than the price listed.
Step 3 - Contact Us There are many more designs available than are shown on our site. Most designers have design catalogs and study plans available at very reasonable prices. If you need more help in locating exactly what you have in mind, we are able to have it designed. You may also use our stylist to lift the sketches off the napkins and bring them to life. For More Information, email us at **Info@PedigreeCats.Com** Please provide us with as much information as possible so that we can better assist you.

Why foam core? Why Airex foam?

Foam core has several advantages: no deterioration, insulated, unsinkable and stronger than solid fiberglass and Aluminum when tested in the same manner.

Foam core sandwich construction is the most technologically advanced form used in construction today, especially in conjunction with E-glass, Kevlar, Carbon Fiber and Structural foams. Structural foams are classified as load carrying, closed cell plastic foams that are non friable (will not readily crumble when stressed). Each designer calls for the materials to be used in the building process, including foam, fabric and resin. Pedigree Catamarans specializes in foam core construction only. The foam used in the hulls, bridge-deck and bulkheads of our catamarans is generally Airex® R63. Because of its high impact specifications. This foam is a resilient, thermo-formable linear linked, PVC foam core material with exceptional slamming load dissipation

Characteristics. AirLite foam is used above the bridge-deck. Other specified foams may be used as the designer specifies.

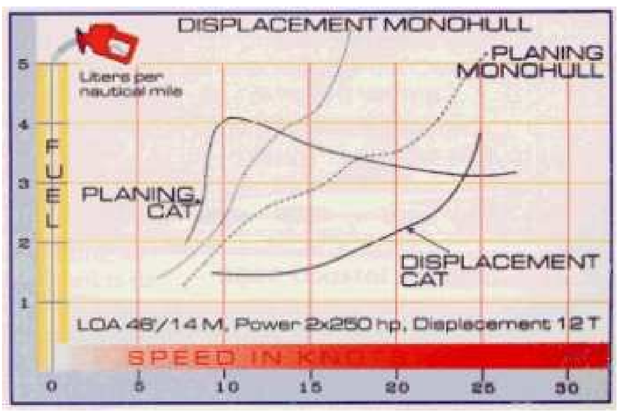
Clients have realized that their multihull has gone up in value over the years, because of the foam core material and because of the replacement cost. Airex® foam core and sandwich construction produces a catamaran that is 35 times stronger than solid fiberglass, wood or aluminum. It is also is about 30 percent lighter; will not rot or corrode; and provides floatation that makes the catamaran virtually unsinkable.

What is displacement?

Displacement is how much the boat weighs. When the boat is placed in water, this is how many pounds of water will be displaced. Foam core construction is about 30% lighter than solid fiberglass, Aluminum, etc. When the designers use the term "full displacement", it usually means the vessel is cruise-ready with equipment and fuel or with the "useful load" on board. While "light displacement" means empty and where it doesn't even have fuel on board. Lighter construction allows more payload to be carried, smaller engines to reach a good cruise speed and cost less, less fuel used, greater speeds, shallow draft, etc.

Displacement vs. Planning Catamarans vs. Displacement Monohulls

From Malcolm Tennant: Superior Performance of the Displacement Power Catamaran



The bottom line on the graph is what you are after, it's hard to read, DC displacement cat.

Fig.1. Graphically illustrates the superior performance of the displacement power catamaran. No other configuration gives you the combination of comfort, relatively high speed [very high speed in comparison with a displacement monohull] and long range cruising. The smaller designs; below 16m, can in some cases go transocean but only at relatively slow speeds because they do not have the capacity to carry enough fuel for longer trips at higher speeds. The larger vessels, from 16m up, can go transocean at speeds from 15 to 20 knots for two to three thousand miles on their basic inbuilt tankage. This is the sort of performance that had previously only been available in monohulls in the 40m+ range. The very low fuel usage that is evidenced in the graph means much lower operating costs. This, combined with the very good seakeeping, and the unprecedented stability, which is inherent in the displacement catamaran, introduced a new concept in long range travel at sea. And of course the smaller horsepower requirements for a particular performance reduces your initial capital cost also.

Bridgedeck Clearance for Cats -- Does it matter?

This exert has been taken out of **Tony Grainger's design catalogue.** "The answer might seem obvious to anyone who has sailed bridge-deck cats offshore but it isn't so obvious to the newcomer to multi-hulls and one could be excused for asking the question when we see the proliferation of production cruising cats with relatively, and sometimes very low bridge clearance.

Excessive clearance will create undesirable windage and it also increases the gap between the boom and the water, which is a major factor in reducing the efficiency of the rig from induced drag.

However, it must be remembered that abridge clearance is reduced as heeling takes place and if the clearance is inadequate, safety, comfort, and overall performance will be compromised.

So what does it matter? Wave slamming is most likely to occur upwind when the pitching of the boat interacts with the occasional steeper wave to cause slamming under the bridge. However, slamming can occur on any angle of sail including downwind and is typically experienced on Australia's East Coast when there is a residual short sharp swell left over from a fresh northeasterly, combined with the more even south easterly swell which is almost always present, even if only small.

The effects can vary from the occasional distraction of a dull thump under the bridge, to constant impacts which will slow the boat, and severely impede progress to windward, and in the extreme will lead to structural damage.

So how much clearance is enough? It depends on the width of the boat (a wider bridge has greater exposed flat area), the degree to which the boat pitches, (subject to hull shapes), and to what extent you value performance (and by implication, safety) as opposed to retaining a low profile, however it could be said that a clearance of much less than 6% or 7% of LOA would be generally considered to be low for an offshore sailing catamaran.

"Straight Shaft" or Stern Drive?

*Straight inboards may be a bit more seaworthy under some conditions. The cats twin engine versions are very maneuverable.

*Weight balance with the inboard is good, but sound can be a problem in the salon/cabin.

*Fuel consumption and engine life are about the same, but the inboard transmission enjoys greater longevity.

*The straight inboard is at a handicap in shallow water due to all that gear beneath the vessel.

*Stern drives are more maneuverable in the single engine installations. This may allow for a better cabin layout. They are often noisier on deck than their straight inboard counterparts. The drive system will trim the vessel up or down while the straight inboard can only trim one way.

*Shallow water operation is better due to the power trim. Fuel consumption is a wash. Engine life is about equal, but the stern drive itself will not last as long as the inboard transmission. Volvo will be introducing a new Composite stern drive this year and along with the 6-year warranty, will be worth considering. This combo is the preferred unit for most of the clients power cats to 65'.

*One other is the V-Drive. It allows the engines to be place aft and still have the shaft and prop as the inboard.

Power Cats and the LCG

From Malcolm Tennant, Professional Boat Builder, April/May 2000

An overweight multihull with trim problems is not easy to fix. Some keelboat designers and builders take a rather cavalier approach toward mass and longitudinal center of gravity (LCG) calculations. In many ways this is quite understandable. By adding and subtracting ballast, the displacement of most monohulls can be adjusted relatively easily after the vessel is built. (This excludes high-tech boats, such as America's Cup competitors, which have ballast ratios of around 80% and ballast concentrated in the keel bulb.) The LCG position can be changed by moving the ballast fore-and-aft to affect trim; the keel can be repositioned; and the mast can often be moved-admittedly all a bit drastic and undesirable. But post-hoc solutions to a trim, or an overweight problem are possible. In fact, these things may often be done so the vessel will achieve a more favorable rating for racing.

Multihull-sailboat designers, on the other hand, don't have any of these luxuries. They may be able to move some fluid tanks around a bit, but this is only a partial solution, since the tanks change weight as they consume the fluid and they constantly need to be topped off to maintain trim. There is no ballast; there is no keel; and the mast stays right where it is, unless you're willing to tear out the structure the mast rests in and rebuild a major part of the internal framework. To compound this problem, the difference between the light-ship condition and the full load displacement can be as high as 30% or more; so mass calculations that are not precise can result in a major trim problem.

An overweight vessel also affects the safety factors calculated into the rig and structure. Loads on rig and structure are calculated for the full-load situation, and with a particular safety factor appropriate to the vessel's intended use. If the vessel is heavier than the designed full-load displacement, then things such as the righting moment and transverse bending moments are higher, which erodes the safety factors in the structural calculations. Unless the overload situation is extreme, it's unlikely it will lead to immediate rig or structural failure. But it will almost certainly mean that the rig will need replacing earlier than would otherwise have been the case, and some structural problems, such as cracking, may occur with age.

Power-monohull designers are in a similar situation. They don't really want to add ballast to correct a trim problem if they can help it; this could exacerbate an existing weight problem.

Power-multihull designers, however, must treat the mass estimates and the calculation of the LCG position as the proverbial Holy Grail. If the vessel is a planing power cat, then the mass estimate and the LCG position are critical, The planing catamaran tends to have a smaller planing surface and higher bottom loading than the equivalent monohull. Because it almost certainly has more skin

area, it also tends to weigh more than the monohull, unless it's built out of advanced composites. If it's overweight and the LCG is in the wrong position, affecting the trim, then there's going to be a major problem getting it to plane. It may, in fact, end up as a rather inefficient displacement boat. [There are also critical factors in dynamic instability. For more on this, see PBB No.31, page 20-Ed.]

<u>Power Cats and the LCG</u> continued

You may think that because weight, per se, is not the same problem from a performance point of view for a displacement catamaran, the mass and LCG calculations would not seem so critical. Wrong! The displacement cat usually has finer hulls than a planing cat (and much finer than a monohull), which gives it a higher hull speed. This makes it more susceptible to changes in longitudinal trim because of the narrower waterplane. It's basically the difference between a plank floating on its edge or on its flat. If weight is added to the end of the plank floating edgewise, then it will "dip" a lot more than the plank floating on its flat with the same added weight. So the position of the LCG relative to the longitudinal center of buoyancy (LCB) and the longitudinal center of flotation (LCF) is crucial, since relatively small shifts in the position of the LCG can cause serious trim problems. What this means in practice is that it's very difficult to keep a power cat in level trim in all conditions from light-ship, through half-load, to full-load displacement; this is especially true of the displacement cat. On vessels with a substantial difference between the light-ship and full-load conditions (such as those craft with transoceanic or long-range capabilities), it's common to arrange a fuel-transfer system to keep the craft in trim as the fuel and water loads change. More seriously, it also means that any increase in weight or shift in the designed LCG position during construction can be disastrous.

An increase in weight may have very little influence on the performance of a displacement power cat (one of our ferry designs, for example, performs with 150 people much the same as when it's empty). This is because the major determiners of hull speed, such as the prismatic coefficient and the ratio between the waterline-length and waterline-beam, are little affected by any immersion.

If the extra weight affects the trim, however, then it adversely affects the performance. Stern-down trim can often reduce speed by a knot or two but more important, the weight increase may also compromise the performance of the vessel by lowering the height of the wing-deck off the water, causing the waves to hit the wing in milder conditions than might have been the case if the vessel were at its correct displacement. And, in similar fashion to the sailing catamaran, the structural integrity is compromised because the loadings on the structure are higher than those in the original structural calculations. This lower wing-deck height severely disturbs passenger comfort -their peace of mind notwithstanding- since waves thump more frequently on the wingdeck.

Weight also increases the longitudinal rotational moments of inertia of the craft, particularly if the added weight has been distributed toward the ends of the vessel. The bows are slower to rise to wave action, which further increases the likelihood of wave impact on the wing, particularly at the leading edge. When the bows come back down again, the wing-deck will hit the water harder, Even in normal conditions, weight should be concentrated toward the center of the vessel as much as possible to minimize the pitching effects that are more evident on the slim-waterplane catamaran.

To counter wing-deck impact, some designers place a vestigial third hull in the center of the wing, up forward - similar to the center "hull" on a wave-piercing catamaran, though somewhat smaller. This obviously costs more to construct than the flat wing, but may be a way of minimizing the impact of the additional weight that always seems to sneak in. It doesn't do any harm to have extra length of empty boat at the ends and to keep the wing-deck as short as possible, and as far back from the bow as practicable. If I can, I prefer to bring the wing-deck up to gunwale level some distance back from the bow; the area forward of this is then left open. A "pickle-fork" bow, with perhaps a trampoline or a forward deck from gunwale at sheer height, is fitted. This forward deck is well off the water (right up at gunwale height) and the central anti-slamming nacelle is brought forward under this area. I carry the nacelle right aft thought the underside of the wing-deck where it becomes a very convenient duct for pipes, holding tanks, etc. On my more recent rough-water performance designs, I have used a "double arch", which has a cross section similar to (but smaller than) those employed on some early wave-piercing catamarans. All these approaches minimize slamming should it occur. Keeping level trim with the wing at the designed height, however, is the real name of the game.

It has also been suggested that the "unknown-items factor" should be increased to compensate for any possible added weight. This "fudge" factor allows for the weight of those small things that are difficult to estimate, such as bolts, screws, clips, hinges, and the like. If this factor is assessed with any precision it will increase the design cost considerably because of the amount of time involved. The unknown-items factor is usually expressed as a percentage of the structural weight, or light-ship displacement.

To some extent an increase in the unknown-items factor can be justified as compensation, but there are a few problems associated with this approach. First, it degrades the accuracy of the whole weight-estimating process and makes it more and more of a guess. If the factor is too big, then there isn't much of a reason to even estimate the weight; you may as well just stay with the original "best guess" established at the beginning of the design process, which is based on previous experience. If you don't have a lot of experience, then you would just have to accept all the uncertainty that goes with it, particularly if you haven't designed a similar vessel before. The basic assumption about all the small items that make up the factor is that they're evenly distributed around the structure of the vessel and, therefore, do not affect the LCG position, only the weight. But if major items are added to or moved around the vessel after the weight estimates are completed, then they can have a marked effect on the LCG position.

Power-multihull designers must make sure that the mass and LCG calculations are as precise and comprehensive as possible, Impress upon clients, in the strongest possible terms, that they must tell you everything they're going to have on the boat, even if they're not going to fit it at the moment. (I have a checklist these days to help with this.) A client can't keep adding equipment to the boat after the design stage is finished. This is a major problem with catamarans of all types because of the amount of interior volume that's generally available, Unfortunately, because of the large load-carrying capability, the owners must be restrained from filling up every available space, particularly with heavy items.

Assuming that the owner can be kept under control, then there's the question of possible differences between the builder and the designer. How do you ensure that the builder is working to the same weights as the designer? This isn't too much of a problem with alloy [aluminum] construction. Because the plating is produced under tightly controlled conditions, you can rely on its being a particular weight per square meter within very close tolerances, and this makes the mass estimates relatively easy, aside from the question of filler. But, in the case of a composite craft, whether it's wood, foam, fiberglass, balsa, or various combinations of these, the construction material isn't manufactured in a factory - it's made on site. Designers use particular fiber-to-resin ratios, thicknesses of plywood, weights of fiberglass, etc., for their mass estimates. These should be based on actual achievable, as-built-in-a-yard weights, not laboratory perfection. But if the builder is not achieving the same weights per square meter as the designer intends - or the builder changes the material - then things can get seriously out of whack very quickly. The solutions to this problem are twofold. One, the designer can get actual, as-built weights from the builder. Unfortunately, this only works with the second boat from a particular builder, and doesn't necessarily work for all of them since laminate-weight variations can be as high as 25% from builder to builder; even with individual laminators at a given shop applying open-mold, hand-lay up techniques. Second, some builders institute careful quality-control procedures covering the laminating techniques and the fiber-to-resin ratios to ensure that they're getting the correct weight estimates. SCRIMP (Seemann Composites Resin Infusion Molding Process), pre-preg fabrics, and wet-out machines may offer better control over fiber-to-resin ratios, at least for a primary structure.

Communication between the designer and builder concerning the actual weights is crucial, And this is no less true for a wood/epoxy composite boat. [See the sidebar on page 49.] To this end, it's advantageous for the designer to supervise construction and be aware of any problems as soon as they become evident. In fact, designers who supervise construction should be constantly on the lookout for any deviation from the plan that's going to have a deleterious effect on the mass of the vessel. The builder can also construct the boat on load cells, or at least weigh the vessel at particular intervals, allowing the builder and designer to monitor the vessel weight and the LCG position as construction progresses, At a particular stage of assembly, if weight is high and the LCG is not where it should be, then it may be possible to take corrective measures. If all weighing happens at the end of construction, then it may be far too late and the unhappy owner is left with a boat that doesn't perform as expected, and with a set of problems that will be expensive to remedy.

A Cautionary Tale

My assistant and I performed nearly three weeks of calculations on a comprehensive spreadsheet to get the mass and LCG estimates as precise as possible on a 19.6m (64.3') power catamaran designed for strip-plank/ply/foam/fiberglass composite construction. In fact, it was probably the most careful mass estimate we had ever done.

When the vessel was launched, it appeared to be floating over its lines. We took measurements from the waterline, and the computer confirmed that in light-ship condition the boat was 27% heavier than the weight estimates. So what had gone wrong?

I had only visited the vessel once in the early stages of its construction because it was being built at a considerable distance from my home base. Somebody told the owners that extra weight did not have an adverse effect on displacement power catamarans. That was correct with regard to speed, but they seemed to be totally unaware of the negative effects on vessel trim-despite my earlier emphasis on weight when discussing the design with them.

Power Cats and the LCG continued

So where had all this extra weight come from? Unbeknownst to us, the builder had substituted 150kg/m3 (9.37 lb/ft3) end-grain balsa for the specified 60kg/m3 (3.75lb/ft3) PVC foam in the core of the ply/foam/ply structures of the wing-deck, bulkheads, and cabin-top. The area involved was several hundred square meters. The exterior sheathing glass was 750g/m2 (22 oz/yd2) instead of the specified 300g/m2 (8 oz/yd2). Factoring in the resin, this is a significant increase in weight. The plywood specified for the interior cabinetry was 4mm to 5mm (.16" to .2"); actual ply in a lot of places was 12mm (.5"). Was the builder the source of the problem? He certainly contributed, and commented that none of the increases in weight was very much. But if you say that 200 times, the result represents a significant increase.

The owners also had the builder move the rather large galley some 2m (6,6') forward and they installed commercial/hotel appliances rather than the domestic units we had allowed for. To compensate for the resulting bow-down trim, the builder put 500kgs (1,100 lbs) of batteries aft. This may have corrected the bow-down trim, but it magnified the longitudinal moment of inertia already initiated by the forward galley.

What could we have done? The owners weren't willing to pay for supervision, but we should have insisted on being informed -in writing- of any design changes. We should also have insisted that the vessel be built on load cells, or at least weighed several times. If these things had taken place we might have been able to notice the problem earlier. Isn't hindsight wonderful?

What is the minimum size for an ocean-going power catamaran?

Taken from *The Power of Multihulls, Spring 2000, by Malcolm Tennant:*

I am often asked "how small" a power catamaran can be and still be used for serious ocean going. This is really a "how long is a piece of string" type of question but the St. John 44 is a serious attempt to actually answer it.

The biggest problem when talking about the size of any catamaran is that people tend to confuse size with length. In the case of a monohull vessel, a longer boat is usually a bigger boat. In the case of the catamaran this is not necessarily so. You can have catamaran with, say, 18m hulls but with the superstructure of a 12m boat. This will be perceived by most people as being a big boat, when in fact, it is just a long boat that is still quite small in volume. It is also perceived that this longer boat will also be a much more expensive boat. But, again, this is not necessarily so. Given that the cost of the hulls of a catamaran is somewhere in the order of 10% of the total cost of the vessel, making the hulls a couple of meters longer has very little effect on the cost of the vessel. It may actually decrease the capital cost, as the boat may now be able to attain the same speed with smaller [cheaper] engines.
However, given that the general perception is that a long boat is a big boat and, of course, the usual marina berth problem. I have tried to restrict the overall length of the St. John 44 to what I consider is a workable minimum for an ocean-capable power cat. The effects of this restriction are twofold.

minimum size for an ocean-going power catamaran continued

Because people still want to carry pretty much the same equipment on the shorter boat that they would on the longer one, and are still looking for the same sort of range, we have had to use a wider hull than is our norm to get the necessary load carrying capability. This then has the effect of lowering the vessel's hull speed and reducing its efficiency slightly because we are now operating farther up the hulls resistance curve. But, we will still get around 25 knots out of 230 hp per side - perfectly satisfactory performance for a vessel of this type. Even if it is a little less than we could normally expect to get from one of our boats of this displacement.

We often have all the cabins on the wing deck with walk-in access. However, this usually means that, if an enclosed wheelhouse is then placed on top of the main structure, and a good wing deck clearance is maintained, the overall height of the boat is substantial. In this design this was not an issue. The clients requirement of having an internal helm on the main deck meant that visibility out the front of the boat was a necessity. Consequently, the forward berths have sitting headroom only, so the helmsman can see forward over the top of them, and are placed in the wing with access from the hulls. This is the configuration that is common with most sailing catamarans. The owner's stateroom, however, is located on the wing deck with an en suite head and shower. The saloon, galley and dining areas are all located on the same wing deck level and use household appliances where possible. The stern cockpit features an aft-facing seat (great for fishing) and generous boarding platforms to port and starboard. The fly-bridge has a second helm, a davit and stowage for a rigid bottom inflatable dinghy.

We have used our standard hull form that has become the shape of choice for most designers of displacement power catamarans since we first evolved it some fifteen years ago. This includes totally protected propellers, installed on a perfectly horizontal shaft in such a way as to completely eliminate the appendage drag normally associated with shafts and struts.

Our usual hull beam, and buoyancy, increasing knuckle is there along with the under-wing girder on the inboard hull side and the central wave breaking nacelle. All features that make our designs particularly good rough-water boats.

Propulsion is by normal four-bladed propeller with the tail shaft attached to a thrust bearing so the boat is being pushed on a bulkhead rather than on the engine. The engine is connected to the thrust bearing by an intermediate shaft and can therefore be more softly mounted, considerably reducing noise and vibration.

We have managed to get most of what the client wanted into this design and we have still retained our generous wing-deck clearance and all the other features that, in our experience, make for a good offshore boat. The vessel also has a range of 2,500 nautical miles at 12 knots.

So, I would have to say that, in my opinion, the St. John 44 is about the minimum size for an ocean-going power catamaran.

Can I use a foreign flag vessel in charter service in U.S. waters?

Presentation by: John H. Thomas, P.A., October, 1996

The following discussion is intended to provide general guidance as to issues that may arise for a particular transaction. Such issues are best considered on an individual case basis.

Any foreign vessel entering for navigation between ports in U.S. waters must be imported, requiring payment of an import duty, or must obtain a U.S. Customs cruising permit. The cruising permit does not allow commercial activity while in the U.S.. such as charter service.

A foreign flag vessel which has been imported is restricted from carrying passengers from one U.S. port to another, or from carrying passengers within U.S. waters without a foreign voyage, because it is not eligible for a coastwise trade license. 46 U S.C. 12106. Only U.S. documented vessels are eligible, and vessels which have been foreign built or foreign owned are excluded from this license. 46 U.S.C. 12106(a)(2); 46 C.F.R. 67.17-5(c). Congressional exemptions may be granted to these requirements, on a case by case basis.

A foreign flag vessel which engages only in foreign voyages, including cruises to nowhere into international waters, would not be in violation of Coast Guard restrictions, though it would have to clear U.S. Customs for each entry and exit. If it is operating as a vessel carrying passengers for hire, there will be inspection requirements which verily compliance with foreign flag state requirements and compliance with U.S. laws.
A foreign flag vessel which has been imported into the U.S. and engages in bare boat charters in U.S. waters must comply with the State requirements for registration and sales tax, and must still clear on every exit and entry from a U.S. port since it is a foreign vessel without a cruising permit

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Insurance?

Based on what experts say, they advise boaters to stop worrying about their insurance and start thinking about how to afford their next boat. Unless you have an arm-length history of claims or are planning to set sail for Tahiti in a ’68 rust bucket with only your significant other as crew, buying insurance shouldn’t be high on your list of worries.
"It's not about the boat, but the individual. It has to do with individual risk. Obtaining insurance depends on the past experience of the boat owner."

<u>Some Insurance Companies</u>

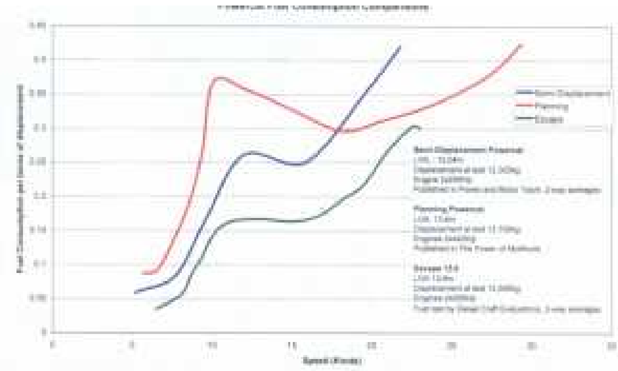
Hinckley Marine Insurance (800) 367-3692

Spencer Lloyd (800) 648-9303

Twin Rivers Marine Insurance (800) 259-5701

Powercat Fuel Consumption Comparisons

by Malcolm Tennant Multihull Design LTD



Frequently in magazines and on web sites you will find claims of 'greater speeds', 'lower fuel consumption', and ‘longer range' for a particular design. Here at Malcolm Tennant Design Ltd we pride ourselves at producing fuel-efficient powerboats, which give high speeds on displacement hulls with as low as possible horsepower requirements. Our efficient hulls allow for longer ranges with a given amount of fuel. To make sure we are delivering the best possible performance to our customers, when possible, we like to compare our hull performance data with other boats as a validation of our design ethos. When fuel consumption tests are published, it allows everybody to look beyond the advertising blurb and estimated performance figures and get down to what a boat is really achieving.

We recently had the 13.6m Escape launched here in New Zealand and had a fuel test completed on her. We managed to find two other published fuel tests for recently launched (2003) vessels of comparable designs. These other two boats have been designed by reputable designers that are competent in designing power multi-hulls.

The other results are for a round bottomed with chine semi-displacement powercat and a hard chine planning powercat. The fuel consumption was matched to the displacements of the vessels so that the slightly heavier planning cat would not be penalized. Our vessel, the Escape, is a full displacement hull that is Malcolm Tennant's signature powerboat hull form.

The results are shown in the following graph. Right across the fuel range the Escape was using less fuel than either of her competitors. Her closest rival below 19knots was the semi-displacement powercat. However, as can be seen from the graph above 10 knots, the Escape is using on average only 65% of the fuel of the semi-displacement vessel! Even below 10 knots the Escape is only burning 60% of the semi's fuel. This means more than 40% more range for the Escape at a given speed.

At all speeds compared, the planning cat was using more fuel than the Escape. At the planning cat's drag hump at around 11 knots the Escape was using only 43% of the horsepower of the other boat! Above this speed the other boat gets onto the plane and her fuel consumption begins to drop until 18 knots where it begins to rise once more. At the top speed the Escape reached with her 200Hp motors of 23 knots she is burning only 90% of the fuel of the planning cat. The planning cat then uses an additional 480HP (total) for another 6.5 knots of speed! So unless very high speeds are required in a boat of this length, the displacement cat is superior.

This figure also shows the second advantage of the displacement cat in that the speed can be reduced to a slower cruise speed for a greatly increased range. If we look at 15 knots for example, the Escape is only using 50% of the fuel of the planning vessel. For a given amount of fuel this equates to twice the range! To increase her range, the planning cat could increase her speed to 18 knots. At this point she would still only have 55% the range of the Escape. The other option for the planning cat would be to reduce her speed to 8 knots to achieve the same range as the Escape achieves at 15 knots. At 15 knots the Escape has a range of 616 nm (with 10 % reserve) and she would cover this distance in 41 hours. The planning cat would take 77 hours to complete this trip. This means she would arrive 1.5 days later! On a return trip cruise you would lose three days out of your holiday just to passage-making!

This has confirmed for us that our displacement powercat hull form is the ideal cruising power boat, capable of both high top speeds and extended cruising ranges that cannot be matched by the other conventional hull forms compared here. To the owner, this equates to lower fuel cost and more time spent on holiday and less time passage-making, which should keep everybody happy!\

A Case for Displacement Power Catamarans

Article by Malcolm Tennant as published in Multihulls Magazine

In our Premier Issue, Malcolm Tennant, one of today's foremost power catamaran designers, discusses the principles of planning vs. displacement catamarans. In this article he makes clear his choice of the displacement cat.

For some fifteen years now our office has been designing powerboats that combine something of the old and something of the very new. To make a leap forward in comfort and economy we looked back to the close of the 19th Century and the early years of the 20th. We have taken the powerboat wisdom of that time and used it in the designing of very modern power catamarans that can have much more living space than their monohull cousins, and that easily surpass them in comfort and economy. Current thinking has it that to go fast in smaller craft it is necessary to plane. This is because the usual monohull displacement craft are restricted to a speed of approximately 1.34 times the square root of their waterline length (Froudes Law). To drive a normal displacement vessel faster than this requires an inordinate amount of horsepower and may even lead to foundering in their own bow and stern waves, or by rolling the gunwales under from the enormous torque produced. Planing is a way to circumventing Froudes Law by getting the vessel to plane on top of the water where the wave making drag is no longer a restriction on their performance. However, planing craft do need to be relatively light, ie: have good power-to-weight ratios, and planing surface-area-to-weight ratios; are very inefficient when they are not planing, and are not as economical to run at some speeds as the displacement craft. So we seem to have two distinct types of boats: a. One that is fast, but uneconomical at slower speeds and can have a bone-jarring ride in a seaway; b. The other, that is economical and comfortable in a seaway, but is slow. Is it then even possible to get a craft that combines the best features of both these types? A boat that has reasonable, even good performance with excellent accommodations and is still economical to build and run and has good seakeeping capabilities: or is this just one of those designers' pipedreams?

One quite successful attempt to achieve this dream was made by Tom Fexas with his Midnight Lace series of monohull designs, in which he used long, light, semi-displacement hulls to improve economy without compromising performance too much. These boats were, in fact, a compromise (aren't all boats?) and, to me, only partially successful by reason of his definition of a slim hull which was, of course, forced on him by the need for stability, accommodation and sea keeping. To Tom Flexas a slim hull was one that had a length-to-beam ratio of four (the waterline length was four times the waterline beam). This was certainly narrow by contemporary planing boat standards, but was unexceptional when compared with earlier boats, or with types of hulls that I am proposing should be used.

Before the improvement of the power-to-weight ratio of the internal combustion engine, and the development of the hard-chine, low-dead rise hull allowed boats to plane, there was only one way to go fast: building long-and-slim, and in the first decade of the 20th Century we find boats such as Slim Jim, that were achieving speeds of 15 knots from a 15 HP engine driving just such long hulls in 1905. Typical of the early boats was Defender: 16.2m (53') long, having a maximum hull beam of 2.28m (7'6"). Headroom under the flush deck was only 1.45m (4'9") and she slept six in berths only 500mm (18") wide. In anything of a seaway it would have been incredibly wet and uncomfortable. The boat had a great deal of grace and elegance to her lines, but her rolling at sea, and lack of accommodations, would be totally unacceptable today except for one small detail: a 48 HP motor propelled this 16.2m boat at 16.5 knots! Is it possible, then, to reconcile these old, easily driven, but incredibly uncomfortable hull forms with the current, ever increasing demands for more interior space and more home comforts that can be the downfall of many a well-designed planing craft? I believe the answer is: catamarans! By joining two of these long, slim hulls together and surmounting them with an extensive superstructure, we are able to provide even more than the currently desirable amount of accommodation and at the same time stabilize the hulls so that rolling is no longer a problem.

Even a very cursory look at sailing catamarans will show that they are not restricted by Froudes Law. Their very fine hulls place them on a very different part of Froudes' wave making continuum, and results in their having a very much higher hull speed than he ever envisioned from his observations in the order of 30+ knots is not unusual for these boats. Certainly the boats with this sort of performance are very lightly loaded racing craft, but even the more heavily laden cruising boats do not have much trouble breaking the 1.34 barrier. If these sorts of speeds can be achieved under sail, than it should be much easier under power. Towing tank tests of long, slim hulls with high prismatic coefficients (fine hulls with a fairly even spread of displacement from bow to stern), such as our displacement powerboats exhibit, have shown no catastrophic increase in wave drag at speed/length ratios above approximately 1.4 such as occurs with "normal" displacement hulls. These high prismatic hulls have a higher displacement hull speed than is "normal." This test data is further supported by the precisely measured performance tests of such boats as the Zenith-47 Antaeus, the Awesome 2000, the Mako-61, the Jaybee and the Icarus 46 in the full-sized ocean test tank. All these boats have prismatic coefficients greater than 0.66 and all easily exceed their theoretical hull speeds, while returning exceptional fuel economy.

So it would seem that all we have to do is to make power catamarans with long, slim hulls, and then we will have speed, economy and accommodation. The potential is there, but is it really that simple? The answer, of course, is "no" not quite! If we compare a sailing catamaran with a keelboat, we will see that the catamaran has one immediately obvious advantage. It is lighter because it is able to eliminate the lead keel upon which the keelboat depends on for its stability.

In the case of the powerboat, there is no such advantage. The catamaran may, in fact, be heavier than the monohull because of its increased area. All is not lost, however, because while the skin area is increasing by the square, the interior volume is increasing by the cube! This possible increase in weight may be a problem with planing catamarans because of their limited planing surface, but it does not mean that our dream is impossible.

The displacement catamaran is not as susceptible to over loading as is the planing craft. The hull speed of the displacement boat is largely dependent on the L:B ratio of the hulls and this does not change very much with modest overloading. This does, however, bring up one of the limitations of the displacement boat. To work successfully, the L:B ratio of the hulls should be in excess of 10, and preferably higher. Consequently, if high displacements and length restrictions force short, fat hulls on the designer, then the displacement approach will not be successful. In this situation the only recourse is to lengthen the hull until the requisite L:B ratio is obtained, or to use a planing hull form. It will be apparent from this, that the displacement concept would seem to have little place in boats shorter than 10m (32'), unless they can be built light or a very modest performance is required. I have designed smaller displacement boats that achieve quite credible 15-knot cruising speeds from very small horsepower (43 HP per side) engines. But if performance on par with planing vessels is required, then the displacement boat must be able to have long, slim hulls, preferably without the planing boats' low deadrise, submerged chine sections, as this increases the drag substantially, and even more if the chines break the surface. This, then, is the approach we have taken with a lot of our power catamaran designs: long, slim, easily driven round-bilge, minimum wetted surface hulls that give performance on a par with planing craft, but with considerably better sea-keeping capability and better fuel economy.

It is, of course, possible to question whether these boats really are displacement craft. Current theory says that for vessels of this length, to go this fast, they must be planing. In fact, if we accept the usual definition of planing vessel, namely: that it has a speed/length ratio of more than 2, then these boats are clearly planing. However, a boat is said to be planing when most of its mass is supported dynamically by the downward directed thrust of the water. A vessel that is planing will typically have a bow out trim and will have bodily risen out of the water. The waters are muddied a little by the fact that there is no sudden jump from displacement to planing. It is a continuum and somewhere in the speed/length ratio range from 1.5 to 2 the craft would be considered to be in a "semi-displacement" mode. We have now designed a large number of displacement power cats exemplifying the "long and slim" approach of powerboat design.

The Zenith-47 displaces 13 tons fully loaded, and motors at 20 knots maximum much more economically at 16 knots with only two 122 kw (160 HP) pushing hulls with a 24.5 knot hull speed. A mono-hulled displacement boat of this length would have a hull speed of about 8.5 knots. The smaller Nomad and Cortez powerboats also have a similar hull speed but are optimized for more for economy with slower speeds with small engines. The Icarus-46 has a top speed of 25 knots from two 150 kw (200 HP) turbo-charged diesels. At the upper end of the scale is the Mako-61, an 18.6m (61') game fishing boat with a hull speed of 37.5 knots which would yield an easy 30 knots with around 500 HP per side. In the interest of economy, this boat is intended to cruise at 16 knots with a maximum of 20 knots using twin 150 kw (200 HP) engines.

These performances are very much faster than those of the traditional displacement boats of comparable size and are on a par with that of a planing boat of similar displacement, but with lesser power requirement and subsequently greater economy. I believe the performance of these designs

demonstrates the potential of the displacement power catamaran to be that very elusive and ephemeral animal; the best of all possible worlds: combining excellent accommodation, comfort, and economical performance with good old-fashioned seaworthiness. It seems to me that there is no reason why this old "long and slim" principle should not be applied to lightweight boats with less superstructure and even finer hulls, to produce 30 or even perhaps 40 knots of fuss-free performance from quite modest horsepower.

In fact, this belief has been partially tested with two offshore designs: the 17.5m (57') Red Diamond II, designed for a Japanese client, capable of a top speed of 33 knots (cruising at 24) from twin 320 kw (430 HP) Yanmar diesels; and the 20m (65') Awesome 2000, which has a top speed of 28 knots, and an open ocean cruising range of 3,000 miles at 15-knot speed. This craft has made the trip from Long Beach, California to Hawaii using only her internal tanks. Although these displacement cats may not be the fastest things around in flat water, they have demonstrated an ability to maintain much higher average speeds than most other craft regardless of sea conditions. In situations where the high-speed planing monohull is forced to drastically reduce its speed, the displacement catamaran is able to continue on with very little reduction in performance.

This ability is displayed day in and day out by the rapidly expanding commercial catamaran ferry fleets whose operators recognized the economic advantages of this concept early on. It has often been pointed out that many people with displacement boats try to push them too fast and, consequently, would be better off with a planing boat. For these people there is now another alternative: displacement boats with the performance of planing craft and the frugal thirst and smooth comfort of the traditional displacement boat.

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