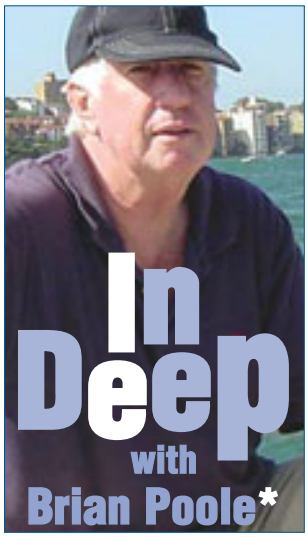

"IF YOU CANNOT MEASURE IT, YOU CANNOT CONTROL IT

IF YOU CANNOT CONTROL IT, YOU CANNOT IMPROVE IT"

You may remember an IN DEEP article of about 12 months ago, when I wrote about engineering being the science of the variable, and advertising the art of the attribute.

A variable is something that you can measure exactly or approximately, depending on the requirement. In this day and age of sporting events being won and lost by one hundred of a second, the accuracy of measurement is all-important. However in our boating world "about 25 knots" may be a good enough measurement of speed for the average boatie. But if you know for sure that you are getting 25 knots and you change the prop and put the boat over a measured mile or use a reliable log, you can measure if there is an increase in speed. Also if you were not getting maximum engine RPM and you reduced propeller pitch a shade you can measure the engine RPM and any change in speed or fuel consumption.

An attribute is something you cannot measure. A boat may look a good boat, it may go well, and it may have a high speed. All these are attributes. What is high speed - 25, 35, or 45 knots? Attributes are the art of the advertising guru as he polishes the English language to an irresistible shine. You have heard it all before; "New, improved technology!" or "Patent pending hull shape", or "Computer design" "The best offshore performance", and on, and on.

If we are to compare boats in an engineering way we need to measure other characteristics apart from the usual length, beam, depth, recommended maximum power, person capacity, etc, The problem is that this is not easily done or all that necessary, as far as the consumer is concerned. Most boats are of conventional shape and have engineering properties similar to a craft of the same waterline length and configuration. Providing more information will only confuse customers. What is important is that the boat is safe when used for the purpose for which it was designed.

From an engineering aspect more information is required to compare similar craft. I would really like to get about six successful single chine designs of the same length and run a series of engineering checks and comparisons on them.

Some engineering outcomes that we could measure would be:

- The light weight of boat fully outfitted with safety gear but without fuel, persons and personal luggage and the centre of gravity of the craft in this condition of loading.
- The fully loaded weight with persons, fuel, and personal effects and the centre of gravity of the boat and persons (both seated and standing) in this condition of loading
- An in the water inclining experiment to determine the centre of gravity of the craft in the lightweight condition. (Design lines plan and computer calculations are also needed to do this)
- The waterline length
- Waterline and transom waterline beam
- Bottom transverse angle of the bottom at various positions
- Height of any self-draining cockpit above the waterline in the light condition
- Height of any self-draining cockpit above the waterline in the loaded condition
- Depth from floor to coaming side
- Speed in the fully loaded and half loaded conditions with the same power
- A standard AS1799 type maximum power speed test around a series of buoys 1 Period of roll tests in the loaded condition at various angles of list caused by an off the centerline load in order to compare outcomes in this situation
- A similar test with free surface in the bilge area
- Determination of the maximum person loading by test in accordance with Australian Standard AS1799 Part 1.
- In worst condition of loading such as 10 percent fuel and all allowable passengers standing up
- A standard wetness test in rough conditions
- Determine the number of kg to make the craft sink 1 centimetre

This information would provide variables that can be compared in order to appreciate the differences in the craft. However undertaking the tests would be an expensive exercise and not worth the effort. This means that we will never really know in engineering terms how the actual outcomes for each design compare with each other. This means that we are left with attributes to inform us.

We are in the hands of the spin merchants.

I rather suspect that all monohulls would be similar and the difference between the monohulls, catamarans, and if available a tri hull, could be identified. For example, uncontained free surface in a monohull would increase the period of roll more than free surface in the catamaran hulls. The kg to sink the catamaran one centremetre would be greater than for a monohull. That is, the catamaran would not be as good a load carrier.

One could argue that all this is a bit academic. That experienced boat handlers, that is those who have had the opportunity to drive and test many craft, develop a feeling for a good boat. It feels right, handles most situation well, and the layout works. I have spoke to "Himself " (Editor, Peter Webster) many times about this.

He is right when he says that he can tell a good boat when he drives one. I just get a bit put off when he uses design terms out of context to their engineering meaning.

He is not alone with this, particularly with regard to stability.

*** Brian Poole is a shipwright and experienced para-professional small craft designer. He trained with HMA Naval Dockyard Garden Island and before retrenchment was the Senior Technical Officer (Marine) in the Defence Contracting Office Sydney. Since then, he has run Boden Boat Plans and is a regular consultant to the marine industry, TAFE and others in the educational field.*

Very few existing trailerboats would be able to fully comply with all apects of the proposed flotation and stability standards - unless they are designed along the lines of the cylinder craft shown here, from Yamba Engineering.

This begs the question "what is stability?". In naval architecture terms stability is the ability of a vessel to return to the upright when "heeled" over by an external force such as wind of wave.

"List" on the other hand is a transverse angle of tilt caused by an onboard off centerline load such as all people standing to one side. With a small craft the stability (as defined) characteristics will vary considerably on craft with an evenly distributed load (upright) and one listed over by the load (persons) all on one side. It would be particularly so if the chine on one side comes out of the water. Further more stability is significantly reduced by free surface, which is loose unrestrained water in the bilge.

The recent number of photographs in boating magazines of persons standing up on the centerline of fully flooded boats to prove the Australian Builders Plate requirements for flotation requirements are misleading. Let them try standing on one side and drive a tinnie past, and then see how stable it is. This is because the stability of a craft depends on three factors:

- The position of the centre of gravity and
- Centre of buoyancy (centroid of underwater volumetric shape)
- The effect of any free surface of internal fluid in that particular condition of loading. (When swamped, there is a lot of free surface).

The measurement of stability is called the metacentric height (GM) and is a distance from a point called the metacentre, and the position of the center of gravity in that particular condition of loading.

GM is significantly reduced by the effect of large areas of free surface. If the area of free surface inside the boat is about the area of the external water plane, you have very little positive GM or stability left.

Now I know this is getting a bit complicated, but there is no easy way to explain it.

With the swamped boat, the guy standing in the centre is in fact an automatic stability machine. The boat goes one way and he goes the other. It is exactly the same as if I was to stand on a see-saw and balance myself. Would you say I was stable as defined? I have to move my weight to return the see-saw to the horizontal.

Remember, stability as defined, is the ability of the boat to return to the upright position without anything moving aboard the boat.

Period of roll in calm water is interesting. The period of roll, or time to complete one complete roll that is induced (such as a rope on the top of a mast being pulled over, then released) is related to GM and stability.

A craft with a slow period of roll (say) 13 seconds is not as stable as a craft with a lower period of roll at (say) 8 seconds. A vessel with a low period of roll is called stiff and can be very uncomfortable at sea. Now when offshore, all boats must roll and a stiff boat can be more uncomfortable, and is sometimes mistaken for being unstable.

This is only part of the problem. Vessels, as they heel over, are subject to a change in GM, (that is the metacentre moves down) because the shape of the actual underwater section changes and may be the chine will come out of the water. Some craft can have a high GM at 40 degrees of heel and some can lose all GM and turn over at 40 degrees if they are top heavy. Of course any free surface in the bilge does not help.

Why all the confusion? I suspect it is because so many skilled tradesmen building great boats did not undertake the Shipwright and Boatbuilders trades course where these fundamentals are taught.

Many top builders have completed a boilermakers, or fitters apprenticeship where they learnt the metal fabrication skills but not the stability theory.

Up to now, not all builders have needed to fully understand this. They build a conventional boat, test it and it goes well. It's a good boat, and they continually improve it. The Australian Builders Plate will change this. As the builder they will have to state, as a competant person, that the particulars on the craft conform to the ABP requirements and that they have verified this.

How do you define a competent person? You cannot verify the particulars if you do not have a copy of and understand the standard. What chance would a builder have in a negligence case if he could not explain stability fundamentals when cross-examined by a QC?

The other question is how seriously will the boat builders and importers take the Australian Builders Plate? After all, apparently no authority is responsible for ensuring compliance. It is up to consumers to complain to the State Consumer Affairs Authority about incorrect information on a plate.

Try asking retailers at the present round of boat shows about the Australian Builders Plate.

Only time will tell.

F&B