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Figure 1 – Prototype AC45

### Introduction

Team Yachting Australia is about to receive their AC45 so I thought I'd put some thoughts on paper. I have some thoughts on the hardware and on the sailing. I have been observing the C-Class, Wings and AC45s for a while and some trends are showing up.

### The Platform

I was watching a video of Team NZ sailing through some chop and looked at it in slow motion. The racking of the hulls was quite distinct and this points at a couple of items.

- 1) When the hulls and beams are connected please assemble them very carefully and securely. Wax and bed them together with epoxy. Once the boat is assembled I recommend giving them a racking test and measure the deflection with a dial gauge. Monitor this deflection regularly. As the system beds down the deflection will get greater. Just like all mechanical systems they wear in (& wear out) and bed down. After some convenient time the platform should be pulled apart and rebuilt. After that I expect not much to change unless something is going wrong. Whoever is in charge of the boat should regularly check the boat racking deflection.
- 2) This deflection is important for two reasons; 1) The wing ball is 35mm diameter so it only takes a 17mm "bump" to have the mast fall out. This will either happen at a very inconvenient time or at a very bad time. Like just before winning an important race. Murphy is always in the background waiting to appear, 2) this deflection affects forestay tension and this is important for the jib performance.
- 3) When I was in Auckland watching them assemble the Team China boat there was concern over the short boss length of several of the sub-structure parts that fitted

together. The teams had cross drilled and laced these so they could not fall out. Whoever is boat manager needs to observe the substructure build and watch it settle in. There is great opportunity in this type of structure for failures and mishaps. There are lots and lots of small parts that can go wrong and it is evident that there are design issues.

### **The Wing**

Apart from it being a complicated thing it has a couple of quirks I think. The control cables come together at the "control quadrant". This area could be organised better. The cables have no easy way to control preload. Team Artemis and Team NZ placed turnbuckles into the system to allow preloading the cables to be done on the water. Looking at the quadrant it seems to me they changed their mind halfway through the design. I'd like to fine tune this area a bit better if given the opportunity. Let's just say it works at the moment but it could work much easier.

### **Sailing – The big issue**

The AC45 is about to be sailed and coached by soft sail sailors. Initially this is OK but major errors will be made. These people will have years and decades of training and experience in soft sails but no Wing experience. I have not sailed a wing but understand them and comment on them from a technical viewpoint. Unfortunately the soft sail, wing combination naturally limits the Wing. On a soft main-sail boat the jib is used to improve the lee side main sail vortex. This does not exist on the Wing so all the jib does is put dirty air onto our nice Wing. I suspect that the trend will be to smaller and smaller jibs.

The jib also has a small operational angle vs the Wing which has a large sweet spot or groove. If the jib is up and we sail to the jib we will be limiting ourselves to the jibs performance. If the jib was not there, we would increase the Wings camber and power it up further, decreasing drag as well. The Wing provides much more drive with less heeling force and drag than the jib/wing combination can.

On USA17 the jib was only used when both hulls were in the water, once the hull left the water the jib was removed immediately allowing USA17 to go faster. With Wings more "sail area" does not mean faster. The flaps provide most of the lift and these need to be learned to be controlled in camber and twist. Soft sailors will understand twist but I don't think they will appreciate the power available in the camber control.

The "soft sailors" will go down the path of soft sail solutions and experience. This will be limiting and we don't have much time to learn by trial and error. The answer is we must embark on achieving a solid velocity plot of the AC45 as soon as possible. As soon as the sailors are comfortable on the boat they need to go out and sail fixed courses and document all of the various sail and wing combinations, camber combinations etc etc. This is the only way we will be able to discover the performance potential of the boat. It may be boring but given a week on the water documenting the sailing then building velocity maps will answer all the questions. Then it's a case of memorising the combinations and tactics to use the fastest solution in the circumstances.

I've attached an article on C-Class cat design illustrating the point.

We have to be smart about this process. All the other sailors are in the same boat. They will be hard wired as well and will fall to the same traps on the water. Muscle memory is very difficult to retrain.

There are other technical bits to discuss but the main point I want to make is that it's imperative to establish a proper Team Australia AC45 velocity plot asap.

### **The photo – Image 1**

Going fwd and lying down was called “Starfishing” on USA17. We don't want to run the risk of sailors falling off, so don't do this in a race!

I picked this out of my AC45 file but it illustrates a couple of things I'd like not to see Team Australia do. The object of racing sailing is to maximise the Righting Moment of the boat at every point of the race. In this photo the team has placed sailors on the lee side and fwd. It implies that they have reached their limit of stability. If sailors came uphill the Rm would increase, the drive would increase and they would go faster. To achieve this I suggest the following. The jib is a large one and is inhibiting the operation of the Wing. If they downsized the jib and increased the camber of the Wing they would be able to have 1 or 2 sailors come up, increasing Rm and consequently go faster. The whole objective is to get the Wing powered up to the max. Be careful with jib and gennaker selection! The correct answer may be in downsizing and using the Wing more. Always use the wing to the max. It's very controllable, big grooved and slippery. All the things that sails aren't.

I chased these things around Auckland Harbour at 20-25kts and most people think this is fast, but this is the usual speed of a C-Class and they don't have the power ratio of the AC45. So I think 25-30kts will be the norm once they learn more about the wings.

Any questions please ask.