

KSS Kits: A No Contest Comparison

By Derek Kelsall

We are often asked for a comparison. Kits are the 'in' word, wherever we look in catamaran custom boat building. The interest has soared during the last five years. This is particularly true in NZ and Australia, where there are probably more catamarans custom built than anywhere else in the World. There are two Kit systems on general offer which are universally applicable. I.e. suitable for any model or size and readily available. They are

1. Our KSS Kits where each part of the kit is produced for the individual part of the individual design as a flat foam sandwich panel. To be strictly correct we need to add that the KSS kits are specific to Kelsall Designs, but the Kelsall equivalent design is available or can be made available.
2. The Duflex kit, the basis of which is plain 8x4m, mass produced, sandwich panels. That panel has a means of joining included on one edge and can be CNC cut and assembled by the builder into the full size parts needed.

Kelsall Catamarans are into our fourth decade of using foam sandwich Kits. We made our first mould table in 1973 and the Kelsall kit panel route has been part of every design since. For the past 15 years the panels have been the basis of every part of every Kelsall cat structure, including the round bilge hulls. KSS kit producers are in NZ, Australia and Germany. Resin infusion has been refined for KSS and is the KSS standard laminating method.

The KSS Advantages are

Versatility

Each job is specific to each design and there are no limits on what can be done using KSS. Where more than one vessel is to be produced, KSS is very effectively combined with part moulds. As appropriate, part moulds will be added by the kit producers for particular models.

Sandwich Structures of Foam Cost with Fibreglass Skins

These are the most versatile, effective and economical materials available. They are particularly suitable for marine structures. The foam, pvc or similar, is mono cellular and does not take up water. Its sheer and compressive strength are ideal as the core of a sandwich. The glass resin matrix has excellent strength properties for the skins. Fiberglass as a sheet material, has one weakness. In comparison to steel or timber it stretches and hence needs to be thick to achieve stiffness. Stiffness is related to the overall thickness, (the cube of thickness) and hence the sandwich combination is ideal. Add to the core thickness, which adds very little to the weight and get the result needed without adding stiffeners or beams, providing more headroom, clean interior surfaces and simpler fit out. Most of the glass used in KSS is unidirectional. An advantage is that there is no side by side overlap, which adds weight and the fiber direction can be specified. There are no limitations on the orientation of the fibers.

Strength for Least Weight

There is no better composite in this respect than the KSS kit. The materials are specified for each application. E-glass with polyester or vinylester resin is the KSS standard for the typical catamaran. Carbon with epoxy are specified where the cost and extra stiffness and less weight are appropriate. The infusion method of producing the sandwich panels allows for accurate fiber positioning by setting out dry. The high vacuum pressure gives a high fiber content for the skins and ensures an excellent bond to the core. Post curing is standard for the kit producers.

Variable Strength and Patch Additions

This includes variable for different parts of the same panel as well as between panels as needed for the specific kit. The stiffness and strength requirements vary throughout the catamaran structure. The KSS core and the skins are varied to suit. There will be 3 or 4 different foam thickness and skin thickness for the typical cat. Patches are added as the panel is made, for such as chain-plate areas, winches etc.

Durability

The materials are specified for durability in the marine environment. Nothing is included that can take up water or rot. Balsa core, however well protected, does not pass this test. Given protection from UV light, the life of the KSS parts is unlimited. Boats we built of these same materials are passing survey 40 years on. Talking today, perhaps most boat builders would say, does it matter what happens that far in the future. I get satisfaction from hearing that the boats I built in the 60's are still sailing and still only need the occasional coat of paint to maintain.

Suitability for Catamarans

The catamaran structure consists largely of flat or gently curved surfaces. Stiffness is the principle requirement. The combination of E glass skins and a foam core as the sandwich structure produces the most efficient and economical panel. This was the main reason we chose PVC foam and unidirectional E-glass as our standard in 1965. We have found no reason to make any change since. These materials have stood the test of time our way.

Built in Insulation and Buoyancy

Insulation is essential for comfort aboard. To have it as part of the structure has to be the most efficient way. No KSS catamaran could ever sink. The amount of built in buoyancy will ensure even total flooding will leave most of the boat's structure above the water.

Economy

The basic materials are economical. When other factors, such as least wastage and least spent on ancillary materials, KSS is least cost in total material costs compared to any equivalent. The cost of the professionally made kit, in our estimate, is quickly justified by the savings to be made in build hours.

Full Size

The typical KSS panels are produced to the length and width required. Typically the bridge deck and the saloon top will be wider than the 3m wide table and are the only panels which have to be joined to get the width. Some bulkheads may also have joins. By using a rebate, which is created while the panel is being made, there is no build up of thickness at the join and the finish is simple to apply to the narrow join area. Working with full size panels has lots of advantages. One of the very first lessons we learnt in using panels was that laminating on the table and making the panels as large as possible pays big dividends. No joining and join material. When a full size panel is set in place, very little control is needed. If a gentle bend is incorporated the panel bends evenly, without any hard join to worry about. Preparation for painting and first paint coats can be applied while still flat.

Low Wastage

Each panel is individually made on the mould table. There are relatively few off-cuts and any reasonable size off-cut can be used on later panels. The resin content for each infusion is calculated and the wastage in the tubing etc., is a minor factor.

Assembly

The kit is designed to control the assembly of the catamaran. The information needed to set the hull spacing and keep everything in line is on the panels.

Unique to KSS – Hull Shaping

The way the KSS hulls are produced is unique. We find it easiest to describe as working with surface shapes rather than with the traditional approach of section shapes. The hull is produced directly from two panels. The topsides areas are complete scantlings. No laminating onto steeply angled surfaces which are difficult to reach. The topsides are relatively stiff and hence, when bent to the gentle curve of the hull side, an absolutely fair curve is achieved. Some further details below. One of the outcomes of the shaping process is purely aesthetic. The final KSS hull loses the flat panel appearance due to some compound curvature introduced into the topsides combined with the generous deck edge radius (part of the hull panel in the kit).

Few Simple Frames

The frames needed could not be simpler. The frame sets the deck width and the depth within the hull. Hence, each frame consists of just two straight timbers and some bracing. Full size templates or those CNC cut frames typical of other custom methods are replaced by just two measurements. KSS hulls need 6-10 frames only.

Accuracy and Fairness

As explained above, the topsides have to take a fair line and would in fact have to be forced out of a fair line. The accuracy of the keel line is equally controlled by the method. The two panels are joined, while shaping, with a steel longitudinal. This steel section (removed after shaping) takes an even bend along the keel line and holds the center line straight. That leaves only the radius chine area. A longitudinal batten is used to ensure a fair line through the middle of the chine area. A mile or two of strip and all that is entailing in cutting, fitting, gluing and fairing, is replaced by a few dart cuts into the two panels and the pulling of a few strings. KSS will stand any comparison on this count.

Large Radius Curves

The front of the bridge-deck needs a nicely curved panel as does cambered decks and saloon tops. These areas of these panels are first produced without one skin. The panel is bent to the curve, either in place or over temporary frame and the second skin added. This unique feature of sandwich construction can be used in many other places, including the interior, for curved bulkheads or furniture units.

Panel Edge Treatment, Rebates, Capping of Cutouts, Window Recesses, Deck Edge Radius, Fendering Recess, Deck Hatches, Solid Pads for Bolts

Are just some of the additions that can be added to the panels while being produced on the table. Each job will take a fraction of the time on the table compared to doing later on the boat.

The Table

The table is the basis of all KSS build. Most Kits are produced by the boat builder himself. The basic table costs no more with melamine covered chipboard or MDF surface than the same size of bench. However, the cost of the table becomes insignificant in comparison to the cost of attaining a smooth finish to the whole of the shell of a catamaran in the usual way. That table will have eliminated a vast amount of onerous finishing work, but it will have done a lot more as well. Joining Duflex panels needs a full sized table.

Materials

Note that all parts of the KSS structure are of foam and glass or one of the more exotic fibers. We can find no justification for choosing one type of structure for one part of the boat and another for another part. Glass and foam does the job better for every part. Timber looks great for trimming or veneer lining but has no place buried within a marine structure where efficiency, durability etc. are the requirement.

The KSS Claims

As designers (and the pioneers of foam sandwich) Kelsall Catamarans is committed to ongoing development and making custom building more efficient. We have made the effort, put the ideas into practice and discovered the best ways to achieve this. We hold pretty well all the records that could be applied to foam sandwich construction and we have no hesitation in claiming the most efficient, the simplest and the best kit system in Kelsall Swiftbuild Sandwich. That is not a claim that is made lightly either. We could quote hours and compare with hours provided by others. That comparison could never be of true like with like and hence could be very misleading. We invite comparison, task by task. Study what is involved at each stage, with each kit system and we believe the message will be very clear. We have demonstrated KSS to literally hundreds, in hands on situations, without one single person ever questioning our claims. Hulls are produced in a quarter of the time or less. Full structure in half the time or less. And with no compromises.

Summary of KSS Gains over Duflex

- 1 More efficient structure and less weight due to
 - Much less join material and build up at joins.
 - Tapered strength and fiber orientation.
 - Resin infusion of almost all of the laminate.
 - A lot less hand laminating on the boat surfaces.
 - A lot less filler fairing material needed.
 - Capping of openings, recesses etc. on panel.

- 2 Time saved at every stage of producing the structure due to
 - A lot less and much simpler framing.
 - Less set up time.
 - Fair lines due to full size panels and technique.
 - Large radius curves starting with single skin.
 - The many additions to the panels, which are produced as each panel is made.
 - The mould table finish.
 - Gel coat as and where needed.
 - The rebates which avoids build up and the extra filling and finishing needed to hide the join.
 - Less laminating on the boat.

- 3 Other KSS gains over Duflex
 - Less of the flat panel look.
 - Less dependent on the skill of the builder.
 - A lot less wastage.

Savings with KSS Kits

We list the important advantages above. Picking up the finish is the big one. The main incentive when we started down the Kit road was the labour bill for long-boarding in our custom build workshop. That smooth finish cost an hour's work for each 2 square feet of surface. KSS can save 1,000 hours or more on most 40 - 50 foot cat projects on this item alone. The second big saving is no strips and all that it entails.

KSS Kit Obstacles

Transporting - full size has to be moved by special vehicle. Cutting long KSS panels into preplanned shorter lengths, to fit into a 40 foot container, and rejoining, is a relatively simple matter. 20m panels have been transported within the country. The cost – more than Duflex, but also more cost effective. However, rectangular panels, as long as you want them, to same specification as Duflex, will cost less than Duflex.

The Duflex literature claims five features as unique to Duflex. Each item on the list is made better, or irrelevant by KSS. The weight given for the biax glass they use and hand laminated csm is not a relevant comparison. In nearly 40 years of designing foam sandwich laminates, I have included a tiny amount of csm in sandwich skins in less than a handful of boats. Where csm is used it is not for structural purposes. A 12m x 2.5m KSS panel can be laid out, with full scantlings and gel coat finish in 12 hours and infused in an hour.