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WHAT IS THE DIFFERENCE BETWEEN OUR BUILDING METHODS AND OTHERS?

Everybody understands the difference between fiberglass and plywood or between traditional wooden boat building and stitch and glue but what makes our material unique is not always well understood. Let's look at three different materials and construction methods:

- Plywood on frame
- Stitch and glue
- Plywood cored composite

PLYWOOD ON FRAME is a boat building method that appeared before WWII: a boat made from plywood panels fastened and glued to a wooden frame. The frame is made of solid or laminated wood. That framing is the skeleton of the boat and supports most of the loads. It is made of many parts that must be beveled and fit precisely together. Those parts are assembled with a combination of mechanical fasteners (screws or boat nails) and glue. The framing is then covered with plywood panels. Long panels are made from scarfed plywood. In some cases, the finished hulls are covered with fiberglass for resistance to abrasion and to seal all the small gaps. A structure made from a large number of parts will not last as long as a one-piece composite hull. Plywood on frame requires good woodworking skills. We do not design for plywood on frame.

STITCH AND GLUE appeared in the 1950's. The consensus is that the first stitch and glue boat was the Dinghy Mirror. The boat was made from plywood panels assembled with fiberglass tape and polyester resin. Over the years, cheap but unreliable polyester was replaced with epoxy resin. Epoxy is all together a glue and a laminating resin. The epoxy bond is stronger than the plywood itself. A stitch and glue hull should be a one-piece structure (monocoque) but many designers lack trust in the material or the knowledge to design a fiberglass structure. Often, the fiberglass tape is used only as a seam between panels, but wood is still used for structural parts like keels, chines and bow stems. Those boats are hybrids between stitch and glue and plywood on frame. A few designers produce plans for stitch and glue boats engineered like fiberglass boats. The hulls are made of plywood panels welded together with fiberglass and resin. No solid wood is used. Just as in a production fiberglass boat, the framing is made of fiberglass beams. With decks and soles integral to the hull, this produces a true monocoque structure stronger than their fiberglass counterparts. Not only is stitch and glue light, stiff, and strong, but it is builder friendly. No exact fit between parts is required, epoxy is gap filling. Gaps between parts are recommended in all text books about composites. This is the opposite of wooden boat building but works in favor of the amateur builder. Stitch and glue is ideal for small boats less than 15'. Some designers produce plans for stitch and glue boats up to 45'. They use thick hull panels laminated from several layers of plywood. We prefer to use more fiberglass as in our plywood cored composite boats.

PLYWOOD CORED COMPOSITE can be considered advanced stitch and glue. The building material may look similar to first generation stitch and glue, and while the framing is identical, the hull skin is different. In plywood cored composites, the panels are a true composite sandwich. Just as in high tech boat building, the panels are made of a core between two skins of fiberglass. Those fiberglass skins can be quite thick. Our composite uses plywood as a core instead of foam or honey comb. It has many advantages for the amateur or custom boat builder. The hull is assembled just like a stitch and glue hull. There is no need for a male jig: thanks to the stiffness of the plywood core, one can often use the frames and bulkheads as a jig. In some cases, the builder can use a basket mold. The thinner plywood panels are easy to bend, and the final product is truly a fiberglass boat without the risk of blisters associated with polyester. The materials are easy to find and familiar to the amateur, but the final product is a high-tech boat usually lighter but much stronger than a production fiberglass boat of the same size. Plywood cored composite is ideal for boats between 15' and 30'. From plywood cored composite to foam sandwich, the transition is easy. The building sequence is similar and only the core material changes. Foam sandwich requires a different type of mold and much thicker fiberglass skins than plywood cored composite. Around 28' , at equal strength, a foam sandwich boat begins to be lighter, but it costs more in labor and material, approximately two times over.

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HOW DO I MAKE LONG PLYWOOD PANELS?

We use standard sized plywood sheets only. This means 4' by 8' (122 by 244 cm). Long panels are made by assembling short pieces with butt blocks or fiberglass splices.

WHAT IS THE PRECISION REQUIRED WHEN CUTTING PANELS?

Not much. There are two factors to consider. 1. Epoxy does not require tight fits, quite the opposite. Some gap between parts is required for the epoxy glue to work. 2. We want to avoid hard spots between panels. The strength comes from the fiberglass and a gap is preferred. For those reasons, 1/4" precision (5 mm) is more than sufficient. Our plans are very precise, but the dimensions use a 1/8" (3 mm) tolerance. Do not try to be more precise, instead focus on fairness and symmetry when scribing and cutting parts.

WHICH TYPE OF SKILLS ARE REQUIRED? WOODWORKING?

90% of our plans are for "stitch and glue", the easiest boat building method that ever existed. No woodworking skills or special tools are required: see the pictures in our tutorials. You must use fiberglass and resin, something you can learn in one hour with our trial kit. There is never any lofting with our plans: we did the lofting for you. All dimensions are given for parts such as side panels and frames: you can cut them flat on the floor. No need to make patterns from a jig! For all small boats, we also supply paper patterns. Builders of larger boats prefer to scribe the outline of the panels from the dimensions: it is more accurate. We always show details like the ideal nesting of the plywood parts on standard plywood panels. All plans are sold with building notes. Altogether, our plans are very detailed and easy to build from.

WHAT IS STITCH AND GLUE?

Please read our How To files and look for the Stitch and Glue 101. Our building method and materials are very different from wooden boat building. The strength of our structures relies on the fiberglass and resin, not on wood assemblies. Our keels, chines, bows, frames, etc. are all made of fiberglass, not wood. Gaps between wood parts are preferred to a tight fit. See our tutorials: building strong and clean fiberglass laminations is easy. Our hull shapes are defined by the hull panels, not the framing or the jig as in wooden boats. This means that there is no lofting and that jigs are often not required. All panel dimensions are precisely calculated for you. Plans and assembly methods are conceived with two top priorities: ease of building and strength. We do not use scarfs, there are no bevels, no need for special tools. Read our How-To files, check the pictures. Visit our builders web sites, many describe the building of their boat step by step.

WHAT IS AN EPOXY FILLET?

An epoxy fillet is a rounded bead of epoxy putty between two plywood parts. The putty is epoxy thickened with silica, microballoons or woodflour. The fillet does two important things. First, it is a structural joint between two parts. Second, the fillet creates a rounded corner so that the fiberglass layer over the top of the fillet makes a smooth corner bend with no air bubbles. The radius of the fillet is equal to or larger than the maximum bending radius of the glass that will cover the fillet, in general. When done correctly, the two panels, the fillet, and the fiberglass tape become one solid fused component that structurally reinforces the boat. Those taped seams are the true chines, keels, and framing of our boats just as in production fiberglass hulls. Those taped seams can be very thick: close to 1" in some cases. Our builders use many techniques to create clean fillets: squirting the fillet material out of a plastic bag like a pastry piping bag, shaping the fillet with tongue depressors, PVC pipes, small plastic spoons etc. See their web sites for pictures.

WHAT IS A FIBERGLASS SEAM?

A fiberglass seam is fiberglass tape joining two parts of the boat. Structural seams are made of biaxial tape, sometimes many layers with offset edges. Thick fiberglass seams become structural stiffeners like chines or keels. Less important seams can be made from plain woven tape.

BUTT BLOCKS OR FIBERGLASS SPLICES?

See our HowTo section for pictures of butt blocks and splices. For small boats we usually specify butt blocks. A butt block is very simple: a piece of plywood epoxy glued on top of the two pieces to join. Very often we use that extra thickness in a strategic place as a reinforcement. Often, we hide it between frames or under seats. Another method used on larger boats is a fiberglass splice, same principle but with fiberglass. It is important to use biaxial as we specify because of the fiber orientation. In all cases, the seams between plywood panels are also joined. For larger boats, they are covered by several layers of glass in and out. The resulting joint is always much stronger than the plywood: try to break one of our butt blocks or splices and it is the plywood that will fail, not the joint. Visit our builder's web sites for pictures of the two methods.

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HOW MUCH FIBERGLASS DO I NEED TO COVER THE BOTTOM?

Almost all our bottom panels are made of plywood with glass on each side, a fiberglass sandwich. You may ask the question because most other designers announce the bottom fiberglass as an option but that is because they design plywood boats. Ours are composite boats and the fiberglass is already there. For the small boats It is not necessary to fiberglass the bottom for strength or resistance to water: all parts are completely coated in epoxy. You may want to fiberglass for resistance to abrasion if you drag the boat on beaches or expect to run aground. First check your plans: the fiberglass for the bottom may be on the plans. If not, it is very easy to estimate: look at the plans, nesting drawing. You will see the bottom panels on standard 4x8 plywood sheets. That is the area you need. Another method is to take the length of a small boat with a safety margin. 50" wide fabric, 6 to 10 oz. woven is perfect and can be bought by the yard from our online store: BoatBuilderCentral.com

HOW TO MAKE PUTTY? GLUE?

Glue and putty recipes are available in our Epoxy Book. Glue and putty are made of epoxy resin mixed with fillers. For glue we use woodflour; for putty, a mix of microballoons and silica. Viscosity varies from ketchup style for glue to peanut butter for putty. It varies with the amount of fillers used. Also see our HowTo files.

WHAT ARE THE STEPS TAKEN TO FINISH THE HULL SURFACE?

The experienced builder will reduce the need for fairing and sanding with clean fiberglass laminations and the use of plastic sheets or peel ply on the last layer. In a nutshell: 1. Fair hull shape 2. Prepare surface 3. Paint or varnish - Reduce the need for sanding with a sheet of plastic or peel ply on the last fiberglass layer - Use a resin slurry to fill imperfections if any - Switch as soon as possible to a high build primer. Those thick paint primers sometimes named sanding primers are easy to sand. Build a small boat first: it is easier to make mistakes and fair a canoe than a 22' boat.

WHY DO YOU RECOMMEND GAPS BETWEEN PARTS?

Since the strength of the joint between parts comes from the fiberglass seam, there is no reason to have a tight fit. There are however very good reasons to have gaps between panels and other parts of the boat: - we want to avoid hard spots. A hard spot is a place where one part pushes hard against another. Loads will concentrate in those hard spots and that may result in failure. We want to spread the efforts on the hull and this is done by distributing the loads over the full length of a seam through the fiberglass tape or fabric. This is not a weird requirement for our plans but an important factor in composite boat building. It is mentioned in all text books about fiberglass boat building. - another reason for avoiding hard spots is to avoid distortion in the panels and "kinky" curves in the panels instead of smooth/fair lines. We recommend gaps of up to 3/8" between panels and between the hull skin and its internal framing: bulkheads, stringers etc.