Version 1.0


## Workshop and Tools

### Workshop

Yes, you can build the ARTEMIS sailing canoe in the garage, with good lighting, and assuming a power supply. To have room to work it needs about a clear meter of space around the hull. When you store epoxy and tools on a shelf, then they are always at hand and cleaned up quickly.

### Table with Vice or Workmate

Working with small parts is much easier if they can be clamped. A table with a fixed bolted vice or a workmate are ideal.

The smallest possible solution would be a mini vice, one which clamps to a table.

### Flat Spline

The most important tools for the boat builders are his eyes. If one looks carefully along a line, you can see if it varies, if there is an even curve. You can place a flat spline as a visual aid. The areas on which it rests unevenly, still need work.
My flat spline is free of knots and as straight as possible lath from the hardware store. It measures 5 x 9 mm and is 240 cm long.

### Two Sawhorses

### Workwear

In the summer I wear overalls without sleeves, in winter overalls with long sleeves. Epoxy stains can only be removed with the stain scissor, therefore after building, work clothes are only good for the garbage.

### Kneepads

If you do not have a long table, you can wire the boat together on the floor. For such floor gymnastics I find kneepads very practical. They are available where ever they sell roller skates.

### Hand Plane

The Stanley Low Angle Plane No. 60 ½ is the workhorse of the small boat builders.

It is much more useful than a large plane - a sports coupe is also faster on the road

than a truck. Planing is faster than sanding, and working with the plane is healthier because there is very little dust.

The plane blade is best sharpened on a fine abrasive paper sheets on a glass plate. I always use a few drops of oil when sharpening. Only a few strokes on an abrasive paper of 1200 grade, then use 2000 grade.

## Knife and Ruler

You cut fibreglass with the knife, and sometimes it is coated with epoxy. Therefore I have a knife with disposable blades that you can replace as needed. Use an aluminium ruler from the hardware store.

## Scissors

For cutting glass tissue. Often epoxy will stick to them. Therefore, they will at the end of the project be only good for the garbage.

## Drawing Materials

Very important: a ball of string, a ruler and a pen.

A scriber's square is not absolutely necessary. I find it quite handy for drawing shorter straight lines The bevel is not really necessary – stencils from cardboard can do it just as well.

## Mitre Saw

I have worked for many years with a conventional European saw. Until I found these Japanese saws. since then there

was no going back. It is razor sharp and works on pull strokes; not on push strokes. This is the reason why directing it is very relaxed and without pressure.
You can not re-sharpen these blades, but replace them.

### Hacksaw

A hacksaw with a metal blade, to cut the bolts to size.

### Rasp / File

A small rasp, on one side half round, and on the other side flat, is really essential.

If you do not have a half-round file, you can also make do with a wooden stick with coarse sandpaper glued around it. It's best to use spray glue for that.

### Sanding Block with Sandpaper, Random Orbit Sander

Sanding boards are very useful if you want to sand large curved surfaces (such as a boat hull for example). The top one is from the vehicle accessory trade, on the bottom is a DIY one with a thin sheet of plywood with broomstick handles. The thin plywood is cut across the grain so that it better fits the curves. The half sheet 40-grit paper is glued with spray adhesive.

In every case you need sheets of sandpaper; 40s or 60s-grade, 80-grade and 120 grade or 150 grade.

A sander with a dozen discs, some 60 grade and a few discs of 120 grade, will save about 3-4 hours of work when sanding the hull. If you work clean, it is not absolutely necessary.


If you sand in closed rooms, a dust mask is a good idea.

## Drill / Cordless Drill

An electric drill with sharp HSS drills, 2mm, 4mm, 6mm and 7 mm. It would be helpful if you have a countersink bit (if not, a 10 mm drill will do). A cordless drill is very useful and is lighter. The cordless drill definitely should have adjustable speed / torque settings and powerful batteries.


## Clamps, optional Spring Clamps

At least about 10 clamps with approx. 10 - 20 cm depth of reach. Every time when they are in the bargain bin of my hardware store, I buy more, yet there are never enough.

The spring clamps are optional. Unfortunately, epoxy coated parts are not held tight enough with the spring clamps to prevent slipping as parts cure. Therefore, you should use them together with clamps. Or secure the epoxied parts in addition with staples or nails to prevent slipping.

Instead of the spring clamps you can use 2 meters of grey plastic drain pipe with 40 mm outer diameter, slit lengthwise and cut into finger-long hoops. These are the poor man's clamps.

## Universal Pliers, String Cutter, Wire

The cutter is for cutting short lengths of wire to stitch the planks together, the plier are for twisting the wires together.

When working with wire, gloves are a good idea.

## Stapler

The plastic ones suck. The metal ones are better - the heavier the better. My stapler can handle 8 mm, 10 mm and 12 mm staples.

## Screwdriver

The kit includes Phillips and small wood screws.

For one or two occasions a small chisel would be a good idea. But you use that so infrequently that I think it's not worth buying one. I think you can also abuse a stable, not more than 4 mm wide screwdriver instead. This one is also very useful for staple removal.

## Small ratchet

The small ratchet with extension and 7 mm socket is the only onboard tool you need. It is used to loosen and tighten the leeboard clutch mechanism. During the build, you are happy to have it for tightening the U-bolts at bow and stern from the inside of the boat.

## Spatula

A small spatula and a wide putty knife made of metal ("Japanese spatula") or plastic squeegee. For filleting I use a few wooden spatula.
The small spatula is useful when bonding planks together. The wide Japanese spatula is used for pulling the epoxy along the tissue during coating. Both have rounded edges. They need to be looked after, because they are precision tools: the blade is cleaned regularly, and then sand just the filler edge.

## Epoxy and Supplies

It is important to mix epoxy resin and hardener in exact proportions with each other, otherwise the epoxy is not as hard and waterproof as it should be, or might not set at all. For ensuring accuracy of mix, you can use a little old scale, or a cheap digital scales from the Internet - eg ebay.

I use an old letter scale with a display accuracy of 5 grams.

There are also epoxy pumps that can be put on the top of resin and hardener bottles. They work – until they clog up. Remember that volume specifications are not the same as weight specifications.

Electronic kitchen scales are very suitable. They weigh to the gram exactly.

The mixing ratio of resin and hardener is stated on the pack - there are different types of epoxy with different mixing ratios. For example, my preferred epoxy mixture has a mixing ratio of:

*40 g by weight of hardener and 100 g of resin.*

Then:

*40 g hardener + 100 g resin = 140 g resin mixture*

Or:

*20 g 50 g resin hardener + = 70 g resin mixture*

Or:

*10 g 25 g resin hardener + = 35 g resin mixture.*

I cannot weigh smaller quantities on my postal scale. I would need a household electronic scale, and I would protect the scale pan by taping some construction foil on it.
Of course, your epoxy can have a different mixing ratio.
I use cleaned yoghurt cups for mixing. They are light and have the optimal size for the job. My epoxy has a short pot life. Therefore, I often mix small quantities and use them within 10-15 minutes. Large amounts of epoxy overheat easily and are no longer usable. Should I need larger quantities (for coating an entire hull), then I mix them in a cleaned wide shallow flat tin.
Hardener and resin must be mixed carefully! The mixing time is at least one minute. I take a wooden spatula and stir vigorously, even in the corners. Then I let the resin stand a few minutes so that the stirred in air bubbles can escape.
My favourite way to apply the epoxy is with cheap flat brushes - and trim the bristles with scissors so that they cannot hold as much epoxy. Used brushes are cleaned with brush cleaner, as long as the epoxy is still liquid. Then I rub a little dishwashing liquid in the bristles, then rinse with warm water and let the brush dry on a radiator.
For covering larger areas such as the hull I use small 2” (or possibly 4”) short hair rollers made for gloss painting. When applying the final epoxy coat on the hull or glassed areas of the hull, I roller the epoxy on and then hold a gloved finger on the roller and very lightly drag the roller along the surface to give a smoother final coat which needs less sanding after it has cured. I You may also find using a small brush to smooth the roller pattern is very

fast and efficient. These roller will be discarded after use.
To mask, I use transparent packing tape, because epoxy will not stick to it. I work with latex - or nitrile gloves and wash off the epoxy residue with a damp cloth with some vinegar – better for the skin than organic solvent.