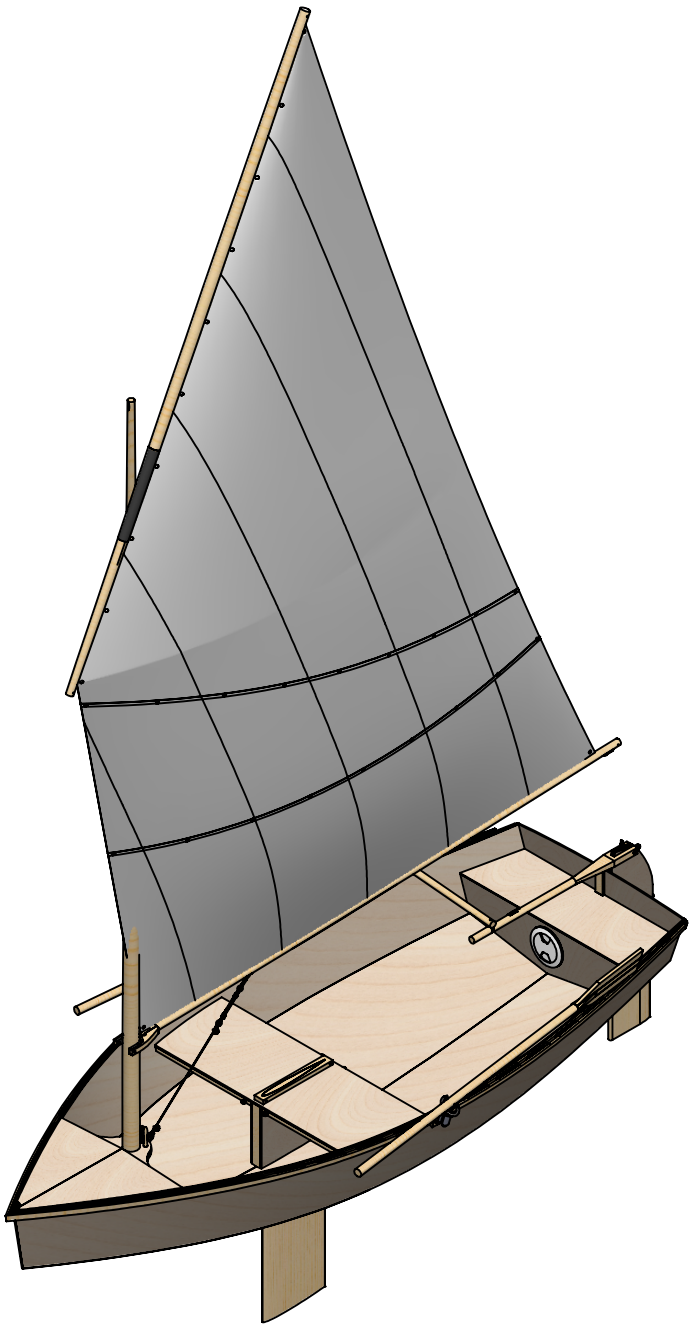
The Melatelia

The Melatelia is a lightweight 2 person day-sail dinghy, designed for very light, yet gusty winds. Weighting only 45kg fully rigged (hull weights 30kg), it can be car-topped by a single person, and does not exceed the legal 35kg roof rack limit found in specifications of most family cars.
What distinguishes this boat is it's light hull with low prismatic coefficient, and a very large sail area. This is, by no means, a racing boat (hull is optimized for 3 knots), and even though it's stability with both reefs allows survival in 26 knot gusts, it is generally not recommended to sail in violent weather conditions, as hull rigidity has been somewhat sacrificed in favor of low hull weight.
Two buoyancy tanks below aft seat and in bow compartment allow for easier recovery in case of capsize, and can be used for dry storage.
A tiller is designed to be lashed for hands-free sailing in safe and predictable conditions.
Melatelia can be also sailed single handed, as well as rowed.

The boat got it's name from Baltic goddess Melatelia (lit. "Mėletėlė") of dyes and colors. Legends tell that she was blue, as this boat is also meant to be.



LOA: 3.3m
Beam: 1.28m
Design displacement: 210kg
Draft: 0.16m (0.77m with daggerboard down)
Hull weight: ~30kg
Sailing weight: ~45kg
Maximum load: ~165kg

Estimated build cost: 470€ (510$)

Specifications

Hull:
Prismatic coefficient: .52
Wetted surface area: 2.73m^2
Longitudinal center of buoyancy: 1.6m from transom
Maximum heel angle before flooding: 25°
Freeboard: 0.26m
Bow buoyancy tank volume: 58l
Stern buoyancy tank volume: 47l

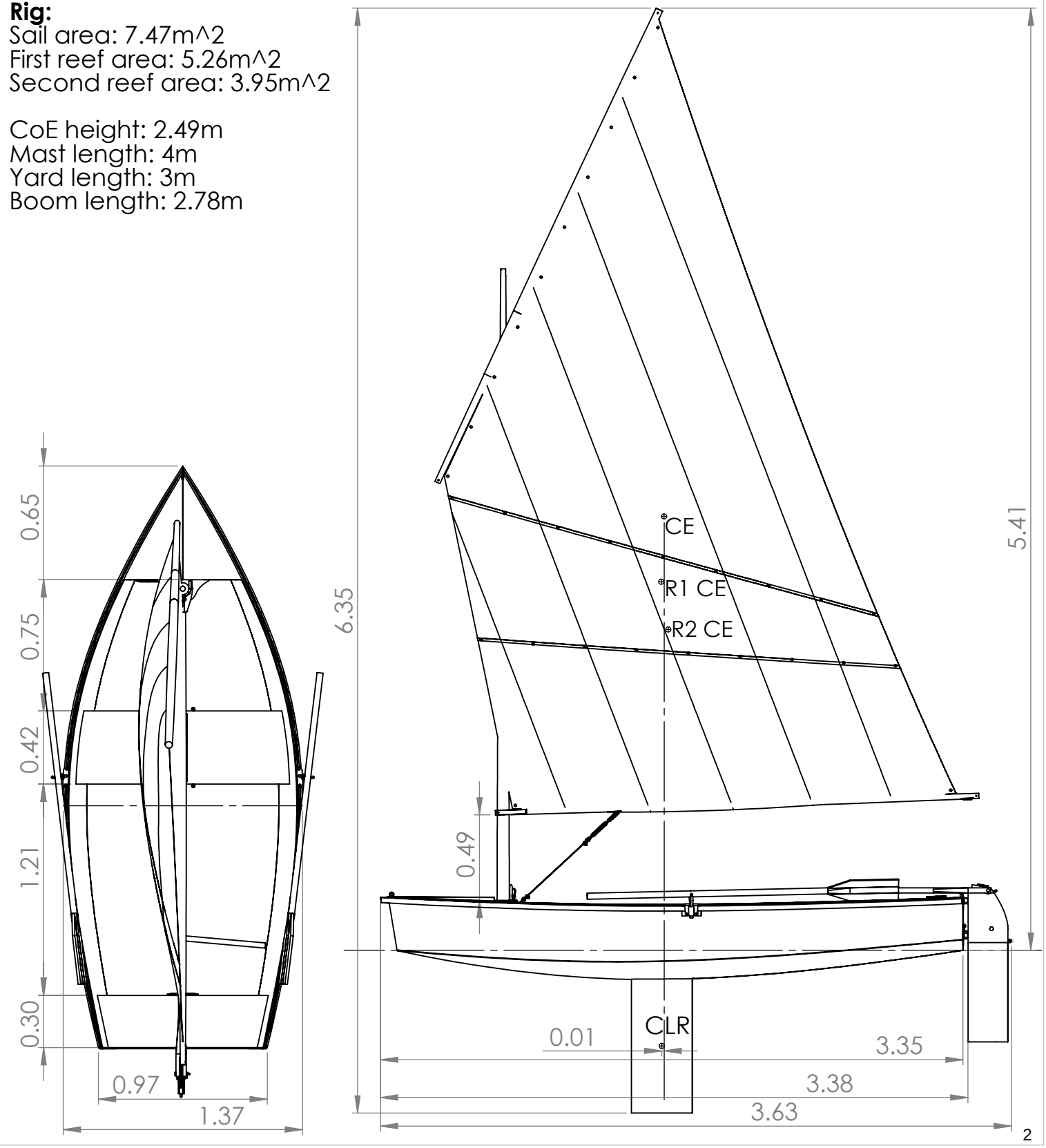
Boards:
Daggerboard area: 0.27m^2 (3.61% of sail area)
NACA 0008 profile

Rudder area: 0.12m^2 (0.44% of sail area)

Balance:
Maximum heel angle before swamping: 25°

Rig:
Sail area: 7.47m^2
First reef area: 5.26m^2
Second reef area: 3.95m^2

CoE height: 2.49m
Mast length: 4m
Yard length: 3m
Boom length: 2.78m



Righting moments:

At 0° heel:

Solo: 255 Nm

2 crew members: 411Nm

At maximum heel:

Solo: 435Nm

2 crew members: 703Nm

Windspeeds at which heeling moment equals righting moment:

2 crew members, 0° heel:

Full sail: 6.30m/s

Reef 1: 8.10m/s

Reef 2: 10.10m/s

2 crew members, maximum heel:

Full sail: 8.30m/s

Reef 1: 10.70m/s

Reef 2: 13.20m/s

Windspeeds at which heeling moment equals righting moment:

Solo, 0° heel:

Full sail: 5m/s

Reef 1: 6.40m/s

Reef 2: 8m/s

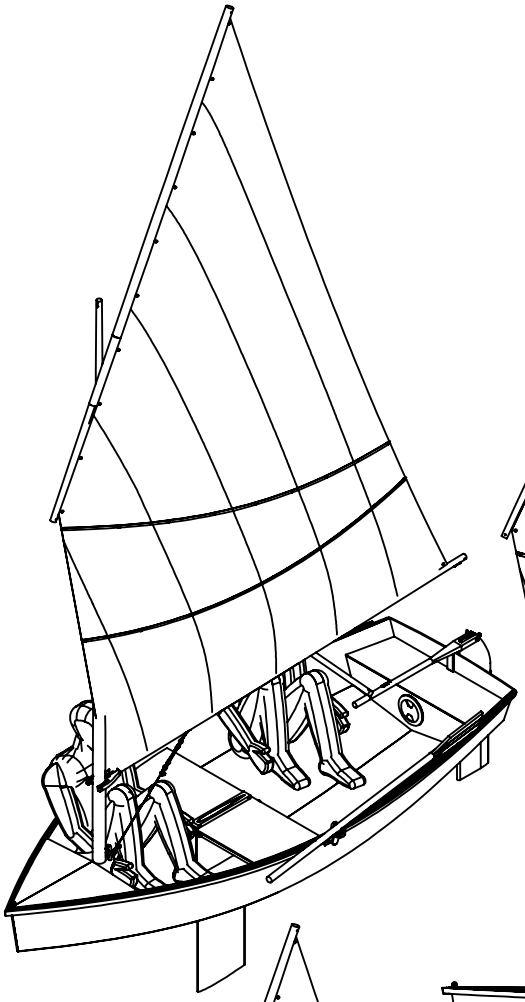
Solo, maximum heel:

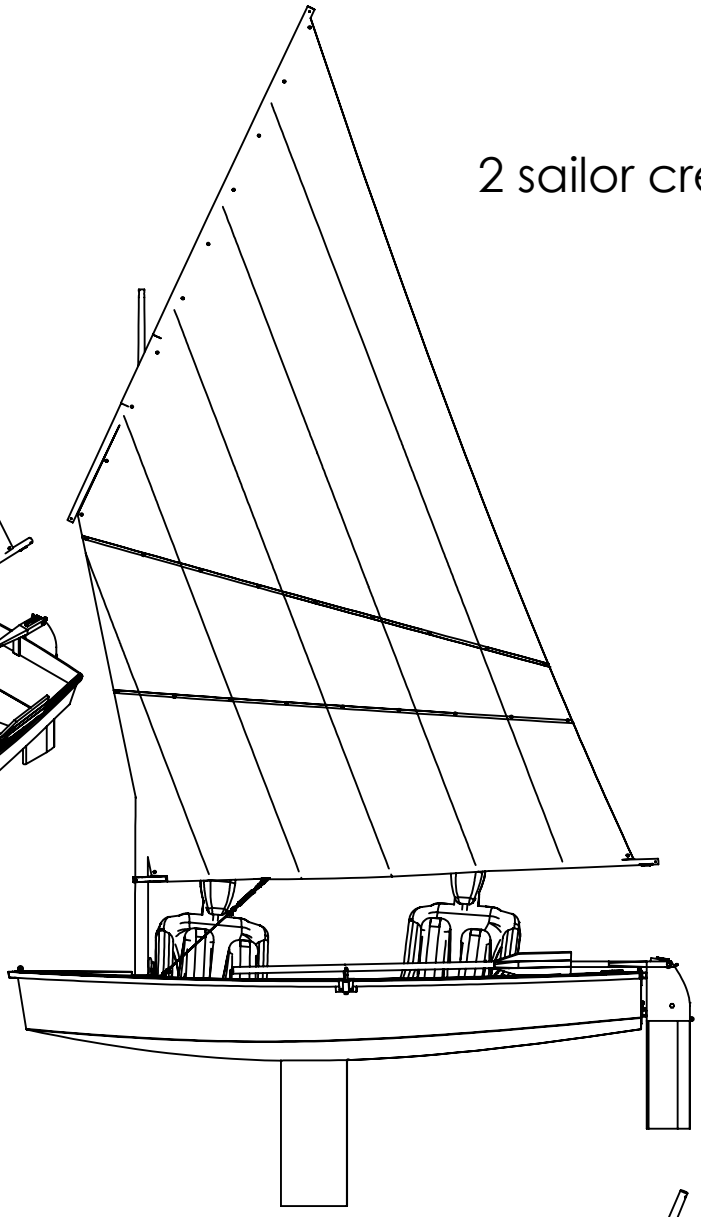
Full sail: 6.50m/s

Reef 1: 8.40m/s

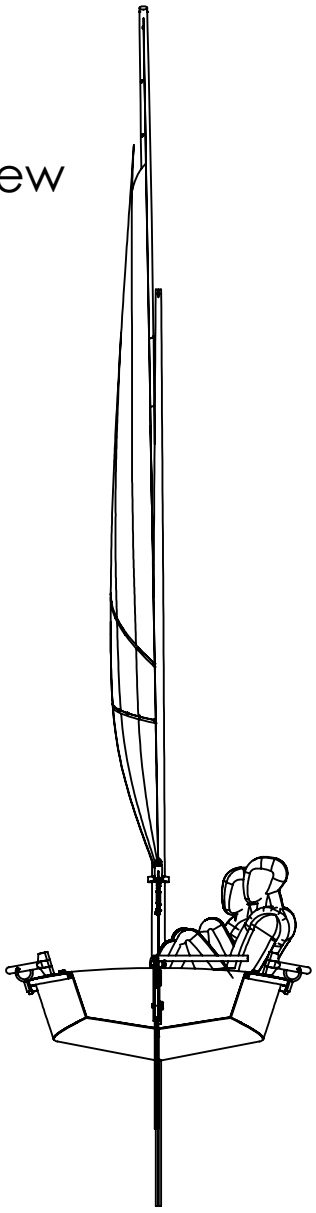
Reef 2: 10.40m/s

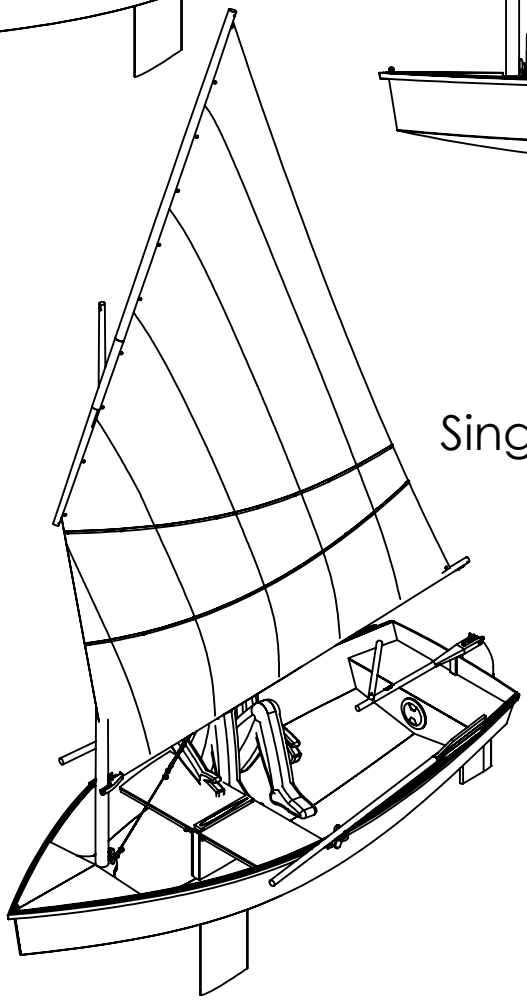
Crew positions



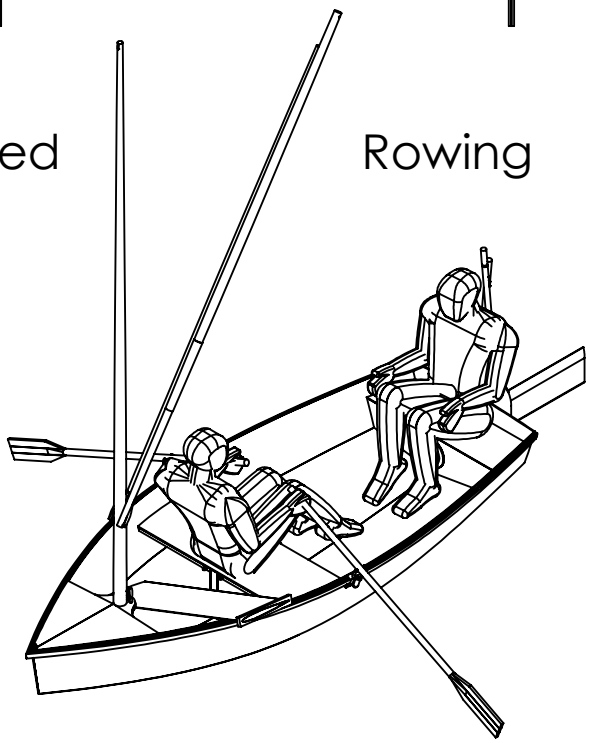


2 sailor crew





Single handed



Rowing

Materials used in construction

Original design calls for 2 sheets of 4mm birch plywood, which is used for hull panels, deck, aft cross section and aft seat. Another 6.5mm birch plywood sheet is used for transom, thwart, bow cross-section, daggerboard case, rudder, mast step and partner pieces. Pine or spruce timber is used for various structural beams, as well as gunwales, spars, tiller and oars. Rudder and daggerboard blades are also made from said timber. Epoxy is used as the main adhesive with some fiberglass tape and fillers (wood flour), while joinery is made using wood screws (nails are not required). Weatherproof paint is used to protect most parts, while varnish is reserved for spars and tiller. Sails are made from Tyvek, sticked with reinforced sticky tape and sewn with typical twine. A small amount of synthetic leather is required to protect some parts from chafe. No specialized hardware is required, as most of these parts can be bought at typical hardware store. Several boat-specific pieces, such as cleats and oarlocks are prefered, but can be substituted with home-made analogues.

Required tools

This project can be completed with a minimum amount of expensive tools. Jigsaw and drill is a must, however, no table saw or router is required, while a power sander and sewing machine is recommended. Hand tools include wood and metal saw, plane, sandpaper, set of clamps, pliers, hammer, screwdrivers, set of rasps, some brushes and metal containers for mixing epoxy, sewing set.

Other notes

Unless specified otherwise in building plans, use flat head screws with set-depth pre-drilling. Although most of possible hardware interferences are accounted for, always check further steps to be sure.

Bill of materials

Plywood sheets:

4x1500x2500 x2
6.5x1250x2500 x1

Timber:

Rudder fitting backing piece:	4x1x33	
Mast step timber:	9x10x2.5	
Thwart beams:	1x2x60	x8
Gunwale spacers:	3x2x312	
Mast partner lower support:	3x4x30	
Mast partner backing horizontal beam:	2x5x31	x2
Gunwale fore and aft spacers:	1x3x55	x4
Hull spreaders:	2x2x118	
	2x2x131	
	2x2x98	
Daggerboard case spacers:	2.5x4.7x31	x2
Rowlock supports:	3x3x11	
Transporting beams:	4x4x220	x2
Transporting beam anglers:	1.5x3x10	x4
Tiller:	3x6x140	
Rudder blade:	1.95x4x75	x6
Daggerboard blade:	4.5x2.9x120	x8
Mast:	7x7x400	
Boom:	4x4x270	
Yard:	5x5x300	
Boom jaws:	2.5x5x18	x2
Oars:	3.62x3.62x180	x2
Oar paddles:	1.5x4.2x41	x4

Hardware:

Flat head screws:
- 10mm x8
- 15mm x2
- 20mm x89
- 25mm x6
- 30mm x156
- 35mm x2
- 40mm x16
- 45mm x12
- 50mm x6
- 65mm x10

Round head screws:
- 6mm x12
- 8mm x3
- 15mm x20
- 25mm x6
- 30mm x8
- 35mm x5
- 50mm x4

Nails:
- 10mm x34

Eye-bolts:
- M6 x6

Bolts:
- M6x40 x1
- M8x80 x1

Nuts:
- M6 x1
- M6 locking x1
- M8 winged x1
- M10 winged x1

Washers:
- M6 x1
- M10 x1

Pad-eyes:
- Diamond x1
- Triangle x1

(see Hull building pages for drawings)

Gate hinges:
- Male D13 x2
- Female D13 x2

Oar hardware:
 Rowlocks 17.4mm x2
 Oarlocks 17.4mm x2

Cleats:
 6cm x2
 11cm x2
 V-cleat x1
 (see Boom building pages for drawing)

Pulleys:
 Double, for 8mm rope x2
 Double, for 4mm rope x2

Carabineers x4

Other:
 L-shaped sheet metal corner 2x2x4mm x1
 D4 wire rope sheaves x2
 Cable tensioner (eye-eye) x1
 Cable clips (adjustable) x2
 Round plastic boat hatch 210,6mm x1
 Round plastic boat hatch 176mm x1
 Roll of wire for stitch&glue x1
 One sided utility sticky tape x1

Leather:
 15x100cm strip

Rope:

Running rigging
Halyard: 8m of 6mm, low stretch;
Downhaul: 2m of 4mm, ultra low stretch;
Mainsheet: 12m of 8mm, normal stretch;
Mainsheet traveler: 1.5m of 4mm, low stretch;
Outhaul: 0.7m of 4mm, low stretch;

Rudder uphaul: 1.5m of 4mm, any stretch;
Rudder downhaul: 0.5m of 4mm, elastic cord;
Tiller lashing: 1.5m of 4mm, elastic cord;

Standing rigging
Daggerboard pull-up line: 0.7m of 8mm, any stretch;
Boom downhaul: 0.7m of 4mm, wire;
Oar holders: 1m of 4mm, elastic cord x2;
Daggerboard lashing: 2.5m of 4mm, elastic cord;
Boom jaws lashing: 0.5m of 6mm, any stretch;
Yard lashing: 4.5m of 4mm, normal stretch;
Yard beads: 0.7m of 4mm, low stretch;
Tack lashing: 0.5m of 4mm, low stretch;
Clew lashing: 0.5m of 4mm, any stretch;
Tiller extension lashing: 0.5m of 4mm, elastic cord;

Sail materials:

Tyvek 10.5m^2 (7 meters of 1.5m roll)
2 spools of white thread
2 rolls of 5cm double sided reinforced sticky tape
4mm grommets x14
6mm grommets x8

Glue, paint, etc:

Epoxy resin:	5 liters
Thickener (wood flour):	?
Primer:	?
Paint:	?