Pipemania - Dugout Stem of the 21st century

Wanna sail your own DIY-built boat, not just along the coast?
You have no time, no money - so here's the solution: PIPEMANIA!

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Like the ancient Pacific islanders some 3-4000 years ago, facing palm-trees as their only supply source, I wondered which of our today's countless industrial products would provide a good floating body.

It's the simple tube, that comes closest to the irksome dugout stem:

A longish, narrow shape with optimum section, available in all Dimensions - and already hollowed. Nevertheless, the "dugout stem"

Dream abruptly stops at the ends, where the hollow "nothing" makes bows impossible, if the Japanese hadn't invented Origami - The art of folding.

PIPEMANIA's Principle:

Remembering, that when evolved a tube makes a rectangle, I fetched a sheet of paper and after some thinking cut two paralell curves. Rolled and taped together, I hoped to get two beautiful bows, but idespite all the wrinkling and folding, the ends turned out bend up and down as well.

Its compression on one side, which forces the opposite to bend downward. For the next step, my paper experience is used on a PVC tube, providing the same properties. While the submerged sections are transferred from the model, the heavily resisting bow's top requires a smarter solution: By sawing out small triangles from top to middle of the bow height, the compression disappears and now forms a nicely shaped bow (diagram 1).

What you read is more than a funny paper design, it's a serious way to develop a hull, especially when verified by a computer program afterward.

The TUBE PROA

10 m overall length / 0.60 m diameter at 3 kg/m² make an overall weight of just 60 kg! At 0.18 m draft the displacement is 700 kg.

Midsection loaded with 1000 kg, a tube of 4000 N/mm² just bends 3 cm. Using these numbers I quickly outlined a proa and checked the weights:

Main hull:	
length	10m
width	0.6 m
weight	75 kg
Ama:	
length	7 m
width	0.3 m
weight	30 kg
Akas (3):	
length	5m
diameter	0.15m (carbon energized)
weight	30kg
Mast:	
length	7 m
diameter	0.15 m (carbon energized)
weight	15 kg
Total: including fairing (for varnish add 10 kg)	
weight	160 kg

Assembled by tube fittings and completed with daggerboard, rig, sail and a simple, habitable "Tepukai"-style superstructure, the overall weight would probably rise to roughly 300 kg. Assuming the given displacement, 400 kg payload left – enough for 2 crew and a 2 weeks summer cruise. If not enough, 2 cm more draft provide a further 50kg load. Not considered here is the amas displacement, because she should fly as soon as possible. Nevertheless, she provides another 500 kg of buoyancy, when fully submerged.

Road transport, assembly and disassembly can be done by one person only: "Beach it, unlash and disassemble the boat into its parts, get'em each onto your trailer or to your shore stowing site."

Back to supply: A tube is not like any other tube. To ease deformation, its stiffness should not be too great. The most suitable tube just keeps its circular shape, can easily be processed by bending and later on foamed and fibered up to requirements. If industrial tubes are unavailable - make your own tube from roll-bent sheet plastic, inflated rubber-tubes or other glassable stuff.

It is a crucial idea, that PIPEMANIA should avoid excessive work and framework.

diagram 1

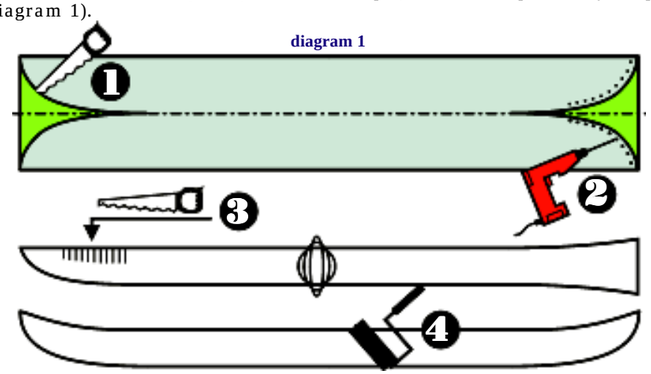
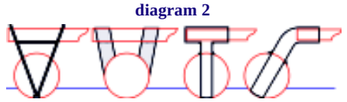


diagram 2



Joining hull-aka-ama could follow historical principles, with the amas resting in a t-style tube like the tree-fork, or personal preferences, using e.g. foam blocks glassed over, or plywood-struts glassed onto, or into the tube (diagram 2). Clamping force is gained through the trampoline or lashings.

The Rig

As PIPEMANIA is a sailer (diagram 3), let's roughly estimate the required sail area: A desirable 30 m²/t at 0.7 t displacement makes some 20 m² sail area. This may seems undercanvassed, but is okay for sailing in higher winds. On the other hand, her even-sided Lateen sail has its CoE just 3m above water, but gluttons can just opt for 10 m² more. To make it all work, the rig is kept flexible, raking fore'n aft as well as to windward and leeward. The windward mast can be telescoped and holds the mechanical setup, which allows for the following (diagram 4):

diagram 3

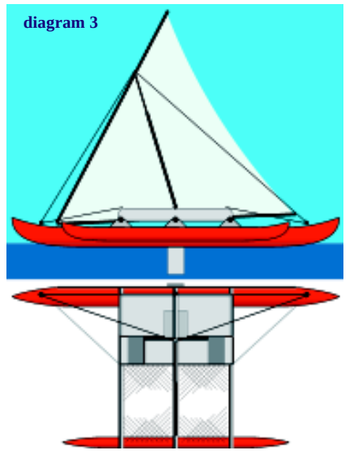
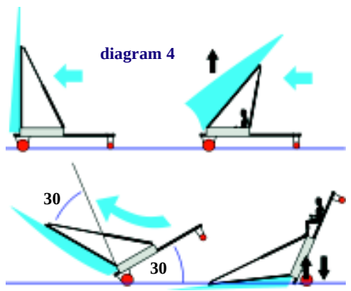


diagram 4



1. Standard setup: Mast vertical for moderate winds
2. Mast raked to windward increases lift in higher winds
3. Mast raked to leeward makes downdraft and lifts the ama
4. Further raking to leeward with watering provides buoyancy
5. to prevent capsize and easy righting.

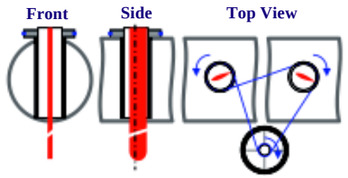
Assuming, that the proa alone can heel over to some 30 , an integrated rubber or spring dampener in the mast could allow for a further 30 leeward rake, analog to the wind pressure. With less than 10% windage, the behavior would be similarily forgiving to that on a monohull, which heels according to the windforce.

Of course other rigs are possible. Multi-mast rigs are possible, as no internal space is used by reinforcing structures and supports. In fact PIPEMANIA can serve as an economy experimental platform, from Bolger's via Gibbons to AeroRig's. On extremely light boats, the crew's weight becomes important, when hiking out or trapezing on the ama.

Steering

Steering on open waters can be done by shifting weight like the windsurfers around the midship centerboard, thus eliminating the need for dragging and sensitive rudderblades. Normally, a steering wheel with wire controls mast rake and sail CoE.

Maneuvering in narrow ports and driving in low winds is done by paddles, with a laid down rig. A more high-tech-oriented steering would be one rudder on each end, with the blades sliding through counter-rotating cylinders. This allows for reduction of draft or to fully take out the blades. Additionally, both rudders are wire controlled by one vertical wheel. With a separate control, the rudder trim would be very responding, with the bow rudder being used to reduce leeway.



The cruising proa

As history has shown, eliminating a habitable hull creates a completely different sailing experience. Those who need more space, simply have to enlarge the concept. Increasing the tubes diameter increases the rigidity, with a relatively small increase in wall thickness.

This means, the larger PIPEMANIA, the more favorable her weight ratio. From 12 m tube length on, she could have sitting height in her main hull, offering enough space for longer trips, from 15 m on up cruising the oceans should not be a problem. As for example in the Pacific - with the 21st century's dugout stem.

For more info visit the website: http://www.multihull.de