Bosch - IAESTE - InPulse design award 2009 | Molnárka | universal rescue boat

INTRODUCTION

About Molnárka

Molnárka is an engined boat capable for lifting its hull about 4 meters (~13 ft) above water, at any point on still water surface. The development of the concept was based on a university tender aiming to design a rescue base that can be optionally placed for sighting, so the rescue procedure can be immediately initiated from water, after notice of emergency.

Unfortunately, the concept failed due to the technical criteria of the university (such as the use of the products of given producers, planting on soil made compulsory, etc.), so we could not go on developing the idea within the scope of the subject. However, we wanted to develop the concept by all means, as according to our opinion, this construction brings better results.

Why time machine?

In case of water accidents, it is very important that the rescue procedure takes effect as fast as possible. The patrolling rescuer may ascend above water surface, so it is easier to notice the swimmer in trouble, and the rescue may begin immediately. The inner space of the hull lets the rescuer see the whole horizon, while the independent control of the two motors lets the boat move fast and dynamically. During the rescue procedure the boat descends to the water surface allowing the swimmer to clamber up (or the rescuer to pull out the swimmer). These factors lead to such timesaving that unambiguously improves the chances of a successful rescue and may decide on life or death.

Water accidents on Lake Balaton

There can be 350 thousand bathers on the 155 appointed bathing resorts of the lake at the same time which increases significantly the chances of accidents.

In the past 18 years the water police of Lake Balaton saved more than 4200 people's lives, on the other hand they were late at 348 cases.

The typical victim is a non-swimmer man, close to the shore (most of the times within 500 meters ~0.3 miles).

80-85% of the tragedies do not occur because of infringement.

In 2009, 40 storm-signals were directed and 337 people were rescued by the water police.

According to László Horváth, Lieutenant-Colonel of Siófok Water Policing Department:

'It is a fundamentally false approach that in case of trouble the water police, or the rescue team will come to me anyway, as only those, nearby one of the untis, can be rescued.'

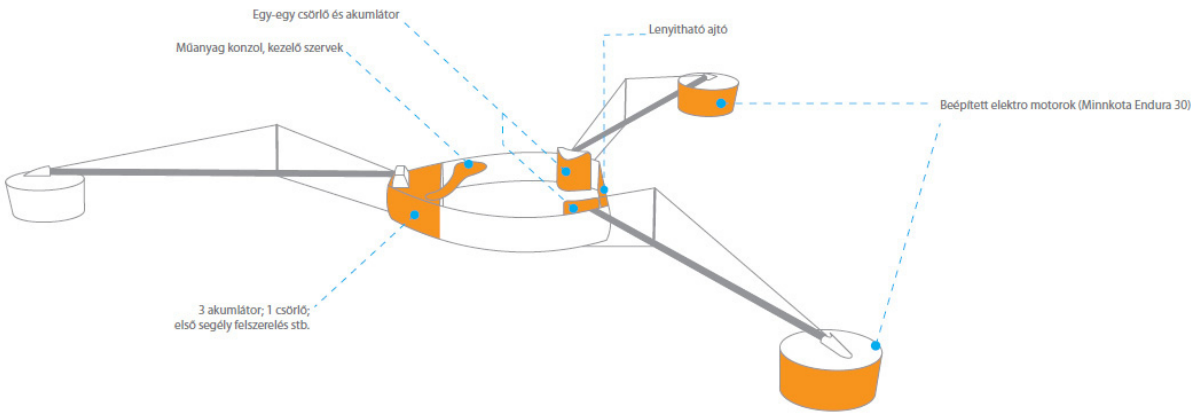
We want in no wise to encourage this irresponsible attitude, but if the accident occurs, the quick assistance of Molnárka increases the chances for a successful rescue.

DESCRIPTION

According to the main concept, the hull leans on three legs floating on water surface which can be pulled together or loosened by winches in order to adjust the height of the hull. The engines, found in the two front legs, can be controlled separately from each other, so the boat can move and turn easily and dynamically without complicated mechanical systems, as the classical Bowden-cable based control in this case is unaccomplishable, while another structure, for example an electric motor rotation engine or rudder would be unnecessarily costly.

A workday of the lifeboat

At rest time, Molnárka can be parked floating on water surface at a buoy, so it does not necessarily occupy berth for mooring. At bath time the lifeboat navigates to the spotting post and engages to observation position, that is ascending from water surface. If necessary, at rescue situation it detaches the splint and hastens to the location of the accident where the rescuer pulls out the person to the lowered hull.



We placed a folding door at the prow of the boat as the boat side wall's height is relatively high. We can do this as the boat uses buoyant force not by the hull's, but the stay-plate's displacement. Hence, an accidental big amount of water in the cabin does not cause trouble since it leaves through the small sink-holes located at the side of the boat, when the boat rises from water. (It is important to mention here, that the buoyant force of the stay-plates and the tensile force of the winches make the boat capable for lifting up much heavier items than the boat itself.)

To make the rescue procedure faster, the boat can start moving before it descends to the water surface, moreover, it is practical for the accident-free service to ply among swimmers at a half-ascended position. A 2x2 meters (6.5x6.5 ft) even surface is formed on the deck where 2 rescued people can be transported at recovery position or the resuscitation can be started. Rising to high position, even sunken bodies can be easily found, moreover it does not debase the survival/rescuing chances because of the fast ascending/descending time (9/6 seconds between end points).

Parts of high account and their descriptions

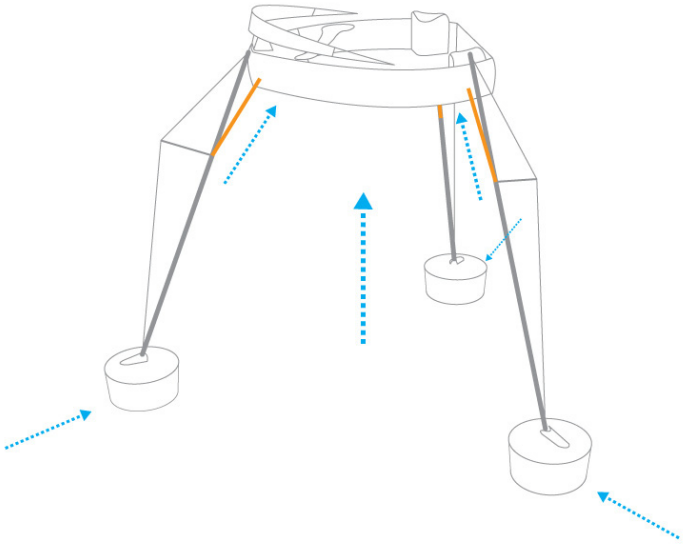
Technical details (in respect of designing) of the winches

Weight: 18 kg (~40 lb)
Tensile force: 20 kN (2 t~4400 lb) /rope: d6,4mm x 15m
engine: 1,2 kW
size: 360x180x160
minimum power supply: approx. 70 Ah
speed: 10 meters/minutes ~ 33 feet/minutes
approx. 200 euros/piece

The tower

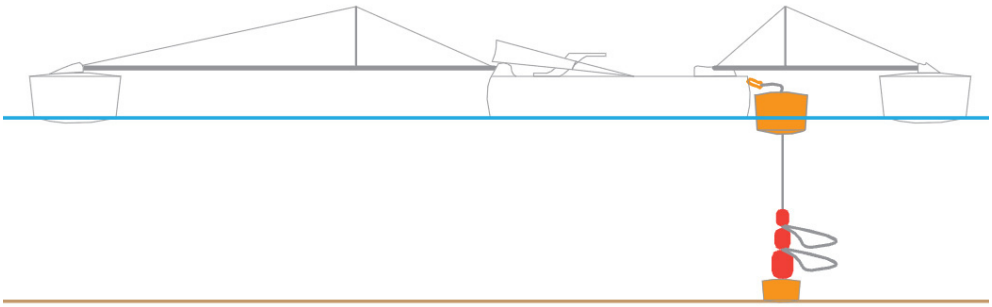
The most important feature of the boat is the ability to use it as an observation post. At this post the boat can rise up to 4 meters (~ 13 ft) from water surface with pulling together its legs. For this operation we used 3 winches, located at the upper hinges of the legs. They can exert 20 kN force so the hull of the boat is lifted up to the maximal 4 meters position in 8-9 seconds.

The winches are placed at points where the legs and the rope to be pulled in (hence the direction of the force) subtend the angle of highest degree, allowing the structure to work at highest efficiency. For this reason, the hinges at the roots of the legs were raised over the hull's edge, making some extra space between the hinges of the legs and the winches where the accumulators for the winches could be placed.

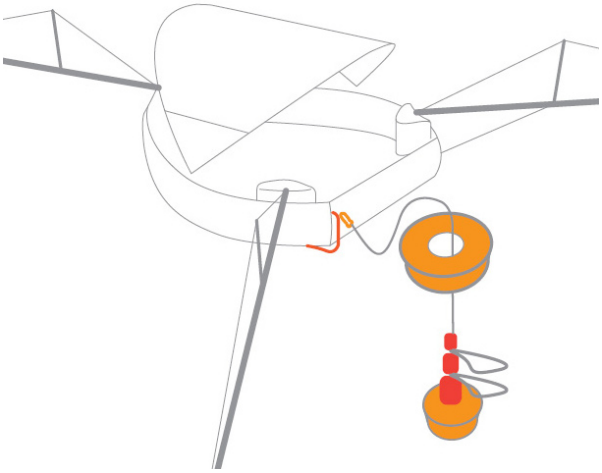


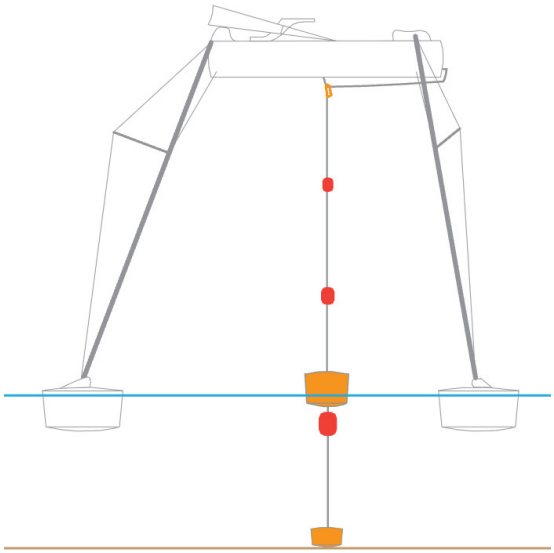
Fixation

In order to prevent the ascended boat from pitching at strong wind and/or waving, it is possible to fix the boat to an appointed buoy at rest and observing positions, so the designing of another object to serve this purpose is unnecessary. During fixation the boat approaches the buoy at descended position and attaches a rope, fixed to the buoy, to the boat with a simple anodized screw-lock carbine. This carbine is fixed to a bar, functioning as a groove, by the rescuer. This bar is easily reachable from the boat and the carbine,

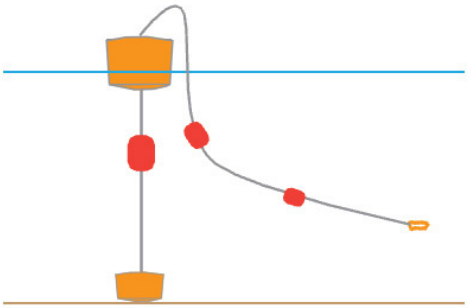


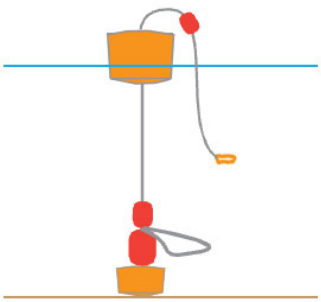
because of its own weight, slides down on it and fixes the boat approximately at the middle of the boat's bilge. The closing device placed here senses the engagement of the engines at rescue position and releases immediately. Hence, it cannot happen that the boat tries to set off at fixed position (which is a very important factor considering both the success of the rescue and the fast discharge of accumulators), and no time is wasted

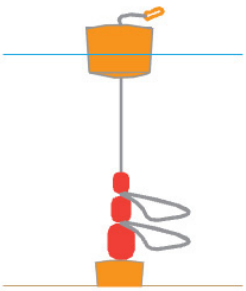




on detaching. After detaching, the rope, hanging on the buoy, is pulled under water by 3 sinkers preventing it from floating freely and allowing the carbine to be always at the same point, on the buoy.







Engines/navigation

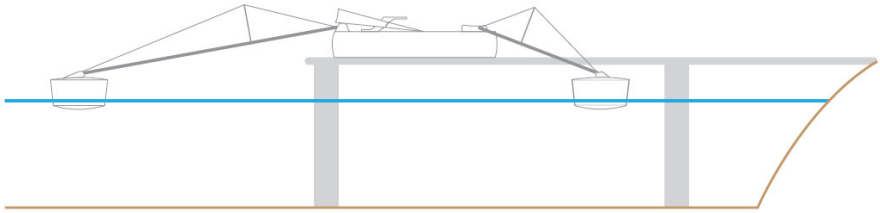
Technical details of the motors

voltage: 12 V
body length: 76 cm~30 in
thrust: 35 lbs
weight: 6,8 kg~15 lb
ideal boat weight limit: 780 kg~1720 lb
electric power: 96 – 360 Watt (depending on gear)
amperage: 8-30 (depending on gear)

There is an independently controlled motor and a screw in each roughly barrel shaped, air filled bodies which abut on water within the bottoms of the two front legs. The independent control allows Molnárka to move easily and fast without the need to build in difficult mechanical systems. In order to make the rescue as fast as possible, the boat can start moving before the hull is descended, since the motors are under water in ascended position as well. As the boat stands on three legs, the motors cannot rise above water surface even at strong waving.

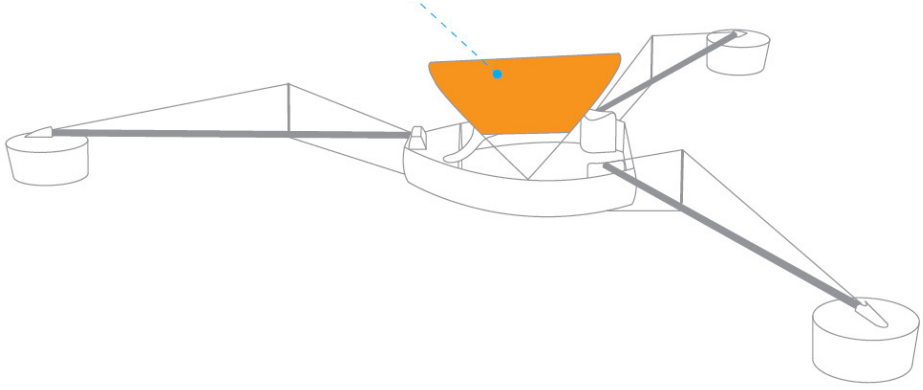
Dockage

Molnárka 'rests' on a pier when out of service or when taking a swimmer to the shore. It is navigated above the appointed pier with ascended hull, then the hull is put on the pier. At this position the legs float on water surface without deflecting force and the necessary equipments can be easily loaded.

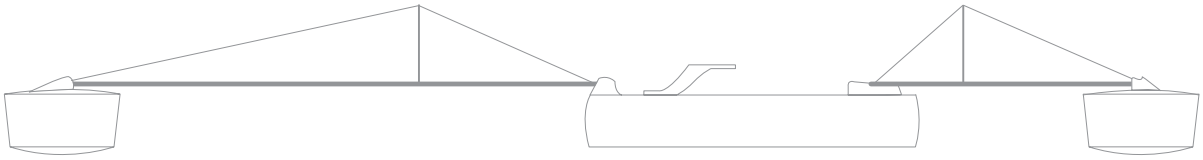


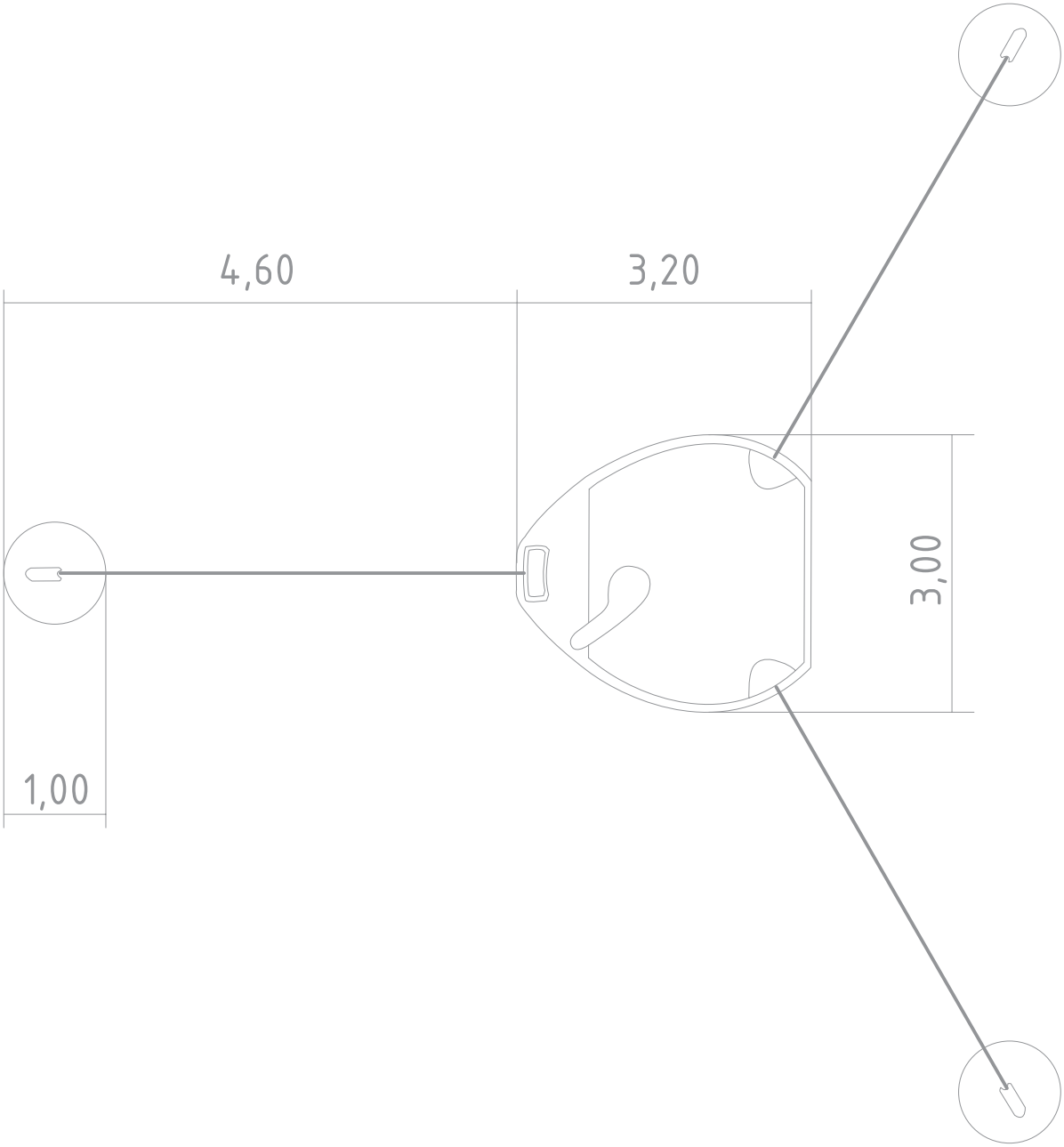
Sunshade

When designing the hull, it was an important factor that the rescuer's view to the whole horizon is not obstructed. We contribute to this by providing a sunshade against sunlight to the rescuer. The sunshade consists of up to date manufactured, flexible solar cell segments, allowing us to gain a considerable amount of energy for the operation (0.3-0.5 kW, depending on weather) out of sun energy.



Dimension of the boat





SUMMARY

Place for ads. We collected why we think our boat is entirely equivalent to the factors engrossed in the tender.

How innovative?

Molnárka is a quite new approach to both water rescue process and to the required technology. Although, there were attempts to create rescue bases with similar functions, Molnárka is the first lifeboat to transform from tower to boat in practically zero time, hence the swimmer can be approached immediately, moreover it is capable for higher speed.

How creative?

The analysis and the reconsideration of the eponymous common water strider (Gerris lacustris) led to a creative bionic solution.

Bionics is a new branch of science mixing biology and applied sciences which aims to the conscious utilization of the living world, imitating the forms of motion that developed through millions of years in the living world. Learning other species' secrets and turn those to our own good. Bionics is not the direct implementation of the structures found in nature to technology. It is rather the recognition of the body and form principles of trees, plants, bones, arms, wings, claws, jaws, fangs, etc…

How implementable?

The hull is nearly the only element to be produced specially for this boat. It is produced through manual lamination process, since we talk about unique production (5-6 pieces), this is one of the easiest technologies. All other components (motors, accumulators, winches) can be procured as semi-finished and finished products even at retail.

How cost-effective?

As only one part has to be produced specially, the boat can be implemented at a relatively small expense. However, Molnárka is cheap at absolute terms as well. The electric devices' (motors, winches, accumulators) prime cost is 1300 Euro (which contains the control for the winches) at retail. The hull is made of the plainest material, fiberglass polyester, because of the boat's low dead load. The only costly part is the sunshade/solar cells, but the 'wasted' money is regained in the maintenance costs and in environmental protection.

We must notice here the advantage of the low dead load, as the cost of the lifting and moving devices grow in direct proportion with weight. The costs spared on weight are incommensurable with the costs of the flexible solar cells.

How environmental conscious?

The boat uses solely electric power and the main part of the energy is gained by the sun foil functioning as sunshade. Its special advantage is that the up to date manufactured sun foil's production generates much less harmful byproduct than the production of traditional solar cells. Hence, this technology can be called green. (As a matter of course, the accumulators can be charged through main electric network.)

How widespread?

Since Molnárka does not stand on the bottom of the water, it can be utilized irrespectively of the depth of the water at any fresh water bath resort and even at sea-coasts, where the placing of fixing buoys can be managed.

How ergonomic?

The ergonomics of the boat are approached from two directions. The first is the rescuer point of view, the design of the control panel and the shipboard. Not detailing the advantages of the boat, such small matters as the delay-action release on the hawser that prevents the boat from setting off at fixed position, or the sunshade which can be adjusted or in case of strong wind can be totally folded, can help a lot.

The second is the rescued persons' and the swimmers' point of view, as it might occur that the boat is navigated among bathers. For this case we put on a life ring like, soft muffling panel, but at the same time the design of it must allow the swimmer to grab the boat anywhere. Signs referring to functions, such as lively colors and unambiguous forms, help a lot.