

Openfoil Open Source Hardware Project

Product name: OF1

Product definition: Hydrofoil for nautical sports such as kitesurf.

Release: 25 July 2017

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0/ License and certification

The product OF1 is placed in open-source hardware protected by the license “Creative Commons Attribution-ShareAlike 4.0 International Public License” in attachment. All the “open source” and “open source hardware” elements of this documentation refers to this license.

OF1 is certified as “open source hardware” by the Open Source Hardware Association. The ID number of this certification is “FR000003”. It is listed in the certification to this address:

<http://certificate.oshwa.org/certification-directory/>

1/ Introduction

OF1 is a hydrofoil designed for the sport kitesurf. It may be used for others nautical sports such as wakeboarding. A hydrofoil applies a vertical force on the kitesurf-board which allows the board to take off from the water surface. In front view, OF1 is a triangular-shaped hydrofoil which is fixed to the kitesurf-board. In side view, the hydrofoil OF1 is slanting: the lower part is more on the back (considering the direction of the foil) than the upper part.



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2/ Advantages of OF1

- The board is fixed under the top-edge of the triangle-shape of OF1. So the hydrofoil doesn't impact the bottom part of the board, which is an advantage when the board touch the water.
- As the shape of OF1 is triangular (in front view) the two down-edges of the triangle are inclined. This provides an auto-stabilization concerning up-down motion. Indeed, when the hydrofoil goes up, the part of the foils in the water decrease, and the lifting force decrease, so the hydrofoil goes down. When the hydrofoil goes down, the part of the foils in the water increase, and the lifting force increase, so the hydrofoil goes up.
- The fact that the shape of OF1 is slanting (in side view) provides an auto stabilization of its incidence. As model-tests showed, if the shape is not slanting, the hydrofoil incidence varies a lot (points in up and down directions) in a way which is difficult to control. But if the shape is slanting (case of OF1), the hydrofoil incidence is more stable.
- OF1 doesn't present sharp corners because its shape is a closed loop (triangle). As a result, it is much safer than classical hydrofoils: it present round corners which cannot cut the rider easily.
- OF1 has two configurations. There is the configuration "in use" when the triangular shape is deployed. And there is the configuration "stored" or "for transport" when the three foils (edges of the triangle) are detached. As the three foils are straight lines, the "stored" configuration is very compact. Also, it is very easy and fast to pass from one configuration to another. Indeed, the connections part (which are a specific design belonging to the product OF1) connect the foils together with one screw. So, there is in total only three screws (the three corners of the triangle).

3/Construction

An important part of the design was done with the plugin "grasshopper" for the software "Rhinceros". A "grasshopper" definition (shared in open source) is able to draw the geometry of OF1 with the inputs (parameters) of mainly the width of the hydrofoil, its height, the distance of slanting, and the shape of the wing-profile.

The three foils of OF1 are aluminum profiles which have the shape of a wing. The shape of the wing could be different and OF1 conception files are ready for a change of profile (thanks to a "grasshopper" definition). The foils (aluminum profiles) have to be cut with the dimensions generated by the "grasshopper" definition.

The connection parts are in plastic. They can be 3D printed (the .stl file and G-code is shared in open source). Also, the geometry of the connection parts is generated by the "grasshopper" definition. By setting different inputs (parameters) in the "grasshopper" definition, another geometry will be generated. Which can then be 3D printed as well. The connection parts work in pair. Each part is on one side plugged and pasted in the corresponding aluminum profile, and on the other side attached to the twin connection part. The attachment between two connection parts is achieved by a long screw. The diameter of the screw used is 1.0 cm, but another value can be set in the "grasshopper"



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definition. Other parameters can also be set to different values in the “grasshopper” definition in order to shape the connection parts differently.

The part which fix OF1 hydrofoil to the kitesurf-board is in wood. It could be in other materials such as plastic. The board is hanging under the top-foil of the triangle shape. The fixation part has a certain height (10 cm) which. The bottom side of the part has a shape which has to be adapted to the board. The top side of the part has the shape of the bottom-side of the foil. This fixation part maintains the distance between the hydrofoil and the board. There is also a strap which pass over the top-foil of the triangle and the down-side of the board. It tight the foil, the fixation part and the board together in a sandwich.

4/ How to use the files

All the conception files are available on the public Facebook page “Openfoil”. There are:

- A 3D file (in 3dm and dwg format) of OF1. It can be used for visualization, measurements, and export of stl format for a 3D print. It is also the support of the “grasshopper” definition.
- A 2D file (in dwg format) with front and side views, and dimensions of the foils in order to cut the aluminum profiles.
- An .stl file and G-code and which contains all the needed information to 3D-print the connections parts between the foils. The geometry is compatible with the foils described in the 2D and 3D files.
- The “grasshopper” definition (.gh format). “Grasshopper” is a plug-in for “Rhinceros” software. The “grasshopper” definition generate the geometry of OF1 with a set of input parameters. All the parameters can be kept or changed in order to use another foil-profile or obtain different dimensions and proportion of the hydrofoil and the connections parts.

5/ Specific points concerned by the certification Open Source Hardware

Are specifically declared in open source hardware the following elements:

- The geometry of the three foils. Especially the inclination of the two bottom foils in front view and the slanting of the two bottom foils in side view.
- The geometry of the connection parts between the three foils.
- The fixation of the hydrofoil to the board by the upper part of the board.

6/ Responsibility

Kitsurfing and windfoiling is dangerous. OF1 is designed to be as safe as possible, however it is still dangerous to use. Openfoil and the author Ludovic Regnault decline all responsibility of any damage, physical or corporal, caused by OF1.



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