

The life cycle of a MOD 70'

Executive summary

Introduction

Multi One Design is a company based in Lausanne (Switzerland). The stated mission of the company is to manage and promote the professional circuit of MOD 70' one-design multihull.

The class of the MOD 70' trimaran class is a new one-design class that will give a new drive to the ocean multihull races, ensuring cost control and international development. More specifically, it will enable the teams of the world to compete on equal terms.

Multi One Design SA is determined to create an international circuit of oceanic and inshort races, the Multi One Championship while integrating the concept of eco-responsibility.

Thus, within the framework of its activity, Multi One Design S.A. has chosen to defend a vital cause for mankind, the preservation of water on the planet. In order to act very concretely in the face of all the major challenges related to the protection of the drinking water resources and the preservation of the oceans, Multi One Design S.A has established the "Multi One Attitude Foundation".

This foundation will be meeting the public, in the very heart of cities. Indeed, the Multi One Championship will have a race village in which the Multi One Attitude Foundation pavilion will be set up. The latter will be a place of exchange on the future of the seas with all the visitors, whether children or grown-ups. The objectives of the Multi One Attitude Foundation are: to act, inform, explain, and convince without moralizing.

With this in mind, Multi One Design S.A has decided to launch its eco-responsible approach by beginning with an analysis of the impacts on the environment of the life cycle of an MOD 70'.

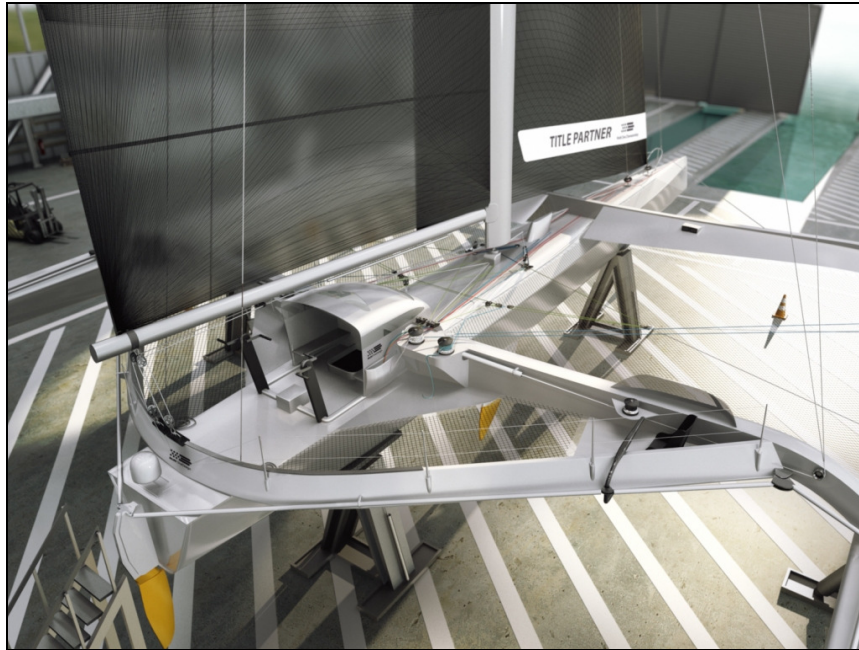


Figure 1: Illustration of an MOD 70'

Methodology

Life cycle analysis is a methodology commonly used to assess the impact on the environment of products and companies. This method is governed by an international norm, the ISO 14'044. By life cycle is generally meant all the life of a product, from the extraction of raw materials to the elimination of the product (recycling, incineration etc.), passing through the phases of manufacture, various logistics and utilization.

Quantis International has done this study for Multi One Design SA. Quantis is a consulting company specialized in the life cycle analysis and the impacts analysis on the environment. It is involved in the latest developments of the “water footprint” study in particular.

For this study, we have chosen to evaluate the impact of a MOD 70' on the environment with the following impact categories:

- **Global warming** (expressed in kg CO₂-equivalent), associated with greenhouse gas emissions. This indicator is the one commonly communicated in the media with regard to climate change.
- **Resources** (expressed in MJ), this indicator weighs up primary and non-renewable energy consumption (or grey energy) and the extraction of minerals.
- **Water footprint** (expressed in M³ of water), recommended by Water Footprint Network (WFN) indicator which includes the direct and indirect use of fresh water consumption necessary to produce goods or services. It analyses the contribution of three types of water: blue water, grey water and green water. Blue water represents evaporated or used water and which is no longer available as resources. Grey water represents the volume of dilution to bring back the produced pollution to acceptable concentrations (legal norms). Green water is rain water evapo-perspired by the plants used in the system under consideration.

Study framework

This study has taken into account all the life cycle of an MOD 70', that is the manufacture phase of the boat, the utilization or navigation phase and the end of life as illustrated by the drawing below. For the manufacture phase, the materials and their transportation were taken into account, from the carbon fibres, the epoxy to the batteries, the fittings and the rigging. The VPLP (Van Peteghem – Lauriot Prevost) naval architects who designed the MOD 70', have enabled to establish a precise assessment of the weights, the total weight ready to navigate being 6'135 kg.

The manufacture phase of the sailing boat is carried out on three different shipyards: Decision SA (in Switzerland), Multiplast and CDK Technologies (in France for the latter two), and the analysis was based on direct values made available by these shipyards.

The utilization phase (or navigation) was more difficult to model for it depends to large extent on factors external to MOD SA. Indeed, the public relations necessary for the functioning of the project are very much dependent on each of the boats involved and their sailing team. Moreover, maintenance can vary from one year to another. As for the navigation, it varies in accordance with the program of the year (World Ocean Tour or European Tour). An average scenario has hence been retained taking all these factors into account.

The end of life of the sailing boat will probably integrate a participation in a second division circuit, however, it could also happen that the boat has another end of life (dismantling, recycling, perils of the sea, storage etc). The latter being very variable, we have preferred not to take account of it in our study or simply take into to consideration the storage in the shipyard, a solution that frequently happens.

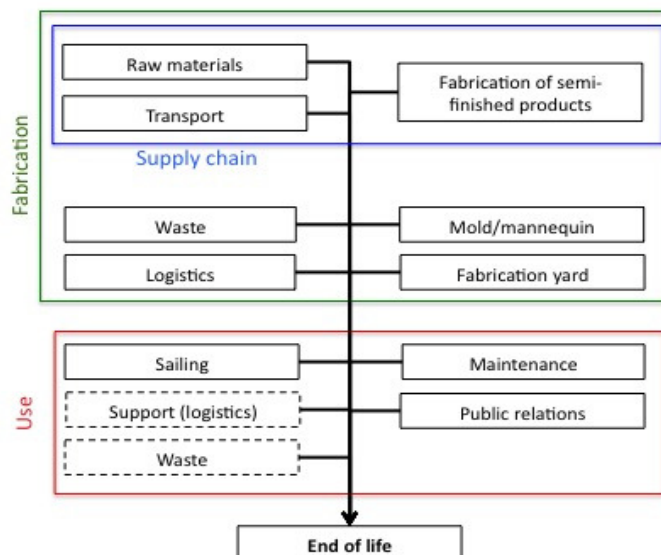


Figure 2: MOD 70' life cycle phases chart

Results

Manufacture phase

MOD 70' impact on the environment was first of all evaluated upon leaving the shipyard (without taking into account the utilization phase and the end of life phase of the life-cycle phases) the chart below illustrates the relative contribution of materials, the transportation of materials and the manufacture shipyards for the three impact indicators retained.

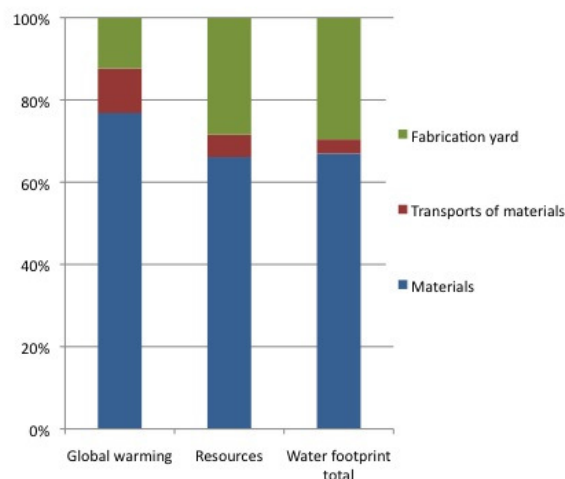


Figure 3: Impact on global warming, resources and water footprint of the construction of an MOD70'

Thus, the impact from the manufacture of an MOD can be determined as:

- **Global warming :** 230 tonnes de CO₂-équiv.
- **Ressources :** 7'810'126 MJ
- **Water footprint :** 5'270 M³ (blue, grey and green water)

The impact of materials on the environment is important, this in the context of the shipyards and in relation to their transportation. Composite materials, particularly carbon fibre, are materials whose manufacture has a great impact on the environment. Nevertheless, it is currently the only material that can be used in the building of multihull of this size and performance.

Utilization phase

When the utilization phase and the end of life of an MOD 70' are included in the previous analysis, an extrapolation of results can be reached per year of utilization of the sailing boat.

The MOD 70' has a life span of 10 years.

Thus the manufacture impact presented below will be spread out over each year of utilization. The graph below represents the relative contributions of each phase of the life cycle of an MOD 70':

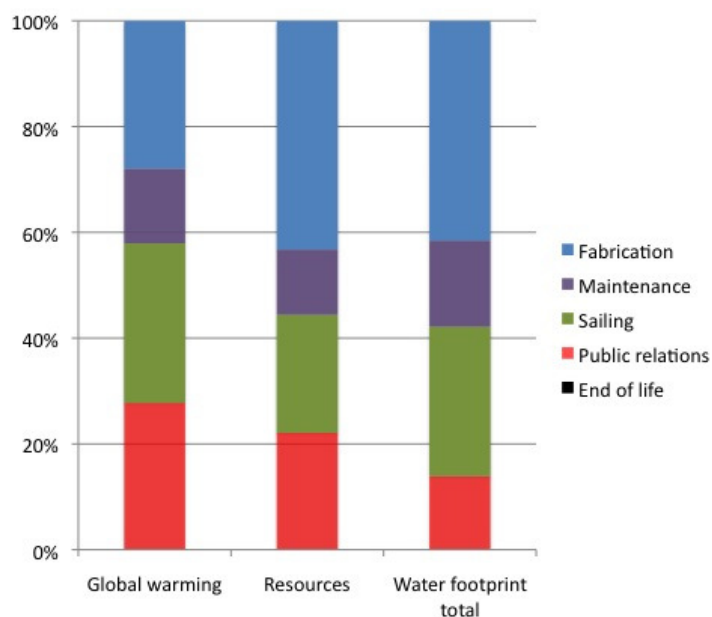


Figure 4: Contributions of the different phases of the life cycle to categories of global warming, resources and Water footprint (for the utilization of an MOD 70' over a year).

Hence the utilization of an MOD 70' amounts to:

- **Global warming** : 82 tonnes CO₂-éq.
- **Ressources** : 1'805'899 MJ primary (primary non-renewable energy)
- **Water footprint** : 1'336 m³

The impact of the use of the MOD 70 is not insignificant in relation to the impact of its manufacture. Indeed, public relations and navigation include a large part of people transport (by air); as for the maintenance, it includes a great part of the use of materials.

Navigation comprises the impact of the boat engine used for part manoeuvres and public relations operations as well as the fuel used on board. Nevertheless, the latter is quite relative since it only represents 1% of the total impact for a year of MOD 70' utilization.- as compared to crew gear (food and drinks and the shore crew (transportation of the container, crew vehicle, etc).

Focus sur le Water Footprint

The Water Footprint indicator is an aggregate of three types of water: blue grey and green water. Green water is nil here since the latter is mainly linked to agricultural products which are not used in the manufacture of the MOD 70'. The quantity of blue, evaporated water or which is no longer available as resource is also relatively low. Finally, grey water is the main component of water footprint. The latter decomposes into chemically polluted water which contributes to as high as a quarter of the quantity used, and in water thermally polluted water, as high as three quarters of the quantity used. This is explained by the industrial production of materials which involves in particular, the use of water as a means of cooling especially for electricity production.

The water footprint for the manufacture of the MOD 70' amounts to 5'270 m³, representing 859 litres per kg of built boat.

This figure is well below the water footprint of most agricultural products. On the contrary, the distribution of the types of water is very different in regard to agricultural products. Indeed, for these products, the distribution comprises a great quantity of green and blue water and a limited quantity of grey water.

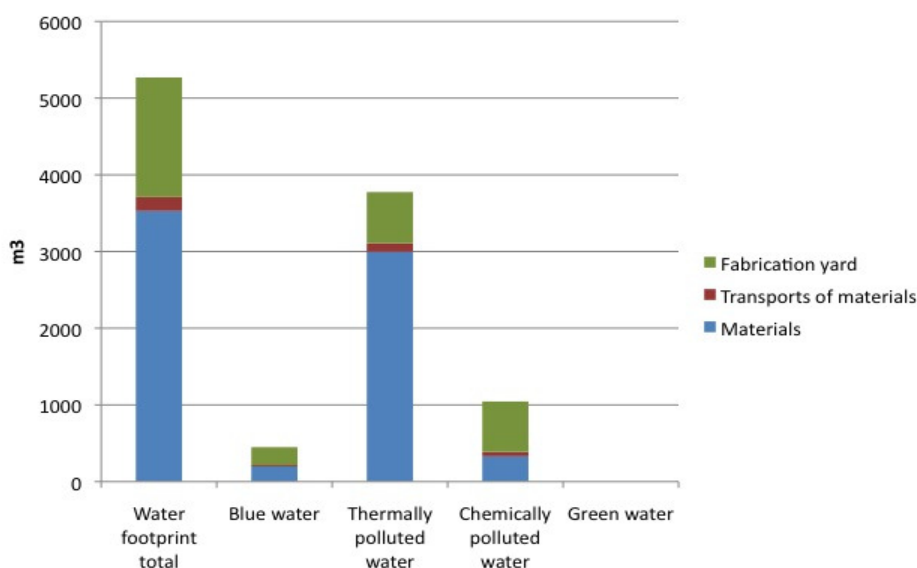


Figure 5: Split of the water footprint category (left column) into blue, grey (chemically and thermally polluted water) and green water.

In terms of direct water use (water used directly at the shipyard) and indirect (water linked to energy use and manufacture of materials), the total consumption of all the shipyards corresponds to 236 liters for the entire MOD manufacture. Indirect water therefore corresponds to more than 99.99% of the water footprint. This indicator becomes 94% when a year of utilization of an MOD 70' is considered, for account is taken of washing the boat, bottled water used on board, grey water pumped out by the sailing boat and water found in cotton clothes (largely irrigated for its production).

What impact for which sailing boat?

In order to demonstrate the advantages of the MOD 70' concept regarding its environmental impact, we made a comparison with the impacts of other racing boats of similar size: a VOR 70', an IMOCA 60' and an old ORMA 60'.

The impacts of these three sailing boats were evaluated on the basis of the MOD 70' impact, and in relation to their overall respective mass. The impact of the manufacture phase for the four sailing boats is presented here below in terms of water footprint.

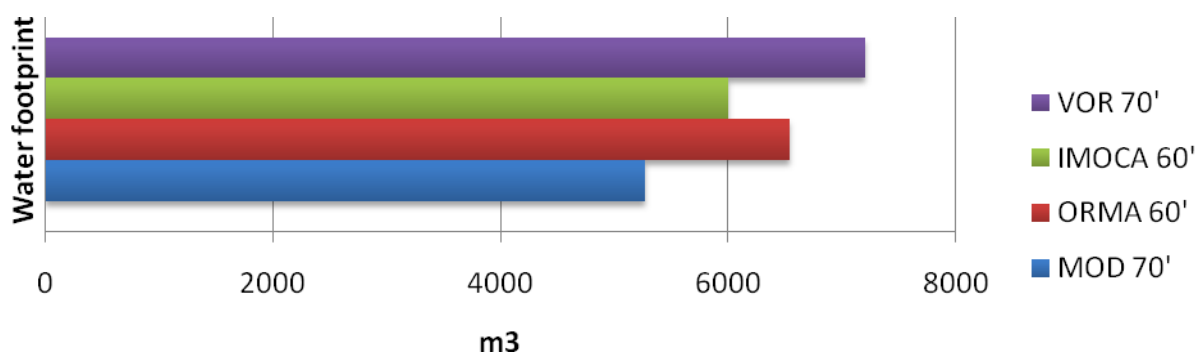


Figure 6: Comparative of different sailing boats manufacture impact for water footprint category.

The utilization phase has not been included for obvious reasons of complexity. Dependent on the team, the program, and the sponsor, this phase can vary from single to triple in terms of impact. We therefore decided to stop at the comparison of the manufacture phase impact of these boats.

The results show that the MOD 70' has a relatively lower impact compared to the other boats, even though having similar weight. This is as a result of the one-design concept; the tooling which represents a great consumption of the composite are reutilized for the construction of the entire series of the 12 MOD 70' multihulls.

When the impact of the various sailing boats' manufacture phase is compared on the basis of a one year high-level competition, the advantage of the one-design concept becomes even clearer. Indeed, an MOD 70' remains competitive for ten years of life. While an IMOCA 60' will be competitive for a Vendée Globe campaign (4years), an ORMA 60, for about 3 years and a VOR 70' for a race around the world campaign (around 2 years).

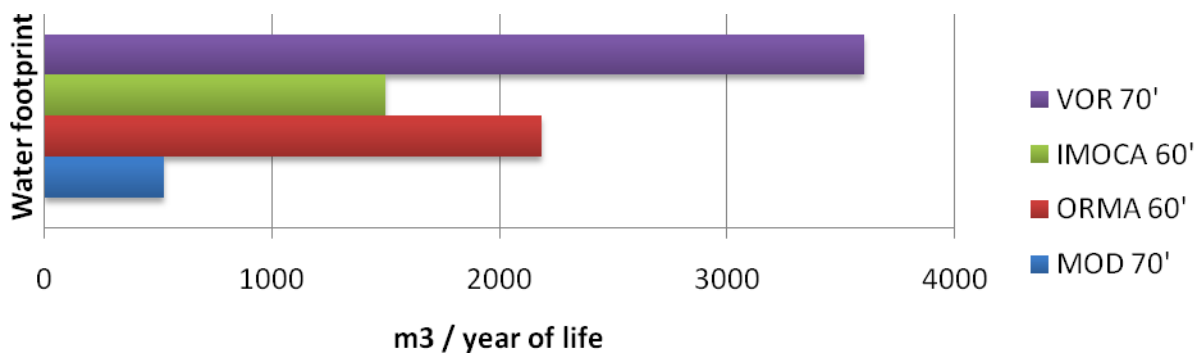


Figure 7: Comparative of different sailing boats' manufacture Water Footprint category impact for a year of high-level competition

Thus the MOD 70', being a one-design sailing boat competitive on a longer period than the other sailing boats has a potentially lower environmental impact in a year.

Stated otherwise, the impact of using an MOD 70' in competition is about three times less on the water footprint than that of the old generations oceanic multihulls, the ORMA 60'.

The one-design concept hence has a real environmental benefit, in as much as the boat is really utilized in a longer period than the other prototype sailing boats, which is the case here.

Conclusion

The impact, during the building of an MOD 70, is mainly due to the boat manufacturing materials, primarily from carbon fibres and composite materials. The transportation of these materials also has a great impact. The main impact for the boat maintenance is also due to the materials.

The navigation (or utilization) phase impact is mainly generated by the MOD 70' shore crew and a great part of this impact comes from the transports. This is especially true of global warming and resources impact categories.

Public relations are responsible in a significant way for the MOD 70' utilization impact. Generally speaking, transportation has an important contribution, up to 50% for the global warming category. The choice of suppliers by MOD SA is a key point for this impact reduction, and in particular the choice of the shipyards which have decided to take the environmental parameter into account.

The end of life has no significant impact in any of the categories

The water footprint of the MOD 70', which represents 859 liters per kilo of constructed boat, is quite below that of most agricultural products namely, 15'500 liters of water to produce a kilo of beef or 3'400 liters for a kilo of rice (source: Water Footprint Network).

As for energy use on board, it represents less than 1% of all impacts for all the categories.

This study presents certain limitations which should be taken in account, the main one being that the utilization phase of an MOD 70' varies according to the crew, to the sponsors or to the race program of the year, leading to some uncertainty about the results. As for the manufacture phase of the boat, the results are quite precise.

On the other hand, the comparison of the MOD 70' with other racing boats has shown that the one-design and long-life circuit concept (10 years) allow to limit the MOD 70' construction impacts, in comparison with other other racing boats which have a shorter life cycle, of about 2 to 4 years.

In conclusion, if reference is made to the three considered impact indicators, the utilization of an MOD 70' during one year corresponds:

In terms of global warming:	to a round trip Geneva Berlin by plane
In terms of resources:	to 308 barrels of petrol
In terms of water footprint :	to water required to produce a ton of wheat

Multi One Design S.A. commitments

Multi One Design S.A. has decided to carry out this study on the MOD 70' life cycle to demonstrate that it is important for the circuit good functioning to be aware of the impact on the environment of each action undertaken in this project and to measure the impact in all honesty.

Without moralizing, or "to preach the good tidings", Multi One S.A is committing to reduce to the maximum the impact on the environment, while constantly putting the priority on the competition, the show and the fun.

To monitor this aspect of the project, Multi One Design S.A. works hand in hand with the Multi One Attitude Foundation which will be responsible during the whole race program, for promoting and helping projects that are related to the defense of water and the seas. Multi One Foundation besides, will be present on the circuit, especially in the main pavilion of the race village, in order to inform, educate and act with the local organizations.

The willingness of Multi Design S.A. to develop an international oceanic race circuit while integrating a concept of eco-responsibility begins by an analysis of its own actions and impacts on the environment. The study on the life cycle of an MOD 70' is only the beginning of a regular and recurrent self evaluation.

A complete study is available on request.

www.multionedesign.com

www.multioneattitude.com

www.quantis-intl.com