FOILING WEEK

Foiling SuMoth Challenge

sponsored by

11TH HOUR RACING

Rules v2022 r0.3

February 12th 2022

ABBREVIATIONS

3R	Reduce Reuse Recycle
11HR	11th Hour Racing
CF	Carbon fiber
CFRP	Carbon fiber reinforced polymer
CAD	Computer Aided Design
CFD	Computational Fluid Dynamics
FEM	Finite Element Model
FSM	Foiling SuMoth
FW	Foiling Week
GFRP	Glass fiber reinforced polymer
IMCA	International Moth Class Association
LCA	Life Cycle Assessment
MS360	Marine Shift 360
SM$	SuMoth dollars

1 GENERAL

1.1 Introduction

The Foiling SuMoth Challenge is a competition inspired by the need for more sustainable and efficient sailboat designs, along with coherent manufacturing methods.
The ultimate goal of this competition is to promote sustainable practices by challenging the University and higher education students in a friendly, technical, and athletic competition.

1.2 Concept

The constitutional goals of the **Foiling Week™** are to provide the foiling experience accessible to everyone, to generate an eco-social behavior, as well as to ensure the safety of the foiling community on the water.
The Foiling SuMoth Challenge concept is in line with the three pillars of **The Foiling Week™** – ***accessibility***, ***sustainability*** *and* ***safety***.

1.2.1 Accessibility

One of the key aspects of the Foiling Week is to allow an inclusive and extensive experience to the sailing community and newcomers into the foiling world.
The Foiling SuMoth challenge allows students from all over the globe to participate in an innovative, sportive and challenging competition.
To allow an inclusive and equilibrated competition between teams, a *standardized manufacturing budget* system is applied to the manufacturing of each boat.
In a mainly man-driven sport like sailing, female sailors in the foiling community are rare. To promote female sailing, and sailing in countries that did not get represented on the Olympic games, the scoring system of the Foiling SuMoth challenge is adapted following the rules on Section 10.2.

1.2.2 Sustainability

Business models in shipyards and naval industry are oriented towards the economic benefit of the production, often choosing cheaper labor locations along with weak environmental regulations to generate a larger income. Such choices result in negative social and environmental impacts.
The Foiling SuMoth challenge organization believes that a student competition is a great opportunity to have raw and creative ideas. The future naval architecture and engineering professionals will be a key factor to change the economic driven approach.
To revert such "business as usual" practices, the Foiling SuMoth aims is to look towards the **"3R"** concept of – ***Reduce Reuse Recycle*** - as well as the three aspects of sustainability.

A sustainable practice can be defined as a balance between environmental, social and economic performances.

- **Environmental**
  The Foiling SuMoth boats are meant to be designed and manufactured with a focus in low-carbon emission practices, where the use of bio-based materials as well as recycling and upcycling obsolete elements is encouraged.
- **Social**
  The Foiling SuMoth challenges the teams to make a reflection about the social impacts along the production chain of the materials used for the design and manufacturing phases of the boats.
- **Economic**
  The Foiling SuMoth must comply with the manufacturing budget and standardize costs. The manufacturing budget was created for two reasons: to limit the manufacturing spending and to have an equilibrated competition.

With these three key elements in mind, the *Foiling SuMoth* concept aims to enhance the sensibility towards more sustainable innovative designs and manufacturing methods to be applied on foiling high efficiency sailboats.

1.2.3 Safety

The SuMoth participating teams should consider the sailing environment and be aware of the importance of safety in high speed sailing. Foiling brought a new generation of sailing boats that can reach high speeds and with it the increased risk of accidents and injuries. The degree of consciousness for safety and security should be higher than ever before in the history of sailing boats.

1.3 Concept application

The *Foiling SuMoth* concept is applied as a three (3) stage competition where; **boat design**, boat **manufacturing & performance** as well as **racing** are evaluated.

The stages are correlated, meaning that the first stage “S1” (Stage #1) needs to be completed before engaging on the second stage “S2”. There is no obligation to engage into a subsequent stage. The general description is defined as follows:

1.3.1 S1 - Design

This stage is fully conceptual. The teams engaged at this stage will create a SuMoth concept complying to the requirements on the budget and produce a report.

1.3.2 S2 - Manufacturing & Performance

While the ultimate goal of the SuMoth Challenge is to compare the concepts on a racecourse, this might not suit all schedules or teams’ capabilities to travel.

The S2 stage is a “standalone” competition where each team will test and record their performance on the water on a defined weather conditions range.

1.3.3 S3 - Racing

The racing stage is the ultimate goal of the SuMoth Challenge. The teams will meet to test their boats against each other.

2 PARTICIPATING TEAMS

The Foiling SuMoth Challenge is open to all students from any school, university or association and from any grade, with the ability of designing, building and/or sailing their own concept safely. The registration and participation does not involve any fees.

All communications between the teams and the Organization will be exclusively made via the *Slack Workspace*. **It is each teams' responsibility to be active on the communication platform to remain informed of all news and relevant information. Access to the platform will be granted to all members once the registration is completed.** The registration form is available on the "Rules and registration" section on the *SuMoth.org* competition website.

2.1 Teams requirements

The teams willing to compete in the Foiling SuMoth Challenge event:

- Shall be fully composed by students, with the exception of the team manager. with no restriction on the career or degree.
- School alumni, graduated the year prior to the competition and who were involved in the process are allowed to integrate the team.
- Shall have a "S3" competition team of up to 10 students, with no restrictions on the number of team members on the design and manufacturing process.

2.2 Team roles

Teams must assign four (4) roles by the time of the registration, being: Team Manager, Captain, Logistics Officer and Communication Officer.

Each person can occupy a maximum of two (2) roles. The Team Captain can only be responsible for a single role. Please refer to "APPENDIX A – Team structure example".

2.2.1 Team Manager

The Team Manager must be formally related to the institution or association (i.e. Teacher, Professor, Assistant, Postdoc, Association president, etc.). The Team Manager will be responsible for the students involved in the project during the design, manufacturing and competition phases, remaining the maximum authority towards the organization.

2.2.2 Captain

The team Captain must be a student. This person will be in charge of the team, remaining the main contact point with the event organization.

The Captain will be responsible to provide the Technical Report and Presentations needed to evaluate the presented concepts.

In the case of multiple Foiling SuMoth concept boats in the same team, each Concept must have one dedicated Captain with the possibility of sharing the Logistics and Communication officers as well as the skippers.

2.2.3 Logistics Officer

The Logistics Officer will be in charge of the arrangements of the team prior and during the competitions (accommodation, transportation, etc.). The person in charge will be in direct contact with the organization management.

2.2.4 *Communication Officer*

The main tasks of the Communication officer are to promote the teams' advancements and achievements during the design and manufacturing phases as well as during the competition.

2.2.5 *Skippers*

Skippers shall be registered prior to the respective S2 and S3 stages.

3 TECHNICAL REQUIREMENTS

3.1 General

To participate in the *Foiling SuMoth Challenge*, boats shall meet all the technical requirements specified in this section.

3.2 IMCA box rule

All foiling SuMoth concepts must meet the IMCA (International Moth Class Association) "box rule" specifications, as seen on Table 1.

Length	3.355 m
Beam	2.250 m
Maximum luff length	5.185 m
Maximum mast length	6.250 m
Hull weight	Unrestricted
Rigged weight	Unrestricted
Sail area	8.25 m^2
Restrictions	Multihulls/trapezes/movable seats/sailboards
Advertising	Category C (Unrestricted)

Table 1 IMCA box rules

3.3 Buoyancy

All boats shall remain unsinkable at all times and under all circumstances with greater buoyancy than its mass plus the skipper (85kg).

3.4 Manufacturing budget

The Foiling SuMoth Concept must be designed and manufactured complying with the manufacturing budget, where the prices are evaluated in "SM$" (SuMoth dollars).

This virtual currency is used to standardize the cost of materials for all participant teams.The manufacturing budget is capped to **10000 SM$**, including all boat elements and spare parts to comply with the challenge rules.

The calculation of the manufacturing costs must be made with the help of the "Standardize cost" tables on the STANDARDIZE COSTS section.

3.5 Manufacturing constraints

Along with the IMCA geometrical restrictions, the main parts of the Foiling SuMoth will have a carbon fiber composite limitation, of which:

- **Hull:** Maximum of 20% per mas CFRP (recycled/upcycled source)
- **Foils and verticals:** Up to 80% per mass CFRP
- **Rig and sails:** Used, recycled and upcycled rigs are allowed.

The CFRP should be calculated with an average of 55% R.C. (resin content by weight).

3.6 Electronics and sailor assistance

Data acquisition and measuring systems are allowed at all times. In the case of battery powered electronics, the compartments used for this purpose must remain fully waterproof (i.e. IP67) firmly fixed and placed above the waterline of the vessel.

4 STANDARDIZE COSTS (SM$)

The standardized cost tables define the price in "SM$" (SuMoth dollars) that the materials used for the manufacturing cost for the competition evaluation.
In the table, the eco-friendliest materials have a cheaper SM$ cost, than those considered less sustainable.
All bio materials, such as natural woods (i.e. Balsa Wood, Paulownia), have **0 SM$** cost.

4.1 Manufacturing raw materials and processes

The materials and processes types and related standardized costs can be found on the Google Sheets document on this Link.
If a material is not present in the document, the team shall contact the organization via the Slack workspace to assign a cost and add it to the document.

4.2 Blocks, tacks and pulleys

The cost of these elements in SM$ will be considered equivalent to the standard manufacturer's suggested retail price (MSRP) costs in US$ (excluding taxes and shipping). The value of each element needs to be provided in the Technical Report as per manufacturing standard prices.

4.3 Recycled elements and materials

4.3.1 Obsolete artifacts and boats (upcycling)

The use of upcycled elements from old obsolete or broken artefacts (i.e. Lowrider IMCA, recycled boats or parts, etc.) is allowed and will have a 0 SM$ cost in the budget calculation. Every element coming from an obsolete artefact must be itemized with the origin description and the transformation involved (Stage S1 Report).
The materials used to turn an obsolete part into a Foiling SuMoth part must be itemized in the manufacturing budget calculations (i.e. repair on broken mast).
If a "classic" IMCA boat (or other class) hull or part is used, the team shall make sure that this part does not belong to the history of such class and, as such, has historical value.

4.3.2 Recycled materials

- **Industrial excess**
  The use of materials coming from industry excess is allowed and encouraged. The budget cost of such material will have a 25% reduction in the cost calculation.
- **Out of shelf life**
  In the case of using out of shelf life materials (i.e. prepreg, epoxy, etc.) these materials will have a reduction of 50% in the cost calculation.

4.3.3 Used parts

Used IMCA boat parts are allowed as long as they are made before 2014.

5 "S1" STAGE - Design

The design stage of the SuMoth Challenge is the cornerstone of all concepts. At this stage, each team will develop their unique design respecting the "TECHNICAL REQUIREMENTS" of the competition. The evaluation will be done on the following deliverables:

5.1 Foiling SuMoth S1 report

The "Foiling SuMoth S1 report" is the Technical Report on which the Jury will evaluate all the concepts. Each competing team will submit theirs by email or Slack before the deadlines of each event:

- Foiling SuMoth Challenge 2022 S1 deadline:
  - **1st deadline - October 10th 2021**
  - **2nd deadline - February 10th 2022**
  - **3rd deadline - June 1st 2022**

The report will have a maximum of 40 pages and present the design and manufacturing specifics of the boats. Including the sustainability path, the manufacturing of the parts. The report shall be done using the "2022 SuMoth Challenge S1 Report Template" on its latest version. The report include the three main sections and subsections:

- **Engineering and Design**
  This section will provide the analysis made by the team to achieve their Foiling SuMoth concept, their calculations and results, from conceptual drawings to any form of CAD, FEM and CFD.
- **Manufacturing and cost analysis**
  Within the limits of the "Manufacturing Constraints", each team will provide a detailed analysis of their path to manufacture their concept. From first use materials to recycled ones to upcycled obsolete elements.
  The cost analysis, following the "Standardized Cost" must be provided in a chart.
- **Sustainability analysis**
  In this section, the team will provide a Life Cycle Assessment (LCA) of the materials and elements used in the manufacturing of their boat, made with **MarineShift360**

LCA Tool. From the molds to the final parts, this section will justify the choices made to achieve the concept with a sustainability approach.

Team members in charge of sustainability are required to attend all webinars proposed by MS360. Specific questions related to the LCA shall be posted on the #lca channel in the Slack workspace.

5.2 S1 Design VLOG

Along with the report, a 3 to 5 minutes video will be delivered containing the key elements of the concept, from the innovations to the sustainability aspects .
*A masterclass on video shooting / editing will be provided by professionals of FW media team. Team members related to communications are required to attend these masterclasses.

5.3 *Project vulgarisation & popular vote*

From the FSMC 2022, the S1 stage will assign **75 points** (over 500) to the team obtaining the most vote from the public.
One month prior to the 3rd S1 report submission deadline (May 1st 2022) each team will provide a 1 page (A4) summary of the project and a 60 seconds (+/- 15 seconds) video teaser.

6 "S2" STAGE - Manufacturing and performance testing

This stage is where the magic happens! The teams will manufacture their SuMoth concepts with innovative sustainable materials and methods. Once finished the teams will test and tune their foiling sustainable boats in their local water plans until a level of confidence on the boat and the skippers is achieved. The steps and deliverables for this stage are the following:

6.1 Teams evaluation request

Following the testing schedule, a team will request for the "S2" evaluation. This process will be accepted upon receival of at least a video proof of the boat sailing steady and under control (specifications TBD).

6.2 Boat measurements

The SuMoth concepts, fully finished, will be measured by a local IMCA measurer at the team base for dimensional compliance with the class and safety.

6.3 Performance testing

Once approved by the measurers, the teams will have a period to record their performance with a GPS tracker (provided by the organisation). Each team will have unlimited test runs up until the end of the period (To be defined). The best runs will be then collected and compared against all other teams.

The test runs will be 500m runs starting from an archimedean mode in both upwind and downwind. The best five average speed runs will be taken into account and averaged.

6.4 Performance showcasing

A video of at least 5 performance runs (2 to 4 minutes), showcasing the SuMoth concept shall be delivered.

6.5 Manufacturing report

To complement the “S1” stage, a manufacturing report shall be delivered, showing how the boat was manufactured, the methods used and the deviation from the original Design on the previous stage.

6.6 “S2” during the FSM event

If a team is joining the Foiling SuMoth event, the elements on 6.2, 6.3 and 6.4 can be achieved during the event.

6.7 S2 diary VLOG

A storyline of the teams’ path to the S2 stage. Containing at least

- Manufacturing phases
- Assembly and fitting
- Sailors preparation, and the road to the big day!
- Testing prior to S2 performance testings

7 “S3” STAGE - Racing

This stage will be split in two, being “Speed test” and “Course Racing”. The speed test will be a downwind slalom course followed by an upwind where two boats will be racing against each other. The course racing will be a fleet governed as per IMCA, event or club rules.

7.1 Fleet racing

The fleet racing regatta will be governed by the international rules of sailing and courses will be held as per IMCA racing rules and course diagrams, with open Speed test.

7.2 SpeedTest

The Speed Test regatta is composed of a two-leg course, starting with a downwind slalom course followed by an upwind leg in a slalom match race configuration

7.3 S3 event Social Media diary

The Social Media diary during S3 shall include small clips, stories, clips and interviews with the team, other teams colleagues or visitors and spectators at the event.

8 COMMUNICATIONS AND SOCIAL MEDIA BLOGS

During the academic year, each participating team shall create **two** blog posts of 1650 words (or 3 single spaced pages). These blog posts will be sent to the SuMoth organization via email (sumoth@foilingweek.com) on or before its due date, respectively. These posts will be published by Foiling Week on its social media channels and website.

8.1 1st Blog post (due on February 1st 2022)

8.1.1 Teams registered before the FSMC 2021

- Team update (new members, organisation, etc.)
- Challenges towards the S2 and S3 stages
- Short discussion about the experience of working during the lockdown
- Any other interesting information!

8.1.2 Teams registered after the FSMC 2021

- The global presentation of the team (i.e. team flag, background, etc.)
- Motivation to participate in the SuMoth Challenge
- Milestones towards the Foiling SuMoth Challenge
- Objectives as a team and outcomes (including planning for S2 and S3)
  Note: If a team registers after the due date, the blog post shall be delivered one month after the registration date.

8.2 2nd Blog post (due on May 1st 2022)

8.2.1 Teams registered before the FSMC 2021

- Ongoing work towards the Foiling SuMoth Challenge 2022
- Overall description and hints on the design
- Achieved milestones
- Readiness to competition, what does the team need to complete before the Challenge
- Sustainable choices applied

8.2.2 Teams registered after the FSMC 2021

- Overall description and hints on the S1 design
- Achieved milestones from the team
- Ongoing work towards the stages S2 and S3

8.3 Regular team progress and milestones

A monthly Social Media advancement reporting is required to showcase the achievement of the teams. At least **one monthly publication** must be done. The publications shall respect one of the following formats:

- Video: Between 1 minute and 3.30 minutes, with an interview.
- Text: format: 400 words and two images minimum
- Publications must include at least #sumothcallenge #foilingweek

9 QUALIFICATIONS, MEASUREMENTS AND SAFETY

Prior stages **S2** and **S3**, each boat shall be measured upon the box rules on Table 1 to comply with the IMCA.

Once measured and complying with IMCA rules, the Foiling SuMoth boats will be allowed to race in the IMCA regattas (if all electronics are disengaged or removed)

A structural and buoyancy examination will be made on each Foiling SuMoth concept boat to ensure safety for all participants.

10 COMPETITION & SCORING

The ***Static phase***, composed by the "S1" Stage, is where the judges will evaluate the "on paper" technical attributes of each development. The ***Dynamic* phases**, composed of "S2" and "S3" stage is where the sailors will compete in standalone and fleet races.

10.1 Scoring system

A total of 1000 point will be possible to obtain, of which:

S1 Stage (500 points)	S2 Stage (300 points)	S3 Stage (200 points)
- Design Report (50 p.) - Presentation (50 p.) - Eco Design (100 p.) - Eng. Design (75 p.) - Innovation (75 p.) - Comms (75 p.) - Popular vote (75 p.)	- Upwind perf. (100 p.) - Downwind perf. (100p.) - Manuf. report (100p.)	- Fleet racing (100 p.) - Speed test (100 p.)

10.2 Equality points (bonus points)

To encourage the participation of female sailors as well as those students coming from countries where sailing is not a common sport, "Equality points" will be awarded for both S3 phases. The points give will be:

1. **Female** = +15 points
2. **Student from non OG participation nation** = +15
3. **Points (1) and (2) combined** = +30 points

10.3 Scientific Publications (bonus points)

To valorize the work achieved by the teams during the Challenge stages, additional points will be awarded to the teams submitting and publishing in the Journal of Sailing Technology (https://onepetro.org/JST)

1. **Submitted =** 10 points per article
2. **Accepted =** 20 points per article

The submissions must be of a high standard scientific publication. For the submitted and not accepted/reviewed papers will be evaluated by the Jury for

points consideration. If a paper is accepted after the Stage 3 (S3) of the SuMoth Challenge, the points will be added to the following year.

10.4 Venue

The venue for the SuMoth Challenge "S3" stage will be held at:

Fraglia Vela Malcesine (FVM)
Via Gardesana 205
Frazione Navene – 37018
Malcesine, Italy

10.5 Schedule

The event will be held during 6 days

Day 1	Measurements and Qualifications start
Day 2	Measurements and Qualifications, Speed Test Day 1
Day 3	Speed Test Day 2 and Fleet Race Day 1
Day 4	Fleet Race Day 2
Day 5	Speed Test and Fleet race finals
Day 6	Prize giving ceremony

11 GRANT ALLOCATIONS

The purpose of the Grant allocation is to help the teams needing financial support to achieve the goal of competing in the **Foiling SuMoth Challenge**. With the financial support of **11th Hour Racing** we are able to provide a grant allocation per country and based on two criteria.

The first one is based on the GDP[1] (Gross Domestic Product). The countries are divided in groups, where the grant amount is inversely proportional to the GDP. The second criteria is based on the geolocation, where the distance from the event and connections to mainland Europe from around the world are considered. The details can be found on the "Grant Allocation Scheme" document.

[1] https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita

Grants are optional, participating teams can decide to refuse the financial support if their program is funded by other means. In the case of a refusal of the grant, the allocation will be distributed to the teams in need of support.
The Grants will be rewarded to the teams after their presence at the Foiling SuMoth Challenge who have proven to comply with all the requirements and amendments defined in the Rules.

12 BOATS TRANSPORTATION TO FOILING SUMOTH CHALLENGE EVENT

GAC Pindar is the Foiling Week official logistic provider. For the SuMoth competition all teams will receive the most competitive quote which can include options for greener shipping solutions and carbon offsetting. Please contact the operations team at pindar@gac.com.

13 EVENT

13.1 Event organization

The Foiling SuMoth event will be held within and during the Foiling Week. The **2nd Foiling SuMoth Challenge** will be held during ***Foiling Week Garda 2022 (June 29th to July 4th 2022)*** after the postponement of the original date in 2020 due to COVID restrictions.

13.2 Organizer

Foiling Week
C.so di Porta Romana 63
20122 Milano, Italy

Contacts
Registration: registration@sumoth.org
Event manager: bruno@sumoth.org

14 INSURANCE

Each participating boat shall be insured with valid third-party liability insurance with a minimum cover of €1.500.000 per incident or the equivalent in other currencies.

15 AWARDS AND PRIZES

15.1 "S1" Stage - Design

- **Foiling SuMoth Sustainability Design Award**
  The Sustainability award will be given to the team who has proven to have developed the concept with the least impact in the ecological, economic and social aspects of sustainability. The award requires a clear explanation of the approach enabling to generate, give priority to and take preventive action

throughout the whole of a product's life cycle in order to minimize the environmental impact of the boat whilst maximizing its performance.

- **Foiling SuMoth Innovation Design Prize**
  Will be awarded to the Team which has applied the best technological improvements and the most visionary and relevant innovations, if they can be adapted to the industrial world and have real economic impact.
- **Foiling SuMoth Overall Design Prize**
  Will be awarded to the Team whose boat will feature the most original and consistent design.

- **Foiling SuMoth S1 Communications Prize**
  Will be awarded to the best blog or video or social post for S1.

15.2 "S2"- Stage - Manufacturing and Performance testing

- **Foiling SuMoth Manufacturing Prize**
  To the team who achieved the most sustainable manufacturing concept.
- **Foiling SuMoth Performance Prizes**
  Will be awarded to the top three teams on the up/down wind performance testing over the GPS data.
- **Foiling SuMoth S2 Communication Prize**
  Will be awarded to the best blog or video or social post for S2

15.3 "S3" Stage - Racing

- **Foiling SuMoth Speed test Prize**
  Will be awarded to the top three teams competing in the fleet race.
- **Foiling SuMoth Fleet Racing Prize**
  Will be awarded to the top three teams competing in the fleet race.

- **Foiling SuMoth Overall Winners Prize**
  The top 3 teams who obtained the most points from all three stages.
- **Foiling SuMoth S3 Communication Prize**
  Will be awarded to the best blog or video or social post for S3

15.4 SuMoth new team Engagement prize

The teams managing to engage other teams for the SuMoth Challenge stages will be awarded a prize. The awards will be given only if the engaged team finishes the stage or stages to which they have committed.

15.5 Prize Money

15.5.1 S1 Stage

- Foiling SuMoth Sustainability Design Prize – €500
- Foiling SuMoth Innovation Design Prize – €500
- Foiling SuMoth Overall Design Prize – €500
- Foiling SuMoth S1 Communications Prize – €500

15.5.2 S2 Stage

- Foiling SuMoth Manufacturing Prize – €500
- Foiling SuMoth Performance Prizes – €700 / €500 / €300
- Foiling SuMoth S2 Communications Prize – €500

15.5.3 S3 Stage

- Foiling SuMoth Speed test Prize – €500
- Foiling SuMoth Fleet Race Prize – €500
- Foiling SuMoth Overall Winners (top 3) – €700 / €500 / €300
- Foiling SuMoth Communication Prize – €500

16 CALCULATION EXAMPLE

The following example is an estimate calculation of a potential Foiling SuMoth, considering the "Standardize cost" tables. The calculation considers the real amounts used to produce the part, including scraps.
Consumables are not considered in the calculations of the manufacturing for this case.

16.1 Hull

The hull will be manufactured in a positive geometry using wood stringers and bulkheads with fiberglass/epoxy lamination and recycled PET core reinforcements, of which:

Item	Qty.	Cost in SM$
Wood	8 kg	0
E-Glass	5kg	120
Bio-based Epoxy	6 kg	90
PET core	2 kg	30
Total		**270**

16.2 Appendages

16.2.1 Main foil and vertical

Item	Qty.	Cost in SM$
Tooling board	20 kg	400
CNC machining	20 h	800
Dry fabric CF HM	2 kg	500
Bio-based Epoxy	2 kg	30
PET core	1 kg	15
Stainless accessories	0.5 kg	15
Total		**1760**

16.2.2 *Rudder and vertical (same mold from main)*

Item	Qty.	Cost in SM$
Tooling board	10 kg	200
CNC machining	10 h	400
Dry fabric CF HM	2 kg	500
Bio-based Epoxy	2 kg	30
PET core	1 kg	15
Stainless accessories	0.5 kg	15
Total		**1160**

16.2.3 *Trampoline*

Item	Qty.	Cost in SM$
Bamboo	10 m	0
Flax tow	40m	0
Std Mach2 tramp.	2	300 (USD)
Stainless accessories	2 kg	60
Total		**360**

16.3 Rig

16.3.1 *Sail*

Item	Qty.	Cost in SM$
Used Mach 2 sail	1	500 (USD)
Total		**500**

16.3.2 *Mast*

Item	Qty.	Cost in SM$
Alu conical mandrel	8 kg	80
Dry T800 CF	2 kg	400
Bio-based Epoxy	2 kg	30
Total		**510**

16.3.3 *Boom*

Item	Qty.	Cost in SM$
PET core	1 kg	80
Dry T700 CF	1 kg	150
Bio-based Epoxy	2 kg	30
Total		260

16.3.4 Shrouds/stays/adjusters

Item	Qty.	Cost in SM$
Stay	1	100 (USD)
Shrouds	2	200 (USD)
Adjusters	3	100 (USD)
Total		400

16.4 Control systems

Item	Qty.	Cost in SM$
Blocks	-	500
Tiller ext	1	100
Ropes/lines	-	200
Wand + ctrl. sys.	1	100
Total		**900**

16.5 TOTAL

Item	Cost in SM$
Hull	270
Appendages	3280
Rig	1760
Control systems	900
Total	**6210**

17 APPENDIX A – Team structure example