**Engineering technical data**

**A little bit of theory**
There are three types of resistances acting on our boat: aerodynamic resistance, wave drag and viscosity. The first is <4% of the total resistance so we can neglect it. Viscosity is estimated with $R_V = \frac{1}{2} * \rho * v^2 * C_V * S$ where $C_v = C_F(1+K)$; and we use the empirical formulas $C_F = \frac{0,075}{[\log_{10} R_e - 2]^2}$, $K = 19\left(\frac{V}{Lw^2 H}\right)^2$ and the Reynold's number $R_e = \frac{Lw * v * \rho}{\mu}$ .
S is evaluated using the Mumford expression:

$$S = 1.7 * Lw * H + \frac{V}{H}$$

where Lw is the water line length, H the draft and V the water volume displaced.
Resistance can now be computed fixing the trimaran's length and velocity.

In multihulls boat wave drag depends on the hull's configuration and is indicated with the coefficient $C_w$. With reference to [1] we designed our trimaran to minimize $C_w$; but in our case, minimizing the resistance would result in a smaller quantity of plastic collected because it would be deviated away from the side hulls. Therefore we decided to make a compromise setting:

0.15 < b/L < 0.25
a/L = -0.25.
0.0008 < $C_w$; < 0.0012

Now that we have the wave drag coefficient we can calculate $R_w$ given the size of the trimaran:

$$R_W = \frac{1}{2} * \rho * v^2 * C_W * S$$

We must consider the viscosity of the nets $R_{net}$as well. Here we calculate the resistance coefficient $C_{net}$ with Reynolds number of the net and its solidity. In our case, we decided to fix the thickness of the twine to at least 1mm and the mesh to 1 mm as well. This results in a solidity of 0.36.

$$R_{net} = \frac{1}{2} * \rho * v^2 * C_{net} * S_{net}$$

As of the size of the nets, we decided to place them 0.5 meter deep in order to avoid interfering with the aquatic ecosystem. In addition to this, we set the velocity of the trimaran relative to the plastic to so that the waves inferred do not disturb the fauna nor push away the pieces of plastic: we estimated that the maximum velocity during the collecting phase is about 2 m/s.

This results in:
-an effective collecting area of at least 10 meters
-central hull length of 25 meters
-side hull length of 12.5 meters
-central hull width of 3.5 meters
-side hull width of 0.5 /1 meter

The trimaran's mass is estimated according to other size-like trimarans and with the principle of Archimedes we calculated the displaced volume and with that the draft of the hulls.

**Now you can take a look at the MATLAB code!**