



Samudra

DESIGN OF ELECTRIC BOAT WITH AUXILIARY SOLAR POWER

A Leisure Boat for Calm Waters

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IDC IIT Bombay

DESIGN OF ELECTRIC BOAT WITH AUXILIARY SOLAR BOAT

A Leisure Boat for Calm Waters

Design Project - I:
Samudra Shipyard (P) Ltd.

Guide:



Submitted By

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DECLARATION

I declare that this written report represents my own idea in my own words, and where others, ideas or words have been included, I have mentioned the original source. I also declare that I have adhered to all principles of academic honesty and integrity and have not falsified, misinterpreted or fabricated any idea, data, facts or source in my submission. I understood that any violation of the above will be cause for disciplinary action by the institute and can also penal action from the source from which proper permission has not been taken, or improperly cited.

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Sign :

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I specially thank Mr. Unni Mohan for his inputs and feedback on the project.

Prakash Sonkamble
Date:- 5th July 2016

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SAMUDRA SHIPYARD (P) LTD.

Established in 1991, Samudra Shipyards (P) Ltd. is India's No.1 fibre glass boat building company. It is known for its lasting boat building technology. Unlike others, Samudra Shipyards designs and manufactures their composite boats up to 34m in length for travel, tourism, defence and fishing. It also manufactures water sport equipments, marker buoys and other marine related products.



EXPERIENCING WATERWAYS

Backwaters of Kerala

To understand waterways and the means of water transport in Kerala, we set on to experience it. As a part of it we have travelled on different boats via National waterways. Mainly the districts of Alappuzha, Kottayam, Kollam, Ernakulam and Kannur are well connected by inland water ways which has frequent water transport facilities. Government run different kinds of boats depending on the distance and the demand of the particular route for an affordable price. They vary from single deck to double decked boats.

Apart from public transport, leisure boats are very popular in Kerala. Tourists from around the world enjoy taking these rides. Even local people show lot of interest in leisure rides now and then. Shikara, Hop on Hop off, House boats are few types that are popular for leisure rides within inland waterways. Samudra Shipyard have given us a chance to experience Canoe, Row boat and also an exclusive 'Kopra Vallam' day cruiser ride.



Kerala Shikara Boat



Kerala Shikara Boat

Kerala Shikara: Sightings from the trip



An 8 Hour Trip: Alappuzha - Kollam

As the water is calm all the boats are limited by speed and are not allowed to travel more than 6 knots. This is to avoid accidents due to the waves of any speeding boat. Water transport here is very slow. The route from Alappuzha to Kollam by road takes 2.5hrs where as by boat it takes 8hrs. As the journey is slow we found that very few local people use it for proper commute and it is mostly considered to be a leisure for tourists. The is generally a non-stop trip but we have observed people getting down at an intermediate stop. Just like road ways they have stops at various points that connect major places of the district. The image of the boat and stop are shown above.



Govt. boat(double deck) for the route Alappuzha to Kollam



an intermediate stop



upper deck of the boat



lower deck of the boat

House Boats

House boats of Kerala are famous world wide and attract tourists every year. These are for long backwater cruise and the size and design varies from boat to boat. The visual design which uses bamboo and cane represents the tradition of Kerala. The design of the hull makes it a capable for accommodating large number of people. Operators demand for the size and design as per their requirement. They are big enough to have bedrooms(mostly air conditioned), bathrooms, hall and even a kitchen. Few of them are double decked and in such a boat the upper deck is used as a party space.



medium sized house boat with upper deck



luxury house boat



dinning and hall area in a house boat



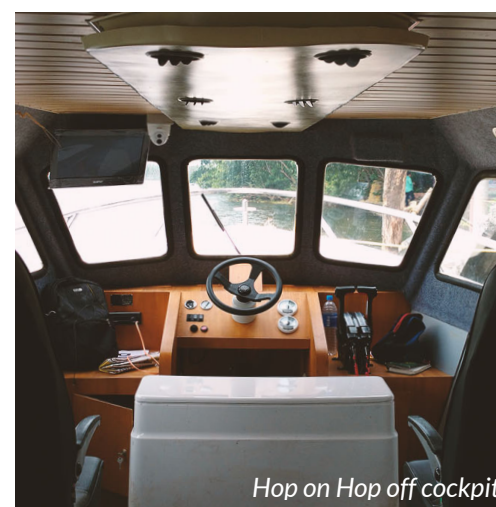
kitchen room in a house boat



bedroom(air conditioned & attached with bathroom)

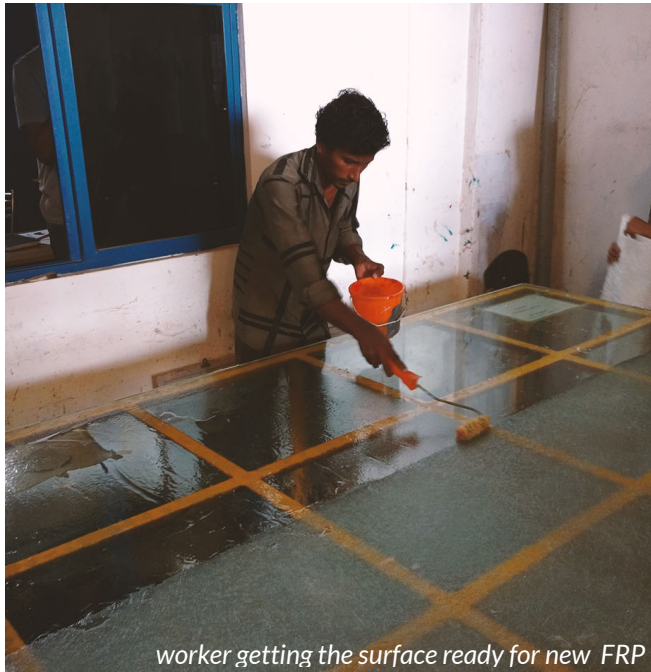
Hop on Hop Off

Hop on Hop off is an other different experience that we had. This trip starts from kochi and takes us around all the tourist spots. It is an 5 hour long trip. It is called Hop on Hop off because you get in and out more often than in other boats. This time the boat air conditioned and is more like a tempo van on water. And interestingly we found that these boats are manufactured by chopping the body of a tempo travellers. The design of the hull is more flat at the bottom. Unlike other boats this boat doesn't get deeper into the water and the current takes it away easily. So once the engine is turned off, it keeps sliding on the water surface.

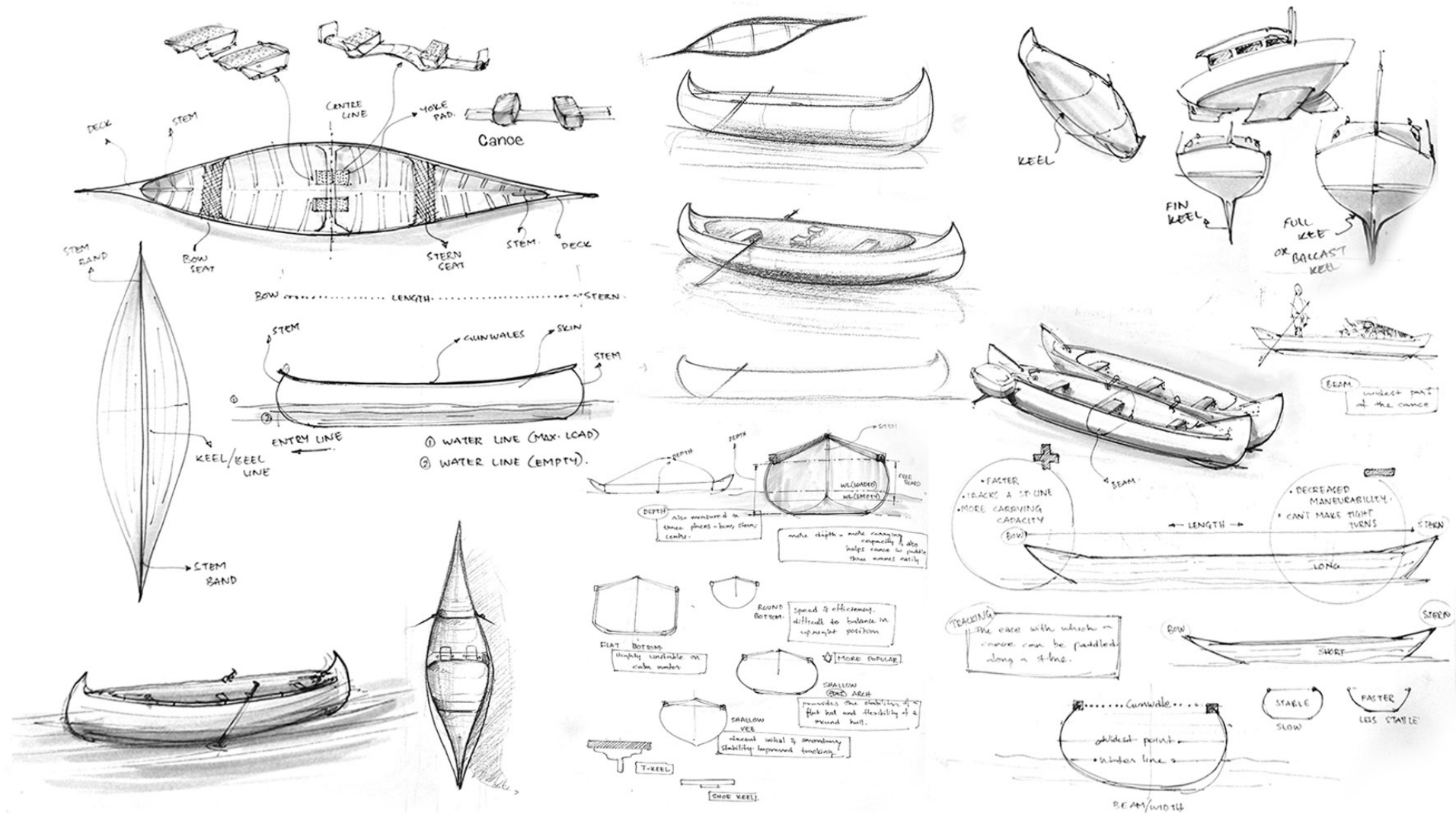


The Industry

As samudra is known for its composite boat building techniques in manufacturing, we got an opportunity to take a closer look at how things are made. There are many ongoing projects like 'Kopra Vallam' a day cruiser, fire fighting boat for Sri Lank Govt. and many such other projects. FRP(Fibre Reinforced Plastic) is widely used in manufacturing the boats. They design the boat then make a mould out of wood which is later used for making the parts. FRP is sandwiched with resin combined with hardener and the let to dry. A gel coat is applied as a last layer which gives the part a glossy look. Generally to save time and manufacturing costs, it is applied only on the outer surfaces of the parts.



Travel Sketchbook





Leisure Boat



20 – 40 Minutes



4 to 5 Maximum
Includes Driver



Electric

THE PROJECT

Design Brief

To design an electric boat with auxiliary solar power for leisure trips in calm waters. It can carry 4 to 5 people at a time and does not need an experienced driver.

Further Observations

From our initial study and our own experience we came to know that tourists are very much interested in leisure boats. Next to Shikara and such leisure cruise boats, they also like taking short rides in small paddle and row boats. These boats allow them to ride the boats on their own.

We have also observed that resorts with backwater contact are using such small boats to attract customers. From small to large and luxury resorts promote these boat rides as an exclusive feature. And they are continuously looking to introduce new trends and options available in the market that seem interesting to the customers.

A self driven electric boat has lot of potential for attracting customers. As boats stay outdoor taking sunlight all day, providing auxiliary solar power can benefit it. They can be fully charged at night which makes it ready for the next day as boating is not allowed after 6pm. Slow moving boats are good for sight seeing and give the customer a confidence that it can be controlled.

- There are more than 70 resorts with backwater contact.
- As of now few of these resorts provide paddle and row boat rides for their

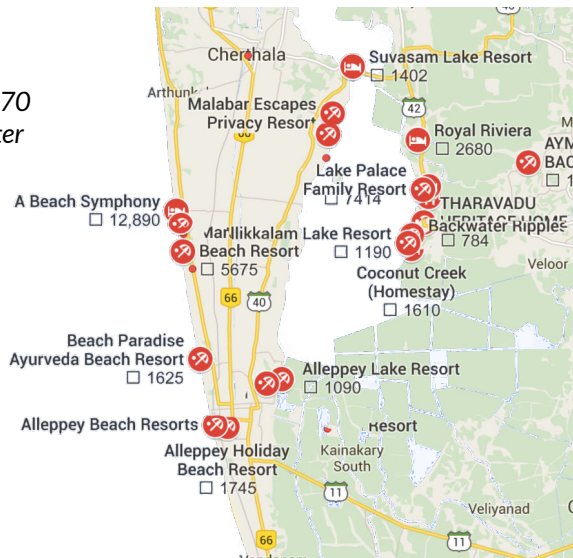
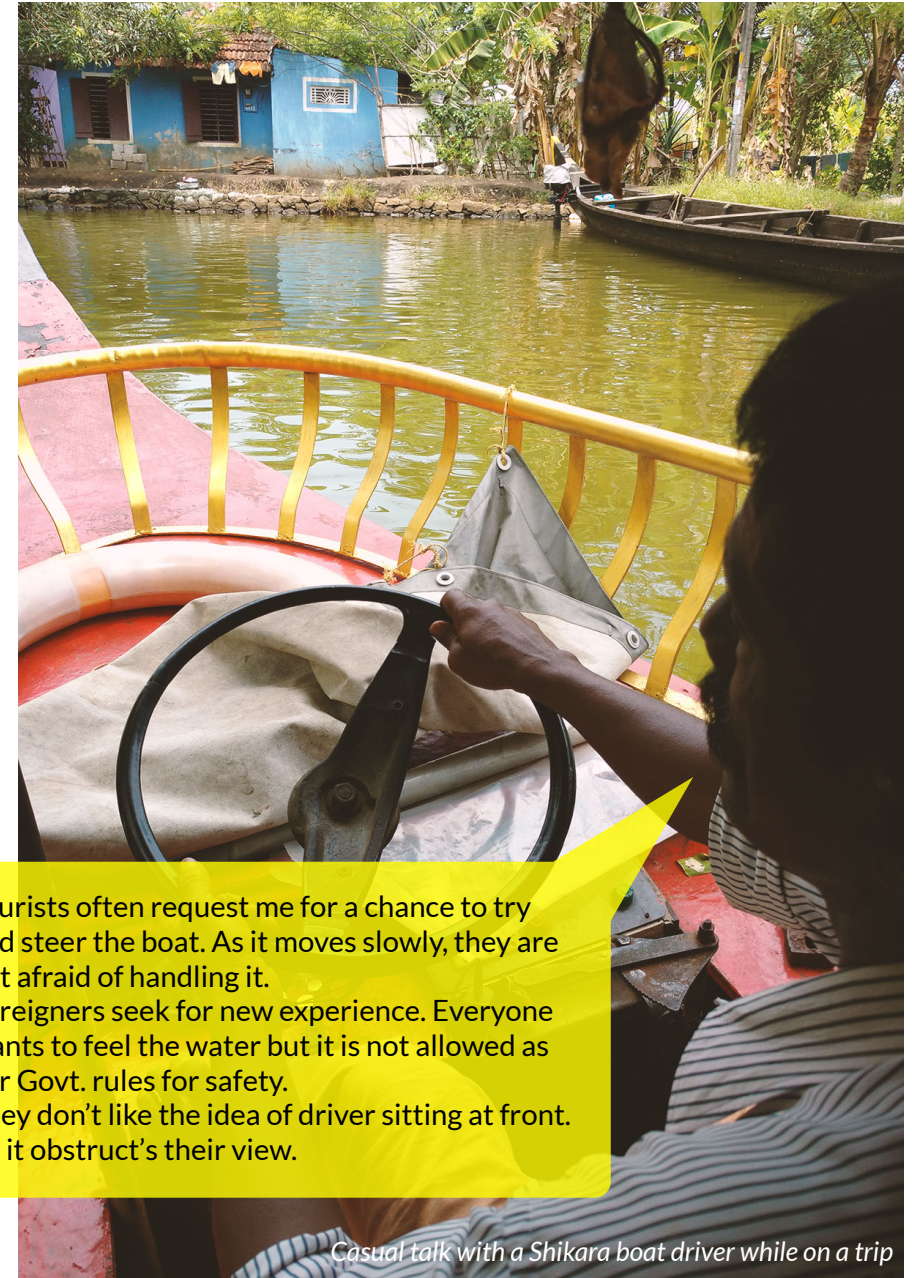


Image Ref. : Google Maps



- Tourists often request me for a chance to try and steer the boat. As it moves slowly, they are not afraid of handling it.
- Foreigners seek for new experience. Everyone wants to feel the water but it is not allowed as per Govt. rules for safety.
- They don't like the idea of driver sitting at front. As it obstruct's their view.

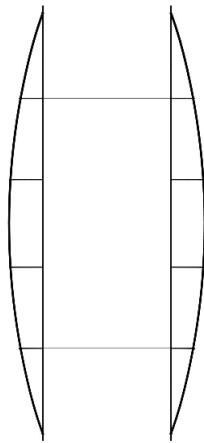
Casual talk with a Shikara boat driver while on a trip

Understanding the Hulls

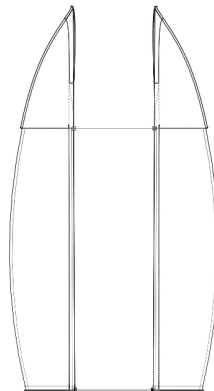
Hulls define the way a boat behaves on water. As described earlier with Hop on and Hop off (*page: 7*) shape of the hull is one important factor that decides the performance of the boat. As canoe's and row boats are widely available we started to study their hulls.

Canoe's contact area with water is more as they have a 'Displacement' hull. As a result they are stable and capable of carrying heavy loads. An 18ft long canoe can carry approx 400 kilos of payload. But because of the same reason, they are vulnerable to wind. On the other hand, row boats have a 'Deep Vee' hull and are good for speeds and smooth rides. But because of that, they might bank while taking turns.

After experiencing both, we thought of going with a catamaran design by splitting the boat into two. This gives us a wide floor to play and added stability. By doing this we can comfortably let four to five sit on it. As catamaran design is rarely used for leisure trips, it can be a new interest for people. It can also be easily manufactured by splitting the current boat moulds into half. Which also reduces the manufacturing cost for the company.



Canoe based Catamaran



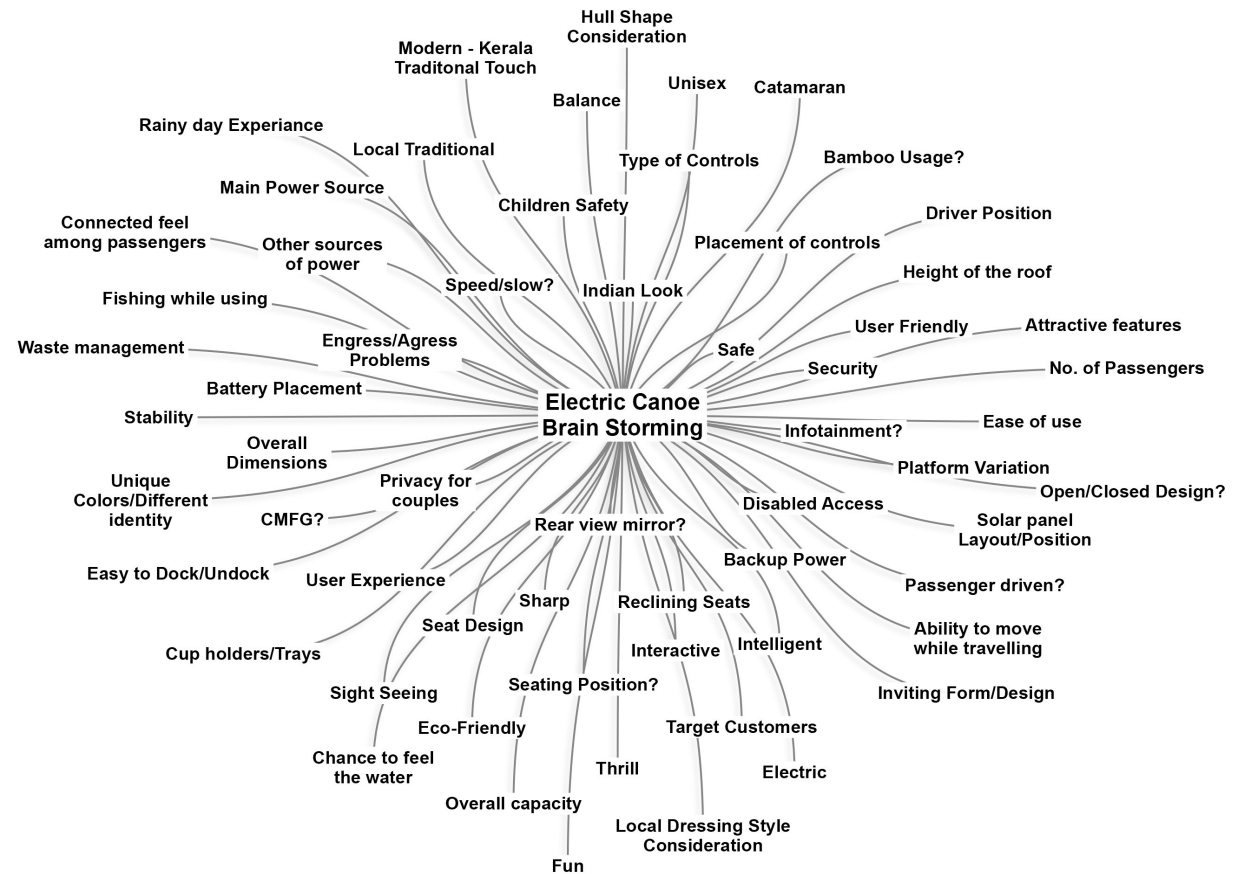
Row Boat based Catamaran



Brain Storming

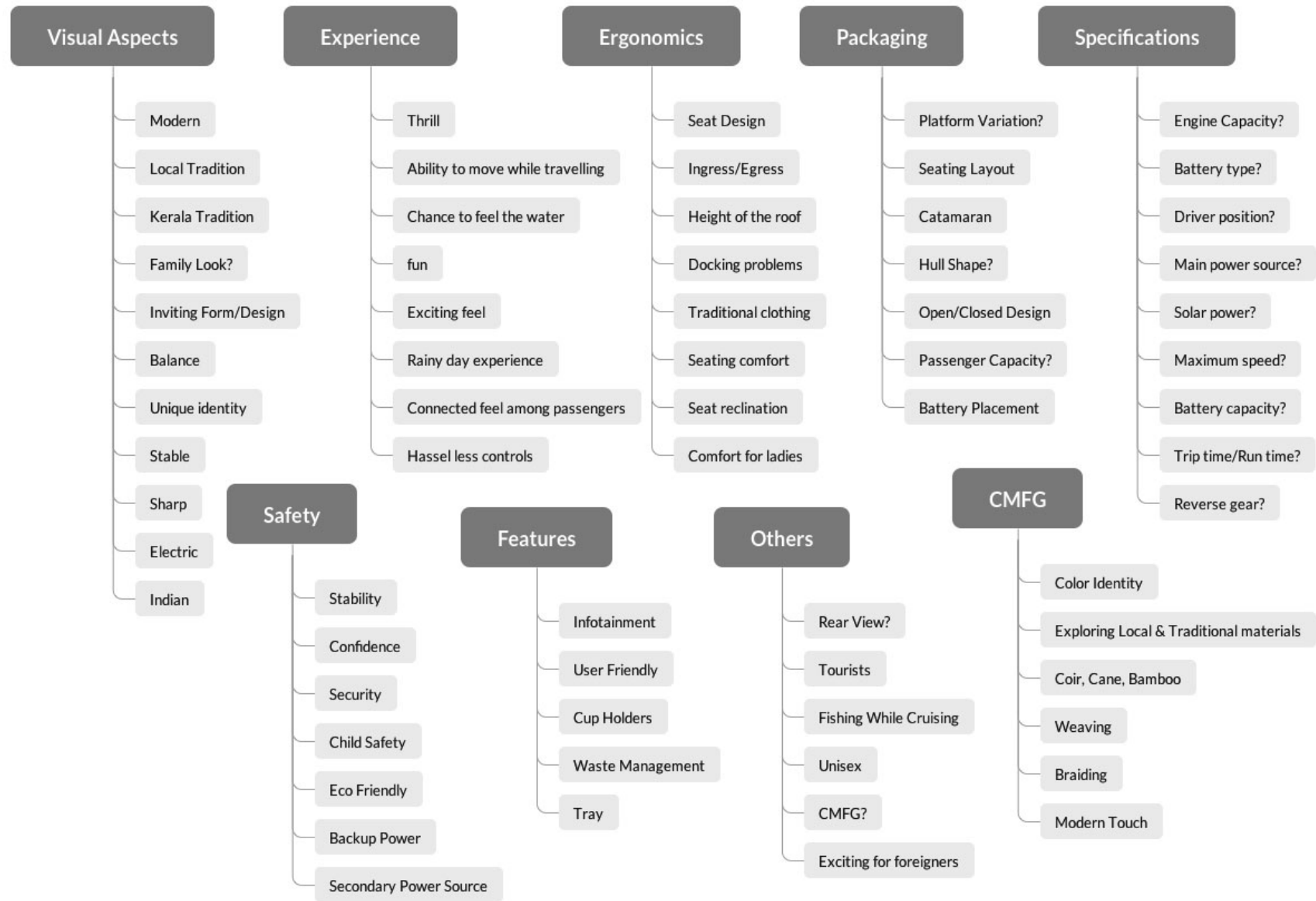


Brain storming at Samudra

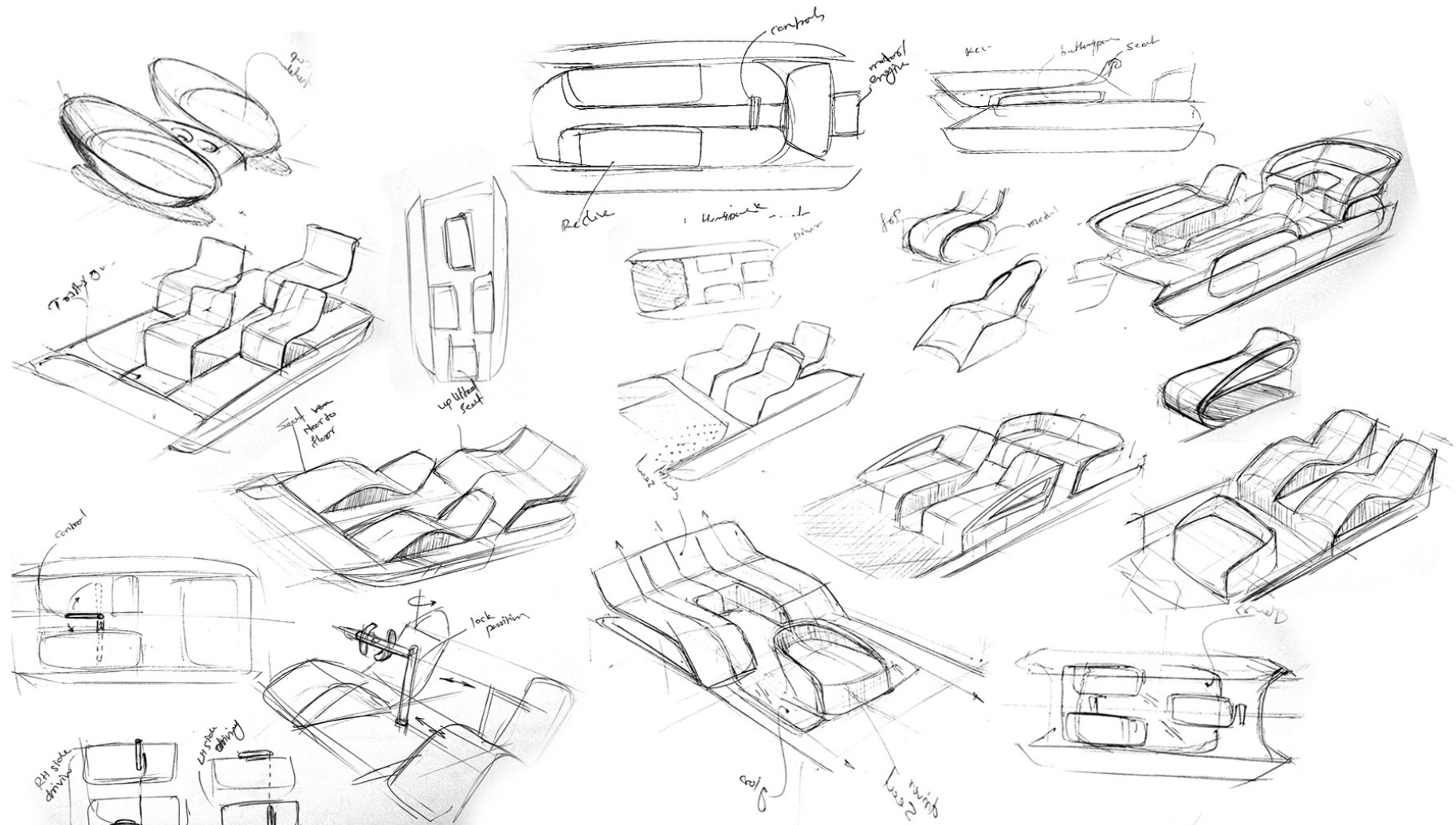


Once we have decided on catamaran design, we had a brainstorming session which gave us some interesting keywords to take forward.

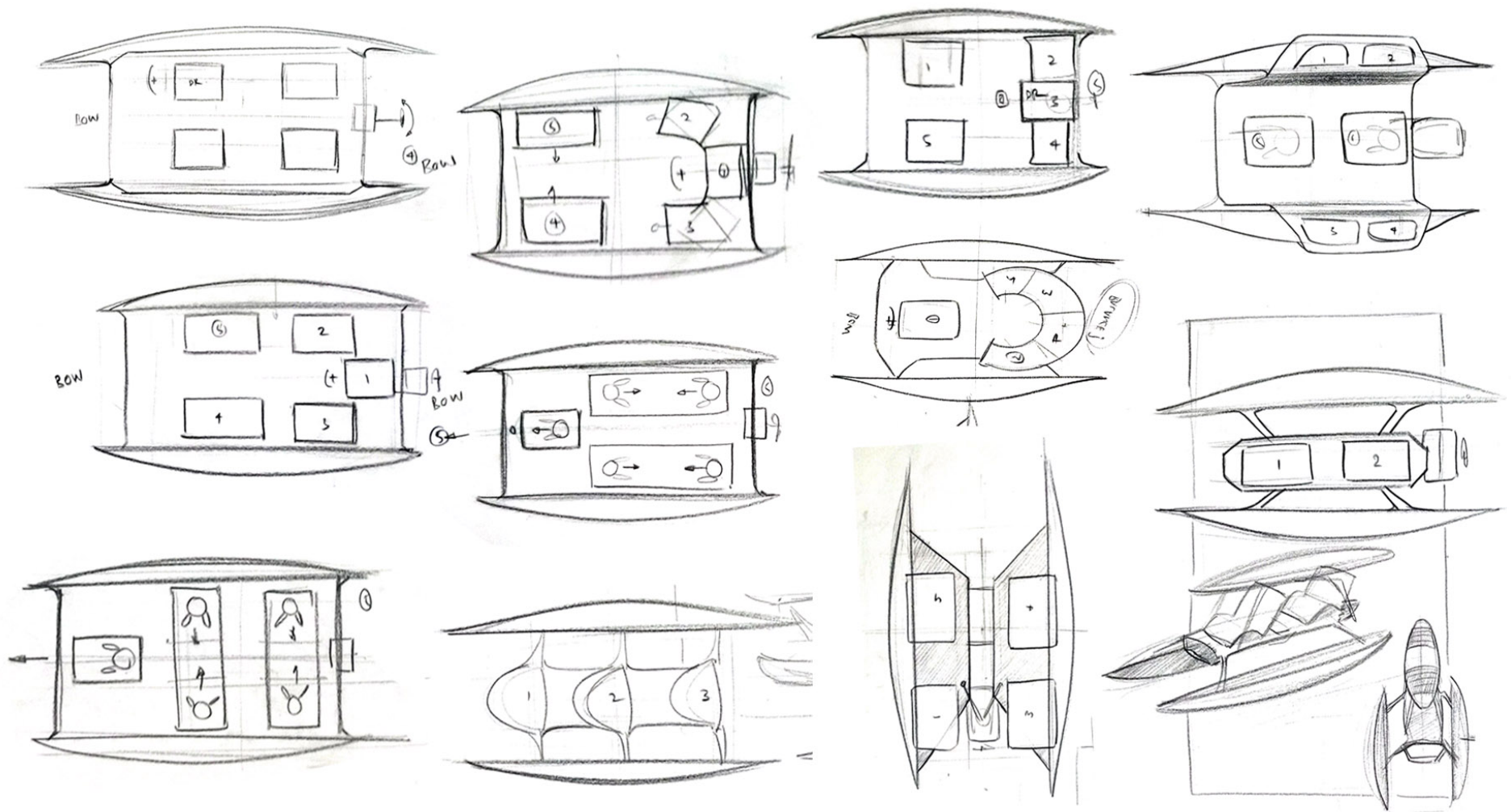
Grouped keywords



Packaging Ideation



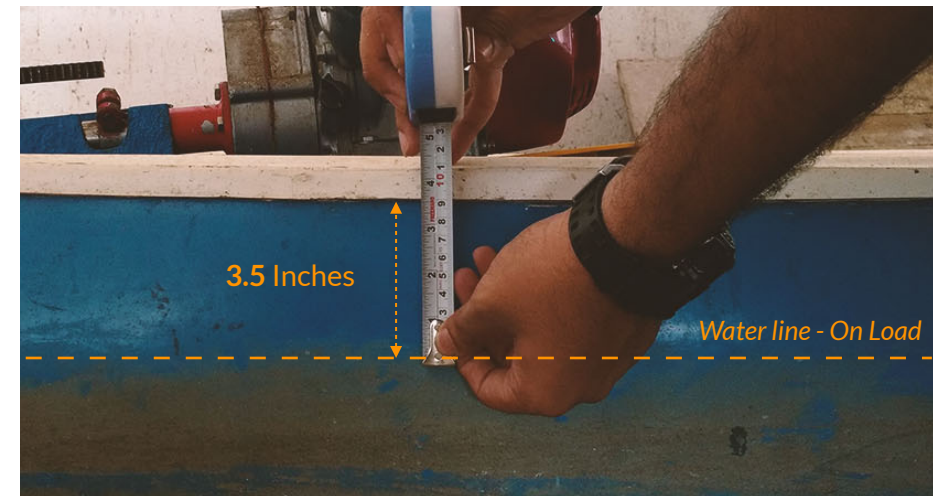
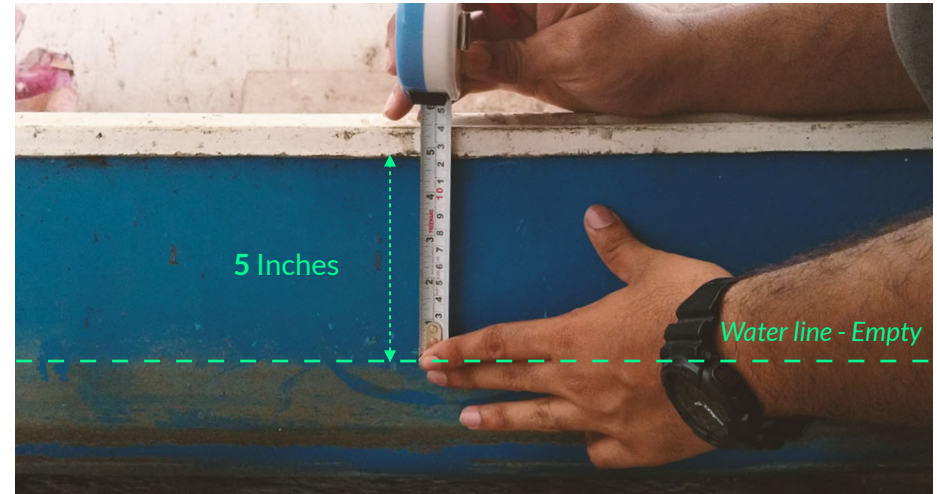
Ideation for packaging was done considering that the boat can carry 4 to 5 people at once



At this point, we have decided to make a mock up model to find out the best layout and packaging configuration.

Making of The Mock Up Model

With the resources we have, we started building a mock up models to feel the scale. This will also give us a chance to play with the layout and find various dimensional values.

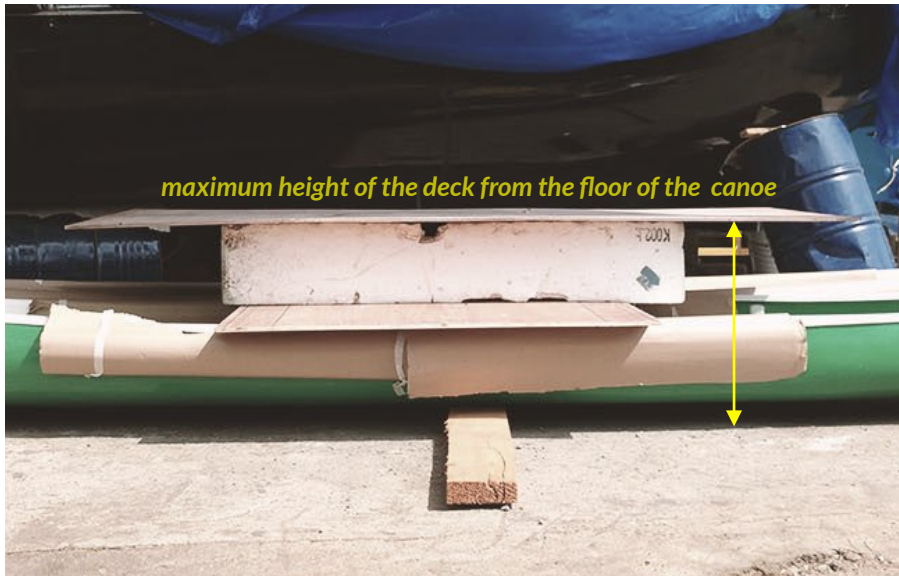


The water line distance from the gunwale for the canoe for both loaded and empty was calculated by taking the dirt on the side surfaces as a reference.

This helped us in deciding the height of the deck. If we directly make the platform on top of the canoe, it makes the entire deck close to the water once it is set in the water. Adding height also helps the algae or any plants pass through easily under the boat.



First mock up with 18ft canoes



After deciding on the deck height, we started mocking the roof to determine the best height for the design





We have asked people of different height to get in and out to check wether it is comfortable or not. Based on the feedback we got the final height of the roof was decided.



Mock up with height of the roof fixed



Mock up for finding the dimensions of the deck



Checking the deck with four occupants



Arrangement showing four occupants sitting comfortably.



Mock up with a row boat



Unlike canoe based catamaran, here Occupants are placed very close to each other. Usually, row boat is comfortable for 2 to 3 people. By splitting the boat we can let 4 people comfortably sit in it. But the problem is, that the occupants sitting in the front row face slight discomfort due to the sloping floor. An alternative should be provided to overcome this.

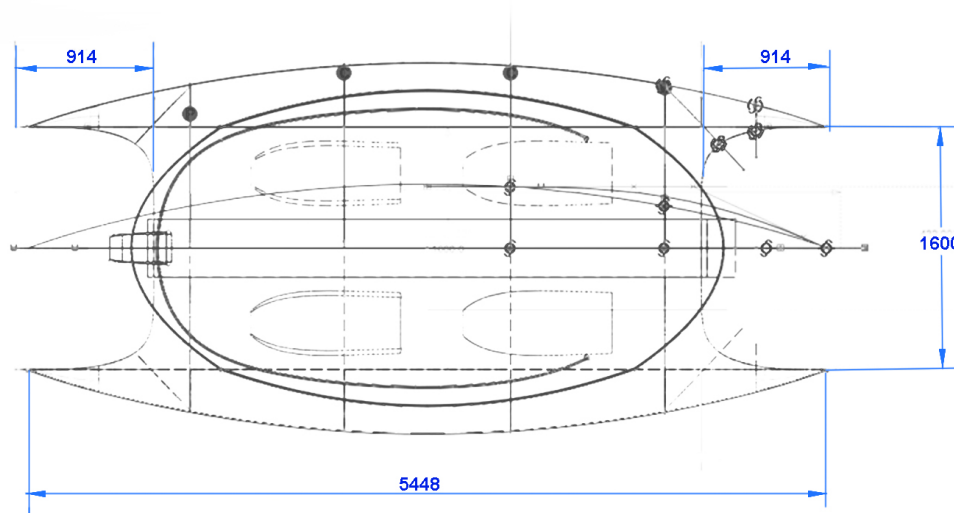
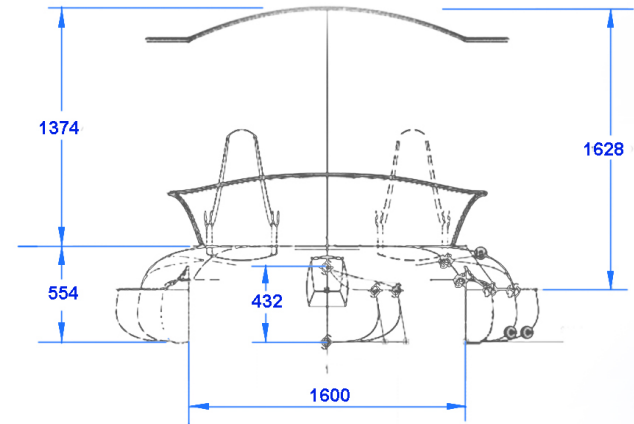
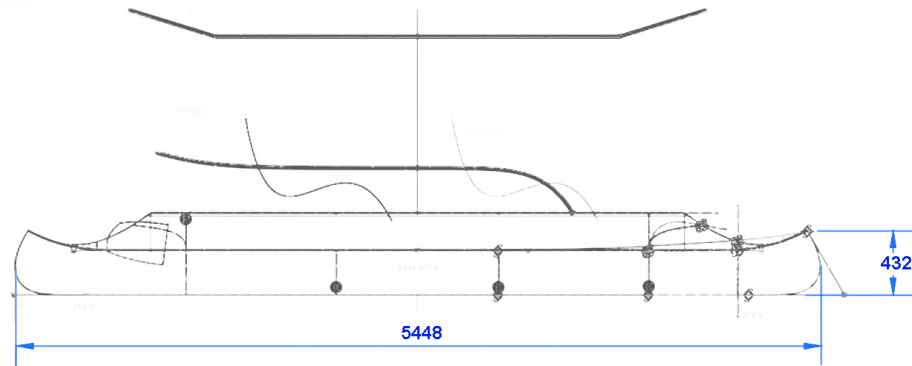


Uneven floor of the row boat



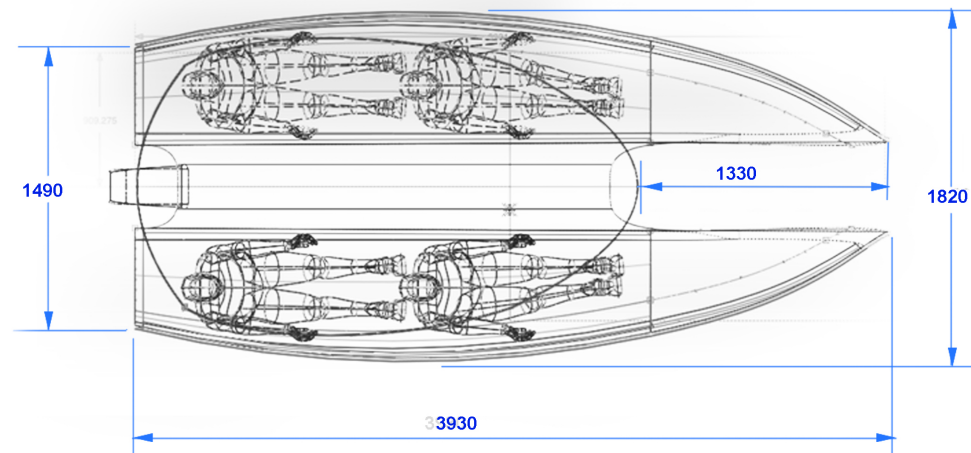
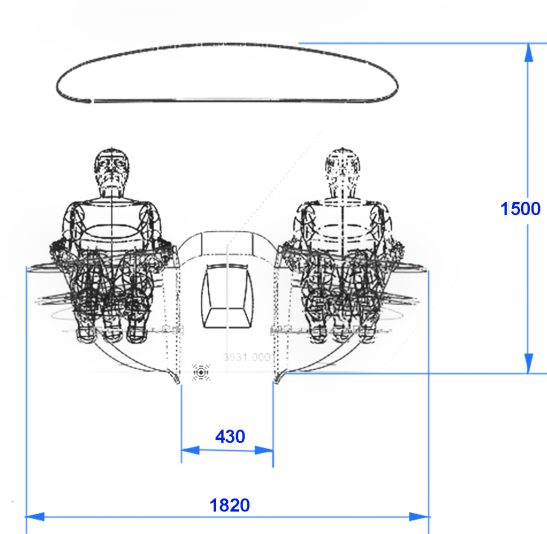
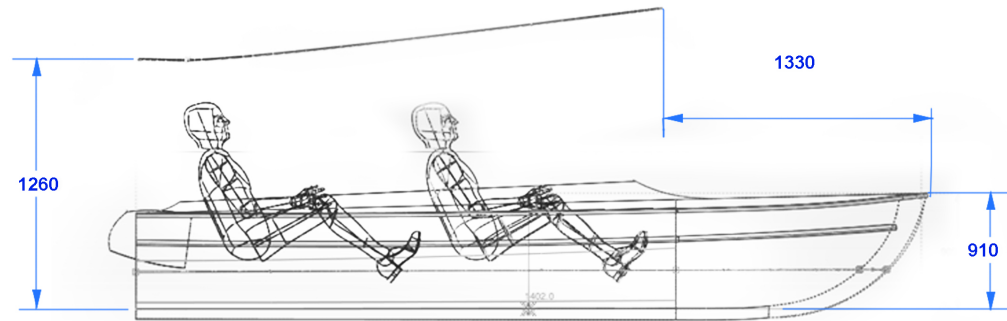
Dimensions Determined

By using the mock up model we have determined the dimensions of the basic boats as shown below,



DIMENSIONS FOR CANOE BASED DESIGN

ALL DIMENSIONS ARE IN MM



DIMENSIONS FOR ROW BOAT BASED DESIGN
ALL DIMENSIONS ARE IN MM

Investor Review

After determining the dimensions and other important factors for both the platforms, we found both to be equally interesting to work. To get out of the confusion on which one to take forward the project was presented to the investor for a review. To make it clear for the investor, we have made quick 3D models for both the platforms and got them rendered.



According to the investor, canoe platform looks more pleasing and safe. To him canoe platform looks stable as it has a wider base. He is also concerned about the passengers sitting close to the water in the row boat platform. Speaking about the investment, he is in more favour of canoe platform as it is less expensive than row boat to manufacture.

So, from the review we have come to know that the investor is interested in canoe platform based design.

Potential User Reviews

After listening to the investor, we tried to get the views of different people. We showed them the same images and asked few questions.

No. of users reviewed : 25
Female : 9
Male : 16



Boat I
Canoe Based



Boat II
Row Boat Based Design

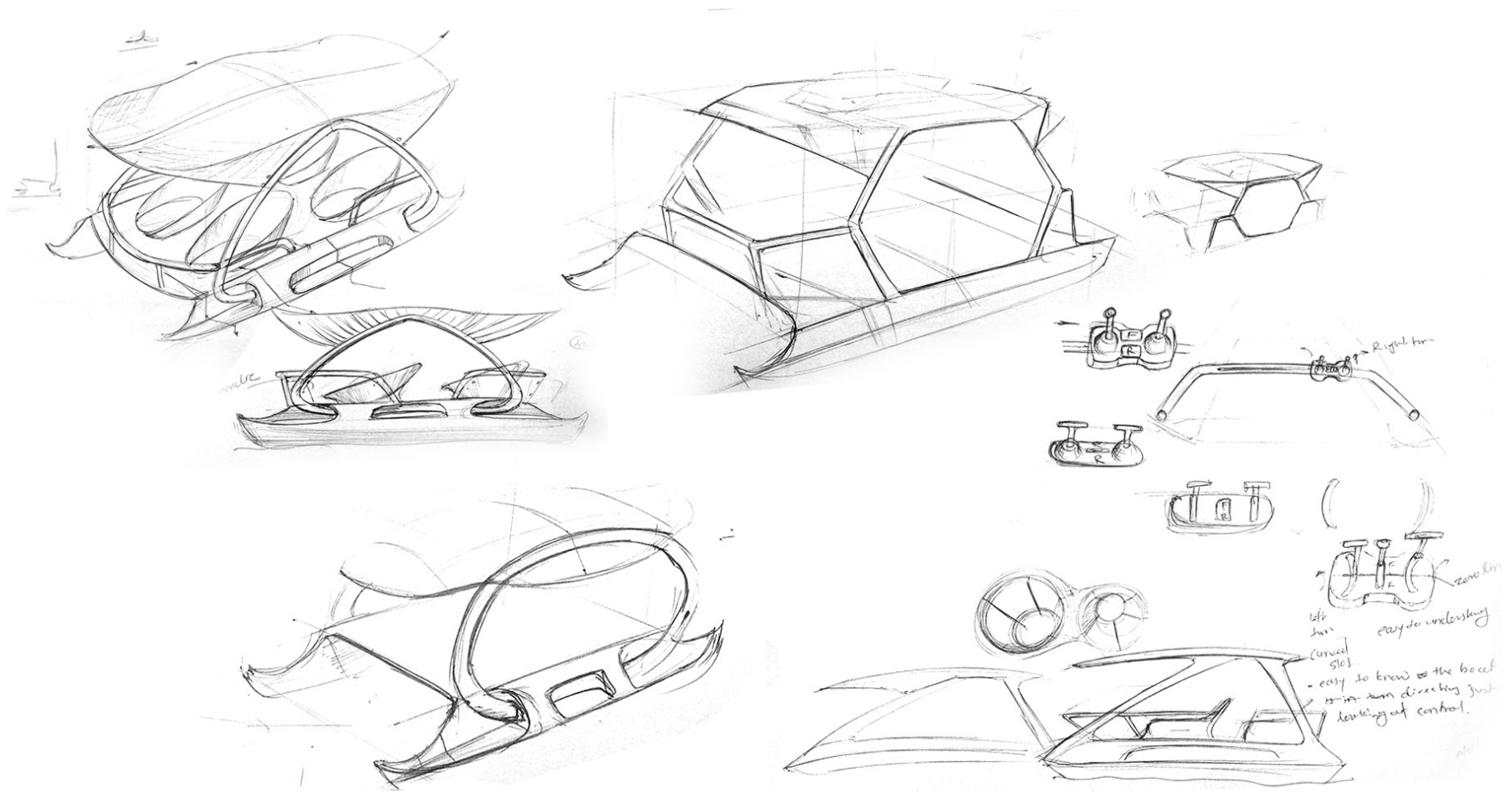
	Boat I	Boat II
Which one do you like the most?	65.7% <div><div></div></div>	34.3% <div><div></div></div>
Which one looks more safe to you?	45.7% <div><div></div></div>	54.3% <div><div></div></div>
Which one looks more safe to travel with children?	42.9% <div><div></div></div>	57.1% <div><div></div></div>
Which one would you pick for a ride with your family?	57.1% <div><div></div></div>	42.9% <div><div></div></div>
	YES	NO
Would you like to sit close to the water while travelling in a boat?	88.0% <div><div></div></div>	12.0% <div><div></div></div>

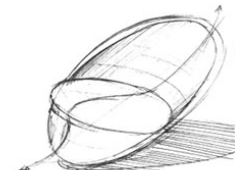
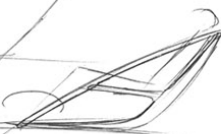
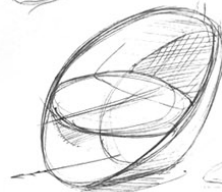
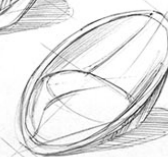
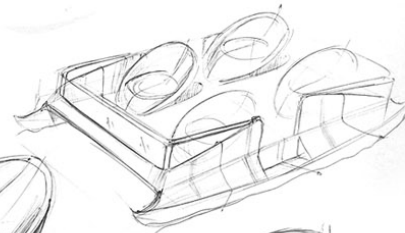
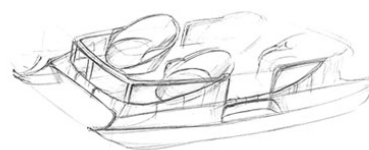
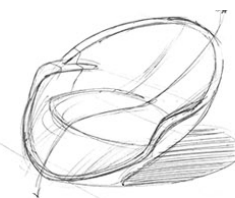
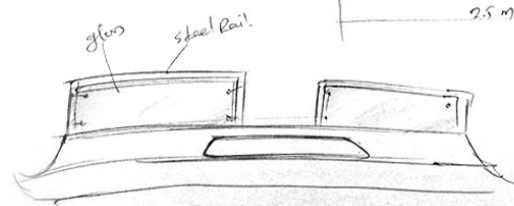
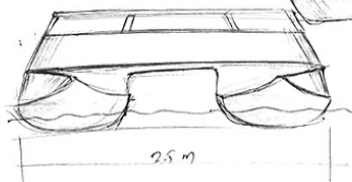
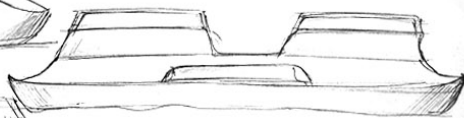
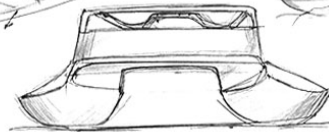
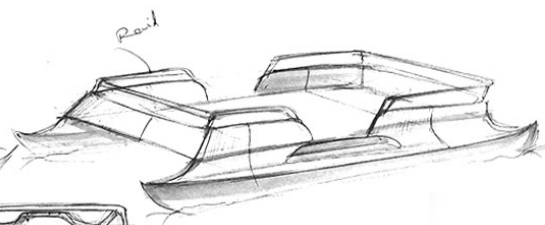
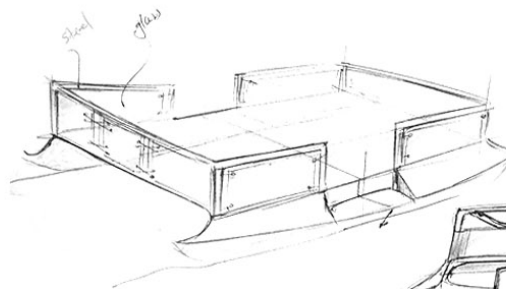
Surprisingly, the results were not in favour of investor any more. After speaking to the users, we got mixed views on both the boats as shown above. After speaking to the users about the designs, we have observed that most of them like 'Boat I' but thinks that 'Boat II' is safe. This might be because of the surrounded feeling they have in boat II. People even liked the edgy design of boat II.

So from the review, we found that users are looking for safety, comfort, and a nice experience. They need to feel protected and confident while in the boat. As it is self driven boat, they want the controls to be user friendly.

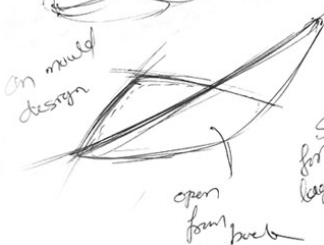
With this, we have decided to take forward canoe platform based design forward keeping all the things observed in mind.

IDEATION



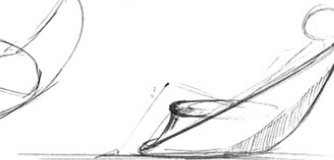


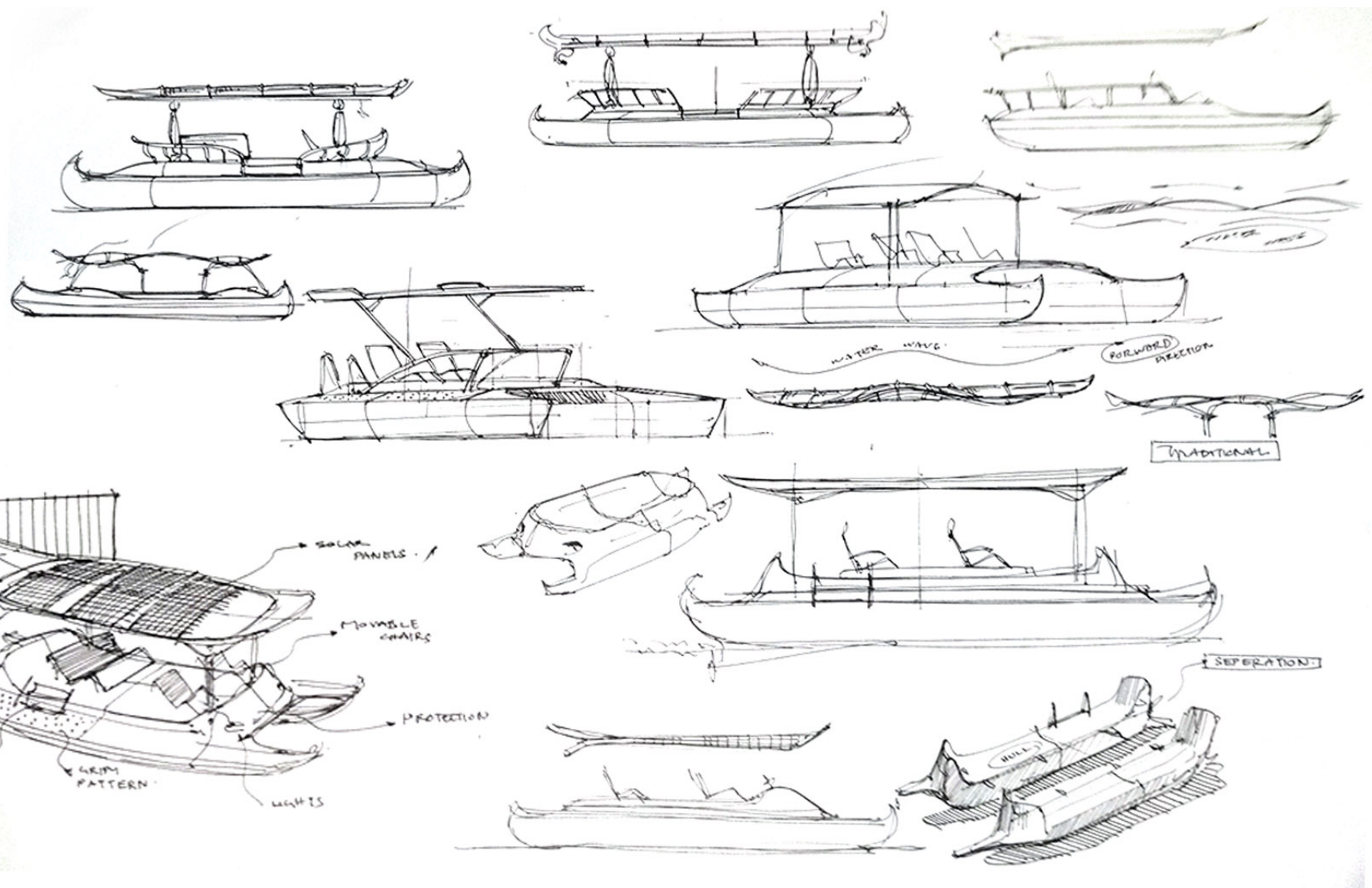
on mould design

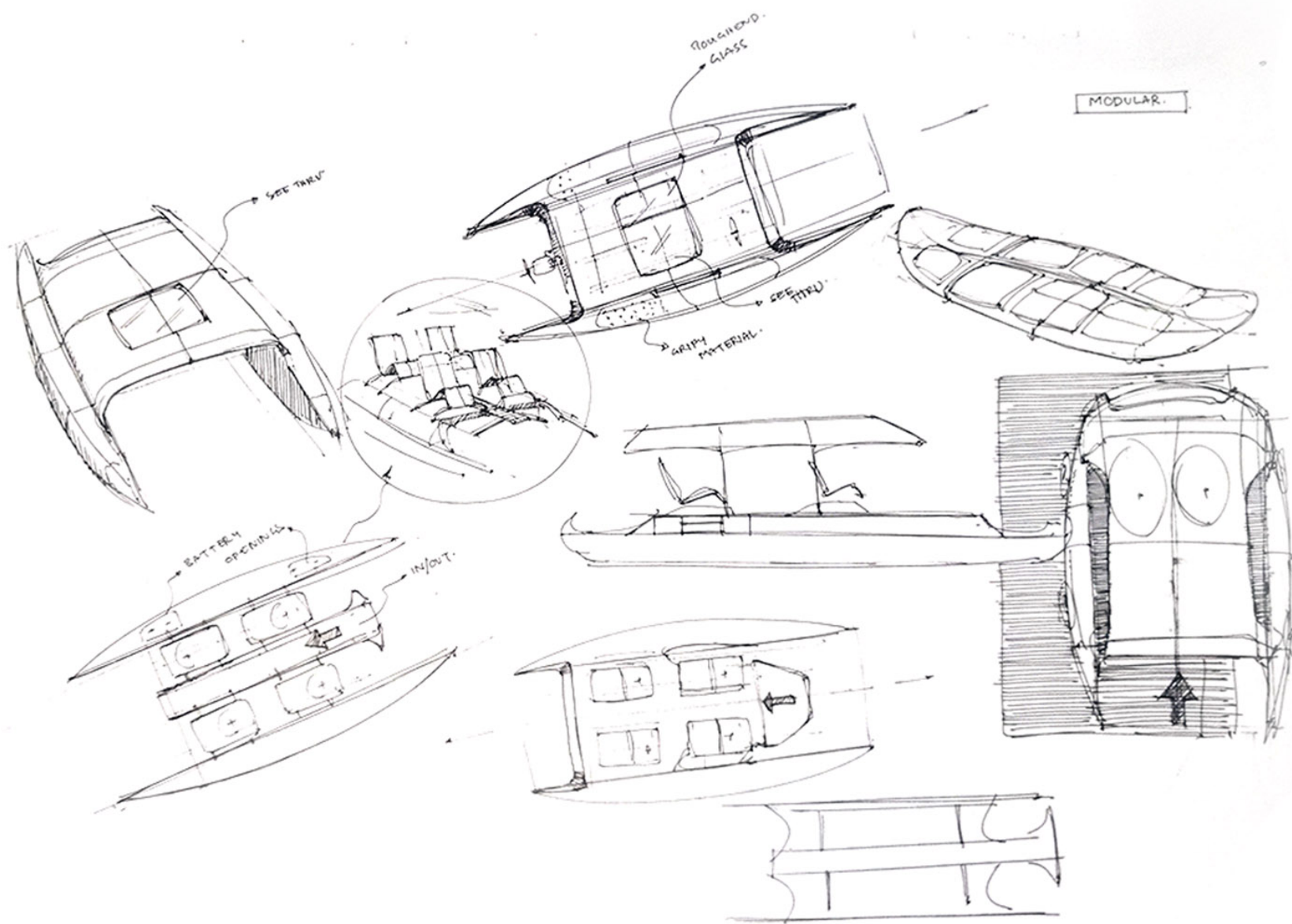


open form

space for luggage



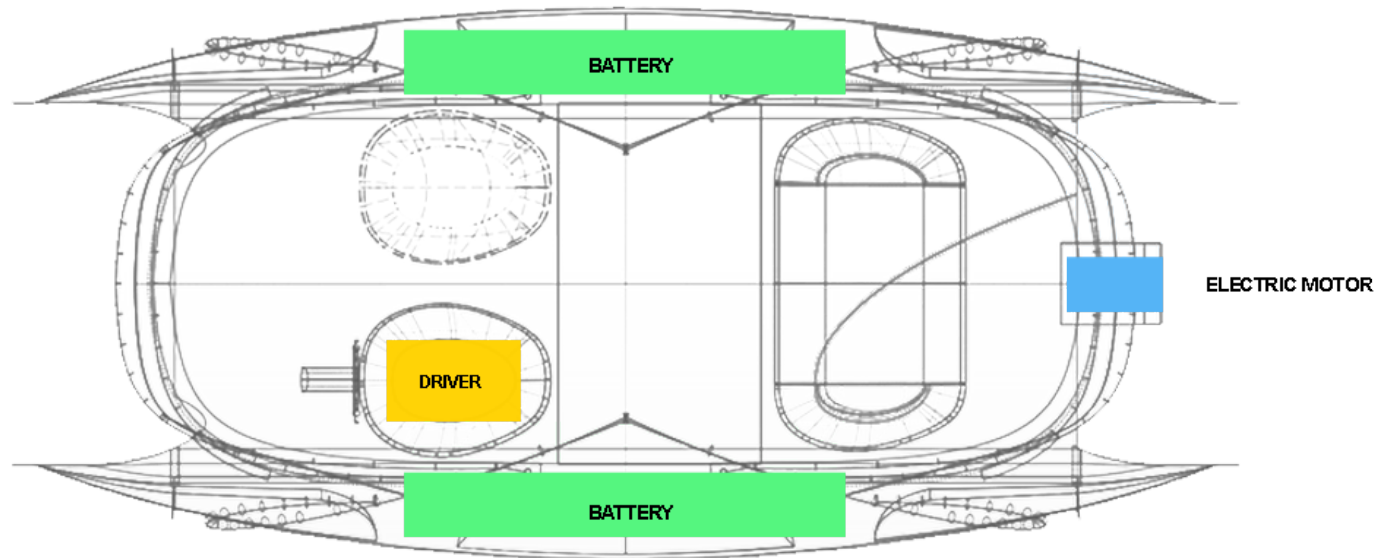
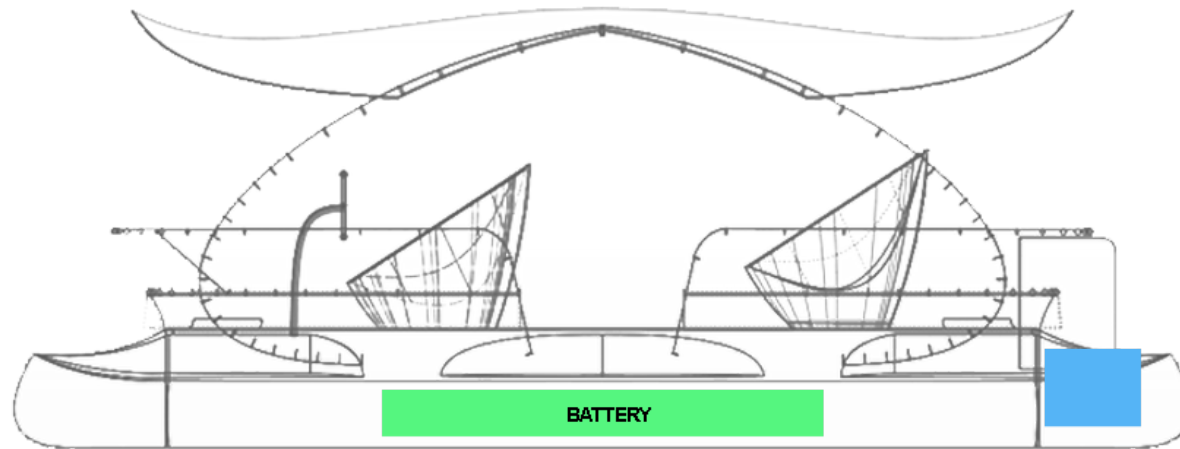




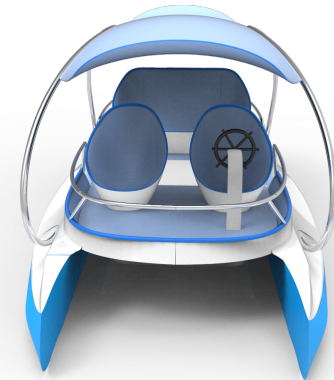
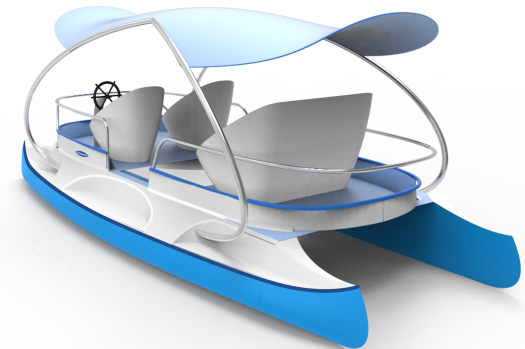
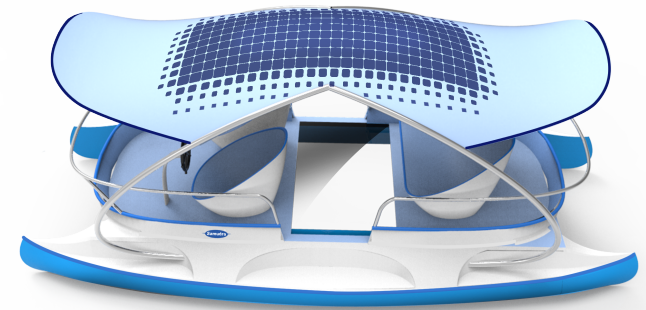
FINAL CONCEPTS

CONCEPT I



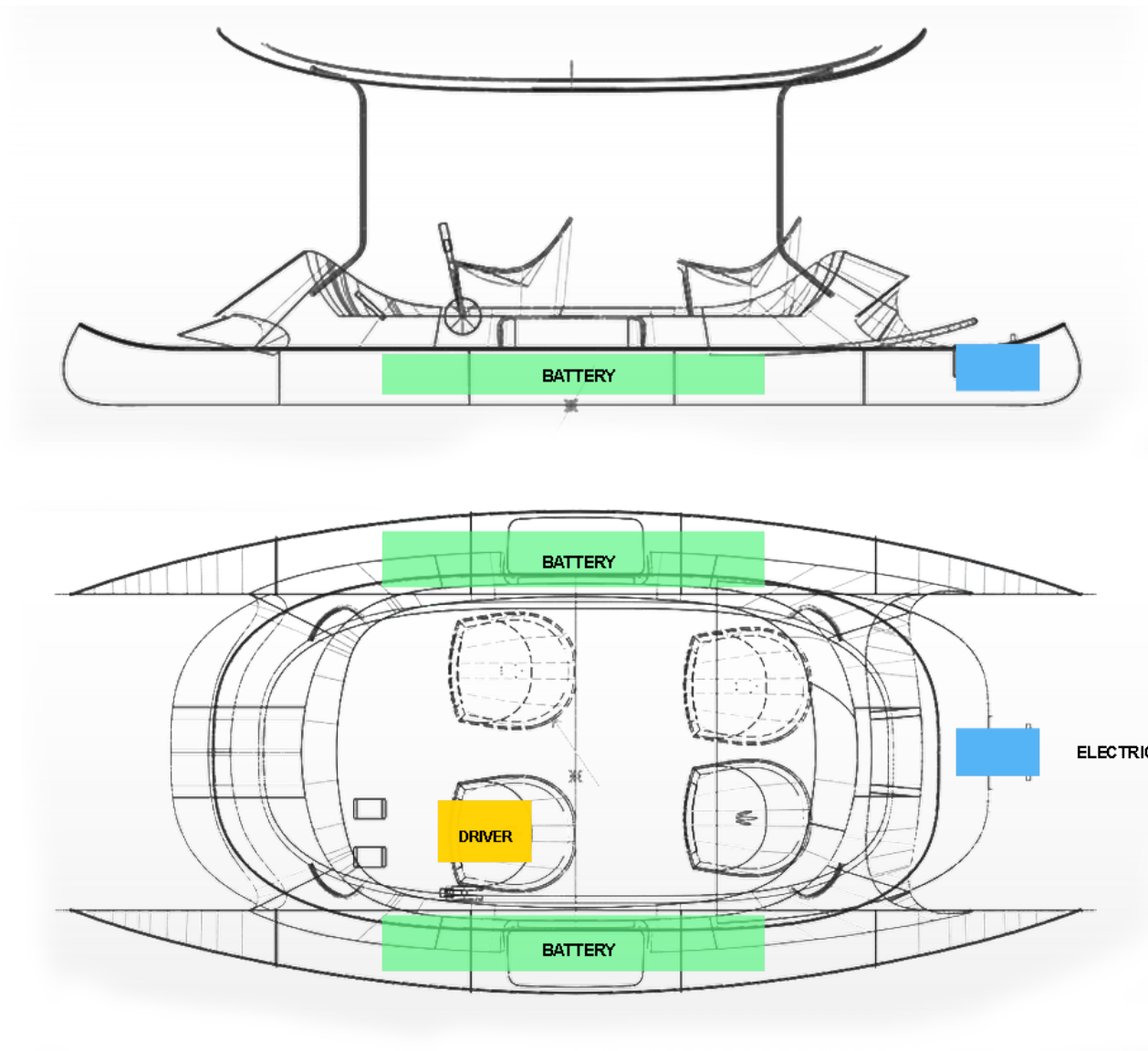


Packaging

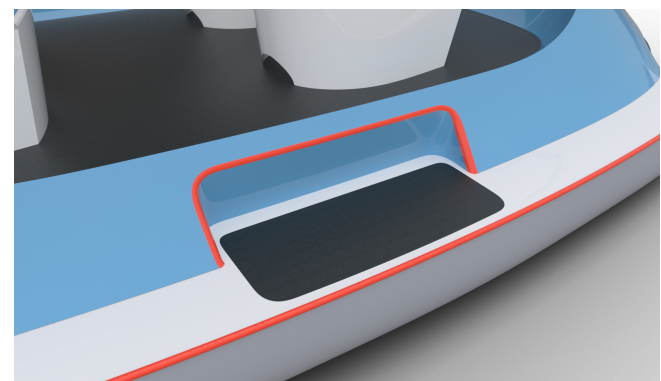
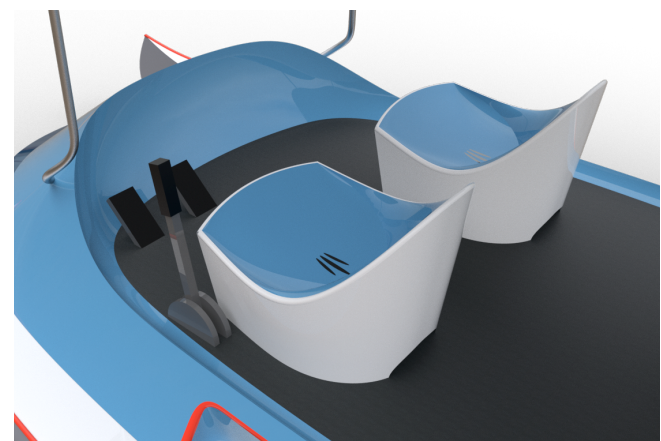
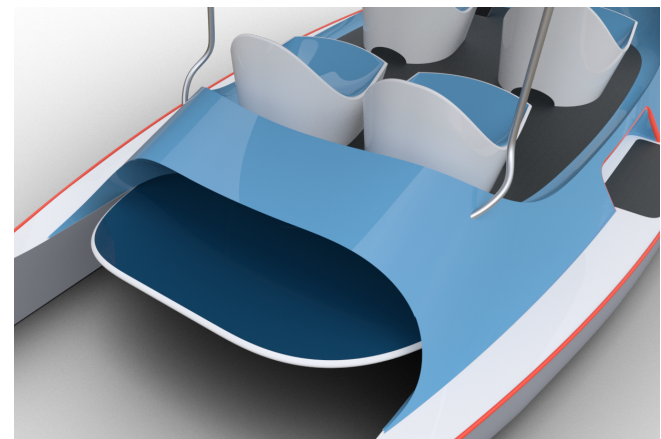


CONCEPT II



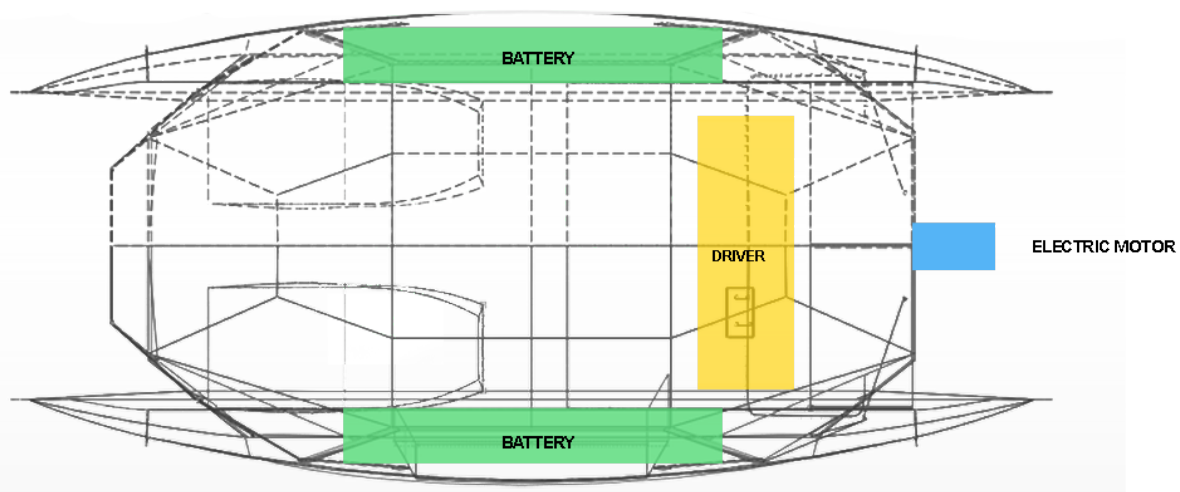
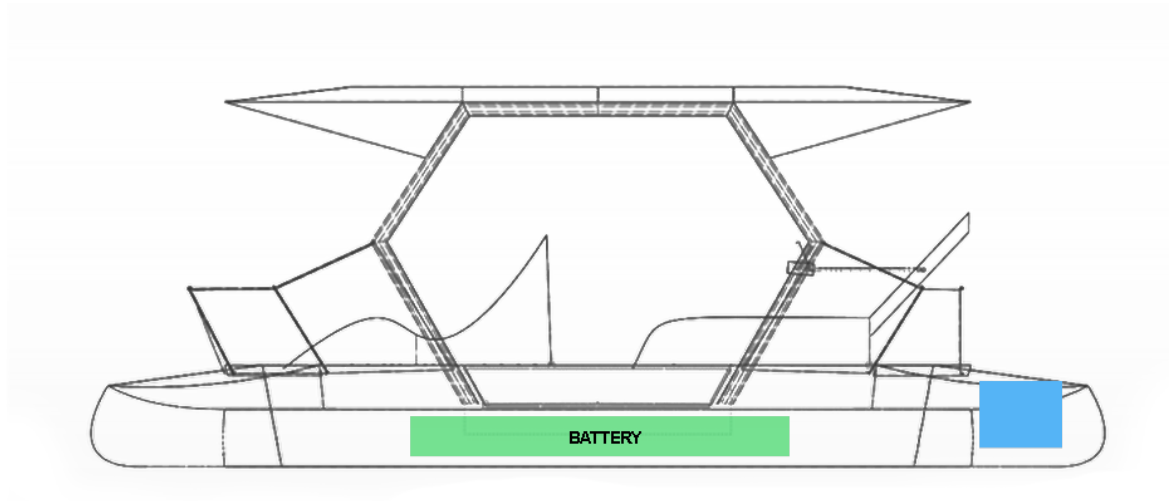


Packaging



CONCEPT III





Packaging

