

Sub marine

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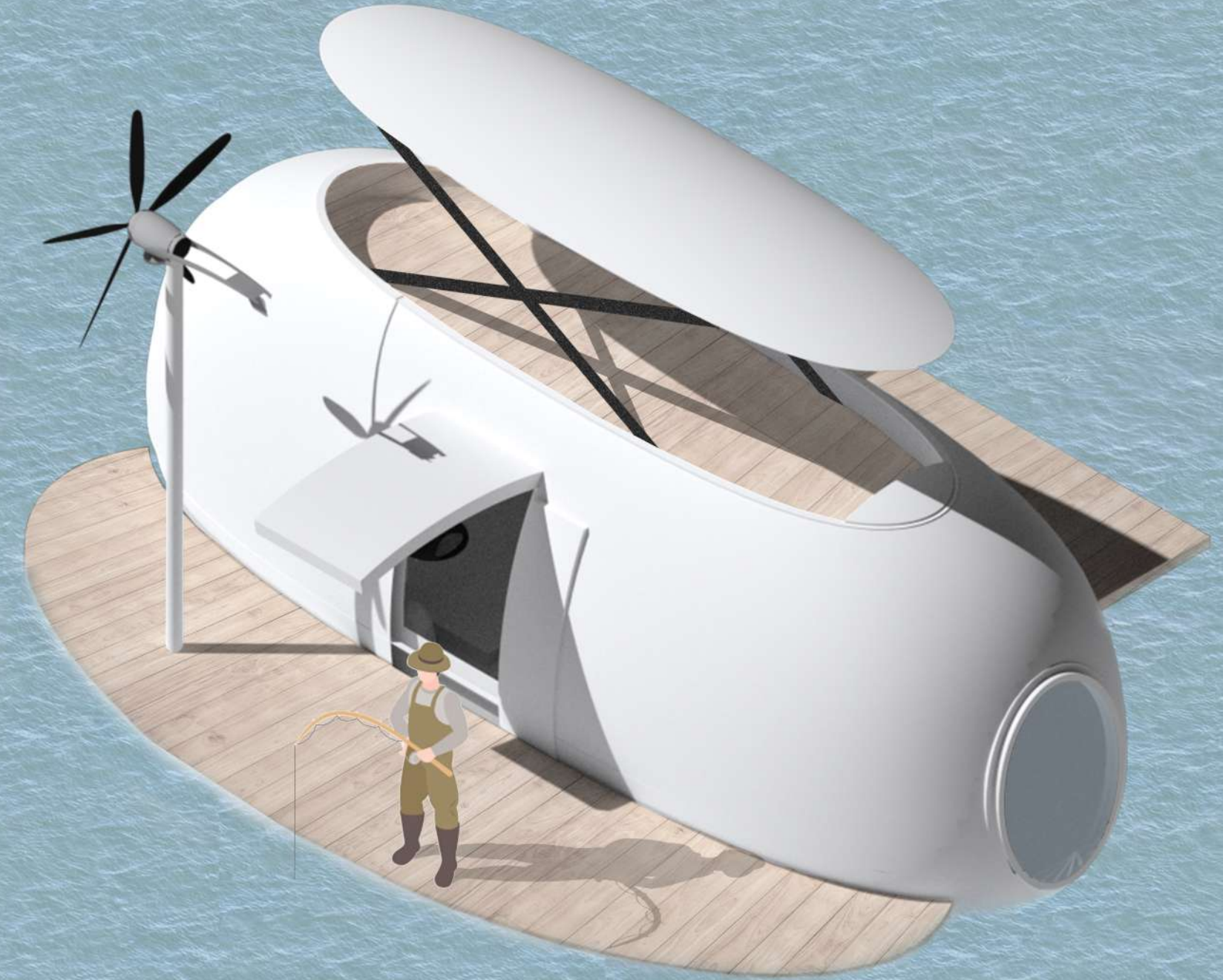
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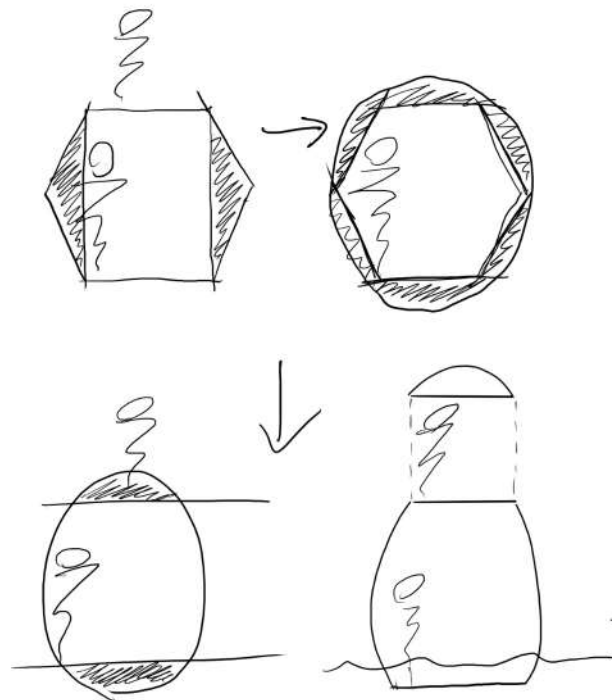
The architectural project aims to design a multifunctional houseboat, serving as both a private waterfront cottage for a family of three and an Airbnb rental during unused periods. Specific requirements include accommodating the family with height differences, providing year-round comfort, and ensuring adaptability for various seasons. The design prioritizes aesthetics for Airbnb appeal, ease of transition between private and rental use, and a child-friendly environment for a 2 year-old family member. Sustainability and energy efficiency are also key considerations. Overall, the goal is to create a versatile, comfortable, and visually appealing houseboat that meets the diverse needs of the clients. The family would like to use the houseboat mainly during the summer months (May-September); and if possible, during the cooler months, too. Alternatively, they would like to rent out the houseboat during the remaining months.

Project description

The entire design of the houseboat is based on the design and structure of a ship. The basic part is the boat-shaped hull, which is designed base on sailboats. The hull itself continues into a complete unit with the help of ribs, which are the main supporting structure. The shape of the houseboat resembles a bubble. I chose this shape for several reasons. One reason is aerodynamics, although the primary function of this houseboat is not sailing; it is advantageous to have this vessel in an aerodynamic shape as it creates less resistance, and a less powerful motor is needed. This means that a weaker electric motor powered by solar panels is sufficient. Another reason for this shape is that it directly derives from the shape of the boat hull and is a natural extension of the hull's construction. Another important aspect of this shape is the interior. Since the houseboat is size-restricted, it was necessary to address the issue of the width of the boat. Even though the floor inside the houseboat is only 2.5 meters wide, it is utilized across the entire width.

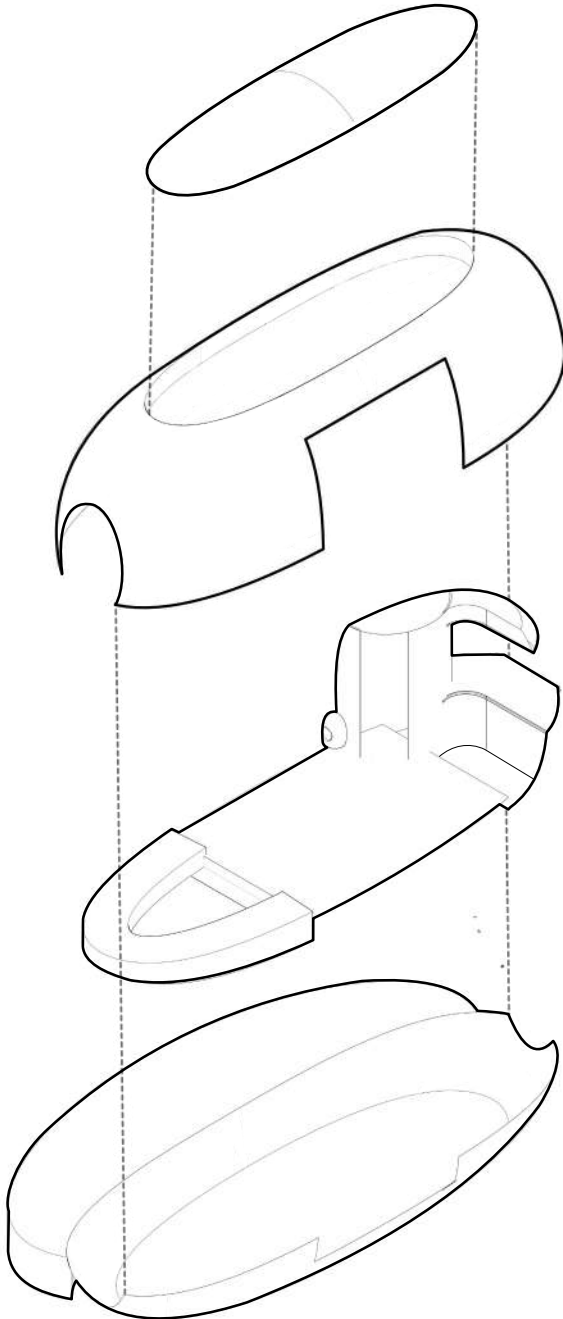


Concept



Living on water is fascinating, but designing a structure that can handle its dynamic conditions is a real challenge compared to traditional land-based architecture. The unstable nature of water necessitates careful consideration of various factors during the design process. Throughout the design process, sustainability and the aesthetic appeal of the structure were crucial. I found inspiration in the aerodynamic form of a bubble, exploring how such organic shapes could inform a more efficient and visually striking houseboat design. At first, I took inspiration from sailing boats for my houseboat design. However, I soon realized that what works for a sailboat does not necessarily work for a houseboat. I had to rethink the initial design and focus on making sure the houseboat was stable above all else. An important turning point came during a consultation with a motorboat designer. This meeting led me to rethink the entire approach, ultimately requiring a compromise between traditional sailboat aesthetics and the practical demands of stability on water.

Exploded diagram



Openable roof serves as protection against weather conditions.

Openable roof

The facade of the houseboat is made of tensile fabric, forming a waterproof layer. I chose this option mainly because of the irregular shape, which is difficult to cover with conventional building materials. Additionally, compared to other materials, it is very lightweight and waterproof.

Facade

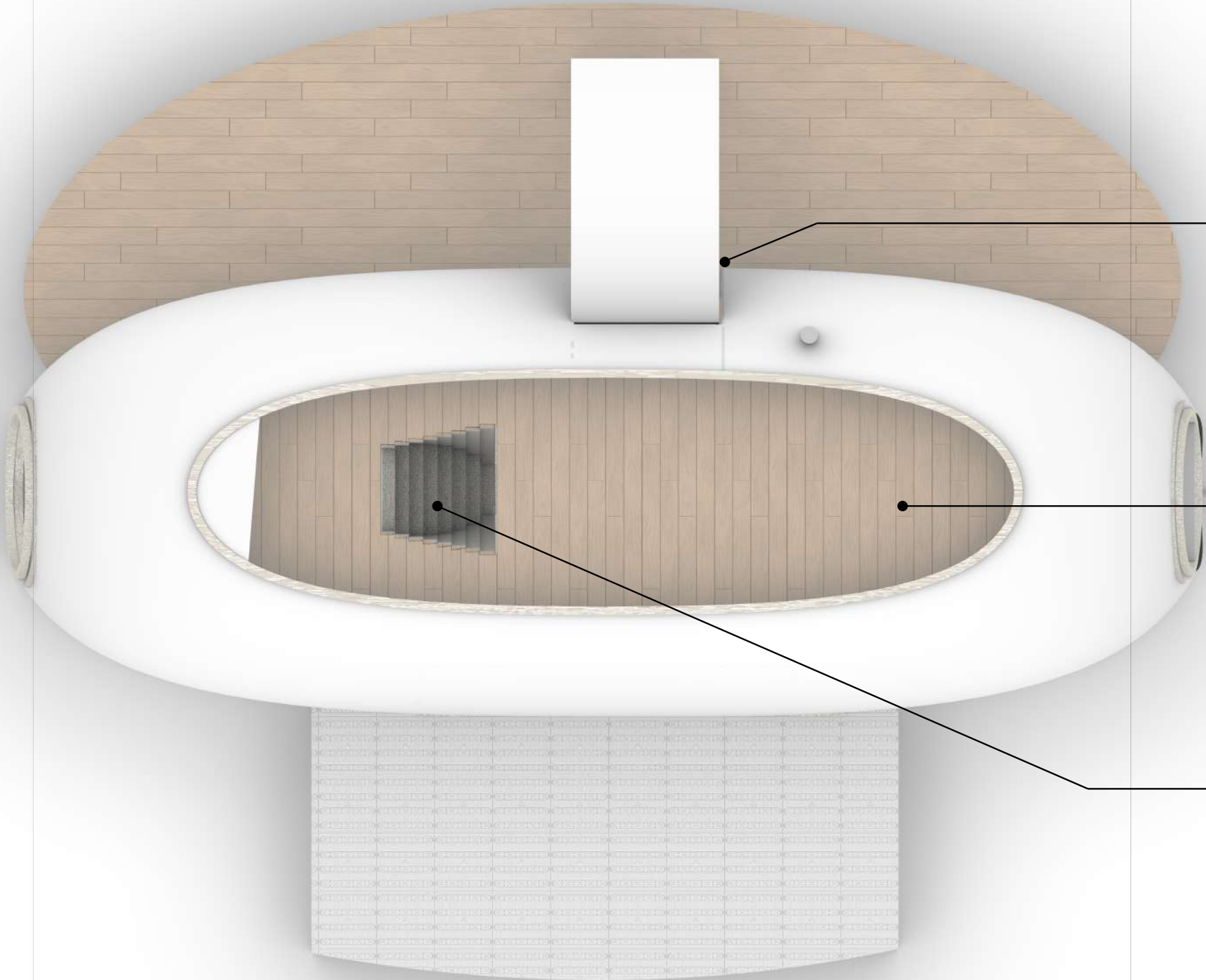
The layout of the houseboat is divided into three main sections: the kitchen, the living area, which can be transformed into a bedroom, and the last section is the bathroom with a toilet. Another additional section is the space in the middle of the houseboat, which remains open and can be modified according to the needs.

Interior

Oval shape houseboat hull

Hull

Top view



The main entrance door are situated on the side of the houseboat facing the jetty.. This door has hinges on the top and bottom, meaning it can be opened horizontally either downwards or upwards as needed.

Main entrance

The houseboat features a concealed roof integrated into the shape of the houseboat and slightly submerged so it is not visible from the outside. The upper terrace includes a space for the captain's helm.

Roof terrace

This opening can also be used as an additional skylight for better illumination of the interior.

Entrance to roof

Floorplan

The bathroom with a toilet is situated closer to the kitchen for plumbing reasons. It is designed in a curved layout to seamlessly integrate with the rest of the houseboat's design. The entrance doors slide to save space. On the exterior side of this unit, there is a stove facing the living room. The chimney from this stove is concealed within the unit, with a spiral wrapped around it for water heating.

Bathroom

The kitchen is situated in the rear part of the houseboat. It is custom-designed to fit the curved shape, with plywood being the primary material for the entire kitchen except for the kitchen desk, which is made of oak wood. The kitchen features an electric double hotplate, a sink with an integrated microwave oven, and a built-in refrigerator. Plenty of storage space is available both in the cabinets and above them. All kitchen doors are sliding to save valuable space.

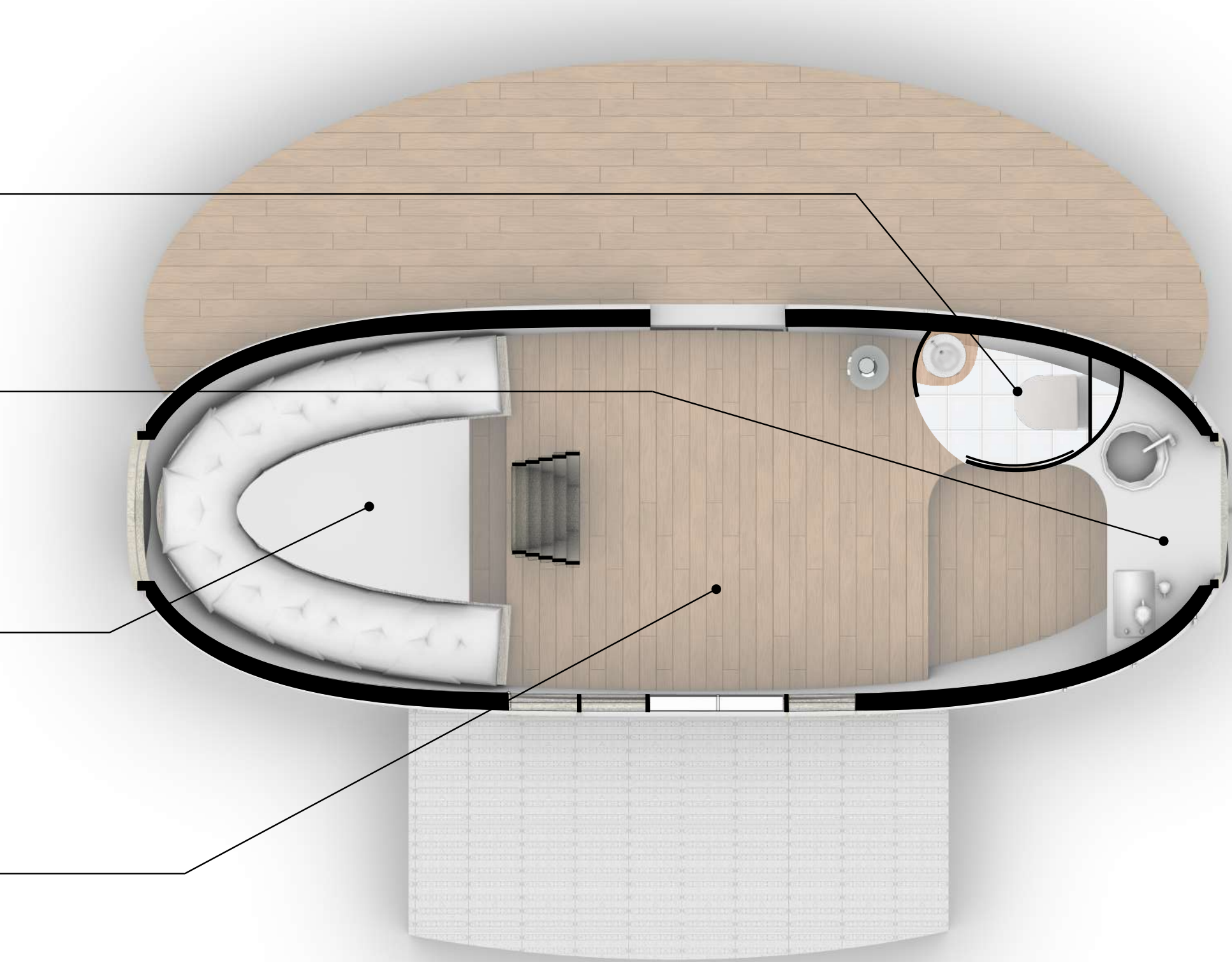
Kitchen

The living area, which can be transformed into a bedroom, is located at the opposite end of the boat from the kitchen, in the front part of the houseboat. This area is defined by a built-in sofa that lines with the perimeter of the front section of the boat. The sofa includes a fold-out captain's chair with a helm. The central part of this space features a platform that can be raised from the floor and used either as a dining table or aligned with the seating to create a large bed.

Bedroom / livingroom

This area has minimal furniture or elements except for a large table sunken in the floor, which can be pulled out and used as a dining table or desk. The dominant feature of this space is a huge window, serving as gateway to the dock from the interior.

Open space



Sction AA

Another part of the houseboat is the additional opening roof, which serves as protection against weather conditions. The opening of this roof is facilitated by a hinge system and pneumatic pistons, which slightly lift the rear part of the roof and open the front part to a position where it is possible to stand upright.

Openable roof

The plywood stairs in this space are designed to fold down from the ceiling, saving space when access to the upper terrace is not needed. The stairs are located in the living room/bedroom area and lead towards the kitchen. They are positioned along the longitudinal axis of the houseboat.

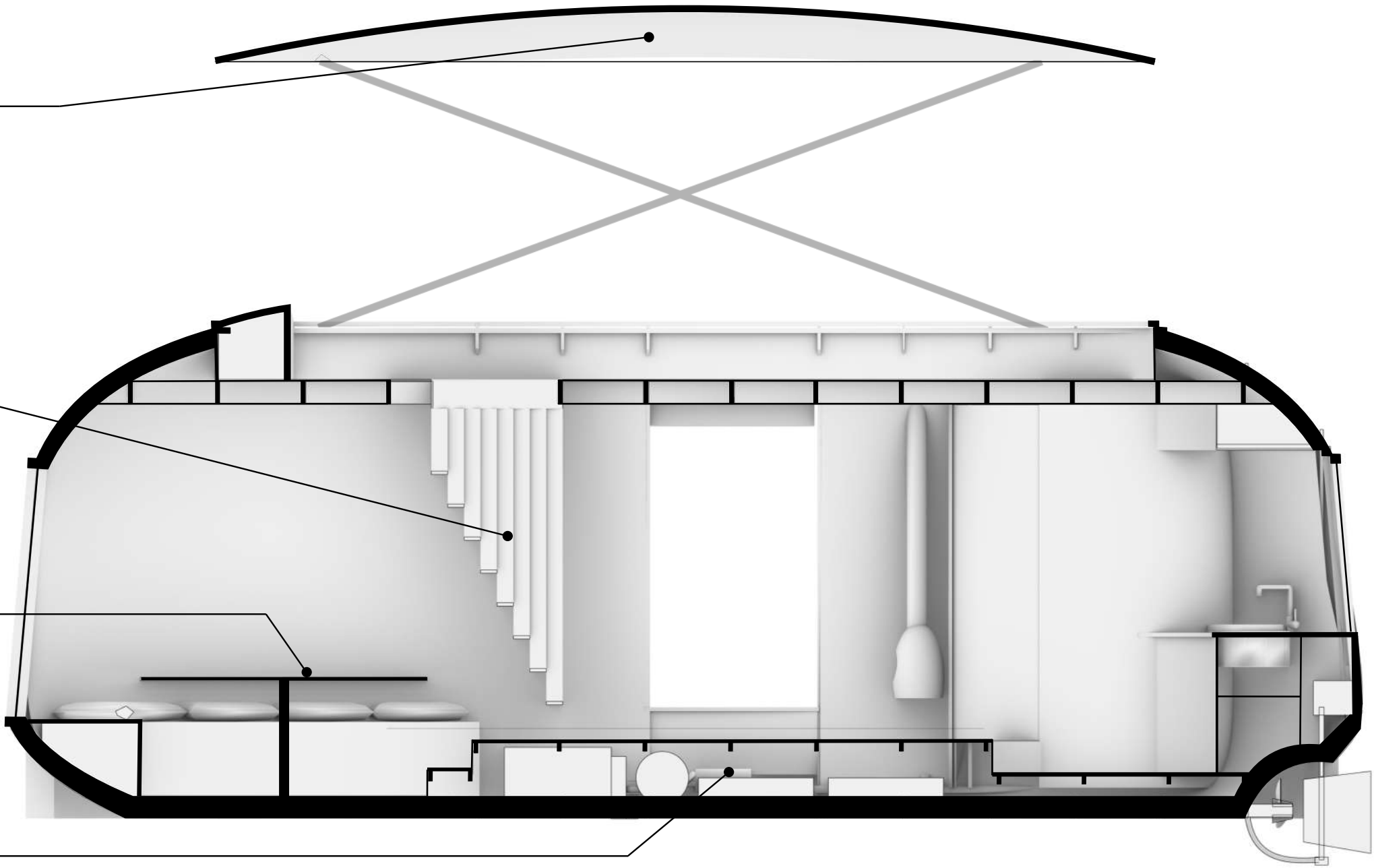
Foldable stairs

This table has multiple uses that are necessary for such a small space. This table can be extended in three positions. Either it is on the ground and is part of the floor, or it is extended to the level of the surrounding seating, thus forming a bed, or it can be extended even higher to form a table for the surrounding seating.

Foldable table

The middle part of the houseboat, located under the floor, serves primarily as a space for the technologies necessary for the operation of the houseboat. Additionally, an electric motor that propels the houseboat is located in this area. There are also numerous storage spaces in this part.

Storage space / technologies space

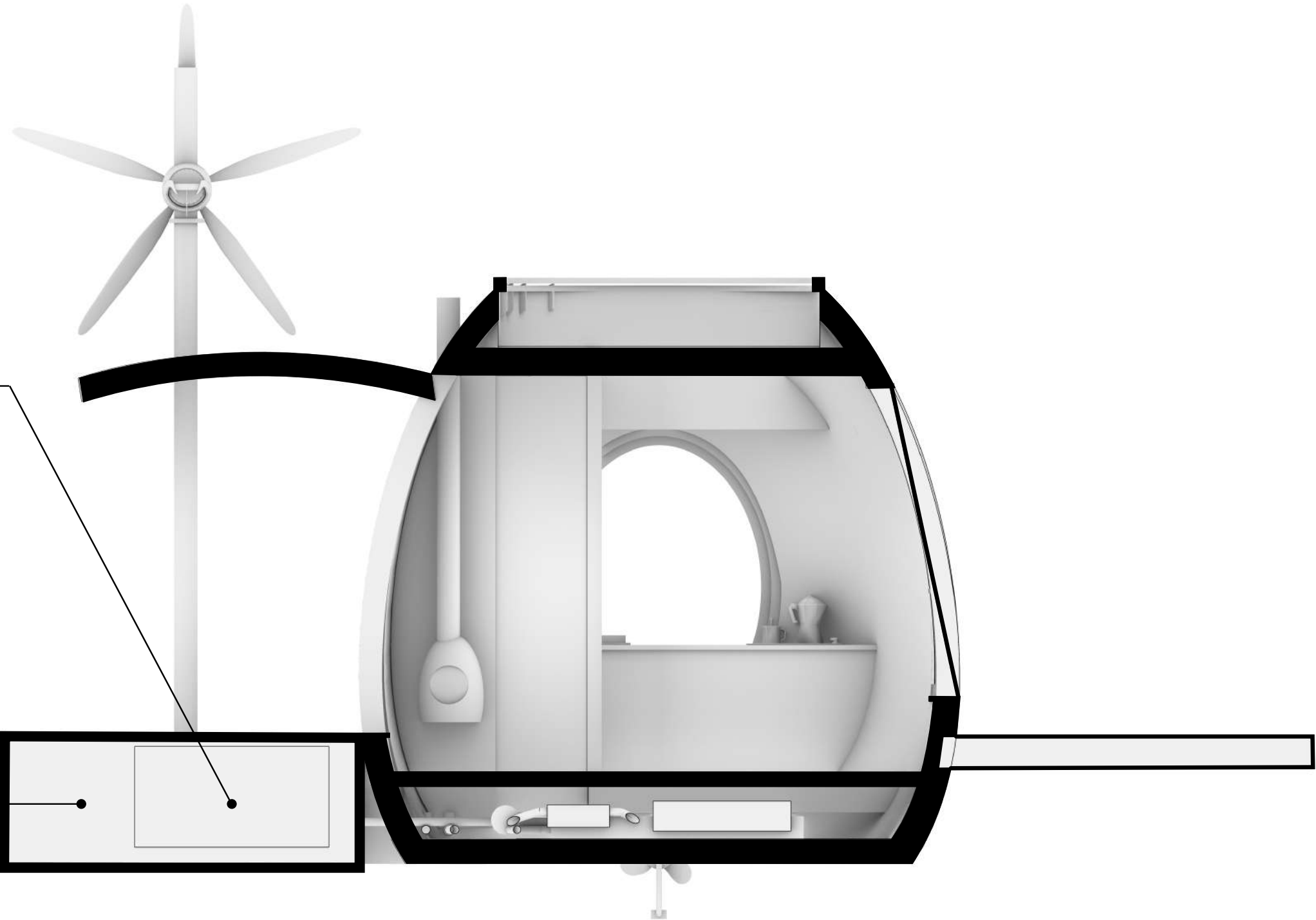


This jetty serves as a station for the houseboat. It's not just a dock for boarding or a terrace; mainly, it's the energy station for the houseboat, ensuring that the houseboat is completely self-sufficient and independent of the grid. The jetty is made up of the same structure as the hull of the houseboat. Walkable surface of the jetty is made of wooden decking boards.

Pier

Inside the jetty, there are gadgets and equipment that couldn't fit onto the houseboat. The jetty also has various storage spaces, like for garden furniture. Some of the tech inside includes water purifiers, tanks for drinking and hot water, a composting toilet tank, a wind turbine, and extra batteries. You can find more details about these technologies in the MEP section.

Technologies



Elevation



The front and rear sections of the houseboat have oval-shaped double-glazed oak windows, which bring light into the kitchen area at the rear and the living area at the front.

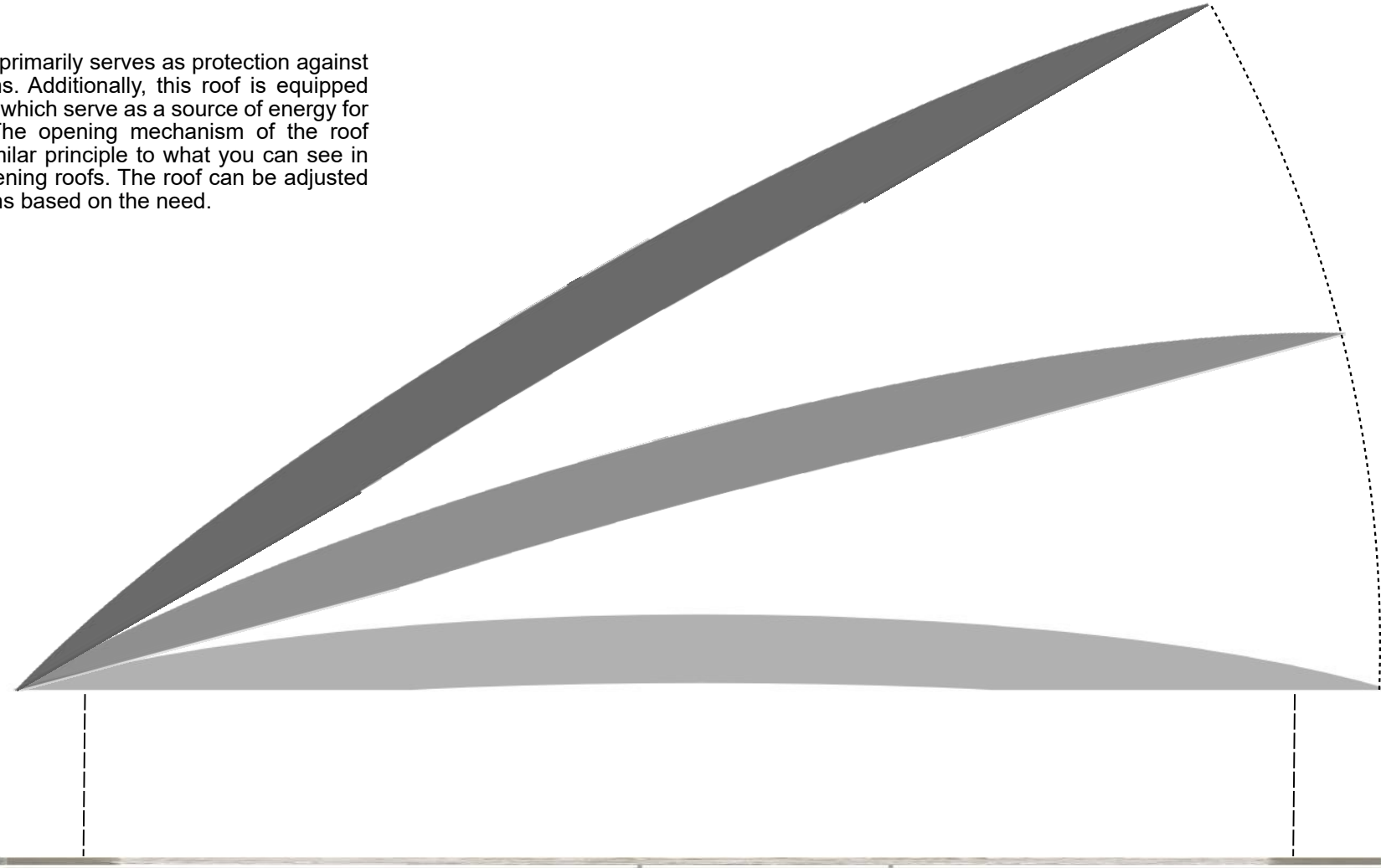
Oval shaped window

This terrace or jetty operates on the principle of inflation. This jetty is concealed in the hull of the houseboat. When a terrace is needed, this jetty is simply inflated and freely placed on the water. The jetty is made of tough rubber material similar to what you can see on paddle boards. This jetty provides an additional terrace, especially when the houseboat is away from the main jetty.

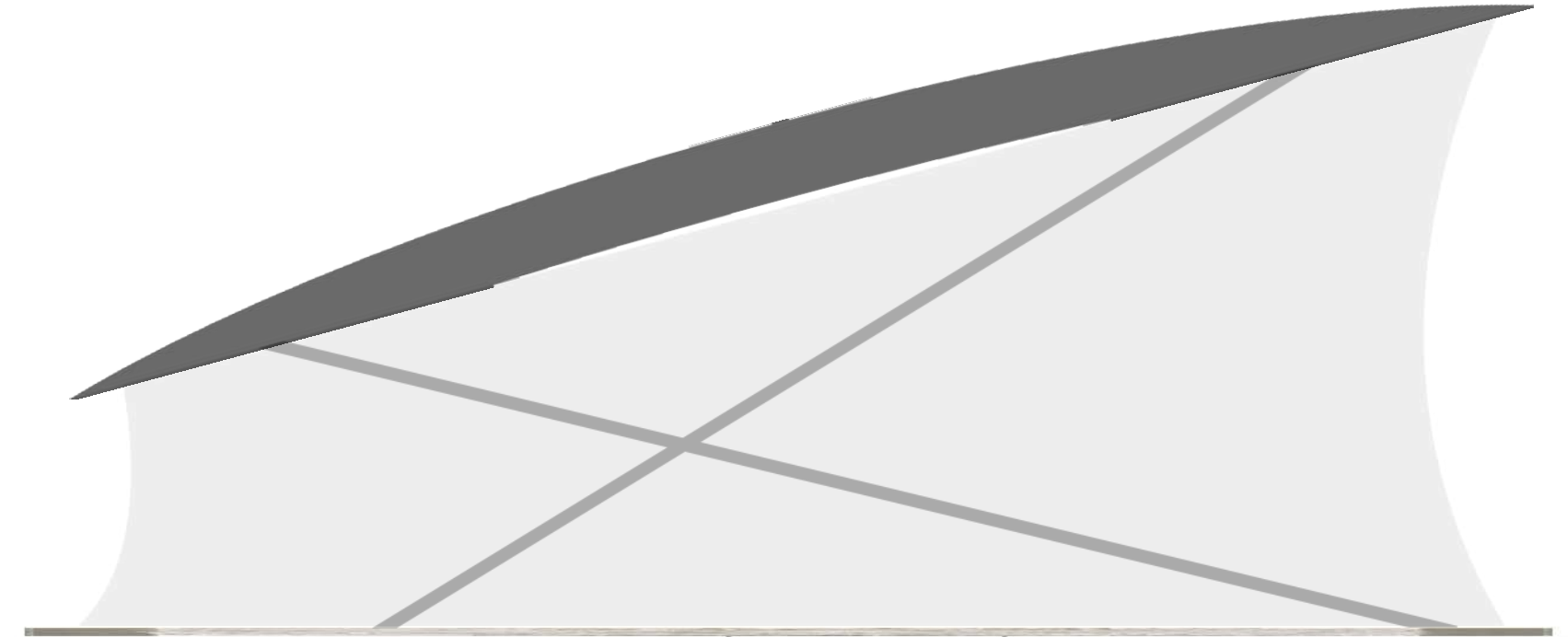
Inflatable pier

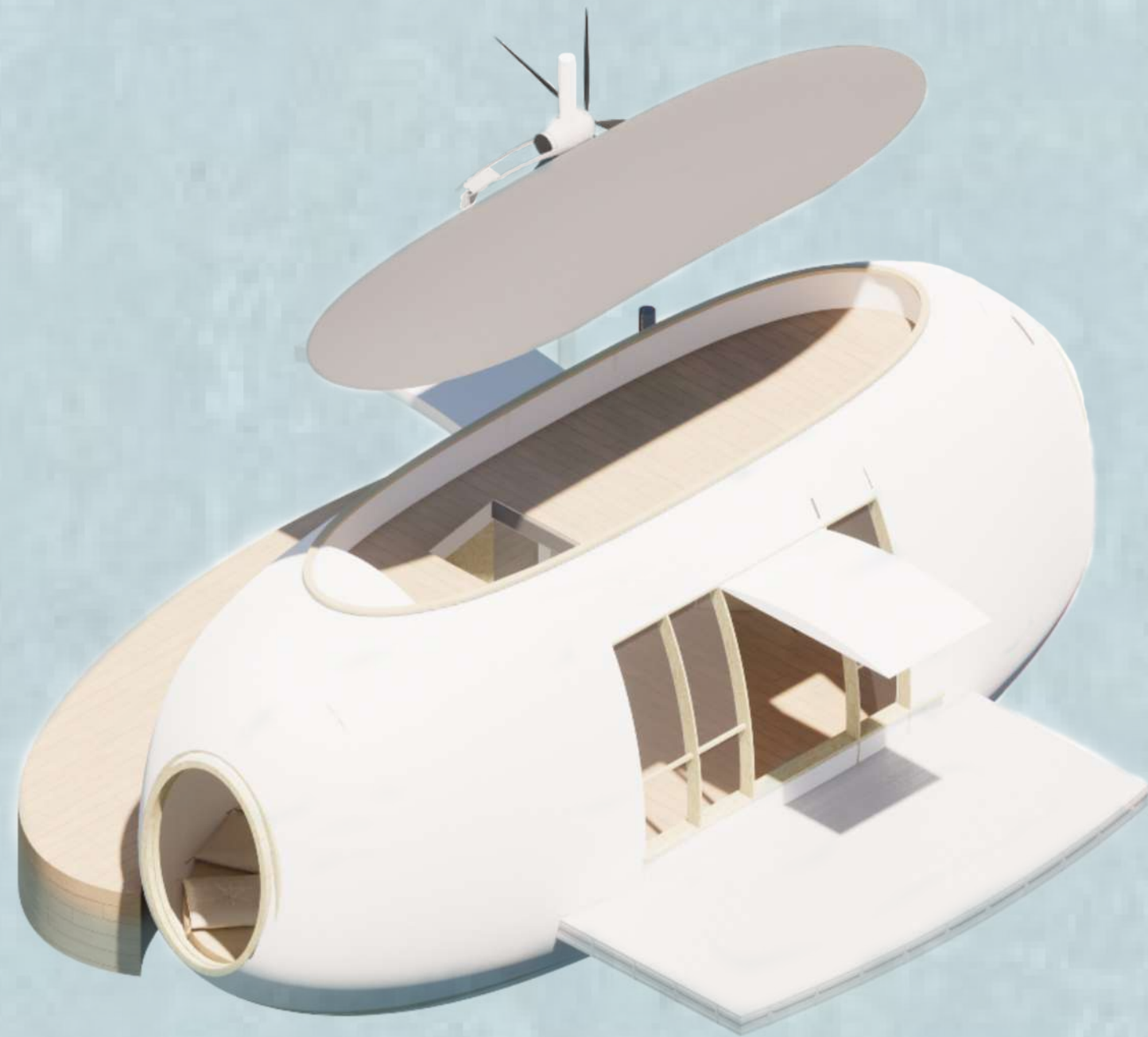
Roof

The opening roof primarily serves as protection against weather conditions. Additionally, this roof is equipped with solar panels, which serve as a source of energy for the houseboat. The opening mechanism of the roof operates on a similar principle to what you can see in caravans with opening roofs. The roof can be adjusted to several positions based on the need.

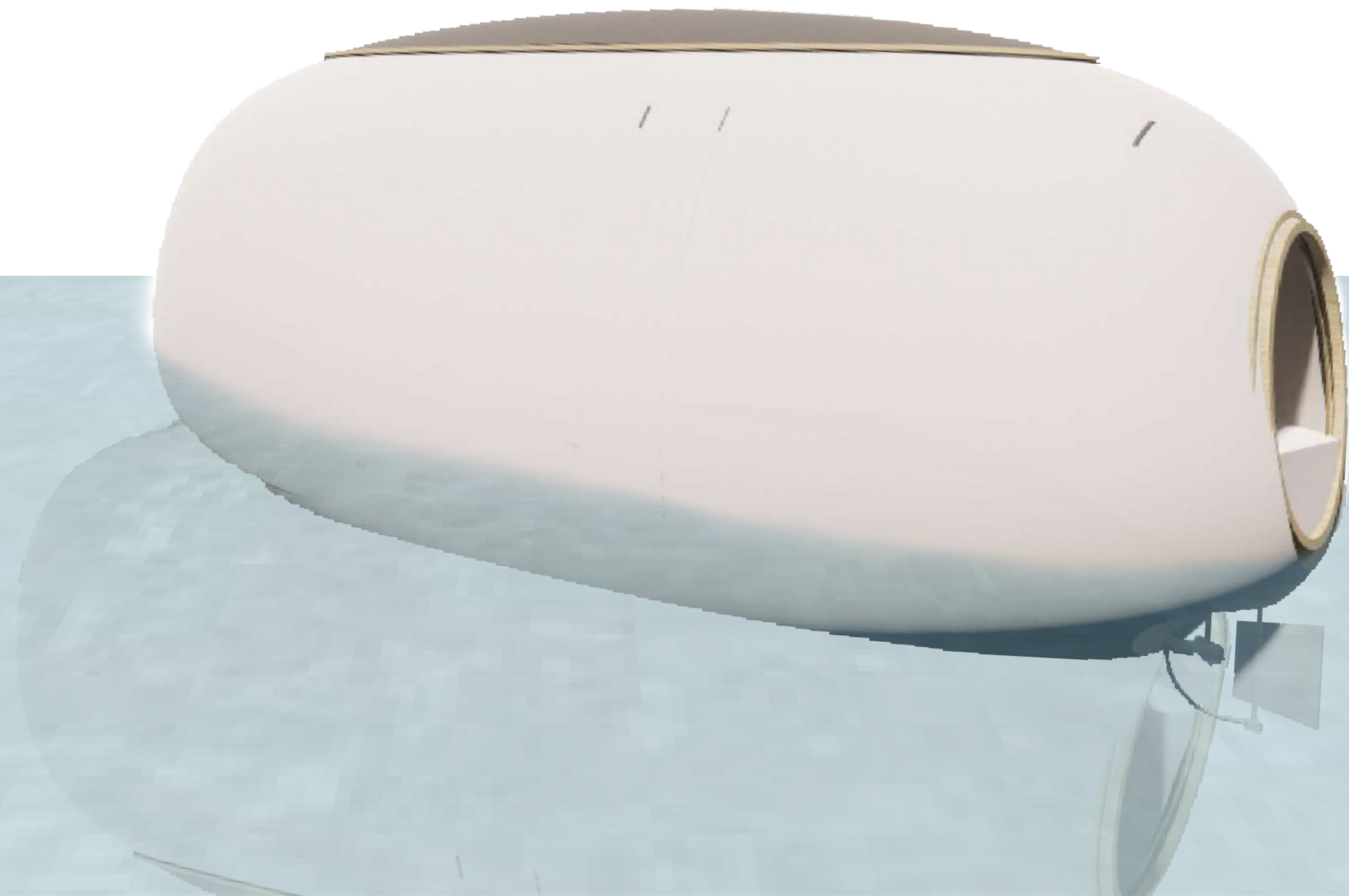


The opening roof also features a removable fabric. This fabric serves as a membrane and protection against weather conditions. This option serves as a tent, meaning that it can be used as an extra room during warmer months, thereby increasing the interior space of the houseboat. In this case, the houseboat can accommodate up to 6 people.

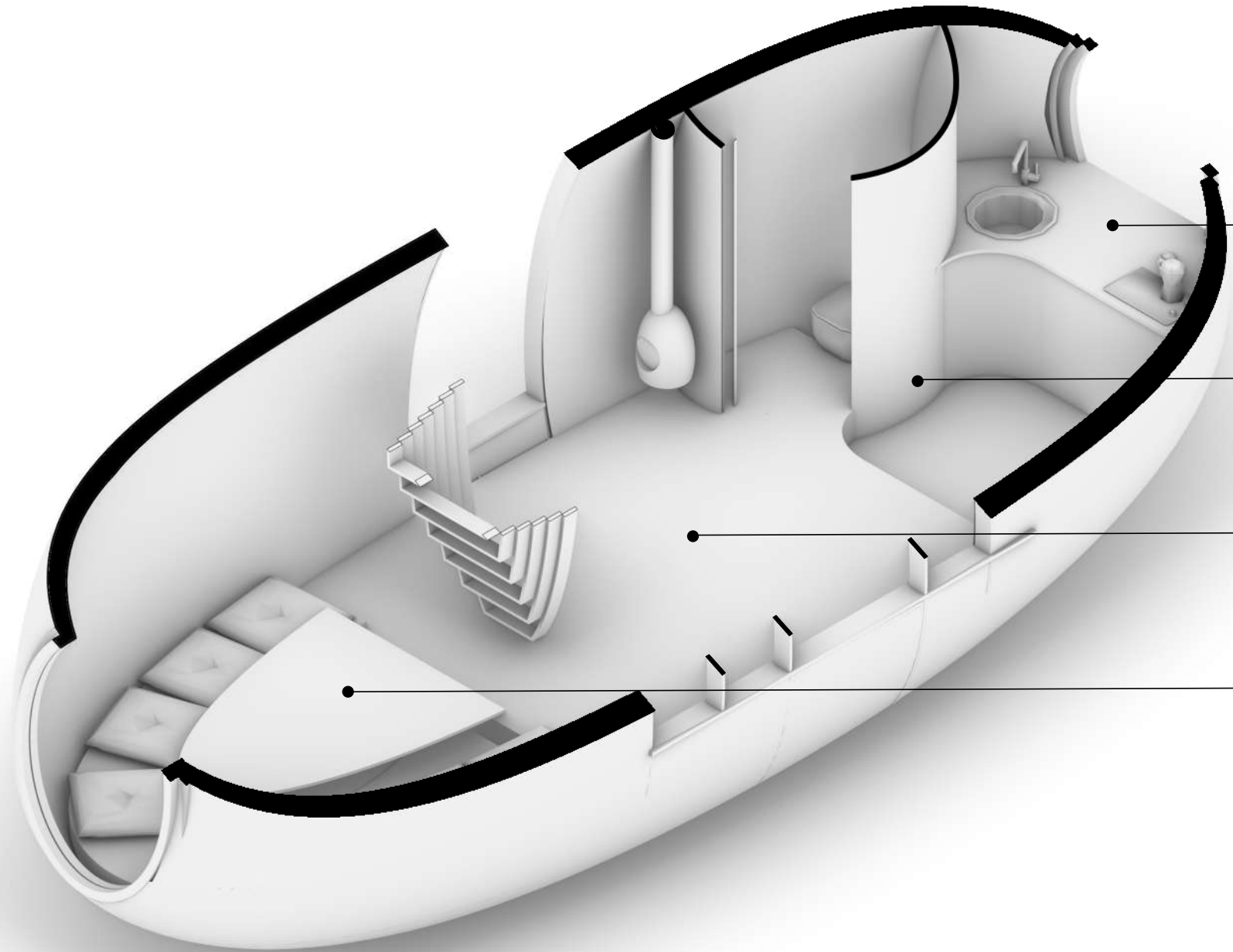




This visualization shows the houseboat with all its opening parts, like doors or shutters, closed. In this state, the houseboat resembles a bubble, which was the initial intention. This feature of the houseboat is advantageous also in terms of maintenance. This configuration of the houseboat is suitable for moving it, allowing the houseboat to achieve optimal aerodynamics. Similarly, this option is advantageous for winterization or closing it off during periods when the



Interior



The kitchen of the houseboat, along with the entire kitchen area, is one level lower than the central part. The kitchen includes a sink, a two-burner stove, a small refrigerator with a freezer, and plenty of storage space.

Kitchen

The bathroom of the houseboat is separated by a plywood wall from the rest of the houseboat and features sliding doors to save as much space as possible. The bathroom includes a toilet, a shower, a sink, and storage space.

Bathroom

The central part of the houseboat is completely open and left for the users' needs. A suitable item for this space is a large table that could be used either as a dining table or a workspace. This area also has direct access to the terrace.

Open space

The front part of the houseboat is dedicated to seating that can be transformed into a large bed. The seating includes generous storage spaces.

Bedroom / livingroom



The interior of the houseboat is designed to create one open space that contains everything necessary for living. The interior is also designed to adapt to the users' needs, meaning that one part of the houseboat can serve multiple purposes. The back part of the houseboat consists of a spacious kitchen and a separate bathroom with a toilet. Just before the bathroom, there is a hanging stove, which serves as a heating element in colder months. The kitchen and bathroom are coordinated in wooden tones using birch plywood. This plywood is one of the main materials of the interior. Since it is relatively affordable and visually pleasing, I decided to use it almost everywhere.



The front part of the houseboat consists of seating that extends along the inner perimeter of the front section. This seating includes a pull-out table built into the floor, which can be extended to serve as a table for seating in the front section or pulled out to align with the seating, forming a large bed. This space can be separated from the rest of the houseboat using a curtain made from theater curtain fabric, which also serves well as a sound insulator. Another feature of the interior is a folding staircase, which creates a portal to the rooftop terrace. This staircase can be folded, as seen in the visualization, or it can be folded upwards towards the ceiling to avoid creating a barrier in the interior when not in use. Generous windows on the sides and front and rear sections also dominate the interior. These windows are made of solid oak wood. This wood is also used for the floors, not only because of its quality and attractive appearance but also because of its weight. In a houseboat, it's important to load the bottom part as much as possible and, conversely, to lighten the top part as much as possible.

1. Structure parts
- Hull

-Superstructure

-Roof

-Joints
2. Details
- Hull

-Wall/roof



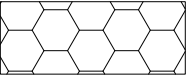
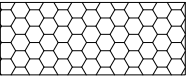
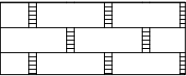



-Side window

-Door

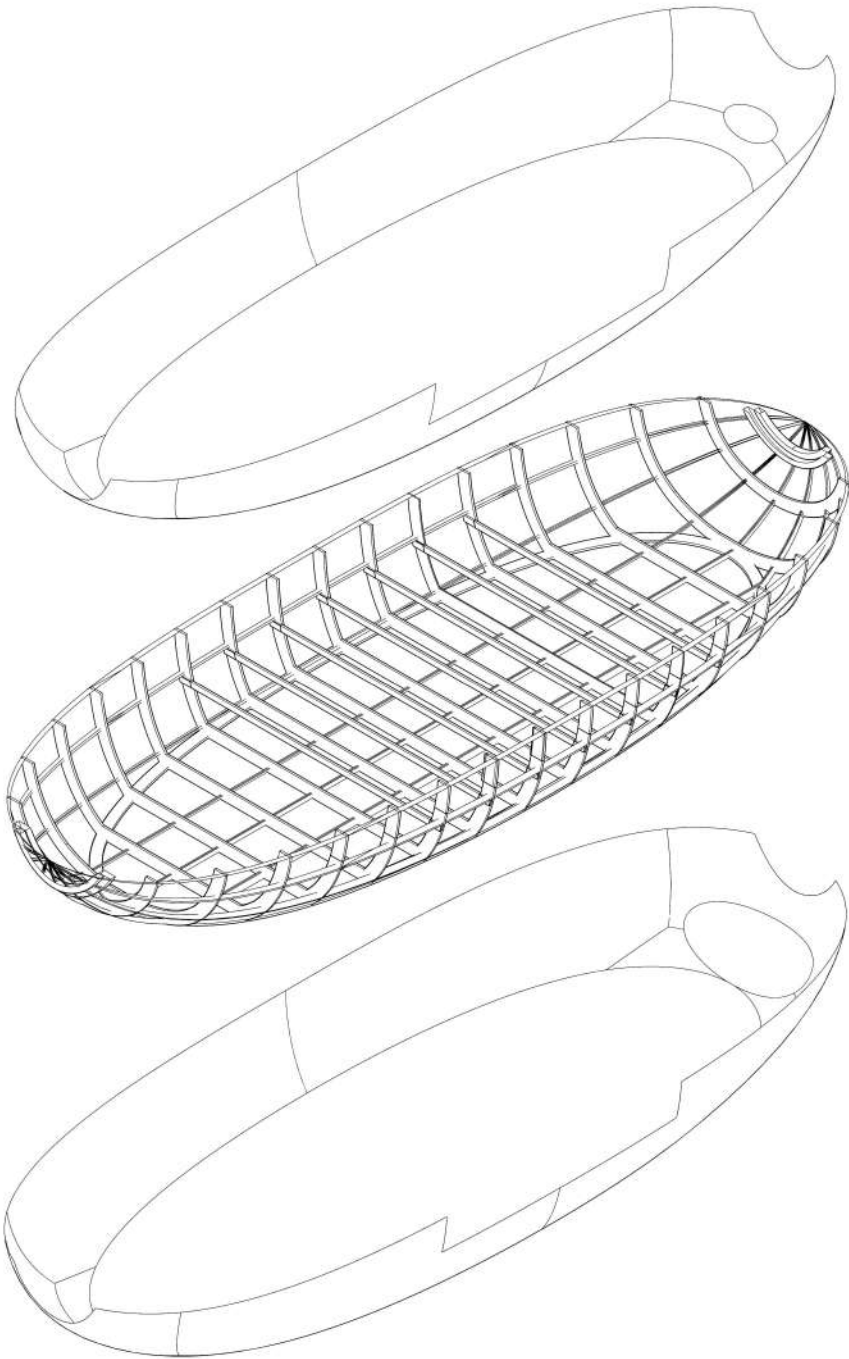
-Roof door

-Front window

Legend

	Plywood
	Solid wood
	Sheepwool insulation
	Wood fiber insulation
	VPL
	Tensile textile
	Fiber glass
	Epoxy

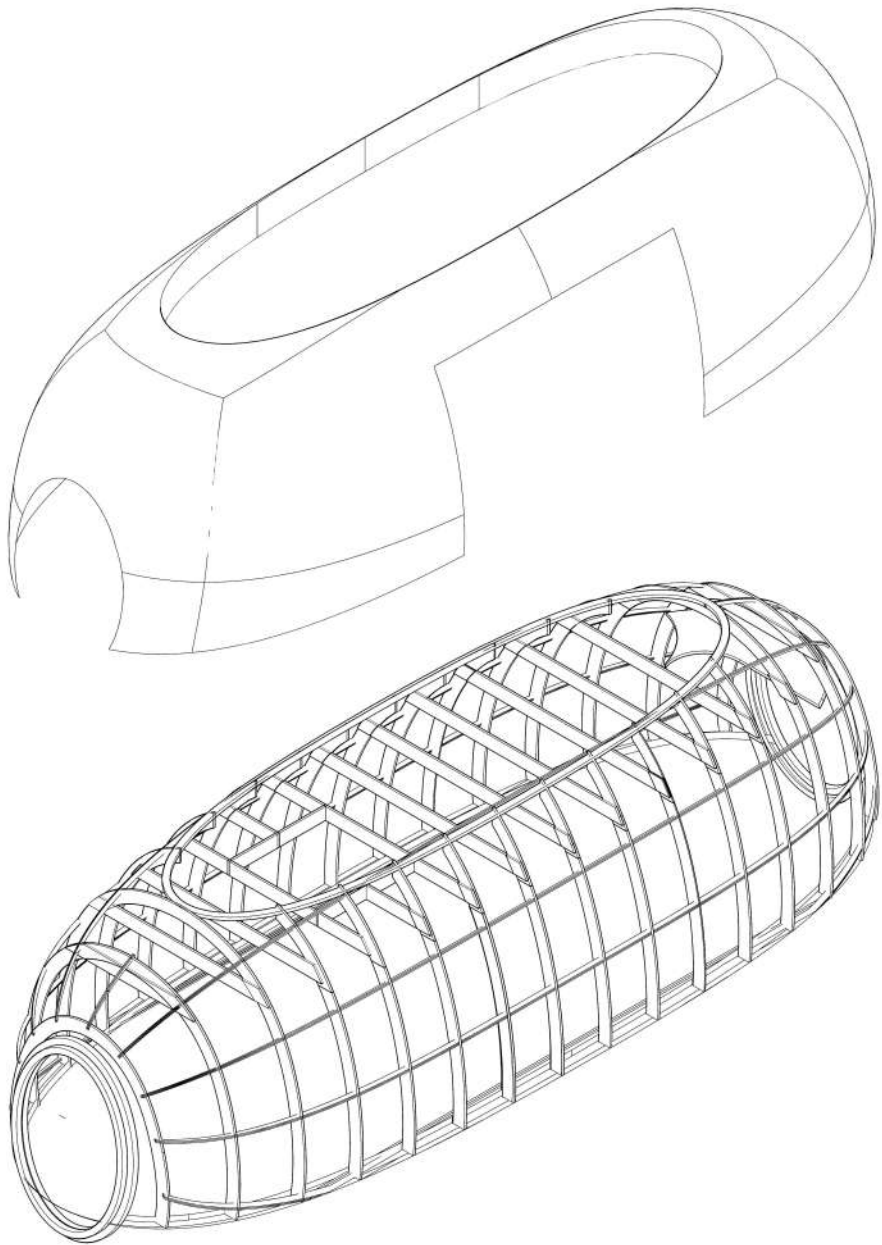
Hull



The houseboat hull is composed of three parts: the structure, the outer shell, and the waterproof layer with coating. The structure of the hull consists of ribs made of plywood, cut to the desired dimensions using a CNC machine. The rib components are joined using a dovetail and carpentry joints to avoid potential corrosion when using metal fasteners. This entire structure is treated with multiple coats of tung oil, which acts as excellent natural protection for the wood against weather conditions. Interior part of the hull consist of VCL layer and layer of one centimeter thick birch plywood.

The ribbed structure is enclosed using plywood and forms the surface of the hull. Gaps between the plywood are filled with an epoxy mixture and subsequently sanded into smooth surface. Another layer is fiberglass, which is applied to the aforementioned part. Then, this layer is covered with several layers of epoxy, creating a waterproof and sturdy layer. This layer may or may not be covered with another layer of paint. It is advisable to use protective paint because it creates a barrier against UV radiation, which can damage the layers beneath the coating over time. For this coating, it is necessary to use a paint that is resistant to UV radiation.

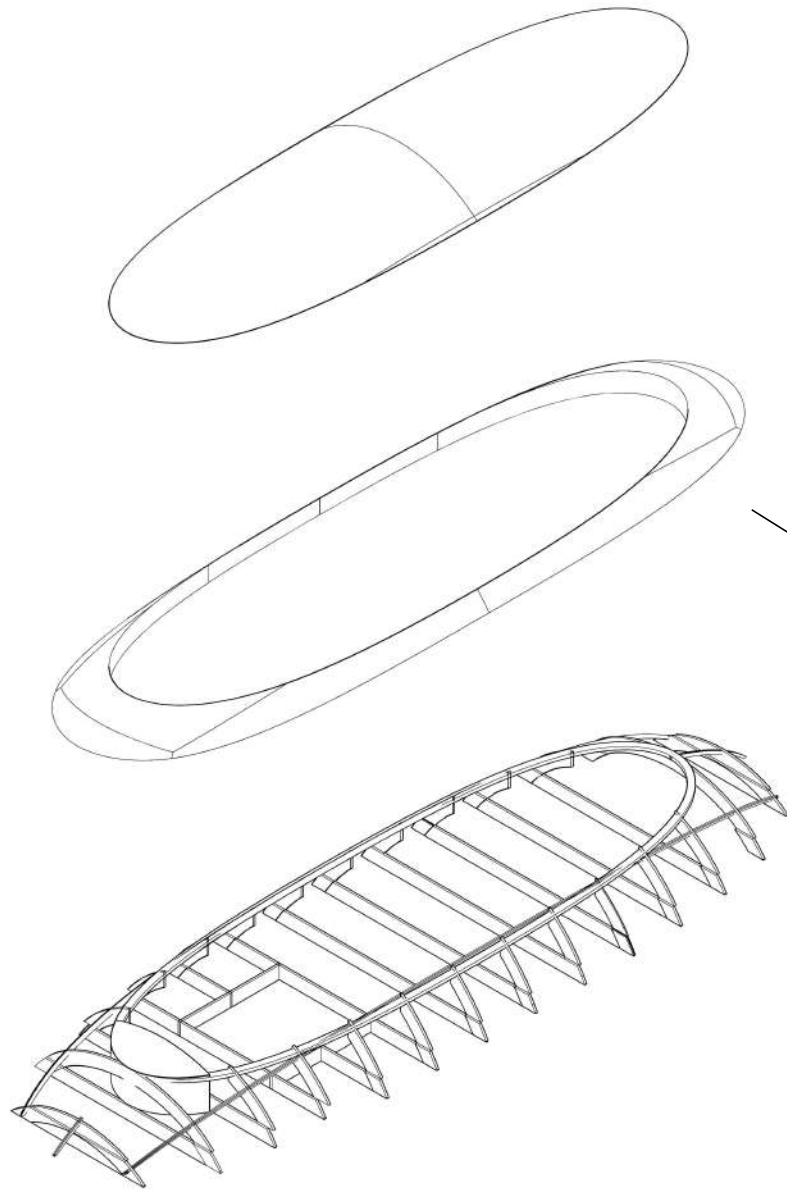
Superstructure



The facade of the houseboat is made of tensile fabric, forming a waterproof layer. I chose this option mainly because of the irregular shape, which is difficult to cover with conventional building materials. Additionally, compared to other materials, it is very lightweight and waterproof.

The structure above the level of the hull is made of the same material as the hull itself, which is plywood processed by a CNC machine to the desired dimensions. The structure above the hull level is a continuation of the hull into the shape of a bubble. It consists of ribbed structures in the vertical direction, following the same principle for horizontal ribs. This construction also includes beams for supporting the roof, which are a direct continuation of the vertical ribs. This structure is also treated with tung oil

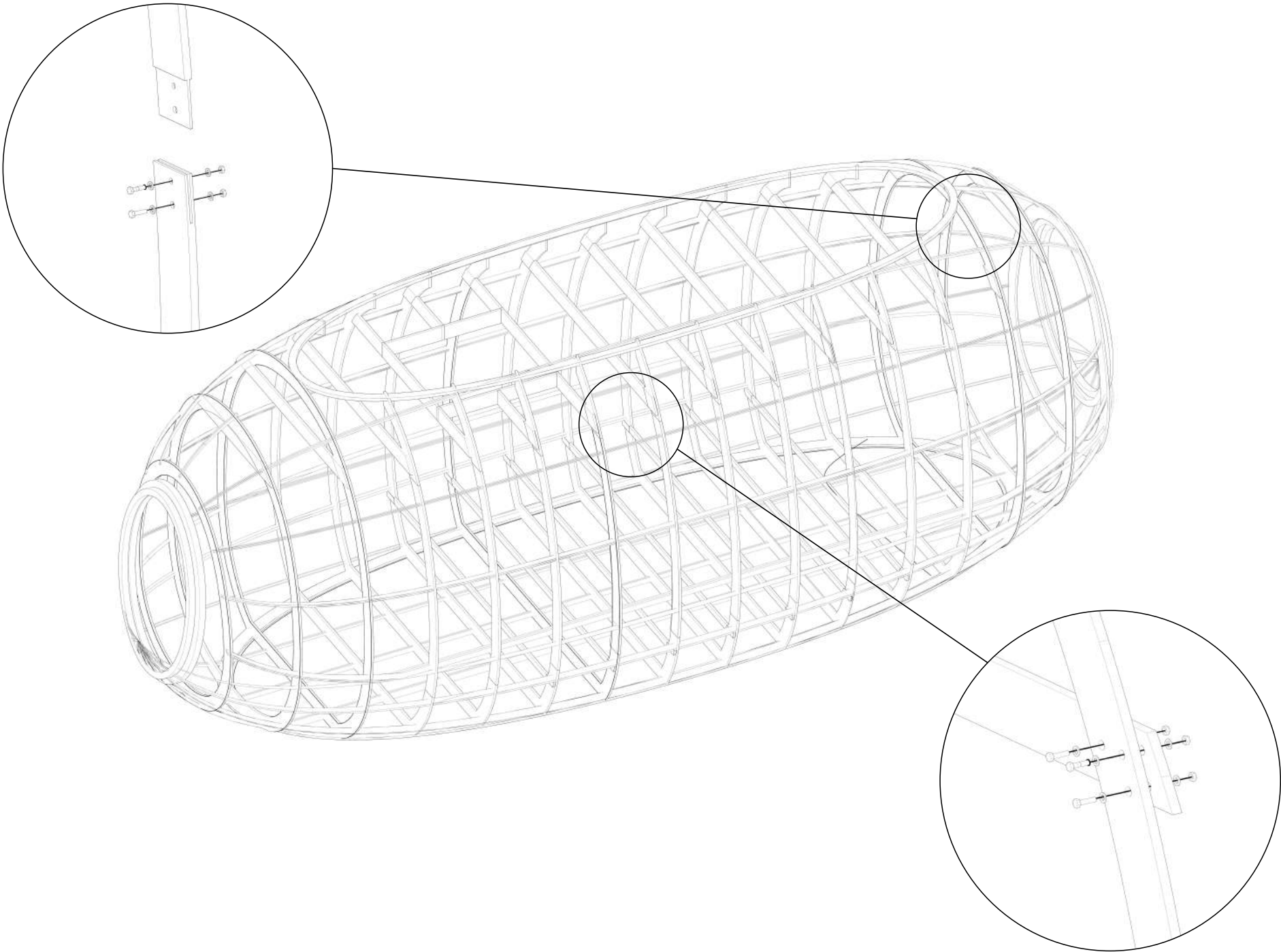
Roof



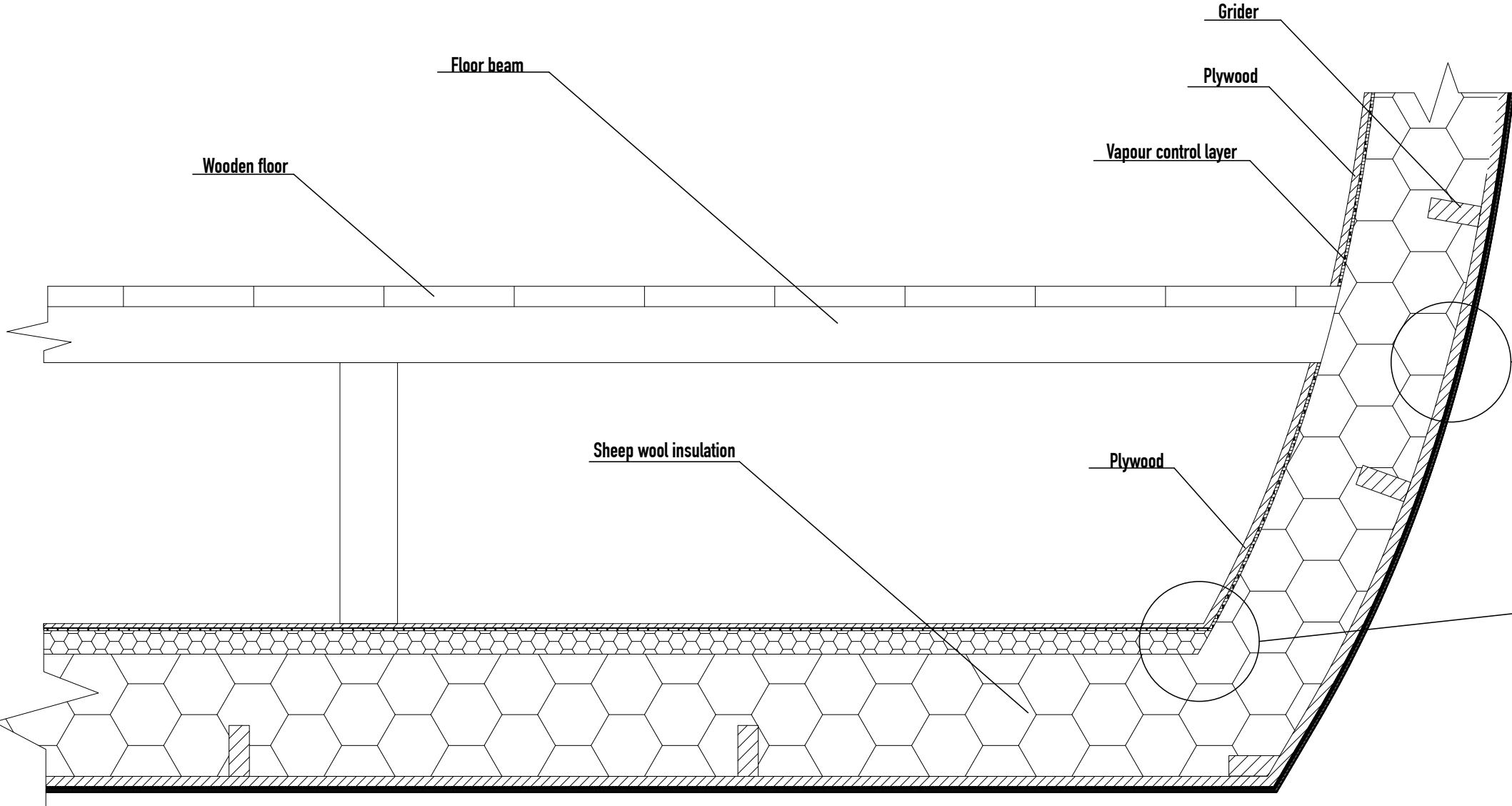
Another part of the houseboat is the additional opening roof, which serves as protection against weather conditions. This section consists of a ribbed structure covered with wooden cladding and treated with an epoxy coating to ensure waterproofing. The opening of this roof is facilitated by a hinge system and pneumatic pistons, which slightly lift the rear part of the roof and open the front part to a position where it is possible to stand upright.

The roof, doubling as a terrace, is formed by the main structure of the houseboat, extending all the way to the roof beams. The space between the beams is filled with the thermal insulation enclosed on the interior side with plywood and on the exterior side with a textile material that extends to the facade, creating an impermeable layer. Above this layer is a grid serving as a supporting base frame for the terrace's perforated cladding. The terrace also includes storage spaces on the sides for storing outdoor furniture, as well as an entrance into the interior, and a space for the captain and the helm.

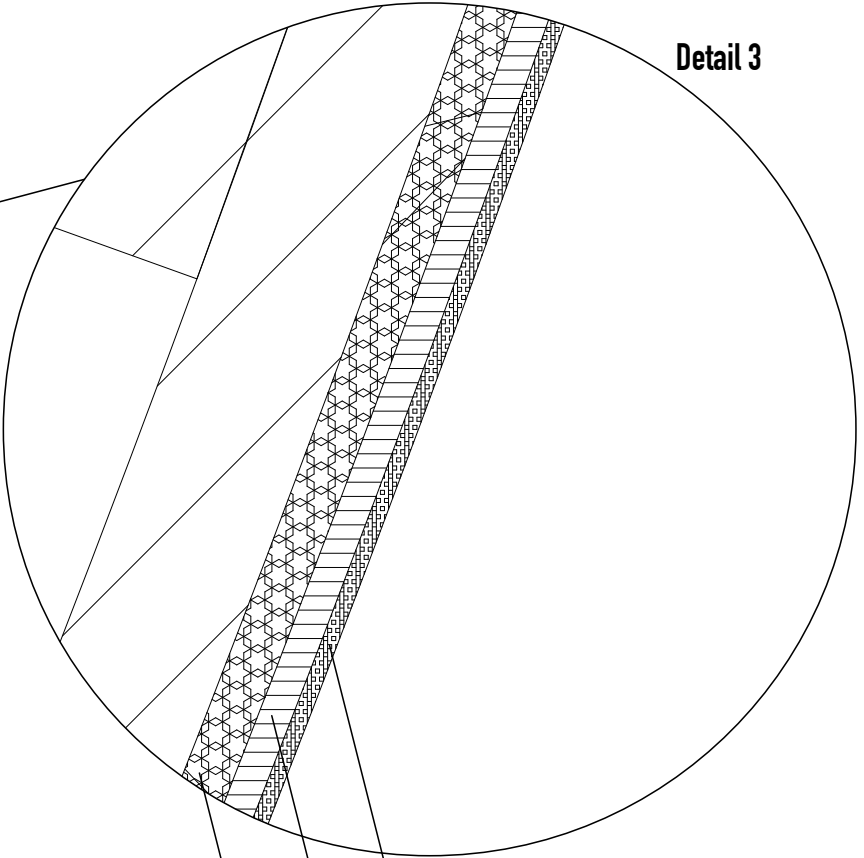
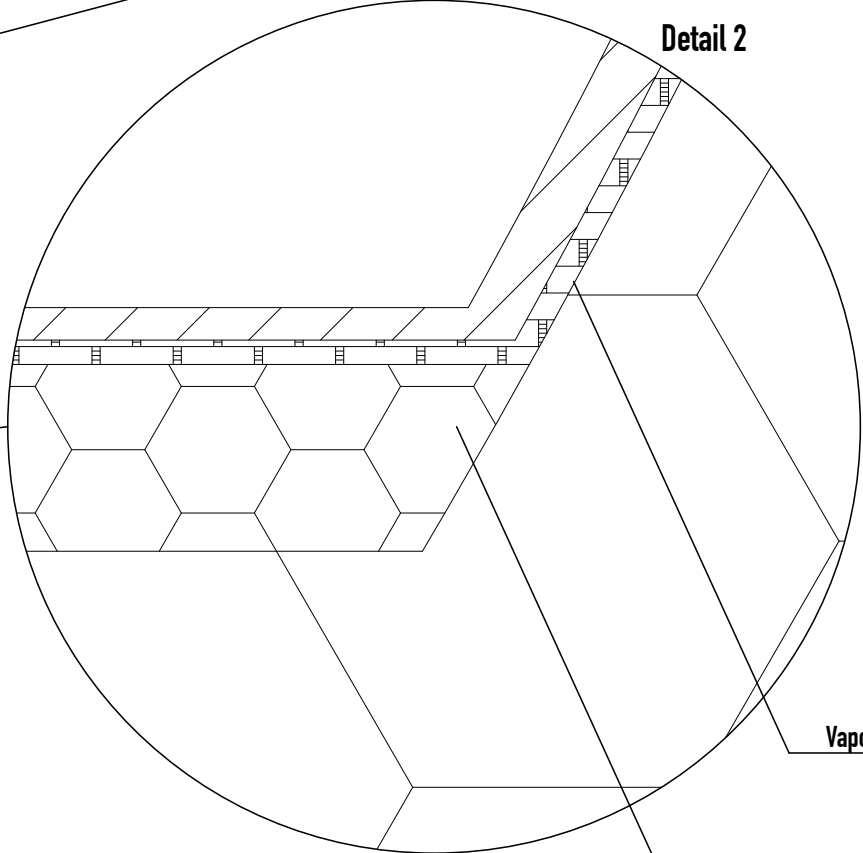
Structure joints



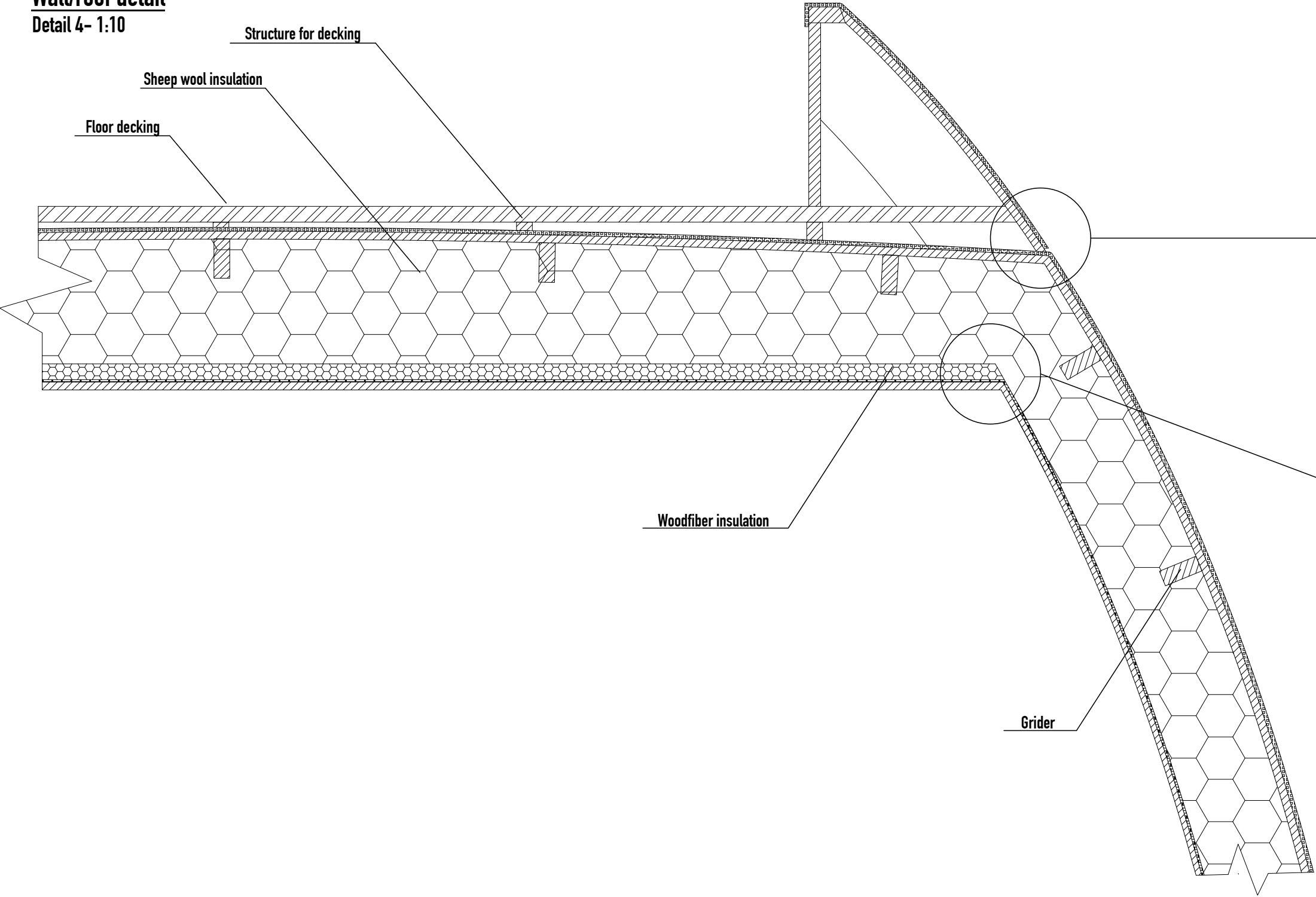
Hull detail
Detail 1- 1:10



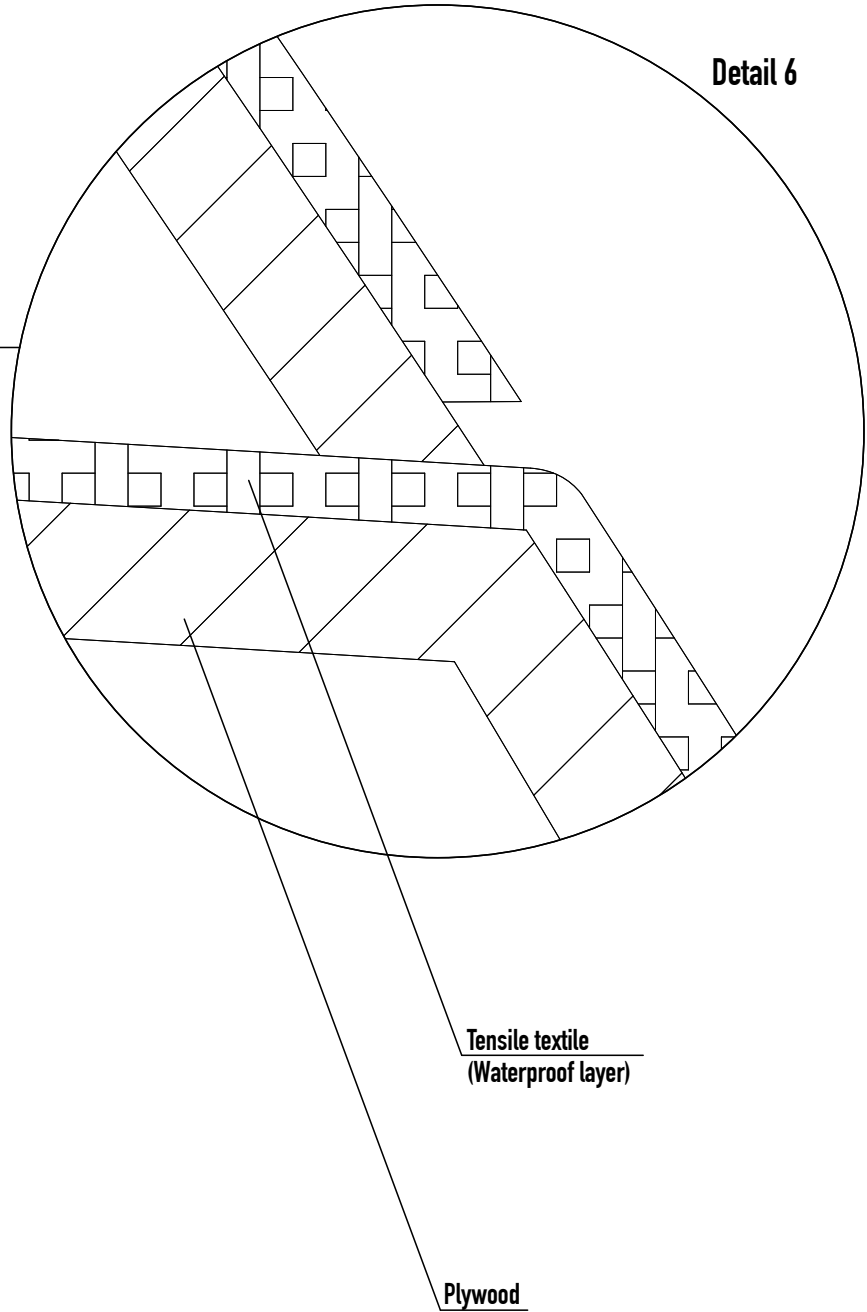
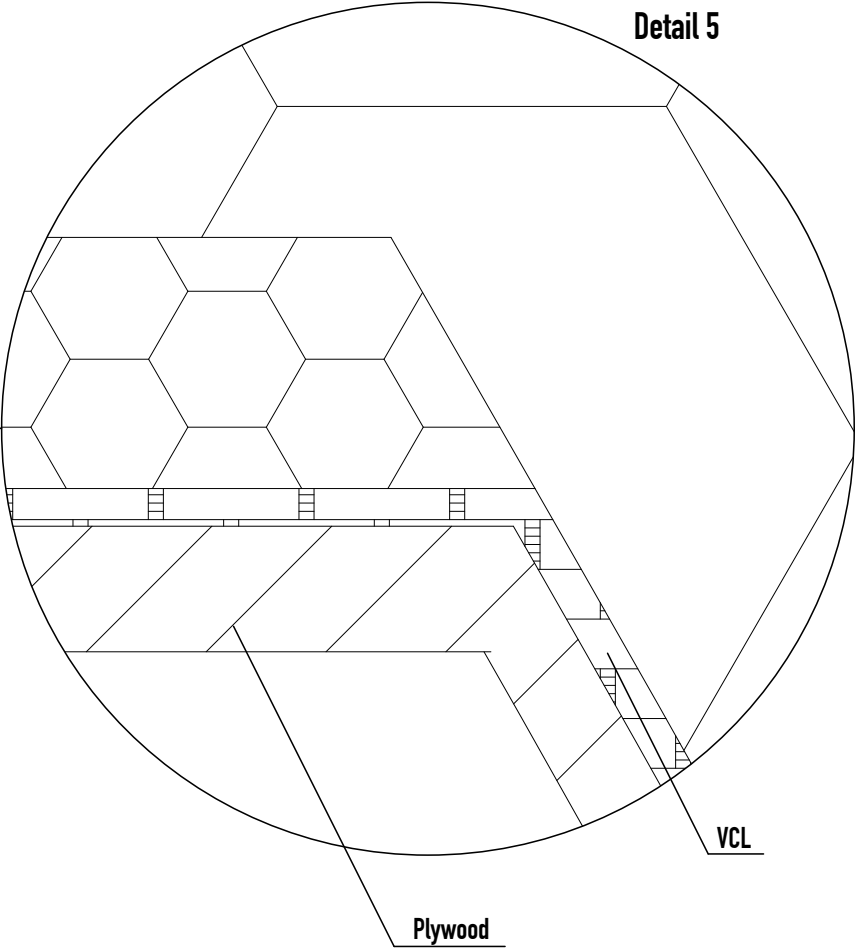
Hull detail
Detail 2,3-2:1



Wall/roof detail
Detail 4- 1:10



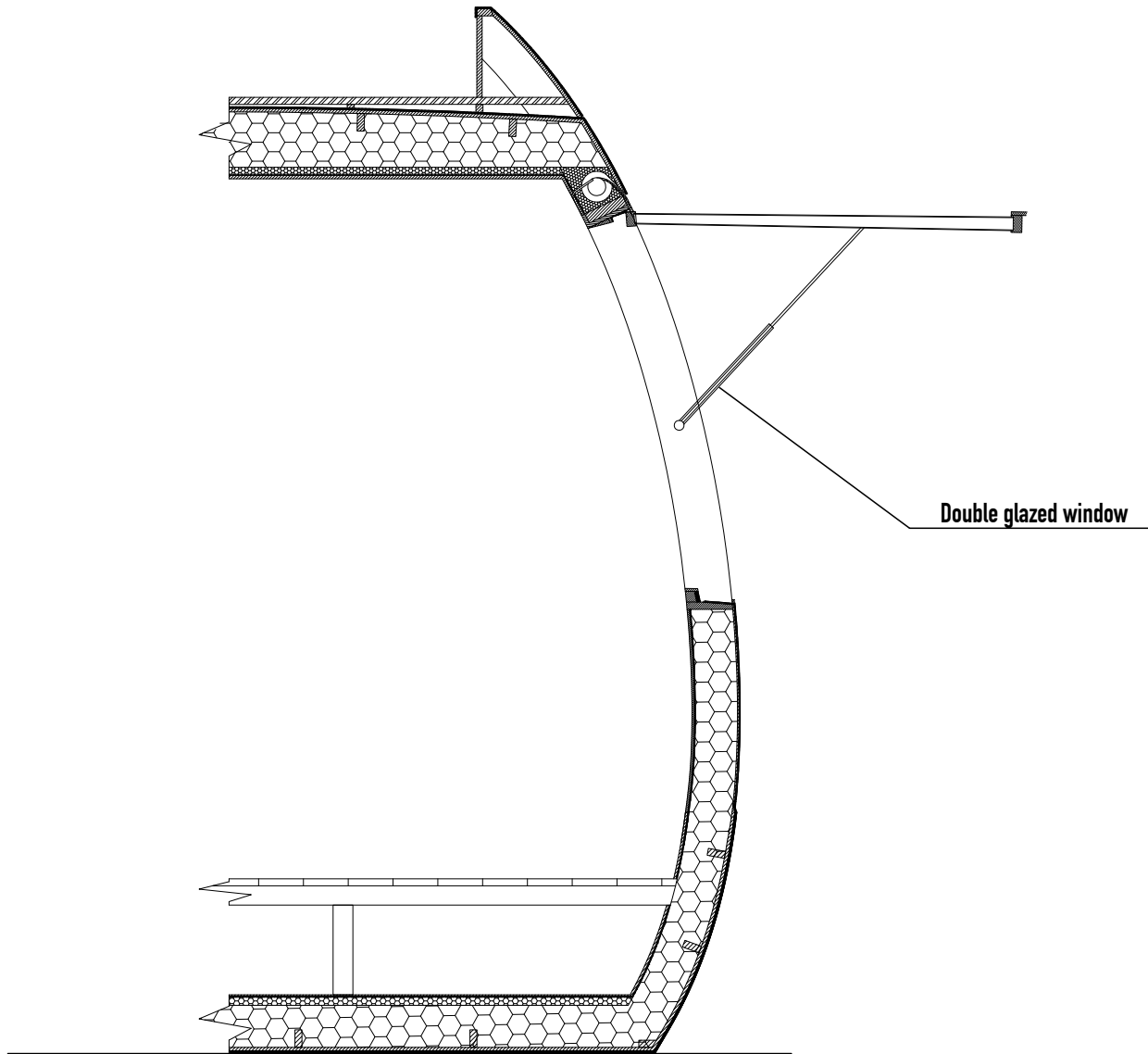
Detail 5,6- 2:1



Detail 6

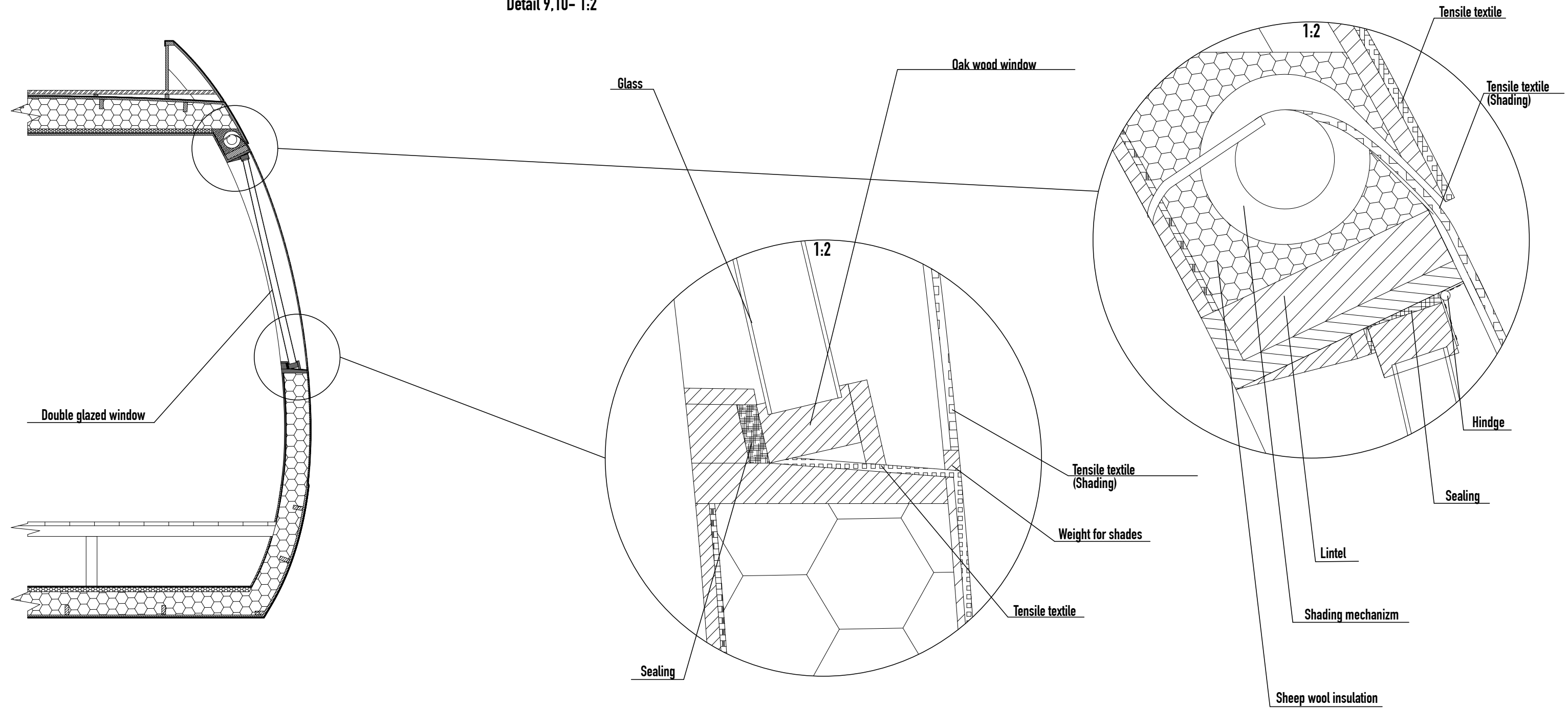
Side window

Detail 7,8- 1:20



Side window

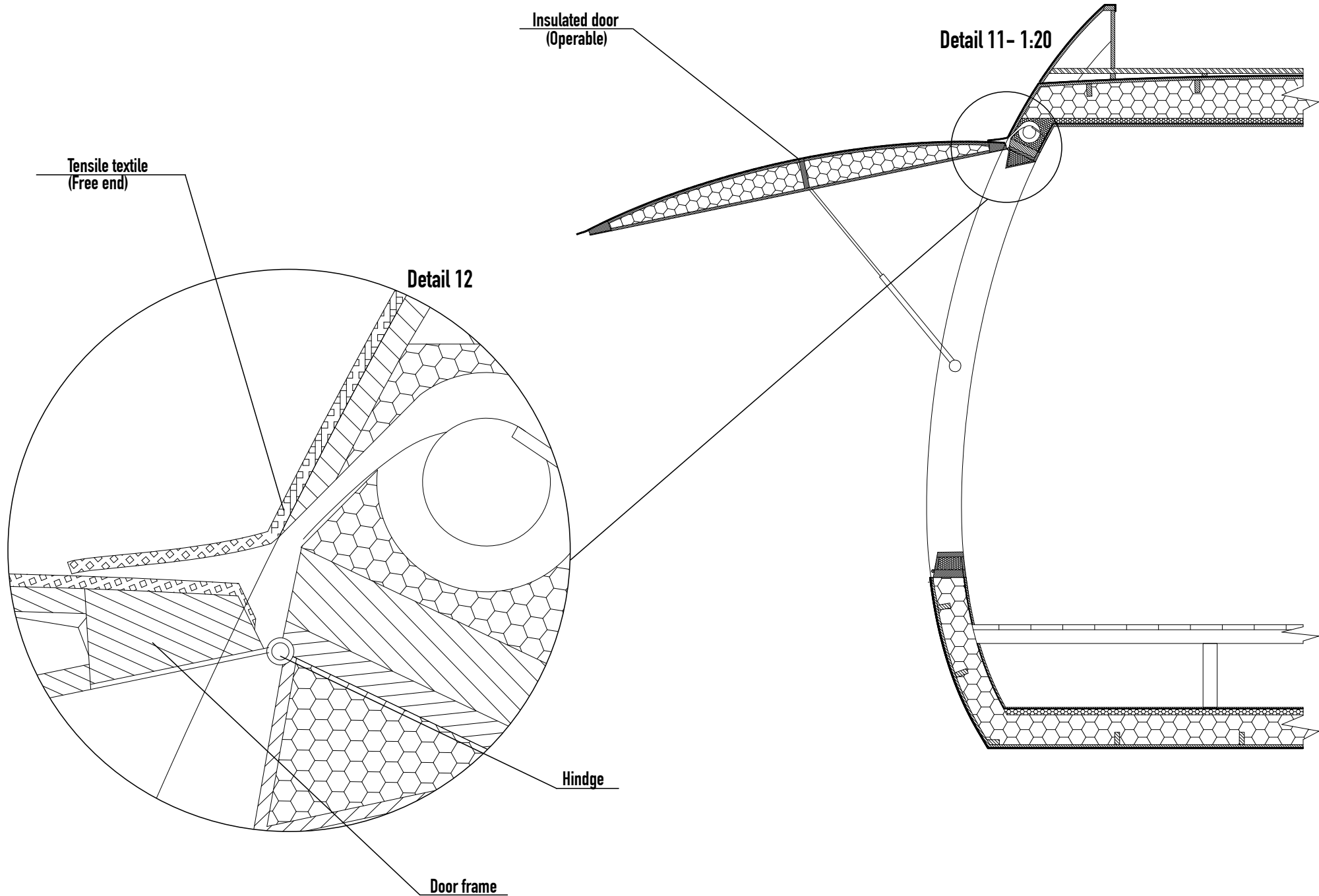
Detail 9,10- 1:2



Door detail

Detail 11- 1:20

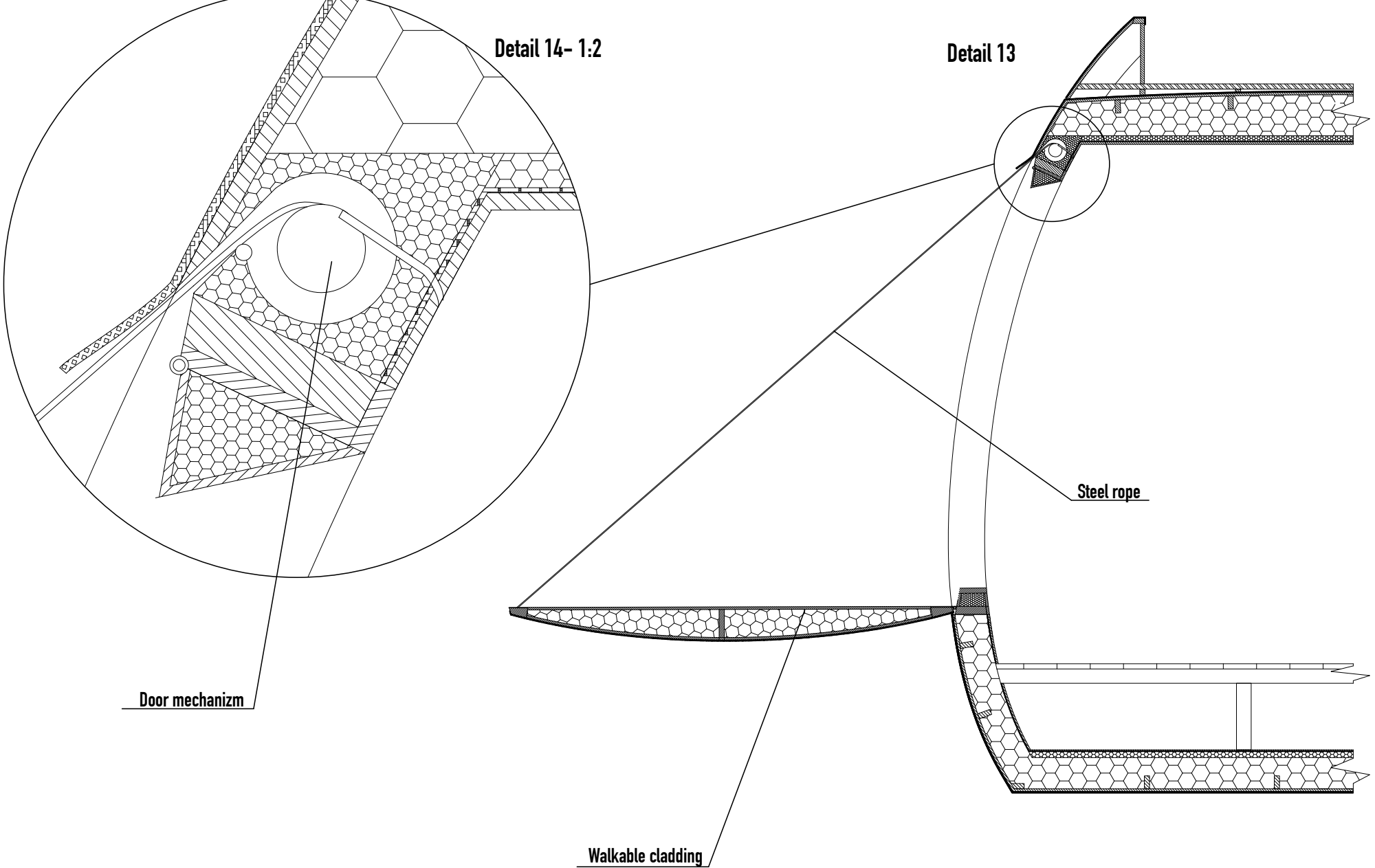
Detail 12- 1:2



Door detail

Detail 13- 1:20

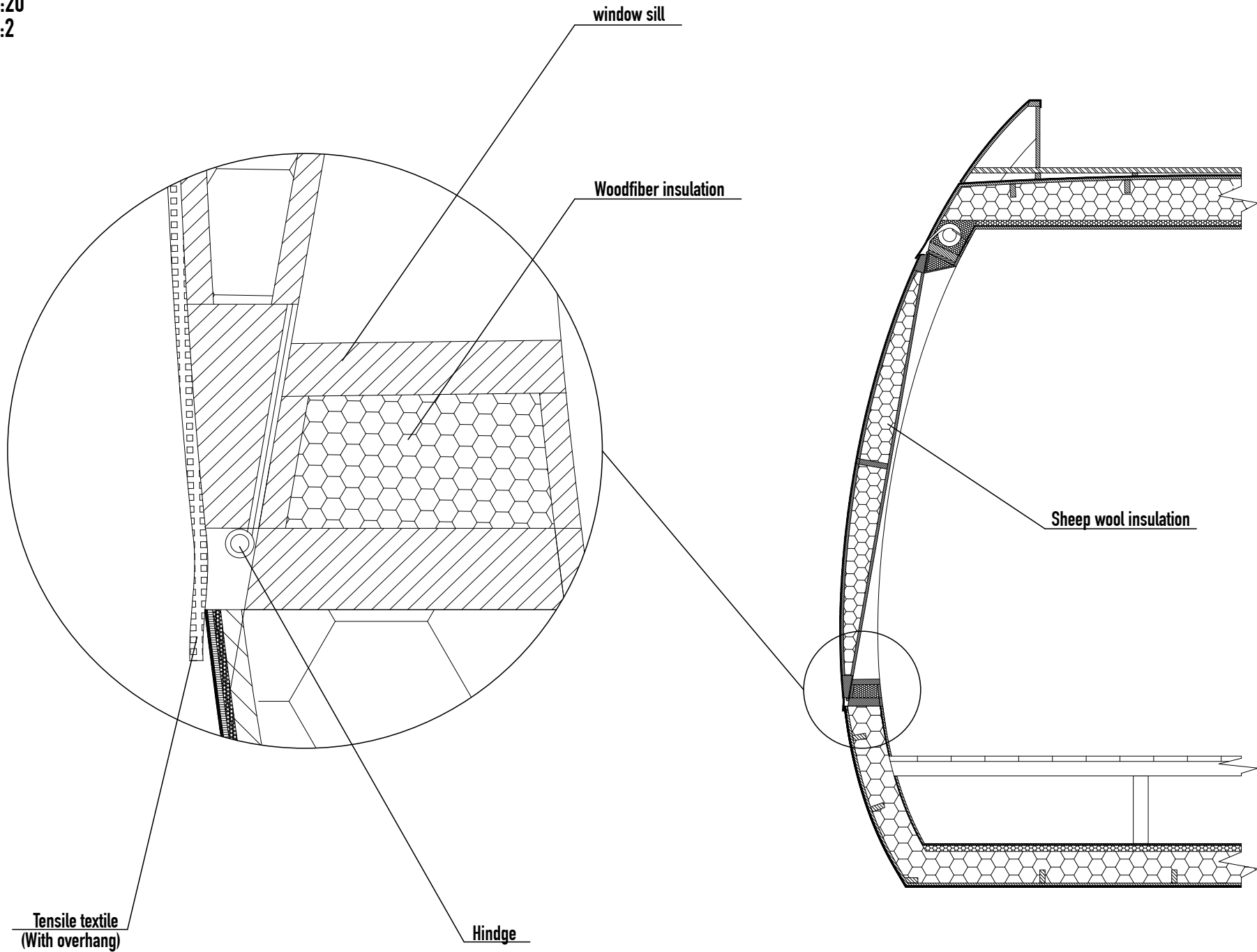
Detail 14- 1:2



Door detail

Detail 15- 1:20

Detail 16- 1:2

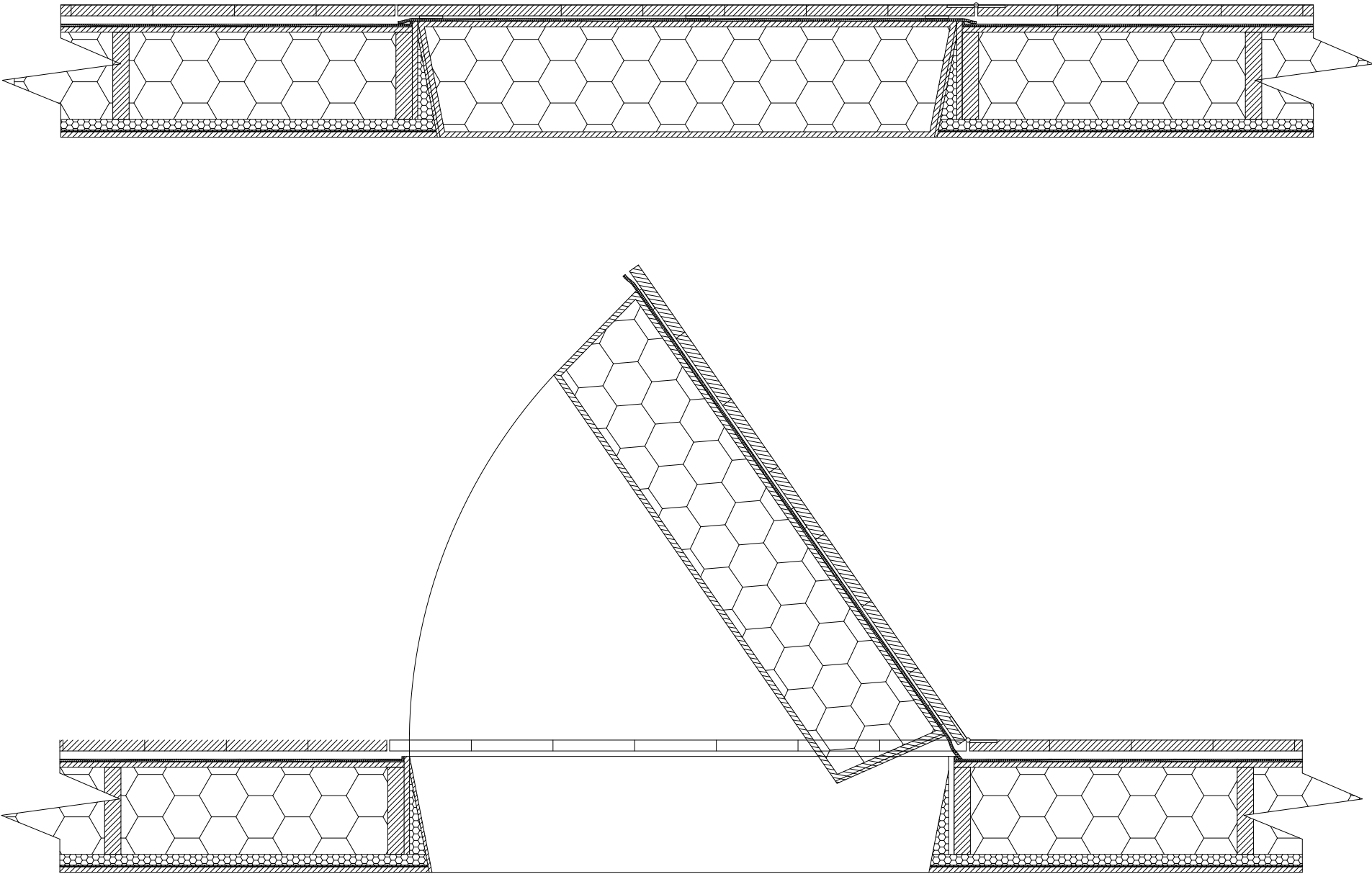


1:20

Roof opening detail

Detail 17- 1:10

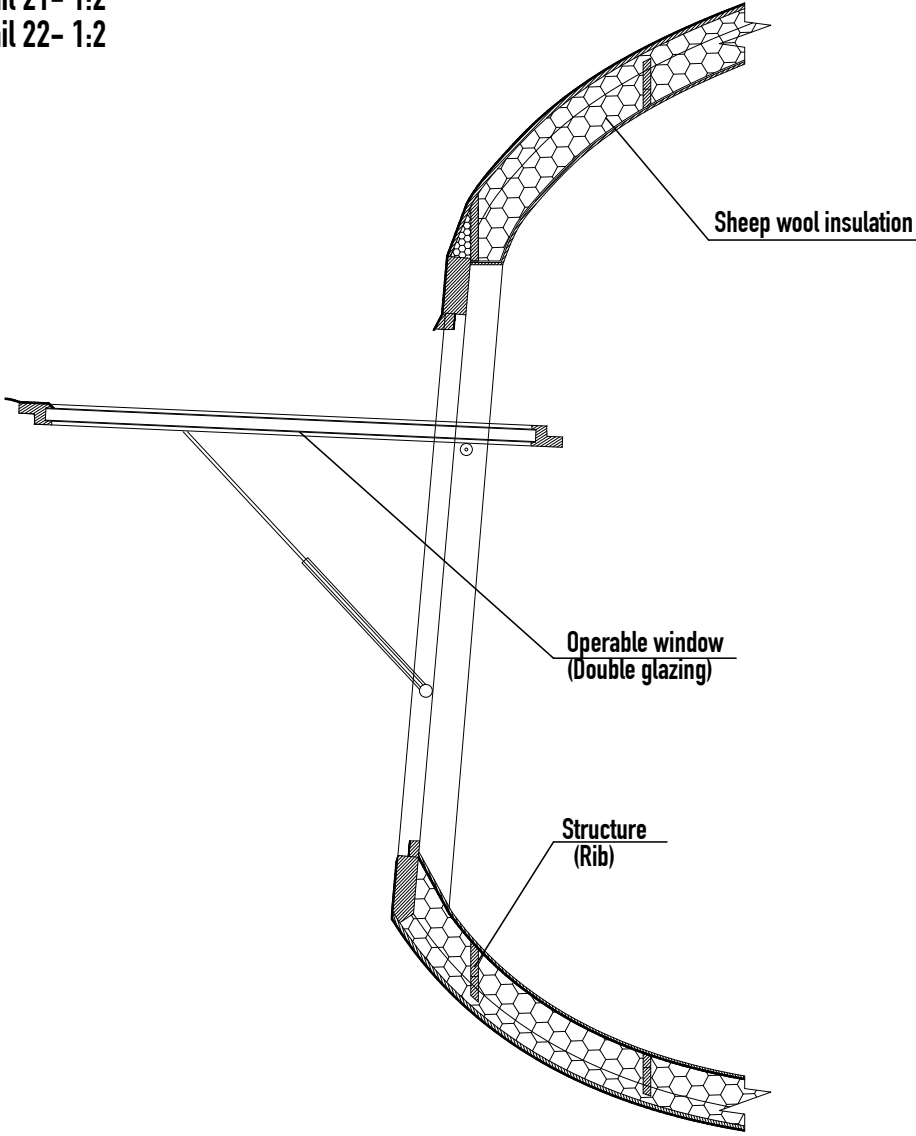
Detail 18- 1:10



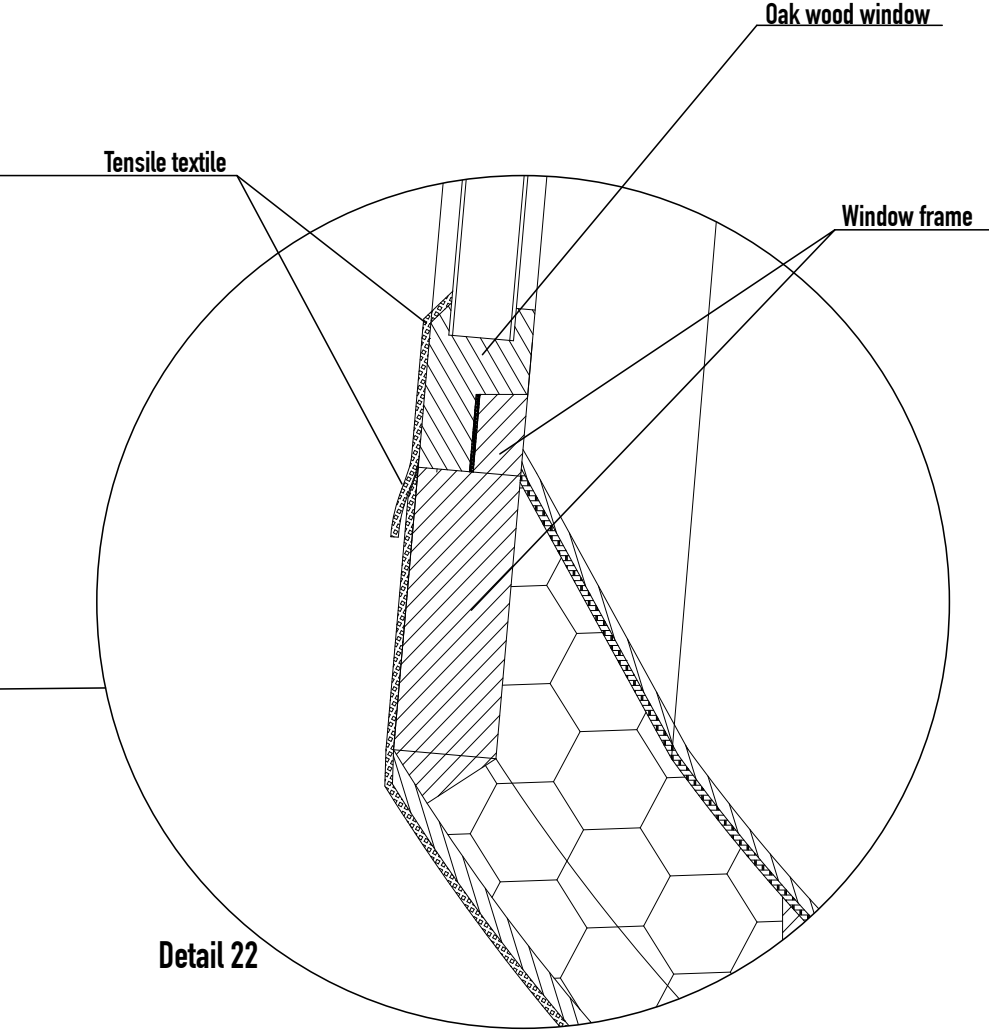
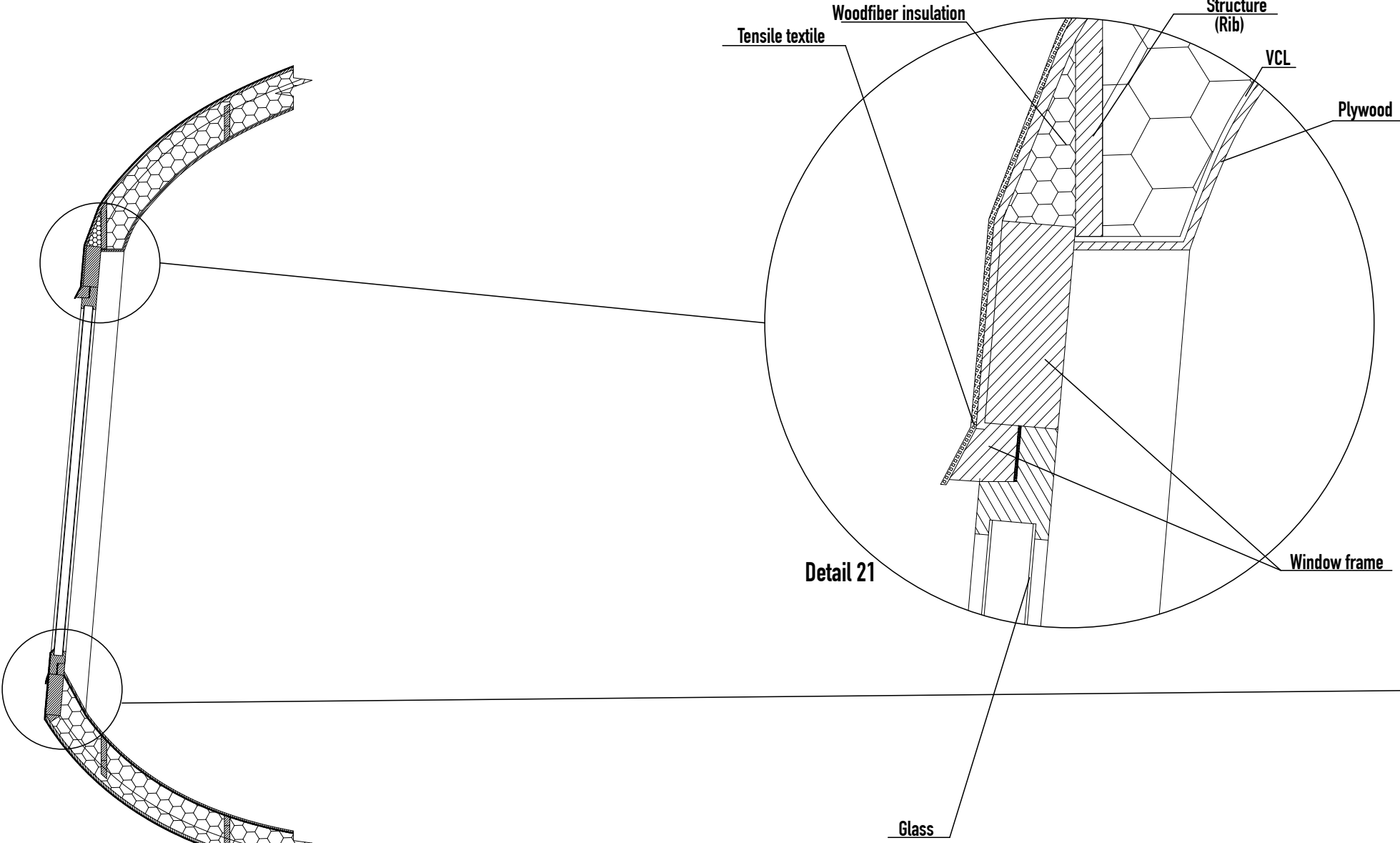
1:20

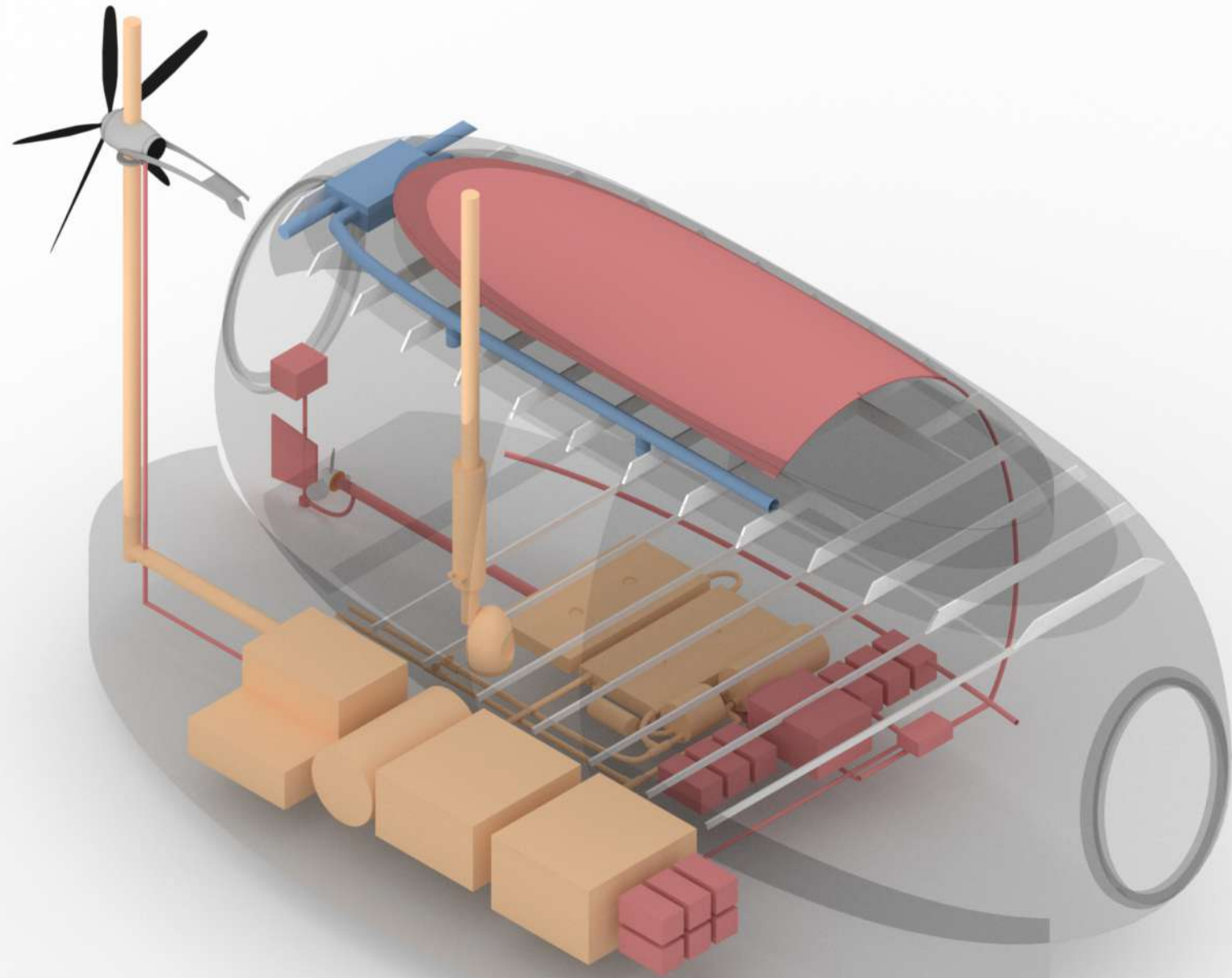
Front window

Detail 19- 1:20
Detail 20- 1:20
Detail 21- 1:2
Detail 22- 1:2



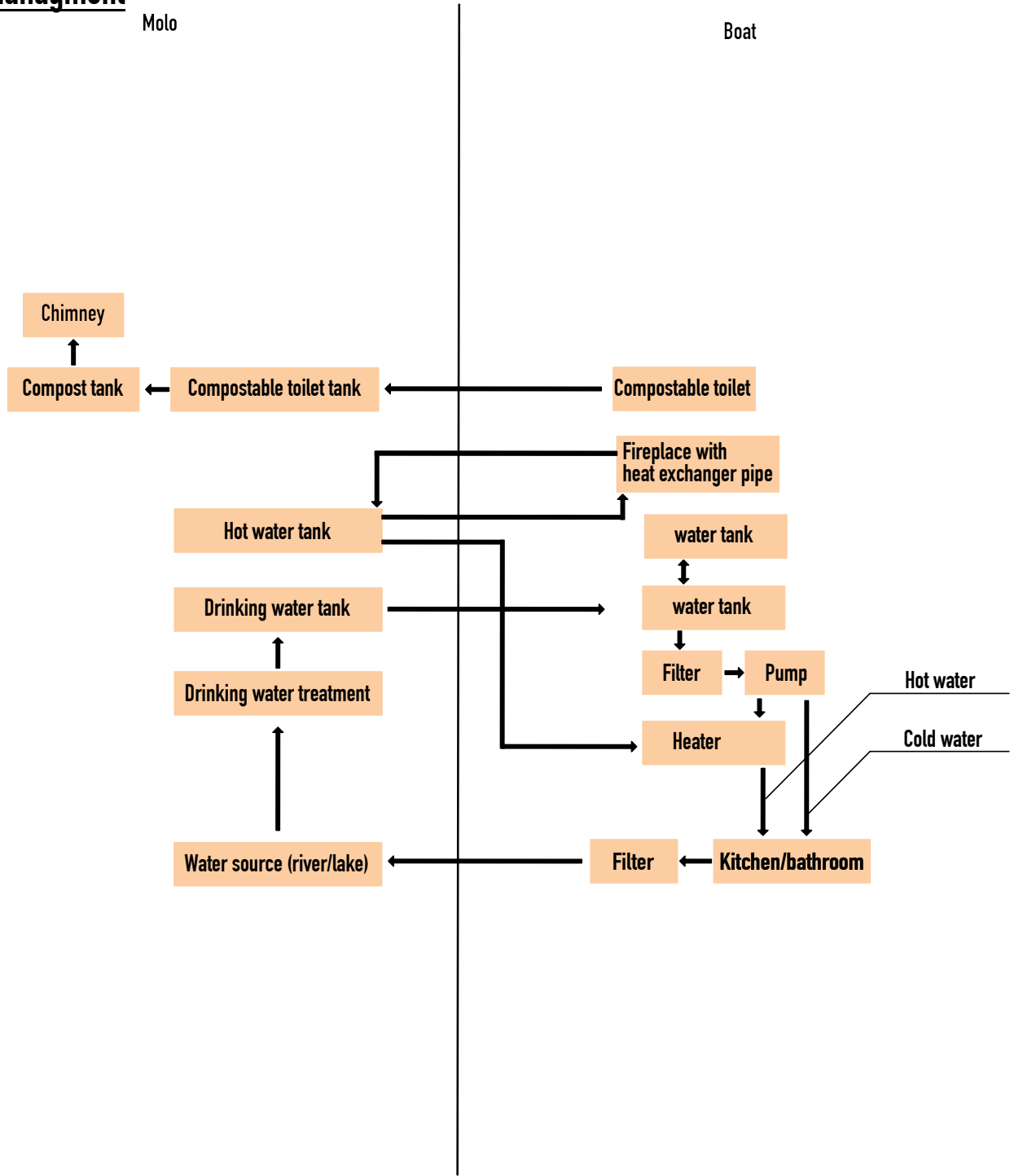
Front window





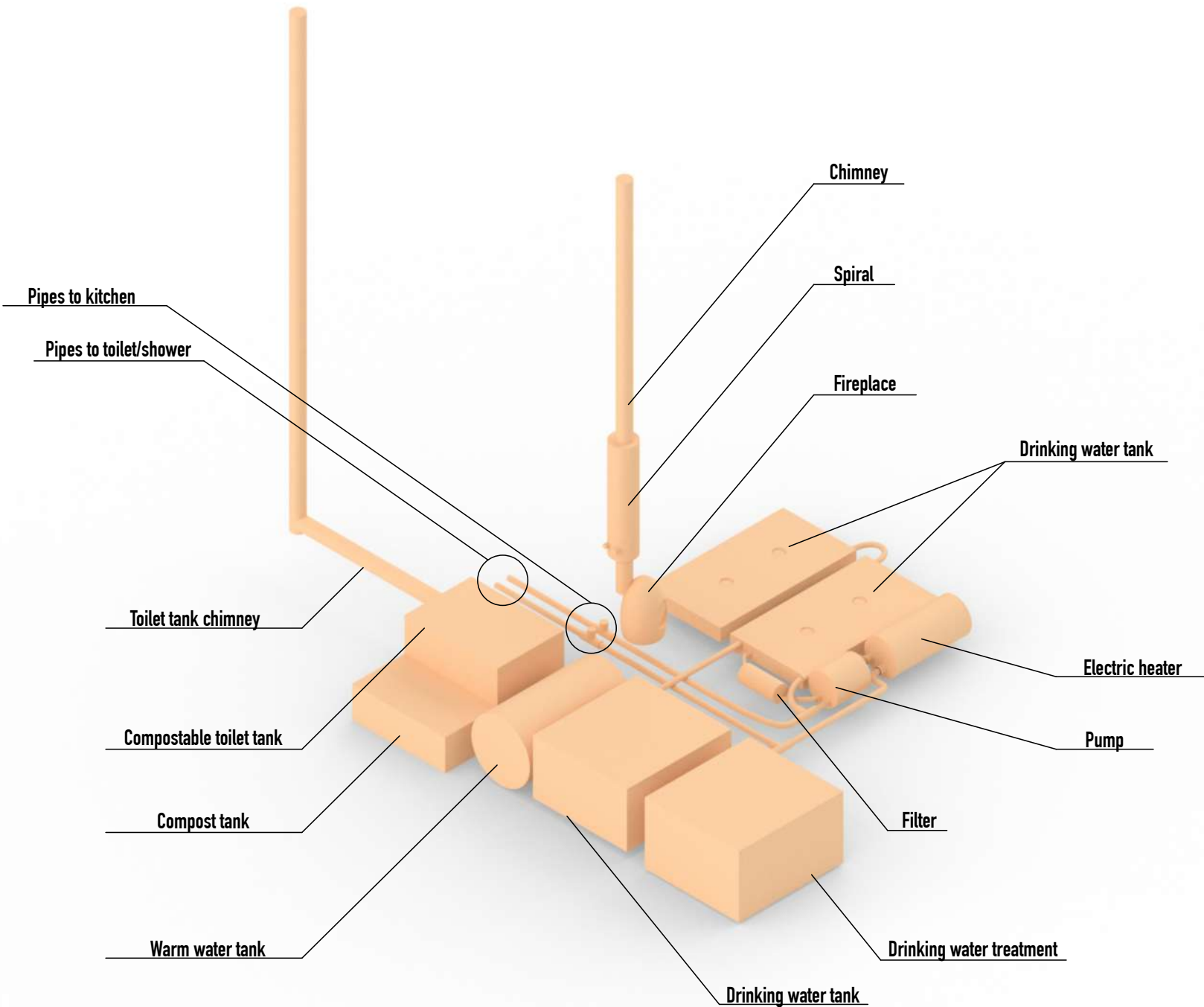
This houseboat is equipped with a larger number of technologies. The main idea is to ensure the greatest possible self-sufficiency of the houseboat, particularly regarding energy. The goal is to create a vessel that is completely energy self-sufficient and not connected to any grids except for the internet. Similarly, the aim is to make this houseboat as energy-efficient as possible so that the system used can function efficiently.

Water managment



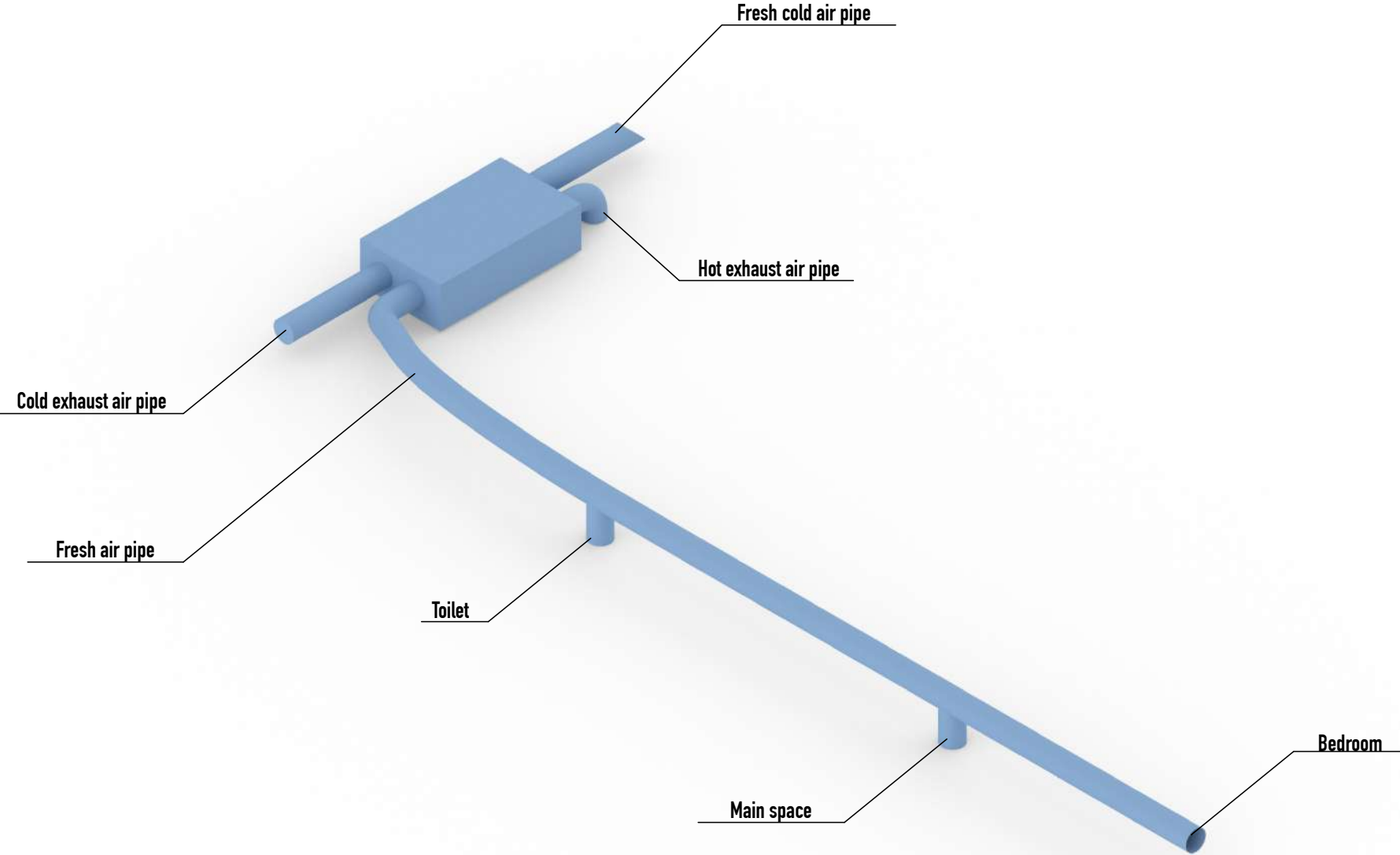
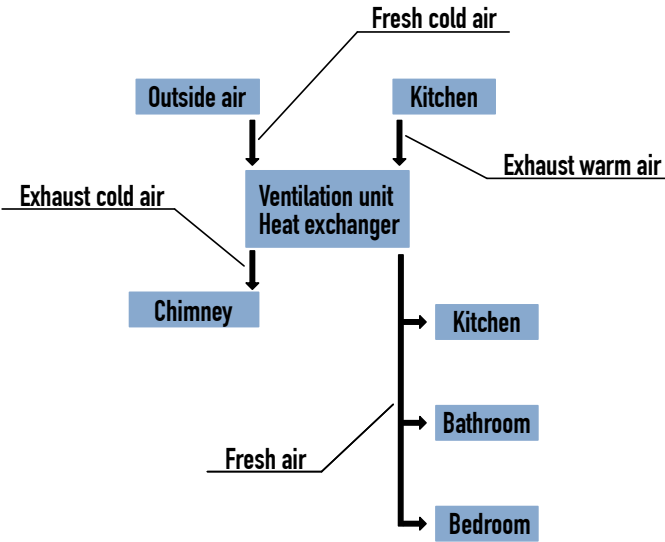
The water management on this houseboat is designed to create a closed loop for water usage. It begins with the first technology, which is drinking water treatment, drawing water directly from the body of water on which it is situated. Through drinking water treatment, the water is purified and stored in a water tank. From there, it is pumped into a boiler where it is heated using electricity from solar panels and made usable for showering or washing. Another option for water heating on the houseboat is a fireplace with a heat exchanger, which can heat water for use, especially during the winter months when the fireplace is in use, ensuring no energy goes to waste. An additional warm water tank is added for this purpose, stored on the jetty and connected to the houseboat. Used water from showers or sinks is filtered and returned to the body of water from which it was drawn. Of course, in this case, no chemicals are allowed to be used on the houseboat, only natural products that are environmentally friendly.

The toilet on the houseboat is composting, meaning all toilet waste is transferred to a composting tank where it eventually turns into harmless compost that can either be further utilized or returned to nature.

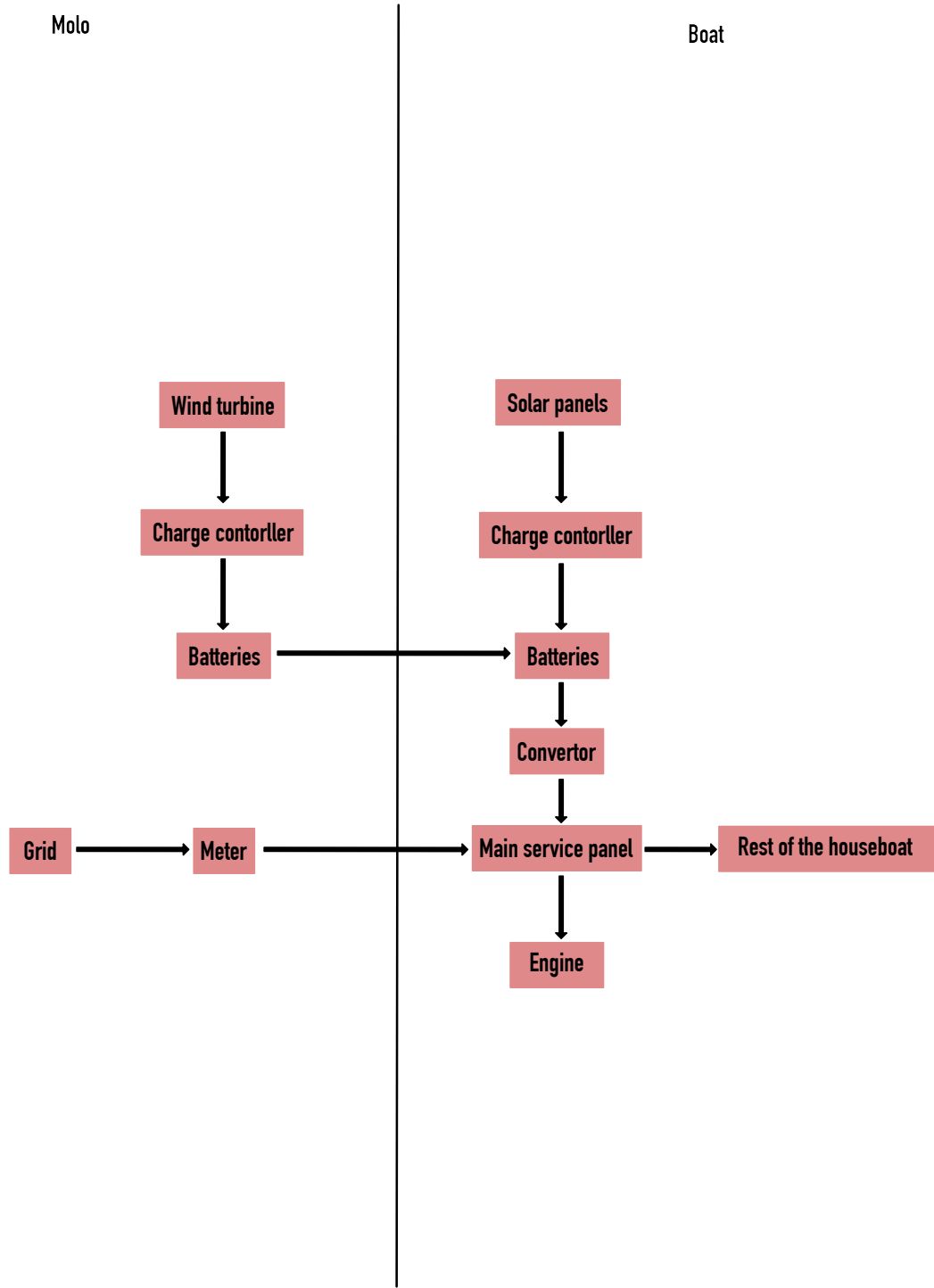


Ventilation

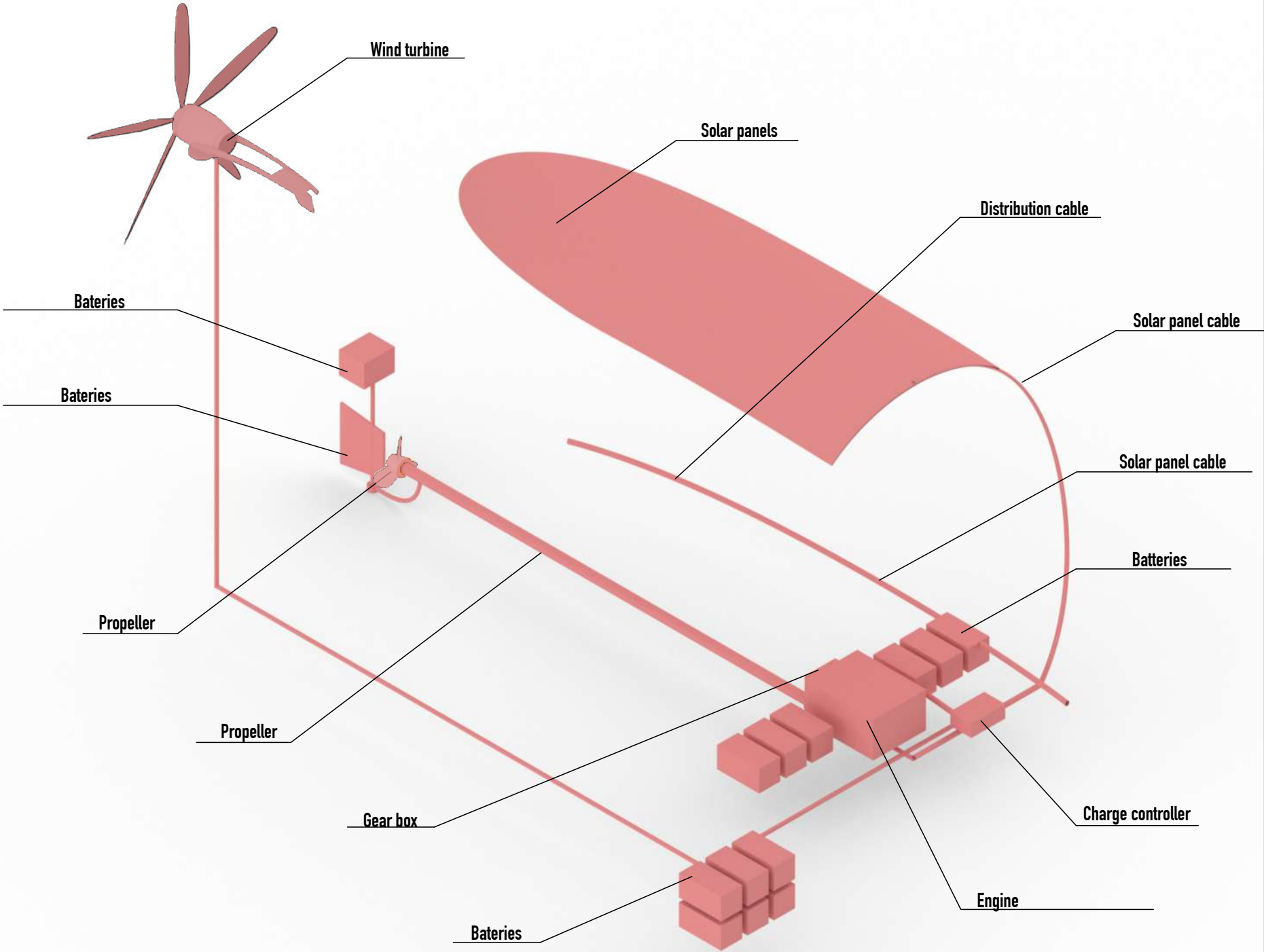
Another technology utilized is ventilation. Since the houseboat does not have sufficient wall thickness to be entirely passive, I have chosen several techniques and combinations to make it as efficient as possible. Ventilation in this houseboat operates on the basis of heat exchange, where warm exhaled air, for example from the kitchen, is exchanged for heated fresh air using a heat exchanger. However, since the houseboat only has 13 cm of insulation, this is not a sufficient heat source. Therefore, I have combined it with a stove that can easily heat this space.



Electricity



The last part involves electricity, which in this case is obtained from two sources, both from solar panels and from a wind turbine, which will serve primarily as an energy source in the winter months. The energy from the panels and the turbine is stored in batteries, allowing electricity to be used even in periods when there is no wind and it is cloudy. The houseboat also has an electric motor powered by batteries.



Technical Report

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11. MEP

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Bibliography

1. Brief

The architectural project aims to design a multifunctional houseboat, serving as both a private waterfront cottage for a family of three and an Airbnb rental during unused periods. Specific requirements include accommodating the family with height differences, providing year-round comfort, and ensuring adaptability for various seasons. The design prioritizes aesthetics for Airbnb appeal, ease of transition between private and rental use, and a child-friendly environment for a 2 year-old family member. Sustainability and energy efficiency are also key considerations. Overall, the goal is to create a versatile, comfortable, and visually appealing houseboat that meets the diverse needs of the clients. The family would like to use the houseboat mainly during the summer months (May-September); andif ossible, during the cooler months, too. Alternatively, they would like to rent out the houseboat during the remaining months.

2. Client

Name: Ivo Kossler

3. Requirements

3.1. Client requirements

A houseboat should serve the client as a cottage on the water + Airbnb rental when not in use.

3.2. General requirements

- The size of the houseboat should not exceed 12 meters in length

- Potable water

- Private toilet (preferably a separating one with a separate container, removable from the exterior)

- Private bathroom with a shower

- The need to consider possible heating/cooling

- Utilization of solar panels for powering the houseboat

- No need for large appliances such as a washer-dryer (only a refrigerator)

- Kitchen: electric double hotplate, small refrigerator with freezer + sufficient storage space

3.3. Technical requirements

General documentation requirements are stated in sections 1.03.1. to 1.03.3 of Annex No. 2

of the regulation. Documentation adapts based on vessel type and construction to include

necessary data for compliance assessment with regulation requirements. When reconstructing, altering, or changing vessel usage, documentation must contain parts specified in Annex No. 5 necessary for assessing compliance with regulation requirements. Drawings and schemas must adhere to technical drawing principles, and written

documentation should respect professional terminology. The regulation in Annex No. 5 specifies that technical documentation must include all relevant data or means used by the manufacturer to ensure compliance with fundamental requirements related to the vessel. It must enable understanding of the design, production, and functioning of the product, allowing assessment of compliance with regulation requirements. The list of necessary documentation parts provided in Annex No. 5 must be understood in the context of cited provisions and introductory clauses. A comprehensive description of the vessel is essential for understanding the entire design and solution. It is crucial to maintain formal Czech language and professional terminology. The description should include vessel type, purpose, expected special abilities, construction type, basic materials, propulsion type, and brief description of main parts. Additionally, it should include technical equipment to be installed on the vessel. Conceptual design and manufacturing drawings and schemas may vary depending on construction type and author's practices but must ensure accurate representation of the vessel according to technical drawing principles. Essential parts of documentation include overall views, internal arrangement representations, construction descriptions, and system schemas. Descriptions and explanations for understanding drawings, schemas, and vessel usage should also be included, detailing construction and equipment. A list of standards applicable to small vessels, along with descriptions of solutions chosen to meet basic requirements, should be provided. Results of construction calculations, excluding those related to buoyancy and stability should be summarized, including calculation methodology and used formulas. Calculation results concerning vessel stability, freeboard, buoyancy, and flotation, along with test protocols, are necessary. Calculations involve determining vessel weight and its center ofgravity, as well as displacement calculations, crucial for understanding vessel stability and flotation. These computations require expertise and are vital for ensuring vessel safety. Documentation must include emission tests for exhaust gases and noise if specially manufactured engines are used. Typically, this involves CE conformity declarations for newengines.

3.4. Layout requirements

- Separate toilet with a window

- Separate bathroom with a shower, sink, window

- Main area, including a kitchen + living/dining room with access to a terrace

- Terrace at the front + if possible, accessible roof

- One separate bedroom (for two adults and child)

4. Houseboat design description

The entire design of the houseboat is based on the design and structure of a ship. The basic part is the boat-shaped hull, which is designed base on sailboats. The hull itself continues into a complete unit with the help of ribs, which are the main supporting structure. The shape of the houseboat resembles a bubble. I chose this shape for several reasons. One reason is aerodynamics, although the primary function of this houseboat is not sailing; it is advantageous to have this vessel in an aerodynamic shape as it creates less resistance, and a less powerful motor is needed. This means that a weaker electric

motor powered by solar panels is sufficient. Another reason for this shape is that it directly derives from the shape of the boat hull and is a natural extension of the hull's construction. Another important aspect of this shape is the interior. Since the houseboat is size-restricted, it was necessary to address the issue of the width of the boat. Even though the floor inside the houseboat is only 2.5 meters wide, it is utilized across the entire width.

4.1. Roof design

The houseboat also features a concealed roof integrated into the shape of the houseboat and slightly submerged so it is not visible from the outside. The houseboat has an additional roof covering the concealed one, completing the integrated shape of the houseboat. This roof is openable and serves as protection against weather conditions and sunlight.

4.2. Openings design

Another feature of the houseboat is its generous oval-shaped windows, which bring plenty of light into the interior. The largest window is divided by rib construction into individual segments, with the central segment being openable, creating an entrance to the houseboat.

4.3. Interior design

The interior of the houseboat is designed to be as simple as possible. The entire space is open. The rear part of the interior consists of seating that can be converted into a large bed. On the opposite side at the front is the kitchen with a bathroom and toilet. The middle part of the houseboat is completely open, providing space for various activities, including a place for a dining table and communal activities, as well as a space for work or enjoying the view from the generous window.

5. Materiality

The clients would like the houseboat to be primarily constructed from natural materials, preferably recycled or upcycled materials. They envision the houseboat to be as ecologically friendly as possible hence, they prefer used materials for construction. The main material component of the entire houseboat is wood, which is used for both the entire structure and interior part.

6. Structure

6.1. Houseboat hull

The houseboat hull is composed of three parts: the structure, the outer shell, and the waterproof layer with coating. The structure of the hull consists of ribs made of plywood, cut to the desired dimensions using a CNC machine. The rib components are joined using a dovetail and carpentry joints to avoid potential corrosion when using metal fasteners. This entire structure is treated with multiple coats of tung oil, which acts as excellent natural protection for the wood against weather conditions.

6.2. The outer shell (research phase)

The ribbed structure is enclosed using plywood and forms the surface of the hull. Gaps between the plywood are filled with an epoxy mixture and subsequently sanded into smooth surface. Another layer is fiberglass, which is applied to the aforementioned part. Then, this layer is covered with several layers of epoxy, creating a waterproof and sturdy layer. This layer may or may not be covered with another layer of paint. It is advisable to use protective paint because it creates a barrier against UV radiation, which can damage the layers beneath the coating over time. For this coating, it is necessary to use a paint that is resistant to UV radiation.

6.3. Superstructure

The structure above the level of the hull is made of the same material as the hull itself, which is plywood processed by a CNC machine to the desired dimensions. The structure above the hull level is a continuation of the hull into the shape of a bubble. It consists of ribbed structures in the vertical direction, following the same principle for horizontal ribs. This construction also includes beams for supporting the roof, which are a direct continuation of the vertical ribs. This structure is also treated with tung oil

7. Facade

The facade of the houseboat is made of tensile fabric, forming a waterproof layer. I chose this option mainly because of the irregular shape, which is difficult to cover with conventional building materials. Additionally, compared to other materials, it is very lightweight and waterproof.

8. Openings

This houseboat features several openings serving both as sources of natural light and as entry points into the houseboat itself or access to the rooftop terrace from the interior of the houseboat.

8.1. Windows

8.1.1. Front and rear window

The front and rear sections of the houseboat have oval-shaped double-glazed oak windows, which bring light into the kitchen area at the rear and the living area at the front.

8.1.2. Side window/entrance

The side window of the houseboat stretches almost the entire length. This window is divided by the rib construction into 5 segments, with the central segment being operable, creating an entrance to the terrace.

8.2. Shadings

All the openings of the houseboat are equipped with shadings. Therefore, the houseboat can be completely closed during periods of non-use.

8.2.1. Front and Rear Shutters

These shutters open upwards and serve as shading. They are equipped with thermal insulation so they can be closed during winter, for example, at night, to eliminate heat loss. Shutters are made from timber rib structure coated with tensile textile from exterior and enclosed by plywood from interior side.

8.2.2. Side shadings

The blinds on the side windows are retractable and can be adjusted to any position as needed. When fully retracted, they blend with the facade, meaning that if they are all closed, the houseboat appears to have no openings and forms a continuous facade.

8.3. Entrance to the upper terrace/roof

This entrance is designed with upward-opening doors, providing easy access to the terrace. The doors of this opening (front and on the both sides) are also equipped with thermal insulation and a waterproof layer.

8.4. Doors

On the houseboat, there are two doors on the sides (main entrance door, doors to terrace).

8.4.1. Main entrance door

The main entrance door consists of a wooden ribbed structure covered with tensioned textile on the exterior side and enclosed with plywood on the interior side. The interior of the door is filled with sheep wool insulation to prevent heat loss. This door has hinges on the top and bottom, meaning it can be opened horizontally either downwards or upwards as needed.

8.4.2. Door to terrace

The door to terrace are same as the main entrance doors, with the only difference being that this opening has hinges only at the top, meaning it opens upwards.

9. Roof/terrace

The roof or top section of the houseboat consists of two parts: the primary roof, which serves as the houseboat's terrace, and a secondary opening roof designed to provide protection against adverse weather conditions.

9.1. Primary roof/terrace

The roof, doubling as a terrace, is formed by the main structure of the houseboat, extending all the way to the roof beams. The space between the beams is filled with the thermal insulation enclosed on the interior side with plywood and on the exterior side with a textile material that extends to the facade, creating an impermeable layer. Above this layer is a grid serving as a supporting base frame for the terrace's perforated cladding. The terrace also includes storage spaces on the sides for storing outdoor furniture, as well as an entrance into the interior, and a space for the captain and the helm.

9.2. Secondary operable roof

Another part of the houseboat is the additional opening roof, which serves as protection against weather conditions. This section consists of a ribbed structure covered with wooden cladding and treated with an epoxy coating to ensure waterproofing. The opening of this roof is facilitated by a hinge system and pneumatic pistons, which slightly lift the rear part of the roof and open the front part to a position where it is possible to stand upright.

10. Interior

The entire interior of the houseboat is custom designed because the shape of the houseboat itself does not allow the use of standard furniture.

10.1. Layout

The layout of the houseboat is divided into three main sections: the kitchen, the living area, which can be transformed into a bedroom, and the last section is the bathroom with a toilet. Another additional section is the space in the middle of the houseboat, which remains open and can be modified according to the needs. The access to the terrace is from this space through the central opening in the facade.

10.1.2. Kitchen

The kitchen is situated in the rear part of the houseboat. It is custom-designed to fit the curved shape, with plywood being the primary material for the entire kitchen except for the kitchen desk, which is made of oak wood. The kitchen features an electric double hotplate, a sink with an integrated microwave oven, and a built-in refrigerator. Plenty of storage space is available both in the cabinets and above them. All kitchen doors are sliding to save valuable space.

10.1.2. Living Room/Bedroom

The living area, which can be transformed into a bedroom, is located at the oppositeend of the boat from the kitchen, in the front part of the houseboat. This area isdefined by a built-in sofa that lines with the perimeter of the front section of the boat.The sofa includes a fold-out captain's chair with a helm. The central part of this spacefeatures a platform that can be raised from the floor and used either as a dining table or aligned with the seating to create a large bed.

10.1.3. Bathroom/Toilet

The bathroom with a toilet is situated closer to the kitchen for plumbing reasons. It is designed in a curved layout to seamlessly integrate with the rest of the houseboat'sdesign. The entrance doors slide to save space. On the exterior side of this unit, thereis a stove facing the living room. The chimney from this stove is concealed within the unit, with a spiral wrapped around it for water heating. This entire system is insulated and separated from both the bathroom and the rest of the houseboat.

10.1.4. Central Open Space

This area has minimal furniture or elements except for a large table sunken in the floor, which can be pulled out and used as a dining table or desk. The dominant feature of this space is a huge window, serving as both an entrance to the houseboat and a gateway to the dock from the interior.

10.2. Interior walls

The interior walls are covered with narrow, easily bendable wooden cladding, which is angled at 45 degrees creating herringbone pattern, serving as reinforcement and strengthening of the structure. This cladding is treated with tung oil.

10.3. Floor

The floor in the houseboat is divided into three levels. The first and largest level is in the middle, where the largest window and the entrance to the houseboat are located. The next level is where the kitchen is situated; in this area, the floor is lowered by 18 centimeters to increase the height of the kitchen. Another level is where the seating area is located; this part is lowered by 10 centimeters. The elevation of the central part also serves to accommodate all necessary technology below this level. The entire floor space is openable, in order to access the technology underneath it. The surface of the floor is made of oak wood. I chose oak wood not only for its visual appeal but also for its quality and weight. To make the houseboat as stable as possible, it is necessary to load the lower part as much as possible. Therefore, I choose to place technology under the floor and also opt for an oak floor.

10.4. Ceiling

For the ceiling, I opted for the lightest material possible to avoid unnecessarily burdening the roof and the upper part of the houseboat. Therefore, I decided to use birch plywood with a thickness of 3mm.

10.5. Stairs

The plywood stairs in this space are designed to fold down from the ceiling, saving space when access to the upper terrace is not needed. The stairs are located in the living room/ bedroom area and lead towards the kitchen. They are positioned along the longitudinal axis of the houseboat.

11. MEP

11.1. Mechanical

11.1.1. Heating

Heating in the houseboat is provided by a stove, with its chimney connected to a coil that heats water in a tank. Additionally, for heating assistance, there is a recuperation system with reheating.

11.1.2. Ventilation

Ventilation in the houseboat is ensured by two methods. One is natural, using windows located at the front and rear, allowing for the creation of airflow. Additionally, ventilation can be achieved through a roof opening, which can create a chimney effect and naturally ventilate the space within a few minutes. Another ventilation option, particularly useful when there are significant temperature differences between the interior and exterior, is recuperation. This method brings in fresh air without altering the interior temperature.

11.2. Electrical

Electricity in this case is obtained from two sources, both from solar panels and from a wind turbine, which will serve primarily as an energy source in the winter months. The energy from the panels and the turbine is stored in batteries, allowing electricity to be used even in periods when there is no wind and/or it is cloudy. The houseboat also has an electric motor powered by batteries.

11.2.1. Source

- The wind turbine is part of the pier and serves as an additional source of energy.
- Solar panels are placed on the opening roof of the houseboat.
- In case there is a lack of electricity, the houseboat has a connection to the grid.

11.2.2. Batteries

There are eight 280Ah 12V batteries built into the houseboat, which serve as a power source for the houseboat. Another six batteries are built in the pier, which are charged by a wind turbine, which is also part of the pier.

11.3. Plumbing

The water management on this houseboat is designed to create a closed loop for water usage. It begins with the first technology, which is drinking water treatment, drawing water directly from the body of water on which it is situated. Through drinking water treatment, the water is purified and stored in a water tank. From water tank, it is pumped into a boiler where it is heated using electricity from solar panels and made usable for showering or washing. Another option for water heating on the houseboat is a fireplace with a heat exchanger, which can heat water for use, especially during the winter months when the fireplace is in use, ensuring no energy goes to waste. An additional warm water tank is added for this purpose, stored on the jetty and connected to the houseboat. Used water from showers or sinks is filtered and returned to the body of water from which it was drawn. Of course, in this case, no chemicals are allowed to be used on the houseboat, only natural products that are environmentally friendly. The toilet on the houseboat is composting, meaning all toilet waste is transferred to a composting tank where it eventually turns into harmless compost that can either be further utilized or returned to nature.

11.3.1 Drinking water

To ensure drinking water on the houseboat, there are water tanks positioned underthe floor of the houseboat, adding to the weight, improving the balance, located inthe boat's hull. This water is pumped into the pipes by a pump with an expansion tank. Drinking water is available in the kitchen and bathroom.

11.3.3. Grey water

The water from the shower and kitchen is discharged through a filter back into the water on which the houseboat is positioned.

11.3.4. Toilet

The toilet on the houseboat is composting, meaning all toilet waste is transferred toa composting tank where it eventually turns into harmless compost that can either be further utilized or returned to nature.

Conclusion

Living on water is fascinating, but designing a structure that can handle its dynamic conditions is a real challenge compared to traditional land-based architecture. The unstable nature of water necessitates careful consideration of various factors during the design process. Throughout the design process, sustainability and the aesthetic appeal of the structure were crucial. I found inspiration in the aerodynamic form of a bubble, exploring how such organic shapes could inform a more efficient and visually striking houseboat design. At first, I took inspiration from sailing boats for my houseboat design. However, I soon realized that what works for a sailboat does not necessarily work for a houseboat. I had to rethink the initial design and focus on making sure the houseboat was stable above all else. An important turning point came during a consultation with a motorboat designer. This meeting led me to rethink the entire approach, ultimately requiring a compromise between traditional sailboat aesthetics and the practical demands of stability on water. In conclusion, the architectural aspect of water living is relatively unexplored in our region, where existing practices tend towards simple boat huts or vessels without nuanced architectural considerations. The challenge is to bring architecture into water living in a way that really fits the unique demands of life on the water.

.Bibliography

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